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Literature

Internet Addresses

Keller-Rudek, H. and Moortgat, G.K. (2005), MPI-Mainz-UV-VIS Spectral Atlas of Gaseous Molecules. URL: www.atmosphere.mpg.de/spectral-atlas-mainz

Smith, P.L., Heise, C., Esmond, J.R., Kurucz, R.L. (1995), Atomic spectral line database from CD-ROM 23 of R.L. Kurucz

Kurucz, R.L. and Bell, B. (1995), Atomic Line Data Kurucz CD-ROM No. 23. Cambridge, Mass.: Smithsonian Astrophysical Observatory. URL: http://cfa-www.harvard.edu/amdata/ampdata/kurucz23/sekur.html

Science-softCon UV/Vis Spectra Data Base URL: http:// www. science-softcon.de/

Rothman, L.S., Barbe, A., Chris Benner, D., Brown, L.R., Camy-Peyret, C., Carleer, M.R., Chance, K., Clerbaux, C., Dana, V., Devi, V.M., Fayt, A., Flaud, J.-M., Gamache, R.R., Goldman, A., Jacquemart, D., Jucks, K.W., Lafferty, W.J., Mandin, J.-Y., Massie, S.T., Nemtchinov, V., Newnham, D.A., Perrin, A., Rinsland, C.P., Schroeder, J., Smith, K.M., Smith, M.A.H., Tang, K., Toth, R.A., Vander Auwera, J., Varanasi, P., Yoshino, K. (2003), The HITRAN molecular spectroscopic database: edition of 2000 including updates through 2001, Journal of Quantitative Spectroscopy & Radiative Transfer **82**, 5–44. http://www.hitran.com

References

Aben, I., Stam, D.M., Helderman, F.: The ring effect in skylight polarisation. Geophys. Res. Lett. **28**(3), 519–522 (2001)

Ahmed, S.M., Kumar, V.: Measurement of photoabsorption and fluorescence cross sections for carbon disulfide at 188–213 nm and 287.5–339.5 nm. J. Phys. **39**, 367–380 (1992)

Albritton, D.L., Schmeltekopf, A.L., Zare, R.N.: An introduction to the least-squares fitting of spectroscopic data, In: Narahar, R.K., Weldon, M.W. (eds.) Molecular Spectroscopy: Modern Research. Academic, Orlando (1976)

Aldener, M., Brown, S.S., Stark, H., Daniel, J.S., Ravishankara, A.R.: Near-IR absorption of water vapor: pressure dependence of line strengths and an upper limit for continuum absorption. J. Mol. Spectrosc. **232**, 223–230 (2005)

Alicke, B.: Messung von troposphärischen Halogenoxidradikalen in mittleren Breiten. Diplomarbeit, Ruprecht-Karls-Universität Heidelberg, Germany (1997)

Alicke, B., Hebestreit, K., Stutz, J., Platt, U.: Detection of iodine oxide in the marine boundary layer. Nature **397**, 572–573 (1999)

Alicke, B.: The role of nitrous acid in the boundary layer. Ph.D. thesis, University of Heidelberg (2000)

Alicke, B., Platt, U., Stutz, J.: Impact of nitrous acid photolysis on the total hydroxyl radical budget during the limitation of oxidant production/Pianura Padana Produzione di Ozono study in Milan. J. Geophys. Res. **107**(D22), 8196 (2002). doi: 10.1029/2000JD000075

Alicke, B., Geyer, A., Hofzumahaus, A., Holland, F., Konrad, S., Pätz, H.W., Schäfer, J., Stutz, J., Volz-Thomas, A., Platt, U.: OH formation by HONO photolysis during the BERLIOZ experiment. J. Geophys. Res. **108**(D4), 8247 (2003). doi:10.1029/2001JD000579, (PHOEBE: BERLIOZ special section)

Aliwell, S.R., Jones, R.L., Fish, D.J.: Mid-latitude observations of the seasonal variation of BrO 1. Zenith-sky measurements. Geophys. Res. Lett. **24**, 1195–1198 (1997)

Aliwell, S.R., Jones, R.L.: Measurements of tropospheric NO_3 at midlatitude. J. Geophys. Res. **103**, 5719–5727 (1998)

Aliwell, S.R., Van Roozendael, M., Johnston, P.V., Richter, A., Wagner, T., Arlander, D.W., Burrows, J.P., Fish, D.J., Jones, R.L., Tørnkvist, K.K., Lambert, J.-C., Pfeilsticker, K., Pundt, I.: Analysis for BrO in zenith-sky spectra—an intercomparison exercise for analysis improvement. J. Geophys. Res. **107**(D14), 4199 (2002). doi: 10.1029/2001JD000329

Allan, B.J., Carlslaw, N., Coe, H., Burgess, R.A., Plane, J.M.C.: Observation of the nitrate radical in the marine boundary layer. J. Atmos. Chem. **33**, 129–154 (1999)

Allan, B.J., McFiggans, G., Plane, J.M.C., Coe, H.: Observation of iodine monoxide in the remote marine boundary layer. J. Geophys. Res. **105**, 14363–14369 (2000a)

Allan, B.J., McFiggans, G., Coe, H., Plane, J.M.C., McFayden, G.G.: The nitrate radical in the remote marine boundary layer. J. Geophys. Res. **105**(D19), 24191–24204 (2000b)

Allan, B.J., Plane, J.M.C., McFiggans, G.: Observations of OIO in the remote marine boundary layer. Geophys. Res. Lett. **28**, 1945–1948 (2001)

Allan, B.J., Plane, J.M.C., Coe, H., Shillito, J.: Observation of NO_3 concentration profiles in the troposphere. J. Geophys. Res. **107**(D21), 4588 (2002). doi:10.1029/2002JD002112

Amerding, W., Herbert, A., Schindler, T., Spiekermann, M., Comes, F.J.: In situ measurements of tropospheric OH radicals—a challenge for the experimentalist. Ber. Bunsenges. Phys. Chem. **94**, 776–781 (1990)

Amerding, W., Herbert, A., Spiekermann, M., Walter, J., Comes, F.J.: Fast scanning DOAS—A very promising technique for monitoring OH and other tropospheric trace gases. Fresenius. J. Anal. Chem. **340**, 654–660 (1991)

Amerding, W., Herbert, A., Spiekermann, M., Walter, J., Comes, F.J.: Ein schnell durchstimmbares Laserspektrometer. Ber. Bunsenges. Phys. Chem. **96**, 314 (1992)

Amerding, W., Spiekermann, M., Grigonis, R., Walter, J., Herbert, A., Comes, F.J.: Fast scanning laser DOAS for local monitoring of trace gases, in particular tropospheric OH radicals. Ber. Bunsenges. Phys. Chem. **96**, 314–318 (1992)

Ammann, M., Kalberer, M., Jost, D.T., Tobler, L., Rössler, E., Piguet, D., Gäggeler, H.W., Baltensperger, U.: Heterogeneous production of nitrous acid on soot in polluted air masses. Nature **395**, 157–160 (1998)

Anderson, D.E., Lloyd, S.A.: Polar twilight UV-visible radiation field: perturbations due to multiple scattering, ozone depletion, stratospheric clouds, and surface albedo. J. Geophys. Res. **95**, 7429–7434 (1990)

Anderson, S.M., Mauersberger, K.: Laser measurements of ozone absorption cross sections in the Chappuis band. Geophys. Res. Lett. **19**(9), 933–936 (1992)

Andreae, M.O., Ferek, R.J., Bermond, F., Byrd, K.P., Chatfield, R.B., Engstrom, R.T., Hardin, S., Houmere, P.D, LeMarrec, F., Raemdonck, H.: Dimethyl sulfide in the marine atmosphere. J. Geophys. Res. **90**, 12891–12900 (1985)

Andres-Hernandez, M.D., Notholt, J., Hjorth, J., Schrems, O.: A DOAS study on the origin of nitrous acid at urban and non-urban sites. Atmos. Environ. **30**(2), 175–180 (1996)

Andrews, L.C.: Field guide to atmospheric optics, SPIE field guides, Vol. FG02. SPIE Press, Bellingham (2004)

Angström, A.: On the atmospheric transmission of sun radiation and on dust in the air. Geogr. Ann. Stockholm **11**, 156–166 (1929)

Angström, A.: On the atmospheric transmission of sun radiation, II. Geogr. Ann. Stockholn **12**, 130–159 (1930)

Appel, B.R., Winer, A.M., Tokiwa, Y., Biermann, H.W.: Comparison of atmospheric nitrous acid measurements by annular denuder and differential optical absorption systems. Atmos. Environ. **24A**, 611–616 (1990)

Arpag, K.A., Johnston, P.V., Miller, H.L., Sanders, R.W., Solomon, S.: Observations of the stratospheric BrO column over Colorado, 40N. J. Geophys. Res. **99**, 8175–8181 (1994)

Arrhenius, S.: On the influence of carbonic acid in the air upon the temperature of the ground. The London, Edinburgh, and Dublin Philosophical Magazine and Journal of Science **41**, 237–276 (1896)

Ashworth, S.H., Allan, B.J., Plane, J.M.C.: High resolution spectroscopy of the OIO radical: Implications for the ozone depleting potential of iodine. Geophys. Res. Lett. **29**(10), 1456–1459 (2002)

Atkinson, R., Carter, W.P.L., Pitts, J.N., Jr, Winer, A.M.: Measurements of nitrous acid in an urban area. Atmos. Environ. **20**, 408–409 (1986)

Atkinson, R., Baulch, D.L., Cox, R.A., Hampson, R.F., Kerr, J.A., Troe, J.: Evaluated kinetic and photochemical data for atmospheric chemistry: Supplement III, J. Phys. Chem. Ref. Data **18**, 881–1095 (1989)

Atkinson, R.: Gas-phase tropospheric chemistry of organic compounds: a review. Atmos. Environ. **24A**, 1–41 (1990)

Aumont, B., Chervier, F., Laval, S.: Contribution of HONO sources to the $NO_X/HO_X/O_3$ chemistry in the polluted boundary layer. Atmos. Environ. **37**, 487–498 (2003)

Axelsson, H., Galle, B., Gustavsson, K., Regnarsson, P., Rudin, M.: A transmitting/receiving telescope for DOAS-measurements using retroreflector technique. In: Digest of topical meeting on optical remote sensing of the atmosphere. OSA **4**, 641–644 (1990a)

Axelsson, H., Edner, H., Galle, B., Ragnarson, P., Rudin, M.: Differential optical absorption spectroscopy (DOAS) measurements of ozone in the 280–290 nm wavelength region. Appl. Spectrosc. **44**, 1654–1658 (1990b)

Axelsson, L., Lauber, A.: Measurement of sulfur dioxide with the differential optical absorption technique combined with Fourier transformation. Appl. Spectrosc. **46**, 1832–1836 (1992)

Axelsson, H., Eilard, A., Emanuelsson, A., Galle, B., Edner, H., Ragnarson, P., Kloo, H.: Measurement of aromatic hydrocarbons with the DOAS technique. Appl. Spectrosc. **49**, 1254–1260 (1995)

Ball, S.M., Povey, I.M., Norton, E.G., Jones, R.L.: Broadband cavity ringdown spectroscopy of the NO_3 radical. Chem. Phys. Lett. **342**, 113–120 (2001)

Ball, S.M., Jones, R.L.: Broadband cavity ringdown spectroscopy. Chem. Rev. **103**, 5239 (2003)

Ball, S.M., Langridge, J.M., Jones, R.L.: Broadband cavity enhanced absorption spectroscopy using light emitting diodes. Chem. Phys. Lett. **398**, 68–74 (2004)

Barrefors, G.: Monitoring of benzene, toluene and p-xylene in urban air with differential optical absorption spectroscopy technique. Sci. Total Environ. **189/190**, 287–292 (1996)

Barrie, L.A., Bottenheim, J.W., Shnell, R.C., Crutzen, P.J., Rasmussen, R.A.: Ozone destruction and photochemical reactions at polar sunrise in the lower Arctic atmosphere. Nature **334**, 138–141 (1988)

Barrie, L., Platt, U.: Arctic tropospheric chemistry: an overview. Tellus B **49**, 449–454 (1997)

Barringer, A.R., Davies, J.H., Moffat, A.J.: The problems and potential in monitoring pollution from satellites, AIAA paper, presented at the AIAA earth resources observations and information systems meeting, Annapolis, MD, 2–4 March 1970, A1AA Paper No. 70–305, pp. 62–75 (1970)

Bass, A.M., Paur, R.J.: The ultraviolet cross section of ozone. I. The measurements. In: Zerefos, C., Ghazy, A (eds.) Proceedings of the Quadrennial Ozone Symposium, Chalkidiki, pp. 606–616 (1985)

Bates, D.R., Nicolet, M.: The photochemistry of the atmospheric water vapor. J. Geophys. Res. **55**, 301 (1950)

Bates, D.R., Witherspoon, A.E.: The photochemistry of some minor constituents of the earth's atmosphere (CO_2, CO, CH_4, N_2O). Mon. Not. R. Astron. Soc. **112**, 101 (1952)

Bates, T.S., Charlson, R.J., Gammon, R.H.: Evidence for the climatic role of marine biogenic sulfur. Nature **329**, 319–321 (1987)

Becker, K.H., Schurath, U., Tatarczyk, T.: Fluorescence determination of low formaldehyde concentrations in air by dye laser excitation. Appl. Opt. **14**, 310–313 (1975a)

Becker, K.H., Inocennio, A., Schurath, U.: The reaction of ozone with hydrogen sulfide and its organic derivatives. Int. J. Chem. Kinet. **7**, 205–220 (1975b)

Becker, K.H. (ed.): The European Photoreactor EUPHORE, Final Report of the EC-Project, Contract EV5V-CT92-0059. Department of Physical Chemistry, Bergische Universität Wuppertal (1996)

Beckett, W.S., Russi, M.B., Haber, A.D., Rivkin, R.M., Sullivan, J.R., Tameroglu, Z., Mohsenin, V., Leaderer, B.P.: Effect of nitrous acid on lung function in asthmatics: a chamber study. Environ. Health. Perspect. **103**, 372–375 (1995)

Bednarz, F. (ed.): GOME, Global Ozone Monitoring Experiment. Users manual, European Space Research and Technology Centre (ESTEC), Frascati, Italy (1995)

Beek de, R., Vountas, M., Rozanov, V.V., Richter, A., Burrows, J.P.: The ring effect in the cloudy atmosphere. Geophys. Res. Lett. **28**(4), 721–724 (2001)

Beilke, S., Markusch, H., Jost, D.: Measurements of NO-oxidation in power plant plumes by correlation spectroscopy. In: Versino, B., Ott, H. (eds.) Proceedings of 2nd Europion Symposium on the Physico-Chemical Behaviour of Atmospheric Pollutants, Varese, 29 September to 1 October 1981, D. Reidel Publishing Company, Dordrecht, Holland, pp. 448–459 (1981)

Beirle, S., Platt, U., Wenig, M., Wagner, T.: Weekly cycle of NO_2 by GOME measurements: a signature of anthropogenic sources. Atmos. Chem. Phys. **3**, 2225–2232 (2003)

Beirle, S.: Estimating source strengths and lifetime of nitrogen oxides from satellite data. Ph.D. thesis, University of Heidelberg, Heidelberg (2004)

Beirle, S., Platt, U., Wenig, M., Wagner, T.: Highly resolved global distribution of tropospheric NO_2 using GOME narrow swath mode data. Atmos. Chem. Phys. **4**, 1913–1924 (2004a)

Beirle, S., Platt, U., von Glasow, R., Wenig, M., Wagner, T.: Estimate of nitrogen oxide emission from shipping by satellite remote sensing. Geophys. Res. Lett. **31**, L18102 (2004b). doi:10.1029/2004GL020312

Beirle, S., Platt, U., Wenig, M., Wagner, T.: NO_X production by lightning estimated with GOME. Adv. Space Res. **34**, 793–797 (2004c)

Belmiloud, D., Schermaul, R., Smith, K.M., Zobov, N.F., Brault, J.W., Learner, R.C.M., Newnham, D.A., Tennyson, J.: New studies of the visible and near infra-red absorption by water vapour and some problems with the database. Geophys. Res. Lett. **27**(22), 3703–3706 (2000)

Benedick, R.E.: Ozone diplomacy. Harvard University Press, Cambridge (1991)

Bergman, S..: Lehrbuch der Experimentalphysik, Bd. III, Optik,. F. Matossi. Walter de Gruyter & Co., Berlin (1966)

Berresheim, H., Elste, T., Plass-Dülmer, C., Eisele, F.L., Tanner, D.J.: Chemical ionization mass spectrometer for long-term measurements of atmospheric OH and H_2SO_4. Int. J. Mass Spectrom. **202**, 91–109 (2000)

Bevington, P.R.: Data reduction and error analysis for the physical sciences. McGraw-Hill, New York (1969)

Biermann, H.W., Green, M., Neider, J.N.: Long-pathlength DOAS (differential optical absorption spectrometer) system for the in situ measurement of xylene in indoor air. In: Schiff, H.I. (ed.) Measurements of Atmospheric Gases, Vol. 1433, pp. 2–7. SPIE-The International Society of Optical Engineering, Bellingham (1991)

Biermann, H.W., Tuazon, E.C., Winer, A.M., Wallington, T.J., Pitts, J.N.: Simultaneous absolute measurements of gaseous nitrogen species in urban ambient air by long pathlength infrared and ultraviolet-visible spectroscopy. Atmos. Environ. **22**, 1545–1554 (1988)

Bloss, W., Gravestock, T., Heard, D.E., Ingham, T., Johnson, G.P., Lee, J.D.L.: Application of a compact all solid-state laser system to the in situ detection of

atmospheric OH, HO_2, NO and IO by laser-induced fluorescence. J. Environ. Monit. **5**, 21–28 (2003)

Bobrowski, N., Hönninger, G., Galle, B., Platt, U.: Detection of bromine monoxide in a volcanic plume. Nature **423**, 273–276 (2003)

Bobrowski, N.: Volcanic gas studies by multi axis differential optical absorption spectroscopy. Ph.D. thesis, University of Heidelberg, Heidelberg (2005)

Bobrowski, N., Hönninger, G., Lohberger, F., Platt, U.: I-DOAS: a new monitoring technique to study the 2D distribution of volcanic gas emissions. J. Volcanol. Geotherm. Res. **150**, 329–338 (2006)

Bobrowski, N., Glasow, R.v., Aiuppa, A., Inguaggiato, S., Louban, I., Ibrahim, O.W., Platt, U.: Reactive halogen chemistry in volcanic plumes. J. Geophys. Res. **112**, DO6311, doi: 10.1029/2006JD007206 (2007)

Bodeker, G.E., Shiona, H., Eskes, H.: Indicators of Antarctic ozone depletion. Atmos. Chem. Phys. **5**, 2603–2615 (2005)

Bonafe, U., Cesari, G., Giovanelli, G., Tirabassi, T., Vittori, O.: Mask correlation spectrophotometry advanced methodology for atmospheric measurements. Atmos. Environ. **10**, 469–474 (1976)

Bongartz, A., Kamens, J., Welter, F., Schurath, U.: Near-UV absorption cross sections and trans/cis equilibrium of nitrous acid. J. Phys. Chem. **95**, 1076–1082 (1991)

Borrell, P., Burrows, J.P., Platt, U., Zehner C.: Determining Tropospheric Concentrations of Trace Gases from Space. ESA Bulletin **107**, 72–81 (2001)

Borrell, P., Burrows, J.P., Richter, A., Platt, U., Wagner, T.: New directions: new developments in satellite capabilities for probing the chemistry of the troposphere. Atmos. Environ. **37**, 2567–2570 (2003)

Bossmeyer, J.: Ship-based multi-axis differential optical absorption spectroscopy measurements of tropospheric trace gases over the Atlantic Ocean: new measurement concepts. Diploma Thesis, University of Heidelberg, Germany (2002)

Bösch, H.: Studies of the stratospheric nitrogen and iodine chemistry by balloon-borne DOAS measurements and model calculations. Ph.D. thesis, University of Heidelberg (2002)

Bösch, H., Camy-Peyret, C., Chipperfield, M.P., Fitzenberger, R., Harder, H., Platt, U., Pfeilsticker, K.: Upper limits of stratospheric IO and OIO inferred from center-to-limb-darkening-corrected balloon-borne solar occultation visible spectra: implications for total gaseous iodine and stratospheric ozone. J. Geophys. Res. **108**, 445 (2003). doi: 10.1029/2002JD003078

Bottenheim, J.W., Gallant, A.G., Brice, K.A.: Measurements of NO_y species and O_3 at 82°N latitude. Geophys. Res. Lett. **13**, 113–116 (1986)

Bottenheim, J.W., Barrie, L. W., Atlas, E., Heidt, L.E., Niki, H., Rasmussen, R.A., Shepson, P.B.: Depletion of lower tropospheric ozone during Arctic spring: the polar sunrise experiment 1988. J. Geophys. Res. **95**, 18555–18568 (1990)

Brand, J.C.D., Srikameswaran, K.: The Π^*–Π (2350 A) band system of sulphur dioxide. Chem. Phys. Lett. **15**, 130–132 (1972)

Brand, J.C.D., Jones, V.T., DiLauro, C.: The $^3B_1$–$^1A_1$ band system of sulphur dioxide: rotational analysis of the (010), (100), and (110) bands. J. Mol Spectrosc **45**, 404–411 (1973)

Brand, J.C.D., Nanes, R.: The 3400–3000 A absorption of sulphur dioxide. J. Mol Spectrosc **46**, 194–199 (1973)

Brandenburger, U., Brauers, T., Dorn, H.-P., Hausmann, M., Ehhalt, D.H.: In-situ measurement of tropospheric hydroxyl radicals by folded long-path laser

absorption during the field campaign POPCORN in 1994. J. Atmos. Chem. **31**, 181–204 (1998)

Brandtjen, R., Klüpfel, T., Perner, D.: Airborne measurements during the European Arctic stratospheric ozone experiment: observation of OClO. Geophys. Res. Lett. **21**, 1363–1366 (1994)

Brasseur, G., Solomon, S.: Aeronomy of the middle atmosphere. D. Reidel Publishing Company, Dordrecht, 2nd edition (1986)

Brassington, D.J.: Sulphur dioxide absorption cross-section measurements from 290 to 317 nm. Appl. Opt. **20**, 3774–3779 (1981)

Brassington, D.J., Felton, R.C., Jolliffe, B.W., Marx, B.R., Moncrieff, J.T.M.: Errors in spectroscopic measurements of SO_2 due to nonexponential absorption of laser radiation, with application to the remote monitoring of atmospheric pollution. Appl. Opt. **23**, 469–475 (1984)

Brauers, T., Dorn, H.-P., Platt, U.: Spectroscopic measurements of NO_2, O_3, SO_2, IO and NO_3 in maritime air. In: Restelli, G., Angeletti, G. (eds.) Physico-Chemical Behaviour of Atmospheric Pollutants, Proceedings of the 5th European Symposium, Varese, Italia, pp. 237–242. Kluwer Academic Publishers, Dordrecht (1990)

Brauers, T.: FZ-Jülich, Germany (1992) Unpublished results

Brauers, T., Hausmann, M., Brandenburger, U., Dorn, H.-P.: Improvement of differential optical absorption spectroscopy using multichannel scanning technique. Appl. Opt. **34**(21), 4472–4479 (1995)

Brauers, T., Aschmutat, U., Brandenburger, U., Dorn, H.-P., Hausmann, M., Heßling, M., Hofzumahaus, A., Holland, F., Plass-Dülmer, C., Ehhalt, D.H.: Intercomparison of tropospheric OH radical measurements by multiple folded long- path laser absorption and laser induced fluorescence. Geophys. Res. Lett. **23**, 2545–2548 (1996)

Brauers, T., Hausmann, M., Bister, A., Kraus, A., Dorn, H.-P.: OH radicals in the boundary layer of the Atlantic Ocean: 1. Measurements by long-path laser absorption spectroscopy. J. Geophys. Res. **106**, 7399ff (1999)

Brenninkmeijer, C.A.M., Manning, M.R., Lowe, D.C., Wallace, G.A., Sparks, R.J., Volz-Thomas, A.: Interhemispheric asymmetry in OH abundance inferred from measurements of atmospheric ^{14}CO. Nature **356**, 50–52 (1992)

Brewer, A.W., McElroy, C.T., Kerr, J.B.: Nitrogen dioxide concentrations in the atmosphere. Nature **246**, 129–133 (1973)

Brimblecombe, P., Heymann, M.: TRAP-45—analysis of tropospheric air pollution problems and air pollution abatement strategies in Europe since 1945, A Subproject in EUROTRAC-2, International Scientific Secretariat, GSF-Forschungszentrum für Umwelt and Gesundheit GmbH, Munich, Germany (1998)

Bröske, R., Kleffmann, J., Wiesen, P.: Heterogeneous conversion of NO_2 on secondary organic aerosol surfaces: a possible source of nitrous acid (HONO) in the atmosphere? J. Atmos. Chem. Phys. **3**, 469–474 (2003)

Brown, S.S., Stark, H., Ciciora, S.J., Ravishankara, A.R.: In-situ measurement of atmospheric NO_3 and N_2O_5 via cavity ring-down spectroscopy. Geophys. Res. Lett. **28**(17), 3227–3230 (2001)

Brown, S.S., Stark, H., Ciciora, S.J., McLaughlin, R.J., Ravishankara, A.R.: Simultaneous in situ detection of atmospheric NO_3 and N_2O_5 via cavity ring-down spectroscopy. Rev. Sci. Instrum. **73**(9), 3291–3301 (2002)

Brown, S.S.: Absorption spectroscopy in high-finesse cavities for atmospheric studies. Chem. Rev. **103**(12), 5219–5238 (2003)

Brown, S.S., Stark, H., Ryerson, T.B., Williams, E.J., Nicks, D.K., Jr, Trainer, M., Fehsenfeld, F.C., Ravishankara, A.R.: Nitrogen oxides in the nocturnal boundary layer: Simultaneous in situ measurements of NO_3, N_2O_5, NO_2, NO, and O_3. J. Geophys. Res. **108**(D9), 4299 (2003). doi:10.1029/2002JD002917

Brune, W.H., Stevens, P.S., Mather, J.H.: Measuring OH and HO_2 in the troposphere by laser induced fluorescence at low pressure. J. Atmos. Sci. (1995)

Brunekreef, B., Holgate, S.T.: Air pollution and health. Lancet **360**, 1233–1242 (2002)

Bruns, M., Buehler, S.A., Burrows, J.P., Heue, K.-P., Platt, U., Pundt, I., Richter, A., Rozanov, A., Wagner, T., Wang, P.: Retrieval of profile information from airborne multi axis UV/visible skylight absorption measurements. Appl. Opt. **43**(22), 4415–4426 (2004)

Bruns, M., Buehler, S.A., Burrows, J.P., Richter, A., Rozanov, A., Wang, P., Heue, K.P., Platt, U., Pundt, I., Wagner, T.: NO_2 profile retrieval using airborne multi axis UV-visible skylight absorption measurements over central Europe. Atmos. Chem. Phys. **6**, 3049–3058 (2006)

Buchwitz, M., Rozanov, V., Burrows, J.: A near-infrared optimised DOAS method for the fast global retrieval of atmospheric CH_4, CO, CO_2, H_2O, and N_2O total column amounts from SCIAMACHY Envisat-1 nadir radiances. J. Geophys. Res. **105**, 15231–15245 (2000)

Burkholder, J.B., Talukdar, R.K.: Temperature dependence of the ozone absorption cross section over the wavelength range 410 to 760 nm. Geophys. Res. Lett. **21**, 581–584 (1994)

Burkholder, J.B., Curtius, J., Ravishankara, A.R., Lovejoy, E.R.: Laboratory studies of the homogeneous nucleation of iodine oxides. Atmos. Chem. Phys. **4**, 19–34 (2004)

Burrows, J.P., Tyndall, G.S., Moortgat, G.K.: Absorption spectrum of NO_3 and kinetics of the reactions of NO_3 with NO_2, Cl, and several stable atmospheric species at 298 K. J. Phys. Chem. **89**, 4848–4856 (1985)

Burrows, J.P., Chance, K.V., Crutzen, P.J., Fishman, J., Fredericks, J.E., Geary, J.C., Johnson, T.J., Harris, G.W., Isaksen, I.S.A., Kelder, H., Moortgat, G.K., Muller, C., Perner, D., Platt, U., Pommereau, J.-P., Rodhe, H., Roeckner, E., Schneider, W., Simon, P., Sundqvist, H., Vercheval, J.: SCIAMACHY phase A study—scientific requirements specification, report to European space Agency (1991)

Burrows, J., Vountas, M., Haug, H., Chance, K., Marquard, L., Muirhead, K., Platt, U., Richter, A., Rozanov, V.: Study of the ring effect, final report for ESA contract 109996/94/NL/CN, ESA ITT No. AO/1-2778/94/NL/CN (1995)

Burrows, J., Platt, U., Chance, K., Vountas, M., Rozanov, V., Richter, A., Haug, H., Marquard, L.: Study of the ring effect. European Space Agency, Noordiwijk (1996)

Burrows, J.P., Dehn, A., Deters, B., Himmelmann, S., Richter, A., Voigt, S., Orphal, J.: Atmospheric remote-sensing reference data from GOME: part I. Temperature-dependent absorption cross-sections of NO_2 in the 231–794 nm range. J. Quant. Spectrosc. Radiat. Transf. **60**, 1025–1031 (1998)

Burrows, J.P., Weber, M., Buchwitz, M., Rozanov, V., Ladstätter-Weißenmayer, A., Richter, A., DeBeek, R., Hoogen, R., Bramstedt, K., Eichmann, K.-U.,

Eisinger, M., Perner, D.: The global ozone monitoring experiment (GOME): mission concept and first scientific results. J. Atmos. Sci. **56**, 151–171 (1999a)

Burrows, J.P., Richter, A., Dehn, A., Deters, B., Himmelmann, S.: Atmospheric remote-sensing reference data from GOME: part 2. Temperature-dependent absorption cross sections of O_3 in the 231–794 nm range. J. Quant. Spectrosc. Radiat. Transf. **61**, 509–517 (1999b)

Bussemer, M.: Der Ring-Effekt: Ursachen und Einfluß auf die spektroskopische Messung stratosphärischer Spurenstoffe. Diploma thesis in Physics, University Heidelberg (1993)

Butkovskaya, N.I., Le Bras, G.: Mechanism of the $NO_3 + DMS$ reaction by discharge flow mass spectrometry. J. Phys. Chem. **98**, 2582–2591 (1994)

Butz, A., Bösch, H., Camy-Peyret, C., Chipperfield, M., Dorf, M., Dufour, G., Grunow, K., Jeseck, P., Kühl, S., Payan, S., Pepin, I., Pukite, J., Rozanov, A., von Savigny, C., Sioris, C., Wagner, T., Weidner, F., Pfeilsticker, K.: Inter-comparison of stratospheric O_3 and NO_2 abundances retrieved from balloon borne direct sun observations and Envisat/SCIAMACHY limb measurements. J. Atmos. Chem. Phys. **6**, 1293–1314 (2006)

Calvert, J.G.: Hydrocarbon involvement in photochemical smog formation in Los Angeles atmosphere. Environ. Sci. Technol. **10**, 256–262 (1976)

Calvert, J.G., Lazrus, A., Kok, G.L., Heikes, B.G., Walega, J.G., Lind, J., Cantrell, C.A.: Chemical mechanisms of acid generation in the troposphere. Nature **317**, 27–35 (1985)

