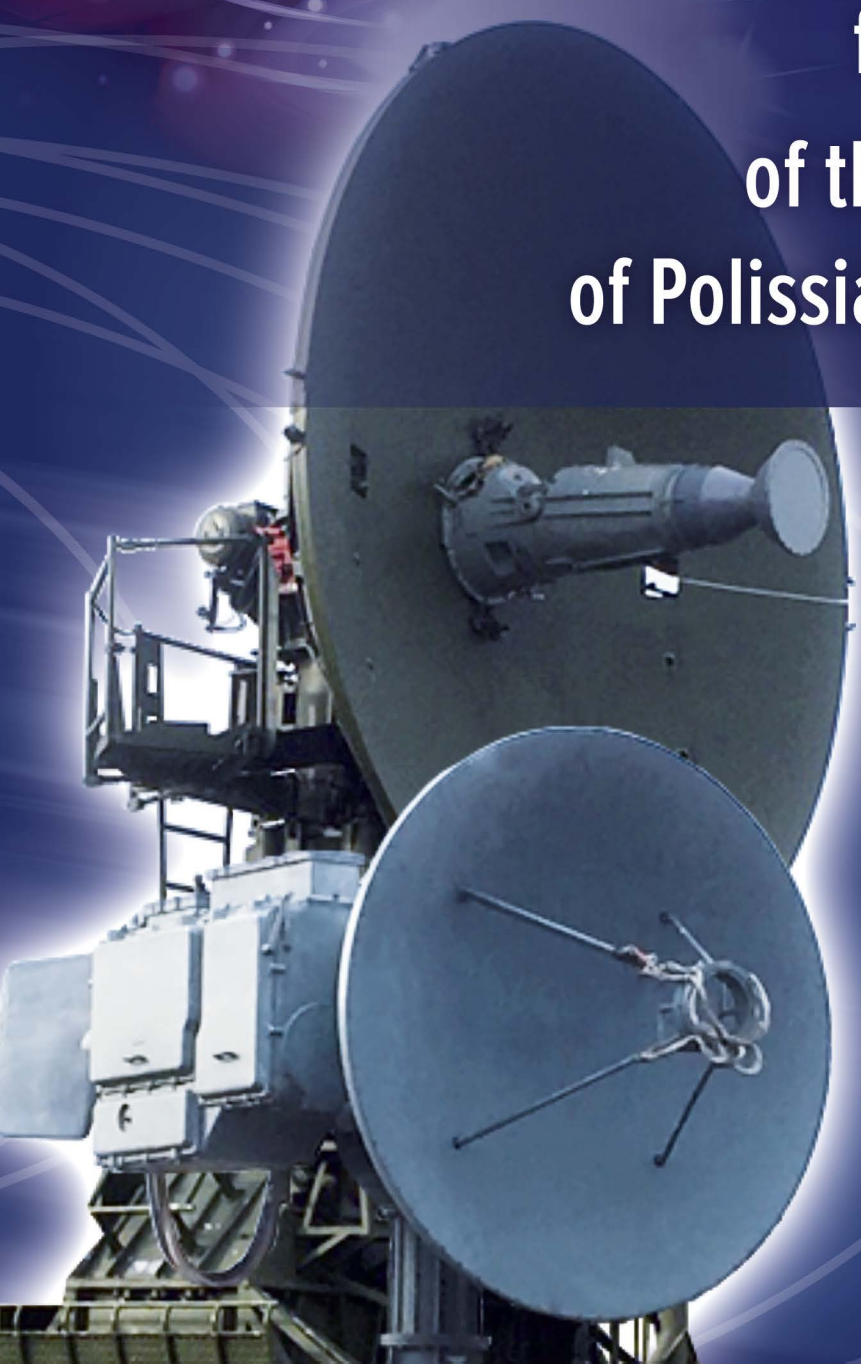
SPACE TECHNOLOGY EDUCATIONAL AND SCIENTIFIC CENTER OF POLISSIA NATIONAL UNIVERSITY

Ground-based information complex for space monitoring of the Earth "REGION" of Polissia National University



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Ground-based information complex for space monitoring of the Earth “REGION” of Polissia National University

Ground-based information complex (GIC) for space monitoring of the Earth (SME) “REGION” of Polissia National University is designed for planning, receiving, processing and storing of Earth remote sensing (ERS) data with the use of operational ground-based information receiving stations (GIRS) of ERS in the VHF, UHF, SHF bands; generation and reporting of data from space monitoring of the Earth to consumers (customers).

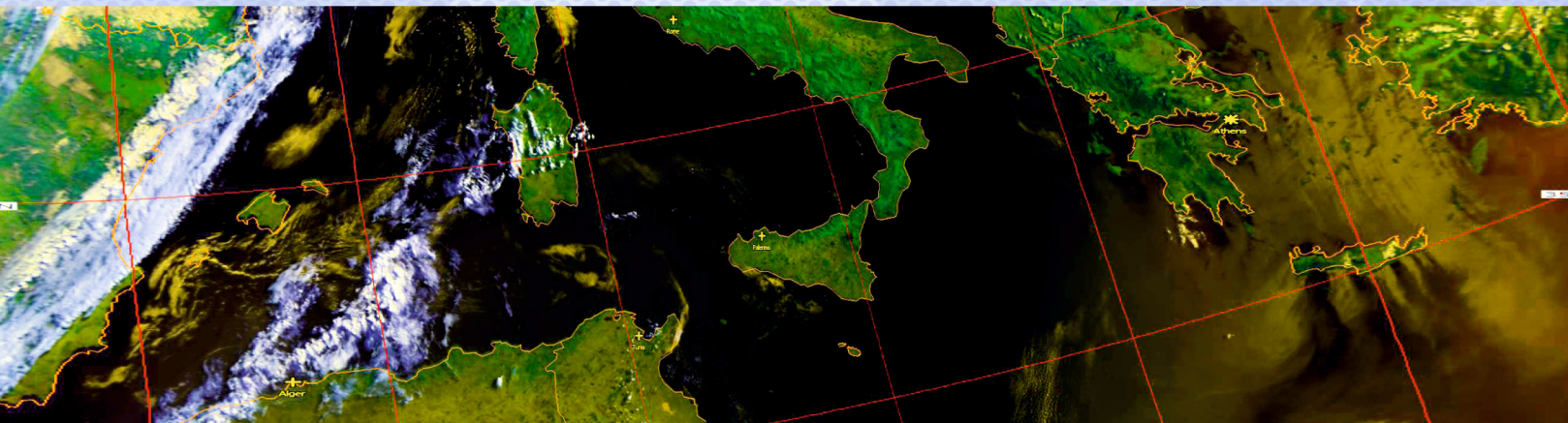
GIC SME “REGION” is capable of handling the following main tasks:

