



SPACE WEATHER
as a global challenge

Improving Research and Observation Services

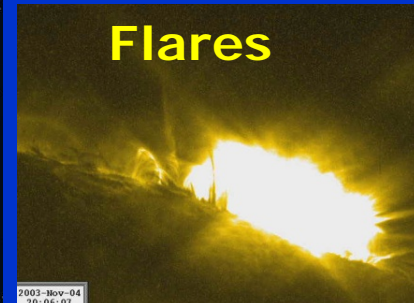
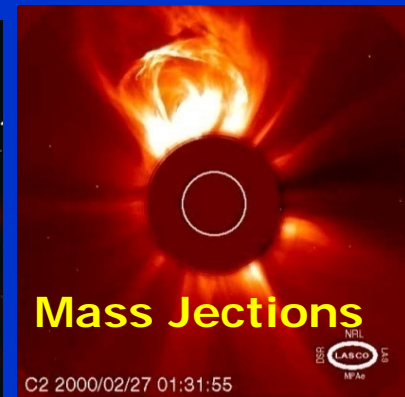
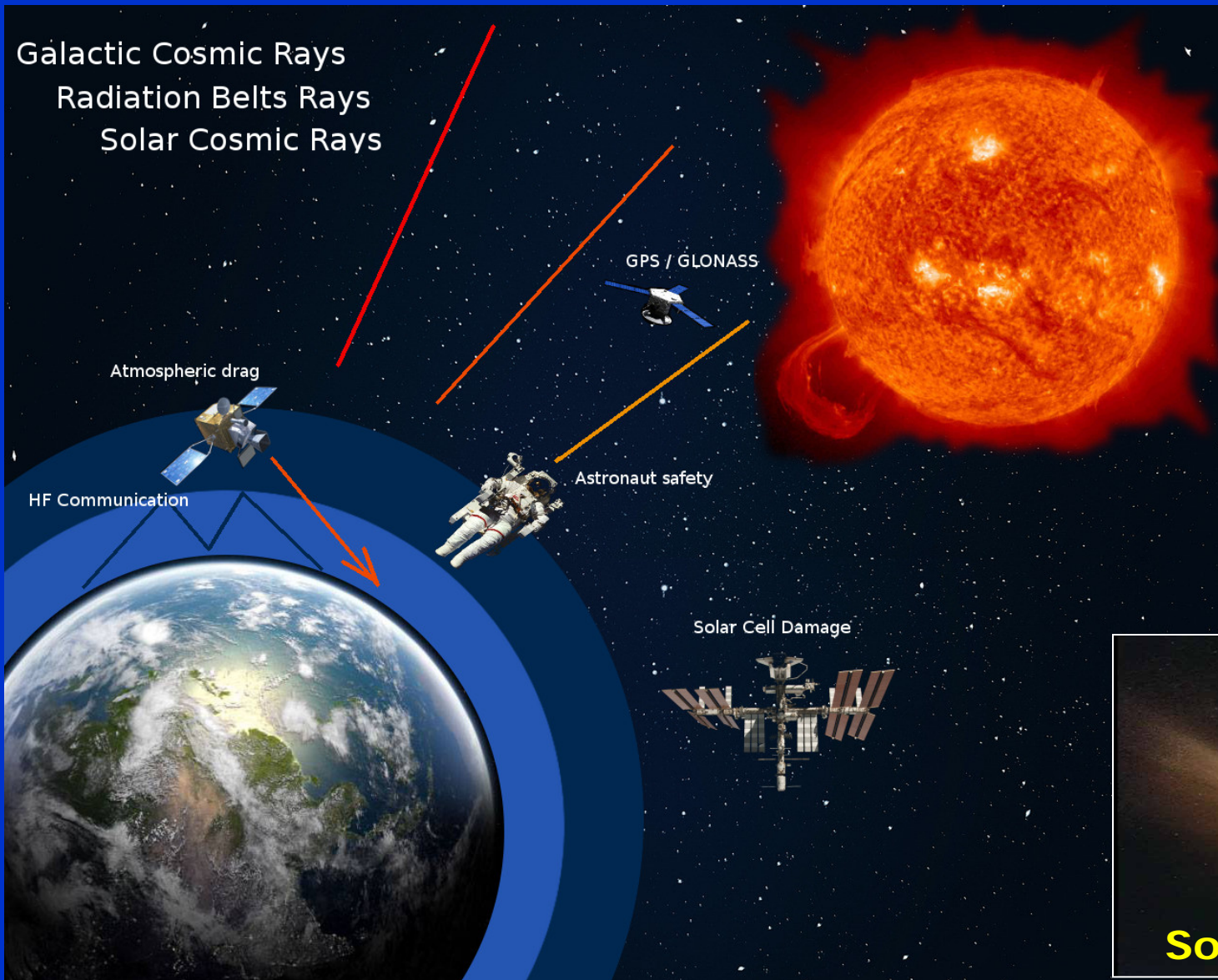
Embassy of Italy, Washington D.C.

May 18, 2017

Russian Space Weather Activities

Alexander Ermolaev

Space Weather



Organizations

Russian Academy of Science

- Space Research Institute (IKI), Moscow
- Institute of Terrestrial Magnetism, Ionosphere and Radiowaves (IZMIRAN), Troitsk
- Polar Geophysical Institute (PGI), Apatity
- Institute of Geosphere Dynamics (IDG), Moscow
- Institute of Solar-Terrestrial Physics (ISZF), Irkutsk
- Institute of Cosmophysical Research and Aeronomy (IKFIA), Yakutsk
- Institute of Applied Physics (IPF), Nizhnij Novgorod
- Laboratory of solar X-ray astronomy, Institute of Physics (FIAN), Moscow
- Institute of Physics of Earth (IFZ), Moscow
- Institute of Cosmophysical Research and Radio Propagation (IKIR), Kamchatka
- Pushchino Radioastronomical Observatory (PRAO), Puschino
- Pulkovo observatory (GAO), St.Petersburg
- Institute of Computational Modelling, Krasnoyarsk

University Centers

- Skobeltsyn Institute of Nuclear Physics, Moscow State University (SINP)
- Department of Geophysics, St.Petersburg State University
- Institute of Radio Physics (NIRFI), Nizhnij Novgorod
- Tomsk State University Department of Cosmic Physics and Ecology
- Institute of Astrophysics, Moscow Institute of Engineering Physics (MEPhI)
- Institute of Cosmophysics, Moscow Institute of Engineering Physics (MEPhI)