Calvert, J.G., Yarwood, G., Dunker, A.M.: An evaluation of the mechanism of nitrous acid formation in the urban atmosphere. Res. Chem. Intermed. **20**(3–5), 463–502 (1994)

Campbell, M.J., Sheppard, J.C.,. Au, B.F.: Measurement of hydroxyl concentration in boundary – layer air by monitoring CO oxidation. Geophys. Res. Lett. **6**, 175–178 (1979)

Campbell, M.J., Farmer, J.C., Fitzner, C.A., Henry, M.N., Sheppard, J.C., Hardy, R.J., Hopper, J.F., Muralidhar, V.: Radiocarbon tracer measurements of atmospheric hydroxyl radical concentrations. J. Atmos. Chem. **4**, 413–427 (1986)

Camy-Peyret, C., Jeseck, P., Hawat, T., Durry, G., Berubeé, Rochette, L., Huguenin, D.: The LPMA balloon borne FTIR spectrometer for remote sensing of the atmospheric constituents. In: Proceedings of 12th ESA Symposium on Rocket and Balloon Programmes and Related Research (1995)

Camy-Peyret, C., Bergqvist, B., Galle, B., Carleer, M., Clerbaux, C., Colin, R., Fayt, C., Goutail, F., Nunes-Pinharanda, M., Pommereau, J.P., Hausmann, H., Platt, U., Pundt, I., Rudolph, T., Hermans, C., Simon, P.C., Vandaele, A.C., Plane, J.M.C., Smith, N.: Intercomparison of instruments for tropospheric measurements using differential optical absorption spectroscopy. J. Atmos. Chem. **23**, 51–80 (1996)

Camy-Peyret, C., Payan, S., Jeseck, P., Té, Y., Hawat, T., Pfeilsticker, K., Harder, H., Fitzenberger, R., Bösch, H.: Recent results obtained with the LPMA and DOAS balloon-borne instruments during the ILAS, SABINE and THESEO campaigns. In: Proceedings of 14th ESA Symposium on Rocket and Balloon Programmes and Related Research (1999)

Canrad-Hanovia.: Compact arc lamps, data sheet. Canrad-Hanovia Inc., Newark (1986)

Cantrell, C.A., Stedman, D.H., Wendel, G.J.: Measurement of atmospheric peroxy radicals by chemical amplification. Anal. Chem. **56**, 1496–1502 (1984)

Cantrell, C.A., Davidson, J.A., McDaniel, A.H., Shetter, R.E., Calvert, J.G.: Temperature-dependent formaldehyde cross section in the near-ultraviolet spectral region. J. Phys. Chem. **94**, 3902–3908 (1990)

Cantrell, C.A., Shetter, R.E., Lind, J.A., Mcdaniel, A.H., Calvert, J.G., Parrish, D.D., Fehsenfeld, F.C., Buhr, M.P., Trainer, M.: An improved chemical amplifier technique for peroxy radical measurements. J. Geophys. Res. **98**, 2897–2909 (1993)

Cardenas, L.M., Brassington, D.J., Allan, B.J., Coe, H., Alicke, B., Platt, U., Wilson, K.M., Plane, J.M.C., Penkett, S.A.: Intercomparison of formaldehyde measurements in clean and polluted atmospheres. J. Atmos. Chem. **37**, 53–80 (2000)

Carpenter, L.J., Sturges, W.T., Penkett, S.A., Liss, P.S., Alicke, B., Hebestreit, K., Platt, U.: Short-lived alkyl iodides and bromides at Mace Head, Ireland: links to biogenic sources and halogen oxide production. J. Geophys. Res. **104**, 1679–1689 (1999)

Carpenter, L.J., Hebestreit, K., Platt, U., Liss, P.S.: Coastal zone production of IO precursors: a 2-dimensional study. Atmos. Chem. Phys. **1**, 9–18 (2001)

Carroll, M.A., Sanders, R.W., Solomon, S., Schmeltekopf, A.L.: Visible and near-ultraviolet spectroscopy at McMurdo Station, Antarctica, 6. Observations of BrO. J. Geophys. Res. **94**(D14), 16633–16638 (1989)

Carslaw, N., Carpenter, L., Plane, J.M.C., Allan, B.J., Burgess, R.A., Clemitshaw, K., Coe, C.H., Penkett, S.A.: Simultaneous observations of nitrate and peroxy radicals in the marine boundary layer. J. Geophys. Res. **102**, 18917–18933 (1997)

Carslaw, N., Creasey, D.J., Heard, D.E., Lewis, A.C., McQuaid, J.B., Pilling, M.J., Monks, P.S., Bandy, B.J., Penkett, S.A.: Modeling OH, HO_2, and RO_2 radicals in the marine boundary layer, 1, Model construction and comparison with field measurements. J. Geophys. Res. **104**, 30241–30255 (1999)

Casadio, S., Zehner, C., Pisacane, G., Putz, E.: Empirical retrieval of the atmospheric air mass factor (ERA) for the measurement of water vapour vertical content using GOME data. Geophys. Res. Lett. **27**(10), 1483–1486 (2000)

Cauer, H.: Schwankungen der Jodmenge der Luft in Mitteleuropa, deren Ursachen und deren Bedeutung für den Jodgehalt unserer Nahrung (Auszug). Angewandte Chemie **52**(11), 625–628 (1939)

Chance, K., Palmer, P.I., Spurr, R.J.D., Martin, R.V., Kurosu, T.P., Jacob, D.J., et al.: Satellite observations of formaldehyde over North America from GOME. Geophy. Res. Lett. **27**(21), 3461–3464 (2000)

Chance, K., Kurosu, T.P., Sioris, C.E.: Undersampling correction for arraydetector-based satellite spectrometers. Appl. Opt. **44**(7), 1296–1304 (2005)

Chapman, S.: On ozone and atomic oxygen in the upper atmosphere. Philos. Mag. **7**, 369–383 (1930)

Chappuis, J.: Sur le spectre d'absorption de l'ozone. C.R. Acad. Sci. **91**, 985 (1880)

Charlson, R.J., Rhode, H.: Factors controlling the acidity of natural rainwater. Nature **295**, 683–685 (1982)

Charlson, R.J., Lovelock, J.E., Andreae, M.O., Warren, S.G.: Oceanic phytoplankton, atmospheric sulphur, cloud albedo and climate. Nature **326**, 655–661 (1987)

Chen, Y.Q., Zhu, L.: Wavelength-dependent photolysis of glyoxal in the 290–420 nm region. J. Phys. Chem. A **107**(23), 4643–4651 (2003)

Chernin, S.M., Barskaya, E.G.: Optical multipass matrix systems. Appl. Opt. **30**, 51–57 (1991)

Chernin, S.M.: New generation of multipass systems in high resolution spectroscopy. Spectrochim. Acta A **52**, 1009–1022 (1996)

Chin, M., Davis, D.D.: Global sources and sinks of OCS and CS_2 and their distribution. Global Biogeochem. Cycles **7**, 321–337 (1993)

Chin, M., Jacob, D.J.: Anthropogenic and natural contributions to tropospheric sulphate: a global model analysis. J. Geophys. Res. **101**, 18691–18699 (1996)

Clarke, D., Basurah, H.: Polarization measurements of the ring effect in the daytime sky. Planet. Space Sci. **37**, 627–630 (1989)

Clemitshaw, K.C., Carpenter, L.J., Penkett, S.A., Jenkin, M.E.: A calibrated peroxy radical chemical amplifier for ground-based tropospheric measurements. J. Geophys. Res. **102**, 25405–25416 (1997)

Clemitshaw, K.C.: A Review of instrumentation and measurement techniques for ground-based and airborne field studies of gas-phase tropospheric chemistry. Crit. Rev. Environ. Sci. Technol. **34**, 1–108 (2004) ISSN: 1064-3389, doi: 10.1080/10643380490265117

Coe, H., Jones, R.L., Colin, R., Carleer, M., Harrison, R.M., Peak, J., Plane, J.M.C., Smith, N., Allan, B., Clemitshaw, K.C., Burgess, R.A., Platt, U., Etzkorn, T., Stutz, J., Pommereau, J.-P., Goutail, F., Nunes-Pinharanda, M., Simon, P., Hermans, C., Vandaele, A.-C.: A comparison of differential optical absorption spectrometers for measurement of NO_2, O_3, SO_2 and HONO. In: Borrell, P.M., Borrell, P., Cvitaš, T., Kelly, K., Seiler, W. (eds.) Proceedings of EUROTRAC Symposium 1996: Transport and Transformation of Pollutants, pp. 757–762. Computational Mechanics Publications, Southampton (1997) ISBN 1 85312 498 2

Coe, H., Allan, B.J., Plane, J.M.C.: Retrievals of vertical profiles of NO_3 from zenith sky measurements using an optimal estimation method. J. Geophys. Res. **107**(D21), 4587 (2002). doi:10.1029/2002JD002111

Coheur, P.-F., Fally, S., Carleer, M., Clerbaux, C., Colin, R., Jenouvrier, A., Mérienne, M.-F., Hermans, C., Vandaele, A.C.: New water vapour line parameters in the 26000–13000 cm^{-1} region. J. Quant. Spectrosc. Radiat. Transf **74**(4), 493–510 (2002)

Colin, R., Carleer, M., Simon, P.C., Vandaele, A.C., Dufour, P., Fayt, C.: Atmospheric absorption measurement by Fourier transform DOAS, EUROTRAC annual report 1991 (TOPAS subproject), pp 14–46 (1991)

Coquart, B., Jenouvrier, A., Merienne, M.F.: The NO_2 absorption spectrum. II. Absorption cross section at low temperatures in the 400–500 nm region. J. Atmos. Chem. **21**, 251–261 (1995)

Cornu, A.: Observation de la limite ultraviolette du spectre solaire a diverses altitudes. C.R. Acad. Sci. **89**, 808 (1879)

Cox, R.A., Sheppard, D.W., Stevens, M.P.: Absorption coefficients and kinetics of the BrO radical using molecular modulation. J. Photochem. **19**, 189–207 (1982)

Cox, R.A., Bloss, W.J., Jones, R.L., Rowley, D.M.: OIO and the atmsopheric cycle of iodine. Geophys. Res. Lett **26**, 1857–1860 (1999)

CRC Handbook of Chemistry and Physics, 88th Edition (Internet Version 2008), In: David R.L., (ed.) CRC Press/Taylor and Francis, Boca Raton, FL. (2008)

Crutzen, P.J.: The influence of nitrogen oxides on the atmospheric ozone content. Qart. J. Roy. Met. Soc. **96**, 320–325 (1970)

Crutzen, P.J.: A discussion of the chemistry of some minor constituents in the stratosphere and troposphere. Pure Appl. Geophys. **106–108**, 1385–1399 (1973)

Crutzen, P.J.: Photochemical reactions initiated by and influencing ozone in unpolluted tropospheric air. Tellus **26**, 47–57 (1974)

Crutzen, P.J., Müller, R., Brühl, Ch., Peter, T.: On the potential importance of the gas phase reaction $CH_3O_2 + ClO \longrightarrow ClOO + CH_3O$ and the heterogeneous reaction $HOCl + HCl \longrightarrow H_2O + Cl_2$ in "ozone hole" chemistry. Geophys. Res. Lett. **19**, 1113–1116 (1992)

Cunningham, R.W.: Comparison of three methods for determining fit parameter uncertainties for the Marquardt compromise. Comput. phys. **7**(5), 570 (1993)

Dahlback, A., Stamnes, K.: A New spherical model for computing the radiation-field available for photolysis and heating at twilight. Plan. Spa. Sci. **39**(5), 671–683 (1991)

Dahlback, A., Rairoux, P., Stein, B., Del Guasta, M., Kyrö, E., Stefanutti, L., Larsen, N., Braathen, G.: Effects of stratospheric aerosols from the Mt. Pinatubo eruption on ozone measuremnts at Sodankylá Finland in 1991/92. Geophys. Res. Lett. **21**(13), 1399–1402 (1994)

Dave, J.V., Mateer, C.L.: A preliminary study on the possibility of estimating total atmospheric ozone from satellite measurements. J. Atmos. Sci. **24**, 414–427 (1967)

Davidson, J.A., Cantrell, C.A., McDaniel, A.H., Shetters, R.E., Madronich, S., Calvert, J.G.: Visible-ultraviolet absorption cross sections for NO_2 as a function of Temperature. J. Geophys. Res. **93**, 7105–7112 (1988)

Davies, J.H.: Correlation spectroscopy. Anal. Chem. **42**, 101A–112A (1970)

Davies, J.H., van Egmond, N.D., Wiens, R., Zwick, H.: Recent developments in environmental sensing with the barringer correlation spectrometer. Can. J. Remote Sens. **1**, 85–94 (1975)

Davis, D.D., Rodgers, M.O., Fischer, S.D., Asai, K.: An experimental assessment of the O_3/H_2O interference problem the detection of natural levels of OH via laser induced fluorescence. Geophys. Res. Lett. **8**, 69–72 (1981)

Davis, D., Crawford, J., Liu, S., McKeen, S., Bandy, A., Thornton, D., Rowland, F., Blake, D.: Potential impact of iodine on tropospheric levels of ozone and other critical oxidants. J. Geophys. Res. **101**, 2135–2147 (1996)

Davies, W.E., Vaughan, G., O'Connor, F.M.: Observations of near-zero ozone concentrations in the upper troposphere at mid-latitudes. Geophys. Res. Lett. **25**, 1173–1176 (1998)

De Maziere, M., Van Roozendael, M., Hermans, C., Simon, P.C., Demoulin, P., Roland, G., Zander, R.: Quantitative evaluation of the post-Pinatubo NO_2 reduction and recovery, based on 10 years of FTIR and UV-Visible. J. Geophys. Res. **103**, 10849–10858 (1998)

Dieke, D.R., Crosswhite, H.M. The ultraviolet bands of OH, Fundamental data. J. Quant. Spectrosc. Radiat. Transfer **2**, 97–199 (1961)

Dillon, T.J., Tucceri, M.E., Hölscher, D., Crowley, J.N.: Absorption cross-section of IO at 427.2 nm and 298 K. J. Photochem. Photobiol. A. Chem. **176**, 3–14

Dimpfl, W.L., Kinsey, J.L: Radiative lifetimes of OH ($A\ ^2\Sigma$) and Einstein coefficients of the A-X system of OH and OD. J. Quant. Spectrosc. Radiat. Transfer **21**, 233–241 (1979)

Dobson, G.M.B., Harrison, D.N.: Measurements of the amount of ozone in the earth's atmosphere and its relation to other geophysical conditions, Part 1. Proc. R. Soc. Lond. A **110**, 660–693 (1926)

Dobson, G.M.B.: A photoelectric spectrophotometer for measuring the amount of atmospheric ozone. Proc. Phys. Soc. **43**, 324–339 (1931)

Dobson, G.M.B.: Forty years' research on atmospheric ozone at Oxford: a history. Appl. Opt. **7**, 387–406 (1968)

Dorf, M., Bösch, H., Butz, A., Camy-Peyret, C., Chipperfield, M.P., Engel, A., Goutail, F., Grunow, K., Hendrick, F., Hrechanyy, S., Naujokat, B., Pommereau, J.-P., Van Roozendael, M., Sioris, C., Stroh, F., Weidner, F., Pfeilsticker, K.: Balloon-borne stratospheric BrO measurements: comparison with Envisat/SCIAMACHY BrO limb profiles. Atmos. Chem. Phys. **6**, 2483–2501 (2006)

Dorn, H.-P., Platt, U.: Eine empfindliche optische Nachweismethode für Spurenstoffe in der Atmosphäre. Elektrizitätswirtschaft **24**, 967–970 (1986)

Dorn, H.-P., Callies, J., Platt, U., Ehhalt, D.H.: Measurement of tropospheric OH concentrations by laser long-path absorption spectroscopy. Tellus B **40**, 437–445 (1988)

Dorn, H.-P., Neuroth, R., Brauers, T., Brandenburger, U., Ehhalt, D.H.: Measurement of tropospheric OH radical concentrations by differential UV laser long-path absorption. In: Schiff, H.I., Platt, U. (eds.) Proceedings of SPIE Symposium on Optical Methods in Atmospheric chemistry, pp 361–366 (1993)

Dorn, H.-P., Neuroth, R., Hofzumahaus, A.: Investigation of OH absorption cross sections of rotational transitions in the $A^2\Sigma^+$, $\mathrm{v}' = 0 < -X^2\Pi$, $v'' = 0$ band under atmospheric conditions: implications for tropospheric long-path absorption measurements. J. Geophys. Res. **100**, 7397–7409 (1995)

Dorn, H.P., Brandenburger, U., Brauers, T., Hausmann, M., Ehhalt, D.H.: In- situ detection of tropospheric OH radicals by folded long- path laser absorption. results from the POPCORN field campaign in August 1994. Geophys. Res. Lett. **23**, 2537–2540 (1996)

Durry, G., Megie, G.: Atmospheric CH_4 and H_2O monitoring with near-infrared InGaAs laser diodes by the SDLA, a balloonborne spectrometer for tropospheric and stratospheric in situ measurements. Appl. Opt. **38**(36), 7342–7354 (1999)

Dvortsov, V.L., Geller, M.A., Solomon, S., Schauffler, S.M., Atlas, E.L., Blake, D.R.: Rethinking reactive halogen budgets in the midlatitude lower stratosphere. Geophys. Res. Lett. **26**, 1699–1702 (1999)

Eckhardt, H.D.: Simple model of corner reflector phenomena. Appl. Opt. **10**, 1559–1566

Edner, H., Sunesson, A., Svanberg, S., Uneus, L., Wallin, S.: Differential optical absorption spectroscopy system used for atmospheric mercury monitoring. Appl. Opt. **25**, 403–409 (1986)

Edner, H., Amer, R., Ragnarson, P., Rudin, M., Svanberg, S.: Atmospheric NH_3 monitoring by long-path UV absorption spectroscopy. In: Proceedings of International Congress on Optical Science and Engineering. Environment and Pollution Measurement Sensors and Systems, Den Haag (1990)

Edner, H., Ragnarson, P., Svanberg, S.: A multi-path DOAS system for large area pollution monitoring. In: Borrell, P.M., et al. (eds.) Proceedings of EUROTRAC Symposium 1992, pp. 220–223, SPB Academic Publishing BV, Den Haag (1992)

Edner, H., Ragnarson, P., Spännare, S., Svanberg, S.: Differential optical absorption spectroscopy (DOAS) system for urban atmospheric pollution monitoring. Appl. Opt. **32**, 327–333 (1993a)

Edner, H., Ragnarson, P., Spännare, S., Svanberg, S.: Differential optical absorption spectroscopy (DOAS) system for urban atmospheric pollution monitoring. Appl. Opt. **32**, 327 (1993b)

Edner, H., Ragnarsson, P., Svanberg, S., Wallinder, E.: Simultaneous tropospheric ozone monitoring using lidar and DOAS systems. Lund Reports on Atomic Physics LRAP – 155 (1994a)

Edner, H., Ragnarson, P., Svanberg, S., Wallinder, E., Ferrara, E., Cioni, R., Raco, B., Taddeucci, G.: Total fluxes of sulfur-dioxide from the Italian volcanoes Etna, Stromboli and Vulcano measured by differential absorption LIDAR and passive differential optical-absorption spectroscopy. J. Geophys. Res. **99**(D9), 18827–18838 (1994b)

Edwards, D.P., Lamarque, J.-F., Attié, J.-L., Emmons, L.K., Richter, A., Cammas, J.-P., Gille, J.C., Francis, G.L., Deeter, M.N., Warner, J., Ziskin, D.C., Lyjak, L.V., Drummond, J.R., Burrows, J.P.: Tropospheric ozone over the tropical Atlantic: a satellite perspective. J. Geophys. Res. **108**(D8), 4237 (2003). doi:10.1029/2002JD002927

Ehhalt, D.H., Drummond, J. W.: The tropospheric cycle of NO_X. In: Chemistry of the Unpolluted and Polluted Troposphere. D. Reidel Publishing, p. 219 (1982)

Ehhalt, D.H., Dorn, H.-P., Poppe, D.: The chemistry of the hydroxyl radical in surface air. Proc. Roy. Soc. Edinburgh **97B**, 17–34 (1991)

Ehhalt, D.H.: Gas phase chemistry of the troposphere In: Zellner, R. (ed.) Global Aspects of Atmospheric Chemistry. Deutsch Bunsen-Gesellschaft für Physikalische Chemie, Steinkopf, Darmstadt, Springer, New York (1999)

Eisberg-Resnik, R.: Quantum physics. John Wiley & Sons, Inc. (1985)

Eisele, F.L., Tanner, D.J.: Ion-assisted tropospheric OH measurements. J. Geophys. Res. **D5**, 9295–9308 (1991)

Eisele, F.L., Mount, G.H., Fehsenfeld, F.C., Harder, J., Madronicj, E., Parrish, D.D., Roberts, J., Trainer, M., Tanner, D.: Intercomparison of tropospheric OH and ancillary trace gas measurements at Fritz Peak Observatory, Colorado. J. Geophys. Res. **D99**, 18605–18626 (1994)

Eisele, F.L., Tanner, D.J., Cantrell, C.A., Calvert, J.G.: Measurements and steady state calculations of OH concentrations at Mauna Loa Observatory. J. Geophys. Res. **101**, 14665–14679 (1996)

Eisinger, M., Richter, A., Ladstätter-Weißmayer, A., Burrows, J.P.: DOAS zenith sky observations: 1. BrO measurements over Bremen (53°N) 1993–1994. J. Atmos. Chem. **26**, 93–108 (1997)

Eisinger, M., Burrows, J.P.: Tropospheric sulfur dioxide observed by the ERS-2 GOME instrument. Geophys. Res. Lett. **25**, 4177–4180 (1998)

Elokhov, A.S., Gruzdev, A.N.: Spectrometric measurements of of total NO_2 in different regions of the globe. SPIE **2107**, 111–121 (1993)

Elokhov, A.S., Gruzdev, A.N.: Estimation od tropospheric and stratospheric NO_2 from spectrometric measurements of column NO_2 abundances. SPIE **2506**, 444–455 (1995)

Engeln, R., Berden, G., Peeters, R., Meijer, G.: Cavity enhanced absorption and cavity enhanced magnetic rotation spectroscopy. Rev. Sci. Instrum. **69**, 3763–3769 (1998)

Erle, F., Pfeilsticker, K., Platt, U.: On the influence of tropospheric clouds on zenith-scattered-light measurements of stratospheric species. Geophys. Res. Lett. **22**, 2725–2728 (1995)

Erle, F., Grendel, A., Perner, D., Platt, U., Pfeilsticker, K.: Evidence of heterogeneous bromine chemistry on cold stratospheric sulphate aerosols. Geophys. Res. Lett. **25**, 4329–4332 (1998)

Erle, F.: Untersuchungen zur Halogenaktivierung der winterlichen arktischen Stratosphäre anhand flugzeuggestützter spektroskopischer Messungen. Ph.D. thesis, University of Heidelberg (1999)

ESA.: The GOME users manual. In: Bednarz, F. (ed.) ESA Publication Division, ESTEC, Noordwijk, The Netherlands (1995)

Etzkorn, T., Klotz, B., Sörensen, S., Patroescu, I.V., Barnes, I., Becker, K.H., Platt, U.: Gas-phase absorption cross sections of 24 monocyclic aromatic hydrocarbons in the UV and IR spectral ranges. Atmos. Environ. **33**, 525–540 (1999)

EUROTRAC Final Report.: Vol. 8: Instrument development for atmospheric research and monitoring. In: Bösenberg, J., Brassington, D., Simon, P.C. (eds.) Chapter 11, Springer Verlag, Berlin, Heidelberg, New York, ISBN 3-540-62516-X (1997)

Evangelisti, F., Giovanelli, G., Orsi, G., Tirabassi, T., Vittori, O.: Application features of mask correlation spectrophotometry to long horizontal paths. Atmos. Environ. **12**, 1125–1131 (1978)

Evangelisti, F., Baroncelli, A., Bonasoni, P., Giovanelli, G., Ravegnani, F.: Differential optical absorption spectrometer for measurement of tropospheric pollutants. Appl. Opt. **34**, 2737–2744 (1995)

Fabry, C.: L'absorption de l'ultraviolet par l'ozone et la limite du spectre solaire. J. Phys. Radium **3**, 196–206 (1913)

Famy, O.G., Famy, M.J.: Mutagenicity of N-α-Acetoxyethyl-N-ethylnitrosamine and N,N-Diethylnitrosamine in relation to the mechanism of metabolic activation of Dialkylnitrosamines. Cancer Res. **36**, 4504–4512 (1976)

Fan, S.-M., Jacob, D.J.: Surface ozone depletion in the Arctic spring sustained by bromine reactions on aerosols. Nature **359**, 522–524 (1992)

Farman, J.C., Gardiner, B.G., Shanklin, J.D.: Large losses of total ozone in Antarctica reveal seasonal ClO_X/NO_X interaction. Nature **315**, 207–210 (1985)

Fastie, W.G.: Ebert spectrometer reflections. Phys. Today **4**(1), 37–43 (1991)

Fayt, C., Dufour, P., Hermans, C., van Roozendael, M., Simon, P.C.: Instrument and software development for DOAS measurements of atmospheric constituents. In: Borrell, P.M., et al. (eds.) Proceedings of EUROTRAC Symposium 1992, pp. 231–233.SPB Academic Publishing BV, Den Haag (1992)

Febo, A., Perrino, C., Allegrini, I.: Measurement of nitrous acid in Milan, Italy, by DOAS and diffusion denuders. Atmos. Environ. **30**(21), 3599–3609 (1996)

Feigelson, M.E.: Radiation in a cloudy atmosphere. D. Reidel Publishing Company, Dordrecht (1981)

Felton, C.C., Sheppard, J.C., Campbell, M.J.: The radiochemical hydroxyl radical measurement method. Environ. Sci. Technol. **24**, 1841–1847 (1990)

Fenger, J.: Urban air quality. Atmos. Environ. **33**(29), 4877–4900 (1999)

Ferlemann, F., Camy-Peyret, C., Fitzenberger, R., Harder, H., Hawat, T., Osterkamp, H., Perner, D., Platt, U., Schneider, M., Vradelis, P., Pfeilsticker, K.: Stratospheric BrO profile measured at different latitudes and seasons: measurement technique. Geophys. Res. Lett. **25**, 3847–3850 (1998)

Ferlemann, F., Bauer, N., Fitzenberger, R., Harder, H., Osterkamp, H., Perner, D., Platt, U., Schneider, M., Vradelis, P., Pfeilsticker, K.: Differential optical

absorption spectroscopy instrument for stratospheric balloon-borne trace gas studies. Appl. Opt. **39**, 2377–2386 (2000)
Fickert, S., Adams, J.W., Crowley, J.N.: Activation of Br_2 and BrCl via uptake of HOBr onto aqueous salt solutions. J. Geophys. Res. **104**, 23719–23728 (1999)
Fiedler, M., Frank, H., Gomer, T., Hausmann, M., Pfeilsticker, K., Platt, U.: Groundbased spectroscopic measurements of stratospheric NO_2 and OClO in Arctic winter 1989/90. Geophys. Res. Lett. **20**, 963–966 (1993)
Fiedler, S.E.: Incoherent broad-band cavity-enhanced absorption spectroscopy. Ph.D. thesis, D83, Faculty II—Mathematics and Sciences, Technical University of Berlin (TU) (2005)
Filsinger, F.: MAX-DOAS measurements of tropospheric BrO at the Hudson Bay. Diploma thesis, University of Heidelberg (2004)
Finlayson-Pitts, B.J., Johnson, S.N.: The reaction of NO_2 with NaBr: Possible source of BrNO in polluted marine atmospheres. Atmos. Environ. **22**, 1107–1112 (1988)
Finlayson-Pitts, B.J., Ezell, M.J., Pitts, J.N.: Formation of chemically active chlorine compounds by reactions of atmospheric NaCl particles with gaseous N_2O_5 and $ClONO_2$. Nature **337**, 241–244 (1989)
Finlayson-Pitts, B.J., Livingston, F.E., Berko, H.N.: Ozone destruction and bromine photo chemistry in the Arctic spring. Nature **343**, 622–625 (1990)
Finlayson-Pitts, B.J., Pitts, J.N.: Chemistry of the Upper and Lower Atmosphere: Theory, Experiments and Applications, Vol. xxii, 969 pp. Academic, San Diego (2000)
Finlayson-Pitts, B.J., Wingen, L.M., Sumner, A.L., Syomin, D., Ramazan, K.A.: The heterogeneous hydrolysis of NO_2 in laboratory systems and in outdoor and indoor atmospheres. An integrated mechanism. Phys. Chem. Chem. Phys. **5**, 223–242 (2003)
Fischer.: Modelling of low-power high-pressure discharge lamps. Philips J. Res. **42**, 58–85 (1987)
Fischer, H.: Remote sensing of atmospheric trace gases. Interdisc. Sci. Rev. **18**(3), 185–191 (1993)
Fischer, H., Oelhaf, H.: Remote sensing of vertical profiles of atmospheric trace constituents with MIPAS limb emission spectrometers. Appl. Opt. **35**(16), 2787–2796 (1996)
Fish, D.J., Aliwell, S.R., Jones, R.L.: Mid-latitude observations of the seasonal variation of BrO: 2. interpretation and modelling study. Geophys. Res. Lett. **24**, 1199–1202 (1997)
Fish, D.J., Roscoe, H.K., Johnston, P.V.: Possible causes of stratospheric NO_2 trends observed at Lauder, New Zealand. Geophys. Res. Lett. **27**, 3313–3316 (2000)
Fitzenberger, R., Bösch, H., Camy-Peyret, C., Chipperfield, M.P., Harder, H., et al.: First profile measurements of tropospheric BrO. Geophys. Res. Lett. **27**, 2921–2924 (2000)
Fix, A., Ehret, G., Flentje, H., Poberaj, G., Gottwald, M., Finkenzeller, H., Bremer, H., Bruns, M., Burrows, J.P., Kleinböhl, A., Küllmann, H., Kuttippurath, J., Richter, A., Wang, P., Heue, K.-P., Platt, U., Pundt, I., Wagner, T.: SCIAMACHY validation by aircraft remote measurements: design, execution, and first results of the SCIA-VALUE mission. Atmos. Chem. Phys. **5**, 1273–1289 (2005)
Fleischmann, O.C., Burrows, J.P.: University of Bremen, Germany, unpublished results (2002)

Fleischmann, O.C., Orphal, J., Burrows, J.P.: New ultraviolet absorption cross-sections of BrO at atmospheric temperatures measured by time-windowing Fourier transform spectroscopy. J. Photochem. Photobiol. A Chem. **168**, 117–132 (2004)

Flentje, H., Dubois, R., Heintzenberg, J., Karbach, H.J.: Retrieval of aerosol properties from boundary layer extinction measurements with a DOAS system. Geophys. Res. Lett. **24**, 2019–2022 (1997)

Foster, K.L., Plastridge, R.A., Bottenheim, J.W., Shepson, P.B., Finlayson-Pitts, B.J., Spicer, C.W.: The role of Br_2 and BrCl in surface ozone destruction at polar sunrise. Science **291**, 471–474 (2001)

Francis, P., Burton, M.R., Oppenheimer, C.: Remote measurements of volcanic gas compositions by solar occultation spectroscopy. Nature **396**, 567–569 (1998)

Frank, H., Platt, U.: Advanced calculation procedures for the interpretation of skylight measurements. In: Proceedings of First European Ozone Workshop, pp. 65–68. Schliersee (1990)

