



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

# PITHIA-NRF

**Sfeervol wetenschappelijk frequentiegebruik  
(thermosfeer, ionosfeer en plasmasfeer)**



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



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



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&

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Radiocommunications Agency, Spectrum Management dept.

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### Hoe ben ik hier terecht gekomen?

Ik heb in diverse landen gewerkt, in telecom en omroeptechniek  
Sinds 1998 werk ik voor Agentschap Telecom

Van 2011-2015 heb ik promotieonderzoek gedaan (part-time)

Van 2017-2019 gewerkt aan de Universiteit van Bath, Engeland (part-time en forens)  
als Research Manager Radio Science

Daarna bewust part-time blijven werken en  
op zoek gegaan naar research funding voor de andere helft

Sinds 1 April 2021 Europese funding,  
daarmee een aanstelling aan Universiteit Twente verdiend  
als Post Doctoral Researcher



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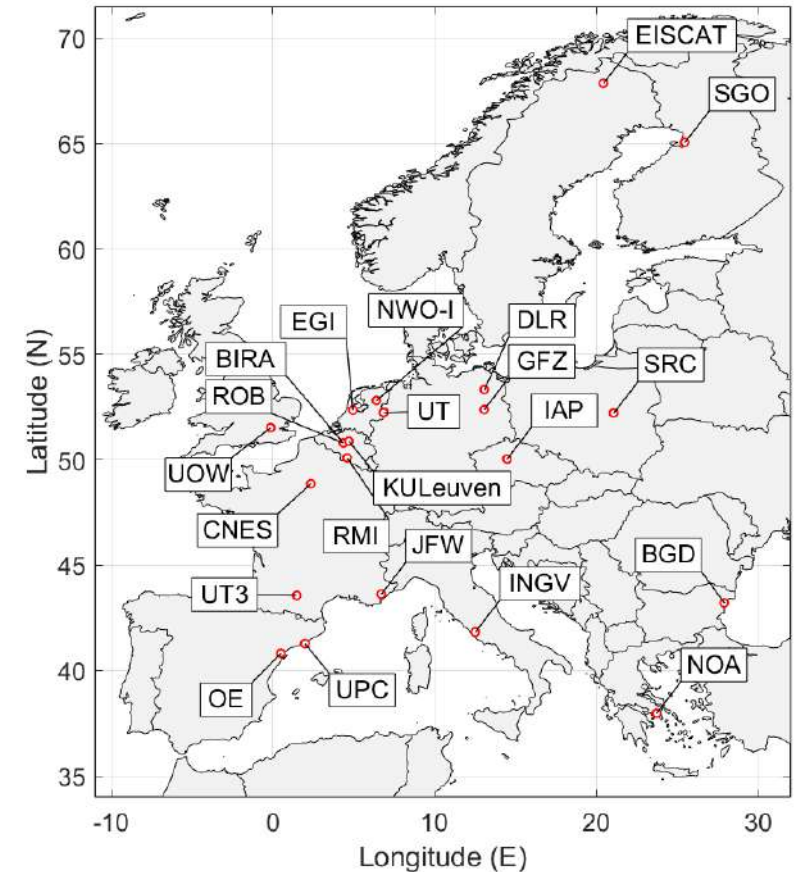
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## In goed gezelschap

Ons project omvat de meeste (alle) grote Europese instituten die zich bezig houden met de Thermosfeer, Ionosfeer en Plasmasfeer

- **BGD**, Borealis Global Design, Varna, Bulgaria
- **BIRA**, Royal Belgian Institute for Space Aeronomy, Uccle, Belgium
- **CNES**, Centre National d'Études Spatiales, Paris, France
- **DLR**, German Aerospace Center, Neustrelitz, Germany
- **EGI**, EGI Foundation, Amsterdam, The Netherlands
- **EISCAT** Scientific Association, Kiruna, Sweden
- **GFZ**, German Research Centre for Geosciences, Potsdam, Germany
- **IAP**, Institute of Atmospheric Physics, Leibniz, Germany
- **INGV**, Istituto Nazionale di Geofisica e Vulcanologia, Rome, Italy
- **JFW**, Jurgen Watermann Consult, La Tourette, France
- **KULEUVEN**, Katholieke Universiteit Leuven, Belgium
- **NOA**, National Observatory of Athens, Greece
- **NWO-I**, Nederlandse Wetenschappelijk Onderzoek Instituten, Dwingeloo, The Netherlands
- **OE**, Observatori de l'Ebre, Roquetes, Spain
- **RMI**, Royal Meteorological Institute, Dourbes, Belgium
- **ROB**, Royal Observatory of Belgium, Brussels, Belgium
- **SGO**, Sodankylä Geophysical Observatory, Oulu, Finland
- **SRC**, Space Research Centre, Warsaw, Poland
- **UOW**, University of Westminster, United Kingdom
- **UPC**, Universitat Politècnica de Catalunya, Barcelona, Spain
- **UT3**, University Paul Sabatier, Institute for Research in Astrophysics and Planetology, Toulouse, France



