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A92 **Atmosphere, ionosphere, safety** / edited by O.P. Borchevkina, M.G. Golubkov and I. V. Karpov. — Kaliningrad, 2020. — 272 p.
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Proceedings of International Conference "Atmosphere, ionosphere, safety" (AIS-2020) include materials reports on: (1) — response analysis of the atmosphere — ionosphere to natural and manmade processes, various causes related geophysical phenomena and evaluate possible consequences of their effects on the human system and process; (2) — to study the possibility of monitoring and finding ways to reduce risk. Scientists from different countries and regions of Russia participated in the conference. Attention was given to questions interconnected with modern nanotechnology and environmental protection. Knowledge of the factors influencing the atmosphere and ionosphere can use them to monitor natural disasters and to establish the appropriate methods on this basis.

Content of the reports is of interest for research and students specializing in physics and chemistry of the atmosphere and ionosphere.

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SENSITIVITY OF THE LOWER ATMOSPHERE CIRCULATION TO THE INTERSECTION OF THE SECTOR BOUNDARIES OF THE INTERPLANETARY MAGNETIC FIELD

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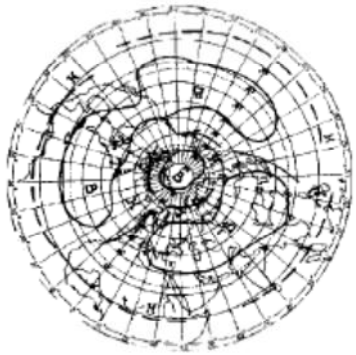
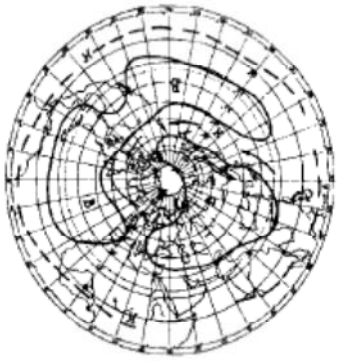
Introduction. The purpose of this study is to find the relationship between the circulation of the lower atmosphere of the Northern hemisphere and the change of sectors of the interplanetary magnetic field (IMP) in near-earth space, based on data on the duration of different forms of elementary circulation mechanisms (ECM) according to the classification of B.L. Dzerdzeevsky [1].

In [1], 4 circulation groups were identified: zonal (Z), zonal disturbance (DZ), meridional North (MN), and meridional South (MS). The circulation of Z-group is characterized by nearly zonal flow in the absence of blocking situations, in case MN circulation - the number of blocking anticyclones increases to 3-4, and for MS - without blocking and low pressure at the pole. There are 13 types and 41

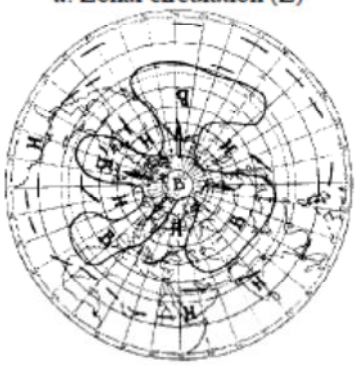
subtypes of circulation by this groups. Examples of dynamic diagrams for each group are shown in Fig.1.



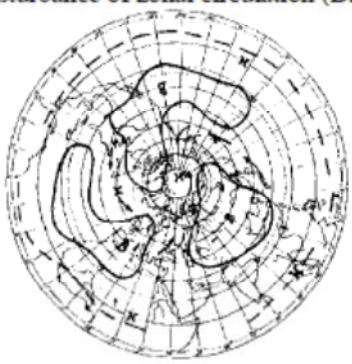
a. Zonal circulation (Z)



b. Disturbance of zonal circulation (DZ)



c. Meridional North circulation (MN)



d. Meridional South circulation (MS)

FIGURE 1. Northern Hemisphere atmospheric circulation groups (the dynamic schemes).

