SuperDARN future plan for Phase X JARE project

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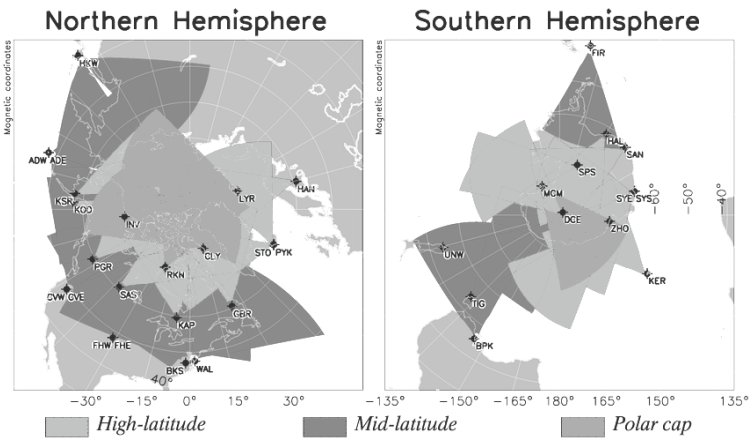
SuperDARN (Super Dual Auroral Radar Network) is an international high-frequency coherent radar network established in 1995. Each over-the-horizon radar has a horizontally large field-of-view in upper atmosphere (mainly ionosphere) reaching more than 3000 km in horizontal radial direction and about or more than 50 degrees in azimuthal direction. More than 35 radars are currently distributed from middle to polar latitudes in both hemispheres and running and operated by more than 15 research institutes in about 10 countries. One of the original main scientific objectives was to obtain real global (mainly high - auroral to polar cap - latitude) plasma flow or convection maps and electric field potential maps not in a statistical manner, which had never been done before by any ground-based or airborne/space observation, to contribute primarily to Space Weather research. The number of researchers, research institutes and radars has still been growing and the fields-of-view now cover considerable portion of middle to high latitude upper atmosphere. As a result, research areas and collaborative studies with other observational, theoretical and simulation groups have also expanded. It can now address many aspects of scientific questions not only on polar ionospheric and magnetospheric physics, its coupling, solar terrestrial physics (aeronomy), and space weather including geomagnetic and auroral storms and substorms, but also on subauroral ionosphere, inner magnetosphere, global upper atmosphere including neutral atmosphere and its coupling with ionised atmosphere (mesosphere-thermosphere-ionosphere coupling), influence of geospace on lower atmosphere and possible global climate change, plasma physics, and practical applied physics including space weather nowcast/forecast relating to communication, geodetic/positioning and satellite failure/errors, major power grid outage and warning/alert system to astronautical activities, and so on.

NIPR has joined the SuperDARN project since its beginning in 1995 and run 2 SENSU SuperDARN radars, Syowa South and Syowa East radars (SENSU stands for "Syowa South & East HF Radars of NIPR for SuperDARN") in Japanese Antarctic Syowa station (69.00 S, 39.58 E) in polar auroral zone. Both radars have substantially contributed to the SuperDARN project and scientific researches, for example, studies on various types of auroral phenomena, geomagnetic pulsations, substorms, reconnection, precise neutral wind observation around mesopause region using meteor echoes, studies on polar mesospheric summer echoes (PMSEs), magnetosphere-ionosphere-neutral atmosphere vertical coupling, studies on influence of low solar activity or grand minimum on geospace space weather. We here summarise our important achievements so far including during current phase IX JARE project period and will discuss on issues remaining unresolved and ways forward and the future perspective of the scientific direction of our SENSU SuperDARN research towards phase X JARE period and beyond as one of the comprehensive observations at Syowa station and as one of the most important basic and cutting-edge geospace scientific tools.



Fields of view of SuperDARN radars in both hemispheres as of 2019
(Courtesy of Virginia Tech SuperDARN group at vt.superdarn.org).

References

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