

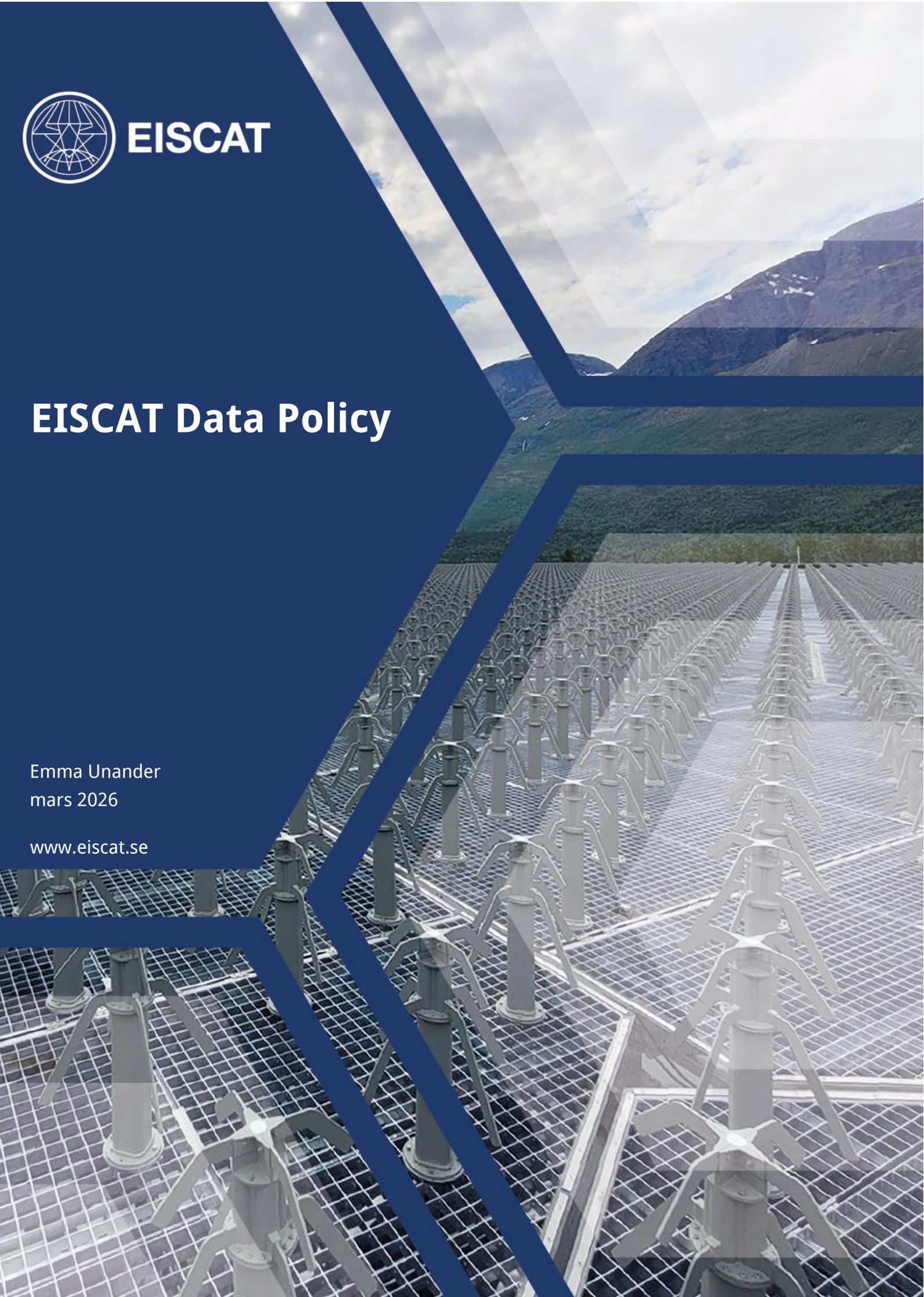


EISCAT

EISCAT Data Policy

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EISCAT Data Policy

1. Purpose and scope

This policy refers to data collected by any of the EISCAT instruments:

- Tromsø Incoherent Scatter Radars
- Tromsø Ionospheric Modification Facility
- EISCAT Svalbard Radar
- EISCAT Headquarters
- EISCAT 3D Karesuvanto
- EISCAT 3D Kaiseniemi
- EISCAT 3D Skibotn

It does not apply to data collected by external instruments in conjunction with EISCAT experiments.

