



## Overview

### PITHIA-NRF Project

*PITHIA-NRF is a Research Infrastructure project funded by the European Commission Horizon 2020 Programme, aiming at building a distributed network that integrates into a unified research environment all key observing facilities, data collections, data processing tools, and prediction models dedicated to ionosphere, thermosphere and plasmasphere research. Through the integration of different assets, the project offers R&D services to expert and early-career researchers and to software and instrument development professionals, enabling leading edge research and fostering innovation.*

*PITHIA-NRF has the ambition to become the European hub that will act as facilitator for coordinated observations, for data processing tools and modelling advances, and for software and data-products standardization, and will advise on the transitioning of models to operations providing e-Science supporting tools so that models can reach the desired accuracy and standards.*

*This e-newsletter aims at communicating to all stakeholders the project developments, specifically regarding the TransNational Access programme, the e-science services, the Training, Dissemination and Communication Activities and potential for collaboration within the Innovation Framework of the project.*

*– Dr. Anna Belehaki, Coordinator of the PITHIA-NRF project*

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Plasmasphere  
Thermosphere  
Research Environment and  
Access services: a Network of  
Research Facilities

Ionosphere  
Integrated

### PITHIA-NRF Project

PITHIA-NRF aims at building a European distributed network that integrates observing facilities, data processing tools and prediction models dedicated to ionosphere, thermosphere and plasmasphere research.

### PITHIA-NRF Newsletter

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## Project extension and finalization actions

Approaching the end of the project, the consortium decided to reallocate several tasks for the more efficient finalization of key activities concerned with the innovation framework and with the sustainability of the PITHIA-NRF Research Infrastructure. This, to become effective, requires additional actions, including

- intensification of the links with the PITHIA-NRF stakeholders with the organization of splinter meetings, innovation and networking days
- enhancement of the e-Science Centre functionalities with the emphasis to the registration of the new workflows based on the users requirements
- awareness regarding the TNA opportunities not only during the current EC funded period, but also in longer term, in collaboration with university programmes for doctorate and post-doctoral research activities
- the preparation of a realistic sustainability plan for the development of a robust operational framework for the PITHIA-NRF activities and functionalities in the longer term.

The European Commission supported the consortium for the implementation of these actions, granting a three months extension, placing the end of the project on 30 June 2025.

## General assembly and high-profile user meetings

On March 13 and 14 the 4<sup>th</sup> General Assembly and the 2<sup>nd</sup> High Profile Meeting were organised in Heraklion, Crete, Greece. Initially, this was planned to be the final general assembly (GASS) of the project, but because the project has been extended a final GASS and networking meeting will be organised in Brussels, Belgium on June 4.

During the general assembly meeting of the consortium, the current state of the project was discussed. Currently all work packages are on schedule and all deliverables have been submitted on time. The remaining work has been rescheduled according to the amended grant agreement, as discussed above.

An important topic during the GASS was the sustainability of the PITHIA-NRF activities after the formal end of the project in June. The consortium has drafted a memorandum of understanding, describing the activities the partners will sustain, on a best effort basis, after the end of the project. The text of the memorandum is now finalised, and the consortium members will verify with the legal departments of their institutes if they can sign it. In any case, the grant agreement already requires partners to keep the activities of the project going for at least four years after the project's end.

Most members of the consortium are strongly favourable to keeping the work of the project going, and there are several ideas for potential future developments of the e-Science Centre. For this reason, the possibility of submitting a proposal for a follow-up project was extensively discussed. However, at the time of the GASS no suitable calls were open. This topic will be take up again at the additional GASS in June.



The Second High Profile Meeting brought together the consortium members with various (potential) end-users whose activities involve the upper atmosphere in some way. The external experts came from very different sectors: international organisations (WMO and ICAO activities), academia, private companies (Google, GMSPazio), and military radar operators.

During the meeting, the consortium first presented its various activities, in particular the development of the e-Science Centre and the Trans-National Access program, as well as the plans to sustain the project's activities in the future. This was followed by presentation by the external experts and discussions on possible collaborations and exploitation and valorisation of the project results.