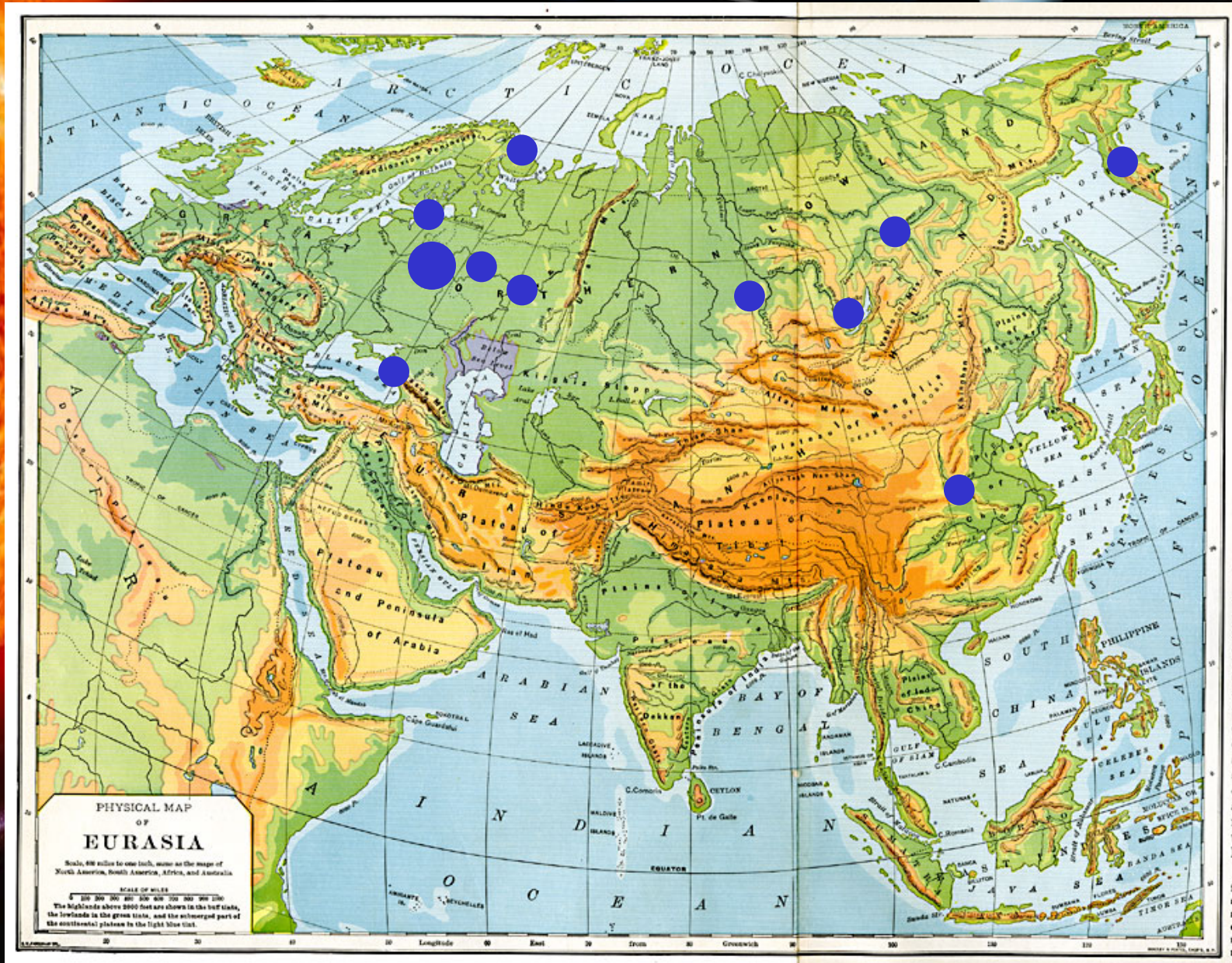
Russian State Agency for Hydrometeorology and Environment Monitoring (ROSHYDROMET)

- Institute of Applied Geophysics (IPG), Moscow
- Arctic and Antarctic Research Institute (AARI), St.Petersburg
- Central Aerological Observatory (CAO) Russian only

Other

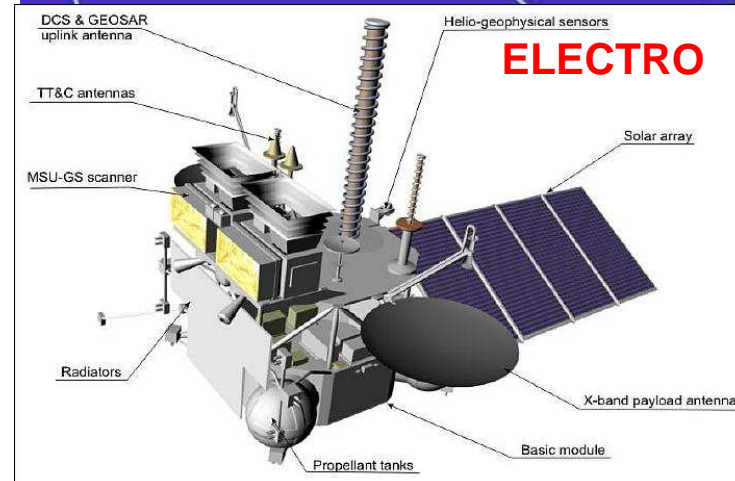
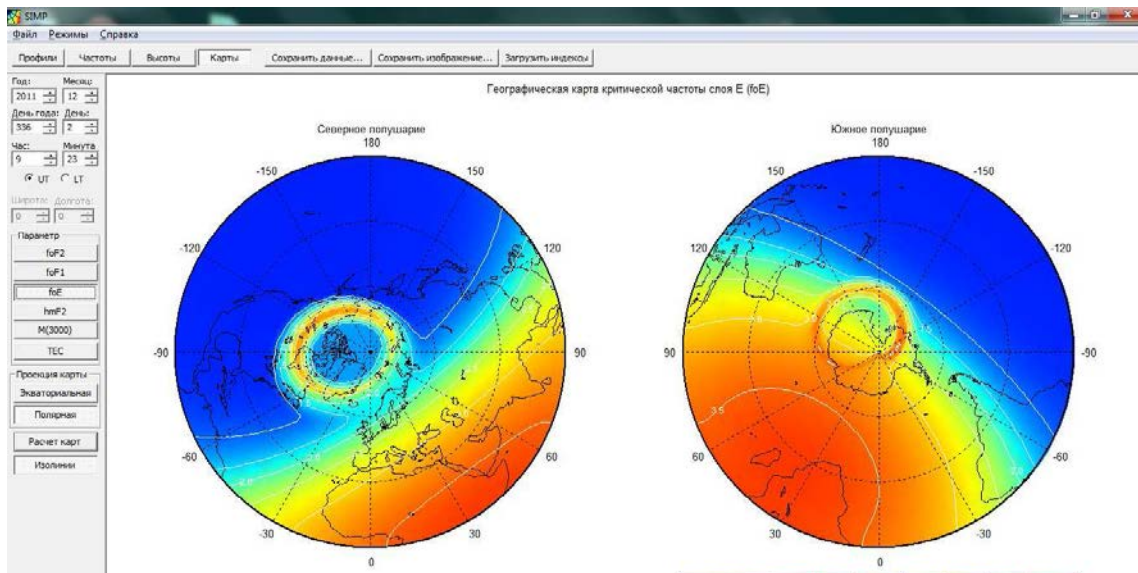
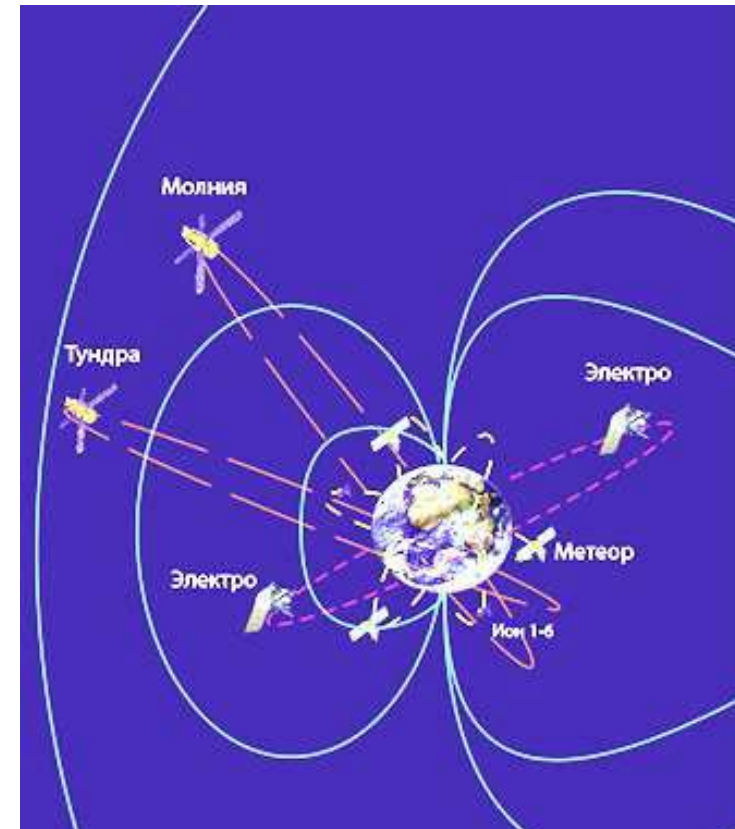
- World Data Center for Solar-Terrestrial Physics (WDCB), Moscow