1) modelling orbital groups of spacecrafts (SC), their orbital parameters research; determination of spatial-temporal characteristics for access of ERS data from space;
2) assessment of conditions for planning and conducting ERS data receiving sessions from SC;
3) real time receiving and recording on disk storage units ERS data from SC;
4) primary processing of received ERS data (normalization, frequency transfer, demodulation, decoding, etc.) and obtaining imagery data in the appointed spectral ranges;
5) imagery data front-end preprocessing (image orientation, geometric adjustment, attributes of the space image);
6) thematic processing of imagery data, preparation and reporting ERS data reporting documents to consumers (customers);
7) archiving and cataloging of space images and reporting documents.

TECHNICAL SPECIFICATIONS
Complex composition

GIC SME “REGION’’ INCLUDES:

- ground-based information receiving stations of ERS from space;
- software and hardware complexes for planning, receiving, front-end and thematic processing of ERS data from SC, generation and reporting of data from space monitoring of the Earth (reporting documents) to consumers (customers).



The GIRS-8.2 ground-based station for ERS data receiving is designed for receiving, registering and front-end processing of ERS data with low, medium and high spatial resolution from SC in the SHF band 7.7–8.5 GHz (average frequency 8.2 GHz), registering and front-end processing of received data.

Antenna assembly

GIRS-8.2

GIRS-8.2 main specifications

Frequency band	7.7–8.5 GHz
Height of the ERS SC orbits	400 – 36 000 km
Antenna type	Parabolic
Reflector diameter	5.0 м
Antenna rotation sector:	
azimuth	0... ± 270 degree
angle of elevation	0...90 degree
Antenna movement rate:	
azimuth	≤ 14.0 degree/sec
angle of elevation	≤ 4.0 degree/sec
Antenna guidance	manual, preset
Guidance error	≤ 4.0 arc minute
Polar pattern width	0.5 degree
X-range signal polarization	circular right-hand and left-hand
X-range signal modulation	BPSK, QPSK, OQPSK, UQPSK, 8PSK
Transmission rate	≥ 75.0 Msps

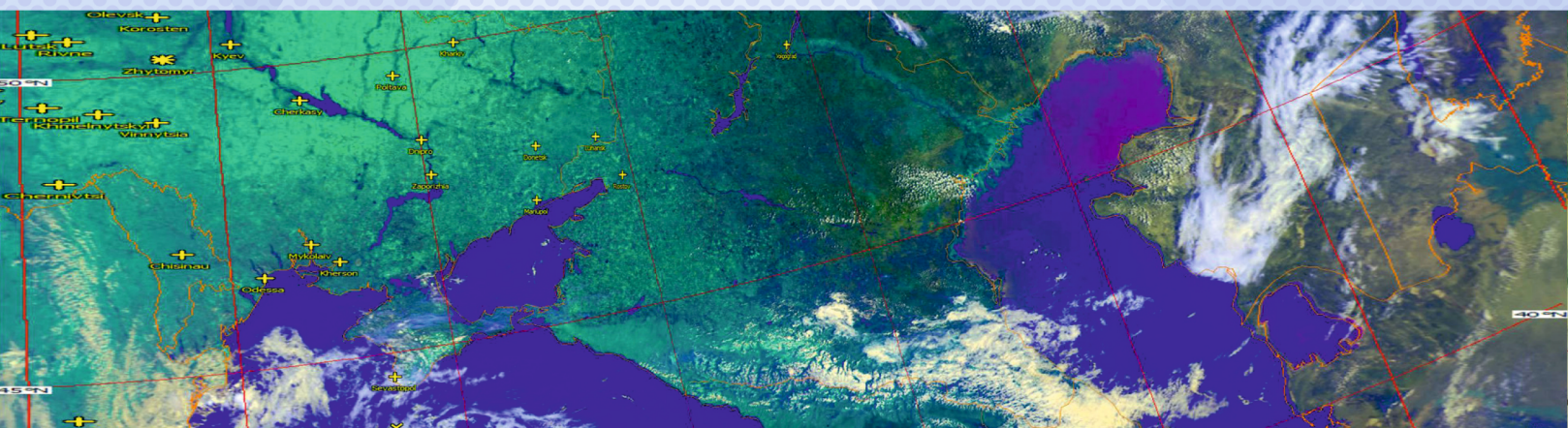
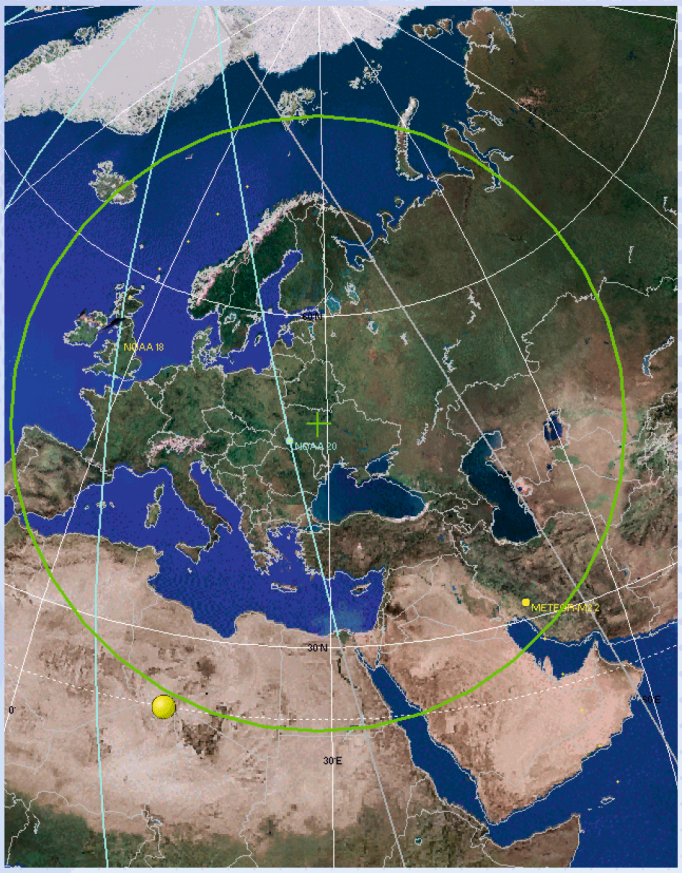
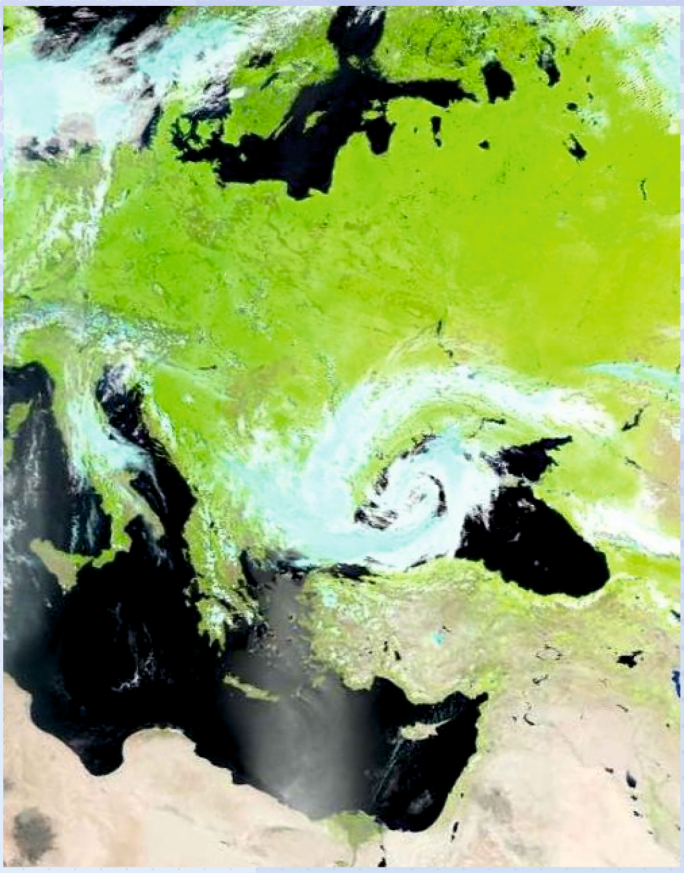