By the time the meeting was closed, many discussions were still ongoing. In order to continue the interactions with the external experts and develop concrete ideas for collaborations, the attending experts have received specific follow-up questions by e-mail. The responses will be analysed and discussed during upcoming meetings of the Innovation Management Team.



### Trans-National Access programme, overview of recent activities

Since one of the objectives of PITHIA-NRF has been to provide good access to research facilities for observations of the upper atmosphere, the Trans-National Access (TNA) programme have played an important role in the project. Researchers and other users have been able to carry out their projects at one of the twelve Nodes through access provided through the project. These Nodes are geographically well distributed over Europe, and their capabilities cover a large set of topics within the project's research areas. The users whose projects have been accepted into the TNA programme have experienced how to work with Nodes during the complete cycle, from the setting-up of a campaign to the analysis and exploitation of the results, with the help of tools and services provided through the project.

There have in total been eight open TNA calls during the PITHIA-NRF project, out of which three were open during 2024 and 2025. These final three calls have attracted 22 projects that are accepted to the Nodes. They span a large variation of research topics including several aspects of travelling ionospheric disturbances, properties of VLF and ELF radio wave propagation, ionospheric responses to a variety of drivers of different scales, such as lightning or geomagnetic storms, and some further new aspects of ionospheric monitoring and modelling. Most of these projects are in their final stages, and they can be presented at the second TNA users meeting, which will take place in Brussels on 3 June.

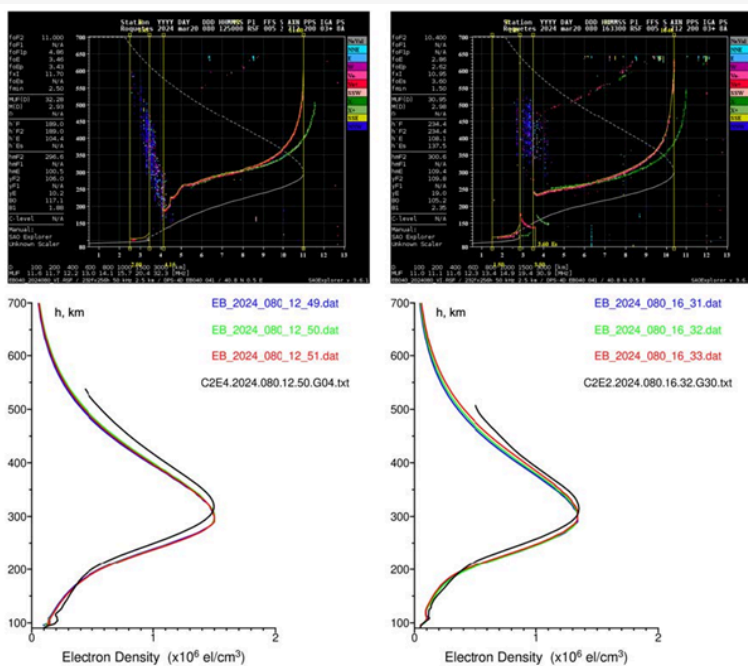


*Anna-Marie Bals (Embry-Riddle Aeronautical University) visiting one of the EISCAT 3D sites as part of her TNA project. She was guided by Harri Hellgren and Anders Tjulin of EISCAT.*