Organizations and Data Centers



Russian Technological Capabilities

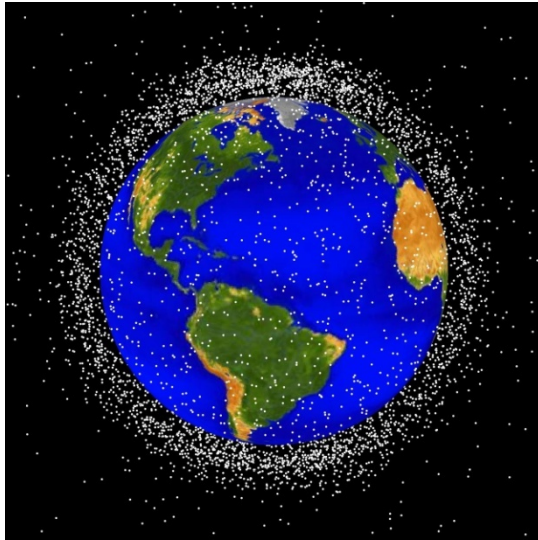
Space Weather Forecast Centers



System of Ionosphere Monitoring and Prediction

Ground based segment

Space Weather Forecast Centers



Part of ROSCOSMOS Automated Space Situational Awareness System (ASPOS)



Siberian Solar Radio Telescope

Space-Based Segment

CORONAS-Photon (Complex Orbital Observations Near-Earth of Activity of the Sun-Photon), research satellite, and part of the international Living With a Star program. 20 scientific instruments to detect solar particles and hard emissions and to register images of the sun.

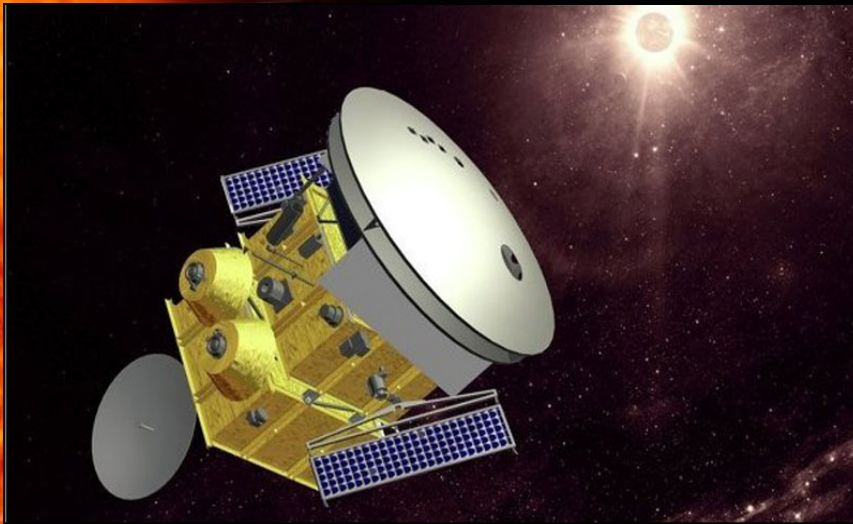
Launched on 2009.

Lost due to the problems with power supply



Russian Space Program 2016-2025

INTERHELIOPROBE



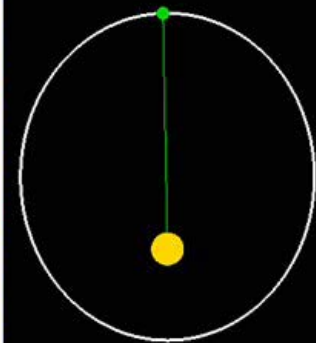
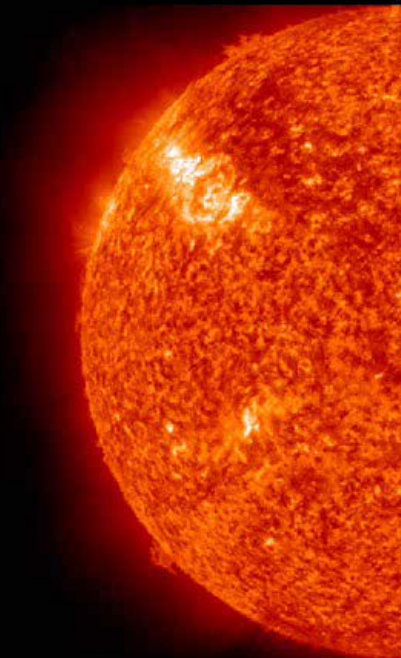
Mission information:

Orbit type: heliocentric non-ecliptic orbit
Period: 150 days (2/3 of the Venus period)
Semi-major axis: 82.72×10^6 km
Perihelion: $60 \times R_{\odot} = 41.76 \times 10^6$ km
Eccentricity: 0.5

Instruments:

