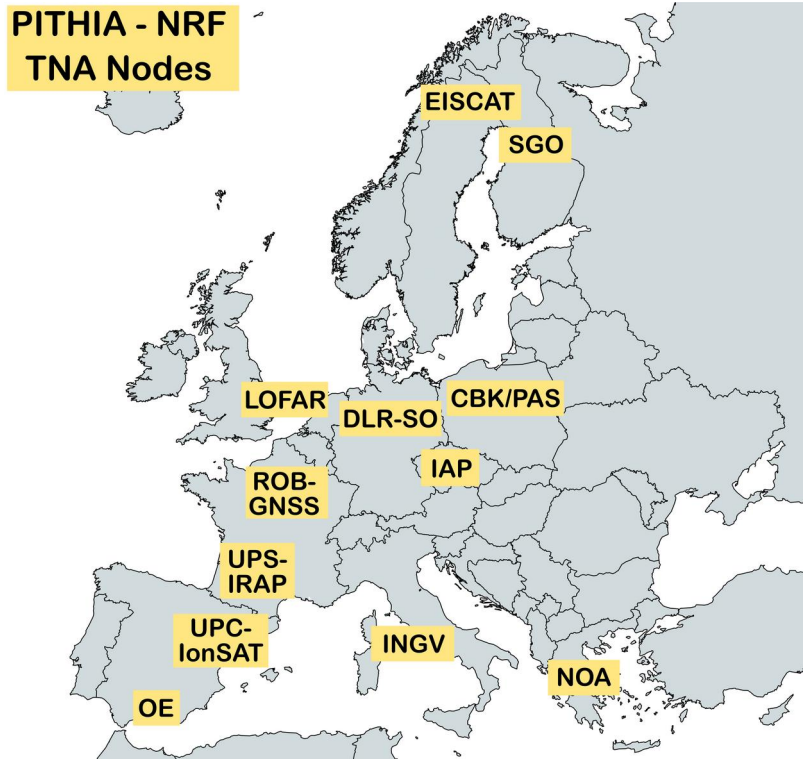
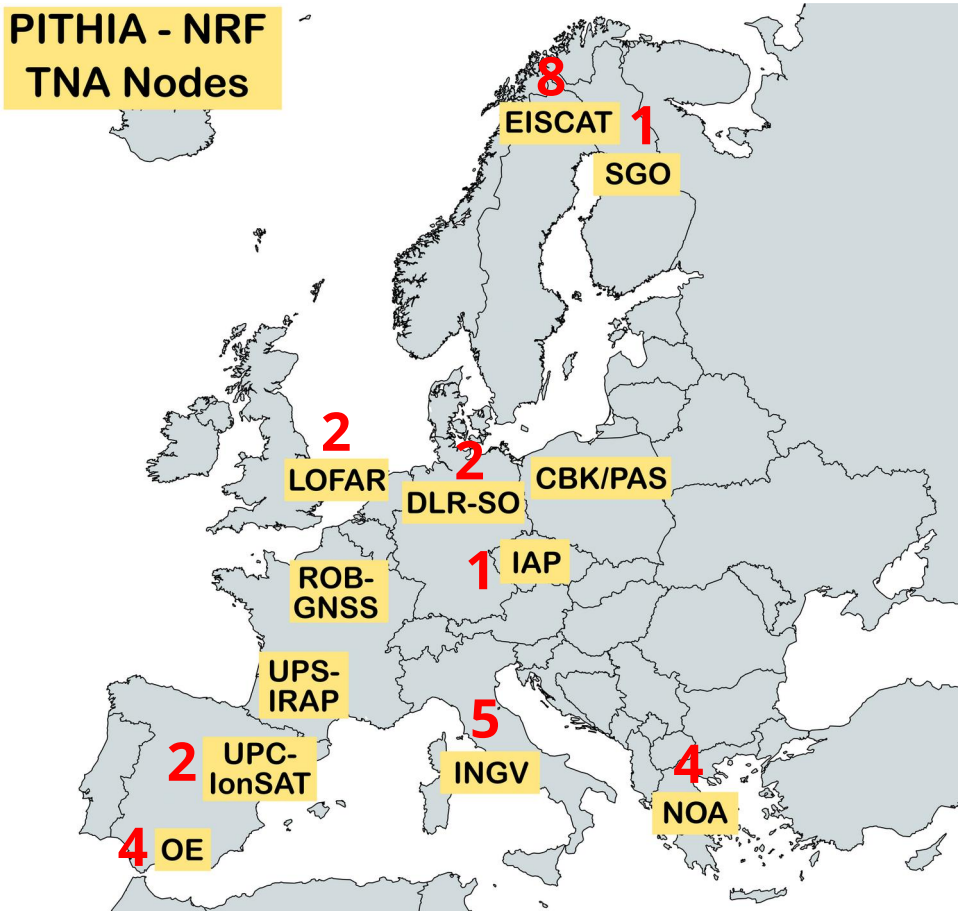