Information about the phases of the 27-day cycle of the IMP direction sectors ("+"- from the Sun, and " - " - to the Sun) is presented in [2]. The values of the frequency of different forms of circulation in separate phases of the IMP over the Northern hemisphere of the Earth were obtained based on data for 2006-2010, which correspond to the solar activity minimum (between 23 and 24 cycles). Days with disturbed geomagnetic conditions were excluded from consideration. The analysis was made separately for each season. The frequency of the circulation groups (Z, NZ, MS, and MU) generally in the entire period corresponds to the average multi-year distribution under review. However, for cold period (December-March) it was found the MN frequency of the circulation group is 19-23% higher than the average value a day after crossing the IMP sector boundery. The DZ group frequency is 14-21% lower than the average climatic value (Fig.2) during this period. These results qualitatively coincide with the conclusions [3, 4]. Wilcox [3] and Hines

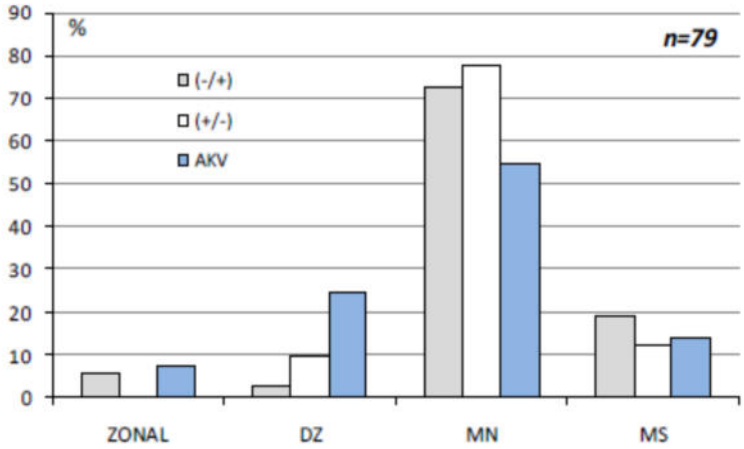


FIGURE 2. The frequency of the circulation groups a day after passing of the IMP sector boundary passage by the Earth. (AKV - average climatic value).

and Halevy [4] showed that the area of tropospheric troughs and upper-level tropospheric vorticity area index decreases one day after the Earth crosses the IMP sector boundary. Since the group of MS is characterized by 3-4 blocking in the hemisphere, the area of cyclones, respectively, decreases. Thus, the results obtained qualitatively confirm the conclusions [3, 4].

The next area of work with data is the study of circulation patterns during periods of sudden stratospheric warming (SSW). Data on the average zonal temperature in the polar atmosphere of the Northern hemisphere (87,5 N) were considered in the period 1992-2016 according to data [5, 6]. The total number of SSW events considered is equal 38. The beginning of the SSW was taken as the moment of wind direction changes from West to East at the level of 10 hPa.

The frequency of different circulation groups before, during, and after SSW is shown in Fig.3. The average climate value (ACV) represents the last column of the diagram. The number of corresponding events is shown in parentheses. The frequency of the DZ group was 8% higher before the SSW and 4% lower after the event (1-2 weeks), and the MS group was 9% higher than the average multi–year value after the end of the SSW. Results for other forms within the standard error range (σ = 3-5%).

The relationship between the onset of SSW and the change of the MMP sign was also investigated. Slightly more than half of the events (n = 21) started in the negative direction of the MMP (towards the Sun) and in n = 17 cases the field was positive (from the Sun). The analysis was hampered by the some uncertainty of the SSW beginning and the MMP sign uncertainty in certain periods. Thus, there was no reliable link between MMP and warming.

Previously, it can be concluded the intersection of IMP sector boundary passage affects the formation of blocking situations in the lower troposphere. Perhaps the negative phase of MMP in combination with some forms of circulation is favorable for the SSW occurrence. In order to establish a more reliable connection, it is planned to continue this research in the future.