In situ: 14 instruments
Remote-sensing: 5 instruments
Launch: 2026

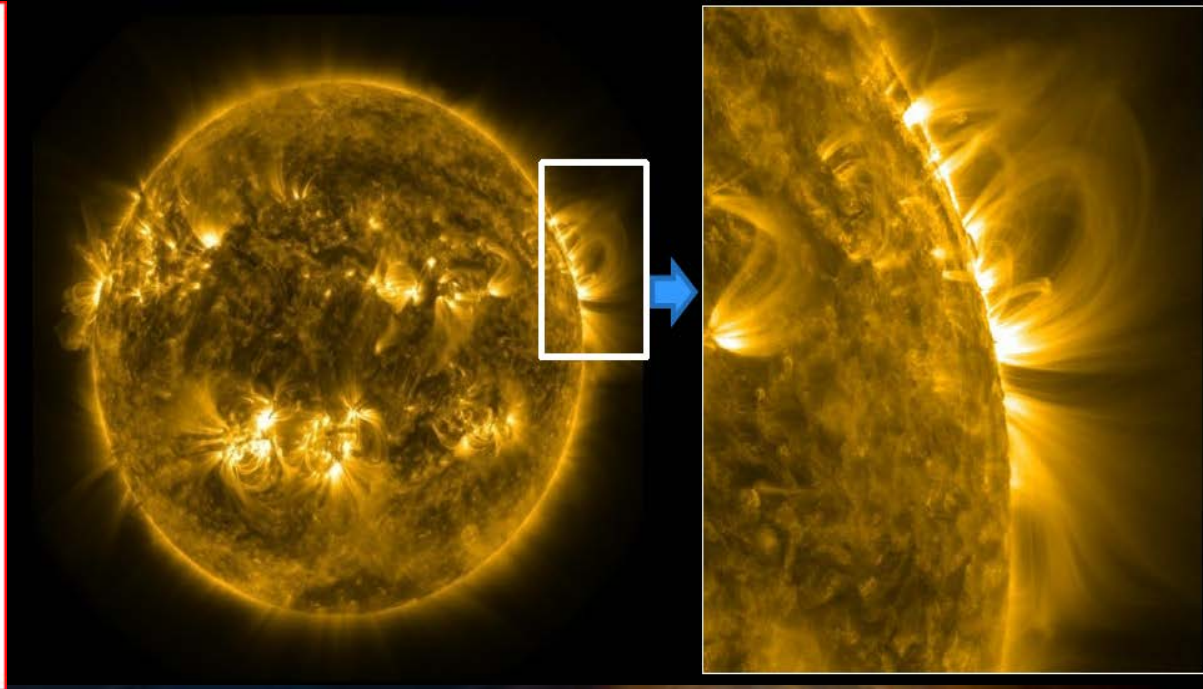
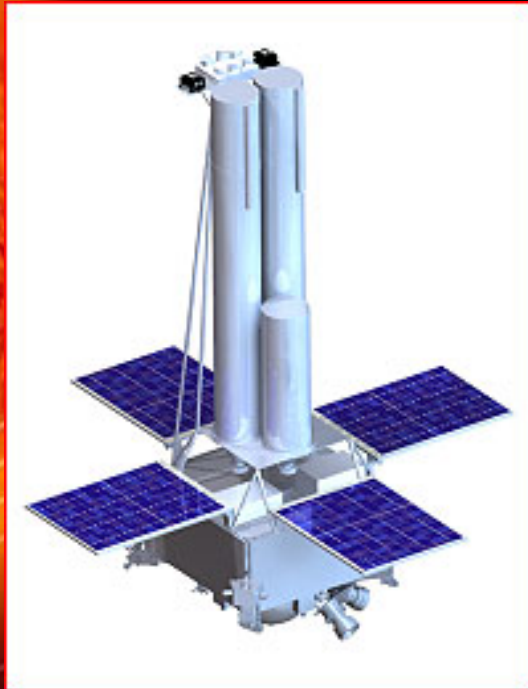
ILWS - International Living with a Star



Days: 128.0
Distance (R_{sun}): 154.8

Russian Space Program 2016-2025

ARKA spacecraft



ARKA is the first Russian small spacecraft for Sun observation

The spacecraft will carry 3 scientific instruments (two telescopes and a coronagraph) to provide high quality imaging of the Sun and Sun's transition level with a precision of 70 km per pixel – the most ever reached during the space solar experiments

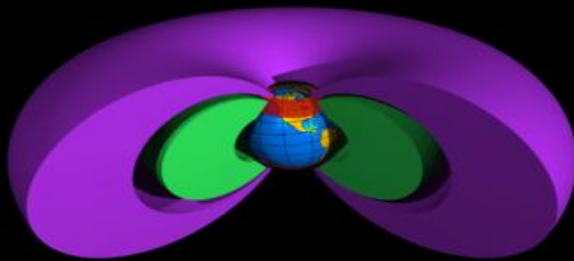
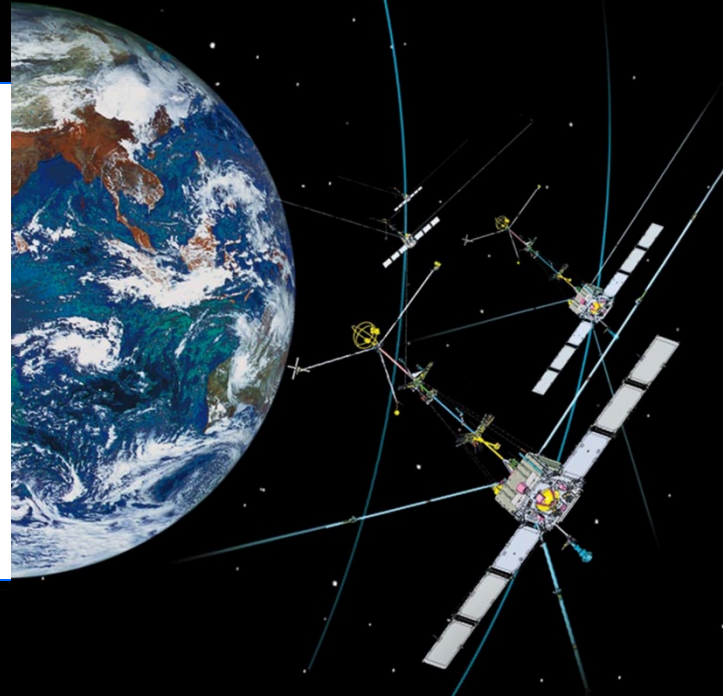
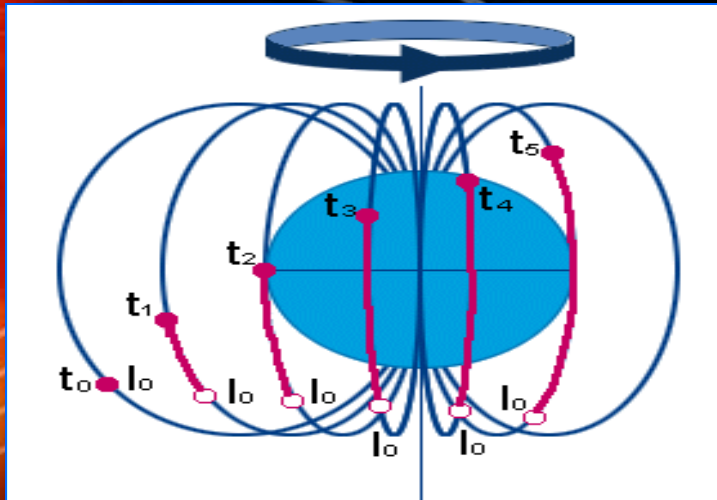
Some systems provided by UK and Germany