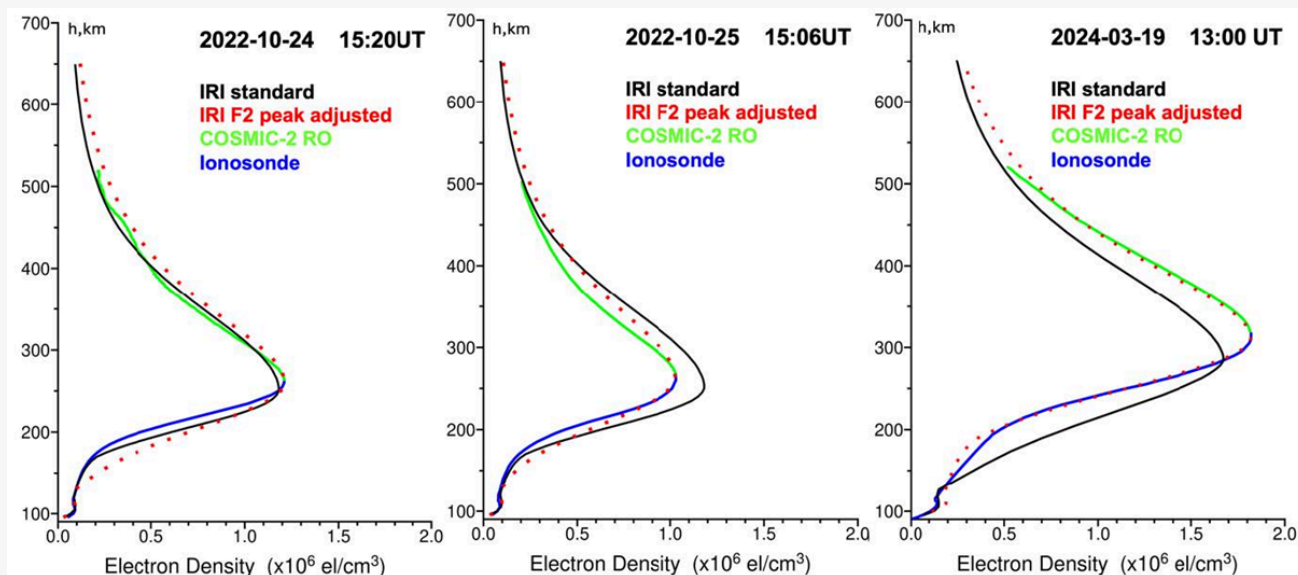
## Summary of TNA activities at the Ebro Observatory Node

As part of the PITHIA-NRF Trans-National Access programme's 7th call (open from 15 August 2024 to 2 October 2024), the Ebro Observatory Node hosted three TNAs focused on ionospheric research:

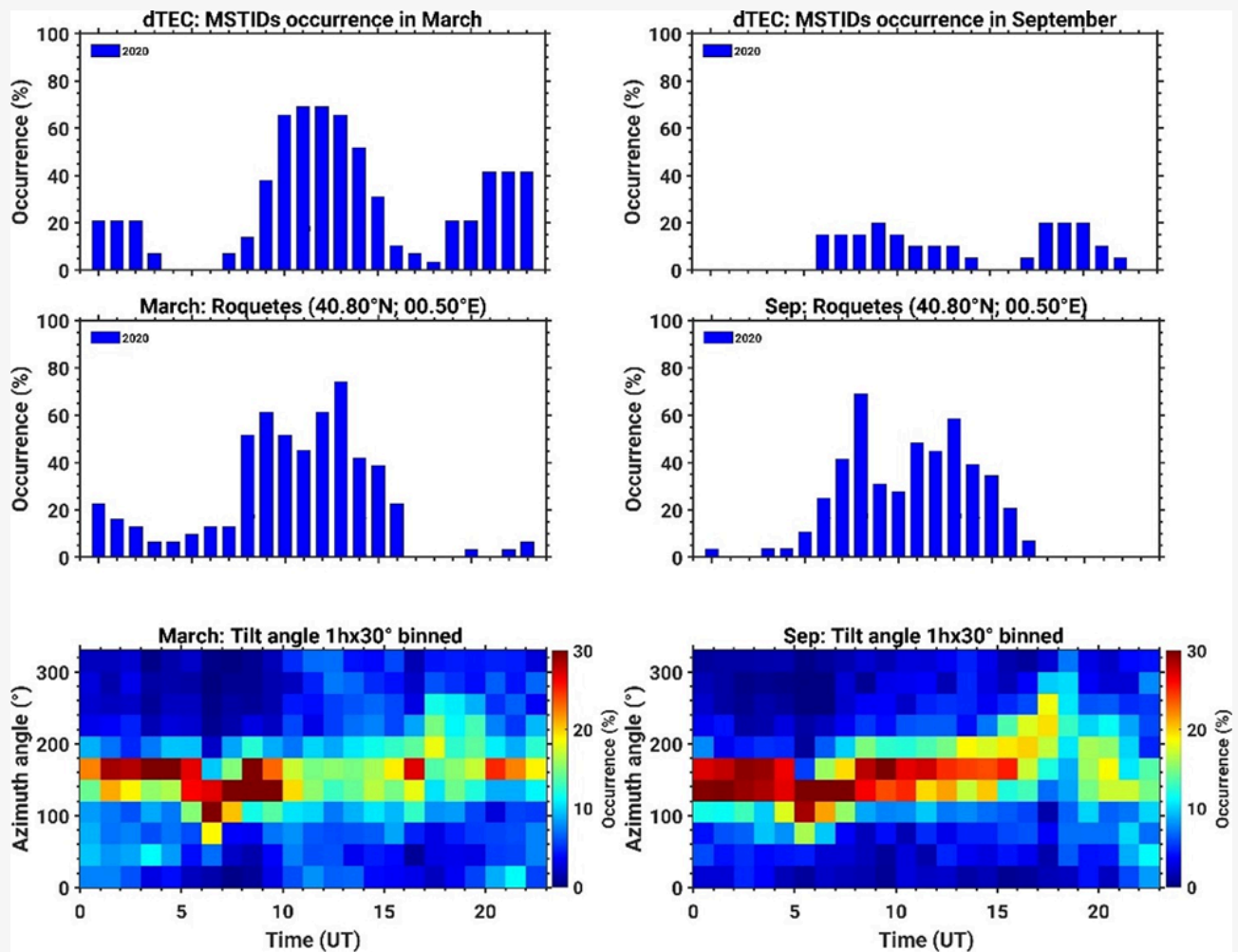
High Rate Ionosonde Sounding Measurements And COSMIC-2 Radio Occultation Collocation Analysis (**HRISMA-CROCA**) developed by Dr. Iurii Cherniak, University Corporation for Atmospheric Research COSMIC Program Office, USA. This project aimed to enhance our understanding of ionospheric plasma density distribution by integrating high-sampling-rate observations from the Ebro ionosonde with COSMIC-2 GNSS radio occultation measurements. The results are expected to improve ionospheric model validation and refine methodologies for combining ionosonde and GNSS radio occultation techniques.



