

A new perspective on atmospheric and geospace sciences in the Arctic with EISCAT_3D

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The European Incoherent Scatter(EISCAT) radar system in northern Feno-Scandinavia and Svalbard have been playing a pivotal role in advancing cutting edge sciences in various area including atmospheric, ionospheric and geospace studies, space weather and global change. Affiliated in the EISCAT Scientific Association in 1996, the EISCAT user community in Japan has jointly contributed to understanding of the magnetosphere-ionosphere-thermosphere coupling processes using the coordinated ground-based and rocket/satellite simultaneous observations with EISCAT radars.

EISCAT_3D is the major upgrade of the existing EISCAT mainland radars, with a multi-static phased array system composed of one central active (transmit-receive) site and 4 receive-only sites to provide us 50-100 times higher temporal resolution than the present system. The core site will transmit radio waves at 233MHz with 10MW power, and all five receiving sites will have sensitive receivers to detect the returned signal using phased-array antenna with 10,000 cross-Yagi elements.

The new radar is expected to overcome current observational difficulties and then open new scientific world that have been never realized. One of the great characteristics is continuous measurements of the space environment-atmosphere coupling in the auroral oval and at the southern edge of the polar vortex. High time resolution data with 3D volume-metric will be obtained by EISCAT_3D. Scientific topics addressed in the Science Case documents (i.e.. McCrea, et al., 2015) are as follows:

1. Atmospheric physics and global change
 - a. Vertical coupling between the atmospheric layers
 - b. Turbulence and waves in the mesosphere and lower thermosphere
2. Space and plasma physics
 - a. Multiple scale interactions in ionosphere-magnetosphere plasmas
 - b. Plasma turbulence and active experiments
3. Inflow and outflow of matters in the Earth's atmosphere
4. Space debris, near-earth objects and space weather
5. Radio astronomy

In this paper, we will overview scientific subjects to be challenged by the new EISCAT_3D radar facility in the Arctic, as well as the possible inter-hemispheric coupling studies with the PANSY radar in the Antarctic.

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