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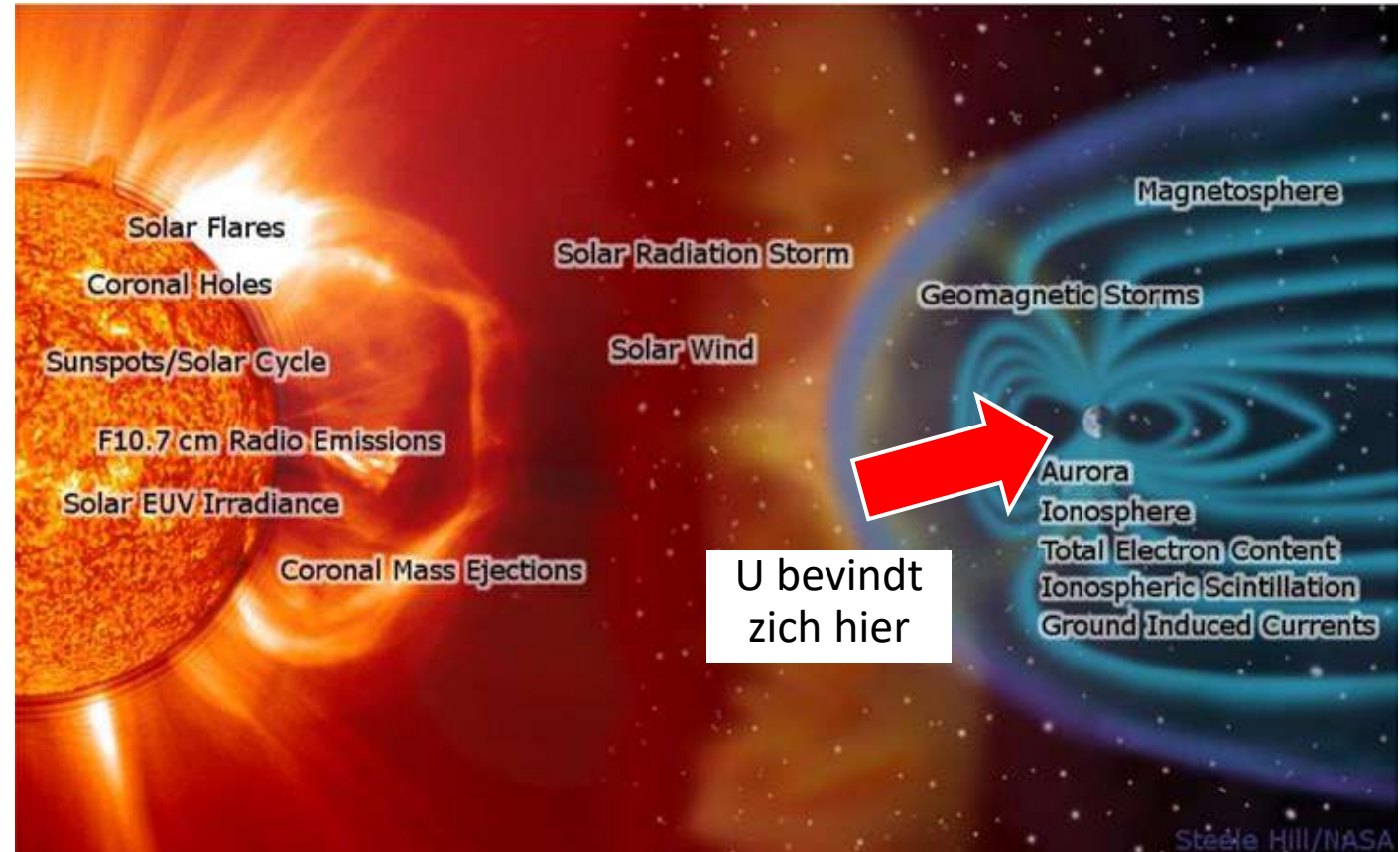
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### Onderzoek in hogere sferen

We doen onderzoek naar:

- De relatie van de aarde met de zon
- Ruimteweer en ruimteklimaat (space weather / space climate)



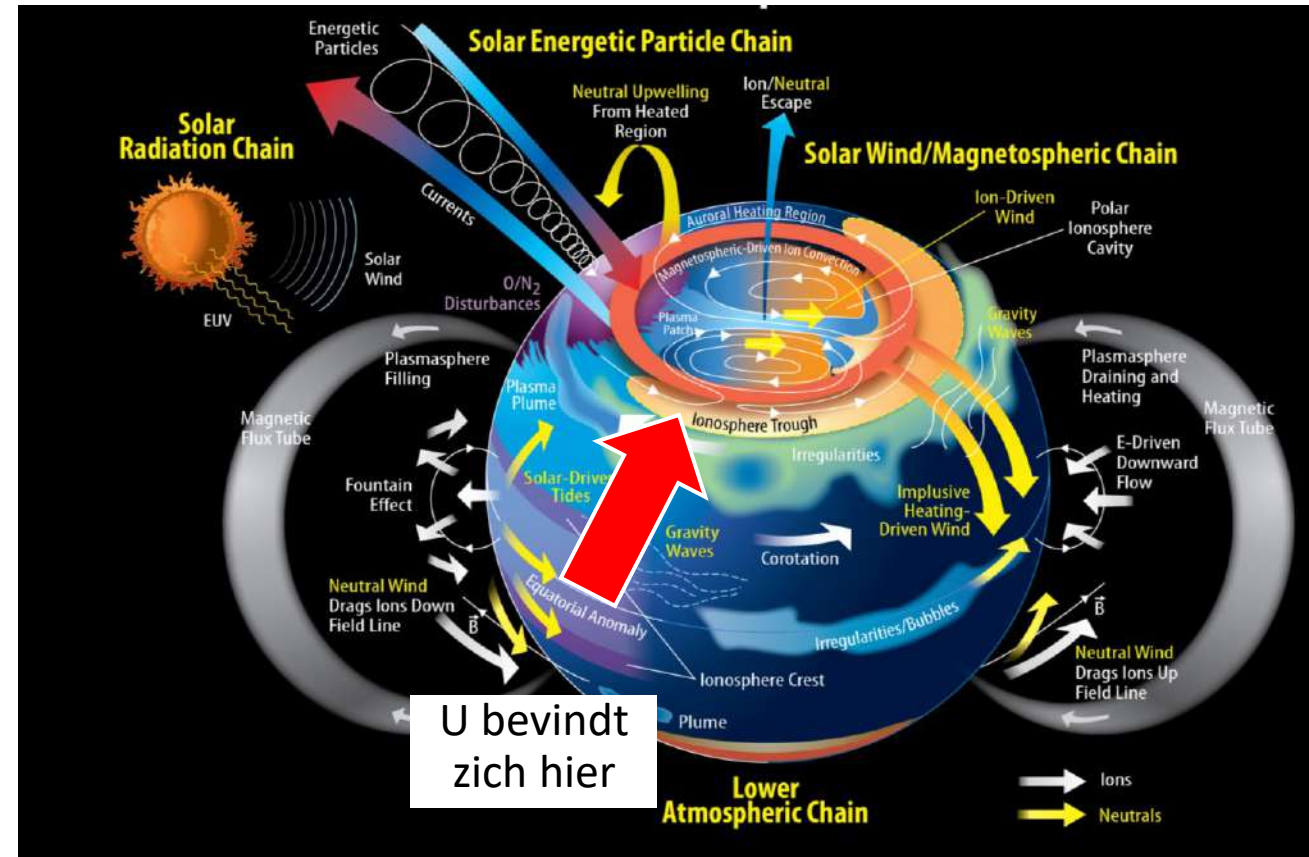
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*Voor als je het te voorgaande te simpel vond ...*





