

Heating of the ionosphere by radio emission from terrestrial installations in the medium and long wave bands

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The vast majority of studies of the ionospheric generation of low-frequency radio waves in the ionosphere were conducted on specialized radio installations operating in the RF band. The so-called heating facilities (such as SURA, EISCAT Tromsø, HAARP) have highly directional antenna arrays containing hundreds of dipoles [1,2]. In the 1980s, only a few experiments were conducted in the medium wave range with an antenna array of eight dipoles and in the long wave range on the “Komintern” broadcast radio station with a regular antenna (vertical dipole) [3, 4]. These experiments have shown the high application efficiency of radio waves in the medium and long wave bands and simple antenna systems for the generation of low-frequency radio waves in the lower ionosphere. In connection with these circumstances the calculations were carried out of the heating of the ionosphere by radio waves in these ranges. It is data on temperature modification that underlies the calculations of the effectiveness of the secondary ionospheric source of low-frequency radio waves. The calculations were performed for a number of frequencies in the LF/MF bands, depending on the time of day and latitude. Well-known international models of the ionosphere, atmosphere, and geomagnetic field were used. The calculations were performed for a vertical directed array consisting of 4 horizontal dipoles and for one vertical dipole. A comparison was made of the calculation results for these two antennas between themselves and with the SURA facility antenna at 4.8 MHz frequency. It was shown that heating in the studied bands using antennas with small amount of dipoles can be comparable or even more effective compared to heating in the HF range with traditional heating facilities.

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References

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