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PITHIA-NRF news

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 Ionosphere Thermosphere Integrated Research Environment and Access services: a Network of Research Facilities

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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PITHIA-NRF Launches Post-Project Collaboration Framework with MoU and Coordination Committee

When the PITHIA-NRF project neared its formal conclusion, the community has taken an important step forward in ensuring its long-term impact and sustainability. A Memorandum of Understanding (MoU) has been established to formalise continued collaboration among project partners. As of June 2025, 17 out of 22 participating institutions have agreed to sign the MoU, reflecting broad commitment to supporting the operational and strategic future of PITHIA-NRF.

The MoU outlines a non-binding collaboration framework focused on:

- Sustaining the operation of the e-Science Centre and related services.
- Advancing communication, outreach, and innovation.
- Supporting joint funding efforts and community coordination.

To implement this vision, the newly formed PITHIA-NRF Coordination Committee has now been officially launched. Composed of representatives from 18 institutions, the Committee will guide the collaborative efforts outlined in the MoU and drive post-project priorities such as:

- Preparing a new collaborative proposal to secure continued funding and support.
- Maintaining PITHIA-NRF services (with continued support from EGI, IN2P3, University of Westminster, and the various PITHIA nodes).
- Coordinating communication and outreach efforts to strengthen stakeholder engagement.
- Ensuring scientific and technical continuity through best-effort collaboration.

The first meeting of the Committee took place in June 2025, marking the formal transition from project-based governance to a community-driven structure. This successful continuation effort highlights the PITHIA-NRF community's shared vision of a sustainable, interoperable research infrastructure supporting Europe's space weather and upper atmosphere science.

Stay tuned for more updates as the committee begins its coordinated work and invites broader community participation.

PITHIA-NRF achievements and strategic development plans

The importance of the socioeconomic impact of the upper atmosphere disturbances in technological systems indicates the need to release improved tools for nowcasting and forecasting the state of the ionosphere, the thermosphere and the plasmasphere. To meet this goal, a first fundamental step is to advance access to science data, analysis tools and scientific models and facilitate the transition of models from research to operational status; this is the main objective and the ambition of the Research Infrastructure project PITHIA-NRF, implemented with funding from the European Commission Horizon 2020 Programme. PITHIA-NRF, the Plasmasphere Ionosphere Thermosphere Integrated Research Environment and Access services: a Network of Research Facilities, builds a European distributed network integrating observing facilities, data collections, data processing tools and prediction models dedicated to ionosphere, thermosphere and plasmasphere (ITP) research. PITHIA-NRF is designed to provide formalised access to experimental facilities, to Findable, Accessible, Interoperable, Re-usable (FAIR) data, to standardised data products and to training and innovation services. PITHIA-NRF paves the way for the establishment of a research environment that provides new observing technologies, procedures and tools that support transition of research models to high-level data products tuned to meet the requirements of the technologies concerned, linking best-in-class R&D facilities for the provision of seamless multi-technology services. All PITHIA-NRF development comply to EGI standards.

The network of the Research Infrastructure consists of Nodes (the experimental facilities where data are produced and stored in local databases) and of the e-Science Centre (the Centre for the registration of data collections, their discovery, access and re-use). The Nodes offer access to a wide range of research infrastructures relevant to the observation of the upper atmosphere and near-Earth space, including: Ionosondes, Incoherent Scatter Radars, Continuous Doppler Sounders, Magnetometers, ground-based GNSS receivers (and the resulting TEC and scintillation data), VLF receivers, LOFAR, Langmuir probes and particle detectors. PITHIA-NRF offers also access to a wide range of model computations and indices.

Within the course of the project the majority of the local databases hosted by the Nodes are upgraded to meet the FAIR requirements and their metadata are registered in the e-Science Centre (eSC). In this way, the eSC became the central Node of the network of local databases, and it is the end point from where PITHIA-NRF data collections can be discovered with open access. In most cases the data itself are hosted and maintained by the participating organisations and not centrally.