PITHIA-NRF TransNationalAccess

Ingemar Häggström
EISCAT Scientific Association, Sweden
High Profile Meeting, 14 March 2023

PITHIA-NRF TNA projects

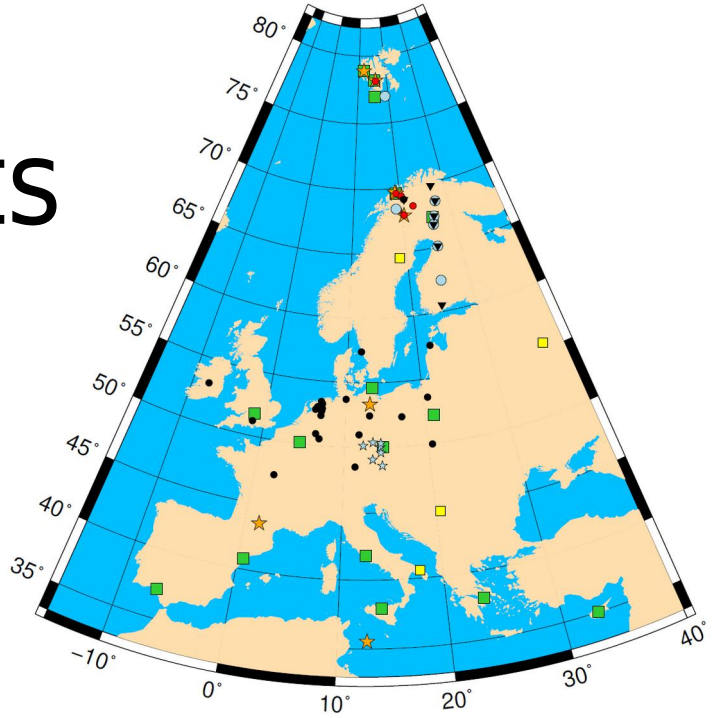


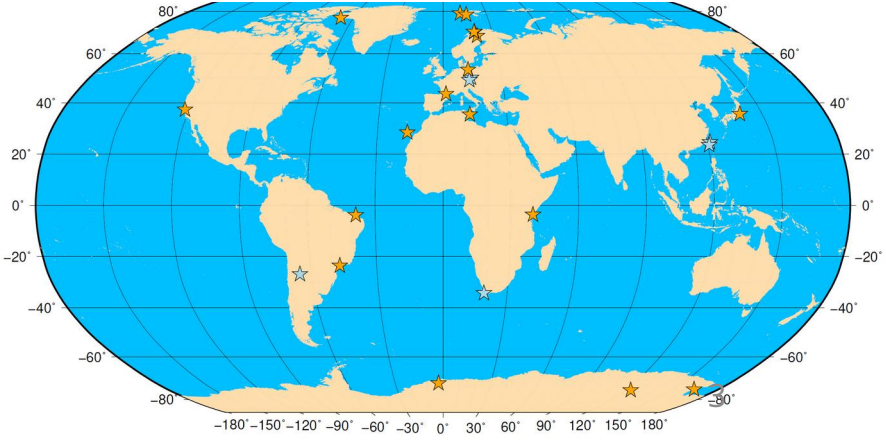
- **3** TNA Calls
- **29** applications received
  - 14+9+6
  - 12(-4)+9+5 accepted
  - 6+6+0 finished
- 9 nodes involved

- **Call 4 – Open call until 15Jun23**
  - **Offer** scientific users subsidized hands-on **access**
    - Conduct selected research projects
    - Learn how to access the observing facilities end-to-end
      - Set up a special campaign
      - Data collection & analysis

