

Comparison study of the ionospheric convection (2) (MHD simulation, empirical model, SuperDARN observation)

Manabu Kunitake[1]; Shinichi Watari[1]; Hiroyuki Shinagawa[1]; Hironori Shimazu[1]; Takashi Tanaka[2]

[1] NICT; [2] Kyushu University

National Institute of Information and Communications Technology (NICT) has been running the real-time magnetohydrodynamic (MHD) simulation (Tanaka 1995, Tanaka 2003, and Den et al. 2006) of the solar wind-magnetosphere-ionosphere (S-M-I) coupling system. The simulation uses actual observed data at ACE spacecraft as input parameters. The simulation includes the field aligned currents and the ionospheric conductivity. The ionospheric convection pattern and the cross polar cap potential value can be reproduced by the real-time run of the simulation. The calculated results have been archived. The ionospheric convection and the cross polar cap potential are suitable parameters for the validation study. It is also important that the comparison between simulation outputs and empirical models, for example, Boyle's model [Boyle et al. (1997)].

1. Comparison between the MHD simulation and Boyle's empirical model

Boyle et al. (1997) derived an empirical equation of the cross polar cap potential by using solar wind and IMF data of IMP 8 and the cross polar cap potential estimated by DMSP satellite. We calculated the cross polar cap potential by Boyle's empirical equation by using ACE data as its input during the period of our real-time simulation. Then, we compared the potential with that resulted from the MHD simulation.

At the fall meeting, we reported about our case studies. The case studies show that the polar cap potential value reproduced by the simulation tends to be larger than that of Boyle's empirical model.

At this spring meeting, we will report the results of statistical analysis based on correlation plots.

2. Comparison between the MHD simulation and SuperDARN observation

SuperDARN is a useful tool for detecting two-dimensional ionospheric convection pattern when its velocity measurement covers a sufficient area of high latitude region.

At the fall meeting, we reported about the case studies. The case studies show that the response of the ionospheric convection to IMF By change appeared in the simulation is very similar to that of the SuperDARN observation.

At this spring meeting, we will report about a statistical study. The study is the comparison analysis of the position of the potential maximum (or minimum) between the MHD simulation and SuperDARN observation.

Acknowledgements

We thank the ACE MAG and SWEPAM instrument teams and the ACE Science Center for providing the ACE level 2 data. We thank all the staff who has contributed to the operation of the SuperDARN radars. We thank all the staff of JHU/APL who has created and archived the convection maps from the SuperDARN observation.

References

- Boyle C. et al., J. Geophys. Res., 102, A1, 111, 1997.
- Den, M. et al., Space Weather, S06004, doi:10.1029/2004SW000100, 2006.
- Tanaka, T., J. Geophys. Res., 100, A7, 12,057, 1995.
- Tanaka, T., J. Geophys. Res., 108, A8, 1315, doi:10.1029/2002JA009668, 2003.