Frank, H.: Ein Strahlungstransportmodell zur Interpretation von spektroskopischen Spurenstoffmessungen in der Erdatmosphäre. Diploma thesis, University of Heidelberg (1991)

Frankenberg, C., Platt, U., Wagner, T.: Iterative maximum a posteriori (IMAP)-DOAS for trace gas retrieval of strong absorbers: model studies for CH_4 and CO_2 retrieval from near infrared spectra of SCIAMACHY onboard ENVISAT. Atmos. Chem. Phys. **4**, 6067–6106 (2004)

Frankenberg, C., Platt, U., Wagner, T.: Retrieval of CO from SCIAMACHY onboard ENVISAT detection of strongly polluted areas and seasonal patterns in global CO abundances. Atmos. Chem. Phys. **4**, 8425–8438 (2004)

Frankenberg, C., Meirink, J.F., van Weele, M., Platt, U., Wagner, T.: Assessing methane emissions from global space-borne observations. Science **308**, 1010–1014 (2005)

Frankenberg, C., Meirink, J.F., Bergamaschi, P., Goede, A., Heimann, M., Körner, S., Platt, U., van Weele, M., Wagner, T.: Satellite chartography of atmospheric methane from SCIAMACHY onboard ENVISAT: (I) Analysis of the years 2003 and 2004. J. Geophys. Res. **111**, D07303 (2006). doi: 10.1029/2005JD006235

Franzblau, E., Popp, C.J.: Nitrogen oxides produced from lightning. J. Geophys. Res. **84**(D8), 11089–11104

Fricke, W., Beilke, S.: Changing concentrations and deposition of sulfur and nitrogen compounds in Central Europe between 1980 and 1992. In: Slanina, J., Angeletti, G., Beilke, S (eds.) Air Pollution Research Report 47, CEC, Proceedings of Joint Workshop CEC/BIATEX of Eurotrac, 4–7 May 1993, Aveiro, Portugal, pp. 9–30 (1993)

Fricke, W., Uhse, K.: Anteile von Witterung und Emissionsminderung am SO_2-Rückgang in Deutschland, Staub-Reinhaltung der Luft **54**, 289–296 (1994)

Friedeburg, V.C., Wagner, T., Geyer, A., Kaiser, N., Vogel, B., Vogel, H., Platt, U.: Derivation of troposphere NO_3 profiles using Off-axis-DOAS measurements during sunrise and comparison with simulations. J. Geophys. Res. **107**, D13 (2002). doi: 10.1029/2001JD000481

Friedeburg, V.C.: Derivation of trace gas information combining differential optical absorption spectroscopy with radiative transfer modelling. Ph.D. thesis, University of Heidelberg (2003)

Frieß, U., Chipperfield, M., Otten, C., Platt, U., Pyle, J., Wagner, T., Pfeilsticker, K.: Intercomparison of measured and modelled BrO slant column amounts for the Arctic winter and spring 1994/95. Geophys. Res. Lett. **26**, 1861–1864 (1999)

Frieß, U.: Spectroscopic measurements of atmospheric trace gases at Neumayer-station, Antarctica. Ph.D. thesis, University of Heidelberg, Heidelberg (2001)

Frieß, U., Wagner, T., Pundt, I., Pfeilsticker, K., Platt, U.: Spectroscopic measurements of tropospheric iodine oxide at Neumayer station, Antarctica. Geophys. Res. Lett. **28**, 1941–1944 (2001)

Frieß, U., Hollwedel, J., König-Langlo, G., Wagner, T., Platt, U.: Dynamics and chemistry of tropospheric bromine explosion events in the Antarctic coastal region. J. Geophys. Res. **109**, D06305 (2004). doi:10.1029/2003JD004133

Frieß, U., Kreher, K., Johnston, P.V., Platt, U.: Ground-based DOAS measurements of stratospheric trace gases at two Antarctic stations during the 2002 ozone hole period. J. Atmos. Sci. **62**(3), 765–777 (2005). doi: 10.1175/JAS-3319.1 (JAS-1076)

Frieß, U., Monks, P.S., Remedios, J.J., Rozanov, A., Sinreich, R., Wagner, T., Platt, U.: MAX-DOAS O_4 measurements: a new technique to derive information on atmospheric aerosols. (II) Modelling studies. J. Geophys. Res. **111**, D14203 (2006). doi:10.1029/2005JD006618

Frins, E., Bobrowski, N., Platt, U., Wagner, T.: Tomographic MAX-DOAS observations of sun illuminated targets: a new technique providing well defined absorption paths in the boundary layer. Appl. Opt. **45**(24), 6227–6240 (2006)

Fung, K., Grosjean, D.: Determination of nanogram amounts of carbonyls as 2,4-dinitrophenylhydrazine by high performance liquid chromatography. Aerosol Sci. Technol. **53**, 168–171 (1981)

Funk, O.: Photon path length distributions for cloudy skies; oxygen a-band measurements and radiative transfer calculations. Ph.D. thesis, University of Heidelberg (2000)

Funk, O., Pfeilsticker, K.: Photon path lengths distributions for cloudy skies: oxygen A-Band measurements and model calculations. Annal. Geophys. **21**, 615–626 (2003)

Fuqi, S., Kuze, H., Yoshii, Y., Nemoto, M., Takeuchi, N., Kimura, T., Umekawa, T., Yoshida, T., Hioki, T., Tsutsui, T., Kawasaki, M.: Measurement of regional distribution of atmospheric NO_2 and aerosol particles with flashlight long-path optical monitoring. Atmos. Environ. **39**, 4959–4968 (2005)

Gall, R., Perner, D., Ladstätter-Weissenmayer, A.: Simultaneous determination of NH_3, SO_2, NO and NO_2 by direct UV-absorption in ambient air. Fresenius J. Anal. Chem. **340**, 646–649 (1991)

Galle, B., Axelsson, H., Edner, H., Eilard, A., Mellqvist, J., Ragnarson, P., Svanberg, S., Zetterberg, L.: Development of DOAS for atmospheric trace species monitoring, EUROTRAC Annual Report 1991 (1991)

Galle, B., Klemedtsson, L., Griffith, D.W.: Application of an FTIR for measurements of N_2O fluxes using micrometeorological methods, an ultralarge chamber system and conventional field chambers. J. Geophys. Res. **99**, 16575–16583 (1994)

Galle, B., Oppenheimer, C., Geyer, A., McGonigle, A, Edmonds, M., Horrocks, L.: A miniaturised ultraviolet spectrometer for remote sensing of SO_2 fluxes: a new tool for volcano surveillance. J. Volcanol. Geotherm. Res. **119**, 214–254 (2003)

Galle, B., Platt, U, Van Roozendael, M., Oppenheimer, C., Hansteen, T., Boudon, G., Burton, M., Delgado, H., Strauch, W., Malavassi, E., Garzon, G.,

Pullinger, C., Kasereka, M., Molina, M., Molina, L., Carn, S.: NOVAC, network for observation of volcanic and atmospheric change. Project proposal to the European Union (2004)

Gamache, R.R., Goldman, A., Rothman, L.S.: Improved spectral parameters for the three most abundant isotopomers of the oxygen molecule. J. Quant. Spectrosc. Radiat. Transf. **59**(3–5), 495–509 (1998)

George, G.A., Morris, G.C.: The intensity of absorption of naphthalene from 30000 cm^{-1} to 53000 cm^{-1}. J. Mol. Spectrosc. **26**, 67–71 (1968)

George, L.A., Hard, T.M., O'Brien, R.J.: Measurement of free radicals OH and HO_2 in Los Angeles smog. J. Geophys. Res. **104**, 11643–11655 (1999)

German, K.R.: Direct measurement of the of the radiative lifetime of the A $^2\Sigma^+$(v'=0) states of OH and OD. J. chem. Phys. **62**, 2584–2587 (1975)

Gershenzon, M.Y., Il'in, S., Fedetov, N.G., Gershenzon, Y.M.: The mechanism of reactive NO_3 uptake on dry NaX (X=Cl, Br). J. Atmos. Chem. **34**, 119–135 (1999)

Geyer, A., Alicke, B., Mihelcic, D., Stutz, J., Platt, U.: Comparison of tropospheric NO_3 radical measurements by differential optical absorption spectroscopy and matrix isolation electron spin resonance. J. Geophys. Res. **104**, 26097–26105 (1999)

Geyer, A.: The role of the nitrate radical in the boundary layer – observations and modeling studies. Doctoral Thesis, University of Heidelberg, Germany (2000)

Geyer, A., Ackermann, R., Dubois, R., Lohrmann, B., Müller, T., Platt, U.: Long-term observation of nitrate radicals in the continental boundary layer near Berlin. Atmos. Environ. **35**, 3619–3631 (2001a)

Geyer, A., Alicke, B., Konrad, S., Schmitz, T., Stutz, J., Platt, U.: Chemistry and oxidation capacity of the nitrate radical in the continental boundary layer near Berlin. J. Geophys. Res. **106**, 8013–8025 (2001b)

Geyer, A., Platt, U.: The temperature dependence of the NO_3 degradation frequency—a new indicator for the contribution of NO_3 to VOC oxidation and NO_X removal in the atmosphere. J. Geophys. Res. **107**, 4431–4442 (2002). doi: 10.1029/2001JD001215

Geyer, A., Hofzumahaus, A., Holland, F., Konrad, S., Klüpfel, T., Pätz, H.-W., Perner, D., Schäfer, H.-J., Volz-Thomas, A., Platt, U.: Nighttime production of peroxy and hydroxyl radicals during the BERLIOZ campaign. Observations and modeling studies. J. Geophys. Res. **108**(D4), 8249 (2003a). doi:10.1029/2001JD000656, (PHOEBE: BERLIOZ special section)

Geyer, A., Alicke, B., Ackermann, R., Martinez, M., Harder, H., Brune, W., Piero di Carlo, Williams, E., Jobson, T., Hall, S., Shetter, R., Stutz, J.: Direct observations of daytime NO_3: implications for urban boundary layer chemistry. J. Geophys. Res. **108**(D12), 4368 (2003b). doi:10.1029/2002JD002967

Geyer, A., Stutz, J.: The Vertical structure of OH-HO_2-RO_2 Chemistry in the nocturnal boundary layer: A one-dimensional study. J. Geophys. Res. **109**, D16301, doi: 10.1029/2003JD004425 (2004)

Gil, M., Puentedura, O., Yela, M., Parrondo, C., Jadhav, D., Thorkelsson, B.: OClO, NO_2 and O_3 total columns observations over Iceland during the winter 1993/94. Geophys. Res. Lett. **23**, 3337–3340 (1996)

Gil, M., Puentedura, O., Yela, E., Cuevas, M.: Behavior of NO_2 and O_3 columns during the eclipse of February 26, 1998, as measured by visible spectroscopy. J. Geophys. Res. **105**, 3583 (2000)

Giovanelli, G., Tirabassi, T., Sandroni, S.: Sulphur dioxide plume structure by mask correlation spectroscopy. Atmos. Environ. **13**, 1311–1318 (1979)

Gleason, W.A., Dunker, A.M.: Investigation of background radical sources in a teflon-film irradiated chamber. Environ. Sci. Technol. **23**, 970–978 (1989)

Goldman, A., Gillis, J.R.: Spectral line parameters of the A $^2\Sigma^+ \leftarrow$ X $^2\Pi$ (0, 0) band of OH for atmospheric and high temperatures. J. Quant. Spectrosc. Radiat. Transfer **25**, 111–135 (1981)

Goodman, A.L., Underwood, G.M., Grassian, V.H.: Heterogeneous reaction of NO_2: Characterization of gas-phase and adsorbed products from the reaction, 2 NO_2(g) + H_2O(a) $\longrightarrow$ HONO(g) + NO_3(a) on hydrated silica particles. J. Phys. Chem. A **103**, 7217–7223 (1999)

Gölz, C., Senzig, J., Platt, U.: NO_3 initiated oxidation of biogenic hydrocarbons, CHEMOSPHERE. Glob. Change Sci. **3**, 339–352 (2001)

GOME Users Manual.: SP-1182, European Space Agency, Publications Division, ESTEC, Noordwijk, The Netherlands, F. Bednarz (ed.), ISBN 92-9092-327-x (1995)

Gomer, T., Stutz, J., Heintz, F., Platt, U.: MFC Handbook. University of Heidelberg (1995)

Götz, P.F.W., Meetham, A.R., Dobson, G.M.B.: The vertical distribution of ozone in the atmosphere. Proc. R. Soc. Lond. A **145**, 416–446 (1934)

Goutail, F., Pommereau, J.-P., Phillips, C., Deniel, C., Sarkissian, A., Lefévre, F., Kyrö, E., Rummukainen, M., Eriksen, P., Andersen, S.B., Kaastad-Hoiskar, B.-A., Braathen, G., Dorokhov, V., Khatatov, V.U.: Depletion of column ozone in the Arctic during the winters of 1993–94 and 1994–95. J. Atmos. Chem. **32**, 1–34 (1999)

Goy, C.A., Pritchard, C.A.: Pressure dependence of the visible iodine bands. J. Mol. Spectrosc. **12**, 38–44 (1964)

Grainger, J.F., Ring, J.: Anomalous fraunhofer line profiles. Nature **193**, 762 (1962)

Grant, W.B., Menzies, R.T.: A survey of laser and selected optical systems for remote measurement of pollutant gas concentrations. J. Air Pollut. Control Assoc. **33**, 187–194 (1983)

Grassi, L., Guzzi, R.: Theoretical and practical consideration on the construction of a zero geometrical loss multi-pass cell based on the use of monolithic multiple-face retro-reflectors. Appl. Opt. **40**(33), 6062–6071 (2001)

Greenblatt, G.D., Orlando, J.J., Burkholder, J.B., Ravishankara, A.R.: Absorption measurements of oxygen between 330 and 1140 nm. J. Geophys. Res. **95**, 18577–18582 (1990)

Grzegorski, M., Wenig, M., Platt, U., Stammes, P., Fournier, N., Wagner, T.: The Heidelberg iterative cloud retrieval utilities (HICRU) and its application to GOME data. Atmos. Chem. Phys. **6**, 4461–4476 (2006)

Guenther, A., Hewitt, C.N., Erickson, D., Fall, R., Geron, C., Graedel, T., Harley, P., Klinger, L., Lerdau, M., McKay, W.A., Pierce, T., Scholes, B., Steinbrecher, R., Tallamraju, R., Taylor, J., Zimmerman, P.: A global model of natural volatile organic compound emissions. J. Geophys. Res. **100**(D5), 8873–8892 (1995). doi: 10.1029/94JD02950

Gurlit, W., Giesemann, C., Ebert, V., Zimmermann, R., Platt, U., Wolfrum, J., Burrows, J.P.: Lightweight diode laser spectrometer "CHILD" for balloon-borne measurements of water vapor and methane. Appl. Opt. **44**(1), 91–101 (2005)

Gutzwiller, L., Arens, F., Baltensperger, U., Gäggeler, H.W., Ammann, M.: Significance of semivolatile diesel exhaust organics for secondary HONO formation. Environ. Sci. Technol. **36**, 677–682 (2002)

Guzzi, R., Burrows, J., Cervino, M., Levoni, C., Cattani, E., Kurosu, T., Torricella, T.: GOME cloud and aerosol data products algorithms development. Report, ESA Contract 11572/95/NL/CN (1998)

Guzzi, R., Zoffoli, S., Corradini, S., Chiarini, M.: Information content of the radiative transfer theory. Agenzia Spaziale Italiana, Rome Report (2003)

Haagen-Smit, A.J.: Chemistry and physiology of Los Angeles smog. Ind. Eng. Chem. **44**, 1342–1346 (1952)

Haagen-Smit, A.J., Fox, M.M.: Photochemical ozone formation with hydrocarbons and automobile exhaust. J. Air Pollut. Control Assoc. **4**, 105–109 (1954)

Hak, C., Pundt, I., Trick, S., Kern, C., Platt, U., Dommen, J., Ordóñez, C., Prévôt, A.S.H., Junkermann, W., Astorga-Lloréns, C., Larsen, B.R., Mellqvist, J., Strandberg, A., Yu, Y., Galle, B., Kleffmann, J., Lörzer, J.C., Braathen, G.O., Volkamer, R.: Intercomparison of four different in-situ techniques for ambient formaldehyde measurements in urban air. J. Atmos. Chem. Phys. **5**, 2881–2900 (2005)

Hall, C.T., Blacet, F.E.: Separation of the absorption spectra of NO_2 and N_2O_4 in the range of 2400–5000 A. J. Chem. Phys. **20**, 1745–1749 (1952)

Hallstadius, H., Unéus, L., Wallin, S.: System for evaluation of trace gas concentration in the atmosphere based on the differential optical absorption spectroscopy technique. Proc. Soc. Photo. Opt. Instrum. Eng. **1433**, 36–43 (1991)

Hallquist, M., Stewart, D.J., Stephenson, S.K., Cox, R.A.: Hydrolysis of N_2O_5 on sub-micron sulfate aerosols. Phys. Chem. Chem. Phys. **5**(16), 3453–3463 (2003)

Hamada, Y., Merer, A.J.: Rotational structure at the long wavelength end of the 2900 A system of SO_2. Can. J. Phys. **52**, 1443–1457 (1974)

Hanst, P.L., Lefohn, A.S., Gay, B.W.: Detection of atmospheric pollutants at parts-per-billion levels by infrared spectroscopy. Appl. Spectrosc. **27**, 188–198 (1973)

Hanst, P.L.: Air pollution measurement by Fourier transform spectroscopy. Appl. Opt. **17**, 1360–1366 (1978)

Hanst, P.L., Hanst, S.T.: Gas measurement in the fundamental infrared region. In: Sigrist, M.W. (ed.) Air Monitoring by Spectroscopic Techniques, Chemical Analysis Series, Vol. 127, pp. 335–470. Wiley, New York (1994)

Hard, T.M., Chan, C.Y., Mehrabzadeh, A.A., Obrien, R.J.: Diurnal HO_2 cycles at clean air and urban sites in the troposphere. J. Geophys. Res. **97**, 9785–9794 (1992)

Hard, T.M., Mehrabzadeh, A.A., Chan, C.Y., O'Brien, R.J.: FAGE measurements of tropospheric HO with measurements and model interferences. J. Geophys. Res. **97**, 9795–9817 (1992)

Hard, T.M., George, L.A., O'Brien, R.J.: FAGE determination of tropospheric HO and HO_2. J. Atmos. Sci. **52**, 3354–3372 (1995)

Hard, T.M., George, L.A., O'Brien, R.J.: An absolute calibration for gas-phase hydroxyl measurements. Environ. Sci. Technol. **36**, 1783–1790 (2002)

Harder, J.W., Brault, J.W., Johnston, P.V., Mount, G.H.: Temperature dependent NO_2 cross section at high spectral resolution. J. Geophys. Res. **102**(D3), 3861–3879 (1997)

Harder, J.W., Jakoubek, R.O., Mount, G.H.: Measurement of tropospheric trace gases by long-path differential absorption spectroscopy during the 1993 OH photochemistry experiment. J. Geophys. Res. **102**, 6215–6226 (1997)

Harder, H., Camy-Peyret, C., Ferlemann, F., Fitzenberger, R., Hawat, T., Osterkamp, H., Perner, D., Platt, U., Schneider, M., Vradelis, P., Pfeilsticker, K.: Stratospheric BrO profile measured at different latitudes and seasons. Atmospheric observations. Geophys. Res. Lett. **25**, 3843–3846 (1998)

Harder, H., Bösch, H., Camy-Peyret, C., Chipperfield, M., Fitzenberger, R., Payan, S., Perner, D., Platt, U., Sinnhuber, B.-M., Pfeilsticker, K.: Comparison of measured and modelled stratospheric BrO: implications for the total amount of stratospheric bromine. Geophys. Res. Lett. **27**, 3695–3698 (2000)

Harris, G.W., Carter, W.P.L., Winer, A.M., Pitts, J.N., Platt, U., Perner, D.: Observations of nitrous acid in the Los Angeles atmosphere and implications for the predictions of ozone-precursor relationships. Environ. Sci. Technol. **16**, 414–419 (1982)

Harris, G.W., Winer, A.M., Pitts, J.N., Platt, U., Perner, D.: Measurement of HONO, NO_3 and NO_2 by long-path differential optical absorption spectroscopy in the Los Angeles basin: In: Killinger, D.K., Mooradian, A. (eds.) Optical and Laser Remote Sensing, Vol. 39, pp. 106–113. Springer, New York (1983)

Harris, G.W., Mackay, G.I., Iguchi, T., Mayne, L.K., Schiff, H.I.: Measurements of formaldehyde in the troposphere by tunable diode laser absorption spectroscopy. J. Atmos. Chem. **8**, 119–137 (1989)

Harrison, A.W.: Midsummer stratospheric NO_2 at latitude 45°S. Can. J. Phys. **57**, 1110–1117 (1979)

Harrison, R.M., Peak, J.D., Collins, G.M.: Tropospheric cycle of nitrous acid. J. Geophys. Res. **101**, 14429–14439 (1996)

Hartley, W.N.: On the probable absorption of solar radiation by atmospheric ozone. Chem. News **42**, 268 (1880)

Hartley, W.N.: On the absorption spectrum of ozone. J. Chem. Soc. **39**, 57–60 (1881)

Harwood, M.H., Jones, R.L.: Temperature dependent ultraviolet-visible absorption cross sections of NO_2 and N_2O_4: low-temperature measurements of the equilibrium constant for 2 NO_2 to N_2O_4. J. Geophys. Res. **99**, 22.955–22.964 (1994)

Harwood, M., Burkholder, J., Hunter, M., Fox, R., Ravishankara, A.: Absorption cross sections and self-reaction kinetics of the IO radical. J. Phys. Chem. A **101**, 853–863 (1997)

Hashmonay, R.A., Yost, M.G., Wu, C.-F.: Computed tomography of air pollutants using radial scanning path-integrated optical remote sensing. Atmos. Environ. **33**, 267–274 (1999)

Hastie, D.R., Weißenmayer, M., Burrows, J.P., Harris, G.W.: Calibrated chemical amplifier for atmospheric RO_X measurements. Anal. Chem. **63**, 2048–2057 (1991)

Haug, H.: Raman-Streuung von sonnenlicht in der Erdatmosphäre, Diploma thesis, University of Heidelberg (1996)

Haug, H., Pfeilsticker, K., Platt, U.: Vibrational Raman scattering in the atmosphere, University of Heidelberg, unpublished manuscript (1996)

Haugen (ed.): Workshop on micrometeorology. American Meteorological Society Science Press, Ephrata (1973)

Hausmann, M., Ritz, D., Platt, U.: New coaxial "long-path-DOAS" system: first application to BrO measurement in the Arctic troposphere. In: Schiff, H.I.,

Platt, U. (eds.) Proceedings Europto Series. Optical Methods in Atmospheric Chemistry, Vol. **1715**, pp. 341–352. (1992)

Hausmann, M., Rudolf, T., Platt, U.: Spectroscopic Measurement of Bromine Oxide, Ozone, and Nitrous acid in Alert, NATO—ASI Series Subseries I "Global Environmental Change", Vol. 7, pp. 189–203. Springer-Verlag (1993)

Hausmann, M., Platt, U.: Spectroscopic measurement of bromine oxide and ozone in the high Arctic during polar sunrise experiment 1992. J. Geophys. Res. **99**, 25399–25413 (1994)

Hausmann, M., Brandenburger, U., Brauers, T., Dorn, H.-P.: Detection of tropospheric OH radicals by long-path differential-optical-absorption spectroscopy: experimental setup, accuracy, and precision. J. Geophys. Res. **102**, 16011–16022 (1997)

Hausmann, M., Brandenburger, U., Brauers, T., Dorn, H.-P.: Simple Monte Carlo methods to estimate the spectra evaluation error in differential-optical-absorption spectroscopy. Appl. Opt. **38**(3), 462–475 (1999)

Hawat, T.M., Camy-Peyret, C., Torguet, R.J.: Suntracker for atmospheric remote sensing. Opt. Eng. **37**(05), 1633–1642 (1998)

Heard, D.E., Pilling, M. J.: Measurement of OH and HO_2 in the troposphere. Chem Rev **103**(12), 5163–5198 (2003)

Hebestreit, K., Stutz, J., Rosen, D., Matveev, V., Peleg, M., Luria, M., Platt, U.: First DOAS measurements of tropospheric BrO in mid latitudes. Science **283**, 55–57 (1999)

Hecht, E.: Optics, 4th edn. Adison Wesley, New York. ISBN 0-8053-8566-5 (2002)

Heckel, A.: Messungen troposphärischer Spurengase mit einem MAXDOAS-Instrument Nachweis von troposphärischem Formaldehyd in Norditalien während der Format Kampagne. Diploma thesis, University of Bremen (2003)

Heckel, A., Richter, A., Tarsu, T., Wittrock, F., Hak, C., Pundt, I., Junkermann, W., Burrows, J.P.: MAX-DOAS measurements of formaldehyde in the Po-Valley. Atmos. Chem. Phys. **5**, 909–918 (2005)

Hegels, E., Crutzen, P.J., Klüpfel, T., Perner, D., Burrows, P.J.: Globale distribution of atmospheric bromine Monoxide from GOME on Earth-observing satellite ERS 2. Geophys. Res. Lett. **25**, 3127–3130 (1998)

Heintz, F., Flentje, H., Dubois, R., Platt, U.: Long-term observation of nitrate radicals at the TOR-Station Kap Arkona (Rügen). J. Geophys. Res. **101**, 22891–22910 (1996)

Heismann, B.: Eine CCD-Kamera zur Messung atmosphärischer Spurenstoffe. Diploma thesis, University of Heidelberg (1996)

Helleis, F., Crowley, J., Moortgat, G.: Temperature dependent rate constants and production branching ratios for the gas phase reaction between CH_3O_2 and ClO. J. Phys. Chem. **97**, 11464–11473 (1993)

Helleis, F., Crowley, J., Moortgat, G.: Temperature dependent CH_3OCl formation in the reaction between CH_3O_2 and ClO. Geophys. Res. Lett. **21**(17), 1795–1798 (1994)

Hendrick, F., Barret, B., Van Roozendael, M., Boesch, H., Butz, A., De Mazière, M., Goutail, F., Hermans, C., Lambert, J.-C., Pfeilsticker, K., Pommereau, J.-P.: Retrieval of nitrogen dioxide stratospheric profiles from ground-based zenith-sky UV-visible observations: validation of the technique through correlative comparisons. Atmos. Chem. Phys. **4**, 2091–2106 (2004) SRef-ID: 1680-7324/acp/2004-4-2091

Hendrick, F., Van Roozendael, M., Kylling, A., Petritoli, A., Rozanov, A., Sanghavi, S., Schofield, R., von Friedeburg, C., Wagner, T., Wittrock, F., Fonteyn, D., De Mazière, M.: Intercomparison exercise between different radiative transfer models used for the interpretation of ground-based zenith-sky and multi-axis DOAS observations. Atmos. Chem. Phys. **6**, 93–108 (2006)

Hermes, Th.: Lichtquellen und Optik für die Differentielle Optische Absorptionsspektroskopie. Diploma thesis in physics, University of Heidelberg (1999)

Herriott, D., Kogelnik, H., Kompfner, R.: Off-axis paths in spherical mirror interferometers. Appl. Opt. **3**, 523–526 (1964)

Herriott, D.R., Schulte, H.J.: Folded optical delay lines. Appl. Opt. **4**, 883–889 (1965)

Heue, K.-P., Bruns, M., Burrows, J.P., Lee, W.-D., Platt, U., Pundt, I., Richter, A., Wagner, T., Wang, P.: NO_2 over the tropics and the arctic measured by the AMAXDOAS in September 2002. Proceedings of the 16th ESA symposium on rocket and balloon program and related research, St. Gallen, 02–05 June 2003, ESA SP-530 (2003)

Heue, K.-P., Bruns, M., Burrows, J.P., Friedeburg, V.C., Lee, W.-D., Platt, U., Pundt, I., Richter, A., Wagner, T., Wang, P.: Validation of scientific NO_2-SCIAMACHY data using the AMAXDOAS instrument. Atmos. Chem. Phys. **5**, 1039–1051 (2005)

Himmelmann, S., Orphal, J., Bovensmann, H., Richter, A., Ladstätter-Weißenmayer, A., Burrows, J.P.: First observation of the OIO molecule by time-resolved flash photolysis absorption spectroscopy. Chem. Phys. Lett. **251**, 330–334 (1996)

Hinkley, E.D. (ed.): Laser Monitoring of the Atmosphere, Topics in Applied Physics, Vol. 14. Springer, Berlin (1976)

Hirokawa, J., Onaka, K., Kajii, Y., Akimoto, H.: Heterogeneous processes involving sodium halide particles and ozone: molecular bromine release in the marine boundary layer in the absence of nitrogen oxides. Geophys. Res. Lett. **25**, 2449–2452 (1998)

Hoff, R.M., Millan, M.M.: Remote SO_2 mass flux measurements using Cospec. J. Air Poll. Cont. Assoc. **31**(4) 381–384 (1981)

Hoff, R.M.: Differential SO_2 column measurements of the Mt. Pinatubo volcanic plume. Geophys. Res. Lett. **19**(2), 175–178 (1992)

Hofmann, D., Bonasoni, P., De Maziere, M., Evangelisti, F., Giovanelli, G., Goldman, A., Goutail, F., Harder, J., Jakoubek, R., Johnston, P., Kerr, J., McElroy, Tom., McKenzie, R., Mount, G., Platt, U., Pommereau, J.-P., Sarkissian, A., Simon, P., Solomon, S., Stutz, J., Thomas, A., Van Roosendael, M., Wu, E.: Intercomparison of UV/visible spectrometers for measurement of stratospheric NO_2 for the network for the detection of stratospheric change. J. Geophys. Res. **100**, 16765–16791 (1995)

Hoffmann, T., O'Dowd, C.D., Seinfeld, J.H.: IO homogeneous nucleation. An explanation for coastal new particle formation. Geophys. Res. Lett. **28**(10), 1949–1952 (2001)

Hofzumahaus, A., Dorn, H.-P., Callies, J., Platt, U., Ehhalt, D.H.: Tropospheric OH concentration measurements by laser long-path absorption spectroscopy. Atmos. Environ. **25A**, 2017–2022 (1991)

Hofzumahaus, A., Aschmutat, U., Heßling, M., Ehhalt, F., Holland, D.H.: The measurement of tropospheric OH radicals by laser- induced fluorescence spectroscopy during the POPCORN field campaign. Geophys. Res. Lett. **23**, 2541–2544 (1996)

Hofzumahaus, A., Brauers, T., Aschmutat, U., Brandenburger, U., Dorn, H.-P., Hausmann, M., Heßling, M., Holland, F., Plass-Dülmer, C., Sedlacek, M., Weber, M., Ehhalt, D.H.: Reply to comment by Lanzendorf et al. Geophys. Res. Lett. **24**, 3039–3040 (1997)

Hofzumahaus, A., Aschmutat, U., Brandenburger, U., Brauers, T., Dorn, H.-P., Hausmann, M., Hessling, M., Holland, F., Plass-Dulmer, C., Ehhalt, D.H.: Intercomparison of tropospheric OH measurements by different laser techniques during the POPCORN campaign 1994. J. Atmos. Chem. **31**(1–2), 227–246 (1998)