Instruments

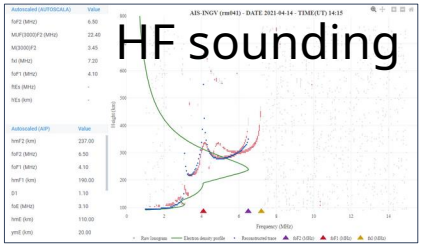
- Ionosondes (■■)
- Doppler sounders, CDSS (★)
- GNSS scintillation receivers (★)
- Incoherent scatter radars (●)
- Riometers (●)
- Pulsation magnetometers (▲)
- LOFAR sites (●)
- GNSS sites of standard networks
  - EUREF and IGS
- Space models
  - local/regional/global

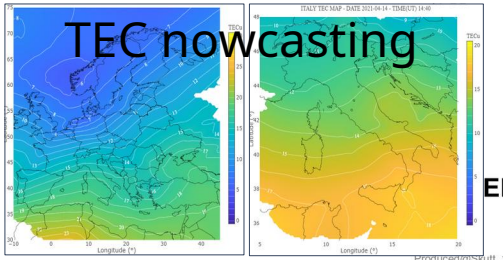


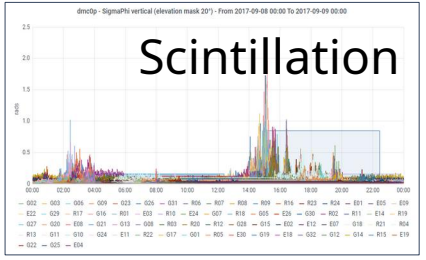


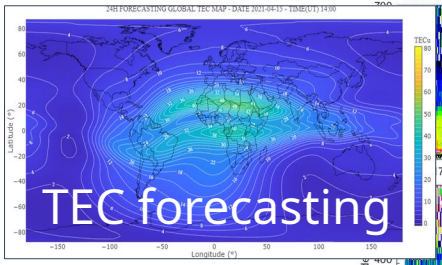
Data examples

- Ionosonde parameters
  - Derived profiles, skymaps, drifts
  - Archive/Nowcasting/Forecasting
  - Models
- Doppler Sounding
  - Gravity Waves, global propagation
- Incoherent Scatter
  - Ionospheric density, temperature profiles
  - Ionospheric convection
- GNSS/LOFAR
  - TEC, Ionospheric scintillation
    - Local/global maps
- Riometer/Magnetometer networks
  - Absorption, Magnetic fields
- Interhemispheric Modelling