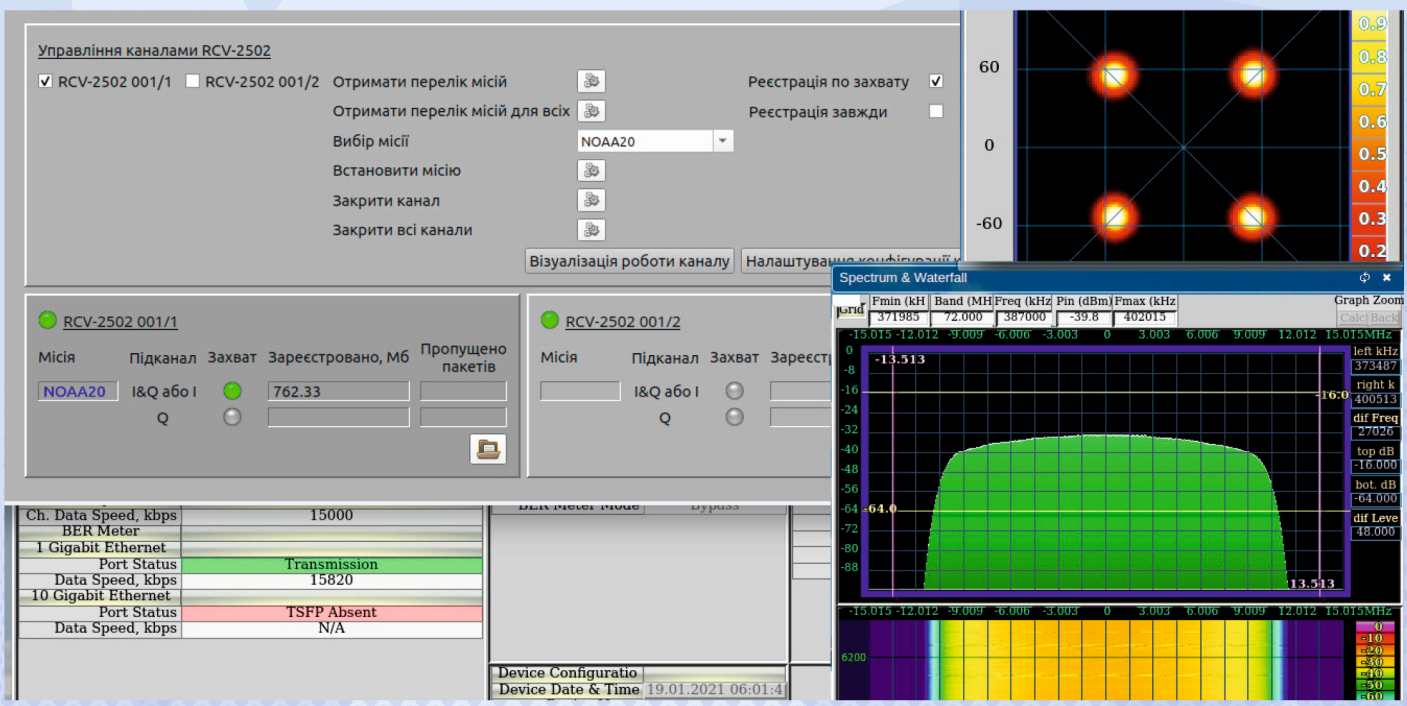
ILLUSTRATION: session diagram and space image