Hoiskar, B.A.K., Dahlbak, A., Vaughan, G., Braathen, G.O., Goutail, F., Pommereau, P., Kivi, R.: Interpretation of ozone measurements by ground-based visible spectroscopy—a study of seasonal dependence of airmass factors for ozone on climatology data. J. Quant. Spectrosc. Radiat. Transf. **57**, 569–579 (1997)

Holland, F., Aschmutat, U., Heßling, M., Hofzumahaus, A., Ehhalt, D.H.: Highly time resolved measurements of OH during POPCORN using laser-induced fluorescence spectroscopy. J. Atmos. Chem. **31**, 205–225 (1998)

Holland, F., Hessling, M., Hofzumahaus, A.: In-situ measurement of tropospheric OH radicals by laser-induced fluorescence: A description of the KFA instrument. J. Atmos. Sci. **52**, 3393–3401 (1995)

Holland, F., Hofzumahaus, A., Schäfer, J., Kraus, A., Pätz, H.: Measurements of OH and HO_2 radical concentrations and photolysis frequencies during BERLIOZ. J. Geophys. Res. **108**(D4), 8246 (2003). doi:10.1029/2001JD001393 (2003)

Hollwedel, J., Wenig, M., Beirle, S., Kraus, S., Kühl, S., Wilms-Grabe, W., Platt, U., Wagner, T.: Year-to- year variability of polar tropospheric BrO as seen by GOME, (Proc. COSPAR 2002). Adv. Space Res. 804–808 (2004)

Hoogen, R., Rozanov, V.V., Burrows, J.P.: Ozone profiles from GOME satellite data: Algorithm description and first validation. J. Geophys. Res. **104**(D7), 8263–8280 (1999)

Hönninger, G.: Referenzspektren reaktiver Halogenverbindungen für DOAS Messungen. Diploma thesis, Institut für Umweltphysik, University of Heidelberg (1999)

Hönninger, G.: Halogen oxide studies in the boundary layer by multi axis differential optical absorption spectroscopy and active longpath-DOAS. Ph.D. thesis, University of Heidelberg (2002)

Hönninger, G., Platt, U.: The role of BrO and its vertical distribution during surface ozone depletion at Alert. Atmos. Environ. **36**, 2481–2489 (2002)

Hönninger, G., Friedeburg, C.V., Platt, U.: Multi axis differential absorption spectroscopy (MAX-DOAS). Atmos. Chem. Phys. **4**, 231–254 (2004a)

Hönninger, G., Bobrowski, N., Palenque, E.R., Torrez, R., Platt, U.: Reactive bromine and sulfur emissions at salar de uyuni, Bolivia. J. Geophys. Res. **31**, L04101 (2004b). doi:10.1029/2003GL018818

Hönninger, G., Leser, H., Sebastian, O., Platt, U.: Ground-based measurements of halogen oxides at the Hudson Bay by active long path DOAS and passive MAX-DOAS. Geophys. Res. Lett. **31**, L04111 (2004c). doi:10.1029/2003GL018982

Horn, D., Pimentel, G.C.: 2.5 km low-temperature multiple-reflection cell. Appl. Opt. **10**, 1892–1898 (1971)

Horowitz, A., Meller, R., Moortgat, G.K.: The UV/Visible absorption cross section of the a-dicarbonyl compounds: pyruvic acid, biacetyl and glyoxal. J. Photochem. Photobiol. A Chem. **146**, 19–27 (2001)

Howard, C.J.: Kinetics of the reaction of HO_2 with NO_2. J. Chem. Phys. **67**, 5258–5263 (1977)

Howie, W.H., Lane, I.C., Newman, S.M., Johnson, D.A., Orr-Ewing, A.J.: The UV absorption of ClO. Phys. Chem. Chem. Phys. **1**, 3079–3085 (1999)

Hübler, G., Perner, D., Platt, U., Tönnissen, A., Ehhalt, D.H.: Groundlevel OH radical concentration: new measurements by optical absorption. J. Geophys. Res. **89**, 1309–1319

Hutley, M.C.: Diffraction Gratings. Academic, London (1982) (ISSN 0308-5392; 6)

Impey, G.A., Shepson, P.B., Hastie, D.R., Barrie, L.A., Anlauf, K.G.: Measurements of photolyzable chlorine and bromine during the polar sunrise experiment 1995. J. Geophys. Res. **102**(D13), 16005–16010 (1997)

IPCC, Climate Change.: The IPCC Scientific Assessment, Intergovernmental Panel on Climate Change. Cambridge University Press, Cambridge (1992)

IPCC: Climate change 2001. Third assessment report of the intergovernmental panel on climate change. Cambridge University Press, Cambridge (2002)

Isaacs, R.G., Wang, W.-C., Worsham, R.D., Goldenberg, S.: Multiple scattering LOWTRAN and FASCODE models. Appl. Opt. **26**, 1272–1281 (1987)

Jaeglé, L., Jacob, D.J., Brune, W.H., Faloona, I., Tan, D., Heikes, B.G., Kondo, Y., Sachse, G.W., Anderson, B., Gregory, G.L., Singh, H.B., Pueschel, R., Ferry, G., Blake, D.R., Shetter, R.E.: Photochemistry of HO_X in the upper troposphere at northern midlatitudes. J. Geophys. Res. **105**, 3877–3892 (2000)

Janssen, J.: Analyse spectrale des e'le'ments de l'atmosphe're terrestre. C. R. Hebd. Seances Acad. Sci. **101**, 649–651 (1885)

Janssen, J.: Sur les spectres d'absorption de l'oxyge'ne. C. R. Hebd. Seances Acad. Sci. **102**, 1352–1353 (1886)

Janssen, M.A.: An Introduction to the Passive Remote Atmospheric Remote Sensing by Microwave Radiometry, pp. 1–36. Wiley, New York (1993)

Jenkin, M.I., Cox, R.A., Williams, D.J.: Laboratory studies of the kinetics of formation of nitrous acid from the thermal reaction of nitrogen dioxide and water vapour. Atmos. Environ. **22**, 487–498 (1988)

Jimenez, J.L., Bahreini, R., Cocker, D.R. III, Zhuang, H., Varutbangkul, V., Flagan, R.C., Seinfeld, J.H., O'Dowd, C.D., Hoffmann, T.: New particle formation from photooxidation of diiodomethane (CH_2I_2). J. Geophys. Res. **108**(D10), 4318 (2003). doi: 10.1029/2002JD002452

Jimenez, R., Taslakov, M., Simeonov, V., Calpini, B., Jeanneret, F., Hofstetter, D., Beck, M., Faist, J., van den Bergh, H.: Ozone detection by differential absorption spectroscopy at ambient pressure with a 9.6 µm pulsed quantum-cascade laser. Appl. Phys. B **78**, 249 (2004)

Jobson, B.T., Niki, H., Yokouchi, Y., Bottenheim, J., Hopper, F., Leaitch, R.: Measurements of C_2-C_6 hydrocarbons during polar sunrise experiment 1992. J. Geophys. Res. **99**, 25355–25368 (1994)

Johnston, H.S., Graham, R.: Photochemistry of NO_x and HNO_x Compounds. Can. J. Chem. **52**(8), 1415–1423, doi: 10.1139/cjc-52-8, 1415 (1974)

Johnston, H.S., Cantrell, C.A., Calvert, J.G.: Unimolecular decomposition of NO_3 to form NO and O_2 and a review of N_2O_5/NO_3 kinetics. J. Geophys. Res. **91**, 5159–5172 (1986)

Johnston, H.S., Morris, E.D., Van den Bogaerde, J.: Molecular modulation kinetic spectrometry. ClOO and ClO_2 radicals in the photolysis of clorine in oxygen. J. Am. Chem. Soc. **91**, 7712–7727 (1969)

Johnston, H.S.: Reduction of stratospheric ozone by nitrogen oxide catalyst from supersonic transport exhaust. Science **173**, 517–522 (1971)

Johnston, P.V., McKenzie, R.L.: Long-path absorption measurements of NO_2 in rural New Zealand. Geophys. Res. Lett. **11**, 69–72 (1984)

Johnston, P.V., McKenzie, R.L.: NO_2 observations at 45S during the decreasing phase of solar cycle 21, from 1980 to 1987. J. Geophys. Res. **94**, 3473–3486 (1989)

Johnston, P.V., McKenzie, R.L., Keys, J.G., Matthews, W.A.: Observations of depleted stratospheric NO_2 following the Pinatubo volcanic eruption. Geophys. Res. Lett. **19**, 211–213 (1992)

Johnston, P.V.: Making UV/Vis Cross sections, reference Fraunhofer and synthetic spectra, Unpublished Manuscript, NIWA, Lauder, Oct. 1996 (1996)

Joiner, J., Bhartia, P.K.: The determination of cloud pressures from rotational Raman scattering in satellite backscatter ultraviolet measurements. J. Geophys. Res. **100**, 23019–23026 (1995)

Joiner, J., Bhartia, P.K., Cebula, R.P., Hilsenrath, E., McPeters, R.D.: Rotational-Raman scattering (ring effect) in satellite backscatter ultraviolet measurements. Appl. Opt. **34**(21), 4513–4525 (1995)

Jones, D.G.: Photodiode array detectors in UV-VIS spectroscopy: part I. Anal. Chem. **57**, 1057–1073 (1985a)

Jones, D.G.: Photodiode array detectors in UV-VIS spectroscopy: part II. Anal. Chem. **57**, 1207–1214 (1985b)

Joseph, D.M., Ashworth, S.H., Plane, J.M.C.: The absorption cross-section and photochemistry of OIO. J. Photochem. Photobiol. A Chem. **176**, 68–77 (2005)

Jourdain, J.L., LeBras, G., Poulet, G., Combourieu, J., Rigaud, R., Leroy, B.: UV absorption spectrum of $ClO(A^2\Pi\text{-}X^2\Pi)$ up to the (1,0) band. Chem. Phys. Lett. **57**, 109–112 (1978)

Junge, C, Chagnon, C.W., Manson, J.E.: A world-wide stratospheric aerosol layer. Science **133**(3463), 1478–1479 (1961)

Junge, C.E.: Air chemistry and radioactivity, Vol. 4. (International Geophysics). Academic, New York (1963)

Junkermann, W., Ibusuki, T.: FTIR spectroscopic measurements of surface bond products of nitrogen oxides on aerosol surfaces: Implications for heterogeneous HNO_2 production. Atmos. Environ. **26**, 3099–3103 (1992)

Junkermann, W., Platt, U., Volz-Thomas, A.: A photoelectric detector for the measurement of photolysis frequencies of ozone and other atmospheric molecules. J. Atmos. Chem. **8**, 203–227 (1989)

Kaiser, N.: Off-axis-Messungen von troposphärischem NO_3. Diploma thesis, University of Heidelberg (1997)

Kaiser, J.W., Burrows, J.P.: Fast weighting functions for retrievals from limb scattering measurements. J. Quant. Spectrosc. Radiat. Transf. **77**(3), 273–283 (2003). doi: 10.1016/S0022-4073(02)00125-5

Kalberer, M., Ammann, M., Arens, F., Gäggeler, H.W., Baltensperger, U.: Heterogeneous formation of nitrous acid (HONO) on soot aerosol particles. J. Geophys. Res. **104**, 13825–13832 (1999)

Kanaya, Y., Sadanaga, Y., Matsumoto, J., Sharma, U.K., Hirokawa, J., Kajii, Y., Akimoto, H.: Daytime HO_2 concentrations at Oki Island, Japan, in summer 1998: Comparison between measurement and theory. J. Geophys. Res. **105**, 24205–24222 (2000)

Kanaya, Y., Sadanaga, Y., Hirokawa, J., Kajii, Y., Akimoto, H.: Development of a ground-based LIF instrument for measuring HOx radicals: Instrumentation and calibrations. J. Atmos. Chem. **38**, 73–110 (2001)

Kasparian, J., Rodriguez, M., Méjean, G., Yu, J., Salmon, E., Wille, H., Bourayou, R., Frey, S., André, Y.-B., Mysyrowicz, A., Sauerbrey, R., Wolf, J.-P., Wöste, L.: White-light filaments for atmospheric analysis. Science **301**, 61–64 (2003)

Keeling, C.D., Barcastow, R.B., Bainbridge, A.E., Ekdahl, C.A., Guenther, P.R., Waterman, L.S.: Atmospheric carbon dioxide variations at Mauna Loa observatory, Hawaii. Tellus **28**, 538–551 (1976)

Keller-Rudek, H., Moortgat, G.K.: MPI-Mainz-UV-VIS spectral atlas of gaseous molecules. (2005) URL: www.atmosphere.mpg.de/spectral-atlas-mainz

Kern, C.: Applicability of light-emitting diodes as light sources for active long path DOAS measurements: a feasibility study. Diploma thesis in physics, Institut für Umweltphysik, University of Heidelberg (2004)

Kern, C., Trick, S., Rippel, B., Platt, U.: Applicability of light-emitting diodes as light sources for active DOAS measurements. Appl. Opt. **45**, 2077–2088 (2006)

Kerr, J.B., McElroy, C.T., Evans, W.F.: Mid-latitude summertime measurements of stratospheric NO_2. Can. J. Phys. **60**, 196–200 (1982)

Kessler, C., Perner, D., Platt, U.: Spectroscopic measurements of nitrous acid and formaldehyde—implications for urban photochemistry. In: Versino, B., Ott, H. (eds.) Proceedings of the 2nd European Symposium on Physico-Chemical Behavior of Atmospheric Pollutants, September 29 to October 1, pp. 393–400, Varese (1981)

Kessler, C.: Gasförmige Salpetrige Säure (HNO_2) in der belasteten Atmosphäre. Ph.D. thesis, University of Cologne (1984)

Kessler, C., Platt, U.: Nitrous acid in polluted air masses: Sources and formation pathways. Proceeding on the 3rd European Symposium on PhysioChemical Behaviour of Atmospheric Pollutants, Varese, Italia, 10–12 Apr., pp. 412–422, D. Reidel, Norwell, Mass (1984)

Khalil, M.A.K., Rasmussen, R.A., Gundwardena, A.: Atmospheric methyl bromide: Trends and global mass balance. J. Geophys. Res. **98**, 2887–2896 (1993)

Khokhar, M.F., Frankenberg, C., Van Roozendael, M., Beirle, S., Kühl, S., Richter, A., Platt, U., Wagner, T.: Satellite observations of atmospheric SO_2 from volcanic eruptions during the time period of 1996 to 2002. Adv. Space Res. **36**(5), 879–887 (2005)

Kim, K.-H., Kim, M.-Y.: Comparison of an open path differential optical absorption spectroscopy system and a conventional in situ monitoring system on the basis of long term measurements of SO_2, NO_2, and O_3. Atmos. Environ. **35**, 4059–4072 (2001)

King, M.D., Dick, E.M., Simpson, W.R.: A new method for the atmospheric detection of the nitrate radical (NO_3). Atmos. Environ. **34**, 685–688 (2000)

Kirchstetter, T.W., Harley, R.A., Littlejohn, D.: Measurement of nitrous acid in motor vehicle exhaust. Environ. Sci. Technol. **30**(9), 2843–2849 (1996)

Kleffmann, J., Becker, K.H., Wiesen, P.: Heterogeneous NO_2 conversion processes on acid surfaces: possible atmospheric implications. Atmos. Environ. **32**, 2721–2729 (1998)

Kleffmann, J., Gavriloaiei, T., Hofzumahaus, A., Holland, F., Koppmann, R., Rupp, L., Schlosser, E., Siese, M., Wahner, A.: Daytime formation of nitrous acid: a major source of OH radicals in a forest. Geophy. Res. Lett. **32**, L05818 (2005). doi:10.1029/2005GL022524

Klein, U., Wohltmann, I., Lindner, K., Künzi, K.F.: Ozone depletion and chlorine activation in the Arctic winter 1999/2000 observed in Ny-Ålesund. J. Geophys. Res. **107**(D20), 8288 (2002). doi:10.1029/2001JD000543

Kley, D.: Tropospheric chemistry and transport. Science **276**, 1043–1045 (1997)

Knight, G., Ravishankara, A.R., Burkholder, J.B.: Laboratory studies of OBrO. J. Phys. Chem. A **104**, 11121–11125 (2000)

Knoll, P., Singer, R., Kiefer, W.: Improving spectroscopic techniques by a scanning multichannel method. Appl. Spectrosc. **44**, 776–782 (1990)

Koelemeijer, R.B.A., Stammes, P., Hovenier, J.W., de Haan, J.F.: A fast method for retrieval of cloud parameters using oxygen A band measurements from the global ozone monitoring experiment. J. Geophys. Res. **106D**, 3475–3490 (2001)

Koike, M., Kondo, Y., Matthews, W.A., Johnston, P.V., Yamazaki, K.: Decrease of stratospheric NO_2 at 44° N caused by Pinatubo volcanic aerosols. Geophys. Res. Lett. **20**, 1975–1978 (1993)

Koike, M., Jones, N.B., Matthews, W.A., Johnston, P.V., McKenzie, R.L., Kinnison, R. L., Rodriguez, J.: Impact of Pinatubo aerosols on the partitioning between NO_2 and HNO_3. Geophys. Res. Lett. **21**, 597–600 (1994)

Koike, M., Kondo, Y., Matthews, W.A., Johnston, P.V., Nakajima, P.V., Kawaguchi, A., Nakane, H., Murata, I., Budiyono, A., et al.: Assessment of the uncertainties in the NO_2 and O_3 measurements by visible spectrometers. J. Atmos. Chem. **32**, 121–145 (1999)

Kolmogorov, A.N.: The local structure of turbulence in incompressible viscous fluid for very large Reynolds number. Dokl. Akad. Nauk SSSR **30**, 229–303 (1941). Reprinted in Proc. R. Soc Lond. A **434**, 15–17 (1991)

Kondo, Y., Matthews, W.A., Solomon, S., Koike, M., Hayashi, M., Yamazaki, K., Nakajima, H., Tsukui, K.: Ground based measurements of column amounts of NO_2 over Syowa Station, Antarctica. J. Geophys. Res. **99**, 14535–14548 (1994)

Kosterev, A.A., Tittel, F.K.: Chemical sensors based on quantum cascade lasers. IEEE J. Quantum Electron. **38**, 582 (2002)

Kraus, S.: DOASIS A Framework Design for DOAS. Dissertation, University of Mannheim, Germany (2005)

Kreher, K.: Messung der Breitenverteilung (50°N–70°S) von stratosphärischem Ozon und Stickstoffdioxid mittels optischer Absorptionsspektroskopie. Diploma thesis, University of Heidelberg (1991)

Kreher, K., Fiedler, M, Gomer, T, Stutz, J., Platt, U.: The latitudinal distribution (50°N–50°S) of NO_2 and O_3 in October/November 1990. Geophys. Res. Lett. **22**, 1217–1220 (1995)

Kreher, K., Keys, J.G., Johnston, P.V., Platt, U., Liu, X.: Ground-based measurements of OClO and HCl in austral spring 1993 at arrival heights, Antarctica. Geophys. Res. Lett. **23**, 1545–1548 (1996)

Kreher, K., Johnston, P.V., Wood, S.W., Platt, U.: Ground-based measurements of tropospheric and stratospheric BrO at arrival heights (78°S), Antarctica. Geophys. Res. Lett. **24**, 3021–3024 (1997)

Kreher, K., Bodeker, G.E., Kanzawa, H., Nakane, H., Sasano, H.: Ozone and temperature profiles measured above Kiruna inside, at the edge of, and outside the Arctic polar vortex in February and March 1997. Geophys. Res. Lett. **26**, 715–718 (1999)

Kromminga, H., Orphal, J., Spietz, P., Voigt, S., Burrows, J.P.: The temperature dependence (213–293 K) of the absorption cross-sections of OClO in the

340–450 nm region measured by Fourier-transform spectroscopy. J. Photochem. Photobiol. A Chem. **157**, 149–160 (2003)

Künzli, N., Kaiser, R., Medina, S., et al.: Public-health impact of outdoor and traffic-related air pollution: a European assessment. Lancet **356**, 795–801 (2000)

Kurosu, T., Rozanov, V.V., Burrows, J.P.: Parameterization schemes for terrestrial water clouds in the radiative transfer model GOMETRAN. J. Geophys. Res. **102**(D18), 21809–21823 (1997)

Kurtenbach, R., Becker, K.H., Gomes, J.A.G., Kleffmann, J., Lörzer, J.C., Spittler, M., Wiesen, P., Ackermann, R., Geyer, A., Platt, U.: Investigations of emissions and heterogeneous formation of HONO in a road traffic tunnel. Atmos. Environ. **35**, 3385–3394 (2001)

Kurtenbach, R., Ackermann, R., Becker, K.H., Geyer, A., Gomes, J.A.G., Lörzer, J.C., Platt, U., Wiesen, P.: Verification of the contribution of vehicular traffic to the total NMVOC emissions in Germany and the importance of NO_3 chemistry in the city air. J. Atmos. Chem. **42**, 395–411 (2002)

Kurucz, R.L., Bell, B.: Atomic Line Data, Kurucz CD-ROM No. 23. Cambridge, Mass.: Smithsonian Astrophysical Observatory. Available in the internet: http://cfa-www.harvard.edu/amdata/ampdata/kurucz23/sekur.html 1995

Kuze, A., Chance, K.V.: Analysis of cloud-top height and cloud coverage from satellites using the O_2 A and B bands. J. Geophys. Res. **99**, 14482–14491 (1994)

Kuznetzov, B.I., Nigmatullina, K.S.: Optical determination of the nitrogen dioxide content in the atmosphere. Izv. Atmos. Oceanic Phys. **13**, 614–617 (1977)

Laan, E., de Vries, J., Kruizinga, B., Visser, H., Levelt, P., van den Oord, G.H.J., Maelkki, A., Leppelmeier, G., Hilsenrath, E.: Ozone monitoring with the OMI instrument. In: Proceedings of SPIE 45th Annual Meeting (Imaging Spectrometry VI: Sensor Applications). The International Symposium on Optical Science and Technology, pp. 334–343. San Diego (2000)

Lambert, J.C., Van Roozendael, M., Simon, P.C., Pommereau, J.P., Goutail, F., Gleason, J.F., Andersen, S.B., Arlander, D.W., Buivan, N.A., Claude, H., De La Noe, J., De Maziere, M., Dorokhov, V., Eriksen, P., Green, A., Karlsen Tornqvist, K., Kastadt Hoiskar, B.A., Kyro, E., Leveau, J., Merienne, M.F., Milinevsky, G., Roscoe, H.K., Sarkissian, A., Shanklin, J.D., Staehelin, J., Wahlstrom Tellefsen, C., Vaughan, G.: Combined characterization of GOME and TOMS total ozone measurements from space using ground-based observations from the NDSC. Adv. Space Res. **26**, 1931–1940 (2001)

Lammel, G., Cape, J.N.: Nitrous acid and nitrite in the atmosphere. Chem. Soc. Rev. **25**, 361–369 (1996)

Lammel, G., Perner, D.: The atmospheric aerosol as a source of nitrous acid in the polluted atmosphere. J. Aerosol Sci. **19**, 1199–1202 (1988)

Lamp, T., Ropertz, A., Weber, K., van Haaren, G.: First results of ambient air measurements with different remote sensing systems over a lake in Germany. Proc. Soc. Photo. Opt. Instrum. Eng. **3534**, 162–172 (1998)

Lang, R., Lawrence, M.G.: Evaluation of the hydrological cycle of MATCH driven by NCEP reanalysis data: comparison with GOME water vapor field measurements. Atmos. Chem. Phys. Discuss. **4**, 7917–7984 (2004)

Langford, A.O., Portmann, R.W., Daniel, J.S., Miller, H.L., Solomon, S.: Spectroscopic measurement of NO_2 in a Colorado thunderstorm: determination of the mean production by cloud-to-ground lightning flashes. J. Geophys. Res. **109**, D11304 (2004). doi: 10.1029/203JD004158

Larche, K.: Die Strahlung des Xenon—Hochdruckbogens hoher Leistungsaufnahme. Z. Phys. **136**, 74–86 (1953)

Lary, D.J., Chipperfield, M.P., Toumi, R., Lenton, T.: Heterogeneous atmospheric bromine chemistry. J. Geophys. Res. **101**, 1489–1504 (1996)

Lary, D.J.: Halogens and the chemistry of the free troposphere. Atmos. Chem. Phys. **5**, 227–237 (2005)

Lauer, A., Dameris, M., Richter, A., Burrows, J.P.: Tropospheric NO_2 columns: a comparison between model and retrieved data from GOME measurements. Atmos. Chem. Phys. **2**, 67–78 (2002)

Lazlo, B., Kurylo, M.J., Huie, R.E.: Absorption cross section, kinetics of formation, and self-reaction of the IO radical via laser photolysis of $N_2O/I_2/N_2$ mixtures. J. Phys. Chem. **99**, 11701–11707

Le Bras, G., Gölz, C., Platt, U.: Production of peroxy-radicals in the DMS oxidation during night-time. In: Restelli, G., Angeletti, G. (eds.) Dimethylsulphide: Oceans, atmosphere and climate: Proceedings of the International Symposium, Belgirate, Italy, 13–15 October 1992, Kluwer Academic Publishers, pp. 251–260 (1993)

Le Bras, G., Platt, U.: A possible mechanism for combined chlorine and bromine catalysed destruction of tropospheric ozone in the Arctic. Geophys. Res. Lett. **22**, 599–602 (1995)

Lee, D.S., Köhler, I., Grobler, E., Rohrer, F., Sausen, R., Gallardo-Klenner, L., Olivier, J.G.J., Dentener, F.J., Bouwman, A.F.: Estimates of global NO_X emissions and their uncertainties. Atmos. Environ. **31**, 1735–1749 (1997)

Lee, J.S., Kuk, B.J., Kim, Y.J.: Development of a differential optical absorption spectroscopy (DOAS) system for the detection of atmospheric trace gas species; NO_2, SO_2, and O_3. J. Korean Phys. Soc. **41**, 693–698 (2002)

Lee, C., Kim, Y.K., Tanimoto, H., Bobrowski, N., Platt, U., Mori, T., Yamamoto, K.: Remote measurement of volcanic halogen oxides and observation of surface ozone depletion. Geophys. Res. Lett. **32**, L21809 (2005). doi:10.1029/2005GL023785

Leighton, P.A.: Photochemistry of Air Pollution. Academic, New York (1961)

Lelieveld, J., Crutzen, P.J.: Influence of cloud and photochemical processes on tropospheric ozone. Nature **343**, 227–233 (1990)

Lelieveld, J., Crutzen, P.J.: The role of clouds in tropospheric photochemistry. J. Atmos. Chem. **12**, 229–267 (1991)

Lenoble, J.: Radiative Transfer in Scattering and Absorbing Atmospheres: Standard Computational Procedures. A. Deepak Publishing, Hampton (1985)

Lerner, J.M., Thevenon, A.: The optics of spectroscopy, Jobin-Yvon Optical Systems/Instrumentss SA (1988)

Leser, H., Hönninger, G., Platt, U.: MAX-DOAS measurements of BrO and NO_2 in the marine boundary layer. Geophys. Res. Lett. **30**(10), 1537 (2003). doi: 10.1029/2002GL015811

Leue, C., Wenig, M., Platt, U.: Retrieval of atmospheric trace gas concentrations. In: Jähne, B., Haußecker, H., Geißler, P. (eds.) Handbook of Computer Vision and Applications. Volume III: Systems and Applications, Academic Press, San Diego (1999)

Leue, C., Wenig, M., Wagner, T., Platt, U., Jähne, B.: Quantitative analysis of NO_X emission from global ozone monitoring experiment satellite image sequences. J. Geophys. Res. **106**, 5493–5505 (2001)

Levelt, P.F., van den Oord, B., Hilsenrath, E., Leppelmeier, G.W., Bhartia, P.K., Malkki, A., Kelder, H., van der, A.R.J., Brinksma, E.J., van Oss, R., Veefkind, P., van Weele, M., Noordhoek, R.: Science Objectives of EOS-Aura's Ozone Monitoring Instrument (OMI). In: Proceedings of Quadrennial Ozone Symposium, Sapporo, Japan, pp. 127–128 (2000)

Levenberg, K.:A method for the solution of certain non-linear problems in least squares. Quant. Appl. Math. **2**, 164–168 (1944)

Levy, H.: Normal atmosphere: large radical and formaldehyde concentrations predicted. Science **173**, 141–143 (1971)

Li, S.-M.: Equilibrium of particle nitrite with gas phase HONO: tropospheric measurements in the high Arctic during polar sunrise. J. Geophys. Res. **99**, 25469–25478 (1994)

Liley, J.B., Johnston, P.V., McKenzie, R.L., Thomas, A.J., Boyd, I.S.: Stratospheric NO_2 variations from a long time series at Lauder, New Zealand. J. Geophys. Res. **105**(D9), 11633–11640 (2000)

Lindberg, S., Brooks, S., Lin, C.-J., Scott, K.J., Landis, M.S., Stevens, R.K., Goodsite, M., Richter, A.: Dynamic oxidation of gaseous mercury in the Arctic troposphere at polar sunrise. Environ. Sci. Technol. **36**, 1245–1256 (2002)

Livesey, N.J., Read, W.G., Froidevaux, L., Waters, J.W., Santee, M.L., Pumphrey, H.C., Wu, D.L., Shippony, Z., Jarnot, R.F.: The UARS microwave limb sounder version 5 data set: theory, characterization, and validation. J. Geophys. Res. **108**(D13), 4378 (2003). doi:10.1029/2002JD002273

Löfgren, L.: Determination of benzene and toluene in urban air with differential optical absorption spectroscopy. Int. J. Environ. Anal. Chem. **47**, 69–74 (1992)

Logan, J.A., Prather, M.J., Wofsy, S.C., McElroy, M.B.: Tropospheric chemistry: a global perspective. J. Geophys. Res. **86**, 7210–7254 (1981)

Lohberger, F., Hönninger, G., Platt, U.: Ground based imaging differential optical absorption spectroscopy of atmospheric gases. Appl. Opt. **43**(24), 4711–4717 (2004)

Long, W.A.: Raman Spectroscopy. McGraw-Hill, New York (1977)

Longfellow, C.A., Imamura, T., Ravishankara, A.R., Hanson, D.R.: HONO solubility and heterogeneous reactivity on sulfuric acid surfaces. J. Phys. Chem. A **102**, 3323–3332 (1998)

Lovelock, J.E.: Gaia: A New Look at Life on Earth. Oxford University Press, Oxford (1979)

Löwe, A.G., Adukpo, D., Fietkau, S., Heckel, A., Ladstätter-Weißenmayer, A., Medeke, T., Oetjen, H., Richter, A., Wittrock, F., Burrows, J.P.: Multi-axis-DOAS observations of atmospheric trace gases at different latitudes by the global instrument network BREDOM. In: Proceedings of 10th Science Conference of IAMAS, CACGP and 7th Science Conference of IGAC, September 2002, Crete (2002)

MacManus, J.B., Kebabian, P.L., Zahniser, M.S.: Astigmatic mirror multipass absorption cells for long-path-length spectroscopy. Appl. Opt. **34**, 3336–3348 (1995)

Majewski, W., Meerts, W.L.: Near-UV spectra with fully resolved rotational structure of naphthalene and perdeuterated naphthalene. J. Mol. Spectrosc. **104**, 271–281 (1984)

Mandelman, M., Nicholls, R.W.: The absorption cross section and f-values for the $v'' = 0$ progression of bands and associated continuum for the ClO (A^2Pi-X^2Pi) system. J. Quant. Spectrosc. Radiat. Transf. **17**, 483–491 (1977)

