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EISCAT Incoherent Scatter Radars Probing High-Latitude Near-Earth Geospace for the EURIPOS Proposal

E. Turunen

EISCAT Scientific Association, Kiruna, Sweden (esa.turunen@eiscat.se / +4698079159)

EISCAT Scientific Association operates currently three incoherent scatter radars in Northern Scandinavia on behalf of its associate members in Finland, China, Germany, Japan, Norway, Sweden and United Kingdom, as well as currently supporting partners in France and Russia. The radar sites include transmitter/receiver site in Tromsø, Norway with a monostatic VHF radar and a tristatic UHF radar transmitter/receiver, UHF receiver sites in Kiruna, Sweden and Sodankylä, Finland and a 2-dish monostatic radar in Longyearbyen, Svalbard. Incoherent scatter radar method is known to be the most sophisticated radio method to remotely sense the ionosphere. The standard parameters analysed from the recorded scattered signals are the electron density, electron temperature, ion temperature, line-of-sight plasma velocity, ion-neutral collision frequency and ion mass. With more assumptions also information for example on neutral density and temperature, neutral velocity, Pedersen and Hall conductivities, electric current density and heat flux is available. Current applications of the radars include also interferometric applications for small-scale structures, mapping of meteroid orbits and monitoring space debris, as well as high-resolution mapping the radar reflectivity of the Moon surface.

In addition to incoherent scatter radars, EISCAT also has a powerful HF heating facility for ionospheric modification experiments, and a dynasonde in Tromsø, as well as another dynasonde in Svalbard for routine ionospheric observations. All the current EISCAT facilities would serve the EURIPOS proposal quantifying the ionospheric variability and response to space weather events at high latitudes. Although the main ISR facilities cannot be run continuously, regular Common Programmes, measurement campaign modes - especially combined with coordinated satellite observations and specific model studies, and the continuous operation of supporting dynasondes, would greatly enhance the EURIPOS proposal. EISCAT real-time analysis of data is available and all measured data is accessible to researchers via the Madrigal database.

In the near future, unprecedented science and technology application opportunities will open up with the construction of the new EISCAT 3D radar arrays. The new multiple site phased-array radar has a design goal of ten times higher temporal and spatial resolution than the present radars, a volumetric radar imaging capability in an extended spatial area with simultaneous full-vector drift velocities, avoiding spatial and temporal ambiguities, having continuous operation modes, short baseline interferometry capability for imaging sub-beamwidth scales, real-time data access for applications and extensive data archiving facilities. Some arrays are very large, in the scale of 30 000 individual antenna elements. The first design study is to be finished in 2009 and a modular construction of the facility would provide first measurements in 2013-2015.