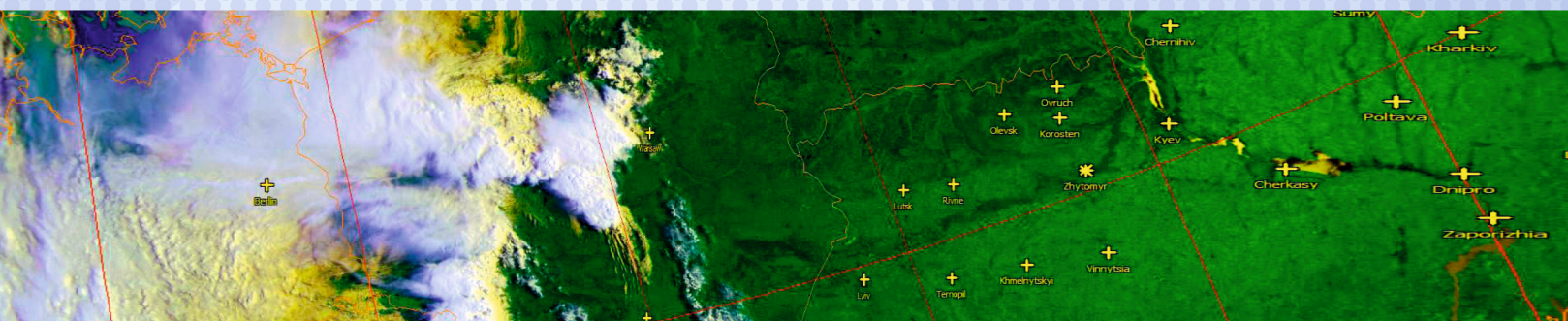


GIRS-8.2 communication session diagram from SC NOAA-20 18.06.2021 13:59 – 14:12



Received image (device VIIRS)





The GIRS-1.7 ground-based station for ERS data receiving is designed for receiving, registering and front-end processing of ERS data with low and medium spatial resolution from meteorological and natural resource SC in the UHF band 1.6–1.71 GHz, registering and front-end processing of received data.

Antenna assembly

GIRS-1.7

GIRS-1.7 main specifications

Frequency band	1.6–1.71 GHz
Height of the ERS SC orbits	400 – 36 000 km
Antenna type	Parabolic
Reflector diameter	2.4 м
Antenna rotation sector: azimuth angle of elevation	 0... ± 180 degree 0...85 degree
Antenna movement rate: azimuth rotation angle of elevation rotation	 ≤ 10.0 degree/sec ≤ 10.0 degree/sec
Antenna guidance	manual, preset
Guidance error	≤ 6.0 arc minute
Polar pattern width	4.0 degree
X-range signal polarization	circular right-hand
X-range signal modulation	PPSK, QPSK
Transmission rate	≤ 30.0 Msps

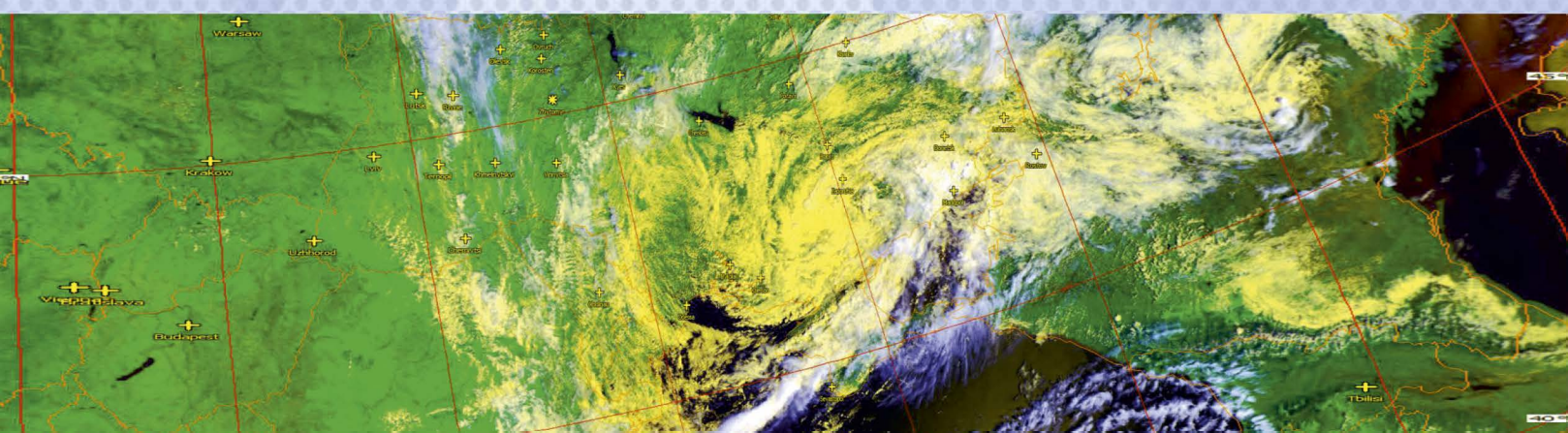
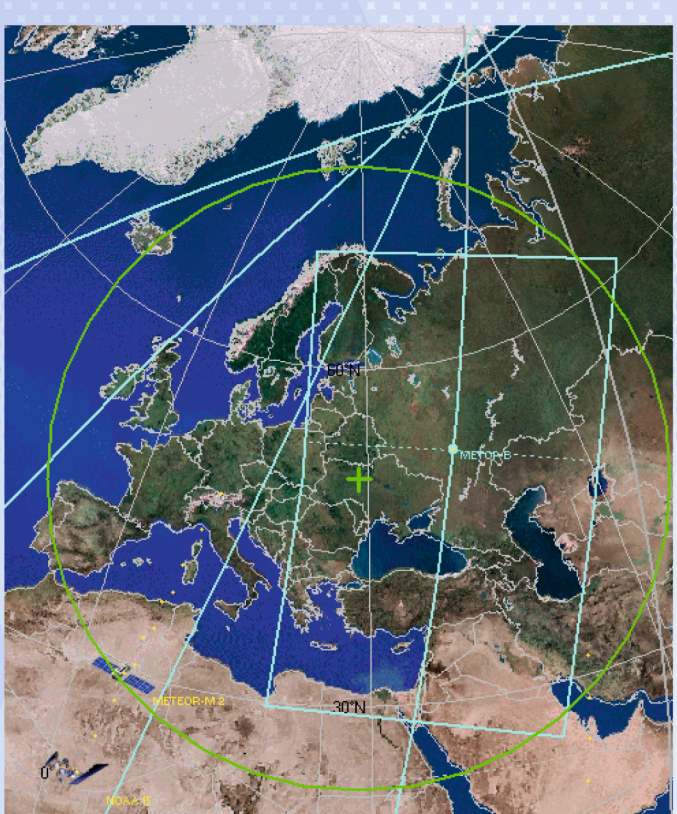
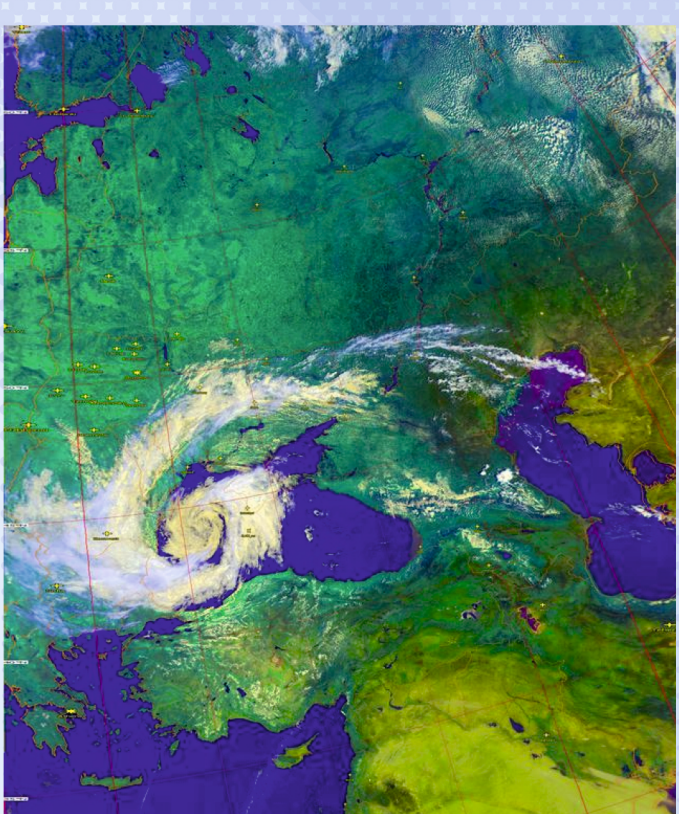