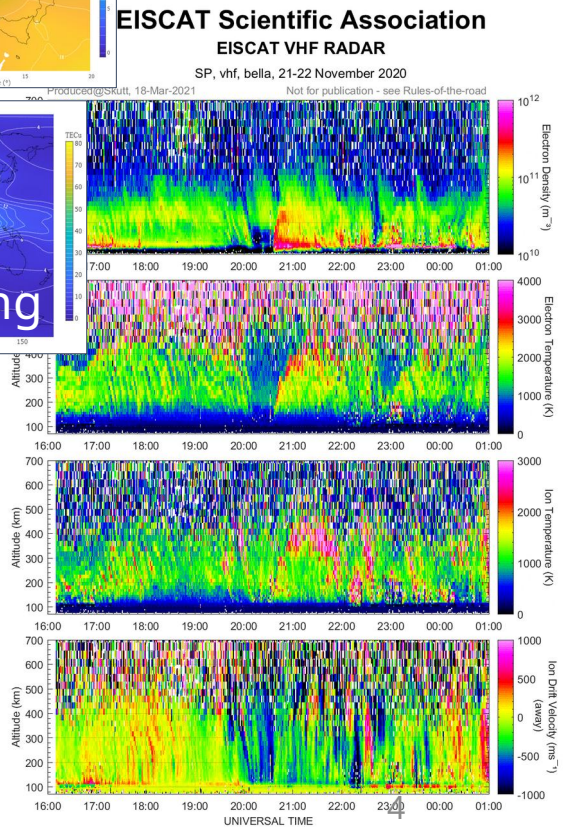




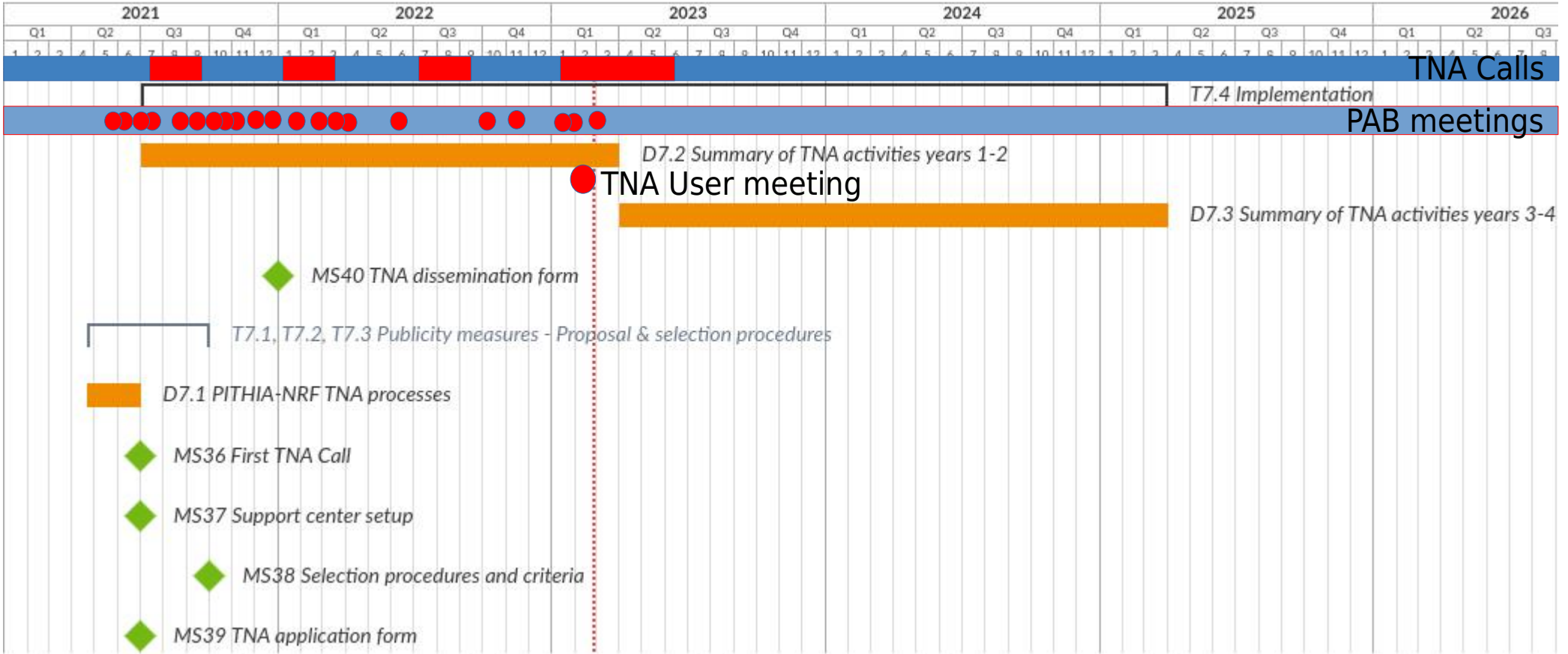


Detection and prediction of TIDs

High latitude



Project activity



TNA User Meeting

Arranged 20 Feb 23
9 TNA project presentations
eScience centre demonstration
Multinode example projects
- HungaTonga eruption
- Solar Eclipse
- Kahramanmaraş Earthquake

