

Russian and Japanese Aerospace Literature

During 1995 the *AIAA Journal* will carry selected abstracts on leading research topics from Russian aerospace literature and, as space permits, from similar Japanese literature. The topics will be chosen and the abstracts reviewed for pertinency by *AIAA Journal* editors. This month features Interplanetary Magnetic Fields from Russia and Spacecraft Equipment from Japan.

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Russian Aerospace Literature This month: *Interplanetary Magnetic Fields*

A94-35908 Electric potential patterns in the northern and southern polar regions parameterized by the interplanetary magnetic field. V. O. PAPITASHVILI, B. A. BELOV, D. S. FAERMARK, YA. I. FELDSHTEJN, S. A. GOLYSHEV, L. I. GROMOVA, and A. E. LEVITIN (IZMIRAN, Troitsk, Russia), *Journal of Geophysical Research* (ISSN 0148-0227), Vol. 99, No. A7, July 1, 1994, pp. 13,251–13,262. 43 Refs. Documents available from Aeroplus Dispatch.

The ability of a numerical scheme for the IZMIRAN electrodynamic model (IZMEM) to model electric potential patterns at any moment of time when IMF data are available is shown. Results obtained using the scheme are summarized. The scheme also estimates ionospheric electric fields associated with 3D current systems.

A94-34665 Electromagnetic weather at 100 km altitude on 3 August 1986. Y. I. FELDSTEIN, A. E. LEVITIN, L. I. GROMOVA, L. A. DREMUHINA (IZMIRAN, Troitsk, Russia), L. G. BLOMBERG, P.-A. LINDQVIST, and G. T. MARKLUND (Royal Inst. of Technology, Stockholm, Sweden), *Geophysical Research Letters* (ISSN 0094-8276), Vol. 21, No. 19, Sept. 15, 1994, pp. 2095–2098. 11 Refs. Documents available from Aeroplus Dispatch.

The electromagnetic weather at high altitudes above the Earth's surface is determined by the transport of ionospheric plasma, which in turn is governed by the magnitude as well as the direction of the electric and magnetic fields. Different models have been proposed that allow an estimation of the electromagnetic parameters of the upper atmosphere, given a knowledge of the magnitude and orientation of the interplanetary magnetic field. Here we use one such model to estimate the global convection pattern and its temporal evolution during a pass of the Swedish satellite Viking over the northern polar cap. The model predictions are shown to agree well with the electric and magnetic fields measured along the satellite trajectory. The good agreement implies that the model can be used to reconstruct, with reasonable confidence, the large-scale distribution of electric and magnetic fields and their time-variation in the entire auroral ionosphere. (Author)

A94-20883 Geomagnetic impulses in the dayside high-latitude region—Principal morphological characteristics and relation to dayside aurora dynamics (Geomagnitnye impul'sy v dnevnoj vysokosirotnoj oblasti—Osnovnye morfologicheskie kharakteristiki i svyaz' s dinamikoj dnevnykh siyanij). V. G. VOROB'EV, V. L. ZVEREV, and G. V. STARKOV (RAN, Polyarnyj Geofizicheskij Inst., Krasnoyarsk, Russia), *Geomagnetizm i Aeronomiya* (ISSN 0016-7940), Vol. 33, No. 5, Oct. 1993, pp. 69–79. In Russian. 24 Refs. Documents available from Aeroplus Dispatch.

The principal morphological characteristics of dayside high-latitude impulses are investigated in relation to the behavior of the dayside aurora, assuming that magnetic impulses are generated by moving ionospheric Hall current loops. It is shown that the probability of impulses has a maximum at 08–10 MLT. The impulses are most frequently recorded under conditions of low overall planetary magnetic activity and low activity in the seminocturnal sector of the auroral region. In 73 percent of the cases, high-latitude impulses coincide to within ± 5 min with positive or negative variations of the horizontal component of the magnetic field at mid-latitude and equatorial stations in the dayside sector.

A94-19147 Electric field in the mid-latitude ionosphere associated with IMF-controlled high-latitude current systems (Elektricheskoe

pole v sredneshirotnoj ionosfere svyazannoe s vysokosirotnymi tokovymi sistemami, kontroliruemyimi MMP). S. A. GOLYSHEV, L. N. DREMUHINA, A. E. LEVITIN, E. O. PAPITASHVILI, and D. S. FAERMARK (IZMIRAN, Troitsk, Russia), *Geomagnetizm i Aeronomiya* (ISSN 0016-7940), Vol. 33, No. 6, Dec. 1993, pp. 151–155. In Russian. 16 Refs. Documents available from Aeroplus Dispatch.

A calculation is made of the spatial distribution of the electric current in the mid-latitude ionosphere associated with the presence of IMF-controlled current systems in the high-latitude ionosphere. It is shown that electric current variability during magnetically quiet periods may be related to the presence of longitudinal currents. The characteristics of the behavior of the field components are examined as a function of the IMF situation.

