What is EISCAT_3D?

EISCAT_3D will be an international research infrastructure, using radar observations and the incoherent scatter technique for studies of the atmosphere and near-Earth space environment above the Fenno-Scandinavian Arctic as well as for support of the solar system and radio astronomy sciences. The radar system is designed to investigate how the Earth's atmosphere is coupled to space but it will also be suitable for a wide range of other scientific targets for e.g space weather forecasts and detecting space debris.

It will be operated by EISCAT Scientific Association and hence be an integral part of an organization that has successfully operated incoherent scatter radars for more than thirty years.

Visit the EISCAT_3D FAQ-section for more information.

Maps of the location are found here.

Design

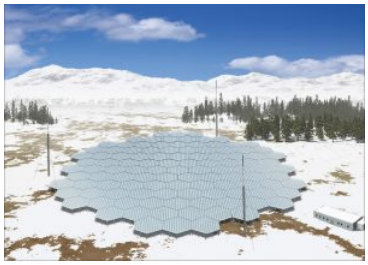

Illustration of the EISCAT_3D.* @NIPR

The EISCAT_3D system will consist of five phased-array antenna fields located in the northernmost areas of Finland, Norway and Sweden. Each field will consist of around 10,000 crossed dipole antenna elements arranged in 109 hexagons in a honeycomb-structure. One of these sites (the core site) will transmit radio waves at 233 MHz, and all five sites will have sensitive receivers to measure the returned radio signals. The central array of each site will be of a size of about 70 m from side to side, and the sites will be located from 90 km to 250 km from the core site in order to be able to maximise the coverage by the system.

EISCAT_3D is designed to use several different measurement techniques which, although they have individually been used elsewhere, have never been combined together in a single radar system. The design of EISCAT_3D allows large numbers of antennas to be combined together to make either a single radar beam, or a number of simultaneous beams, via beam-forming. While traditional radar systems with a single slow-moving antenna, and thus a single beam, can only show us what is happening along a single line in the upper atmosphere, volumetric imaging allows us to see geophysical events in their full spatial context, and to distinguish between processes which vary spatially and those which vary over time.

Measurements

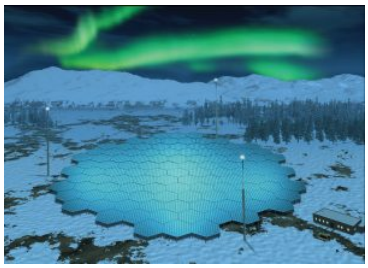

Illustration of the EISCAT_3D in aurora.* @NIPR

EISCAT_3D will measure the spectra of radio-waves that are back-scattered from free electrons, whose motions are controlled by inherent ion-acoustic and electron plasma waves in the ionosphere. The measured spectra reveal high-resolution information on the ionospheric plasma parameters, but can also be used for obtaining atmospheric data and observations of meteors and space debris orbits. In both active and passive mode, the receivers will provide high-quality scientific and monitoring data from the ionosphere as well as from space within its designed frequency spectrum. The research will both be organized through common observation modes and through requests from individual groups.

Since EISCAT_3D is very flexible compared to traditional ionospheric radars, it will allow several new operating modes, including the capabilities to determine vector velocities of moving objects and to respond intelligently to changing conditions, for instance by changing the parameters of a scanning experiment. EISCAT_3D will also allow remote continuous operations, limited only by power consumption and data storage. This is important for monitoring the state of the atmosphere, especially as a function of solar variability, as well as capturing events that appear suddenly and are hard to predict. Radio astronomy observations will be performed when the transmitters are inactive. Read more here.

Illustration of arrangement of antenna elements in one hexagon.* @EISCAT Scientific Association

**All pictures are examples and may come to look different in the future.*

Listen to what scientists have to say about the EISCAT_3D