Martinez, M., Perner, D., Hackenthal, E., Kultzer, S., Schultz, L.: NO_3 at Helgoland during the NORDEX campaign in October 1996. J. Geophys. Res. **105**(D18), 22685–22695 (2000)

Marquard, D.W.: An algorithm for least-squares estimation of nonlinear parameters. J. Soc. Indust. Appl. Math. **11**, 431–441 (1963)

Marquard, L.C.: Modellierung des Strahlungstransports in der Erdatmosphäre für absorptionsspektroskopische Messungen im ultravioletten und sichtbaren Spektralbereich, Doktoral thesis, University of Heidelberg (1998)

Marquard, L.C., Wagner, T., Platt, U.: Improved approaches for the calculation of air mass factors required for scattered light differential optical absorption spectroscopy. J. Geophys. Res. **105**, 1315–1327 (2000)

Martin, R.V., Chance, K., Jacob, D.J., Kurosu, T.P., Spurr, R.J.D., Bucsela, E., Gleason, J.F., Palmer, P.I., Bey, I., Fiore, A.M., Li, Q., Yantosca, R.M., Koelemeijer, R.B.A.: An improved retrieval of tropospheric nitrogen dioxide from GOME. J. Geophys. Res. **107**(D20), 4437 (2002). doi:10.1029/2001JD001027

Martin, R.V., Parrish, D.D., Ryerson, T.B., Nicks, D.K., Jr, Chance, K., Kurosu, T.P., Jacob, D.J., Sturges, E.D., Fried, A., Wert, B.P.: Evaluation of GOME satellite measurements of tropospheric NO2 and HCHO using regional data from aircraft campaigns in the southeastern United States. J. Geophys. Res. **109**, D24307 (2004). doi:10.1029/2004JD004869

Martinez, M., Arnold, T., Perner, D.: The role of bromine and chlorine chemistry for arctic ozone depletion events in Ny-Ålesund and comparison with model calculations. Ann. Geophys. **7**, 941–956 (1999)

Martini, L., Sladkovic, R., Slemr, f., Werle, P.: Monitoring of air pollutants: long term intercomparison of DOAS with conventional techniques. Proceedings Of 87th Annual Meeting & Exhibition of Air & Waste Management Association, Cincinnati, Ohio, 19–24 June 1994

Marx, B.R., Birch, K.P., Felton, R.C., Jolliffe, B.W., Rowley, W.R.C., Woods, P.T.: High-resolution spectroscopy of SO_2 using a frequency-doubled continuous-wave dye laser. Opt. Comm. **33**, 287–291 (1980)

Mateer, C.L., Dutsch, H.U., Staehelin, J.: Influence of a priori profiles on trend calculations from Umkehr data. J. Geophys. Res. **101**(D11), 16779–16787 (1996)

Matsumoto, J., Imai, H., Kosugi, N., Kajii, Y.: Development of a measurement system of nitrate radical and dinitrogen pentoxide using a thermal conversion/laser-induced fluorescence. Rev. Sci. Instrum. **76**, 064101 (2005). doi: 10.1063/1.1927098

Matveev, V., Peleg, M., Rosen, D., Tov-Alper, D.S., Stutz, J., Hebestreit, K., Platt, U., Blake, D., Luria, M.: Bromine oxide – ozone interaction over the dead sea. J. Geophys. Res. **106**, 10375–10378 (2001)

Maurellis, A.N., Lang, R., van der Zande, W.J.: A new DOAS parametrization for retrieval of trace gases with highly-structured absorption spectra. Geophys. Res. Lett. **27**, 4069–4072 (2000a)

Maurellis, A.N., Lang, R., van der Zande, W.J., Aben, I., Ubachs, W.: Precipitable water column retrieval from GOME data. Geophys. Res. Lett. **27**, 903–906 (2000b)

McConnell, J.C., Henderson, G.S., Barrie, L., Bottenheim, J., Niki, H., Langford, C.H., Templeton, E.M.J.: Photochemical bromine production implicated in Arctic boundary-layer ozone depletion. Nature **355**, 150–152 (1992)

McElroy, C.T., McLinden, C.A., McConnell, J.C.: Evidence for bromine monoxide in the free troposphere during Arctic polar sunrise. Nature **397**, 338–340 (1999)
McGonigle, A.J.S., Hilton, D.R., Fischer, T.P., Oppenheimer, C.: Plume velocity determination for volcanic SO_2 flux measurements. Geophys. Res. Lett. **32**, L11302 (2005). doi:10.1029/2005GL022470
McKeen, S.A., Trainer, M., Hsie, E.Y., Tallamraju, R.K., Liu, S.C.: On the indirect determination of atmospheric OH radical concentrations from reactive hydrocarbon measurements. J. Geophys. Res. **95**, 7493–7500 (1990)
McKenzie, R.L., Johnston, P.V.: Seasonal variations in stratospheric NO_2 at 45° S. Geophys. Res. Lett. **9**, 1255–1258 (1982)
McKenzie, R.L., Johnston, P.V.: Stratospheric nitrogen dioxide measurements at arrival heights, Antarctica, N.Z. Antarct. Rec. **5**, 12 (1983)
McKenzie, R.L., Johnston, P.V.:Springtime stratospheric NO_2 in Antarctica, Geophys. Res. Lett. **11**, 73–75 (1984)
McKenzie, R.L., Johnston, P.V., McElroy, C.T., Kerr, J.B., Solomon, S.: Altitude distributions of stratospheric constituents from ground-based measurements at twilight. J. Geophys. Res. **96**, 15499–15511 (1991)
McMahon, B.B., Simmons, E.L.: Ground based measurements of atmospheric NO_2 by differential optical absorption. Nature **287**, 710–711 (1980)
McManus, J.B., Kebabian, P.L.: Narrow optical interference fringes for certain setup conditions in multipass absorption cells of the Herriott type. Appl. Opt. **29**(7), 898–900 (1990)
McManus, J.B., Kebabian, P.L., Zahniser, M.S.: Astigmatic mirror multipass absorption cells for long-path-length spectroscopy. Appl. Opt.-LP **34**(18), 3336–3348 (1995)
Melamed, M.L., Solomon, S., Daniel, J.S., Langford, A.O., Portmann, R.W., Ryerson, T.B., Nicks, D.K., Jr, McKeeen, S.A.: Measuring reactive nitrogen emissions from point sources using visible spectroscopy from aircracft. J. Environ. Monit. **5**, 29–34 (2003)
Meller, R., Moortgart, G.K.: Temperature dependence of the absorption cross sections of formaldehyde between 223 and 323 K in the wavelength range 225–375 nm. J. Geophys. Res. **201**, 7089–7101 (2000)
Mellqvist, J., Rosén, A., Axelsson, H.: Temperature dependence of the absorption spectra of nitrogen oxide, nitrogen dioxide and sulfur dioxide in the application of differential optical. Analyst **117**, 417–418 (1992)
Mellqvist, J., Rosén, A.: DOAS for flue gas monitoring – I. Temperature in the U.V./visible absorption spectra of NO, NO_2, SO_2 and NH_3. J. Quant. Spectrosc. Radiat. Transf. **56**, 187–208 (1996)
Mentel, T.F., Bleilebens, D., Wahner, A.: A study of nighttime nitrogen oxide oxidation in a large reaction chamber – the fate of NO_2, N_2O_5, HNO_3, and O_3 at different humidities. Atmos. Environ. **30**, 4007–4020 (1996)
Mérienne, M.F., Jenouvrier, A., Coquart, B.: The NO_2 absorption spectrum. I. Absorption cross-sections at ambient temperature in the 300–500 nm region. J. Atmos. Chem. **20**, 281–297 (1995)
Mérienne, M.F., Jenouvrier, A., Hermans, C., Vandaele, A.C., Carleer, M., Clerbaux, C., Coheur, P.F., Colin, R., Fally, S., Bach, M.: Water vapor line parameters in the 13,000–9250 cm^{-1} region. JQSRT **82**, 99–117 (2003)
Mie, G.: Beiträge zur Optik trüber Medien, speziell kolloidaler Metallösungen, Annalen der Physik, Vierte Folge, Band **25**(3), 377–445 (1908)

Migeotte, M.V.: Lines of methane at 7.7μ in the solar spectrum. Phys. Rev. **74**, 112–113 (1948)

Migeotte, M.: The fundamental band of carbon monoxide at 4.7 μm in the solar spectrum. Phys. Rev. **75**, 1108–1109 (1949)

Mihelcic, D., Holland, F., Hofzumahaus, A., Hoppe, L., Konrad, S., Müsgen, P., Pätz, H.-W., Schmitz, T., Schäfer, H.-J., Schmitz, T., Volz-Thomas, A., Bächmann, K., Schlomski, S., Platt, U., Geyer, A., Alicke, B., Moortgat, G.: Peroxy radicals during BERLIOZ at Pabstthum: measurements, radical budgets, and ozone production. J. Geophys. Res. **108**(D4), 8254 (2003). doi:10.1029/2001JD001014, (PHOEBE: BERLIOZ special section)

Mihelcic, D., Muesgen, P., Ehhalt, D.H.: An improved method of measuring tropospheric NO_2 and RO_2 by matrix isolation and electron spin resonance. J. Atmos. Chem. **3**, 341–361 (1985)

Mihelcic, D., Klemp, D., Müsgen, P., Pätz, H.W., Volz-Thomas, A.: Simultaneous measurements of peroxy and nitrate radicals at Schauinsland. J. Atmos. Chem. **16**, 313–335 (1993)

Millan, M., Townsend, S., Davies, J.: Study of the Barringer refractor plate correlation spectrometer as a remote sensing instrument. Utias rpt. 146, m.a.sc. thesis, University of Toronto, Toronto, Ontario, Canada (1969)

Millán, M.M.: A study of the operational characteristics and optimization procedures of dispersive correlation spectrometers for the detection of trace gases in the atmosphere. Ph.D. thesis, Universidad de Toronto, Ontario (1972)

Millan, M.M., Hoff, R.M.: Dispersive correlation spectroscopy: a study of mask optimization procedures. Appl. Opt. **16**, 1609–1618 (1977)

Millan, M.: Recent advances in correlation spectroscopy for the remote sensing of SO_2. In: Proceedings of 4th Joint Conference on Sensing of Environmental Pollutants, pp. 40–43 (1978)

Millan, M.M.: Remote sensing of air pollutants. A study of some atmospheric scattering effects. Atmos. Environ. **14**, 1241–1253 (1980)

Miller, H.L., Weaver, A., Sanders, R.W., Arpag, K., Solomon, S.: Measurements of arctic sunrise surface ozone depletion events at Kangerlussuaq. Greenland (67 ° N to 51 ° W), Tellus B, **49**(5), 496–509 (1997)

Min, Q.-L., Harrison, L.C., Clothiaux, E.: Joint statistics of photon path length and cloud optical depth: case studies. J. Geophys. Res. **106**, 7375–7386 (2001)

Minato, A., Sugimoto, N., Sasano, Y.: Optical design of cube-corner retroreflectors having curved mirror surfaces. Appl. Opt. **31**, 6015–6020 (1992)

Minato, A., Sugimoto, N.: Design of a four-element, hollow-cube corner retroreflector for satellites by use of a genetic algorithm. Appl. Opt. **37**, 438–442 (1998)

Mohammed-Tahrin, N., South, A.M., Newnham, D.A., Jones, R.L.: An accurate wavelength calibration for the ozone absorption cross-section in the near-UV spectral region, and its effect on the retrieval of BrO from measurements of zenith-scattered sunlight. J. Geophys. Res. **106**(D9), 9897–9907 (2001)

Molina, L.T., Molina, M.J.: Production of the Cl_2O_2 from the Self-Reaction of the ClO Radical. J. Phys. Chem. **91**(2), 433–436 (1987)

Molina, M.J., Rowland, F.S.: Stratospheric sink for chlorofluoromethans. Chlorine atom catalyzed destruction of ozone. Nature **249**, 810 (1974)

Monks, P.S., Carpenter, L.J., Penkett, S.A., Ayers, G.P.: Night-time peroxy radical chemistry in the remote marine boundary layer over the southern ocean. Geophys. Res. Lett. **23**, 535–538 (1996)

Montzka, S., Butler, J., Myers, R.M.T., Swanson, T., Clarke, A., Lock, L., Elkins, J.: Decline in the tropospheric abundance of halogen from halocarbons: implications for stratospheric ozone depletion. Science **272**, 1318–1320 (1996)

Mount, G.H., Sanders, R.W., Schemltekopf, A.L., Solomon, S.: Visible spectroscopy at McMurdo Station, Antarctica, 1. Overview and daily variations of NO_2 and O_3, austral spring, 1986. J. Geophys. Res. **92**, 8320–8328 (1987)

Mount, G.H.: The measurement of tropospheric OH by long path absorption. 1. Instrumentation. J. Geophys. Res. **97**, 2427–2444 (1992)

Mount, G.H., Eisele, F.L.: An intercomparison of tropospheric OH. Measurements at Fritz Peak Observatory, Colorado. Science **256**, 1187–1190 (1992)

Mount, G.H., Rumburg, B., Havig, J., Lamb, B., Westberg, H., Yonge, D., Johnson, K., Kincaid, R.: Measurement of atmospheric ammonia at a dairy using differential optical absorption spectroscopy in the mid-ultraviolet. Atmos. Environ. **36**, 1799–1810 (2002)

Mount, G.H., Sanders, R.W., Brault, J.W.: Interference effects in reticon photodiode array detectors. Appl. Opt. **31**, 851 (1992)

Mozurkewich, M., Calvert, J.G.: Reaction probability of N_2O_5 on Aqueous aerosol. J. Geophys. Res. **93**, 15889–15896 (1988)

Murtagh, D., Frisk, U., Merino, F., Ridal, M., Jonsson, A., Stegman, J., Witt, G., Eriksson, P., Jiménez, C., Megie, G., Noë, de la J., Ricaud, P., Baron, P., Ramon Pardo, J., Hauchcorne, A., Llewellyn, E.J., Edward, J., Degenstein, E.J., Gattinger, R.L., Lloyd, N.D., Evans, W.F.J., McDade, I.C., Haley, C.S., Sioris, C., Savigny, C.V., Solheim, B.H., McConnell, J.C., Strong, K., Richardson, E.H., Leppelmeier, G.W., Kyrölä, E., Auvinen, H., Oikarinen, L.: An overview of the Odin atmospheric mission. Can J. Phys. **80**, 309–319 (2002)

Nardi, B., Bellon, W., Oolman, L.D., Deshler, T.: Spring 1996 and 1997 ozonesonde measurements over McMurdo Station, Antarctica. Geophys. Res. Lett. **26**, 723–726 (1999)

Nash, T.: The colorimetric estimation of formaldehyde by means of the Hantzsch reaction. Biochem. J. **55**, 416–421 (1953)

Naus, H., Ubachs, W.: Visible absorption bands of the $(O_2)_2$-collision complex at pressures below 760 Torr. Appl. Opt. **38**, 3423–3428 (1999)

Neftel, A., Blatter, A., Staffelbach, T.: Gas phase measurements of NH_3 and NH_4^+ with differential optical absorption spectroscopy and gas stripping scrubber in combination with flow injection analysis. In: Restelli G., Angeletti, G. (eds.) Proceedings of Symposium on Physico-Chemical Behaviour of Atmospheric Pollutants, pp. 83–91. Kluwer, Dordrecht (1990)

Neftel, A., Blatter, A., Hesterberg, R., Staffelbach, T.: Measurements of concentration gradients of HNO_2 and HNO_3 over a semi-natural ecosystem. Atmos. Environ. **30**, 3017–3025 (1996)

Nestlen, M., Platt, U., Flothmann, D.: A new instrument for measuring dry deposition velocities of SO_2 using the eddy-correlation method. Proceedings of Workshop "Trockene Deposition", Oberursel 1981

Neuroth, R., Dorn, H.-P., Platt, U.: High resolution spectral features of a series of aromatic hydrocarbons and BrO: potential interferences with OH measurements. J. Atmos. Chem. **12**, 12287–12298 (1991)

Newchurch, M.J., Yang, E.-S., Cunnold, D.M., Reinsel, G.C., Zawodny, J.M., Russell, J.M. III: Evidence for slowdown in stratospheric ozone loss:

First stage of ozone recovery. J. Geophys. Res. **108**(D16), 4507 (2003). doi:10.1029/2003JD003471

Newitt, D.M., Outridge, L.E.: The ultraviolet absorption bands ascribed to HNO_2. J. Chem. Phys. **6**, 752–754 (1938)

Newman, S.M., Lane, I.C., Orr-Ewing, A.J., Newnham, D.A., Ballard, J.: Integrated absorption intensity and einstein coefficients for the O_2 $^{a^1\Delta_g \leftarrow X^3\Sigma_g^-}$ transition: a comparison of cavity ringdown and high resolution fourier transform spectroscopy with a long-path absorption cell. J. Chem. Phys. **110**(22), 10749–10757 (1999)

Newman, S.M., Orr-Ewing, A.J., Newnham, D.A., Ballard, J.: Temperature and pressure dependence of linewidths and integrated absorption intensities for the $^{a^1\Delta_g \leftarrow X^3\Sigma_g^-}$ (0,0) transition. J. Phys. Chem. A, **104**(42), 9467–9480 (2000)

Newnham, D.A., Ballard, J.: Visible absorption cross section and integrated absorption intensities of molecular oxygen (O_2 and O_4). J. Geophys. Res. **103**, 28801–28816 (1998)

Nguyen, M.T., Sumathi, R., Sengupta, D., Peeters, J.: Theoretical analysis of reactions related to the HNO_2 energy surface: OH + NO and H + NO_2. Chem. Phys. **230**(1), 1–11 (1998)

Nicolet, M.: On the molecular scattering in the terrestrial atmosphere: an empirical formula for its calculation in the homosphere. Planet. Space Sci. **32**(11), 1467–1468 (1984)

Niki, H., Becker, K.H. (eds.): NATO Advanced Research Workshop: "The Tropospheric Chemistry of Ozone in the Polar Regions", NATO ASI Series, Subseries I "Global Environmental Change". Springer, Heidelberg (1993)

Noël, S., Bovensmann, H., Burrows, J.P., Frerick, J., Chance, K.V., Goede, A.H.P.: Global atmospheric monitoring with SCIAMACHY. Phys. Chem. Earth (C). **24**(5), 427–434 (1999)

Noel, S., Buchwitz, M., Bovensmann, H., Burrows, J.P.: Retrieval of total water vapour column amounts from GOME/ERS-2 data. Remote Sensing of Trace Constituents in the Lower Stratosphere, Troposphere and the Earth's Surface: Global Observations, Air Pollution and the Atmospheric Correction **29**(11), 1697–1702 (2002)

Notholt, J., Hjorth, J., Raes, F.: Long path field measurements of aerosol parameters and trace gas concentrations – formation of nitrous acid during foggy periods. J. Aerosol Sci. **22**(S1), S411–S414 (1991)

Notholt, J., Hjorth, J., Raes, F., Schrems, O.: Simultaneous long path field measurements of HNO_2, CH_2O and aerosol. Ber. Bunsenges. Phys. Chem. **96**, 290–293 (1992)

Notholt, J., Toon, G.C., Lehmann, R., Sen, B., Blavier, J.-F.: Comparison of Arctic and Antarctic trace gas column abundances from ground-based FTIR spectrometry. J. Geophys. Res. **102**, 12863–12869 (1997)

Noxon, J.F., Goody, R.: Noncoherent scattering of skylight. Atmos. Ocean. Phys. **1**, 257–281 (1965)

Noxon, J.F.: Nitrogen dioxide in the stratosphere and troposphere measured by ground-based absorption spectroscopy. Science **189**, 547–549 (1975)

Noxon, J.F., Norton, R.B., Henderson, W.R.: Observation of atmospheric NO_3. Geophys. Res. Lett. **5**, 675–678 (1978)

Noxon, J.F.: Stratospheric NO_2. 2. Global behavior, J. Geophys. Res. **84**(C8), 5067–5076 (1979)

Noxon, J.F., Whipple, E.C., Hyde, R.S.: Stratospheric NO_2. 1. Observational method and behavior at midlatitudes. J. Geophys. Res. **84**(C8), 5047–5065 (1979)

Noxon, J.F., Norton, R.B., Marovich, E.: NO_3 in the troposphere. Geophys. Res. Lett. **7**, 125–128 (1980)

Noxon, J.F.: NO_3 and NO_2 in the mid-Pacific troposphere. J. Geophys. Res. **88**, 11017–11021 (1983)

NRC: Review of the NARSTO Draft Report: An assessment of tropospheric ozone pollution –A North American perspective. The National Academy of Sciences (2000)

O'Dowd, C.D.: Biogenic coastal aerosol production and its influence on aerosole radiative properties. J. Geophys. Res. **106**(D2), 1545–1549 (2001)

O'Dowd, C., Jimenez, J.L., Bahreini, R., Flagan, R.C., Seinfeld, J.H., Hämeri, K., Pirjola, L., Kulmala, M., Jennings, S.G., Hoffmann, T.: Marine aerosol formation from biogenic iodine emissions. Nature **417**, 632–636 (2002)

Oetjen, H.: Messung atmosphärischer Spurengase in Ny-Alesund, Aufbau und Inbetriebnahme eines neuen DOAS-Meßsystems, Diploma thesis, University of Bremen (2002)

Ogryzlo, E.A., Thomas, G.E.: Pressure dependence of the visible absorption bands of molecular iodine. J. Mol. Spectrosc. **17**, 198–202 (1965)

Oltmans, S.J., Komhyr, W.D.: Surface ozone distributions and variations from 1973 to 1984 measurements at the NOAA geophysical monitoring for climate change baseline observatories. J. Geophys. Res. **91**, 5229–5236 (1986)

Oppenheimer, C., Tsanev, V.I., Braban, C.F., Cox, R.A., Adams, J.W., Aiuppa, A., Bobrowski, N., Delmelle, P., Barclay, J., McGonigle, A.J.: BrO formation in volcanic plumes. Geochim. Cosmochim. Acta. **70**, 2935–2941 (2006)

Orlando, J.J., Tyndall, G.S.: The atmospheric chemistry of the HC(O)CO. Radical. Int. J. Chem. Kinet. **33**, 149–156 (2001)

Orphal, J., Bogumil, K., Dehn, A., Deters, B., Dreher, S., Fleischmann, O.C., Hartmann, M., Himmelmann, S., Homann, T., Kromminga, H., Spietz, P., Türk, A., Vogel, A., Voigt, S., Burrows, J.P.: Laboratory spectroscopy in support of UV-visible remote-sensing of the atmosphere. In: Pandalai S.G. (ed.) Recent Research Developments in Physical Chemistry, Transworld Research, Trivandrum, pp. 15–34 (2002)

Orphal, J.: A critical review of the absorption cross-sections of O_3 and NO_2 in the ultraviolet and visible. J. Photochem. Photobiol. A: Chem. **157**, 185–209 (2003)

Orphal, J., Fellows, C.E., Flaud, P.-M.: The visible absorption spectrum of NO_3 measured by high-resolution Fourier transform spectroscopy. J. Geophys. Res. **108**(D3), 4077 (2003). doi:10.1029/2002JD002489

Ortgies, G., Gericke, K.H., Comes, F.J.: Is UV laser induced fluorescence a method to monitor tropospheric OH? Geophys. Res. Lett. **7**, 905–908 (1980)

Osterkamp, H.: Messung von atmosphärischen O_4-Profilen. Diploma Thesis, University of Heidelberg, Germany (1997)

Osterkamp, H., Ferlemann, F., Harder, H., Perner, D., Platt, U., Schneider, M., Pfeilsticker, K.: First measurement of the atmospheric O_4 profile, in polar stratospheric ozone 1997. In: Proceedings of the Fourth European Symposium,

22 to 26 September, Schliersee, Germany, Air Pollution Report 66, pp. 478–481, European Commission, Brussels (1998)

Otten, C.: Messung stratosphärischer Spurenstoffe in den Wintern 1992/93 bis 1994/95 über Kiruna in Nordschweden, Ph.D. thesis, University of Heidelberg (1997)

Otten, C., Ferlemann, F., Platt, U., Wagner, T., Pfeilsticker, K.: Groundbased DOAS UV/visible measurements at Kiruna (Sweden) during the SESAME winters 1993/94 and 1994/95, J. Atmos. Chem. **30**, 141–162 (1998)

Oum, K.W., Lakin, M.J., DeHaan, D.O., Brauers, T., Finlayson-Pitts, B.J.: Formation of molecular chlorine from the photolysis of ozone and aqueous Sea-Salt particles. Science **279**, 74–77 (1998a)

Oum, K.W., Lakin, M.J., Finlayson-Pitts, B.J.: Bromine activation in the troposphere by the dark reaction of O_3 with seawater ice. Geophys. Res. Lett. **25**, 3923–3926 (1998b)

Pagsberg, P., Bjergbakke, E., Ratajczak, E., Sillesen, A.: Kinetics of the gas phase reaction OH+NO(+M) $\longrightarrow$ HONO(+M) and the determination of the UV absorption cross sections of HONO. Chem. Phys. Lett. **272**(5–6), 383–390 (1997)

Paldus, B.A., Zare, R.N.: CRDS an historical perspective and introduction, In: Busch, K.W., Busch, M.A. (eds.) Cavity-Ringdown Spectroscopy: An Ultralow-Absorption Measurement Technique, ACS, Washington, DC (1999)

Palmer, P.I., Jacob, D.J., Fiore, A.M., Martin, R.V., Chance, K., Kurosu, T.P.: Mapping isoprene emissions over North America using formaldehyde column observations from space. J. Geophys. Res. **108**(D6), 4180 (2003). doi:10.1029/2002JD002153

Parrish, D.D., Trainer, M., Williams, E.J., Fahey, D.W., Huebler, G., Eubank, C.S., Liu, S.C., Murphy, P.C., Albritton, D.L., Fehsenfeld, F.C.: Measurements of the NO_x-O_3 photostationary state at Niwot Ridge, Colorado. J. Geophys. Res. **91**, 5361–5370 (1986)

Paulson, S.E., Sen, A.D., Ping, L., Fenske, J.D., Fox, M.J.: Evidence for formation of OH radicals from the reaction of O_3 with alkenes in the gas phase. Geophys. Res. Lett. **24**(24), 3193–3196 (1997)

Paulson, S.E., Chung, M., Hasson, A.: OH radical formation from the gas-phase reaction of ozone with terminal alkenes, and the relationship between structure and mechanism. (Invited Feature Article) J. Phys. Chem. **103**, 8125–8138 (1999)

Penkett, S.A., Blake, N.J., Lightman, P., Marsh, A.R.W., Anwyl, P., Butcher, G.: The seasonal variation of nonmethane hydrocarbons in the free troposphere over the North Atlantic Ocean: possible evidence for extensive reaction of hydrocarbons with the nitrate radical. J. Geophys. Res. **98**, 2865–2885 (1993)

Penndorf, R.: Tables of the refractive index for standard air and the Rayleigh scattering coefficient for the spectral region between 0.2 and 20.0 μ and their application to atmospheric optics. J. Opt.Soc. Amer. **47**, 176–182 (1957)

Penney, C.M., St. Peters, R.L., Lapp, M.: Absolute rotational Raman cross sections for N_2, O_2, and CO_2, J. Opt. Soc. Am. **64**, 712–716 (1974)

Perliski, L.M., Solomon, S.: Radiative influences of Pinatubo volcanic aerosols on twilight observations of NO_2 column abundances. Geophys. Res. Lett. **19**, 1923–1926 (1992)

Perliski, L.M., Solomon, S.: On the evaluation of air mass factors for atmospheric near-ultraviolet and visible absorption spectroscopy. J. Geophys. Res. **98**, 10363–10374 (1993)

Perner, D., Ehhalt, D.H., Pätz, H.W., Platt, U., Röth, E.P., Volz, A.: OH-radicals in the lower troposphere, Geophys. Res. Lett. **3**, 466–468 (1976)

Perner, D., Platt, U.: Detection of nitrous acid in the atmosphere by differential optical absorption. Geophys. Res. Lett. **6**, 917–920 (1979)

Perner, D., Platt, U.: Absorption of light in the atmosphere by collision pairs of oxygen $(O_2)_2$. Geophys. Res. Lett. **7**, 1053–1056 (1980)

Perner, D., Kessler, C., Platt, U.: HNO_2, NO_2, and NO measurements in automobile engine exhaust by optical absorption. In: Grisar, R., Preier, H., Schmidke, G., Restelli, G. (eds.) Monitoring of Gaseous Pollutants by Tunable Diode Laser, Reidel, Dordrecht pp. 116–119 (1987a)

Perner, D., Platt, U., Trainer, M., Hübler, G., Drummond, J.W., Junkermann, W., Rudolph, J., Schubert, B., Volz, A., Ehhalt, D.H., Rumpel, K.J., Helas, G.: Measurement of tropospheric OH concentrations: a comparison of field data with model predictions. J. Atmos. Chem. **5**, 185–216 (1987b)

Perner, D., Klüpfel, T., Parchatka, U., Roth, A., Jörgensen, T.: Ground-based UV-vis spectroscopy: diurnal OClO – profiles during January 1990 above Söndre Strømfjord, Greenland. Geophys. Res. Lett. **18**, 787–790 (1991)

Perner, D., Roth, A., Klüpfel, D.: Groundbased measurements of stratospheric OClO, NO_2, and O_3 at Söndre Strömfjord in winter 1991/92. Geophys. Res. Lett. **21**, 1367–1370 (1994)

Perner, D., Arnold, T., Crowley, J., Klüpfel, T., Martinez, M., Seuwen, R.: The measurements of active chlorine in the atmosphere by chemical amplification. J. Atmos. Chem. **34**, 9–20 (1999)

Peters, C.: Studies of reactive halogen species (RHS) in the marine and mid-latitudinal boundary layer by active longpath differential optical absorption spectroscopy, Ph.D. thesis, University of Heidelberg (2004)

Peters, C., Pechtl, S., Stutz, J., Hebestreit, K., Hönninger, G., Heumann, K.G., Schwarz, A., Winterlik, J., Platt, U.: Reactive and organic halogen species in three different European coastal environments. Atmos. Chem. Phys. **5**, 3357–3375 (2005)

Petritoli, A., Ravegnani, F., Giovanelli, G., Bortoli, D., Bonafe, U., Kostadinov, I., Oulanovsky, A.: Off-Axis measurements of atmospheric trace gases by use of an airborne ultraviolet-visible spectrometer. Appl. Opt. **27**, 5593–5599 (2002)

Petropavlovskikh, I., Bhartia, P.K., DeLuisi, J.: New Umkehr ozone profile retrieval algorithm optimized for climatological studies. Geophys. Res. Lett. **32**, L16808 (2005). doi:10.1029/2005GL023323

Pfeilsticker, K., Platt, U.: Airborne measurements during the Arctic stratospheric experiment: observation of O_3 and NO_2. Geophys. Res. Lett. **21**, 1375–1378 (1994)

Pfeilsticker, K., Erle, F., Funk, Senne, T., Wagner, T., Platt, U.: Can enhanced tropospheric photon path lengths explain the anomalous cloud absorption phenomenon? In: Poster, Third European Symposium on Polar Stratospheric Ozone, Schliersee, 18–22 September (1995)