Launch – 2023

International Cooperation: ILWS - International Living with a Star

Russian Space Program 2016-2025

RESONANCE mission



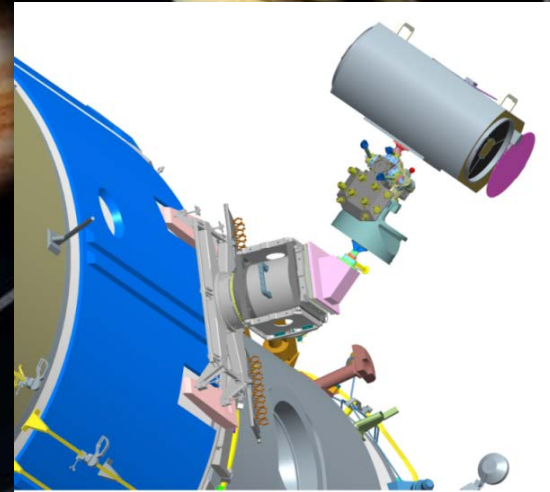
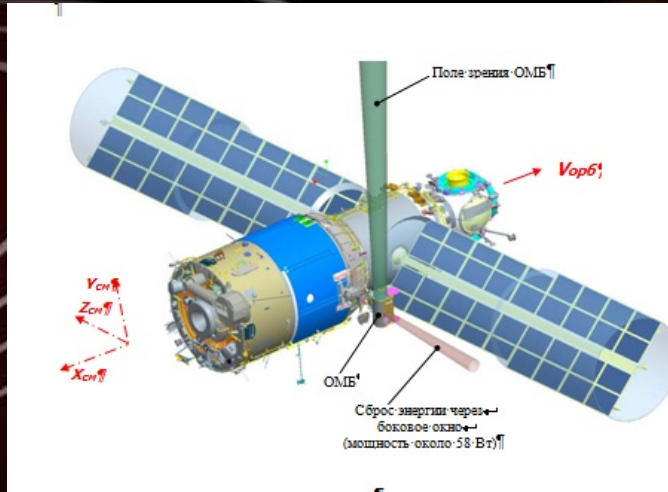
The RESONANCE mission – 4 spacecrafts to study wave-particle interactions and plasma dynamics in the inner magnetosphere from magnetosynchronous orbit.

Cooperation with US, France, Germany, Finland

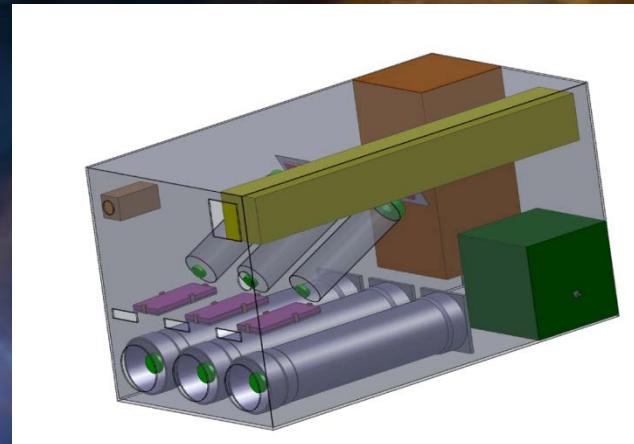
Russian Space Program 2016-2025

ISS

TAKHOMAG

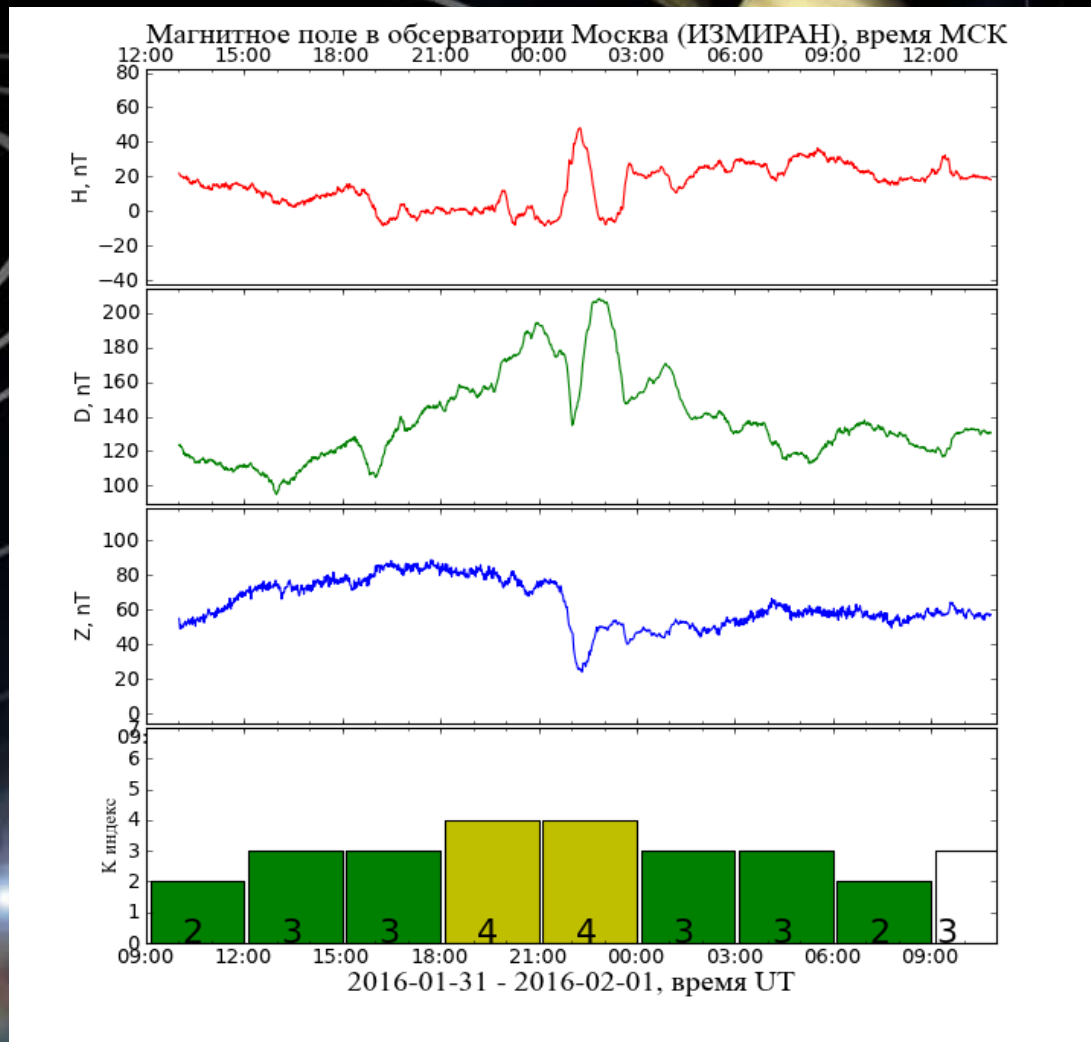


KORTES – telescopes and spectrometers (2021)