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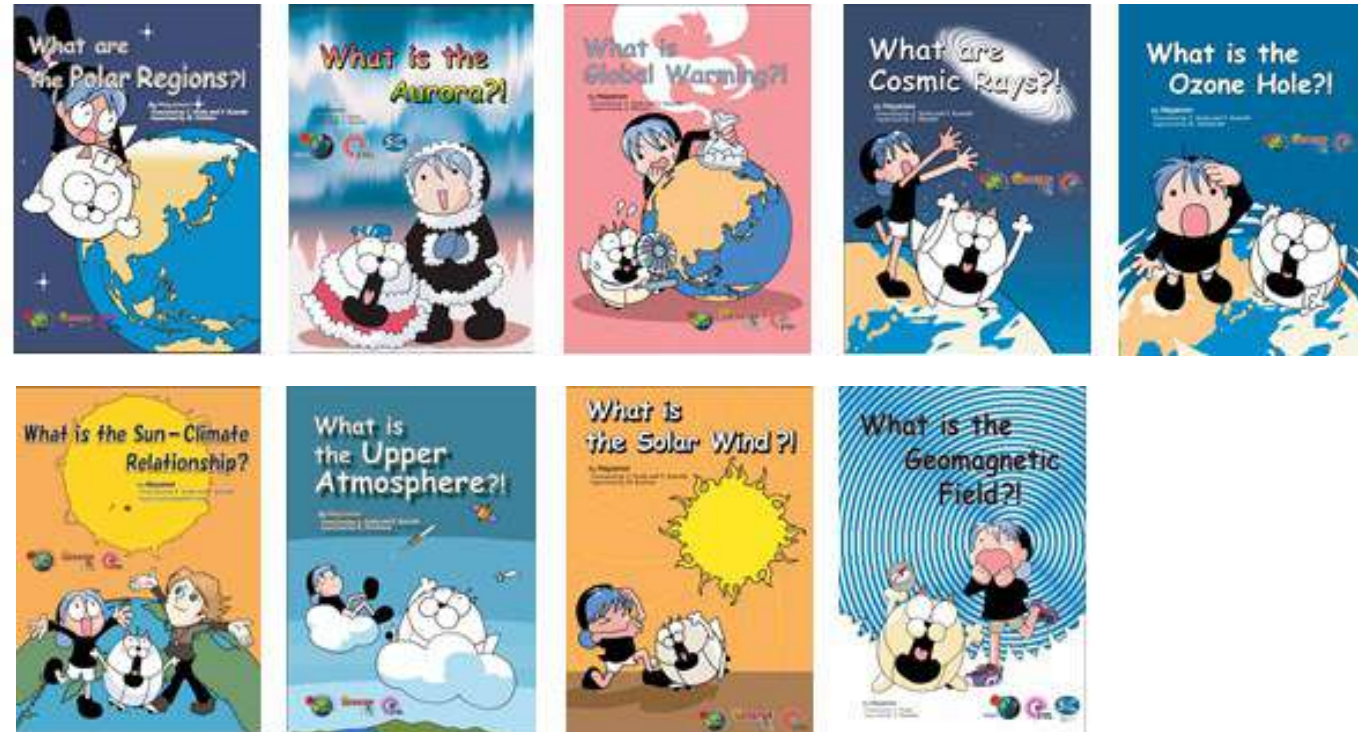


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<https://pithia-nrf.eu/activities-results/outreach/outreach-material/space-weather-comic-books>