*Selected high quality data COSMIC-RO products for the representative local time intervals at quiet ionospheric conditions combined with digisonde Electron Density Profiles (EDPs) results to reference EDPs (left) and have been used to assess performance of the IRI-2020 model to represent a real shape of electron density vertical distribution (down).*



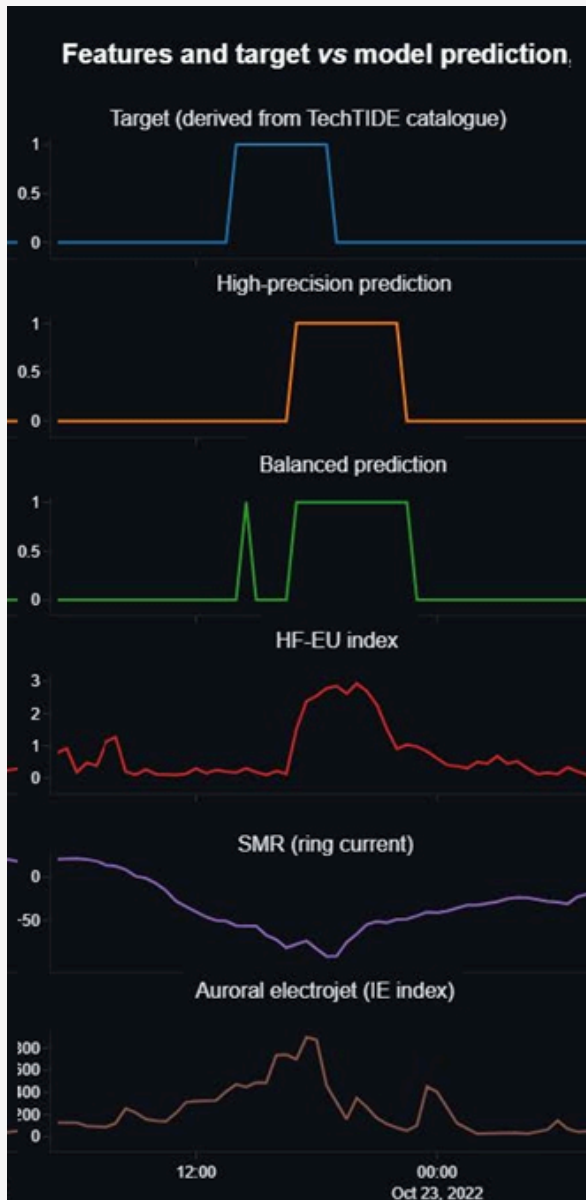
Comparisons and validation of the TIDs occurrence in the ionospheric tilt measurements with the GNSS observations (**CVTIDs**) developed by Dr. Sivakandan Mani, Leibniz-Institut für Atmosphärenphysik, Germany. The research focused on comparing medium-scale travelling ionospheric disturbances (MSTIDs) observed via ionosonde tilt measurements with GNSS-based total electron content (TEC) methods. The study found a strong correlation between the different techniques, contributing to a more comprehensive understanding of MSTID climatology over Europe.