PITHIA-NRF offered access and training to more than 80 researchers, and a large number of projects were implemented in topics relevant to:

- Multi-instrument data analysis for detection and modelling of ionospheric storm effects and irregularities.
- Development and validation of scientific models.
- Ionosphere-magnetosphere-plasmasphere imaging methods.
- Calibration of new instruments.

Building upon this foundation, several avenues can be pursued to further develop PITHIA-NRF and achieve breakthrough advances:

- Enhance Data Integration and Interoperability.
- Foster Collaborative Research and Innovation through international collaboration and especially with industry stakeholders to translate research findings into practical applications.
- Expand Training and Capacity Building.
- Ensure Sustainability and Long-Term Impact.

By focusing on these strategic areas, PITHIA-NRF can enhance its role as a pivotal infrastructure in near-Earth space research, driving innovations that address both scientific inquiries and practical challenges in understanding the near Earth's space environment and its interactions with the lower atmosphere.

Final release of the PITHIA e-Science Centre

After a long journey of four years of planning, designing and developing, we are happy to announce the final release of the PITHIA e-Science Centre. This is now a fully working version that is ready to serve the needs of scientists. It is only final from the project's point of view as we will keep maintaining and developing it in the future, subject to future funding opportunities. The e-Science Centre is available at esc.pithia.eu.

The e-Science Centre developed quite a lot since its previous release a year ago. We reorganised the main screen to show better the various entry categories, such as Data Collections, Workflows or Static Datasets, and the various features of interests and their associated Data Collections. While the number of Data Collections have also grown in size, the major additions to the content are the six workflows and the twenty-four static data subsets. Workflows are combining multiple Data Collections into a more complex execution flow to realise pre-defined scenarios where the output of one model execution can be automatically fed into another. Static Datasets represent data that was "frozen" at a certain point of time, for example data used in a particular publication or data that was used to train a machine learning model. Such subsets can have their DOIs assigned in the e-Science Centre.

Besides new content, the registration of Data Collections, Workflows and Static Datasets was also made easier. A clever Registration Wizard now makes it more convenient to publish any of the above-mentioned entities in the e-Science Centre. Resource owners only need to enter the specific values describing their assets. The XML file is then automatically generated by the e-Science Centre, relieving the owners to learn and understand the complex XML syntax.

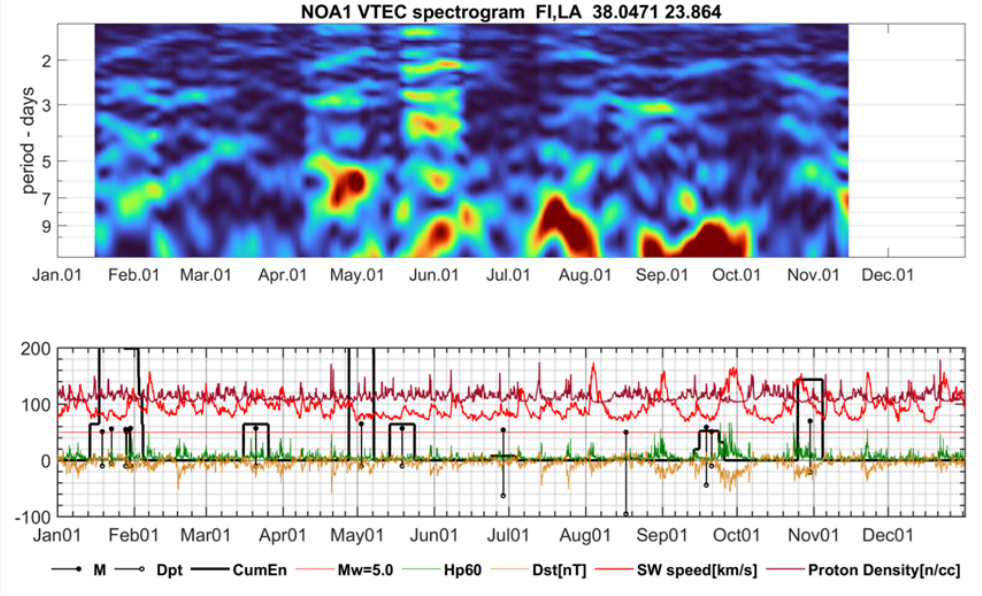
Although PITHIA-NRF has concluded, the e-Science Centre will stay up and operational. We strongly encourage you to keep or start using it. In case you face any difficulties, please raise a ticket and we will fix it.

