The Earth's Plasmasphere and Topside Ionosphere

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Abstract

The plasmasphere and topside ionosphere is a region of the near Earth's space filled by dense and low energy plasma, where interaction with the neutral atmosphere are less important than diffusion along magnetic field lines and electrodynamic drifts. The topside ionosphere is the part of ionosphere above the main plasma density maximum in the F region, which is denoted as NmF2 and its altitude is denoted as hmF2. The major ion in the F region, as well as in the topside ionosphere, is the atomic oxygen ion (O+). The above lying plasmasphere consists of hydrogen ions (H+), with a small amount of helium ions (He+) at altitudes near transition between the two space regions. The plasmasphere is stretched upward to about 20,000 km above equator, but its upper boundary, named plasmapause, follows magnetic field lines and hence, its thickness decreases with latitude as square of the cosine dependence. The topside ionosphere and plasmasphere have long been studied by satellites, but they are invisible for the ground-based ionosondes. The plasmasphere and topside ionosphere are important physical place for the space-based human activities as radio communications, navigation, television, etc.

The lecture will provide basic information on the following topics:

- basic parameters describing the structure and dynamics of the both regions;
- empirical formulas describing the structure;
- sources of the plasma variability;
- the upper ionosphere and plasmasphere boundaries;
- thermal balance and heating of plasmasphere.

Date: Wednesday 27 October 2010
Time: 09:00-10:50
Room: Kastler Lecture Hall @ Adriatico Guest House

Space Weather Empirical Modelling Techniques

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Abstract

Empirical modelling is a powerful tool for revealing the main characteristics of the phenomena like space weather. Empirical modelling is always based on the data. It is actually an approximation of the data with analytical functions. Ionospheric empirical modelling, which historically precedes the nowaday more generalized space weather modelling, mainly approximates the critical frequency of the F2 layer (foF2), the peak height hmF2 and the propagation factor M(3000)F2, being functions of local time, season, latitude, and/or solar indices. The space weather modelling cover other, non-ionospheric parameters, like geomagnetic and solar indices indices, but the main of modelling approach remains the same. Types of empirical models, mathematical formulation and components of modelling technique are illustrated by modelling the ionospheric parameter foF2. Empirical modelling is closely connected with forecasting. Empirical models are the main part of forecasting techniques, but the latter includes also adjusting to the fresh data, organizing the input flow and output format, dissemination, etc.

The lecture includes the following elements:

- basic approach in the empirical modelling;
- selection of analytical functions and driving parameters;
- delayed reaction to pulse forcing;
- types of models: single station, regional, and global;
- forecasting approach: weighted extrapolation of data and empirical model with drivers;
- forecasting techniques.

Date: Wednesday 27 October 2010
Time: 11:10-13:00
Room: Kastler Lecture Hall @ Adriatico Guest House

Ivan Stefanov Kutiev – born 23.11.1941.

Education
Higher education in physics at Sofia University in 1967.
PhD in ionospheric physics in 1973.
Doctor of Science degree in 1987.

Carreer
Researcher in the Geophysical Institute, BAS -1967,
senior scientist -1978,
professor – 1990.

Fields of research
space plasma measurements and analysis,
ionospheric modelling and forecasting,
empirical modelling the topside electron density profiles,
low-latitude ionosphere and TEC disturbances.