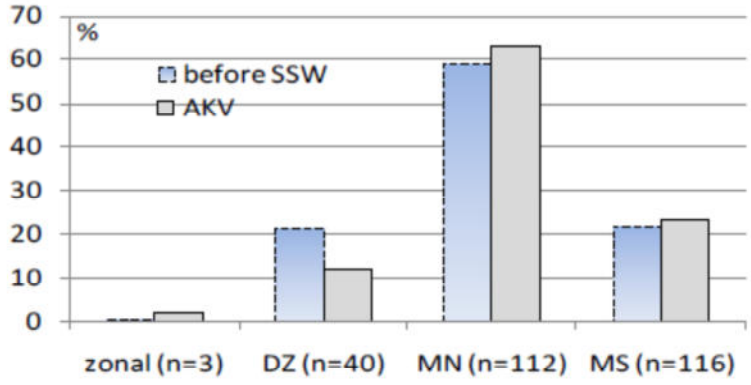


FIGURE 3a. The frequency of the circulation groups before SSW (2 weeks).

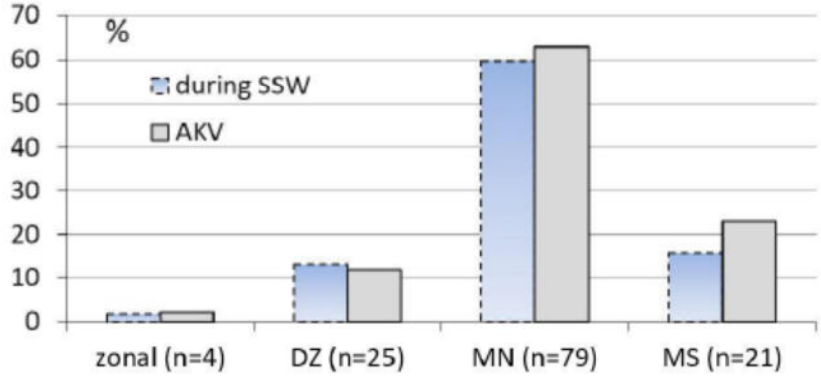


FIGURE 3b. The frequency of the circulation groups during SSW

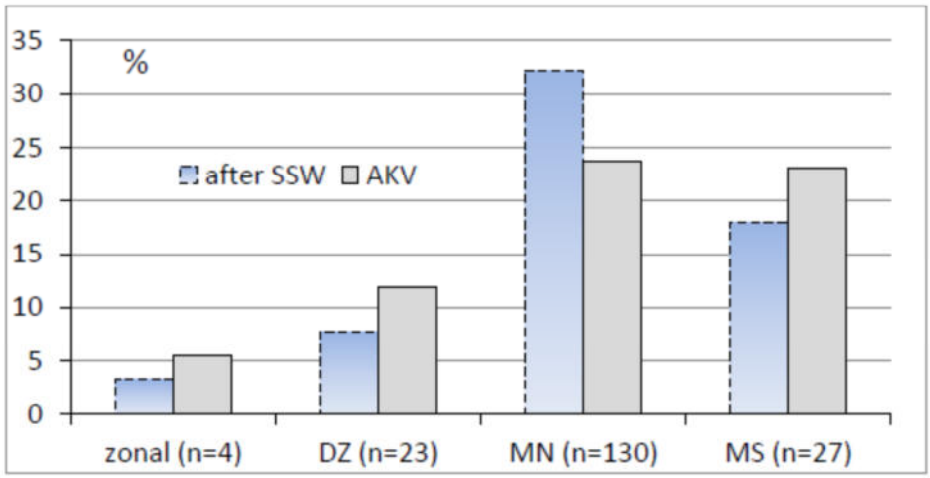


FIGURE 3c. The frequency of the circulation groups after SSW (2 weeks).

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NUMERICAL MODELING OF THE SOLAR TERMINATOR AND SOLAR ECLIPSE USING LIDAR DATA

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Introduction. The propagation of infrasound and internal gravity waves (IGW) from the troposphere to the thermosphere significantly affects the state of the atmosphere and ionosphere at all altitudes. The sources of atmospheric waves in the lower atmosphere can be processes associated with the evolution of meteorological disturbances, seismic activity, the passage of the solar terminator or solar eclipse. In numerous theoretical studies, various problem of generation, propagation, and the influence of atmospheric waves on the state of the atmosphere have been studied in sufficient detail. However, in most works simplified situations are considered, when either the processes of wave interaction with each other and the background state of the atmosphere are neglected, or the real stratification of the atmosphere is not taken into account. Some modern numerical models take these features into account