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Foreword

In this issue we continue publication of the papers presented at the International Conference on Geocosmos, which was held on 22–26 May 2000, at the University of St. Petersburg (Russia). The first part of the papers presented at the Conference has been published in Issue 1 of this volume.

The papers by *Pudovkin et al.* [this issue, pp. 93–107], and by *Semenov et al.* [this issue, pp. 109–116] presented in this issue complete a series of the studies devoted to the physics of the magnetosheath and the magnetopause published in the previous issue. In the *Pudovkin et al.* [this issue, pp. 93–130] paper, a review of various models of the solar wind flow around the magnetosphere is given. Two plasma models, isotropic and anisotropic (the latter in the approximation given by *Chew et al.*, [1956]), are considered, and a conclusion is drawn that the proton temperature anisotropy weakly influences plasma density and magnetic field intensity profiles across the magnetosheath. At the same time, it affects significantly a development of various wave processes in the sheath plasma. A method to estimate the value of the characteristic time of the relaxation of the proton temperature anisotropy (τ) from experimental data is proposed. The bounded anisotropy model by *Denton et al.* [1994] is discussed and compared with the finite τ model by *Pudovkin et al.* [1999].

The paper by *Semenov et al.* [this issue, pp. 109–116] is devoted to the problem of magnetopause erosion during the periods of the southward interplanetary magnetic field. It is known that the location of the subsolar magnetopause is determined by the balance between the magnetosheath plasma and magnetic field pressures on one side of the magnetopause and the geomagnetic field pressure on the other side of it. Respectively, an earthward displacement of the magnetopause suggests a decrease of the magnetic field intensity in the dayside magnetosphere. As a fundamental process responsible for the decrease of the magnetospheric magnetic field intensity, the authors propose the magnetic field reconnection. According to the main idea of the model, the process of the reconnection is greatly asymmetric: The field depression caused by the reconnection is filled up outside the magnetopause much faster than inside it. As a result, every pulse of reconnection causes the magnetopause to displace earthwards. Although the resulting current system responsible for the depression of the magnetospheric magnetic field in the steady state is not investigated, the proposed mechanism of the magnetopause erosion seems to be interesting.

Several papers presented in this issue are devoted to the problems of formation, equilibrium state, and evolution of the plasma sheet in the magnetotail. One of the acute problems in this field is that concerning the “convection crisis” [*Ericson and Wolf*, 1980]. The main point of this problem is that the observed distribution of the plasma density and pressure along the plasma sheet drastically differs from that predicted by the models assuming the conservation of the particle numbers within convecting magnetic tubes.

A new approach to the solution of this problem is presented in the paper by *Antonova* [this issue, pp. 117–130]. The proposed solution is based on the assumption on the essential role of the high-level turbulence in the plasma transport processes and in generation of field-aligned electric field and currents. An interesting, “magnetospheric topology” mechanism of the generation of the dawn-dusk electric field is also discussed in this paper. According to this model, field-aligned currents, large-scale electric field, and magnetospheric plasma convection may be caused by non-coincidence of isolines of the magnetic field and plasma pressures in some magnetosphere regions. This allows one to explain the existence of field-aligned currents not only within the boundary layers at the magnetopause, but also within the inner magnetosphere. At the same time, it should be noted that the question on the energy sources of the considered processes is discussed in the paper rather schematically.

The evolution of a current sheet affected by an intense pulse of an external electric field is considered by *Runov et al.* [this issue, pp. 131–139] on the basis of a numerical modeling of the process. The problem has been discussed earlier in a number of papers by Hayashi, Sato, Hoshino, and others. As a result, it is shown that the process of the driven magnetic field reconnection is preceded by a rather long period of the magnetic energy accumulation associated with the plasma sheet thinning. Nevertheless, in both the models of a strong [*Sato and Hayashi*, 1979] and a weak [*Hoshino*, 1991] forced reconnection, only a late stage of the process is studied, while the phase of the energy storage in the plasma sheet is not investigated. In the present paper by Runov et al., all the phases of the plasma sheet evolution are considered in detail.