This policy explains the data collection and ensures the protection of the data produced by the EISCAT facilities listed above.

2. Description of data products

The chain of data levels described here starts from the digital signal processing in the receiver system.

Level 1. Voltage-level data samples.

Level 2. The time integrated power spectral data, decoded from the voltage data. The data obtained from passive observations or the data from other EISCAT instruments are also Level 2 data.

Level 3. The physical parameters that are derived from the level 2 data. At present these are the profiles of physical parameters of the ionospheric plasma (electron density, electron temperature, ion temperature, ion velocity).

Level 4. External value-added data products. They are normally derived by the users in a process that combines EISCAT data with data from other sources.

Metadata. The operational parameters accumulated at all sites, like antenna pointing, output power, radar pulses and data processing used are stored and denoted here as metadata.

3. Data collection, storage, and access

All data collection, storage, and access is made or arranged by EISCAT through the EISCAT staff.

Level 1 data are not stored at wide bandwidth, though band-limited measurements are stored as resources permit. EISCAT also stores wide-bandwidth Level 1 data for limited time to generate further data products. For well-defined research or development projects users can apply for specific sets of wide-bandwidth Level 1 data to be stored. Such applications will undergo technical and scientific reviews before final consideration. When approved, an agreement must be formulated on the life span of the collected data with a scheme of what data products will be delivered to the EISCAT data archive including a time line for this delivery.

Level 2 data are archived by EISCAT. These data are for exclusive use of the user who carried out the observation during 1 year, and for exclusive use within the EISCAT membership for 2 following years. In the case of newly developed data products that are produced over a time span exceeding 2 years, these are for exclusive use within the EISCAT membership for two years after final production. Users can apply for extended time of exclusive use. Those users carrying out the observations can also reduce the period of exclusive use to open up public access at an earlier time.

Level 3 data are archived by EISCAT. Preliminary, un-validated level 3 data are normally generated in real time and are made available as quick-look plots. These plots are not intended for scientific publication or presentation. Validated level 3 products are made available and archived by EISCAT at a later date as workforce permits. These are for the exclusive use of the user that carried out the observations until 1 year after the observation, at which time they will be made publicly available. Users can reduce the period of exclusive use if they wish.

Level 4 data are normally not archived by EISCAT. When level 4 data are published by the users, it is subject to the same exclusivity as the level 2 or 3 data that was used to create it. Reference to the origin of the data and to the association needs to be given and EISCAT always needs to be informed of the publication. Any usage of data that is not intended for basic research resulting in scientific publications needs to be negotiated with Council in advance.

Operational parameters (metadata) like antenna pointing, output power, radar pulses and data processing used are open to the public at any time.

4. Data ownership and acknowledgement

1. Ownership of all EISCAT Level 1-3 data shall be permanently vested in the EISCAT organisation, for the benefit of all the Associates and Affiliates.
2. Published papers in which data from the EISCAT facility have been used shall always contain an acknowledgement of the support provided by EISCAT, preferably in the standard form available from EISCAT.
3. Authors are required to send reprints of papers in electronic form to the EISCAT Headquarters where a file of EISCAT publications will be kept. Authors are also encouraged to send pre-prints of papers in advance of peer review and publication.
4. A summary of observations shall be published in the EISCAT Annual Reports or other similar document.

5. Transparency and logging of EISCAT operations

EISCAT shall strive to have full transparency in its operations and with respect to the data generated. All observation campaigns shall be clearly documented and the campaign log shall be available for inspection in accordance with the EISCAT Agreement.