A94-19135 Contributions of various sources to the field of a geomagnetic storm (Vklad razlichnykh istochnikov v pole geomagnitnoj buri). A. A. ARYKOV and YU. P. MALTSEV (RAN, Polyarnyj Geofizicheskij Inst., Apatity, Russia), *Geomagnetizm i Aeronomiya* (ISSN 0016-7940), Vol. 33, No. 6, Dec. 1993, pp. 67–74. In Russian. 17 Refs. Documents available from Aeroplus Dispatch.

A general expression is obtained which relates geomagnetic field depression at low latitudes to ring current intensity, solar wind pressure, and magnetic flux in the magnetotail. It is shown that the magnetic flux emerging from the polar cap and the auroral zone is sufficient to support most of the geomagnetic depression during most of the storms, which demonstrates the important role of plasma sheet currents. In some storms, however, the effect of the ring current is commensurate with the effect of magnetotail currents. In such cases, however, solar wind pressure also increases, so that compression ring current effects may be mutually compensated.

A94-19134 Modeling geomagnetic field variations during an intense magnetic storm (Modelirovanie variatsij geomagnitnogo polya v period intensivnoj magnitnoj buri). YA. I. FELDSHTEJN, L. A. DREMUHINA, U. B. VESHCHERZHOVA, S. A. GOLYSHEV, L. V. KIZIRIYA (IZMIRAN, Troitsk, Russia; AN Gruzii, Inst. Geofiziki, Tbilisi, Georgia), and A. GRAFE, *Geomagnetizm i Aeronomiya* (ISSN 0016-7940), Vol. 33, No. 6, Dec. 1993, pp. 58–66. In Russian. 12 Refs. Documents available from Aeroplus Dispatch.

The intensity of the asymmetric part of the ring current magnetic field is shown to be closely related to the energy input to the magnetosphere from solar wind. The asymmetry increases faster than the ring current field during the main stage of a magnetic storm and decreases faster during the recovery stage. The main component of the geomagnetic disturbance field is calculated by the linear filtering method assuming that the magnetosphere functions as a linear system. For a quantitative description of auroral activity indices and ring current field, the use of solar wind parameters during several preceding hours is required.

A94-19129 Cosmic ray diffusion in a magnetic field with allowance for strong random scattering (Diffuziya kosmicheskikh luchey v magnitnom pole s uchedom sil'nogo sluchajnogo rassseyaniya). YU. P. MEL'NIKOV (Rybinskij Aviatsonnyj Tekhnologicheskij Inst., Rybinsk, Russia), *Geomagnetizm i Aeronomiya* (ISSN 0016-7940), Vol. 33, No. 6, Dec. 1993, pp. 18–24. In Russian. 11 Refs. Documents available from Aeroplus Dispatch.

Formulas for the diffusion coefficient and the transport path length of cosmic ray particles are obtained from a kinetic equation with a nonlinear quadratic (with respect to the Green function) collision term. The formulas allow for strong small-scale random scattering to a mean angle of the order of 1 at a single magnetic inhomogeneity. It is shown that the solar wind velocity contributes significantly to the energy dependence of the transport path length in the case of low particle energies.

A94-18511 Conditions of the formation of wavelike auroral structures during a magnetospheric substorm (Usloviya formirovaniya volnoobraznykh struktur polyarnykh siyanij v khode magnitosfernoj subburi). N. E. MOLOCHUSHKIN, S. I. SOLOV'EV, and G. A. MAKAROV (RAN, Inst. Kosmofizicheskikh Issledovaniy i Aehronomii, Yakutsk, Russia), *Geomagnetizm i Aehronomiya* (ISSN 0016-7940), Vol. 33, No. 4, Aug. 1993, pp. 112-118. In Russian. 14 Refs. Documents available from Aeroplus Dispatch.

Based on statistical studies of wavelike diffuse auroral structures, it is shown that auroral jets, as compared with omega bands, are recorded during periods of increased geomagnetic and solar activity, at larger negative values of the IMF Bz component, and at lower latitudes. In the presence of a series of omega bands, the boundary of diffuse auroras moves toward the equator, whereas the occurrence of a group of jets is often characterized by the stable location of this boundary. The possible mechanisms of the formation of nonstationary luminescence structures at the boundary of diffuse auroras are discussed.

A94-18506 Interplanetary medium parameters for very strong magnetic storms (Parametry mezhplanetnoy sredy dlya ochen' bol'shikh magnitnykh bur'). A. D. SHEVNIN and L. V. EVDOKIMOVA (IZMIRAN, Troitsk, Russia), *Geomagnetizm i Aehronomiya* (ISSN 0016-7940), Vol. 33, No. 4, Aug. 1993, pp. 69-78. In Russian. 4 Refs. Documents available from Aeroplus Dispatch.