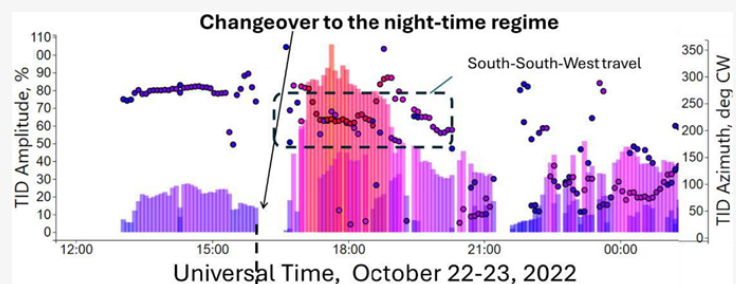
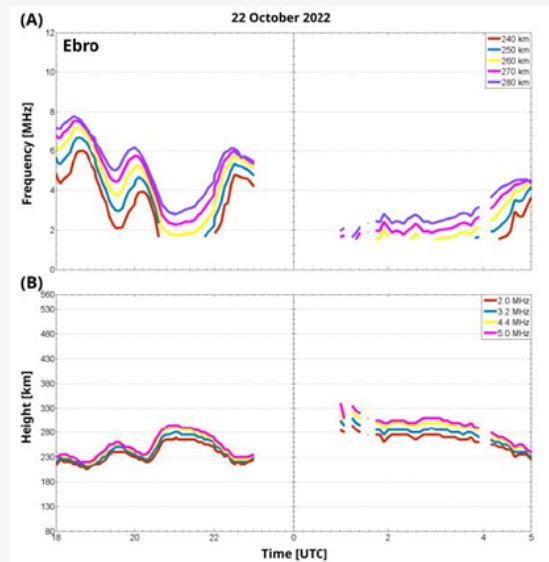
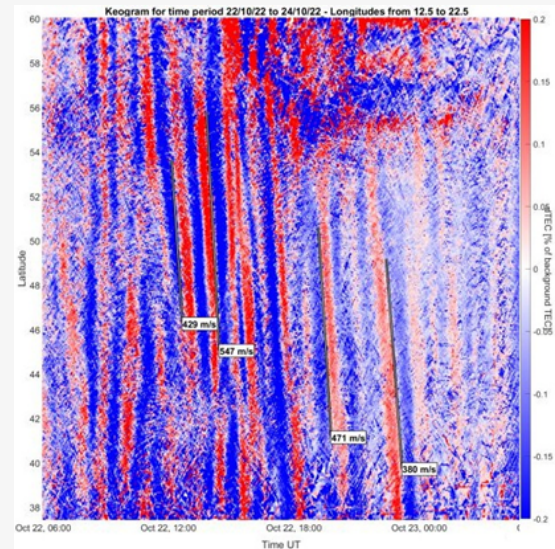
Diurnal occurrence characteristics of hourly mean TIDs observed in the dTEC based keogram (top panel), of ionogram signatures of TIDs (middle panel) and of the distribution of the tilt angle estimation (bottom panel) for given seasons of 2020.