Generally, data segments containing radar echoes from resident space objects shall be filtered out at a low processing level. When such filtering is not adequate to reach the objectives of the approved observation campaign, special care must be taken to avoid a breach of the Objects and Means of the association as laid down in the EISCAT Agreement.

EISCAT raw data containing radar echoes from satellites shall not be distributed to other agencies.

6. Data procedures

The EISCAT Data Policy indicates areas that require special attention to ensure that EISCAT systems adhere to the goals of the organisation, but it does not prescribe detailed procedures for avoiding or handling potentially politically sensitive observations. This document describes the procedures implemented by EISCAT to adhere to the Data Policy.

The Data Policy originated largely from recommendations made by the former EISCAT Scientific Association Council's Expert Group on Satellite and Space Debris Observations. The expert group was formed in response to concerns about the future capabilities of the EISCAT_3D radar and the

potential for abuse of this new system, either accidentally or intentionally. EISCAT AB has adopted these recommendations.

The EISCAT Data Policy indicates, in section 4. Transparency and Logging of EISCAT Operations:

EISCAT shall strive to have full transparency in its operations and with respect to the data generated. All observation campaigns shall be clearly documented, and the campaign log shall be available for inspection in accordance with the EISCAT Agreement.

Generally, data segments containing radar echoes from resident space objects shall be filtered out at a low processing level. When such filtering is not adequate to reach the objectives of the approved observation campaign, special care must be taken to avoid a breach of the Objects and Means of the organisation as laid down in the EISCAT Agreement.

EISCAT raw data containing radar echoes from satellites shall not be distributed to other agencies.

The particular Objects and Means in question are as follows:

- The aim of EISCAT is to provide access to radar, and other, high-latitude facilities of the highest technical standard for non-military scientific purposes.
- EISCAT may contribute to the international task of tracking objects in space (natural or man-made). For this activity, an agreed list of objects shall be maintained, and EISCAT shall only conduct tracking of objects from this list.
- All use of observation time must be in line with the aims of EISCAT. Users shall not use the facilities for collecting data on military sensitive objects.
- All data obtained shall become the property of EISCAT and shall be managed according to the EISCAT data policy.

5.1. Data protection

While no operational procedure can be 100% effective in avoiding the collection and dissemination of data containing classified or sensitive objects, especially not in an environment where state-of-the-art radar and signal processing techniques are being advanced, the following overlapping measures greatly reduce such risks. The expectation is that these procedures will minimize the risk without significantly impacting the scientific results from the measurements.

The former EISCAT Scientific Association Council's Expert Group on Satellite and Space Debris Observations specifically noted, in their report from October 2015: *"Although some high-precision measurements of satellite range and velocity can be made using the EISCAT radar, the capabilities of the present system in terms of orbit accuracy are such that tracking capabilities*

can be considered rudimentary compared to the open Space-Track catalogue. The statistical surveys that can be done with EISCAT are not restricted.”

As a result, some of the Data Policy Procedures are not implemented on the legacy EISCAT systems (particularly those procedures requiring specialized technical solutions). Other procedures are, however, more generally applicable for all observations.

5.1.1. First level of protection

The first level of protection comes from the experiment request procedures. This is a web based process where experimenters are required to explain the purpose(s) of their measurement campaign(s) and the specific measurement techniques (e.g. pulse sequences, etc.) to be employed. This vetting of the experiment requests allows EISCAT to block users who unknowingly wish to attempt prohibited measurement campaigns. The vetting process will occur in two stages.

5.1.1.1 First stage

In the first stage, experiments with no apparent conflicts with the aims of EISCAT can be simply approved. This includes operations for basic ionospheric measurements using standard pulse coding and processing schemes and measurement modes not amenable to characterizing classified or sensitive space objects. If there is any question about the acceptability of the goals of an experiment, the request will be passed on to the second stage.

