

SuperDARN studies on possible grand minimum influences on geospace environment

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The current unusual solar cycle is thought possibly to be the beginning of so-called Grand-Minimum period when solar activity stays at a very low level for a considerably long period. If this is the case, geospace environment (e.g., solar wind energy input and high energy particles distribution) might change largely and consequently resulting in e.g., less frequent storms and substorms, shrunk polar cap and auroral oval and unexpected environmental changes in upper atmosphere or even global climate changes. Such a view is one of the important scientific issues in new SCOSTEP VarSITI program (2014-2018).

SuperDARN HF radar network is a powerful tool to monitor fundamental ionospheric physical parameters to investigate global electric potential maps and the dynamics of ionospheric and magnetospheric plasma convection under a variety of solar wind and magnetospheric/ionospheric conditions.

SuperDARN HF radar network and various ground-based electro-magnetic field/waves and optical instruments at manned and unmanned stations have been deployed in Antarctic region - which are powerful and unique tools to study storms, substorms and M-I (magnetosphere-ionosphere) coupling processes. Using these instrumental setup, the influence of current solar activity changes on storms, substorms and a variety of coupling processes in Earth's geospace environment should be investigated at this opportunity by collaborating with in-situ satellite measurements (e.g., THEMIS, VAP, ERG) and theoretical researches.

How SuperDARN and NIPR Space and Upper Atmospheric Sciences Research Group can contribute to this particular important studies and what can be expected to be done during JARE (Japanese Antarctic Research Expedition) project phase IX period (2016-2022) will be discussed, and how polar cap sizes and cusp latitudes, global convection strength and cross polar cap potential have behaved depending on the past solar cycle activities and under current solar activity will be studied and shown mainly using long term global SuperDARN observation data and influences of possible grand minimum will be discussed.

Keywords: SuperDARN, Grand Minimum, low solar activity, polar upper atmosphere, ionospheric convection, cross-region coupling