ROSHYDROMET updates since CGMS-53 and report on the medium to long-term future plans on earth observation

Presented to CGMS-54 plenary session, agenda item 6

Coordination Group for Meteorological Satellites

CGMS

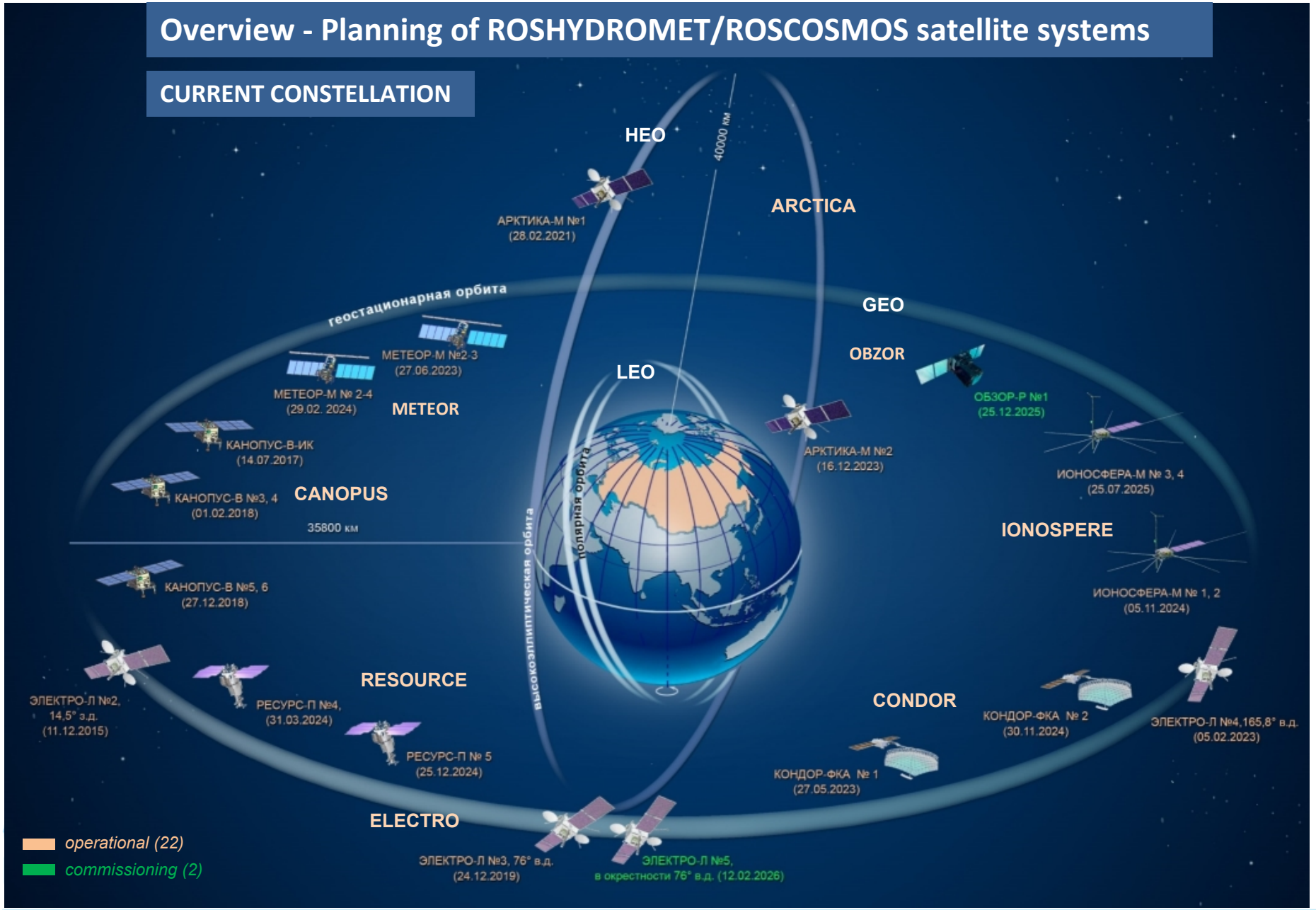
Executive summary

This document addresses the current status of the Russian satellite systems for hydrometeorology and heliogeophysics.

Since CGMS-53 the Russian hydrometeorological satellite constellation has been increased by 2 polar-orbiting heliogeophysical satellites Ionosphere-M N3 and Ionosphere-M N4 launched on 5 November 2025 by group launch and 1 geostationary satellite Electro-M N5 launched on 12 February 2026.