IZMIRAN

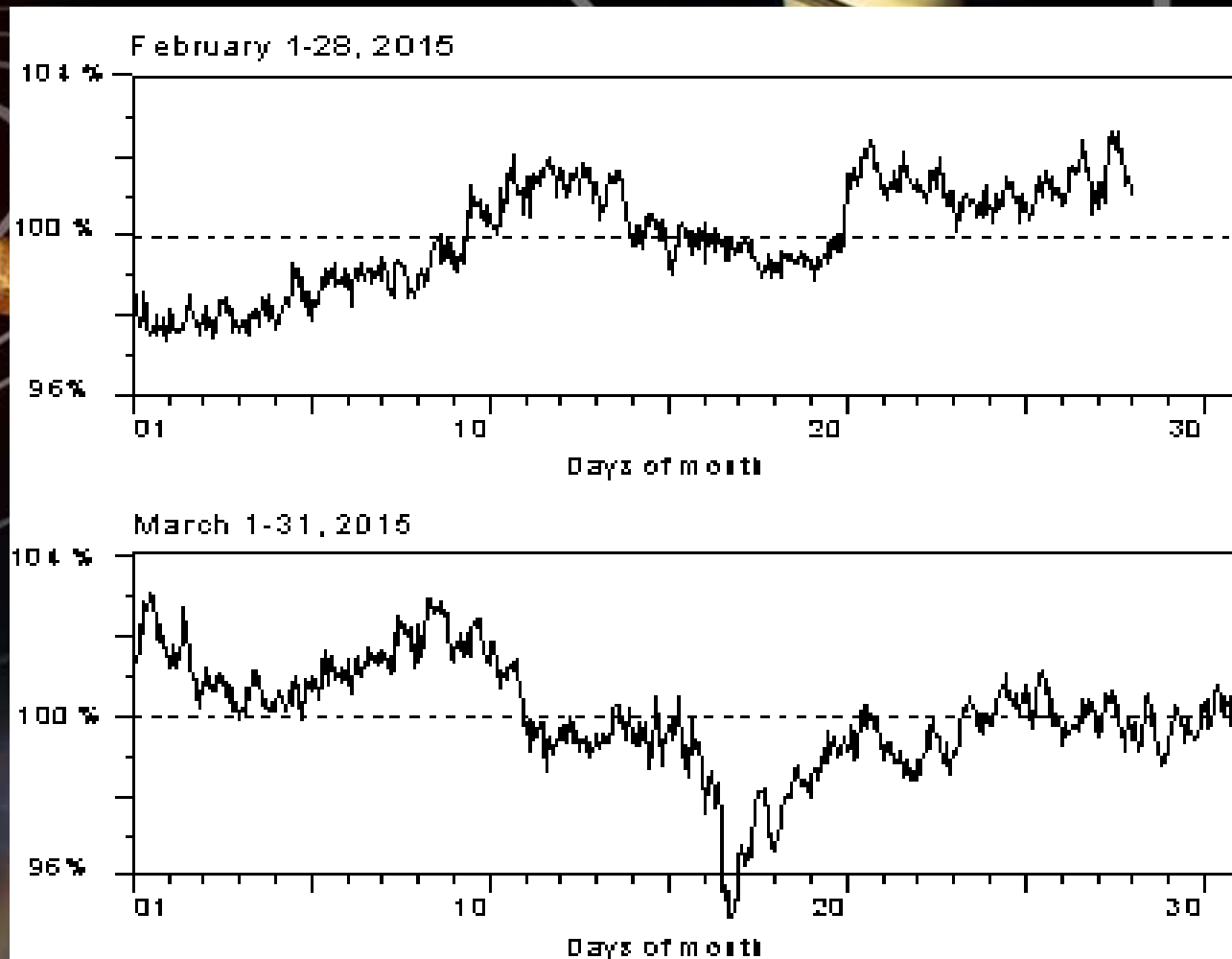
Scientific data



Measurements of the Earth's magnetic field in the Moscow Region

Polar Geophysical Institute (Murmansk)

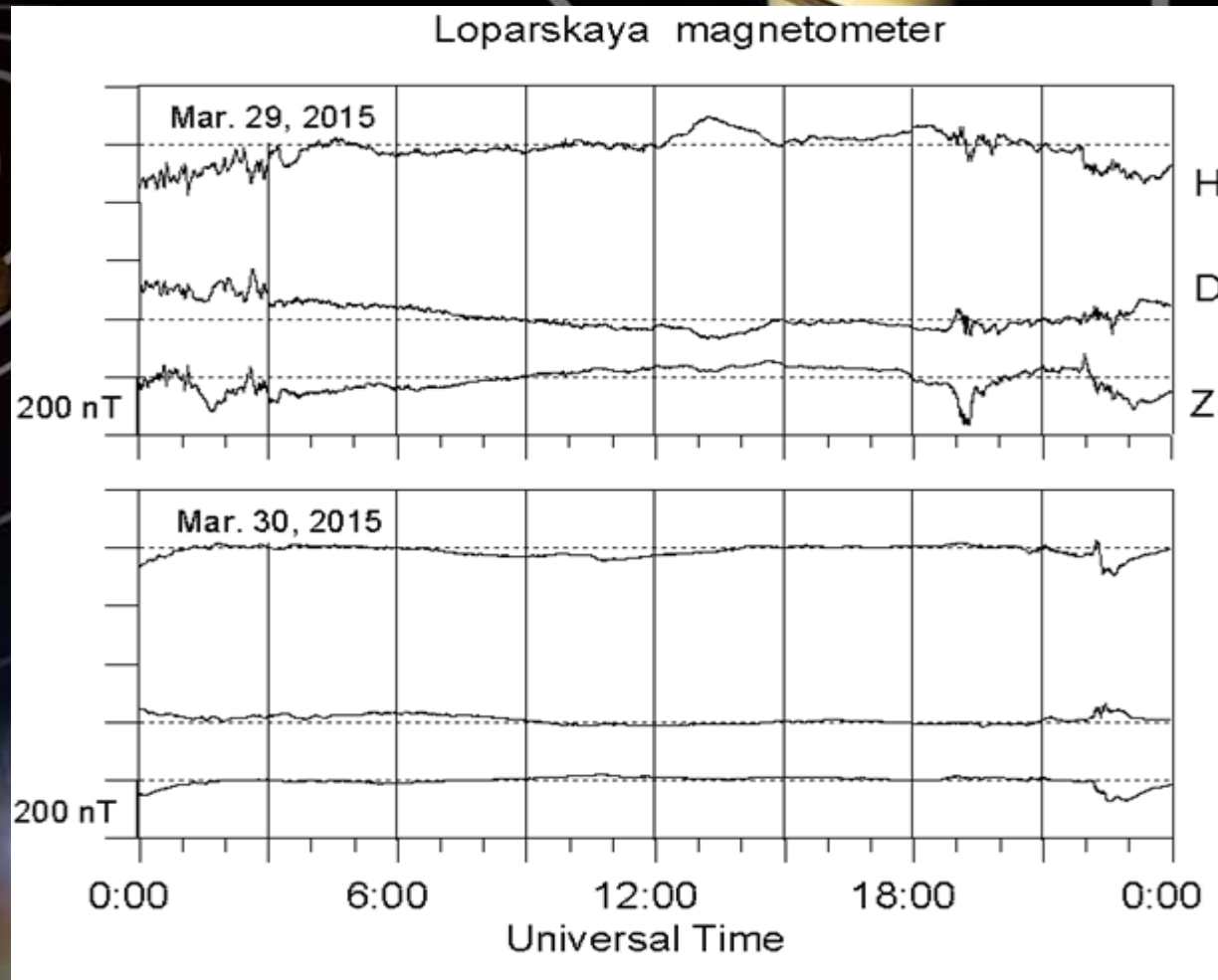
Scientific data



Neutron monitor near Apatity city

Polar Geophysical Institute (Murmansk)

