Editorial on the Research Topic

Space- and ground-based observations of ELF (extremely low frequency)/VLF (very low frequency) electromagnetic waves and their propagation mechanisms

A large number of anthropogenic and natural ELF (Extremely Low Frequency)/VLF (Very Low Frequency) electromagnetic (EM) waves can be observed on the ground and in space. The ELF/VLF EM waves in the atmosphere could propagate not only in the earth-ionosphere waveguide but also penetrate through the Earth’s ionosphere and into the magnetosphere to interact with energetic electrons in the radiation belts via gyroresonance (Helliwell, 1965) and induce electron precipitation onto the ionosphere (Helliwell et al., 1973). Conversely, EM waves originating from the magnetosphere can also propagate to and affect the ionosphere (Bortnik et al., 2011; Chen et al., 2017).

In recent years, many spacecrafts operating in near-Earth space such as CSES, GOES, Cluster, THEMIS, the Van Allen Probes, Arase, and Swarm, combined with ground-based observatories such as the MAGDAS, SuperMAG, and INTERMAGNET networks, are utilized to study the characteristics of these EM waves. Meanwhile, many models have also been developed to study the upward and downward propagation mechanisms of the EM wave (Starks et al., 2008; Lehtinen and Inan, 2009; Bortnik et al., 2011; Chen et al., 2017). Therefore, the main goal of this Research Topic is to study the EM waves observed by different...
The EM waves in the ionosphere and magnetosphere, as well as promoting the EM waves in space for science and engineering applications.

Author contributions

SZ: Writing–original draft. XS: Writing–review and editing. CZ: Writing–review and editing. ZX: Writing–review and editing. HP: Writing–review and editing. LL: Writing–review and editing.

Funding

The author(s) declare financial support was received for the research, authorship, and/or publication of this article. This work was funded by the Specialized Research Fund for State Key Laboratories, National Space Science Center, Chinese Academy of Sciences, Talent startup research grants from National Space Science Center, Chinese Academy of Sciences (Grant Nos. 2023000034, E3RC2TQ4, E3RC2TQ5), the National Natural Science Foundation of China (Grant Nos. 41704156), the China Research Institute of Radiowave Propagation (Research on low ionosphere satellite detection).

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher’s note

All claims expressed in this article are solely those of the authors and do not necessarily represent those of their affiliated organizations, or those of the publisher, the editors and the reviewers. Any product that may be evaluated in this article, or claim that may be made by its manufacturer, is not guaranteed or endorsed by the publisher.

References


Zhao et al.