Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

PEM06-15 Room:312 Time:April 30 16:45-17:00

SuperDARN global observation of energy input and coupling processes and recent technical development

YUKIMATU, Akira sessai[1*] ; NISHITANI, Nozomu[2] ; NAGATSUMA, Tsutomu[3]

[1]NIPR/SOKENDAI, [2]STEL, Nagoya Univ., [3]NICT

SuperDARN (Super Dual Auroral Radar Network) [Greenwald, et al., 1995] is an international collaborative HF-radar network [Greenwald, et al., 1985] operated by more than 15 institutions in over 10 countries, and the number of the radars is currently more than 30 and it is still growing and the fields-of-view (FOVs) have been expanding to both higher and mid-latitudes covering considerable portions of global upper atmosphere in both hemispheres.

SuperDARN was originally designed to measure line-of-sight plasma Doppler spectra and ionospheric electric field to obtain global large scale two-dimensional polar ionospheric plasma convection patterns and polar cap potential drop in both hemispheres with a temporal resolution of 1 to 2 minutes in real time since 1995, which have never been possible by any other observational techniques, and this capability provides us very important and essential information on solar energy input to our geospace, magnetosphere and polar ionosphere, which has greatly contributed to basic understanding of coupling processes in Sun-Earth system as well as space weather researches.

SuperDARN is a powerful tool to be applied to many scientific issues [Chisham, et al., 2007 and references therein]. It can be used not only to deduce dynamics of global large-scale convection patterns, but also to study dynamics of transient meso-scale phenomena like FTEs and TCVs, and polar cap boundary or open-closed field line boundary (OCB), to detect reconnection sites and to deduce reconnection rates, to study substorms, storms and phenomena related to subauroral regions like sub-auroral polarisation stream (SAPS), to deduce field aligned currents (FACs), to study MHD waves in a variety of frequency ranges, and also to study ionospheric irregularities in D-, E-, and F-regions. Moreover, it can be utilised not only to ionospheric researches but also to neutral atmospheric studies, e.g., on atmospheric waves like TIDs, tides and gravity waves, neutral winds around mesopause region, and also polar mesospheric summer echoes (PMSEs), etc.

These days, the fields-of-view (FOVs) of SuperDARN have been expanded to higher latitude (PolarDARN) and mid-latitude (StormDARN) which covers considerable portions of mid- and polar latitudes of earth's ionosphere in both hemispheres and enables us to address much wider ranges of scientific questions including inner magnetospheric physics. There are also ongoing discussions to expand the SuperDARN radars field of view to even lower latitudes, up to low latitude and equatorial regions.

SuperDARN has extensively evolved successfully and has been extremely productive by strong cooperation and competitions within the community and also by collaborative studies with other ground-based and satellite/rocket observations and theoretical researches, which has greatly contributed to a variety of studies especially on magnetosphere-ionosphere coupling processes and ionosphere and neutral atmosphere coupling.

As SuperDARN could have provided basic and important physical parameters in global upper atmosphere, collaborative studies with other projects like IS-radars like EISCAT and PANSY providing many detailed physical parameters at fix points as well as satellite missions like THEMIS, VAP, and ERG and rocket campaigns providing in-situ measurements will be particularly important to contribute to our deeper understanding of the Sun-Earth coupling processes.

Also some SuperDARN radars has developed new technical upgrade including imaging radar capabilities providing higher spatial resolution. New science targets with SuperDARN with new capabilities will also be discussed.

Keywords: SuperDARN, HF radar, coupling processes, imaging radar, MI coupling, neutral wind