5.1.1.2. Second stage

In the second stage, the experiment request will be evaluated by a group of radar experts, called the Experiment Review Panel, to determine whether the experiment goals/capabilities are at odds with EISCAT's mandates. The panel will be chaired by the EISCAT Head of Operations and may include experts from outside the organization. This second stage evaluation may require additional information/clarification from the person(s) requesting the measurement(s).

In the case of an experiment aimed at measuring the orbital parameters of one or multiple known satellites or other kinds of objects in space, the details of the target satellite(s) will be provided by the experimenter(s) and the satellite(s) will be compared to a list of approved objects (White List). For objects not on the White List at the time of the request, it is up to the requestor to justify an addition and demonstrate that the requested object is allowable.

In any event, the Experiment Review Panel's analysis must indicate that the experiment does not conflict with EISCAT's mandate before said experiment can be performed.

5.1.1.3. White List

The White List will be openly available and initially based on the Open Space-Track Catalog (www.space-track.org). Any Associate or Affiliate can anonymously request to have an object removed from the White List. Non-manmade objects (e.g. near earth objects) can generally be

added to the White List with minimal review. Ablating meteoroids are automatically on the White List and are identified primarily by their altitudes (below operational satellite altitudes).

5.1.2. Second level of protection

The second level of protection comes from the automated removal of hard-target returns from the low level data stream. This protection level is specific to EISCAT_3D and it entails the detection and removal of returns from the output data stream of each subarray of 91 antennas. The removal is only done for altitudes above 200 kilometres (thus leaving most meteor head echoes unaffected) and for Doppler velocities less than the escape velocity of 11.2 km/sec (thus ignoring objects that cannot be in Earth orbit).

The algorithms employed are based on standard matched filter processing and the threshold is set to ensure a satisfactorily low false alarm rate while detecting the vast majority of actual targets. The specific objects of greatest interest for removal are, in any event, operational satellites and, as such, tend to have relatively large radar cross sections. Thus, if the algorithms fail to detect some objects, those objects will be primarily smaller pieces of space debris, etc. The algorithms will be periodically tested with objects of various cross sections from the White List and test reports will be available on line.

Some experiments will require that this automatic removal be disabled. In particular, it cannot be used for experiments that target objects on the White List or, for instance, searches for meteoroids prior to their interaction with the atmosphere or near earth objects (asteroids). When the automatic removal algorithm is disabled, the metadata for the radar returns will indicate this via dedicated tags. Reports will be sent to EISCAT Board periodically to specify which experiments and how much total time was used with the automatic removal disabled.

5.1.3. Third level of protection

The third level of protection takes the form of full transparency of all EISCAT operations. No data will be collected without the details being added to an open and publicly accessible campaign log. This log will be automatically generated and updated during operations. Metadata, which describe operations as they occur (e.g. radar mode, antenna steering, etc.), are also openly available.

5.1.3.1. Inspections

Furthermore, all sites are available for inspection by the relevant agencies in the hosting countries. When practical, they will also be available for inspection by non-hosting countries, though this may be subject to local law (e.g. the need for travel visas, etc.). Inspections will have access to both the physical resources (after safety concerns have been taken into account) and the software source code and data.

If any operations are discovered that violate the aims of the association, experiments can be immediately terminated by EISCAT and data can be made inaccessible.

5.1.4. Fourth level of protection

The fourth level of protection comes from the fact that all data collected on EISCAT systems remain the property of EISCAT.

Raw data shall not be disseminated to other agencies, either automatically or individually. Raw data can be accessed by the scientists who requested the experiments or, after the embargo period, by all Associates and Affiliates, but only processed results will be made openly available.

Scientists may, at times, need to cache data from their experiments at their home facilities. These temporary caches are allowed if reasonable precautions are taken to ensure that the raw data are not disseminated further. Users must also ensure that their caches of EISCAT data are purged after use and that they, in any event, are not retained longer than two years unless explicitly permitted by EISCAT, in writing, and under extraordinary circumstances (e. g., to support PhD students during their university studies).