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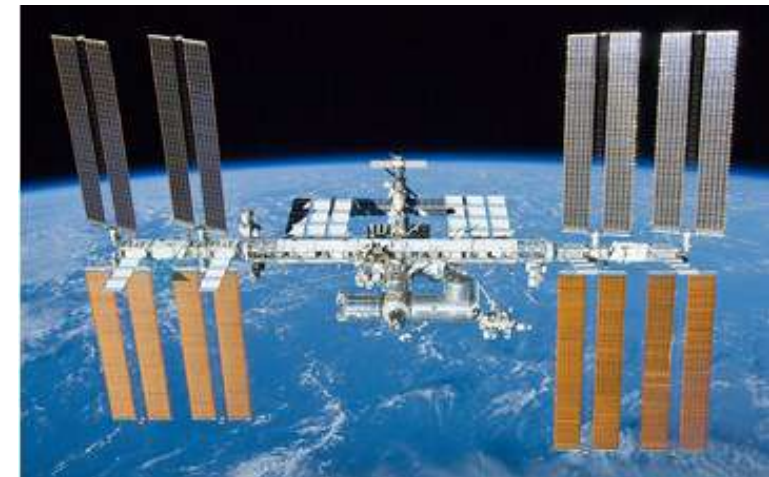


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### Onderzoek vanwege

- Ruimtevaart en luchtvaart (stralingsblootstelling)
- Bescherming satellieten (zonnwind en atmosferische 'drag')
- Navigatie voor luchtvaart, scheepvaart, transport en landbouw (scintillatie)
- Kortegolf radioverkeer (propagatievoorspellingen en verstoring door zonnevlammen)
- Koppeling met het gewone weer op lagere hoogten
- Wetenschap: proberen te begrijpen, modelleren en voorspellen



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## Onderzoeksapparatuur

- All-Sky Imager
- Continuous Doppler Sounder
- Cosmic Ray Detector
- Electric Field Mill
- GNSS Receiver Network
- Incoherent Scatter Radar
- Infrasound network
- Ionosonde
- Magnetometer
- Meteor camera
- Meteor radar
- Research satellites
- RIOmeter
- VLF receivers

PITHIA research instruments	BIRA IASB	BGD	CNES	DLR	EGI	EISCAT	GFZ	IAP	INGV	JFW	KULEUVEN	NOA	NWO-I ASTRON	UT3 IRAP	OE	RMI	ROB	SGO UOULU	SRC PAS	UOW	UPC IONSAT	UTWENTE
All-Sky Imager								X														
Continuous Doppler Sounding								X														
Cosmic ray detector																X		X				
Electric field mills								X														
GNSS receiver network				X					X								X		X		X	
Incoherent scatter radar						X																
Infrasound network																		X				
Ionosonde	X					X		X	X			X			X	X			X			
Ionospheric heating						X																
Low frequency radio telescope													X					X	X			
Magnetometer							X									X		X				
Meteor camera																		X				
Meteor radar																		X				
Research satellites	X																					
RIOmeter																		X	X			
VLF receivers	X			X														X				

Instrument beschrijvingen:

<https://pithia-nrf.eu/activities-results/outreach/space-weather-research-in-europe/instruments-of-european-observatories>

En supercomputers met natuurkundige modellen



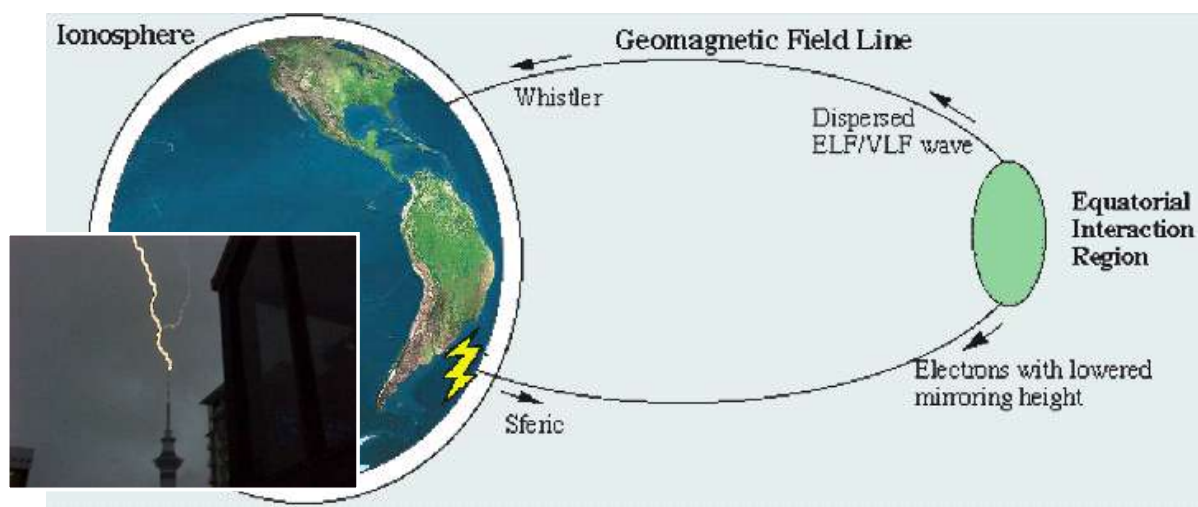
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Whistler sound