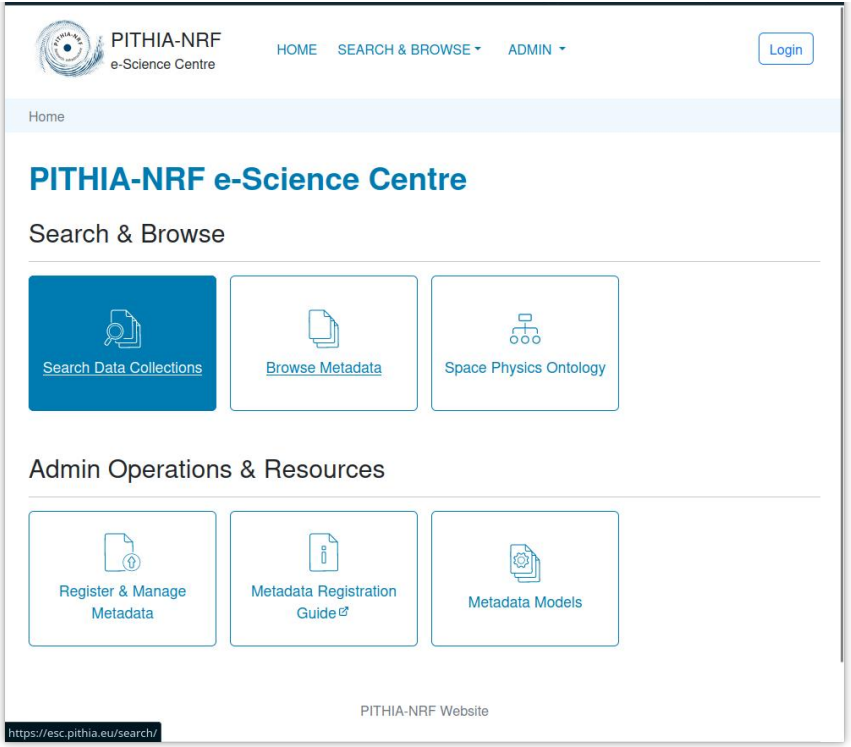
Discussions

- **Anna Morozova, Portugal, UPC-IonSAT**
  - Portuguese regional ionosphere maps
- **Andres Calabia Aibar, China/Spain, OE**
  - Characterization of Plasma Depletions and Effects on Geodetic Applications
- **Nataliya Porayko, Germany, UPC-IonSAT**
  - Validating GPS-driven models of the ionosphere using LOFAR pulsar observations.
- **Simon Mackovjak, Slovakia, DLR-SO**
  - Contribution to feasibility study of data-driven Autonomous Service for Prediction of Ionospheric Scintillations
- **Ashik Paul, India, EISCAT**
  - Study of the characteristics of ionospheric irregularities at high and low latitudes through coordinated observations of EISCAT and VHF Radar at Haringhata, India
- **Rositsa Miteva, Bulgaria, LOFAR**

  Study on Ionospheric Disturbance due to Space Weather in LOFAR data
- **Wojciech Jarmołowski, Poland, NOA**
  - Sensitivity of Ionospheric Disturbance detection by Swarm in time of strong Earthquakes in Aegean region
- **Haixia Lyu, China, OE**
  - The F2-layer peak height response at mid-latitudes to Space Hurricane
- **Saioa Arquero Campuzano, Spain, INGV, OE, NOA**
  - STorm-related Study of Ionospheric iRRegularities over southern Europe using digisondes and GNSS Data

Test of e-Science centre

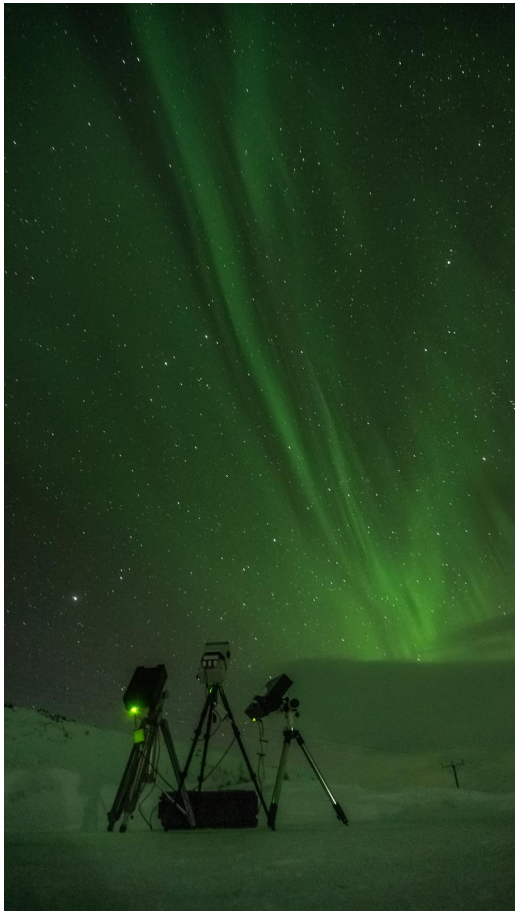
- Data exploitation in TNA projects
- Usage of PITHIA-NRF tools and services
  - Multinode
  - Remote access
  - Virtual access
- Live tests → feedback → improvements!



TNA project – CEP (IPAG)

Objective: To **measure the emission** of the thermosphere and ionosphere (O and N_2^+) in the **same volume** as the EISCAT antennas from three distant sites (50 to 100 km apart) so as to retrieve the **vector polarisation**, i.e. its angle in 3D. This angle is that of the currents. Solving the Maxwell – Ampère equation, it is planned to retrieve the magnetic field variability.
In the E region, the currents are mainly horizontal (Hall and Pedersen) while they are mostly aligned in the F region. Observing in **different colours** will therefore allow retrieving a full current chart.

