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Application of high-time resolution geomagnetic data to diagnosis of neutral atmospheric waves in the upper atmosphere

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High-time resolution geomagnetic data such as 1 second sampling data have been used mainly for the study of geomagnetic pulsations of magnetospheric origin or for the study of conductivity anomalies by the analysis of the induction effects. After the Great Sumatra earthquake in 2004, it has become clear that the atmospheric disturbances also cause geomagnetic pulsations having some specific periods around 4 minutes through the vertical acoustic wave resonance between the Earth's surface and lower thermosphere. The resonance frequency may reflect the thermal structure of the atmosphere and the neutral wind in the upper atmosphere, and hence, the geomagnetic data could provide the information of the upper atmosphere and the acoustic gravity wave activity. On the other hand, precise magnetic measurements by low-altitude satellites such as the Champ or the Oersted revealed a ubiquitous existence of small scale field-aligned currents even in mid- or low-latitude on the day side, and most probably they are caused by the lower atmospheric waves such as the acoustic gravity waves or the internal gravity waves (see Nakanishi et al., EM32, this meeting). The precise and high-time resolution magnetic measurements at geomagnetic observatories show almost always very small amplitude oscillations with period around several minutes, and they could be the effect of the slowly varying field-aligned currents mentioned above and the ionospheric currents connected to the field-aligned currents. Therefore combining the ground and satellite data, geomagnetic diagnosis of neutral atmospheric waves in the upper atmosphere could be possible, and the stable and high-time resolution data from geomagnetic observatory may play an important role in the study of the upper atmosphere.

Keywords: geomagnetic field, high-time resolution, acoustic gravity wave, field-aligned current, mid and low latitudes, ionospheric dynamo