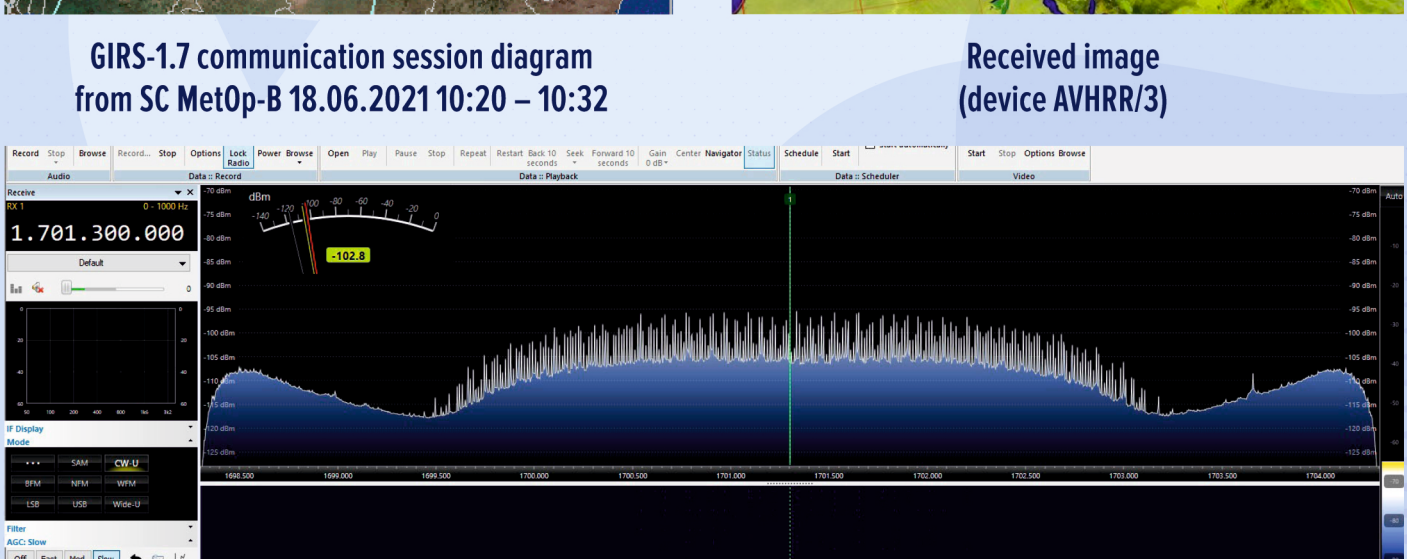
ILLUSTRATION: session diagram and space image

