

Japanese science targets by using the EISCAT 3D

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These are scientific topics proposed and to be made by Japanese scientists until now (May 21, 2009). Needless to say, simultaneous observations with other radars (SuperDARN, MF, Meteor, STARE, and PANSY), LIDARs, FPIs and optical imagers are needed to achieve our goals. Also, collaborative studies with satellites and rockets will be conducted.

(1) Auroras : fine structures of auroras and 3D structures of pulsating auroras

If we can observe 3D structures of the electron density and the electric fields, we can do study fine structures of auroras as well as pulsating auroras more in detail.

(2) 3D structures of naturally enhanced ion-acoustic and plasma lines

By utilizing multi beams of the EISCAT 3D, we can study fine and 3D structures of NEIALs.

(3) Meso- and micro-scale spatiotemporal structures in the electromagnetic energy dissipation

Reality of the horizontal pattern appeared in the electromagnetic energy dissipation is not well known, in particular, for the meso- and micro-scale structures, although we can easily imagine the presence of such fine structures from the aurora image data.

(4) Meso- and micro-scale spatiotemporal structures in the thermosphere

Need to understand the causality to produce fine structures found in the recent observations. Some experimental evidences suggest that thermospheric response to sudden ionospheric changes is considerably quicker than general ion-drag time constant by more than an order. Horizontal pattern also has meso- and micro-scale structures in the thermosphere.

(5) Effects of the ionospheric/thermospheric fluctuations on global scale signatures and their feedback to the magnetosphere

Atmospheric gravity waves, ionospheric irregularities can propagate horizontally and vertically modulating the in-situ conductivity and the electric field in the ionosphere. Some theoretical predictions suggest greater energy dissipation in association with the current fluctuations than the DC current.

(6) Development of the methodology for measuring height profile of the ion composition

throughout the ionosphere

The IS radar may be available to do so if SNR of the IS spectrum is good. The ion composition is one of the fundamental important parameters. Other ionospheric parameters from the IS radar (Ne, Ti, Te, etc.) are dependent on the ion composition; but now we need to use a model to obtain it.

(7) Study of the lower thermospheric wind

By utilizing EISCAT 3D capabilities, we can derive 3D neutral wind velocity more accurately. Also we can obtain 3D structures of the wind. These are great advantage to investigate the lower thermospheric wind dynamics. Furthermore, by combining other optical measurements such as LIDAR and FPI, we can investigate the response of the lower thermosphere to the magnetospheric forces.

(8) Atmospheric waves: Gravity, Tides and planetary waves

Continuous observations of the lower thermospheric wind make it possible to study the tides and planetary waves in the lower thermosphere. Also, observations of the 3D structures make it possible to study gravity waves and its coupling with mean winds and other waves.

(9) Ion upflow

3D information of the topside ionosphere makes it possible to investigate 3D structures of the ion upflow as well as its generation mechanism.

(10) Ionospheric current and field-aligned current.

Horizontal (3D) observations of the electron density (conductivity) and the electric field make possible to advance our understanding of the 3D current system.

(11) Collaborative studies with PANSY

Simultaneous observations of the northern and southern ionosphere/upper atmosphere are important to understand the coupling process between the Magnetosphere and the Ionosphere. Collaborative studies of EISCAT and PANSY give us great opportunities to investigate resemblances/differences of the ionosphere/atmosphere.

(12) Collaborative studies with in situ measurements (satellites and rockets).

Simultaneous/collaborative studies with satellites and rocket are also important to promote our understandings of the upper atmosphere and ionosphere.