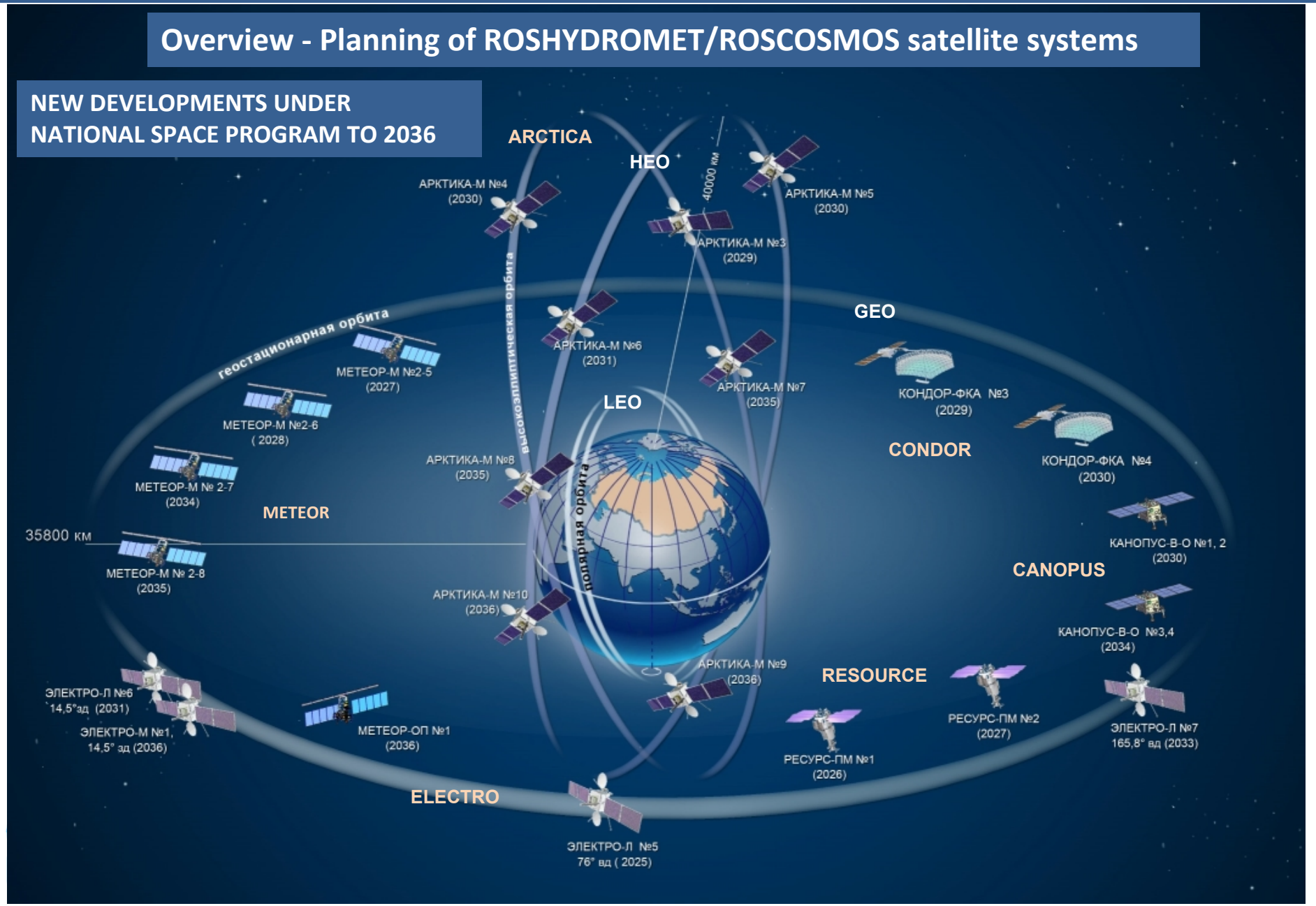
Overview - Planning of ROSHYDROMET/ROSCOSMOS satellite systems

CURRENT CONSTELLATION



Overview - Planning of ROSHYDROMET/ROSCOSMOS satellite systems

NEW DEVELOPMENTS UNDER NATIONAL SPACE PROGRAM TO 2036



CURRENT GEO SATELLITES

- Electro-L constellation standing points:
  14,5 ºW – Electro-L N2
  76 ºE – Electro-L N3, N5*
  165,8 ºE – Electro-L N4

  * under commissioning by end June 2026

- Instrument payload:
  - MSU-GS imager
  - Heliogeophysical complex GGAK-VE
  - Data collection system
  - COSPAS-SARSAT system
  - direct broadcast HRIT/LRIT