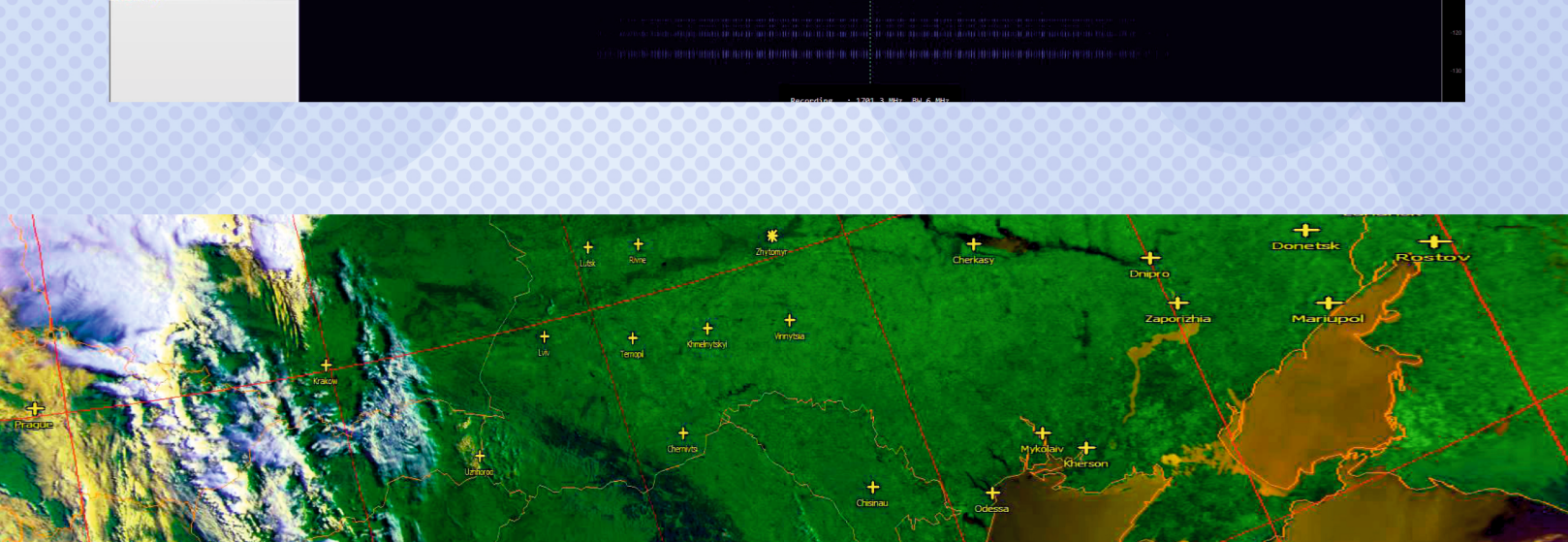


GIRS-1.7 communication session diagram
from SC MetOp-B 18.06.2021 10:20 – 10:32



Received image
(device AVHRR/3)





The GIRS-137 training station for ERS information receiving is designed for receiving and processing ERS data with low spatial resolution (1.0 ÷ 4.0 km) transmitted from meteorological SC in direct broadcasting mode in the VHF band137–138 MHz.

Antenna assembly

GIRS-137

GIRS-137 main specifications

Frequency band	137–138 MHz
Height of the ERS SC orbits	400 – 800 km
Antenna type	Turnstile
1/4-wavelength dipoles length	538 mm
1/2-wavelength dipoles length	1195 mm
Radio coverage zone: azimuth angle of elevation	 360 degrees 0 – 90 – 0 degree
Polar pattern	Circular
Number of data receive chains	1
Signal polarization	Circular
Signal modulation	FM–AM
Transmission rate	Analog data signal

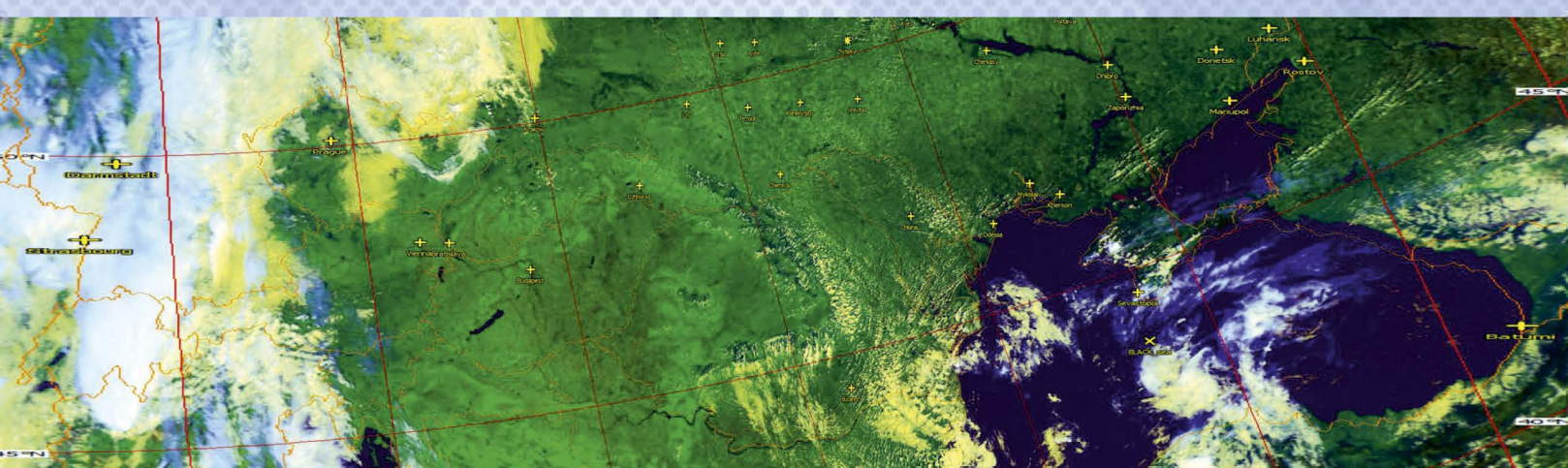
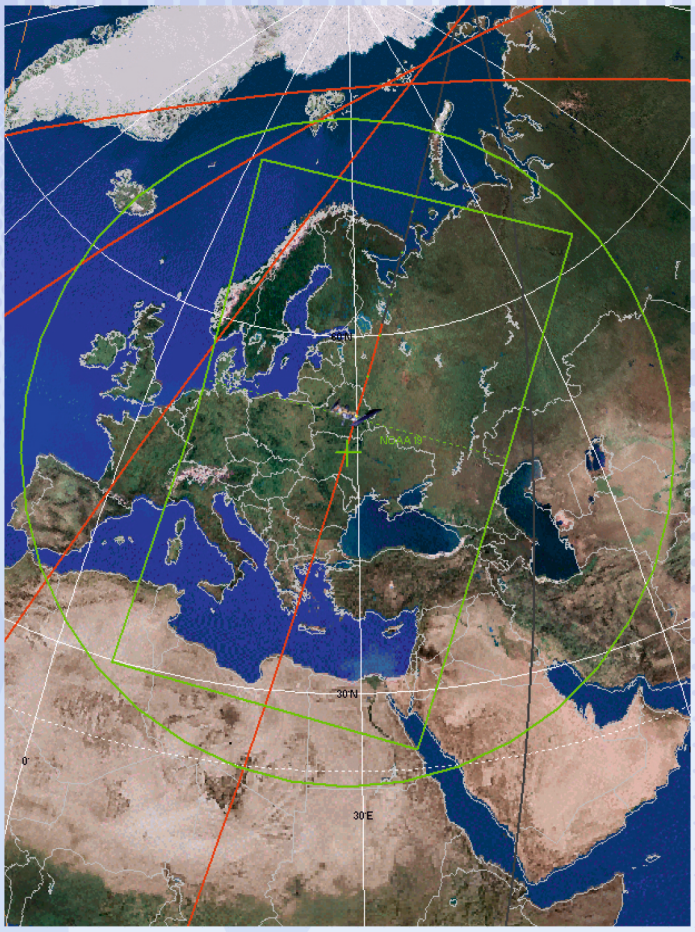
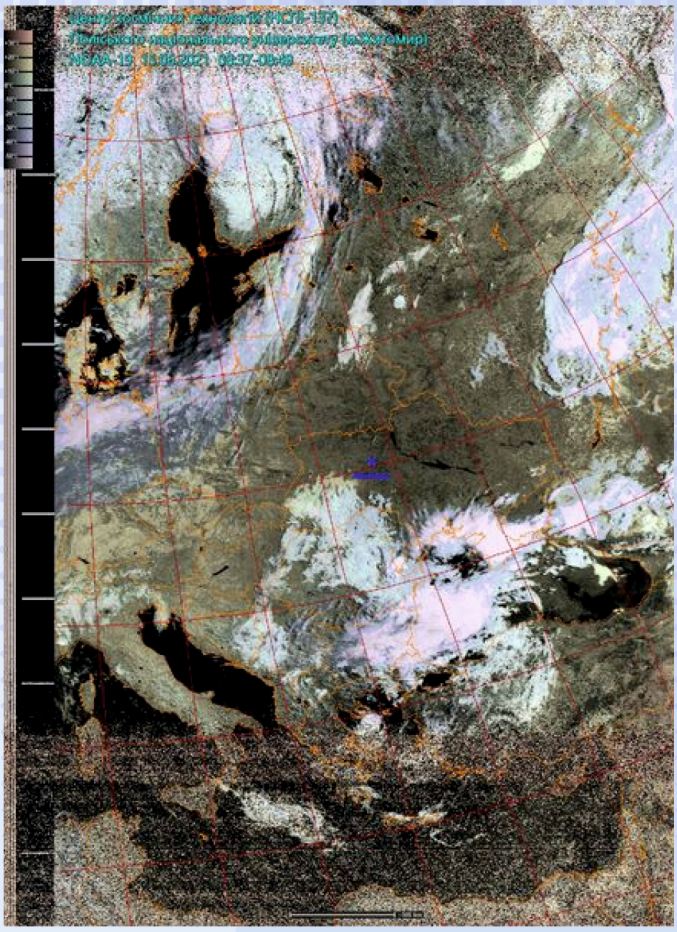