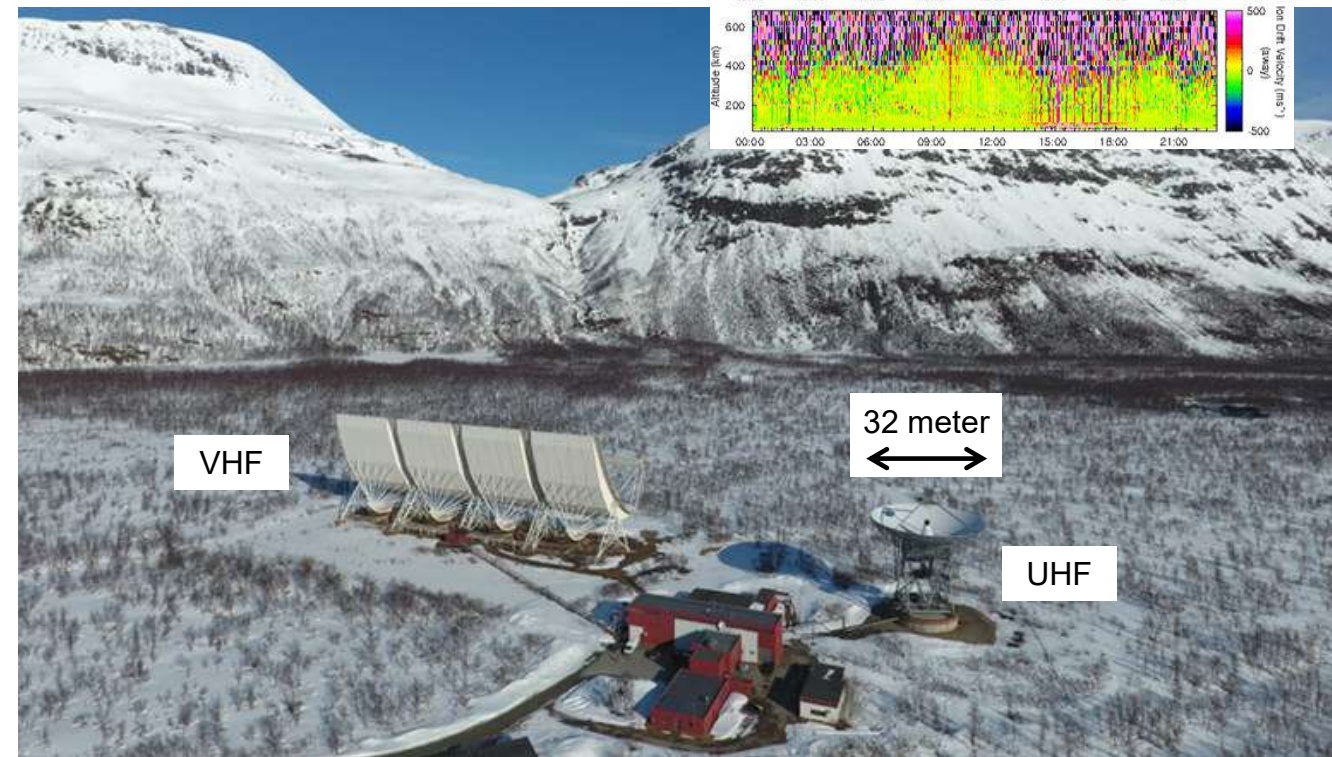
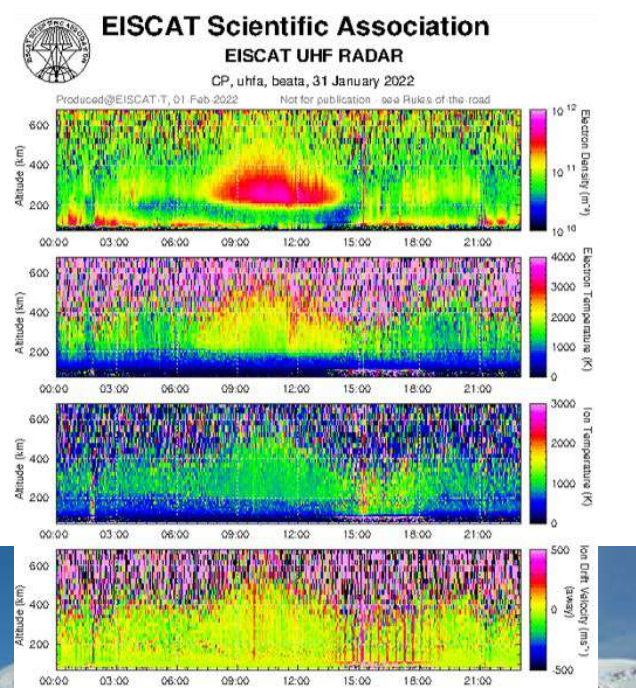
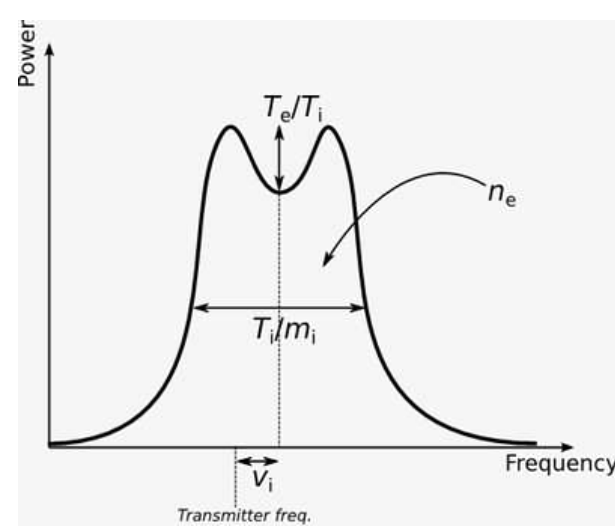


