IMULTANEOUS OBSERVATIONS OF THE IAR WAVE STRUCTURE AT THE MID-LATITUDE AND AURORAL STATIONS

Alexander Potapov

Institute of Solar-Terrestrial Physics SB RAS, Irkutsk, Russia,
potapov@iszf.irk.ru

An experimental comparison of the structure of the ionospheric Alfvén resonator (IAR) emissions at middle (MND – Mondy and UZR – Uzur stations) latitudes and in the auroral zone (IST – Istok station), showed a fundamental difference in the frequency ratio of harmonics (standing waves) in these two zones. At middle latitudes, the frequency ratio is proportional to a series of odd numbers 1:3:5…, which, taking into account the constant presence of a magnetic field node at the upper boundary of the resonator, means the formation of a stable antinode of the magnetic field at the lower boundary. In the auroral zone, the frequency ratio distribution is chaotic. The same applies to the phase factor, which is easily calculated from the frequency ratio of the harmonics. We are trying to explain the obtained results using the previously put forward [Guglielmi et al., 2021; Potapov et al., 2022] hypothesis, according to which the waves captured in the IAR reach the ground by penetrating the horizontally homogeneous mid-latitude ionosphere, so that the lower boundary of the resonator for them is the highly conductive earth's crust, where the antinode of the wave's magnetic field is formed. In contrast, the high-latitude ionosphere has the form of a set of domains with dimensions of 10–300 km, which is smaller than the transverse dimensions of the resonator. In this case, some of the waves form a magnetic field node on the ionosphere and are reflected from it, while some still penetrate to the ground. As a result, a chaotic distribution of the frequency ratio is formed, containing both ratios of odd numbers and arbitrary values, including a sequence of natural numbers (1:2:3...) [Potapov, 2024].

The work was supported by RF Ministry of Science and Higher Education. The results were obtained using the equipment of Shared Equipment Center "Angara" http://ckp-rf.ru/ckp/3056/.

REFERENCES

1. Guglielmi A.V., Klain B.I., Potapov A.S. Discrete spectrum of ULF oscillations of the ionosphere. 2021. arXiv:2105.01871 [physics.geo-ph].

2. Potapov A.S., Guglielmi A.V., Klain B.I. Ratio between discrete IAR frequencies from observations in the solar cycle 24. IEEE Transactions on Geoscience and Remote Sensing. 2022. V. 60. Art no. 2004605.

3. Potapov A.S. Comparison of the wave structure of IAR emission in the mid-latitude and auroral regions. IEEE Transactions on Geoscience and Remote Sensing. 2024. V. 62. Art no. 2002606.