By using King's catalogs for the period 1969-1982, empirical distributions of solar wind and interplanetary magnetic field parameters are obtained for eleven very strong magnetic storms. Histograms (distribution densities) are presented along with the some statistical characteristics, including arithmetic mean values, medians, modes, rms deviations, asymmetry indices, and confidence intervals. The characteristics of specific distributions for some of very strong magnetic storms are discussed.

A94-18505 A simple scheme for diagnosing the parameters of an equivalent electrical circuit of the magnetosphere. II—Test calculations (Prostaya skhema diagnostiki parametrov ehkivivalentnoy ehlektricheskoy tsepi magnitosfery. II—Probnye raschety). V. V. SHELOMENTSEV and E. V. PERFILEVA (RAN, Inst. Solnechno-Zemnoj Fiziki, Irkutsk, Russia), *Geomagnetizm i Aehronomiya* (ISSN 0016-7940), Vol. 33, No. 4, Aug. 1993, pp. 63-68. In Russian. 10 Refs. Documents available from Aeroplus Dispatch.

Results of test calculations based on the method proposed by Shelomentsev (1993) for diagnosing the integral parameters of an equivalent electrical RL-circuit of the polar magnetosphere are presented. The results are consistent with a scheme in which the primary dynamo is a voltage source characterized by an ordinary (linear) relation with the magnetospheric-ionospheric load.

A94-18500 Fractal and multifractal structures in solar wind (Fraktal'nye i mul'tifraktal'nye struktury v solnechnom vetre). L. M. ZELENYJ and A. V. MILOVANOVA (RAN, Inst. Kosmicheskikh Issledovaniy, Moscow, Russia), *Geomagnetizm i Aehronomiya* (ISSN 0016-7940), Vol. 33, No. 4, Aug. 1993, pp. 18-28. In Russian. 28 Refs. Documents available from Aeroplus Dispatch.

Results of a study of interplanetary magnetic field turbulence at heliocentric distances of 1-30 AU are analyzed. It is shown that the fractal distribution of magnetic force tubes over the sun surface, discovered at distance scales of 400-40,000 km, leads to the formation of magnetic clouds at heliocentric distances of about 10 solar radii, with the spatial distribution of the magnetic clouds in solar wind characterized by a fractal dimension close to 3/2. The value of the spatial fractal dimension that determines the fine structure of the magnetic cloud as a fractal cluster of magnetic force tubes is obtained. The relationship between the spatial fractal dimension and the turbulence spectrum of interplanetary plasma is examined.

A94-18499 Solar sources, structure, and configuration of the interplanetary disturbance of September 17-18, 1979 (Solnechnye istochniki, struktura i konfiguratsii mezhplanetnogo vozmushcheniya 17-18 sentyabrya 1979 g.). K. G. IVANOV (IZMIRAN, Troitsk, Russia), *Geomagnetizm i Aehronomiya* (ISSN 0016-7940), Vol. 33, No. 4, Aug. 1993, pp. 10-17. In Russian. 17 Refs. Documents available from Aeroplus Dispatch.

A study is made of the structure and configuration of the unusual interplanetary disturbance of September 17-18, 1979, which was responsible for a strong magnetospheric storm with a weak correlation between the geomagnetic indices and coupling functions. It is shown that this disturbance was due to the occurrence of a solar situation that was unique for the 20th solar cycle: a compact series of flares exactly at the heliocentric projection of the earth, far from the heliospheric streamer in a sector with a weak magnetic field.

A94-17563 Magnetic field 24 x 10 exp 6 km downstream of the earth from Phobos-2 measurements in September 1988 (Magnitnoe pole na

24 x 10 exp 6 km vnz po potoku ot zemli po izmereniyam na KA 'FOBOS-2' v sentyabre 1988 g.). V. A. STYAZHKIN, K. G. IVANOV, and E. G. EROSHENKO, *Kosmicheskie Issledovaniya* (ISSN 0023-4206), Vol. 31, No. 5, Oct. 1993, pp. 137-143. In Russian. 11 Refs. Documents available from Aeroplus Dispatch.

A moderate magnetic disturbance, with a current sheet present between antiparallel fields, was observed by Phobos-2 on 17 September 1988 at approximately 3900 earth radii downstream of the earth. A day before, a similar disturbance was recorded by the IMP-J satellite near the earth. On the sun, two filaments were observed to suddenly dissipate on September 13-14 in the vicinity of the heliospheric current sheet and near the earth helioprojection. The spatial-temporal relations, the structure, and the intensity of the disturbance recorded by Phobos-2 suggest that it may have been produced by a perturbed heliospheric streamer propagating away from the sun.