Validation AND Assessment of near-real time detection and forecasting of LS-TIDs in Europe (**VANDALS-TIDE**) developed by Dr. Kitti Alexandra Berényi, HUN-REN Institute of Earth Physics and Space Science, Hungary. This project concentrated on validating and assessing Large-Scale Travelling Ionospheric Disturbances (LSTIDs) detection and forecasting methods. The research cross-validated forecasted LSTID events with independent data sources, enhancing the reliability of prediction tools used at PITHIA-TNA Nodes.



Validation of the ML based forecasting LSTID model with independent data for event occurred on 22 October 2022.



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## Recent publications

A joined paper by all consortium members was published in the journal *Advances in Space Research*, describing the various activities and accomplishments of the project: A. Belehaki, I. Haggstrom, T. Kiss, I. Galkin, A. Tjulin, et al., “Integrating plasmasphere, ionosphere and thermosphere observations and models into a standardised open access research environment: The PITHIA-NRF international project.” *Advances in Space Research* 75(3), 3082–3114. This paper was published in open access and can be downloaded at <https://doi.org/10.1016/j.asr.2024.11.065>.

Other publications from the consortium members; during this period:

- V. Pierrard, T. Verhulst, J.-M. Chevalier, N. Bergeot, and A. Winant, “Effects of the Geomagnetic Superstorms of 10–11 May 2024 and 7–11 October 2024 on the Ionosphere and Plasmasphere”, *Atmosphere* 16, 299, 2025, doi:[10.3390/atmos16030299](https://doi.org/10.3390/atmos16030299).
- V. Navas-Portella, D. Altadill, E. Blanch, M. Altadill, A. Segarra, V. de Paula, C.C. Timoté, J.M. Juan, “Estimation of the drift velocity of Equatorial Plasma Bubbles using GNSS and digisonde data”, *Journal of Space Weather and Space Climate* 15, 2, 2025, doi:[10.1051/swsc/2024038](https://doi.org/10.1051/swsc/2024038).
- J.-F. Ripoll, S. Thaller, D. Hartley, D. Malaspina, W. Kurth, G.S. Cunningham, V. Pierrard, J. Wygant, “Statistics and models of the electron plasma density from the Van Allen Probes”, *Journal of Geophysical Research: Space Physics* 129, e2024JA032528, 2024, doi:[10.1029/2024JA032528](https://doi.org/10.1029/2024JA032528).
- V. Pierrard, A. Winant, E. Botek, M. Péters de Bonhome, “The Mother’s Day solar storm of 11 May 2024 and its effect on Earth’s radiation belts”, *Universe* 10(10), 391, 2024, doi:[10.3390/universe10100391](https://doi.org/10.3390/universe10100391).
- P. Koucká Knížová, K. Potužníková, K. Podolská, T. Šindelářová, T. Bozóki, M. Setvák, et al., “Impacts of storm “Zyprian” on middle and upper atmosphere observed from Central European stations”, *Remote Sensing* 16, 4338, 2024, doi:[10.3390/rs16224338](https://doi.org/10.3390/rs16224338).
- B.A. Witvliet, “Gap Analysis of Ambient Electromagnetic Noise Measurements Stored in the ITU Data Banks”, *Sensors* 24, 6832, 2024, doi:[10.3390/s24216832](https://doi.org/10.3390/s24216832).
- K.D. Aksonova, A.O. Sopin, D. Burešová, A.V. Zalizovski, I.F. Domnin, “Synchronous observations of travelling ionospheric disturbances by the multi-point Doppler sounding, ionosonde and the incoherent scatter radar: Case study”, *Advances in Space Research* 73, 4414–4425, 2024, doi:[10.1016/j.asr.2024.01.032](https://doi.org/10.1016/j.asr.2024.01.032).



## Upcoming Events

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### Second TNA Users Meeting

The Second TNA Users Meeting will be held on June 3 at the RMI in Brussels, Belgium. This meeting is an opportunity for the TNA researchers to share their experiences and results from the TNA calls, and to learn more about what PITHIA-NRF can offer. Practical information and the registration for this meeting can be found on the [project website](#).

## Imprint

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