Pfeilsticker, K., Blom, C.E., Brandtjen, R., Fischer, H., Glatthor, N., Grendel, A., Gulde, T., Hopfner, M., Perner, D., Piesch, C., Platt, U., Renger, W., Sessler, J., Wirth, M.: Aircraft-borne detection of stratospheric column amounts of O_3, NO_2, OClO, $ClNO_3$, HNO_3, and aerosols around the arctic vortex (79 ° N to 39 ° N) during spring 1993.1. Observational data. J. Geophys. Res. **102**(D9), 10801–10814 (1997a)

Pfeilsticker, K., Erle, F., Platt, U.: Absorption of solar radiation by atmospheric O_4. J. Atm. Sci. **54**, 933–939 (1997b)

Pfeilsticker, K., Erle, F., Funk, O., Marquard, L., Wagner, T., Platt, U.: Optical path modifications due to tropospheric clouds: implications for zenith sky measurements of stratospheric gases. J. Geophys,. Res. **103**, 25323–25335 (1998a)

Pfeilsticker, K. Erle, F., Funk, O., Veitel, H., Platt, U.: First geometrical path lengths probability density function derivation of the skylight from spectroscopically highly resolved oxygen A-band observations. 1. Measurement technique, atmospheric observations and model calculations. J. Geophys. Res. **103**, 11483–11504 (1998b)

Pfeilsticker, K.: First geometrical path lengths probability density function derivation of the skylight from high resolution oxygen A-band spectroscopy. 2. Derivation of the Lévy index for the skylight transmitted by mid-latitude clouds. J. Geophys. Res. **104**, 4101–4116 (1999)

Pierson, A., Goldstein, J.: Stray light in spectrometers: causes and cures. Lasers. Optronics. Sept. issue, 67–74 (1989)

Pfeilsticker, K., Arlander, D.W., Burrows, J.P., Erle, F., Gil, M., Goutail, F., Hermans, C., Lambert, J-C Platt, U., Pommereau, J-P., Richter, A., Sarkissian, A., Van Roozendael, M., Wagner, T., Winterrath, T.: Intercomparison of the influence of tropospheric clouds on UV-visible absorption detected during the NDSC intercomparison campaign at OHP in June 1996. Geophys. Res. Lett **26** 1169–1173 (1999a)

Pfeilsticker, K., Erle, F., Platt, U.: Observation of the stratospheric NO_2 latitudinal distribution in the northern winter hemisphere. J. Atmos. Chem. **32**, 101–120 (1999b)

Pikelnaya, O., Hurlock, S., Trick, S., Stutz, J.: Measurements of reactive iodine species on the Isles of Shoals. Gulf of Maine. Eor Trans. AGU, **86**, Abstract A14A–06 (2005)

Pikelnaya, O., Hurlock, S.H., Trick, S., Stutz, J.: Intercomparison of multiaxis and long-path differential optical absorption spectroscopy measurements in the marine boundary layer. J. Geophys. Res. **112**, D10S01, doi: 10.1029/2006JD007727, (2007)

Pitts, J.N., Finlayson, B.J., Winer, A.M.: Optical systems unravel smog chemistry. Environ. Sci. Technol. **11**, 568–573 (1977)

Pitts, J.N., Jr: Formation and fate of gaseous and particulate mutagens and carcinogens in real and simulated atmospheres. Environ. Health Perspect. **47**, 115–140 (1983)

Pitts, J.N., Jr, Biermann, H.W., Atkinson, R., Winer, A.M.: Atmospheric implications of simultaneous night-time measurements of NO_3 radicals and HONO. Geophys. Res. Lett. **11**, 557–560 (1984)

Pitts, J.N., Biermann, H.W., Winer, A.M., Tuazon, E.C.: Spectroscopic identification and measurement of gaseous nitrous acid in dilute auto exhaust. Atmos. Environ. **18**, 847–854 (1984a)

Pitts, J.N., Sanhueza, E., Atkinson, R., Carter, W.P.L., Winer, A.M., Harris, G.W., Plum, C.N.: An investigation of the dark formation of nitrous acid in environmental chambers. Int. J. Chem. Kinet. **16**, 919–939 (1984b)

Pitts, J.N., Wallington, T.J., Biermann, H.W., Winer, A.M.: Identification and measurement of nitrous acid in an indoor environment. Atmos. Environ. **19**, 763–767 (1985)

Plane, J.M.C., Nien, C.-F.: Study of night-time NO_3 chemistry by differential optical absorption spectroscopy. In: Schiff, H.I. (ed.) SPIE Proceedings, Vol. 1433, Measurement of Atmospheric Gases (The International Society for Optical Engineering) Bellingham, pp. 8–20 (1991)

Plane, J.M.C., Nien, C.F.: Differential optical absorption spectrometer for measuring atmospheric trace gases. Rev. Sci. Instr. **63**, 1867–1876 (1992)

Plane, J.M.C., Smith, N.: Atmospheric monitoring by differential optical absorption spectroscopy. In: Clark, R.J.H., Hester, R.E. (eds.) Spectroscopy in Environmental Sciences, pp. 223–262. John Wiley & Sons Ltd., (city) (1995)

Platt, U.: Mikrometeorologische Bestimmung der SO_2-Abscheidung am Boden Dissertation, Uni Heidelberg (1977)

Platt, U.: Dry deposition of SO_2. Atmos. Environ. **12**, 363–367 (1978)

Platt, U., Perner, D., Pätz, H.: Simultaneous measurement of atmospheric CH_2O, O_3, and NO_2 by differential optical absorption. J. Geophys. Res. **84**, 6329–6335 (1979)

Platt, U., Perner, D.: Direct measurements of atmospheric CH_2O, HNO_2, O_3, NO_2 and SO_2 by differential optical absorption in the near UV. J. Geophys. Res. **85**, 7453–7458 (1980)

Platt, U., Perner, D., Harris, G.W., Winer, A.M., Pitts, J.N.: Detection of NO_3 in the polluted troposphere by differential optical absorption. Geophys. Res. Lett. **7**, 89–92 (1980a)

Platt, U., Perner, D., Harris, G.W., Winer, A.M., Pitts, J.N.: Observations of nitrous acid in an urban atmosphere by differential optical absorption. Nature **285**, 312–314 (1980b)

Platt, U., Perner, D., Schröder, J., Kessler, C., Tönnissen, A.: The diurnal variation of NO_3. J. Geophys. Res. **86**, 11965–11970 (1981)

Platt, U., Perner, D., Kessler, C.: The importance of NO_3 for the atmospheric NOx cycle from experimental observations. In: Proceedings of the 2nd Symposium Composition of the Nonurban Troposphere, Williamsburg, May 82, 25–28 (1982)

Platt, U., Perner, D.: Measurements of atmospheric trace gases by long path differential UV/visible absorption spectroscopy. In: Killinger, D.K., Mooradien, A. (eds.) Optical and Laser Remote Sensing, Springer Series in Optical Science, Vol. 39, pp. 95–105. Springer-Verlag, Berlin (1983)

Platt, U., Perner, D.: Ein Instrument zur spektroskopischen Spurenstoffmessung in der Atmosphäre. Fresenius Z. Anal. Chem. **317**, 309–313 (1984)

Platt, U., Winer, A.M., Biermann, H.W., Atkinson, R., Pitts, J.N.: Measurement of nitrate radical concentrations in continental air. Environ. Sci. Techn. **18**, 365–369 (1984)

Platt, U.: The origin of nitrous and nitric acid in the atmosphere. W. Jäschke, (ed.) NATO ASI-series, Springer Verlag, Heidelberg, pp. 299–319 (1986)

Platt, U., Rateike, M., Junkermann, W., Hofzumahaus, A., Ehhalt, D.H.: Detection of atmospheric OH radicals. Free. Rad. Res. Comms. **3**, 165–172 (1987)

Platt, U., Rateike, M., Junkermann, W., Rudolph, J., Ehhalt, D.H.: New tropospheric OH measurements. J. Geophys. Res. **93**, 5159–5166 (1988)

Platt, U., Perner, D., Semke, S.: Observation of nitrate radical concentrations and lifetimes in tropospheric air. In: Bojkov, R.D., Fabian, P. (eds.) Ozone in the Atmosphere. Proceedings of the Quadrennial Ozone Symposium 1988, pp. 512–515. A. Deepak Publishing, Hampton (1989)

Platt, U., LeBras, G., Poulet, G., Burrows, J.P., Moortgat, G.: Peroxy radicals from night-time reaction of NO_3 with organic compounds. Nature **348**, 147–149 (1990)

Platt, U.: Spectroscopic measurement of free radicals (OH, NO_3) in the atmosphere. Fresenius J. Anal. Chem. **340**, 633–637 (1991)

Platt, U.: Differential optical absorption spectroscopy (DOAS). In: Sigrist, M.W. (ed.) Air Monitoring by Spectroscopic Techniques. Chemical Analysis Series, Vol. 127, John Wiley & Sons, Inc, New York, Chichester, Brisbane, Toronoto, Singapore, ISBN 0–471–55875–3, pp. 27–84 (1994)

Platt, U., Heintz, F.: Nitrate radicals in tropospheric chemistry. Israel. J. Chem. **34**, 289–300 (1994a)

Platt, U., Hausmann, M.: Spectroscopic measurement of the free radicals NO_3, BrO, IO, and OH in the troposphere. Res. Chem. Intermed. **20**, 557–578 (1994b)

Platt, U., Janssen, C.: Observation and role of the free radicals NO_3, ClO, BrO and IO in the troposphere. Faraday Discuss. **100**, 175–198 (1996a)

Platt, U., Lehrer, E. (eds.): Arctic Tropospheric Halogen Chemistry. Final Report to EU (1996b)

Platt, U., Lehrer, E.: Arctic Tropospheric Ozone Chemistry, ARCTOC, Final Report of the EU-Project EV5V-CT93-0318, Heidelberg (1997)

Platt, U., Marquard, L., Wagner, T., Perner, D.: Corrections for zenith scattered light DOAS. Geophys. Res. Lett. **24**, 1759–1762 (1997)

Platt, U., Le Bras, G.: Influence of DMS on the NO_X – NO_Y partitioning and the NO_X distribution in the marine background atmosphere. Geophys. Res. Lett. **24**, 1935–1938 (1997)

Platt, U.: Modern methods of the measurement of atmospheric trace gases. J. Physical Chemistry Chemical Physics 'PCCP' **1**, 5409–5415 (1999)

Platt, U.: Air Monitoring by Differential Optical Absorption Spectroscopy, In: Meyers, R.A. (ed.) Encyclopedia of Analytical Chemistry, pp. 1936–1959, John Wiley & Sons Ltd, Chichester (2000)

Platt, U., Alicke, B., Dubois, R., Geyer, A., Hofzumahaus, A., Holland, F., Mihelcic, D., Klüpfel, T., Lohrmann, B., Pätz, W., Perner, D., Rohrer, F., Schäfer, J., Stutz, J.: Free radicals and fast photochemistry during BERLIOZ. J. Atmos. Chem. **42**, 359–394 (2002)

Platt, U., Hönninger, G.: The role of halogen species in the troposphere. Chemosphere **52**(2), 325–338 (2003)

Platt, U. Allan, W. Lowe, D.: Hemispheric average Cl atom concentration from $^{13}C/^{12}C$ ratios in atmospheric methane. Atmos. Chem. Phys. **4**, 2393–2399 (2004)

Platt, U., Pfeilsticker, K., Vollmer, M.: Radiation and optics in the atmosphere, Ch. 19. In: Träger, F. (ed.) Springer Handbook of Lasers and Optics, Springer, Heidelberg, ISBN-10: 0–387–95579–8, pp. 1165–1203 (2007)

Plum, C.N., Sanhueza, E., Atkinson, R., Carter, W.P.L., Pitts, J.N., Jr: OH radical rate constants and photolysis rates of a-dicarbonyls. Environ. Sci. Technol **17**, 479–484 (1983)

Pommereau, J.P.: Observation of NO_2 diurnal variation in the stratosphere. Geophys. Res. Lett. **9**(8), 850–853 (1982)

Pommereau, J.P., Goutail, F.: An advanced visible-UV spectrometer for atmospheric composition measurements. ESA SP-**270**, 197–200 (1987)

Pommereau, J.P., Goutail, F.: O_3 and NO_2 ground-based measurements by visible spectrometry during the arctic winter and spring 1988. Geophys. Res. Lett. **15**, 891–894 (1988a)

Pommereau, J.P., Goutail, F.: Stratospheric O_3 and NO_2 Observations at the southern polar circle in summer and fall 1988. Geophys. Res. Lett. **15**, 895 (1988b)

Pommereau, J.-P., Piquard, J.: Ozone and nitrogen dioxide vertical distributions by UV–visible solar occultation from balloons. Geophys. Res. Lett. **21**, 1227–1230 (1994a)

Pommereau, J.-P., Piquard, J.: Observations of the vertical distribution of stratospheric OClO. Geophys. Res. Lett. **21**, 1231–1234 (1994b)

Poppe, D., Wallasch, M., Zimmermann, J.: The dependence of the concentration of OH on its precursors under moderately polluted conditions – a model study. J. Atmos. Chem. **16**, 61–78 (1993)

Pope, F.D., Smith, C.A., Davis, P.R., Shallcross, D.E., Ashfold, M.N.R., Orr-Ewing, A.J.: Photochemistry of formaldehyde under tropospheric conditions. Faraday Discuss. **130**, 59–72 (2005a)

Pope, F.D., Smith, C.A., Ashfold, M.N.R., Orr-Ewing, A.J.: High-resolution absorption cross sections of formaldehyde at wavelengths from 313 to 320 nm. Phys. Chem. Chem. Phys. **7**, 79–84 (2005b)

Portmann, R.W., Brown, S.S., Gierczak, T., Talukdar, R.K., Burkholder, J.B., Ravishankara, A.R.: Role of nitrogen oxides in the stratosphere: a reevaluation based on laboratory studies. Geophys. Res. Lett. **26**(15), 2387–2390 (1999)

Povey, I.M., South, A.M., t'Kint de Roodenbeke, A., Hill, C., Freshwater, R.A., Jones, R.L.: A broadband lidar for the measurement of tropospheric constituent profiles from the ground. J. Geophys. Res. **10**(D3), 3369–3380 (1998)

Press, W.H., Flannery, B.P., Teukolsky, S.A., Vettering, W.T.: Numerical Recipes in C. Cambridge University Press, Cambridge (1986)

Preston, K.E., Jones, R.L., Roscoe, H.K.: Retrieval of NO_2 vertical profiles from ground-based UV-visible measurements: method and validation. J. Geophys. Res. **102**(D15), 19089–19097 (1997)

Pribram, J.K., Penchina, C.M.: Stray light in czerny-turner and ebert spectrometers. Appl. Opt. **7**, 2005–2014 (1968)

Price, P.N.: Pollutant tomography using integrated concentration data from non-intersecting optical paths. Atmos. Environ. **33**, 275–280 (1999)

Prinn, R., Cunnold, D., Rasmussen, R., Simmonds, P., Alyea, F., Crawford, A., Fraser, P., Rosen, R.: Atmospheric trends in methylchloroform and the global average for the hydroxyl radical. Science **238**, 945–950 (1987)

Pszenny, A.A.P., Keene, W.C., Jacob, D.J., Fran, S., Maben, J.R., Zetwo, M.P., Sringer-Young, M., Galloway, J.N.: Evidence of inorganic chlorine gases other than hydrogen chloride in marine surface air. Geophys. Res. Lett. **20**(8), 699–702 (1993)

Pundt, I., Pommereau, J.P., Lefevre, F.: Investigation of stratospheric bromine and iodine oxides using the SAOZ balloon sonde. In: Bojkov, R.D., Visconti, D. (eds.) Proceedings of XVIII Quadrennial Ozone Symposium L'Aquila, International Ozone Commission Italy, 12–21 September, pp. 575–578 (1996)

Pundt, I., Pommereau, J.P., Phillips, C., Lateltin, E.: Upper limit of iodine oxide in the lower stratosphere. J. Atmos. Chem. **30**, 173–185 (1998)

Pundt, I., Roozendael van, M., Wagner, T., Richter, A., Chipperfield, M.P., Burrows, J.P., Fayt, C., Hendrick, F., Pfeilsticker, K., Platt, U., Pommereau,

J.P.: Simultaneous UV-vis measurements of BrO from balloon, satellite and ground: implications for tropospheric BrO, In: Harris, N.R.P., Guirlet, M., Amanatis, G.T. (eds.) Air Pollution Research Report 73, Proceedings 5th European Symposium on Polar Stratospheric Ozone 1999, European Commission, Directorate General for Research Unit D.I. – Environment and Sustainable Development Programme, EUR 1934. pp. 316–319 (2000)

Pundt, I., Pommereau, J.-P., Chipperfield, M.P., Van Roozendael, M., Goutail, F.: Climatology of the stratospheric BrO vertical distribution by balloon-borne UV–visible spectrometry. J. Geophys. Res. **107**(D24), 4806 (2002). doi:10.1029/2002JD002230 (2002)

Rairoux, P., Schillinger, H., Niedermeier, S., Rodriguez, M., Ronneberger, F., Sauerbrey, R., Stein, B., Waite, D., Wedekind, C., Wille, H., Wöste, L., Ziener, C.: Remote sensing of the atmosphere using ultrashort laser pulses. App. Phys. B (Lasers and Optics) **71**, 573–580 (2000). doi: 10.1007/s003400000375

Ramacher, B., Rudolph, J., Koppmann, R.: Hydrocarbon measurements in the spring Arctic troposphere during the ARCTOC 95 campaign. Tellus **49B**, 466–485 (1997)

Ramacher, B., Rudolph, J., Koppmann, R.: Hydrocarbon measurements during tropospheric ozone depletion events: evidence for halogen atom chemistry. J. Geophys. Res. **104**, 3633–3653 (1999)

Rayleigh, L.: On the transmission of light through an atmosphere containing many small particles in suspension, and on the origin of the blue of the sky, Phil. Mag. **41**, 447–454. Also: in the scientific papers of Lord Rayleigh, Vol. 4, Dover, New York, 1964 (1899)

Reader, J., Sansonetti, C.J., Bridges, J.M.: Irradiances of spectral lines in mercury pencil lamps. Appl. Opt. **35**, 78–83 (1996)

Redemann Fischer, H.E., Fergg, F., Rabus, D.: Measurements of stratospheric NO_2 profiles using a gas correlation radiometer in the solar occultation mode. J. Atmos. Chem. **3**, 203–231 (1985)

Reisinger, A.R., Fraser, G.J., Johnston, P.V., McKenzie, R.L., Matthews, W.A.: Slow-scanning DOAS system for urban air pollution monitoring. In: Bojkov, R.D., Visconti, G. (eds.) Atmospheric ozone, Proceedings of the XVIII Quadrennial Ozone Symposium, L'Aquila, Italy, September 1996, Vol. 2, pp. 959–962. Parco Scientifico e Tecnologico d'Abruzzo, L'Aquila (1998)

Ren, X., Harder, H., Martinez, M., Lesher, R.L., Oliger, A., Simpas, J.B., Brune, W.H., Schwab, J.J., Demerjian, K.L., He, Y., Zhou, X., Gao, H.: OH and HO_2 chemistry in urban atmosphere of New York city. Atmos. Environ. **37**, 3639–3651 (2003)

Renard, J.-B., Pirre, M., Robert, C., Moreau, G., Huguenin, D., Russell, III J.M.: Nocturnal vertical distribution of stratospheric O_3, NO_2 and NO_3 from balloon measurements. J. Geophys. Res. **101**, 28793–28804 (1996)

Renard, J.-B., Pirre, M., Robert, C., Lefèvre, F., Lateltin, E., Nozière, B., Huguenin, D.: Vertical distribution of nighttime stratospheric NO_2 from balloon measurements: comparison with models. Geophys. Res. Lett. **24**, 73–76 (1997a)

Renard, J.B., Lefèvre, F., Pierre, M., Huguenin, D.: Vertical profile of night-time stratospheric OClO. J. Atmos. Chem. **26**, 65–76 (1997b)

Renard, J.B., Pierre, M., Robert, C., Huguenin, D.: The possible detection of OBrO in the stratosphere. J. Geophys. Res. **103**, 25383–25395 (1998)

Renard, J.-B., Chartier, M., Robert, C., Chalumeau, G., Berthet, G., Pirre, M., Pommerreau, J.-P., Goutail, F.: SALOMON: a new, light balloonborne UV-visible spectrometer for nighttime observations of stratospheric trace-gas species. Appl. Opt. **39**(3), 386–392 (2000a)

Renard, J.-B., Taupin, F.G., Rivière, E.D., Pirre, M., Huret, N., Berthet, G., Robert, C., Chartier, M.: Measurements and simulation of stratospheric NO_3 at Mid- and High-latitudes in the Northern Hemisphere. J. Geophys. Res. **106**, 32387–32399 (2000b)

Rhode, H., Charlson, R., Crawford, E.: Svante Arrhenius and the greenhouse effect. AMBIO **26**, 2–5 (1997)

Richter, A.: Absorptionsspektroskopische Messungen atmosphärischer Spurengase über Bremen, 53°N, Doktoral thesis, University of Brmen (1997)

Richter, A., Wittrock, F., Eisinger, M., Burrows, J.P.: GOME observation of tropospheric BrO in northern hemispheric spring and summer 1997. Geophys. Res. Lett. **25**, 2683–2686 (1998)

Richter, A., Eisinger, M., Ladstätter, Weißenmayer, A. Wittrock, F., Burrows, J.P.: DOAS zenith-sky observations: seasonal variations of BrO over Bremen (53°N) 1994–1995. J. Atmos. Chem. **32**, 83–99 (1999)

Richter, A., Burrows, J.P.: Retrieval of tropospheric NO_2 from GOME measurements. Adv. Space Res. **29**(11), 1673–1683 (2002)

Richter, A., Wittrock, F., Ladstätter-Weißenmayer, A., Burrows, J.P.: GOME measurements of stratospheric and tropospheric BrO. Adv. Space. Res. **29**(11), 1667–1672 (2002)

Richter, A., Burrows, J.P., Nüß, H., Granier, C., Niemeier, U.: Increase in tropospheric nitrogen dioxide over China observed from space. Nature **437**, 129–132 (2005). doi:10.1038/nature04092

Richter, A., Wittrock, F., Weber, M, Beirle, S., Kühl, S., Platt, U., Wagner, T., Wilms-Grabe, W., Burrows, J.P.: GOME observations of stratospheric trace gas distributions during the splitting vortex event in the Antarctic winter 2002 Part I: measurements. J. Atmos. Sci. **62**(3), 778–785 (2005)

Rigaud, P., Leroy, B., Le Bras, G., Poulet, G., Jourdain, J.L., Combourieu, J.: About the identification of some UV atmospheric absorptions laboratory study of ClO. Chem. Phys. Lett. **46**, 161 (1977)

Rigaud, P., Naudet, J.-P., Huguenin, D.: Simultaneous measurements of vertical distribution of stratospheric NO_3 and O_3 at different periods of the night. J. Geophys. Res. **88**, 1463–1467 (1983)

Rinsland, C.P., Mahieu, E., Zander, R., Jones, N.B., Chipperfield, M.P., Goldman, A., Anderson, J., Russell, J.M. III, Demoulin, P., Notholt, J., Toon, G.C., Blavier, J.-F., Sen, B., Sussmann, R., Wood, S.W., Meier, A., Griffith, D.W.T., Chiou, L.S., Murcray, F.J., Stephen, T.M., Hase, F., Mikuteit, S., Schulz, A., Blumenstock, T.: Long-term trends of inorganic chlorine from ground-based infrared solar spectra: past increases and evidence for stabilization. J. Geophys. Res. **108**(D8), 4252 (2003). doi:4210.1029/2002JD003001

Rityn, N.E.: Optics of corner cube reflectors. Sov. J. Opt. Tech. **34**, 198–201 (1967)

Ritz, D., Hausmann, M., Platt, U.: An improved open-path multireflection cell for the measurement of NO_2 and NO_3. In: Schiff, H.I., Platt, U. (eds.) Proceedings Europto series, Optical Methods in Atmospheric Chemistry, SPIE **1715**, 200–211 (1992)

Röckmann, T., Brenninkmeijer, C.A.M., Crutzen, P.J., Platt, U.: Short term variations in the $^{13}C/^{12}C$ ratio of CO as a measure of Cl activation during tropospheric ozone depletion events in the arctic. J. Geophys. Res. 104, 16911697 (1999)

Rodgers, C.D.: Characterisation and error analysis of profiles retrieved from remote sounding measurements. J. Geophys. Res. **95**(D5), 5587–5595 (1990)

Rodgers, C.D.: Inverse Methods for Atmospheric Sounding, Theory and Practice. World Scientific Publishing, Singapore (2000)

Rohrer, F., Bohn, B., Brauers, T., Brüning, D., Johnen, F.-J., Wahner, A., Kleffmann, J.: Characterisation of the photolytic HONO-source in the atmosphere simulation chamber SAPHIR. Atmos. Chem. Phys. Discuss. **4**, 7881–7915 (2004). SRef-ID: 1680-7375/acpd/2004-4-7881

Roscoe, H.K., Pyle, J.A.: Measurements of solar occultation: the error in a naive retrieval if the constituent's concentration changes. J. Atmos. Chem. **5**, 323–341 (1987)

Roscoe, H.K., Fish, D.J., Jones, R.L.: Interpolation errors in UV-visible spectroscopy for stratospheric sensing: implications for sensitivity, spectral resolution, and spectral range. Appl. Opt. **35**, 427–432 (1996)

Roscoe, H.K., Clemitshaw, K.C.: Measurement techniques in gas-phase tropospheric chemistry: a selective view of the past, present, and future. Science **276**, 1065–1072 (1997)

Roscoe, H.K., Johnston, P.V., Van Roozendael, M., Richter, A., Sarkissian, A., Roscoe, J., Preston, K.E., Lambert, J.-C., Hermans, C., et al.: Slant column measurements of O_3 and NO_2 during the NDSC intercomparison of zenith-sky UV-visible spectrometers in June 1996. J. Atmos. Chem. **32**, 281–314 (1999)

Roscoe, H.K., Charlton, A.J., Fish, D.J., Hill, J.G.T.: Improvements to the accuracy of measurements of NO_2 by zenith-sky visible spectrometers II: errors in offset using a more complete chemical model. J. Quant. Spectrosc. Radiat. Trans. **68**, 337–349 (2001)

Roscoe, H.K., Hill, J.G.T., Jones, A.E., Sarkissian, A.: Improvements to the accuracy of zenith-sky measurements of total ozone by visible spectrometers II: use of daily air-mass factors. J. Quant. Spectrosc. Radiat. Trans. **68**, 327–336 (2001)

Rothe, K.W., Brinkmann, U., Walther, H.: Applications of tunable dye lasers to air pollution detection: measurements of atmospheric NO_2 concentrations by differential absorption. Appl. Phys. **3**, 115–119 (1974)

Rothman, L.S., Gamache, R.R., Tipping, R.H., Rinsland, C.P., Smith, M.A.H., Benner, D.C., Malathy Devi, V., Flaud, J.-M., Camy-Peyret, C., Perrin, A., Goldman, A., Massie, S.T., Brown, L.R., Toth, R.A.: The HITRAN molecular database: editions of 1991 and 1992. J. Quant. Spectrosc. Radiat. Transf. **48**(5/6), 469–508 (1992)

Rothman, L.S., Rinsland, C.P., Goldman, A., Massie, S.T., Edwards, D.P., Flaud, J.-M., Perrin, A., Camy-Peyret, C., Dana, V., Mandin, J.-Y., Schroeder, J., McCann, A., Gamache, R.R., Wattson, R.B., Yoshino, K., Chance, K.V., Jucks, K.W., Brown, L.R., Nemtchinov, V., Varanasi, P.: The HITRAN molecular spectroscopic database and HAWKS (HITRAN Atmospheric Workstation): 1996 edition. J. Quant. Spectrosc. Radiat. Transf. **60**(5), 665–710 (1998)

Rothman, L.S., Barbe, A., Chris Benner, D., Brown, L.R., Camy-Peyret, C., Carleer, M.R., Chance, K., Clerbaux, C., Dana, V., Devi, V.M., Fayt, A., Flaud, J.-M., Gamache, R.R., Goldman, A., Jacquemart, D., Jucks, K.W., Lafferty,

W.J., Mandin, J.-Y., Massie, S.T., Nemtchinov, V., Newnham, D.A., Perrin, A., Rinsland, C.P., Schroeder, J., Smith, K.M., Smith, M.A.H., Tang, K., Toth, R.A., Vander Auwera, J., Varanasi, P., Yoshino, K.: The HITRAN molecular spectroscopic database: edition of 2000 including updates through 2001. J. Quant. Spectros. Rad. Transf. **82**, 5–44 (2003)

Rothman, L.S., Jacquemart, D., Barbe, A., Chris Benner, D., Birk, M., Brown, L.R., Carleer, M.R., Chackerian, C., Chance, K., Dana, V., Devi, V.M., Flaud, J.-M., Gamache, R.R., Goldman, A., Hartmann, J.-M., Jucks, K.W., Maki, A.G., Mandin, J.-Y. Massie, S.T., Orphal, J., Perrin, A., Rinsland, C.P., Smith, M.A.H., Tennyson, J., Tolchenov, R.N., Toth, R.A., Vander Auwera, J., Varanasi, P., Wagner, G.: The HITRAN 2004 molecular spectroscopic database. J. Quant. Spectrosc. Radiat. Transf. **96**, 139–204 (2005)

Rotstayn, L.D., Lohmann, U.: Simulation of the tropospheric sulfur cycle in a global model with a physically based cloud scheme. J. Geophys. Res. **107**(D21), 4592 (2002). doi:10.1029/2002JD002128

Rozanov, V., Diebel, D., Spurr, R., Burrows, J.: GOMETRAN: A radiative transfer model for the satellite project GOME – the plane-parallel version. J. Geophys. Res. **102**(D14), 16683–16695 (1997)

Rozanov, A., Rozanov, V.-V., Burrows, J.-P.: Combined differential-integral approach for the radiation field computation in a spherical shell atmosphere: Nonlimb geometry. J. Geophys. Res. **105**(D18), 22937–22942 (2000)

Rozanov, A., Rozanov, V.-V., Burrows, J.-P.: A numerical radiative transfer model for a spherical planetary atmosphere: combined differential-integral approach involving the Picard iterative approximation. J. Quant. Spectrosc. Radiat. Transf. **69**(4), 491–512 (2001)

Rudich, Y., Talukdar, R., Ravishankara, A.R.: Reactive uptake of NO_3 on pure water and ionic solutions. J. Geophys. Res. **D101**, 21023–21031 (1996)

Rudolph, J., Fu, B.R., Anlauf, T.A.K., Bottenheim, J.: Halogen atom concentrations in the Arctic troposphere derived from hydrocarbon measurements: Impact on the budget of formaldehyde. Geophys. Res. Lett. **26**(19), 2941–2944 (1999)

Russell, A.G., Cass, G.R., Seinfeld, J.H.: On some aspects of nighttime atmospheric chemistry. Environ. Sci. Technol. **20**, 1167–1172 (1986)

Russwurm, G.: Differential optical absorption spectroscopy (DOAS)—A Status Report on the Instrumentation (1999)

Saiz-Lopez, A., Plane, J.M.C., Shillito, J.A.: Bromine oxide in the mid-latitude marine boundary layer. Geophys. Res. Lett. **31**, L03111.1–L03111.4 (2004a). doi:10.1029/2003GL018 956

Saiz-Lopez, A., Plane, J.M.C., Shillito, J.A.: Novel iodine chemistry in the marine boundary layer. Geophys. Res. Lett. **31**, L04112 (2004b). doi: 10.1029/2003GL019215