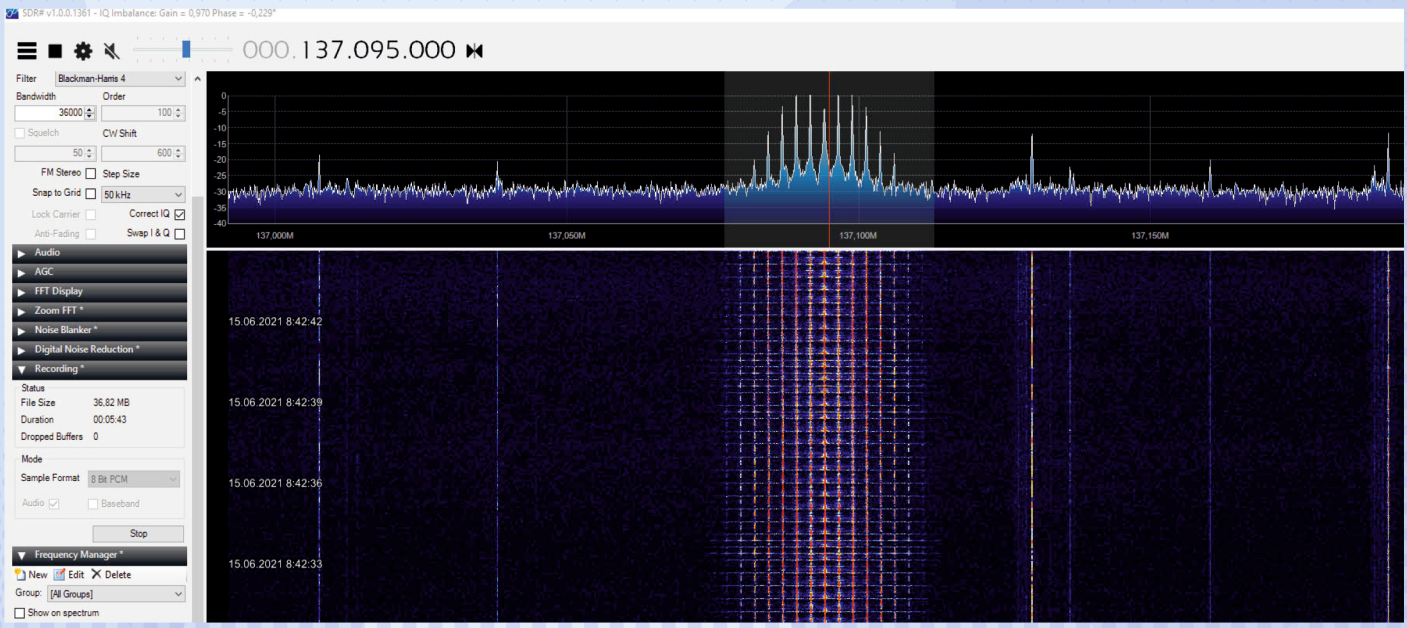
ILLUSTRATION: session diagram and space image

