# EISCAT_3D Data Solutions

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EISCAT, originally the European Incoherent Scatter Scientific Association, was established in 1975 as a
collaboration between Norway, Sweden, Finland, UK, Germany and France.
The purpose was to develop an
incoherent scatter radar for the Northern auroral zone.
EISCAT has been operational since 1981
and has grown to a globally used research infrastructure.
The present members are Norway, Sweden, Finland, UK, China and Japan.
Many research groups world-wide have used EISCAT for studies of the middle atmosphere,
ionosphere and magnetosphere, either through collaboration with member institutes or by applying for time
through the peer-review access programme.

The existing EISCAT radars are single beam systems with parabolic dish antennas.
EISCAT has now started to construct the next generation imaging incoherent scatter radar, EISCAT_3D.
This will be a system of distributed antenna arrays with fully digital signal processing that will
enable comprehensive three-dimensional vector observations of the atmosphere
and ionosphere above Northern Fenno-Scandinavia.
Through the use of new technology based on the latest advances within digital signal processing,
it aims to achieve ten times higher temporal and spatial resolution compared to present radars.
It will also offer continuous measurement capabilities through fully remote operation.

On each of the three EISCAT_3D radar receiver sites will be 109 sub-arrays of 91 antennas each, each with a
first stage beamformer, based on FPGA technology, to form 10 wide-angle beams at two polarizations.
Subsequently, the wide-angle beam data packets from each sub-array will be stored in a fast RAM memory
buffer and combined into 100 narrow-angle beams by a second stage beamformer on the site level.
Data from each site will be sent to a storage buffer at a central site.
At this central site, computing capacity connected to the storage buffer will combine the site data to form
spatially resolved data products.
The operational modes of the EISCAT_3D radars may be affected
or controlled by results produced at the central site.
Quality-checked final data products will be sent to
long-term storage at data centres.
This data is subsequently served to the EISCAT_3D users, under FAIR principles, for further analysis.

The Nordic e-Infrastructure Collaboration (NeIC) facilitates development
and operation of high-quality e-Infrastructure solutions in areas of joint Nordic interest.
NeIC is a distributed organisation consisting of technical experts from academic high-performance
computing centres across the Nordic countries.

The NeIC EISCAT_3D Data Solutions (E3DDS) project follows from EISCAT_3D support project (E3DS).
This project cooperates with national e-infrastructure providers in the EISCAT_3D participating countries in
order to simulate the data flows at the radar receive sites and from the sites to the central data storage and
computing.
A scale simulation of the on-site processing will be deployed in national e-infrastructures in collaboration
with the providers.
The simulations of on-site processing will generate data and send to a test storage (simulating the central disk
buffer).
Also the networking configurations between the future EISCAT_3D sites can be tested in collaboration with
Nordic network providers.

The EISCAT_3D data will be accessible according to the FAIR principles.
Users will access data primarily through a portal using their federated identity.
EISCAT does have internal policies regarding data access, but overall the principle of data as
findable, accessible, interoperable and re-usable is followed.

## Summary

The EISCAT_3D data chain is simulated as the construction of the experiment proceeds. In order that data can be served to the users in a timely manner the production of data on the remote sites and transfer to data centres must be simulated. Some of the questions to be answered with this simulation include the data format, addition of persistent identifiers in order to serve data in a FAIR manner.

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