Annales Geophysicae

ISSN: 0992-7689 (printed version)
ISSN: 1432-0576 (electronic version)

Abstract Volume 12 Issue 10/11 (1994) pp 996-1005

Impact on ozone of high-speed stratospheric aircraft: effects of the emission scenario

G. Pitari, S. Palermi, G. Visconti

Dipartimento di Fisica, Universitá degli Studi, I-67010 Coppito, L'Aquila, Italy

Received: 18 October 1993/Revised: 28 February 1994/Accepted: 9 May 1994

Abstract. A photochemical-transport two-dimensional model has been used to assess the impact of a projected fleet of high-speed stratospheric aircraft using different emissions scenarios. It is shown that the presence in the background atmosphere of nitric acid trihydrate aerosols is responsible for a lower stratospheric denoxification in addition to that caused by the sulfate aerosol layer. This has the effect of further decreasing the relative role of the odd nitrogen catalytic cycle for ozone destruction, so that the lower stratosphere is primarily controlled by chlorine species. The effect of aircraft injection of nitric oxides is that of decreasing the level of ClO, so that the lower stratospheric ozone (below about 20-25 km altitude) increases. The net effect on global ozone is that of a small increase even at Mach 2.4, and is enhanced by adopting emission scenarios including altitude restriction at 15 or 18 km. Reductions of the emission index (EI) of nitric oxides below relatively small values (about 15) are shown to reduce the aircraft-induced ozone increase, because of the associated smaller decrease of ClO. This conclusion is no more valid when the emission index is raised at the present values (about 45).