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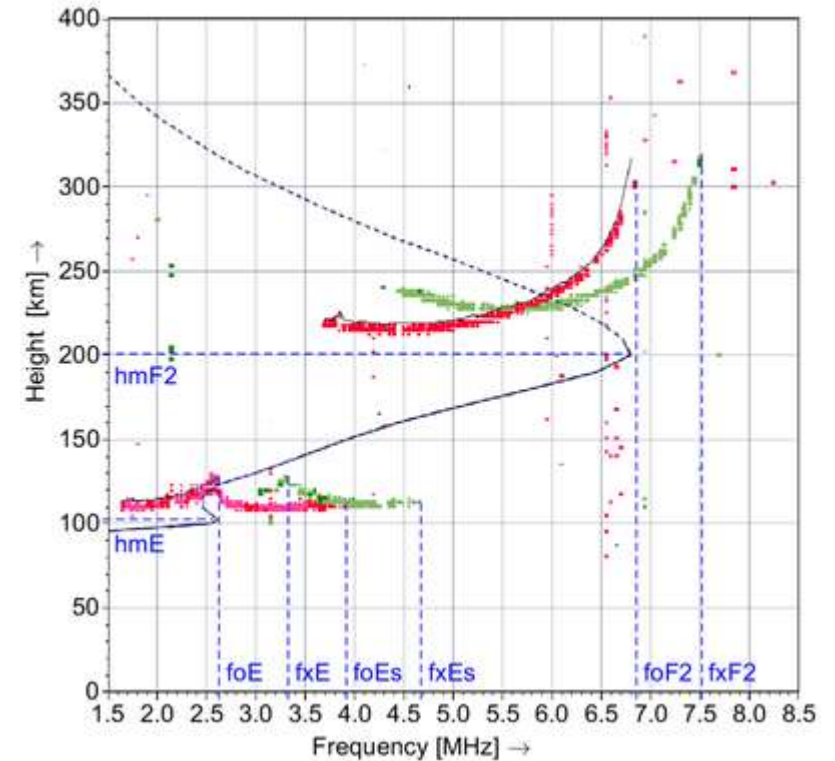
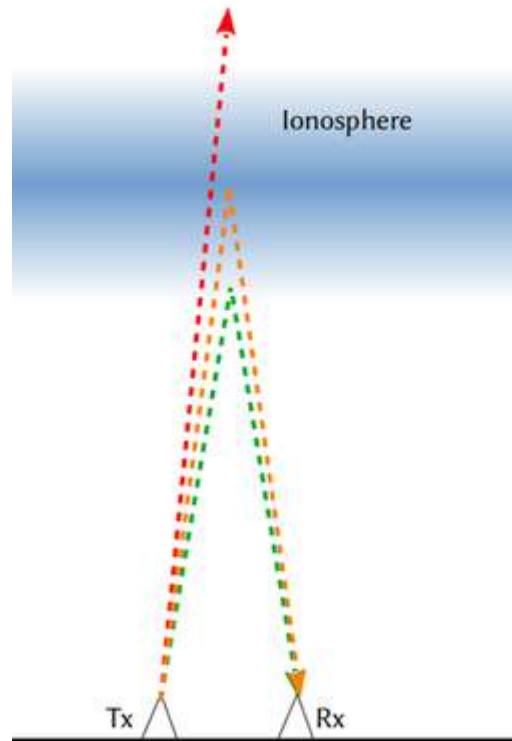
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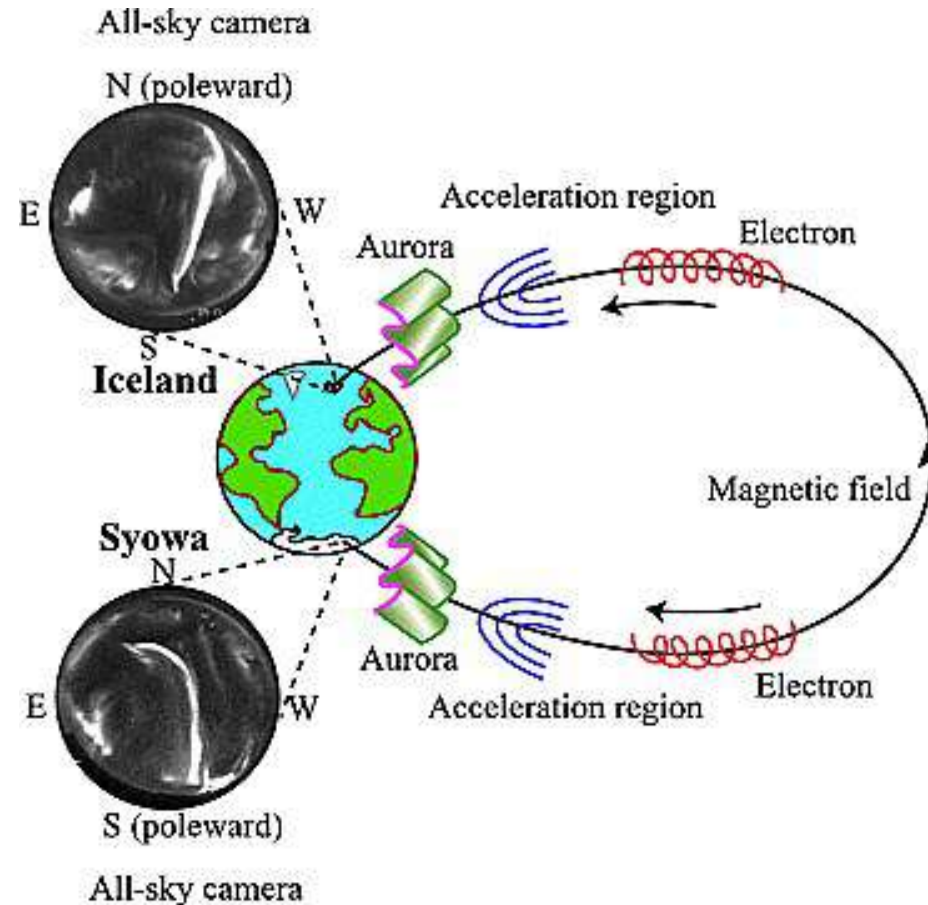
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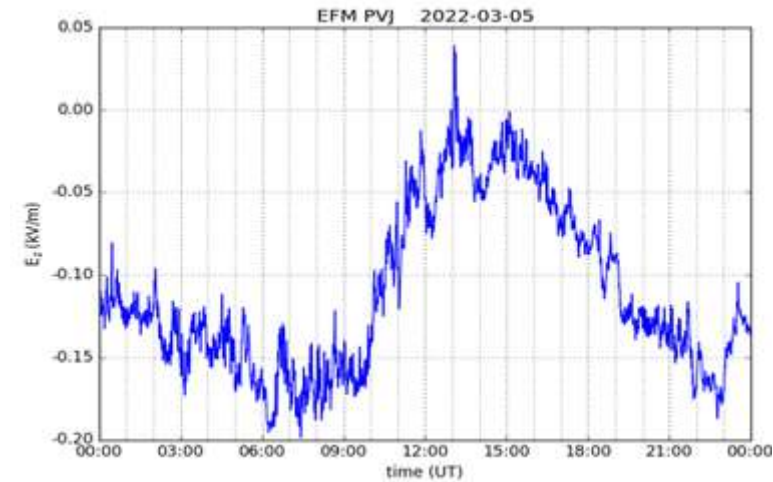
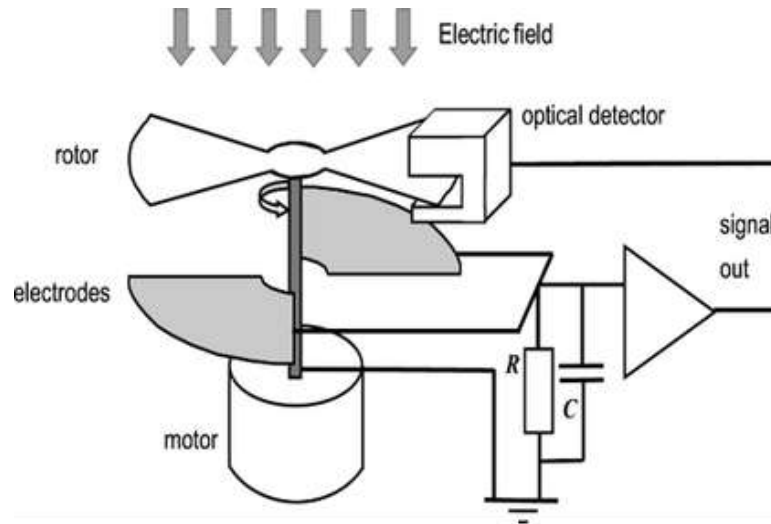
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## Onderzoeksapparatuur (ons 'speelgoed')