A94-13459 Structure of the tail plasma/current sheet at approximately 11 RE and its changes in the course of a substorm. V. A. SERGEEV (St. Petersburg State Univ., Russia), D. G. MITCHELL (Johns Hopkins Univ., Laurel, MD), C. T. RUSSELL (California Univ., Los Angeles), and D. J. WILLIAMS (Johns Hopkins Univ., Laurel, MD), *Journal of Geophysical Research* (ISSN 0148-0227), Vol. 98, No. A10, Oct. 1, 1993, pp. 17,345-17,365. 56 Refs. Documents available from Aeroplus Dispatch.

An analysis is made of a substorm event of April 2, 1978, during which a pair of ISEE spacecraft encountered a thin current sheet at about 11 RE on the nightside both before and during the substorm expansion phase. The discussion focuses on the quantitative aspects and on the local characteristics of the current sheet and their evolution in the course of the substorm prior to the current disruption. The data analysis provides the first direct confirmation that a very thin current structure developed inside the thicker plasma sheet in the near tail during the substorm growth phase. It is also shown the thin current sheets developing during substorm growth and expansion phases can play an important role in the following current redistribution and energy conversion via current disruption in this region.

A94-12838 22-year intensity variations of galactic cosmic rays and the evolution of the heliospheric current sheet (22-letnie variatsii intensivnosti galakticheskikh kosmicheskikh luchey i ehvolyutsiya geliosfernogo tokovogo sloya). I. S. SAMSONOV, D. Z. BORISOV, and Z. N. SAMSONOVA (RAN, Yakutskij Nauchnyy Tsentr, Yakutsk, Russia), *Rossiyskaya Akademiya Nauk, Izvestiya, Seriya Fizicheskaya* (ISSN 0367-6765), Vol. 57, No. 7, July 1993, pp. 48-50. In Russian. 9 Refs. Documents available from Aeroplus Dispatch.

In order to explain certain properties of 22-year variations of the intensity and anisotropy of galactic cosmic rays, the notion of a modulation region that is without spherical symmetry and is closely connected with the heliospheric current sheet is put forward. A qualitative explanation of differences in the intensity modulation levels at the minima of even and odd solar cycles is offered.

A94-12835 Secular variation of cosmic-ray intensity (Vekovaya variatsiya intensivnosti kosmicheskikh luchey). P. A. KRIVOSHAPKIN, A. I. KUZ'MIN, and V. G. GRIGOR'EV (RAN, Inst. Kosmofizicheskikh Issledovaniy i Aehronomii, Yakutsk, Russia), *Rossiyskaya Akademiya Nauk, Izvestiya, Seriya Fizicheskaya* (ISSN 0367-6765), Vol. 57, No. 7, July 1993, pp. 37-39. In Russian. 7 Refs. Documents available from Aeroplus Dispatch.

Measurements with the ASK-1 ionization chamber in Yakutsk led to the discovery of a variation of the relationship linking the intensity of galactic cosmic rays and the inclination angle of the IMF neutral surface with the phase of the 22-year magnetic cycle of the sun. The energy spectrum of the modulation of galactic cosmic rays varies with a period of 11 years as well as with a period of 22 years.

A94-10951 Gasdynamic structure of the heliosphere—Theory and experiment (Gazodinamicheskaya struktura geliosfery—Teoriya i ehksperiment). V. B. BARANOV, *Rossiyskaya Akademiya Nauk, Izvestiya, Mekhanika Zhidkosti i Gaza* (ISSN 0568-5281), No. 3, June 1993, pp. 3-24. In Russian. 64 Refs. Documents available from Aeroplus Dispatch.

The development of gasdynamic models of the structure of the heliosphere is reviewed from a historical perspective. A gasdynamic model of supersonic flow of interstellar gas past solar wind is described. Attention is then given to current scientific programs concerned with the study of the circumsolar space at large heliocentric distances. Some new gasdynamic problems associated with these programs are formulated.

A93-55386 An investigation of the relationship between the magnetic storm Dst-index and different types of solar wind streams. V. G. ESELEVICH and V. G. FAINSHTEIN (Russian Academy of Sciences, Inst. of Solar-Terrestrial Physics, Irkutsk, Russia), *Annales Geophysicae* (ISSN 0992-7689), Vol. 11, No. 8, Aug. 1993, pp. 678-684. 20 Refs. Documents available from Aeroplus Dispatch.

In this paper it is shown that the intensity of the negative Bz-component of the IMF in the region of interaction of fast and slow quasi-stationary solar wind streams can be the source of rather strong magnetic storms with Dst less than 100 nT. It is found that the level of magnetic disturbance, caused by sporadic solar wind streams, depends largely on characteristics of the medium through which these streams propagate. (Author (revised))