Second PITHIA-NRF TNA Users meeting

In the finishing months of PITHIA-NRF programme, the TNA centre together with local organisers in Brussels organised the second TNA Users Meeting. This took place on 3 June 2025 at RMI in Brussels, Belgium. Its purpose was to promote the PITHIA-NRF community and to strengthen the ties between the researchers that used the TNA programme. It was also a good opportunity for consortium members to gather insights from the users about their experiences with our community and the tools — such as the e-Science Centre — that we have been building over the project run-time.

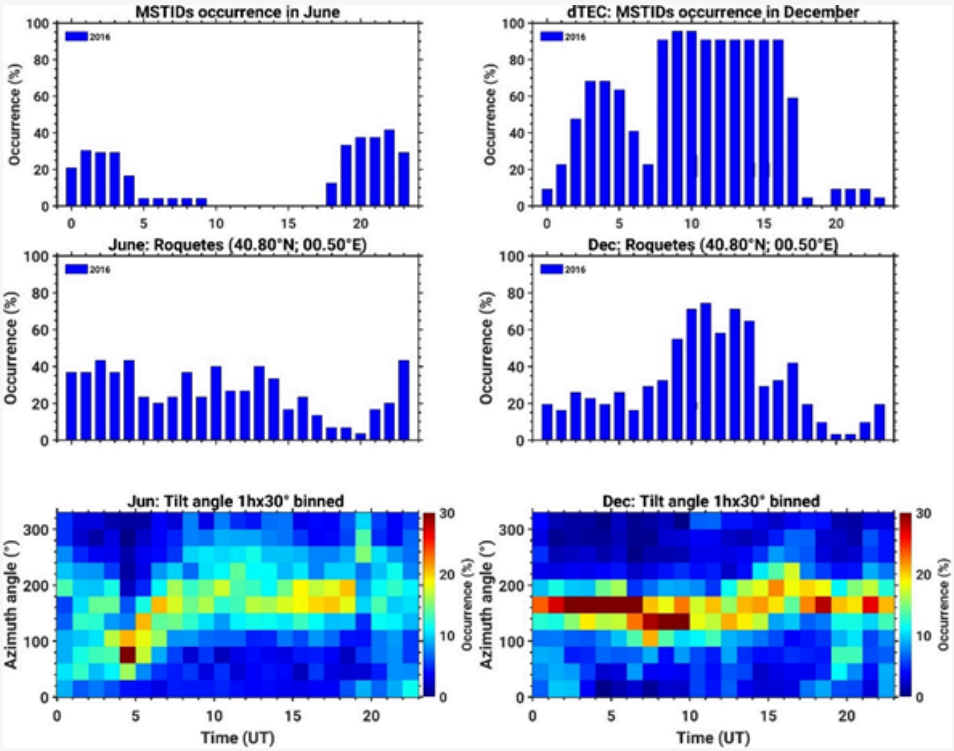
During the meeting the participants from the different TNA calls had an opportunity to present their projects to an audience consisting of other researchers participating in the programme, members of the nodes, and other interested scientists.

There were in total fourteen presentations made by TNA users outlining the work that was facilitated through the TNA programme:



Correlation of ionospheric disturbances to seismic events.