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En supercomputers met natuurkundige modellen





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GNSS receiver network				X					X								X		X		X	
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Ionosonde	X					X		X	X			X			X	X			X			
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Low frequency radio telescope													X					X	X			
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RIOmeter																		X	X			
VLF receivers	X			X														X				

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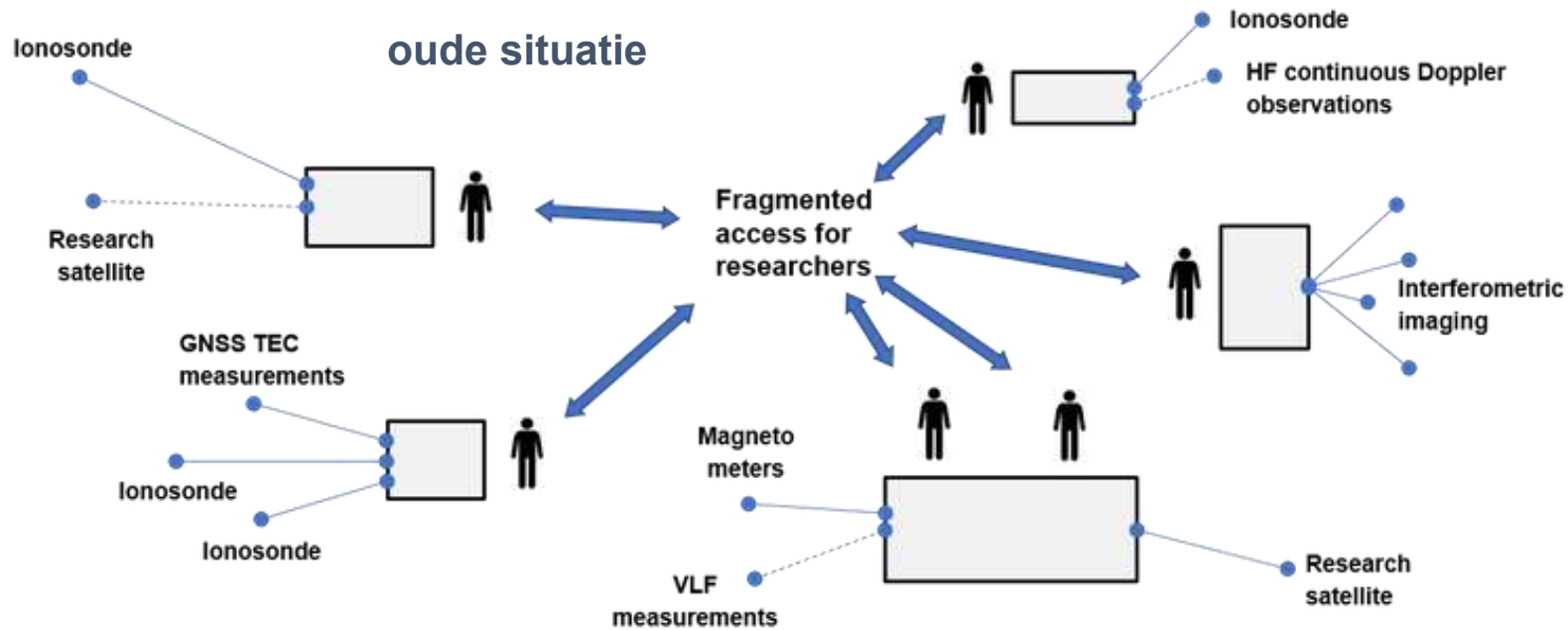
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## Krachten bundelen

