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3D MHD simulations of electromagnetic variations in the ionosphere caused by waves from the lower atmospere

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It has been shown from a lot of observation that acoustic and internal gravity waves generated in the lower atmosphere can propagate to the ionosphere [e.g., Davies and Jones, 1971; Heki et al., 2006, Otsuka etal., 2006, Choosakul et al., 2009]. A geomagnetic pulsation was observed at Phimai in Thailand, shortly after the origin time of the Sumatra earthquake on December 26, 2004[Iyemori et al., 2005]. The localized nature and the period of oscillations suggest that the magnetic pulsation was generated by dynamo action in the lower ionosphere, set up by an acoustic wave generated by the earthquake. However, geomagnetic pulsations caused by atmospheric waves excited in the lower atmosphere have hardly ever been observed. Accordingly, the objective of this paper is to estimate the physical mechanism of this phenomenon.

Shinagawa et al. [2007] performed a numerical simulation by using a two dimensional atmosphere-ionosphere model, in which atmosphere is non-hydrostatic and compressible, and ionosphere is single-fluid of O+. Results of the simulation agreed with observational results of ionospheric disturbances caused by atmospheric waves generated by a large earthquake. The numerical model used in this simulation does not include the electromagnetic variations. In this work a MHD model is developed which use the plasma velocity calculated with a three dimensional expanded from the model of Shinagawa et al., 2007. Temporal variations of the magnetic field is considered to investigate whether the geomagnetic pulsations caused by atmospheric waves from the lower atmosphere are due to hydromagnetic waves or not.

In this paper, initial results obtained with this model will be reported.