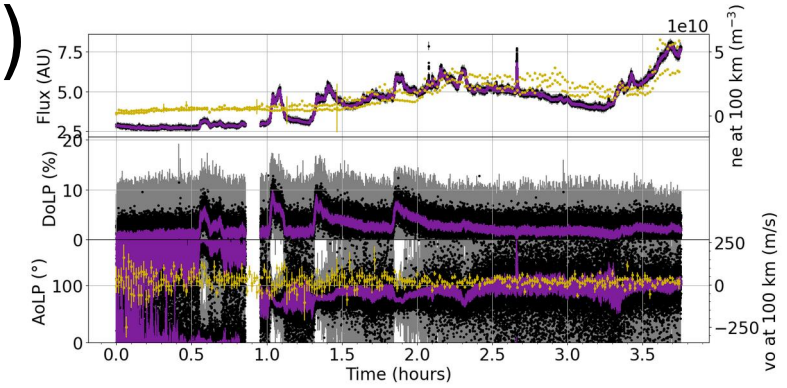
Jean Lilensten from IPAG with 7 students (own funding) visited **EISCAT** between 1–5 March 2022

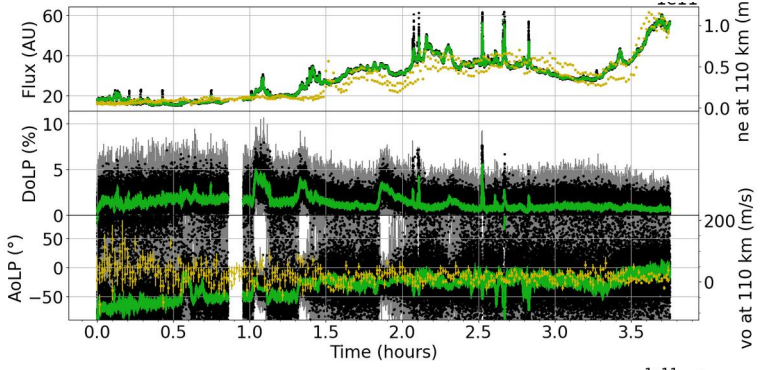


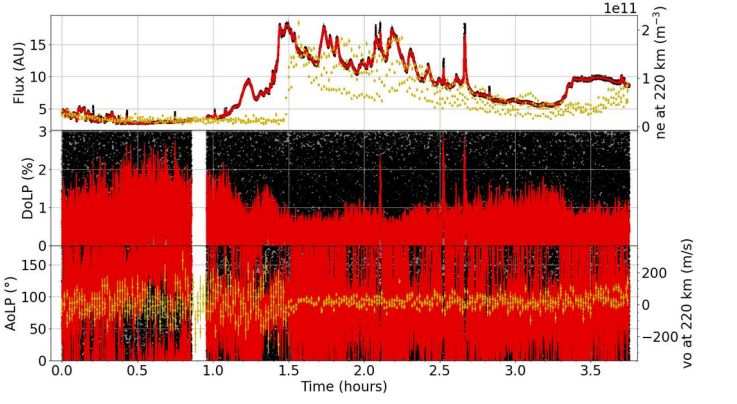
The 3 polarimeters used in this study 3 March, 2022. From left to right, Grand Cru, Carmen Cru and Corbel Cru. In this configuration, Grand Cru and Carmen Cru are looking in the EISCAT direction while Corbel Cru points 90° apart

TNA project – CEP (IPAG)

Results: This campaign **confirms** that the polarisation of the auroral emissions is a new tool to monitor the ionospheric electron density and the ionospheric currents at different altitudes, allowing drawing their profiles. This monitoring can be processed in real time, at any latitude, provided a clear sky. It will therefore constitute a **major technique** for monitoring and predicting the ionosphere, particularly (but not exclusively) in for HF communication in the frame of **space weather**.
In the next future, comparisons with the equivalent current deduced from magnetometers will be performed, and an article is expected by the end of the year.







Superposition of the electron densities measured around 100, 110 and 220 km to the purple, green and red lines respectively (upper panels). An assumption is that the AoLP is a marker for the ionospheric currents, so the ion velocities is superposed to the AoLP (lower panels).

Thank you for your attention!

WEB:
https://www.pithia-nrf.eu

The PITHIA-NRF project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101007599