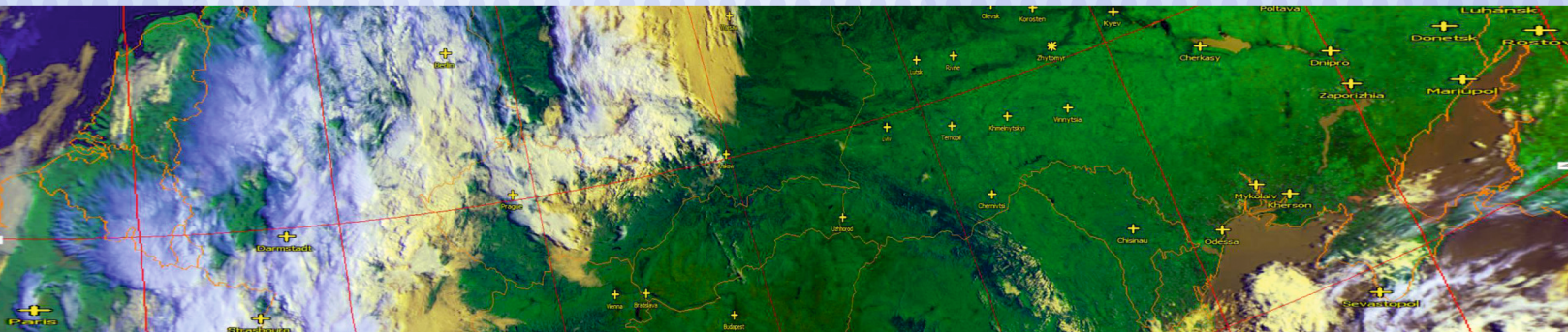


GIRS-137 communication session diagram
from SC NOAA-19 15.06.2021 08:37-08:49



Received image
(device AVHRR/3)





Software and hardware complexes for planning, receiving, front-end and thematic processing of ERS data from SC, generation and reporting of data from space monitoring of the Earth:

- **mission planning** – Wxtrack
- **data receiving** – SDR Console, SDRSharp
- **data processing** – RT-STPS, IPOPP, C-BPSK-Demodulator,QPSK-Demodulator, MetFy3x, Launcher MetOp Viterbi Decoder + Deframer, ReadHRPT, SatSignal, LRPTrx, LRPToffLineDecoder, CorrectGeometry

GIC SME "REGION" supports the following SC and sensors:

Spacecrafts	Hardware
VHF-band	
NOAA-15 (NOAA-K) NOAA-18 (NOAA-N) NOAA-19 (NOAA-N)	AVHRR/3
L-band	
NOAA-15 (NOAA-K) NOAA-18 (NOAA-N) NOAA-19 (NOAA-N)	A-DCS, AMSU-A, AVHRR/3, HIRS/4, MHS,S&RSAT,SBUV/2, SEM
MetOp-B MetOp-C	AVHRR/3
FengYun-3B (FY-3B) FengYun-3C (FY-3C)	VIIR
L-band	
NOAA-15 (NOAA-K) NOAA-18 (NOAA-N) NOAA-19 (NOAA-N)	A-DCS, AMSU-A, AVHRR/3, HIRS/4,MHS,S&RSAT, SBUV/2, SEM
MetOp-B MetOp-C	AVHRR/3
FengYun-3B (FY-3B) FengYun-3C (FY-3C)	VIIR
X-band	
Terra (EOS AM-1)	ASTER, CERES, MISR, MODIS, MOPITT
Aqua (EOS-PM1)	AIRS, AMSR-E, AMSU-A, CERES, HSB, MODIS
Aura	HIRDLS, MLS, OMI, TES-limb, TES-nadir
Suomi NPP (NPP) NOAA-20 (JPSS-1)	ATMS, CrIS, OMPS, VIIRS, CERES
MetOp-B MetOp-C	A-DCS, AMSU-A, ASCAT, AVHRR/3, GOME-2, GRAS, IASI, MHS
FengYun-3D (FY-3D)	HIRAS, GAS, GNOS, MERSI-2, MWHS-2, MWRI, MWTS-2, SWS

GIC SME "REGION" can implement any combination of these missions depending on the customer's requirements.

Primary ERS data received in different frequency ranges are archived and stored in wav, raw, raw16, hpt, dat formats.

Data are subjected to front-end processing and stored in mission-specific formats, or as level 0, level 1, level 2 in PDS, HDF, h5, tif, bmp, jpg formats.

OUR COMPETITIVE ADVANTAGES: • immediacy • reliability

We always receive, process and deliver satellite data quickly and at the right time.

GIC SME "REGION" data can be used for thematic processing of ERS data in the interests of:

METEOROLOGY	
1.1	Quick analysis, assessment and forecasting of the meteorological situation in a region and in separate administrative-territorial units, in particular:
1.2	Precipitation estimation and forecasting
1.3	Drought and dry wind forecasting
ENVIRONMENTAL PROTECTION	
2.1	Impact analysis of man-made and natural disasters (high water, floods, wildfires, explosions, hurricanes, etc.) throughout the country.
2.2	Tracking climate change and its impact on the environment
AGRICULTURE	
3.1	Land surface temperature
3.2	Normalized difference vegetation index (NDVI)
3.3	Normalized difference water index (NDWI)
3.4	Normalized difference snow index (NDSI)
3.5	Normalized difference drought index (NDDI)
3.6	Index of Drought (ID)
WATER MANAGEMENT	
4.1	Sea surface temperature
4.2	Monitoring of water bodies
FOREST MANAGEMENT	
5.1	Detection of temperature anomalies (wildfires) in forest areas throughout the country.
5.2	Prediction of fire-hazardous areas
CRISIS MANAGEMENT (emergencies)	
6.1	Detection of temperature anomalies (wildfires) throughout the country.
6.2	Snowmelt monitoring
6.3	Monitoring of emergencies and their consequences (wildfires, floods, storms, etc.)


ПОЛІСЬКИЙ
НАЦІОНАЛЬНИЙ УНІВЕРСИТЕТ


ЦЕНТР
КОСМІЧНИХ ТЕХНОЛОГІЙ

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