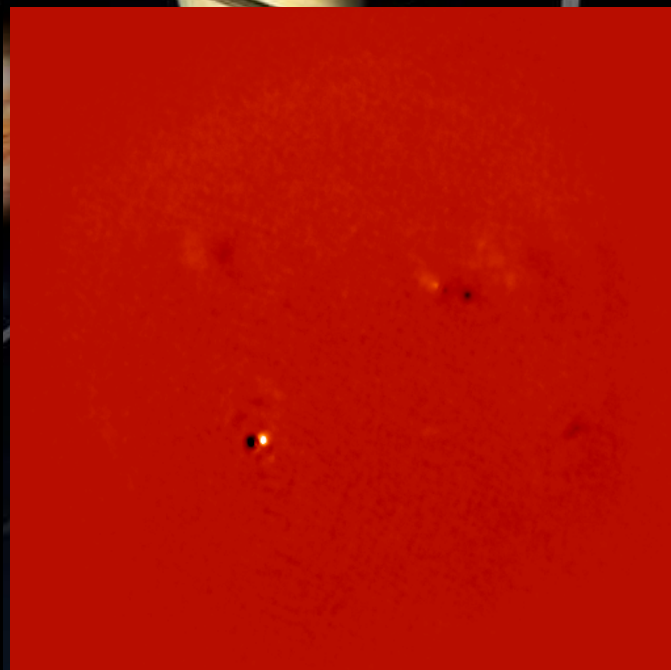
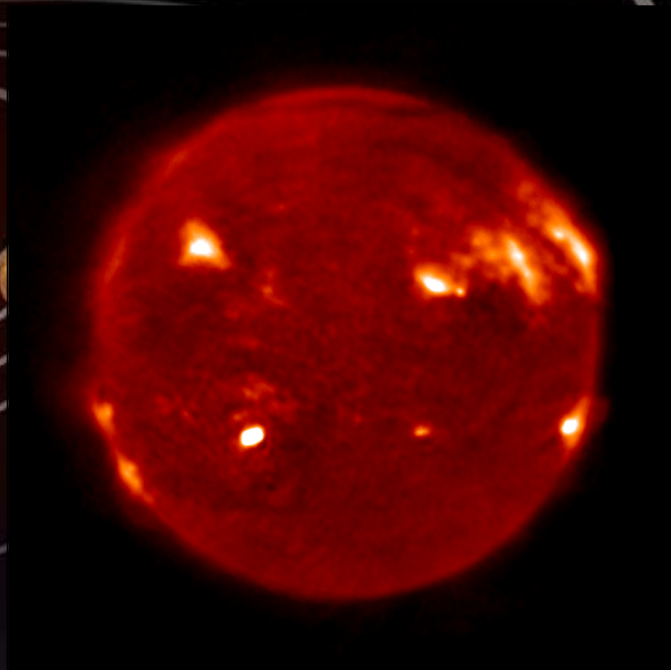
Scientific data



Measurements of the Earth's magnetic field in 2 points near Murmansk

Institute of Solar-Terrestrial Physics (Irkutsk)

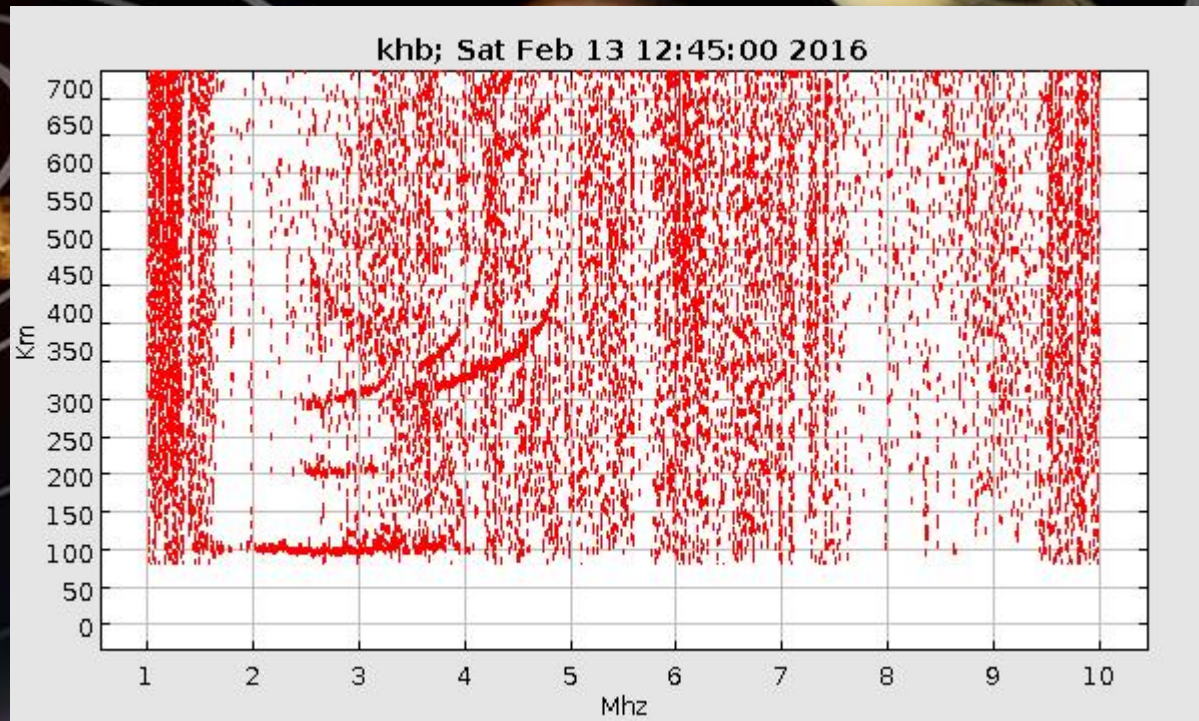
Scientific data



Radio observations of the Sun (intensity and polarization) at 5.7 GHz

Institute of Cosmo-Physical Research and Radio Wave Propagation (Kamchatka)