PITHIA-NRF gaat zorgen voor centrale toegang tot al deze instrumenten, voor extra krachtig onderzoek







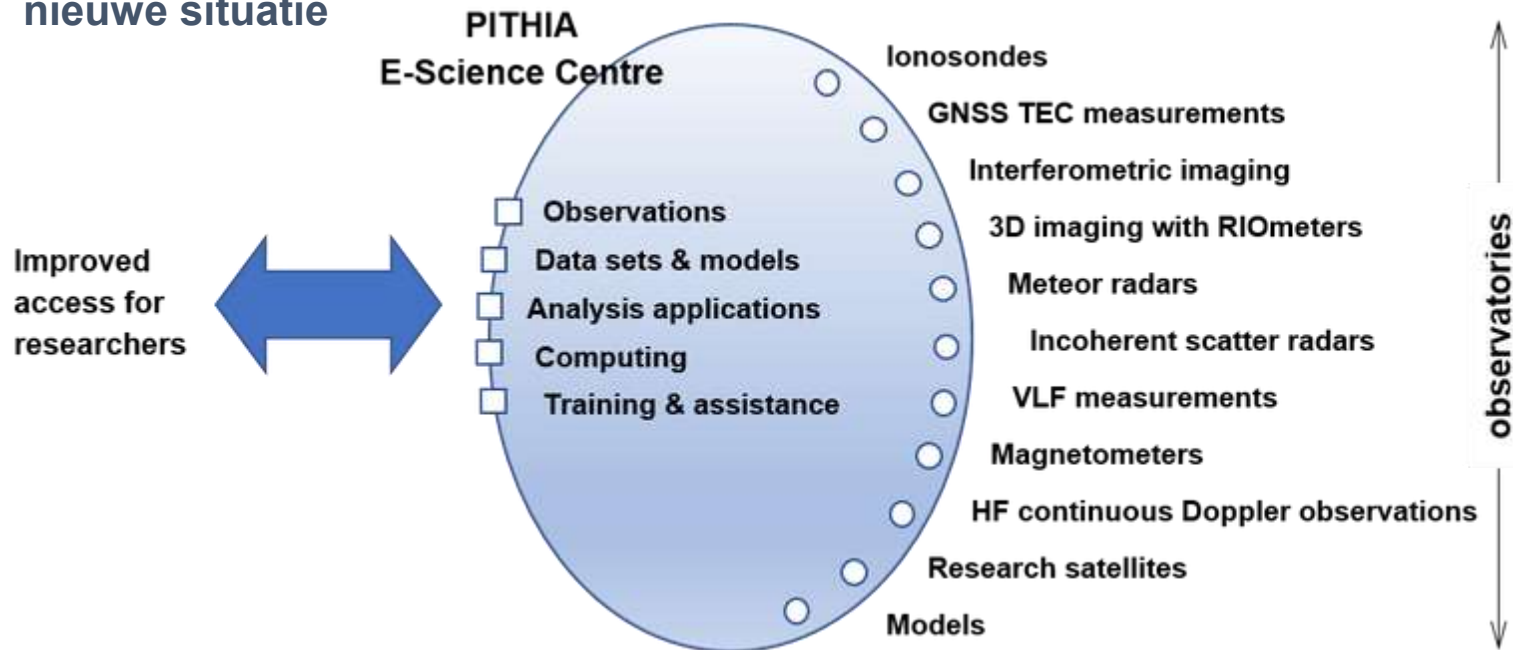
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### nieuwe situatie



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Ik hoop dat dit een beetje beeld geeft van mijn “andere werk”

**Vragen?**



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Toegift uit een andere presentatie



## Outreach to specific communities: ITU

The International Telecommunications Union (ITU) is the world-wide organization that manages the frequency spectrum. This includes the frequencies used by our scientific instruments.

Currently the ITU works on the “Working document towards a draft new fascicle on RF techniques to retrieve ionospheric parameters”.

We have offered to contribute to this document. [UT lead]