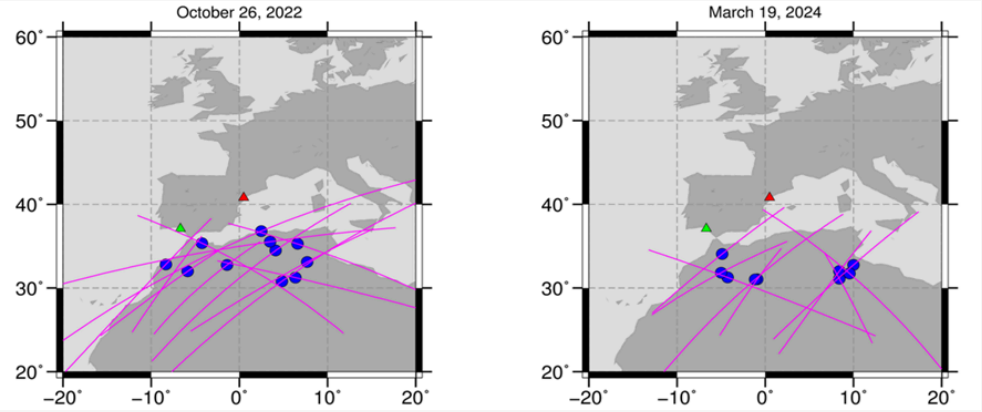
Wojciech Jarmołowski from University of Warmia and Mazury in Olsztyn introduced his project realised at the NOA node called “Spectral analysis of local ground-based GNSS VTEC in view of its relation with seismic activity in Aegean region (TECSEA)”. Ivana Kolmašová from the Institute of Atmospheric Physics of the Czech Academy of Sciences talked about her work with SGO node on “High latitude lightning atmospherics belonging to transient luminous phenomena”. Tamás Bozóki (HUN-REN Institute of Earth Physics and Space Science) explained his work on “Narrowband VLF measurements as a tool to study gravity waves in the lower ionosphere”. Jean Lilensten (IPAG-CNRS) introduced his new instrument and his work on “Retrieving the ionospheric currents and magnetic field variations from the observation of the upper atmosphere emissions polarisation”.



Comparison of dTEC and ionosonde tilt in 2016

Sivakandan Mani from the Leibniz Institute of Atmospheric Physics at the University of Rostock showed the results of two of his projects realised through the PITHIA-NRF TNA access programme: "Comparisons and validation of the TIDs occurrence in the ionospheric tilt measurements with the GNSS observations (CVTIDs)" and "Exploration on the Impact of Solar Variabilities on TID Occurrence Characteristics using Ionospheric Tilt Measurements (ExSoTIDs)". Aramesh Seif from Department of Physics of the Shahid Beheshti University made an online presentation about her work with LOFAR, UPC-IonSAT and DLR about "Ionospheric Irregularities Response to the April 2023 Major Geomagnetic Storm: A European Perspective". The topic of "Characteristics of traveling ionospheric disturbances over Europe during HSS/CIR driven storm on Mar. 30 – Apr. 6, 2023 from GNSS, LOFAR and ionosonde data" was introduced by Sergii Panasenko from Institute of Atmospheric Physics CAS in Czech Republic as a result of his collaboration with the CBK-PAS node. Anna Morozova from University of Coimbra looked at "Scintillations in Southern Europe during the geomagnetic storm of June 2015: analysis of a plasma bubbles spill-over using ground-based data (ALERT project)".

Iurii Cherniak from COSMIC Program Office of University Corporation for Atmospheric Research introduced his work on "Combination of high rate ionosonde measurements with COSMIC-2 radio occultation observations: first results and future developments". The topic of "Validating the Swarm S4 index over Africa using the Eswua Database VSS4AED" was introduced by Ola A. Abu Elezz (Space Weather Monitoring Center, Helwan University). "Radio scintillation studies for prospects of space weather forecasting and analyses (RadioScint)" project was realised and introduced in the meeting by Oyuki Chang from UKRI-STFC RAL Space. Šimon Mackovjak from Slovak Academy of Sciences talked about his project on "Multi instrumental detections of ionospheric disturbances". And the meeting was closed by an online presentation from Haixia Lyu (Wuhan University) on "Getting rid of ionospheric mapping function for improving STEC correction".



COSMIC radio occultation traces selected for comparison to observations from nearby ionosondes.

In addition to the presentations from the TNA users, the one-day long event also included presentations made by consortium members about the TNA programme itself and a discussion about the needs and expectations from the community with respect to TNA and other services.

The meeting details are available on PITHIA-NRF website.

Imprint

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