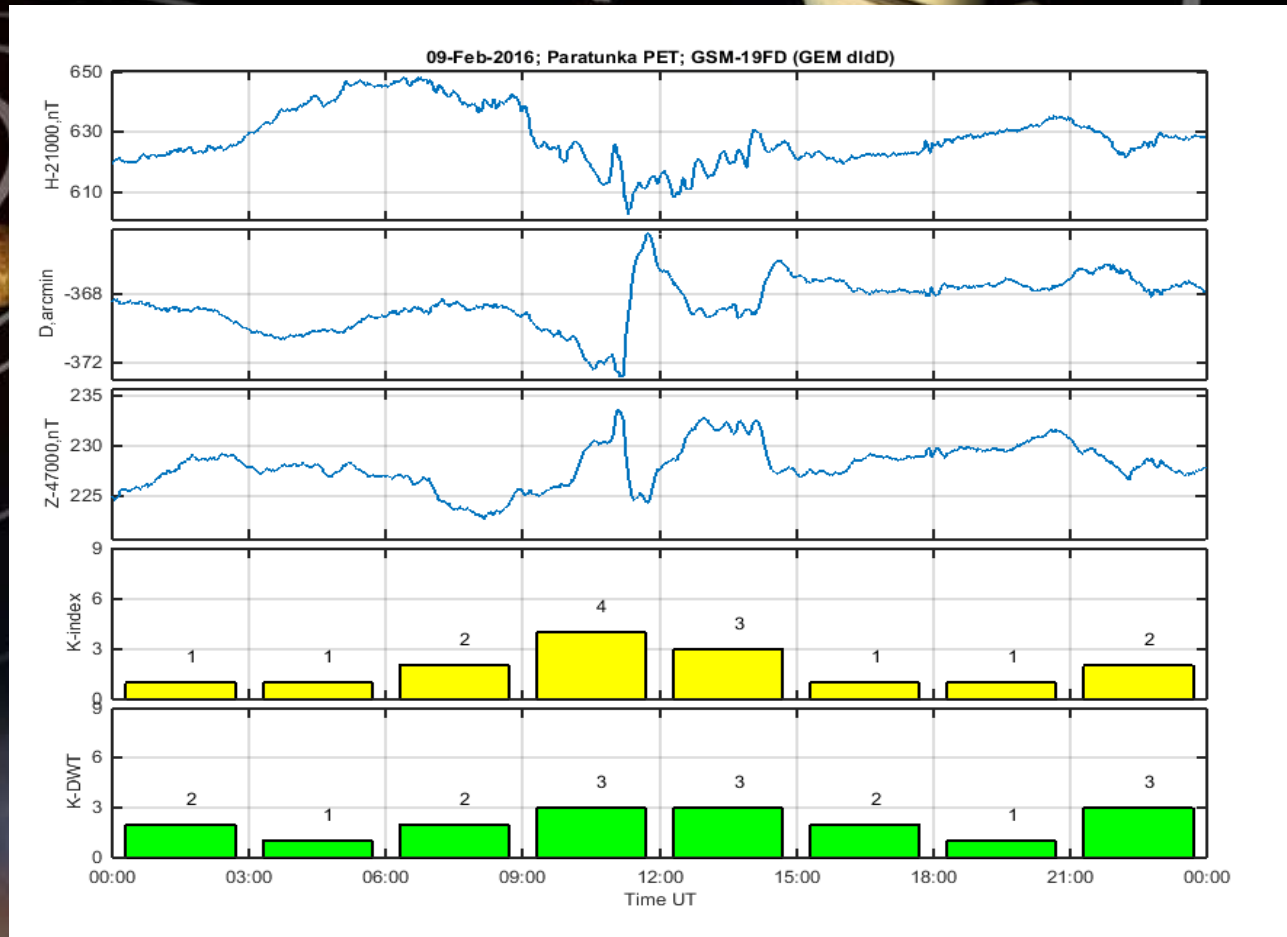
Scientific data



Monitoring of ionosphere in radio waves

Institute of Cosmo-Physical Research and Radio Wave Propagation (Kamchatka)

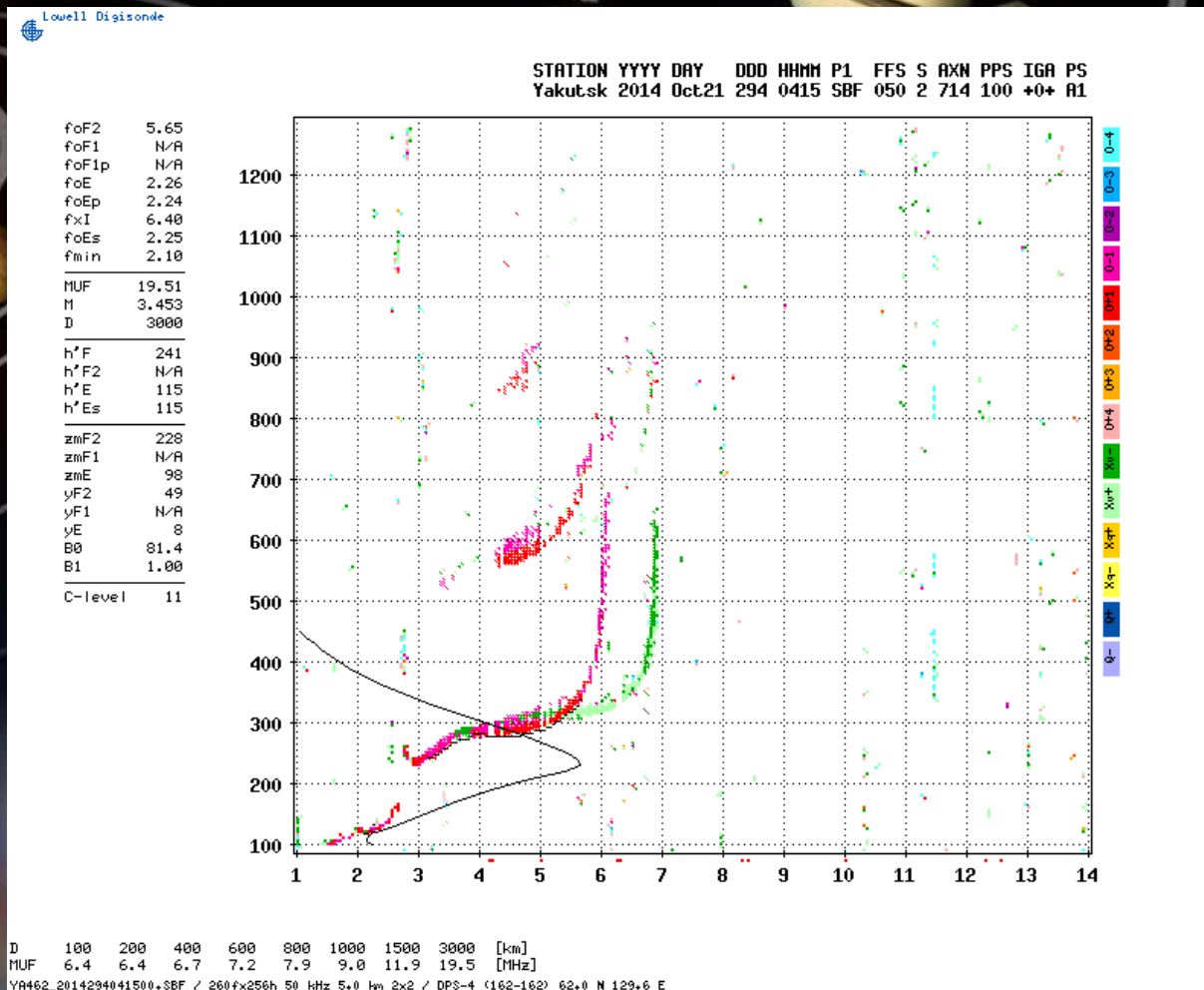
Scientific data



Measurements of the Earth's magnetic field in 3 points in the Kamchatka region

Chafer Institute of Cosmo-Physical Research and Aeronomy (Yakutsk)

Scientific data



Monitoring of ionosphere in radio waves

United Nations (UN)



Committee on the Peaceful Uses of Outer Space (COPUOS)

Scientific and Technical Subcommittee

Working Group

«Long-Term Sustainability of Outer Space Activities»

Expert Groups			
A	B	C	D

Expert Group C: Space Weather



Thank you
for your attention