Saiz-Lopez, A., Saunders, R.W., Joseph, D.M., Ashworth, S.H., Plane, J.M.C.: Absolute absorption cross-section and photolysis rate of I_2. Atmos. Chem. Phys. **4**, 1443–1450 (2004c) SRef-ID: 1680-7324/acp/2004-4-1443

Saiz-Lopez, A., Shillito, J.A., Coe, H., Plane, J.M.C.: Measurements and modelling of I_2, IO, OIO, BrO and NO_3 in the mid-latitude marine boundary layer. Atmos. Chem. Phys. Discuss. **5**, 9731–9767 (2005). SRef-ID: 1680-7375/acpd/2005-5-9731

Sakamaki, F., Hatakeyama, S., Akimoto, H.: Formation of nitrous acid and nitric oxide in the heterogeneous dark reaction of nitrogen dioxide and water vapor in a smog chamber. Int. J. Chem. Kinet. **XV**, 1013–1029 (1983)

Saltzman, B.E.: Colorimetric microdetermination of nitrogen dioxide in the atmosphere. Anal. Chem. **26**, 1948–1955 (1954)

Sanders, R., Solomon, S., Mount, G., Bates, M.W., Schmeltekopf, A.: Visible spectroscopy at McMurdo station, Antarctica: 3. Observation of NO_3. J. Geophys. Res. **92**, 8339–8342 (1987)

Sander, S.P., Friedl, R.R.: Kinetics and product studies of the reaction ClO + BrO using flash photolysis-ultraviolet absorption. J. Phys. Chem. **93**, 4764–4771 (1989)

Sanders, R.W., Solomon, S., Carroll, M.A., Schmeltekopf, A.L.: Visible and near-ultraviolet spectroscopy at McMurdo station, Antarctica 4. Overview and daily measurements of NO_2, O_3, and OClO during 1987. J. Geophys. Res. **94**(D9), 11381–11391 (1989)

Sanders, R.W., Solomon, S., Smith, J.P., Perliski, L., Miller, H.L., Mount, G.H., Keys, J.G., Schmeltekopf, A.L.: Visible and near-UV spectroscopy at McMurdo station, Antarctica, 9. Observations of OClO from April to October 1991. J. Geophys. Res. **98**(D4), 7219–7228 (1993)

Sanders, R.W.: Improved analysis of atmospheric absorption spectra by including the temperature dependence of NO_2. J. Geophys. Res. **101**, 20945–20952 (1996)

Sanders, R.W., Solomon, S., Kreher, K., Johnston, P.V.: An intercomparison of NO_2 and OClO measurements at arrival heights, Antarctica during austral spring 1996. J. Atmos. Chem. **33**, 283–298 (1999)

Sander, R., Keene, W.C., Pszenny, A.A.P., Arimoto, R., Ayers, G.P., Baboukas, E., Cainey, J.M., Crutzen, P.J., Duce, R.A., Hönninger, G., Huebert, B.J., Maenhaut, W., Mihalopoulos, N., Turekian, V.C., Van Dingenen, R.: Inorganic bromine in the marine boundary layer: a critical review. Atmos. Chem. Phys. **3**, 1301–1336 (2003)

Sansonetti, C.J., Salit, M.L., Reader, J.: Wavelengths of spectral lines in mercury pencil lamps. Appl. Opt. **35**, 74–77 (1996)

Sarkissan, A., Pommereau, J.P, Goutail, F.: Identification of polar stratospheric clouds from the ground by visible spectrometry. Geophys. Res. Lett. **18**, 779–782 (1991)

Sarkissian, A., Fish, D., Van Roozendael, M., Gil, M., Chen, H.B., Wang, P., Pommereau, J.P., Lenoble, J.: Ozone and NO_2 air-mass factors for zenith sky spectrometers: intercomparison of calculations with different radiative transfer models. Geophys. Res. Lett. **21**, 1113–1116 (1995)

Sarkissian, A., Vaughan, G., Roscoe, H.K., Bartlett, L.M., O'Connor, F.M., Drew, D.G., Hughes, P.A., Moore, D.: Accuracy of measurements of total ozone by a SAOZ ground-based zenith-sky visible spectrometer. J. Geophys. Res. **102**, 1379–1390 (1997)

Savigny, C.V., Funk, O., Platt, U., Pfeilsticker, K.: Radiative smoothing in zenith-scattered skylight transmitted to the ground. Geophys. Res. Lett **26**, 2949–2952 (1999)

Savitzky, A., Golay, M.J.E.: Smoothing and differentiation of data by simplified least squares procedures. Anal. Chem. **36**, 1627–1639 (1964)

Schall, C., Heumann, K.G.: GC determination of volatile organoiodine and organobromine compounds in seawater and air samples. Fresenius J. Anal. Chem. **346**, 717–722 (1993)

Schauffler, S.M., Atlas, E.L., Flocke, F., Lueb, R.A., Stroud, V., Travnicek, W.: Measurement of bromine-containing organic compounds at the tropical tropopause. Geophys. Res. Lett. **25**, 317–320 (1998)

Schermaul, R., Brault, J.W., Canas, A.A.D., Learner, R.C.M., Polyansky, O.L., Zobov, N.F., Belmiloud, D., Tennyson, J.: Weak line water vapour spectrum in the regions 13,200–15,000 cm^{-1}. J. Mol. Spectrosc. **211**, 169–178 (2002)

Schiff, H.I., Karecki, D.R., Harris, G.W., Hastie, D.R., Mackay, G.I.: A tunable diode laser system for aircraft measurements of trace gases. J. Geophys. Res. **95**, 10147–10154

Schiller, C., Wahner, A., Platt, U., Dorn, H.-P., Callies, J., Ehhalt, D.H.: Near UV atmospheric absorption measurements of column abundances during airborne Arctic stratospheric expedition, January–February 1989: 2. OClO observations. Geophys. Res. Lett. **17**, 501–504 (1990)

Schmidt, M.: Von Christian Friedrich Schönbein bis zum Ozonloch, ein Abriß der Geschichte der Ozonforschung, Max-Planck-Insitut für Aeronomie, Katlenburg-Lindau bei Göttingen, Germany (1988)

Schmölling, J.: Uebersicht über regulatorische Massnahmen zur Luftreinhaltung und deren Auswirkungen. AGF- Tagung "Luftreinhaltung – Luftverschmutzung", Bonn, 3–4, Nov. (1983)

Schneider, W., Moortgat, G.K., Tyndall, G.S., Burrows, J.P.: Absorption cross-sections of NO_2 in the UV and visible region (200–700 nm) at 298 K.J. Photochem. Photobiol. **40**, 195–217 (1987)

Schofield, R., Connor, B.J., Kreher, K., Johnston, P.V., Rodgers, C.D.: The retrieval of profile and chemical information from ground-based UV-visible spectroscopic measurements. J. Quant. Spectr. Rad. Transf. **86**, 115–131 (2004)

Schofield, R., Johnston, P.V., Thomas, A., Kreher, K., Connor, B.J., Wood, S., Shooter, D., Chipperfield, M.P., Richter, A., von Glasow, R., Rodgers, C.D.: Tropospheric and stratospheric BrO columns over arrival heights, Antarctica, 2002. J. Geophys. Res. **111**, D22310 (2006). doi:10.1029/2005JD007022

Scholl, T.: Photon path length distributions for cloudy skies – Their first and second-order moments inferred from high resolution oxygen A-Band spectroscopy. PhD Thesis, University of Heidelberg, Germany (2006)

Schönbein, C.F.: Beobachtungen über den bei der Elektrolysation des Wassers and dem Ausströmen der gewöhnlichen Electrizität aus Spitzen sich entwickelnden Geruch. Ann. Phys. Chem. **50**, 616 (1840)

Schroeder, W.H., Anlauf, K.G., Barrie, L.A., Lu, J.Y., Steffen, A., Schneeberger, D.R., Berg, T.: Arctic springtime depletion of mercury. Nature **394**, 331–332 (1998)

Schrötter, H.W., Klöckner, H.W.: Raman scattering cross-sections in gases. In: Weber, A. (ed.) Topics in Current Physics: Raman Spectroscopy of Gases and Liquids, Springer, Verlag (1979)

Schultz, M., Heitlinger, M., Mihelcic, D., Volz-Thomas, A.: Calibration source for peroxy radicals with built-in actinometry using H_2O and O_2 photolysis at 185 nm. J. Geophys. Res. **100**, 18811–18816 (1995)

Schulz-DuBois, E.O.: Generation of square lattice of focal points by a modified white cell. Appl. Opt. **12**, 1391–1393 (1973)

Schwartz, S.E.: Are global cloud albedo and climate crontrolled by marine phytoplankton. Nature **336**, 441–445 (1988)

Schweitzer, F., Mirabel, P., George, C.: Heterogeneous chemistry of nitryl halides in relation to tropospheric halogen activation. J. Atmos. Chem. **34**, 101–117 (1999)

Seinfeld, J.H., Pandis, S.N.: , Atmospheric Chemistry and Physics. John Wiley & Sons, Inc., New York (1998)

Seisel, S., Caloz, F., Fenter, F.F., Van den Bergh, H., Rossi, M.J.: The heterogeneous reaction of NO_3 with NaCl and KBr: a nonphotolytic source of halogen atoms. Geophys. Res. Lett. **24**, 2757–2760 (1997)

Senne, T., Stutz, J., Platt, U.: Measurement of the latitudinal distribution of NO_2 column density and layer height in Oct./Nov. 1993. Geophys. Res. Lett. **23**, 805–808 (1996)

Senzig, J.: Troposphärische DOAS-Messungen stickstoffhaltiger und aromatischer Verbindungen in Heidelberg, (in German), Diploma thesis, University of Heidelberg (1995)

Shangavi, S.: An effcient Mie theory implementation to investigate the influence of aerosols on radiative transfer, Diploma thesis, University of Heidelberg (2003)

Shapley, D.: Nitrosamines: scientists on the trail of prime suspect in. urban cancer. Science **191**, 268–270 (1976)

Shirinzadeh, B., Wang, C.C., Deng, D.Q.: Pressure dependence of ozone interference in the laser fluorescence measurements of OH in the atmosphere. Appl. Opt. **26**, 2102–2105 (1987)

Sigrist, M.W. (ed.): Air Monitoring by Spectroscopic Techniques, Chemical Analysis Series, Vol. 127. Wiley, New York (1994a)

Sigrist, M.W.: Air monitoring by laser photoacoustic spectroscopy. In: Sigrist, M.W. (ed.) Air Monitoring by Spectroscopic Techniques, Chemical Analysis Series, Vol. 127, pp. 163–238. Wiley, New York (1994b)

Sillman, S., Logan, J.A., Wofsy, S.C.: The Sensitivity of ozone to nitrogen oxides and hydrocarbons in regional ozone episodes. J. Geophys. Res. **95**, 1837–1852 (1990)

Simon, F.G., Schneider, W., Moortgat, G.K., Burrows, J.P.: A study of the ClO absorption cross-section between 240 and 310 nm and the kinetics of the self-reaction at 300 K. J. Photochem. Photobiol. A Chem. **55**, 1–23 (1990)

Simpson, W.R.: Continuous wave cavity ring-down spectroscopy applied to in situ detection of dinitrogen pentoxide (N_2O_5). Rev. Sci. Instrum. **74**(7), (2003). doi: 10.1063/1.1578705

Singh, H.B., Gregory, G.L., Anderson, B., Browell, E., Sachse, G.W., Davis, D.D., Crawford, J., Bradshaw, J.D., Talbot, R., Blake, D.R., Thornton, D., Newell, R., Merrill, J.: Low ozone in the marine boundary layer of the tropical Pacific Ocean: photochemical loss, chlorine atoms, and entrainment. J. Geophys. Res. **101**, 1907–1917 (1996)

Sinreich, R., Filsinger, F., Friess, U., Platt, U., Sebastian, O., Wagner, T.: MAX-DOAS detection of glyoxal during ICARTT 2004. Atmos. Chem. Phys. **7**, 1293–1303 (2007)

Sinreich, R., Friess, U., Wagner, T., Platt, U.: Multi axis differential optical absorption spectroscopy (MAX-DOAS) of gas and aerosol distributions. Farad. Disc. **130**, 153–164 (2005)

Sinnhuber, B.-M., Arlander, D.W., Bovensmann, H., Burrows, J.P., Chipperfield, M.P., Ennel, C.-F., Frieß, U., Hendrick, F., Johnston, P.V., Jones, R.L., Kreher, K., Mohamed-Tahrin, N., Müller, R., Pfeilsticker, K., Platt, U., Pommereau,

J.P., Pundt, I., Richter, A., South, A., Toernkvist, K.K., Van Roozendael, M., Wagner, T., Wittrock, F.: Comparison of measurements and model calculations of stratospheric bromine monoxide. J. Geophys. Res. **107**(D19), 4398 (2002). doi:10.1029/2001JD000940

Sinreich, R., Frieß, U., Wagner, T., Platt, U.: Multi axis differential optical absorption spectroscopy (MAXDOAS) of gas and aerosol distributions. Faraday Discuss. **130**, 153–164 (2005). doi: 10.1039/B419274P

Sioris, C.E., Evans, W.F.J.: Filling in of Fraunhofer and gas-absorption lines in sky spectra as caused by rotational Raman scattering. Appl. Opt. **38**(12), 2706–2713 (1999)

Sjödin, A.: Studies of the diurnal variation of nitrous acid in urban air. Environ. Sci. Technol. **22**, 1086–1089 (1988)

Slusser, J., Hammond, K., Kylling, A., Stamnes, K., Perliski, L., Dahlback, A., Anderson, D., DeMajistre, R.: Comparison of air mass computations. J. Geophys. Res. **101**, 9315–9321 (1996)

Slusser, J.R., Fish, D.J., Strong, E.K., Jones, R.L., Roscoe, H.K., Sarkissian, A.: Five years of NO_2 vertical column measurements at Faraday (65°S): evidence for the hydrolysis of $BrONO_2$ on Pinatubo aerosols. J. Geophys. Res. **102**, 12987–12993 (1997)

Smith, J., Solomon, S.: Atmospheric NO_3: 3. Sunrise disappearance and the stratospheric profile. J. Geophys. Res. **95**, 13819–13827 (1990)

Smith, J., Solomon, S., Sanders, R., Miller, H., Perliski, L., Keys, J., Schmeltekopf, A.: Atmospheric NO_3: 4. Vertical profiles at middle and polar latitudes at sunrise. J. Geophys. Res. **98**, 8983–8989 (1993)

Smith, N., Plane, J.M.C., Nien, C., Solomon, O.A.: Nighttime radical chemistry in the San Joaquin Valley. Atmos. Environ. **29**, 2887–2897 (1995)

Smith, P.L., Heise, C., Esmond, J.R., Kurucz, R.L.: Atomic spectral line database from CD-ROM 23 (1995 Atomic Line Data (Kurucz, R.L., Bell, B.) Kurucz CD-ROM No. 23. Cambridge, Mass.: Smithsonian Astrophysical Observatory) (1995), Solberg, S., Schmidtbauer, N., Semb, A., Stordal, F.: Boundary-layer ozone depletion as seen in the Norwegian Arctic in spring. J. Atmos. Chem. **23**, 301–332 (1996)

Smith, K.M., Newnham, D.A.: Near-infrared absorption spectroscopy of oxygen and nitrogen gas mixtures. Chem. Phys. Lett. **308** (1–2) 1–6 (1999)

Smith, F.G., King, T.A.: Optics and Photonics. An Introduction. Wiley, New York (2000). ISBN 0-471-48924-7

Smith, K.M., Newnham, D.A.: Near-infrared absorption cross sections and integrated absorption intensities of molecular oxygen (O_2, O_2-O_2, and O_2-N_2). J. Geophys. Res. **105**(D6), 7383–7396 (2000)

Smith, K.M., Newnham, D.A., Williams, R.G.: Collision-induced absorption of solar radiation in the atmosphere by molecular oxygen at 1.27 μm: field observations and model calculations. J. Geophys. Res. **106**(D7), 7541–7552 (2001)

Solomon, S., Mount, G., Sanders, R.W., Schmeltekopf, A.: Visible spectroscopy at McMurdo station, Antarctica: 2. Observation of OClO. J. Geophys. Res. **92**, 8329–8338 (1987b)

Solomon, S., Mount, G.H., Sanders, R.W., Jakoubek, R.O., Schmeltekopf, A.L.: Observations of the nighttime abundance of OClO in the winter stratosphere above Thule, Greenland. Science **242**, 550–555 (1988)

Solomon, S., Miller, H.L., Smith, J.P., Sanders, R.W., Mount, G.H., Schmeltekopf, A.L., Noxon, J.F.: Atmospheric NO_3, 1. Measurement technique and the annual cycle at 40°N. J. Geophys. Res. **94**, 11041–11048 (1989a)

Solomon, S., Sanders, R.W., Carroll, M.A., Schmeltekopf, A.L.: Visible and near-ultraviolet spectroscopy at McMurdo Station, Antarctica, 5. Observations of the diurnal variations of BrO and OClO. J. Geophys. Res. **94**, 11393–11403 (1989b)

Solomon, S., Sanders, R.W., Mount, G.H., Carroll, M.A., Jakoubek, R.O., Schmeltekopf, A.L.: Atmospheric NO_3, 2. Observations in polar regions. J. Geophys. Res. **94**(D13), 16423–16427 (1989c)

Solomon, S., Sanders, R.W., Carroll, M.A., Schmeltekopf, A.L.: Visible and near-ultraviolet spectroscopy at McMurdo Station, Antarctica, 6. Observations of the diurnal variations of BrO and OClO. J. Geophys. Res. **94**(D9), 11393–11403 (1989d). 10.1029/88JD03127

Solomon, S., Sanders, R.W., Miller, H.L. Jr: Visible and near-ultraviolet spectroscopy at McMurdo Station, Antarctica, 7. OClO diurnal photochemistry and implications for ozone destruction. J. Geophys. Res. **95**, 13807 (1990)

Solomon, S., Sanders, R.W., Garcia, R.R., Keys, J.G.: Increased chlorine dioxide over Antarctica caused by volcanic aerosols from Mount-Pinatubo. Nature **363**, 245–248 (1993a)

Solomon, S., Smith, J.P., Sanders, R.W., Perliski, L., Miller, H.L., Mount, G.H., Keys, J.G., Schmeltekopf, A.L.: Visible and near-ultraviolet spectroscopy at McMurdo Station, Antarctica, 8. Observations of nighttime NO_2 and NO_3 from April to October 1991. J. Geophys. Res. **98**, 993–1000 (1993b)

Solomon, S., Sanders, R.W., Jakoubek, R.O., Arpag, K., Stephens, S.L., Keys, J.G., Garcia, R.R.: Visible and near-ultraviolet spectroscopy at McMurdo Station, Antarctica, 10. Reductions of NO_2 due to Pinatubo aerosols. J. Geophys. Res. **99**, 3509–3516 (1994a)

Solomon, S., Garcia, R.R., Ravishankara, A.R.: On the role of iodine in ozone depletion. J. Geophys. Res. **99**, 20491–20499 (1994b)

Solomon, S.: Stratospheric ozone depletion: a review of concepts and history. Rev. Geophys. **37**, 275–316 (1999)

South, A.M., Povey, I.M., Jones, R.L.: Broadband lidar measurements of tropospheric water vapour profiles. J. Geophys. Res. **103**, 31191–31202 (1998)

Spicer, C.W., Chapman, E.G., Finlayson-Pitts, B.J., Plastridge, R.A., Hubbe, J.M., Fast, J.D., Berkowitz, C.M.: Unexpectedly high concentrations of molecular chlorine in coastal air. Nature **394**, 353–356 (1998)

Spicer, C.W., Plastridge, R.A., Foster, K.L., Finlayson-Pitts, B.J., Bottenheim, J.W., Grannas, A.M., Shepson, P.B.: Molecular halogens before and during ozone depletion events in the Arctic at polar sunrise: concentrations and sources. Atmospheric Environment **36**, 2721–2731 (2002)

Spichtinger, N., Wenig, M., James, P., Wagner, T., Platt, U., Stohl, A.: Satellite detection of a continental-scale plume of nitrogen oxides from boreal forest fires. Geophys. Res. Lett. **28**, 4579–4582 (2001)

Spietz, P., Gómez Martín, J., Burrows, J.P.: Effects of column density on I2 spectroscopy and a determination of I2 absorption cross section at 500 nm. Atmos. Chem. Phys. **6**, 2177–2191 (2006)

Spurr, R.J.D.: Linearized Radiative Transfer Theory: A General Discrete Ordinate Approach to the Calculation of Radiances and Analytic Weighting Functions,

with Application to Atmospheric Remote Sensing. Ph.D. thesis, Technical University of Eindhoven (2001)

Staehelin, J., Thudium, J., Bühler, R., Volz-Thomas, A., Graber, W.: Trends in surface ozone concentrations at Arosa (Switzerland). Atmos. Environ. **28**, 75–87 (1994)

Stamnes, K., Tsay, S.-C., Wiscombe, W., Jayaweera, K.: Numerically stable algorithm for discrete-ordinate-method radiative transfer in multiple scattering and emitting layered media. Appl. Opt. **27**, 2502–2509 (1988)

Stern, D.: Global sulphur emissions from 1850 to 2000, Chemosphere 58, 163–175 (2005) (update from November 2005, http://www.rpi.edu/∼sternd/datasite.html)

Stevens, R.K., Vossler, T.L.: DOAS (differential optical absorption spectroscopy) urban pollution. In: Schiff, H.I. (ed.) Measurements of Atmospheric Gases, Vol. 1433, pp. 25–35. SPIE-The International Society of Optical Engineering, Bellingham (1991)

Stevens, R.K., Drago, R.J., Mamane, Y.: A long path differential optical absorption spectrometer and EPA-approved fixed-point methods intercomparison. Atmos. Environ. **27B**, 231–236 (1993)

Stockwell, R.W., Calvert, J.G.: The near ultraviolet absorption spectrum of gaseous HONO and N_2O_3. J. Photochem. **8**, 193–203 (1978)

Stockwell, W.R. and Calvert, J.G.: The mechanism of the OH–SO_2 reaction. Atmos. Environ. **17**, 2231–2235 (1983)

Stoiber, R.E., Jepsen, A.: Sulfur-dioxide contributions to atmosphere by volcanos. Science **182**(4112), 577–578 (1973)

Strutt, R.J.: Ultra-violet transparency of the lower atmosphere, and its relative poverty in ozone. Proc. R. Soc. A **94**, 260–269 (1918)

Stuhl, F., Niki, H.: Flash photochemical study of the reaction OH + NO + M using resonance fluorescent detection of OH. J. Chem. Phys. **57**, 3677–3679 (1972)

Stutz, J., Platt, U.: Problems in using diode arrays for open path DOAS measurements of atmospheric species. In: Schiff, H.I., Platt, U. (eds.) Proceedings of the Europto Series. Optical Methods in Atmospheric Chemistry. **1715**, 329–340 (1992)

Stutz, J.: Messung der Konzentration troposphärischer Spurenstoffe mittels Differentieller-Optischer Absorptionsspektroskopie: Eine neue Generation von Geräten und Algorithmen. Ph.D. thesis, University of Heidelberg (1996)

Stutz, J., Platt, U.: Numerical analysis and error estimation of differential optical absorption spectroscopy measurements with least squares methods. Appl. Opt. **35**, 6041–6053 (1996)

Stutz, J., Platt, U.: Improving long-path differential optical absorption spectroscopy (DOAS) with a quartz-fiber mode-mixer. Appl. Opt. **36**, 1105–1115 (1997a)

Stutz, J., Platt, U.: A new generation of DOAS instruments. In: Bösenberg, J., Brassington, D.J., Simon, P.C. (eds.) EUROTRAC Final Report Vol 8: Instrument Development for Atmospheric Research and Monitoring, pp. 370–378 (1997b)

Stutz, J., Alicke, B., Neftel, A.: Nitrous acid formation in the urban atmosphere: gradient measurements of NO_3 and HONO over grass in Milan, Italy. J. Geophys. Res. **107**(D22), 8192 (2002a). doi: 10.1029/2001JD000390

Stutz, J., Ackermann, R., Fast, J.D., Barrie, L.: Atmospheric reactive chlorine and bromine at the Great Salt Lake, Utah. Geophys. Res. Lett. **29**, (2002b). doi:10.1029/2002GL014812

Stutz, J., Alicke, B., Ackermann, R., Geyer, A., Wang, S., White, A.B., Williams, E.J., Spicer, C.W., Fast, J.D.: Relative humidity dependence of HONO chemistry in urban areas. J. Geophys. Res. **109**, D03307 (2004a). doi:10.1029/2003JD004135

Stutz, J., Alicke, B., Ackermann, R., Geyer, A., White, A., Williams, E.: Vertical profiles of NO_3, N_2O_5, O_3, and NO_X in the nocturnal boundary layer: 1. Observations during the Texas Air Quality Study 2000. J. Geophys. Res. **109**, D12306 (2004b). doi:10.1029/2003JD004209

Stutz, J., Kim, E.S., Platt, U., Bruno, P., Perrino, C., Febo A.: UV-visible absorption cross-sections of nitrous acid. J. Geophys. Res. **105**, 14585–14592 (2000)

Sugimoto, N. and Minato, A.: Retroreflector with acute dihedral angles. Opt. Lett. **19**, 1660–1662 (1994)

Svanberg, S.: Atomic and Molecular Spectroscopy, 2nd edn. Springer Series on Atoms and Plasmas, Springer Berlin, Heidelberg (1992)

Svensson, R., Ljungström, E., Lindqvist, O.: Kinetics of the reaction between nitrogen dioxide and water vapour. Atmos. Environ. **21**, 1529–1539 (1987)

Syed, M.Q., Harrison, A.W.: Ground based observations of stratospheric nitrogen dioxide. Can. J. Phys. **58**, 788–802 (1980)

Tajime, T., Saheki, T., Ito, K.: Absorption characteristics of the γ-0 band of nitric oxide. Appl. Opt. **17**, 1290–1294 (1978)

Talmi, Y., Simpson, R.W.: Self-scanned photodiode array: a multichannel spectrometric detector. Appl. Opt. **19**, 1401–1414 (1980)

Talukdar, R.K., Longfellow, C.A., Gilles, M.K., Ravishankara, A.R.: Quantum yields of $O(^1D)$ in the photolysis of ozone between 289 and 329 nm as a function of temperature. Geophys. Res. Lett. **25**, 143–146 (1998)

Tang, T., McConnel, J.C.: Autocatalytic release of bromine from arctic snow pack during polar sunrise. Geophys. Res. Lett. **23**, 2633–2636 (1996)

Tellinghuisen, J.: Resolution of the visible-infrared absorption spectrum of I_2 into three contributing transitions. J. Chem. Phys. **58**, 2821–2834 (1973)

Thomas, K., Volz-Thomas, A., Kley, D.: Zur Wechselwirkung von NO_3-Radikalen mit wässrigen Lösungen: Bestimmung des Henry- und des Massenakkommodationskoeffizienten. Berichte des Forschungszentrums Jülich (Dissertation K. Thomas Univ. Wuppertal D468) 2755 (1993)

Thomsen, O.: Messung des Absorptionswirkungsquerschnitts von Schwefeldioxid im Wellenlängenbereich von 265 bis 298 nm. Diplomarbeit, Fachber, Physik Univ. Hamburg/GKSS-Geesthacht (1990)

Thornton, J.A., Wooldridge, P.J., Cohen, R.C., Martinez, M., Harder, H., Brune, W.H., Williams, E.J., Roberts, J.M., Fehsenfeld, F.C., Hall, S.R., Shetter, R.E., Wert, B.P., Fried, A.: Ozone production rates as a function of NO_X abundances and HO_X production rates in the Nashville urban plume. J. Geophys. Res. **107**(D12), 4146, doi: 10.1029/2001JD000932 (2002)

Thornton, J.A., Wooldridge, P.J., Cohen, R.C., Williams, E.J., Hereid, D., Fehsenfeld, F.C., Stutz, J., Alicke, B.: Comparisons of in situ and long path measurements of NO_2 in urban plumes. J. Geophys. Res. **108**(D16), 4496, doi:10.1029/2003JD003559 (2003)

Tolchenov, R.N., Naumenko, O., Zobov, N.F., Shirin, S.V., Polyansky, O.L., Tennyson, J., Carleer, M., Coheur, P.-F., Fally, S., Jenouvrier, A., Vandaele, A.C.: Water vapour line assignments in the 9250–26000 cm^{-1} frequency range. J. Mol. Spectrosc. **233**, 68–76 (2005)

Tørnkvist, K.K., Arlander, D.W., Sinnhuber, B.-M.: Ground-based UV measurements of BrO and OClO over Ny-Ålesund during Winter 1996 and 1997 and Andøya during Winter 1998/1999. J. Atmos. Chem. **43**, 75–106 (2002)

Toumi, R., Bekki, S.: The importance of the reactions between OH and ClO for stratospheric ozone. Geophys. Res. Lett. **20**, 2447–2450 (1993)

Toumi, R.: BrO as a sink for dimethylsulphide in the marine atmosphere. Geophys. Res. Lett. **21**, 117–120 (1994)

Tremmel, H.G., Junkermann, W., Slemr, F., Platt, U.: On the distribution of hydrogen peroxide in the lower troposphere over the Northeast United States during late summer 1988. J. Geophys. Res. **98**, 1083–1099 (1993)

Trick, S.: The formation of nitrous acid on urban surfaces—a physical-chemical perspective. Ph. D. thesis, University of Heidelberg (2004)

Trolier, M., Mauldin R.L., III Ravishankara, A.R.: Rate coefficients for the termolecular channel of the self-reaction of ClO (263 K). J. Phys. Chem. **94**, 4896–4907 (1990)

Trost, B., Stutz, J., Platt, U.: UV- absorption cross sections of a series of monocyclic aromatic compounds. Atmos. Environ. **31**, 3999–4008 (1997)

Tuazon, E.C., Winer, A.M., Graham, R.A., Pitts, J.N.: Atmospheric measurements of trace pollutants by kilometer-pathlength FT-IR spectroscopy. Environ. Sci. Technol. **10**, 259–299 (1980)

Tuazon, E.C., Winer, A.M., Pitts, J.N.: Trace pollutant concentrations in a multiday smog episode in the California South Coast Air Basin by long path length Fourier transform IR spectroscopy. Environ. Sci. Technol. **15**, 1232–1237 (1981)

Tucceri, M.E., Hölscher, D., Rodriguez, A., Dillon, T.J., Crowley, J.N.: Absorption cross section and photolysis of OIO. Phys. Chem. Chem. Phys. **8**, 834–846 (2006)

Tuckermann, M.: Troposphärische DOAS-Messungen zum halogenkatalysierten Ozonabbau im arktischen Frühjahr (Ny-Ålesund, Svalbard). Diploma thesis in physics, University of Heidelberg (1996)

Tuckermann, M., Ackermann, R., Gölz, C., Lorenzen-Schmidt, H., Senne, T., Stutz, J., Trost, B., Unold, W., Platt, U.: DOAS-observation of halogen radical-catalyzed Arctic boundary layer ozone destruction during the ARCTOC-campaigns 1995 and 1996 in Ny-Ålesund, Spitsbergen. Tellus B **49**, 533–555 (1997)

Tyndall, G.S., Orlando, J.J., Calvert, J.G.: Upper limit for the rate coefficient for the reaction $HO_2 + NO_2 \rightarrow HONO + O_2$. Environ. Sci. Technol. **29**, 202–206 (1995)