A numerical solution of equations describing the anomalous transport of an anisotropic magnetized four-component

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plasma (hot protons and electrons, thermal protons and electrons) is obtained by *Zakharov and Meister* [this issue, pp. 141–150]. Profiles of the plasma parameters, of the field-aligned electric field, as well as of the coefficients of the thermal conductivity along the magnetic tube are considered in the paper. The growth and dispersion properties of oblique ion cyclotron waves existing in a drifting magnetized plasma are also studied. The expression evolved by *Gary and Schriver* [1987] and by *Xue et al.* [1996] for the $K_{\alpha\beta}$ components of the dielectric tensor K for the anisotropic plasma are generalized. To do this, the effects of the plasma drift are taken into account for obliquely propagating waves. It is found that electric oblique ion-cyclotron waves may reveal properties of bursts of polarized transverse electromagnetic waves at frequencies near the proton gyrofrequency.

The auroral radio wave scatter experiments EISCAT and STARE show that in the E region of the auroral ionosphere rather intense electrostatic structures may exist which are related to essential modifications of the density distribution of the background charged particles. According to the current views, these plasma structures can be a consequence of the excitation of the modified two-stream Farley-Buneman (FB) plasma turbulence. The linear theory of the FB instability explains many of the observed peculiarities of radio echoes. However, there still exist many problems not yet solved. In this connection a non-linear interaction of waves in the collisional ionospheric plasma considered analytically and numerically in the paper by *Volosevich and Meister* [this issue, pp. 151–156] may be of a great interest. It is shown that the wave interaction results in the generation of rather intensive nonlinear waves which propagate perpendicularly to the electron drift velocity. This wave region corresponds to large aspect and flow angles of the small-scale waves.

Three other papers (by *Mullayarov et al.* [this issue, pp. 167–171], *Petrova and Kirkwood* [this issue, pp. 173–180], and *Morozova et al.* [this issue, pp. 181–189]) are dedicated to some aspects of the ionosphere and lower atmosphere physics. In the paper by *Mullayarov et al.* [this issue, pp. 167–171], the direction of propagation of magnetospheric VLF emissions within the Earth–ionosphere waveguide is studied at two points spaced along the meridian by 150 km. It is found that for both stations, the exit points of the hiss emissions from the ionosphere are usually located southward or south-eastward of the station zenith, and the chorus emissions are located in the zenith or northward of it.

Petrova and Kirkwood analyze the EISCAT radar measurements of the electron density N_e in the mesosphere ($h = 70$ km) during two proton events on 13 August and 23 October 1989. As a result, a rather unexpected phenomenon is revealed: The electron density values measured during sunset on 23 October are by a factor of 1.5–3-higher than the N_e values measured on 13 August; at the same time, the ionization rate calculated from the solar proton fluxes in the October event was by a factor of 1.5 lower than in the August event. The apparent inconsistency of these results is interpreted by the authors as an indication that the ozone concentration at $h = 70$ km was essentially greater on 13 August than on 23 October, and there was a corresponding increase of the electron losses in the process of dissociative attachment of ozone molecules ($e + O_3 \rightarrow O^- + O_2$) during the first event. Calculation of the N_e variation using the ion chemistry model and measured proton fluxes confirms the proposed interpretation.

The influence of the cosmic ray flux variations on the state of the lower atmosphere is studied in the paper by Morozova et al. The data on the surface air pressure at 230 meteorological observatories of the USSR during 23 Solar Proton Events (SPE) and during 10 Forbush decreases (FD) of Galactic Cosmic Rays are used. For every event, the spatial distribution of the air pressure on the 2–3 days before the day of the onset of the corresponding SPE or FD is obtained , and the evolution of this distribution for several subsequent days is studied. It is found that the most characteristic feature of this evolution is predominantly eastward drift of the whole pressure pattern during the SPEs, and the southward drift of that pattern during FDs. The analysis of the air temperature vertical profiles obtained at several observatories in the Northern Atlantic and Greenland shows that the cosmic ray effect in the lower atmosphere distinctly depends on the initial state of the latter.

The paper by *Gorban et al.* [this issue, pp. 191–197] has a methodological character. The authors propose a technique for recovering lost data in the geophysical time series using the neural networks method. The proposed technique is applied to the analysis of some known geophysical time series with artificially produced gaps (up to 50% of points). The results of the recovery of the deleted data are compared with the original data series, and the efficiency of the used technique is convincingly shown.

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