Annales Geophysicae

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

Abstract Volume 12 Issue 1 (1994) pp 25-32

Shear flow instabilities in the earth's plasma sheet region

Sunayna Kalra, G. S. Lakhina

Indian Institute of Geomagnetism, Dr Nanabhai Moos Marg, Colaba, Bombay 400005, India

Received: April 06, 1993; revised: August 26, 1993; accepted: September 10, 1993

Abstract. Shear flow instability arising from the velocity shear between the inner and the outer central plasma sheet regions is studied by treating the plasma as compressible. Based on the linearized MHD equations, dispersion relations for the surface wave modes occurring at the boundary of the inner central plasma sheet (ICPS) and the outer central plasma sheet (OCPS) are derived. The growth rates and the eigenmode frequencies are obtained numerically. Three data sets consisting of parameters relevant to the earth's magnetotail are considered. The plasma sheet region is found to be stable for constant plasma flows unless M_A>9.6, where M_A is the Alfvén Mach number in the ICPS. However, for a continuously varying flow velocity profile in the ICPS, the instability is excited for M_A\geq1.4. The excited modes have oscillation periods of 2-10 min and 1.5-6 s, and typical transverse wavelengths of 30-100 R_E and 0.5-6 R_E for data sets 1 and 2 (i.e., case of no neutral sheet) respectively. For the data set 3, which corresponds to a neutral sheet at the center of the plasma sheet, the excited oscillations have periods of 2 s-1 min with transverse wavelengths of 0.02-1 R_E.

Correspondence to: S. Kalra

Article not available online