Ulshöfer, V.S.: Photochemische Produktion von Carbonylsulfid im Oberflächenwasser der Ozeane und Gasaustausch mit der Atmosphäre. Ph.D. thesis, University of Heidelberg (1995)

Ulshöfer, V.S., Andreae, M.O.: Carbonyl sulfide (COS) in the surface ocean and the atmospheric COS budget. Aquat. Geochem. **3**, 283–303 (1998)

Unold, W.: Bodennahe Messungen von Halogenoxiden in der Arktis. Diploma thesis, University of Heidelberg (1995)

URL: http://cfa-www.harvard.edu/amdata/ampdata/kurucz23/sekur.html

van de Hulst, H.C.: Multiple Light Scattering, Tables, Formulas and Applications, Vol. 1 (ISBN 0-12-710701-0) and Vol. 2 (ISBN 0-12-710702-9). Academic, New York (1980)

van der, A.R.J., Peters, D.H.M.U., Eskes, H., Boersma, K.F., Van Roozendael, M., De Smedt, I., Kelder, H.M.: Detection of the trend and seasonal variation

in tropospheric NO_2 over China. J. Geophys. Res. **111**, D12317 (2006). doi:10.1029/2005JD006594

Van Doren, J.M., Watson, L.R., Davidovits, P., Worsnop, D.R., Zahniser, M.S., Kolb, Ch.E.: Temperature dependence of the uptake coefficients of HNO_3, HCl and N_2O_5 by water droplets. J. Phys. Chem. **94**, 3265–3269 (1990)

Van Roozendael, M., Hermans, C., DeMaziere, M., Simon, P.C.: Stratospheric NO_2 observations at the Jungfraujoch Station between June 1990 and May 1992. Geophys. Res. Lett. **21**, 1383–1386 (1994a)

Van Roozendael, M., de Maziere, M., Simon, S.: Ground-based visible measurements at the Jungfraujoch station since 1990. J. Quant. Spectrosc. Radiat. Transf. **52**, 231–240 (1994b)

Van Roozendael, M., Fayt, C., Bolsee, D., Simon, P.C., Gil, M., Yela, M., Cacho, J.: Cacho, ground-based stratospheric NO_2 monitoring at Keflavik (Iceland) during EASOE. Geophys. Res. Lett. **21**, 1379–1382 (1994c)

Van Roozendael, M., De Mazière, M., Hermans, C., Simon, P.C., Pommereau, J.P., Goutail, F., Tie, X.X., Brasseur, G.P. and Granier, C.: Ground-based observations of stratospheric NO_2 at high and mid-latitudes in Europe after the Mount Pinatubo eruption. J. Geophys. Res. **102**, 19171–19176 (1997)

Van Roozendael, M., Wagner, T., Richter, A., Pundt, I., Arlander, D.W., Burrows, J.P., Chipperfield, M., Fayt, C., Johnston, P.V., Lambert, J.-C., Kreher, K., Pfeilsticker, K., Platt, U., Pommereau, J.-P., Sinnhuber, B.-M., Tørnkvist, K.K., Wittrock, F.: Intercomparison of BrO measurements from ERS-2 GOME, ground-based and balloon platforms. Adv. Space Res. **29**, 1661–1666 (2002)

Van Roozendael, M., Fayt, C., Post, P., Hermans, C., Lambert, J.-C.: Retrieval of BrO and NO_2 from UV-visible observations. In: Borell, P., et al. (eds.) Sounding the Troposphere from Space: A New Era for Atmospheric Chemistry. Springer-Verlag, ISBN 3-540-40873-8, (2003)

Vandaele, A.C., Carleer, M., Colin, R., Simon, P.C.: Detection of urban O_3, NO_2, H_2CO and SO_2 using Fourier transform spectroscopy. In: Proceedings of International Symposium on Environmental Sensing, European Optical Society, Berlin, 22–26 June, SPIE, Bellingham, USA, ISBN 0–8194–0880–8, pp. 288–292 (1992)

Vandaele, A.C., Simon, P.C., Guilmot, J.M., Carleer, M., Colin, R.: SO_2 absorption cross section measurement in the UV using a Fourier transform spectrometer. J. Geophys. Res. **99**, 25599–25605 (1994)

Vandaele, A., Hermans, C., Simon, P., Van Roozendael, M., Guilmot, J., Carleer, M., Colin, R.: Fourier transform measurements of NO_2 absorption cross-section in the visible range at room temperature. J. Atmos. Chem. **25**, 289–305 (1996)

Vandaele, A.C., Hermans, C., Simon, P.C., Carleer, M., Colin, R., Fally, S. Merienne, M.F. Jenouvrier, A., Coquart, B.: Measurements of the NO_2 absorption cross section from $42,000\,cm^{-1}$ to $10,000\,cm^{-1}$ (238–1,000 nm) at 220 K and 294 K. J. Quant. Spectrosc. Radiat. Transf. **59**, 171–184 (1998)

Vandaele, A.C., Hermans, C., Fally, S., Carleer, M., Mérienne, M.-F., Jenouvrier, A., Coquart, B., Colin, R.: Absorption cross-sections of NO_2: simulation of temperature and pressure effects. J. Quant. Spectrosc. Radiat. Transf. **76**, 373–391 (2003). doi: 10.1016/S0022-4073(02)00064-X

Vaughan, G., Roscoe, H.K., Bartlett, L.M., O'Connor, F.M., Sarkissian, A., Van Roozendael, M., Lambert, J.C., Simon, P.C., Karlsen, K., Kastad Hoiskar, B.A., Fish, D.J., Jones, R.L., Freshwater, R.A., Pommereau, J.P., Goutail, F., Andersen, S.B., Drew, D.G., Huges, P.A., Moore, D., Mellquist, J., Hegels, E., Klüpfel,

T., Erle, F., Pfeilsticker, K., Platt, U.: An intercomparison of ground-based UV-visible sensors of ozone and NO_2. J. Geophys. Res. **102**, 1411–1422 (1997)

VDI.: Fernmessverfahren—Messungen in der bodennahen Atmosphäre nach dem DOAS-Prinzip—Messen gasförmiger Emissionen und Immissionen—Grundlagen, VDI Richtlinie VDI 4212, Blatt 1. (Remote sensing—atmospheric measurements near ground with DOAS—measurements of emissions and ambient air—fundamentals, VDI Guideline VDI 4212, 1) (2005)

Veitel, V., Funk, O., Kurz, C., Platt, U., Pfeilsticker, K: Geometrical path length probability density function of the skylight transmitted by mid-latitude cloudy skies; some case studies. Geophys. Res. Lett **25**, 3355–3358 (1998)

Veitel, H.: Vertical profiles of NO_2 and HONO in the boundary layer. Ph.D. thesis, University of Heidelberg (2002)

Veitel, H., Kromer, B., Mößner, M., Platt, U.: New techniques for measurements of atmospheric vertical trace gas profiles using DOAS. Environ. Sci. Pollut. Res., special issue **4**, 17–26 (2002)

Vitushkin, A.L., Vitushkin, L.F.: Design of a multipass optical cell based on the use of a shift corner cubes and rightangle prisms. Appl. Opt. **37**, 162–165 (1998)

Vogt, S.S., Tull, R.G., Kelton, P.: Self-scanned photodiode array: high performance operation in high dispersion astronomical spectrophotometry. Appl. Opt. **17**, 574–592 (1978)

Vogt, R., Finlayson-Pitts, B.J.: Tropospheric HONO and reactions of oxides of nitrogen with NaCl. Geophys. Res. Lett. **21**(21), 2291–2294 (1994)

Vogt, R., Crutzen, P.J., Sander, R.: A mechanism for halogen release from sea-salt aerosol in the remote marine boundary layer. Nature **383**, 327–330 (1996)

Voigt, S., Orphal, J., Bogumil, K., Burrows, J.P.: The temperature dependence (203–293 K) of the absorption cross sections of O_3 in the 230–850 nm region measured by Fourier-transform spectroscopy. J. Photochem. Photobiol. A Chem. **143**, 1–9 (2001)

Voigt, S., Orphal, J., Burrows, J.P.: The temperature- and pressure-dependence of the absorption cross-section of NO_2 in the 250–800 nm region measured by Fourier-transform spectroscopy. J. Photochem. Photobiol. A Chem. **149**, 1–7 (2002)

Volkamer, R., Etzkorn, T., Geyer, A., Platt, U.: Correction of the oxygen interference with UV spectroscopic (DOAS) measurements of monocyclic aromatic hydrocarbons in the atmosphere. Atmos. Environ. **32**, 3731–3747 (1998)

Volkamer, R.: A DOAS study on the oxidation mechanism of aromatic hydrocarbons under simulated atmospheric conditions. Ph.D. thesis, University of Heidelberg (2001)

Volkamer, R., Platt, U., Wirtz, K.: Primary and secondary glyoxal formation from aromatics: experimental evidence for the bicycloalkyl-radical pathway from BTX. J. Phys. Chem. A **105**, 7865–7874 (2001)

Volkamer, R., Klotz, B., Barnes, I., Imamura, T., Wirtz, K., Washida, N., Becker, K.-H., Platt, U.: OH-initiated oxidation of benzene: I. Phenol formation under atmospheric conditions. Phys. Chem. Chem. Phys. **4**, 1598–1610 (2002)

Volkamer, R., Spietz, P., Burrows, J.P., Platt, U.: High-resolution absorption cross-section of glyoxal in the UV/vis and IR spectral ranges. J. Photochem. Photobiol. A Chem. **172**, 35–46 (2005a). doi: 10.1016/j.jphotochem.2004.11.011

Volkamer, R., Molina, L.T., Molina, M.J., Shirley, T., Brune, W.H.: DOAS measurement of glyoxal as an indicator for fast VOC chemistry in urban air. Geophys. Res. Lett. **32**, L08806 (2005b). doi:10.1029/2005GL022616

Volz, A., Ehhalt, D.H., Derwent, R.G.: Seasonal and latitudinal variation of ^{14}CO and the tropospheric concentration of OH radicals. J. Geophys. Res. **86**, 5163–5171 (1981)

Volz, A., Kley, D.: Ozone measurements in the 19th century: an evaluation of the Montsouris series. Nature **332**, 240–242 (1988)

von Friedeburg, C., Pundt, I., Mettendorf, K.U., Wagner, T., Platt, U.: Multi-axis-DOAS measurements of NO_2 during the BAB II motorway emission campaign. Atmos. Env. **39**(5), 977–985 (2005)

von Glasow, R., Sander, R., Bott, A., Crutzen, P.J.: Modeling halogen chemistry in the marine boundary layer. 1. Cloud-free MBL. J. Geophys. Res. **107D**, 4341 (2002). doi:10.1029/2001JD000942

von Glasow, R., Crutzen, P.J.: Tropospheric halogen chemistry. In: Keeling, R.F. (ed.) The Atmosphere Vol. 4 Treatise on Geochemistry Holland, H.D., Turekian, K.K. (eds.), pp. 21–64. Elsevier-Pergamon, Oxford (2003)

von Glasow, R., Crutzen, P.J.: Model study of multiphase DMS oxidation with a focus on halogens. Atmos. Chem. Phys. **4**, 589–608 (2004)

von Glasow, R., von Kuhlmann, R., Lawrence, M.G., Platt, U., Crutzen, P.J.: Impact of reactive bromine chemistry in the troposphere. Atmos. Chem. Phys. **4**, 2481–2497 (2004)

Vountas, M., Rozanov, V.V., Burrows, J.P.: Impact of Raman scattering on radiative transfer in earth's atmosphere. J. Quant. Spectrosc. Radiat. Transf. **60**(6), 943–961 (1998)

Vountas, M., Richter, A., Wittrock, F., Burrows, J.P.: Inelastic scattering in ocean water and its impact on trace gas retrievals from satellite data. Atmos. Chem. Phys. **3**, 1365–1375 (2003)

Wagner, H.E.: Bestimmung der Spurengaszusammensetzung in der Troposphäre mit Langpfad-DOAS (Differenzielle Optische Absorptionsspektroskopie), Diploa thesis in physics, Inst. f. Physikalische und Theoretische Chemie, TU München (1990)

Wagner, T., Senne, T., Erle, F., Otten, C., Stutz, J., Pfeilsticker, K., Platt, U.: Determination of cloud properties and cloud type with DOAS measurements, Poster, Third European Symposium on Polar Strat. Ozone, Schliersee, 18–22 September (1995)

Wagner, T., Erle, F., Marquard, L., Otten, C., Pfeilsticker, K., Senne, Th., Stutz, J., Platt, U.: Cloudy sky photon path lengths as derived from DOAS observations. J. Geophys. Res. **103**, 25307–25321 (1998)

Wagner, T., Platt, U.: Observation of tropospheric BrO from the GOME satellite. Nature **395**, 486–490 (1998)

Wagner, T., Otten, C., Platt, U.: Observation of atmospheric NO_3 in the Arctic winter. Geophys. Res. Lett. **27**(21), 3441–3444 (2000)

Wagner, T., Leue, C., Pfeilsticker, K., Platt, U.: Monitoring of the stratospheric chlorine activation by global ozone monitoring experiment (GOME) OClO measurements in the austral and boreal winters 1995 through 1999. J. Geophys. Res. **106**, 4971–4986 (2001a)

Wagner, T., Leue, C., Wenig, M., Pfeilsticker, K., Platt, U.: Spatial and temporal distribution of enhanced boundary layer BrO concentrations measured by the GOME instrument aboard ERS-2. J. Geophys. Res. **106**, 24225–24235 (2001b)

Wagner, T., Wittrock, F., Richter, A., Wenig, M., Burrows, J.P., Platt, U.: Continuous monitoring of the high and persistent chlorine activation during the Arctic winter 1999/2000 by the GOME instrument on ERS-2. J. Geophys. Res. **107**(D20), 8267 (2002a). doi: 10.1029/2001JD000466

Wagner, T., Friedeburg, v.C., Wenig, M., Otten, C., Platt, U.: UV/vis observation of atmospheric O_4 absorptions using direct moon light and zenith scattered sunlight under clear and cloudy sky conditions. J. Geophys. Res. **107**(D20), 4424 (2002b). doi: 10.1029/2001JD001026

Wagner, T., Chance, K., Frieß, U., Gil, M., Goutail, F., Hönninger, Johnston, P.V., Karlsen-Tørnkvist, K., Kostadinov, I., Leser, H., Petritoli, A., Richter, A., Van Roozendael, M., Platt, U.: Correction of the ring effect and I_0effect for DOAS observations of scattered sunlight, ESA Technical Report (2002c)

Wagner, T., Heland, J., Zöger, M., Platt, U.: A fast H_2O total column density product from GOME—validation with in-situ aircraft measurements. Atmos. Chem. Phys. **3**, 651–663 (2003)

Wahner, A., Jakoubek, R.O., Mount, G.H, Ravishankara, A.R., Schmeltekopf, A.L.: Remote sensing observations of nighttime OClO column during the airborne antarctic ozone experiment, September 8, 1987. J.Geophys. Res. **94**, 11405–11411 (1989a)

Wagner, T., Dix, B., Friedeburg, C.v., Frieß, U., Sanghavi, S., Sinreich, R., Platt, U.: MAX-DOAS O_4 measurements: a new technique to derive information on atmospheric aerosols–principles and information content. J. Geophys. Res. **109**, D22205 (2004). doi: 10.1029/2004JD004904

Wahner, A., Jakoubek, R.O., Mount, G.H, Ravishankara, A.R., Schmeltekopf, A.L.: Remote sensing observations of daytime column NO_2 during the airborne Antarctic ozone experiment, August 22 to October 2, 1987. J.Geophys. Res., **94**, 16619–16632 (1989b)

Wahner, A., Callies, J., Dorn, H.-P., Platt, U., Schiller, C.: Near UV atmospheric absorption measurements of column abundances during airborne Arctic stratospheric expedition, January–February 1989: 1. Technique and NO_2 observations. Geophys. Res. Lett. **17**,497–500 (1990a)

Wahner, A., Callies, J., Dorn, H.-P., Platt, U., Schiller, C.: Near UV atmospheric absorption measurements of column abundances during airborne Arctic stratospheric expedition, January–February 1989: 3. BrO observations. Geophys. Res. Lett. **17**, 517–520 (1990b)

Wagner, T., Burrows, J.P., Deutschmann, T., Dix, B., Hendrick, F., Friedeburg, C.v., Frieß, U., Heue, K.-P., Irie, H., Iwabuchi, H., Keller, J., McLinden, C., Oetjen, H., Palazzi, E., Petrotoli, A., Platt, U., Postylyakov, O., Pukite, J., Richter, A., van Roozendael, M., Rozanov, A., Rozanov, V., Sinreich, R., Sanghavi, S., Wittrock, F.: Comparison of box-air-mass-factors and radiances for MAX-DOAS-geometries calculated from different UV/visible radiative transfer models. Atmos. Chem. Phys. Discuss. **6**, 9823–9876 (2006)

Wahner, A. Schiller, C.: Twilight variation of vertical column abundances of OClO and BrO in the North polar region. J. Geophys. Res. **97**(D8), 8047–8055 (1992)

Wahner, A., Mentel, T.F., Sohn, M.: Gas-phase reaction of N_2O_5 with water vapor: importance of heterogeneous hydrolysis of N_2O_5 and surface desorption of HNO_3 in a large teflon chamber. Geophys. Res. Lett. **25**, 2169–2172 (1998a)

Wahner, A., Mentel, T.F., Sohn, M., Stier, J.: Heterogeneous reaction of N_2O_5 on sodium nitrate aerosol. J. Geophys. Res. **103**, 31103–31112 (1998b)

Wamsley, P.R., Elkins, J.W., Fahey, D.W., Dutton, G.S., Volk, C.M., Myers, R.C., Montzka, S.A., Butler, J.H., Clarke, A.D., Fraser, P.J., Steele, L.P., Lucarelli, M.P., Atlas, E.L., Schauffler, S.M., Blake, D.R., Rowland, F.S., Sturges, W.T., Lee, J.M., Penkett, S.A., Engel, A., Stimpfle, R.M., Chan, K.R., Weisenstein, D.K., Ko, M.K.W., Salawitch, R.J.: Distribution of halon-1211 in the upper troposphere and lower stratosphere and the 1994 total bromine budget. J. Geophys. Res. **103**(D1), 1513–1526, 10.1029/97JD02466 (1998)

Wang, P., Bruns, M., Richter, A., Burrows, J.P., Heue, K.-P., Pundt, I., Wagner, T., Platt, U.: Validation of SCIAMACHY with AMAXDOAS measurements from the DLR Falcon. Geophys. Res. **5**, 09341 (Abstracts) (2003)

Wang, P., Richter, A., Bruns, M., Rozanov, V., Burrows, J., Heue, K.-P., Wagner, T., Pundt, I., Platt, U.: Measurements of tropospheric NO_2 with an airborne multi-axis DOAS instrument. Atmos. Chem. Phys. **5**, 337–343 (2005)

Wängberg, I., Etzkorn, T., Barnes, I., Platt, U., Becker, K.H.: Absolute determination of the temperature behaviour of the $NO_2 + NO_3 + (M) \Leftrightarrow N_2O_5 + (M)$ equilibrium. J. Phys. Chem. A **101**(50), 9694–9698 (1997)

Watts, S.: The mass budgets of carbonyl sulfide, dimethyl sulfide, carbon disulfide and hydrogen sulfide. Atmos. Environ. **34**, 761–779 (2000)

Wayne, R.P., Barnes, I., Biggs, P., Burrows, J.P., Canosa-Mas, C., Hjorth, J., Le Bras, G., Moortgat, G., Perner, D., Poulet, G., Restelli, G., Sidebottom, H.: The nitrate radical: physics, chemistry and the atmosphere. Atmos. Environ. **25A**, 1–250 (1991)

Wayne, R.P., Poulet, G., Biggs, P., Burrows, J.P., Cox, R.A., Crutzen, P.J., Haymann, G.D., Jenkin, M.E., LeBras, G., Moortgat, G.K., Platt, U., Schindler, R.N.: Halogen oxides: radicals, sources and reservoirs in the laboratory and in the atmosphere. Atmos. Environ. **29**, 2675–2884 (1995)

Weaver, A., Solomon, S., Sanders, R.W., Arpag, K., Miller, H.L.: Atmospheric No 3.5. Off-axis measurements at sunrise: Estimates of tropospheric NO_3 at 40 degrees N. J. Geophys. Res. **101**(D13), 18605–18612 (1996)

Weber, A.: Applications. In: Anderson, A. (ed.) The Raman Effect, Vol. 1 and 2. Dekker Inc., New York (1973)

Weber, M., Dhomse, S., Wittrock, F., Richter, A., Sinnhuber, B.-M., Burrows, J.P.: Dynamical control of NH and SH winter/spring total ozone from GOME observations in 1995–2002. Geophys. Res. Lett. **30**, 37.1–37.4 (2003). doi 10.1029/2002GL016799

Weibring, P., EdnerH., Svanberg, S., Cecchi, G., Pantani, L., Ferrara, R., Caltabiano, T.: Monitoring of volcanic sulphur dioxide emissions using differential absorption lidar (DIAL), differential optical absorption spectroscopy (DOAS) and correlation spectroscopy (COSPEC). Appl. Phys. B **67**(4), 419–426 (1998)

Weidner, F., Bösch, H., Bovensmann, H., Burrows, J. P., Butz, A., Camy-Peyret, C., Dorf, M., Gerilowski, K., Gurlit, W., Platt, U., von Friedeburg, C., Wagner, T., Pfeilsticker, K.: Balloon-borne limb profiling of UV/vis skylight radiances,

O_3, NO_2, and BrO: technical set-up and validation of the method. Atmos. Chem. Phys. **5**, 1409–1422 (2005). SRef-ID: 1680-7324/acp/2005-5-1409

Weinstock, B.: Carbon monoxide: residence time in the atmosphere. Science **166**, 224–225 (1969)

Wenig, M.: Satellite measurement of long-term global tropospheric trace distributions and source strength—algorithm development and data analysis. Ph.D. thesis, University of Heidelberg (2001)

Wenig, M., Spichtinger, N., Stohl, A., Held, G., Beirle, S., Wagner, T., Jähne, B., Platt, U.: Intercontinental transport of nitrogen oxide pollution plumes. Atmos. Chem. Phys. **3**, 387–393 (2003)

Wenig, M., Kühl, S., Beirle, S., Bucsela, E., Jähne, B., Platt, U., Gleason, J., Wagner, T.: Retrieval and analysis of stratospheric NO_2 from the global ozone monitoring experiment. J. Geophys. Res. **109**, D04315 (2004). doi:10.1029/2003JD003652

Wenig, M., Jähne, B., Platt, U.: Operator representation as a new differential optical absorption spectroscopy formalism. Appl. Opt. **44**(16), 3246–3253 (2005)

Wennberg, P.O., Hanisco, T.F., Jaeglé, L., Jacob, D.J., Hintsa, E.J., Lanzendorf, E.J., Anderson, J.G., Gao, R.-S., Keim, E.R., Donnelly, S.G., Del Negro, L.A., Fahey, D.W., McKeen, S.A., Salawitch, R.J., Webster, C.R., May, R.D., Herman, R.L., Proffitt, M.H., Margitan, J.J., Atlas, E.L., Schauffler, S.M., Flocke, F., McElroy, C.T., Bui, T.P.: Hydrogen radicals, nitrogen radicals, and the production of O_3 in the upper troposphere. Science **279**, 49–53 (1998)

Wennberg, P.O.: Bromine explosion. Nature **397**, 299–301 (1999)

Werle, P.W., Josek, K., Slemr, F.: Application of FM spectroscopy in atmospheric trace gas monitoring: a study of some factors influencing the instrument design. In: Schiff, H.I. (ed.) Measurement of Atmospheric Gases Vol. 1433, pp. 128–135. SPIE, Bellingham (1991)

West, P.W., Gaeke, G.C.: Fixation of sulfur dioxide as disulfitomercurate(II) and subsequent colorimetric estimation. Anal. Chem. **28**, 1816–1819 (1956)

White, J.U.: Long optical paths of large aperture. J. Opt. Soc. Am. **32**, 285–288 (1942)

White, J.U.: Very long optical paths in air. J. Opt. Soc. Am. **66**, 411–416 (1976)

WHO (World Health Organization): Monitoring ambient air quality for health impact assessment. WHO Regional Publications, European Series, No. 85. WHO Regional Office for Europe, Copenhagen; ISBN 92 890 1351 6 (1999)

Wilmouth, D.M., Hanisco, T.F., Donahue, N.M., Anderson, J.G.: Fourier transform ultraviolet spectroscopy of the $A(^2\Pi_{3/2}) \leftarrow X(^2\Pi_{3/2})$ transition of BrO. J. Phys. Chem. **103**, 8935–8944 (1999)

Wine, P.H., Ravishankara, A.R., Philen, D.L., Davis, D.D., Watson, R.T.: High resolution absorption cross sections for the $A^2\Pi - X^2\Pi$ system of ClO. Chem. Phys. Lett. **50**, 101–106 (1977)

Winer, A.M., Atkinson, R., Pitts, J.N.: Gaseous nitrate radical: possible night-time atmospheric sink for biogenic organic compounds. Science **224**, 156–159 (1984)

Winer, A.M., Biermann, H.W.: Measurements of nitrous acid, nitrate radicals, formaldehyde, and nitrogen dioxide for the Southern California Air Quality Study by differential optical absorption spectroscopy. In: Schiff, H. (ed.) Measurement of Atmospheric Gases Vol. 1433, pp. 44–57. SPIE, Bellingham (1991)

Winer, A.M., Biermann, H.W.: Long pathlength differential optical absorption spectroscopy (DOAS) measurements of gaseous HONO, NO_2 and HCHO in the California south coast air basin. Res. Chem. Intermed. **20**(3–5), 423–455 (1994)

Wingenter, O.W., Kubo, M.K., Blake, N.J., Smith, T.W., Blake, D.R., Rowland, F.S.: Hydrocarbon and halocarbon measurements as photochemical and dynamical indicators of atmospheric hydroxyl, atomic chlorine, and vertical mixing obtained during Lagrangian flights. J. Geophys. Res. **101**, 4331–4340 (1996)

Winterrath, T., Kurosu, T., Richter, A., Burrows, J.P.: O_3 and NO_2 in thunderstorm clouds: convection or production? Geophys. Res. Lett. **26**, 1291–1294 (1999)

Wiscombe, W.J.: Improved mie scattering algorithms. Appl. Opt. **19**, 1505–1509 (1980)

Wittrock, F., Müller, R., Richter, A., Bovensmann, H., Burrows, J.P.: Measurement of iodine oxide (IO) above Spitsbergen. Geophys. Res. Lett. **27**(10), 1471–1474 (2000a)

Wittrock, F., Richter, A., Ladstätter-Weißenmayer, A., Burrows, J.P.: Global observations of formaldehyde. Proceedings of ERS-ENVISAT Symposium, Gothenburg, October 2000. ESA publication SP-461 (2000b)

Wittrock, F., Oetjen, H., Richter, A., Fietkau, S., Medeke, T., Rozanov, A., Burrows, J.P.: MAX-DOAS measurements of atmospheric trace gases in Ny-Ålesund. Atmos. Chem. Phys. **4**, 955–966 (2004)

Wittrock, F., Richter, A., Oetjen, H., Burrows, J.P., Kanakidou, M., Myriokefalitakis, S., Volkamer, R., Beirle, S., Platt, U., Wagner, T.: Simultaneous global observations of glyoxal and formaldehyde from Space. Geophys. Res. Lett. **33**, L16804 (2006). doi:10.1029/2006GL026310

WMO.: WDCGG Data Summary, WDCGG No. 29, GAW DATA, Vol. IV-Greenhouse Gases and Other Atmospheric Gases. Japan Meteorological Agency in Co-Operation with World Meteorological Organisation (2005)

Wolf de, D.A.: Optical propagation through turbulent air. Opt. Laser Technol. **11**, Issue 1, February, 29–36 (1979)

Wood, E.C., Wooldridge, P.J., Freese, J.H., Albrecht, T., Cohen, R.C.: Prototype for in situ detection of atmospheric NO_3 and N_2O_5 via laser-induced fluorescence. Environ. Sci. Technol. **37**(24), 5732–5738 (2003)

Wu, C.Y.R., Judge, D.L.: SO_2 and CS_2 cross section data in the ultraviolet region. Geophys. Res. Lett. **8**, 769–771 (1981)

Yates, D.A., Kuwana, T.: Evaluation of a self-contained linear diode array detector for rapid scanning spectrophotometry. Anal. Chem. **48**, 510–514 (1976)

Yoshii, Y., Kuze, H., Takeuchi, N.: Long-path measurement of atmospheric NO_2 with an obstruction flashlight and a charge-coupled-device spectrometer. Appl. Opt. **42**(21), 4362–4368 (2003)

Young, A.T.: On the Rayleigh-scattering optical depth of the atmosphere. J. Appl. Meteorol. **20**, 328–330 (1981)

Yu Y., Geyer, A., Xie, P., Galle, B., Limin, C., Platt, U.: Observations of carbon disulfide by differential optical absorption spectroscopy in Shanghai. Geophys. Res. Lett. **31**, L11107 (2004). doi: 10.1029/2004GL019543

Yvon, S.A., Butler, J.H.: An improved estimate of the oceanic lifetime of atmospheric CH_3Br. Geophys. Res. Lett. **23**, 53–56 (1996)

Zabarnick, S.: Kinetics of the reaction OH + NO + M → HONO + M as a function of temperature and pressure in the presence of argon, SF_6, and N_2 bath gas. Chem. Phys. **171**(1–2), 265–273 (1993)

Zellner, R.,nd Hägele, J.: A double-beam UV-laser differential method for monitoring tropospheric trace gases. Opt. Laser Technol. **4**, 79–82 (1985)

Zender, C.S.: Global climatology of abundance and solar absorption of oxygen collision complexes. J. Geophys. Res. **104**, 24471–24484 (1999)

Zhou, X., Beine, H.J., Honrath, R.E., Fuentes, J.D., Simpson, W., Shepson, P.B., Bottenheim, J.W.: Snowpack photochemical production of HONO: a major source of OH in the Arctic boundary layer in springtime. Geophys. Res. Lett. **28**, 4087–4090 (2001)

Zhou, X., Civerolo, K., Dai, H., Huang, G., Schwab, J., Demerjian, K.: Summertime nitrous acid chemistry in the atmospheric boundary layer at a rural site in New York State. J. Geophys. Res. **107**, 4590 (2002). doi:10.1029/2001JD001539

Zhou, X., Gao, H., He, Y., Huang, G., Bertman, S., Civerolo, K., Schwab, J.: Nitric acid photolysis on surfaces in low-NO_X environments: significant atmospheric implications. Geophys. Res. Lett. **30**, 2217 (2003). doi:10.1029/2003GL018620

Zhu, L., Kellis, D., Ding, C.F.: Photolysis of glyoxal at 193, 248, 308 and 351 nm. Chem. Phys. Lett. **257**(5–6), 487–491 (1996)

Zimmermann, R.: Entwicklung eines miniaturisierten ballongetragenen Diodenlaser-Spektrometers zur Messung von stratosphärischen Methan- und Wasserdampfkonzentrationen. Ph.D. thesis, University of Heidelberg (2003)

Zingler, J., Platt, U.: Iodine oxide in the dead sea valley: evidence for inorganic sources of boundary layer IO. J. Geophys. Res. **110**, D07307 (2005). doi:10.1029/2004JD004993