- Objectives of Electro-L mission:
  - Continuous observation of the Earth disc within a radius of 55-60 degrees centered at the sub-satellite point;
  - Simultaneous images of cloud cover and the Earth's surface in 3 visible and 7 infrared channels;
  - Heliogeophysical measurements at geostationary orbit altitudes;
  - Collection and retransmission of the hydrometeorlogical data from national and international platforms (DCPs);
  - Retransmission of the data from Roshydromet regional centers;
  - Data dissemination in HRIT/LRIT formats to national and foreign users

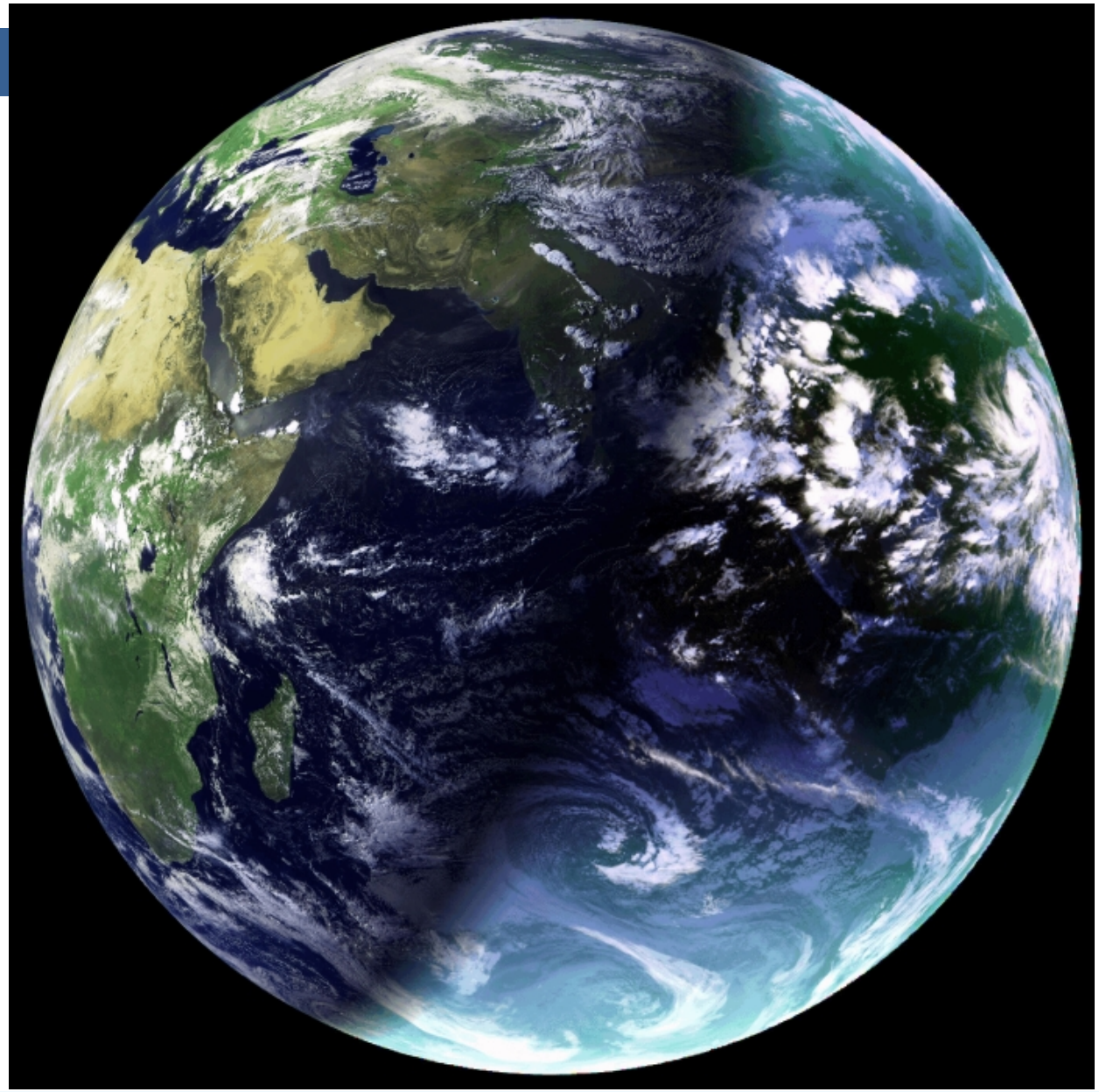
Coordination Group for Meteorological Satellites

CGMS

CURRENT GEO SATELLITES

Electro-L N5
MSU-GS animation
VIS – daytime
IR - nighttime

28-29/05/2026



Coordination Group for Meteorological Satellites

CGMS

CURRENT HEO SATELLITES

- The main purposes of the mission Arctica-M are meteorology, oceanography, including ice cover monitoring and disaster monitoring in the Arctic region. To perform operational monitoring of polar regions 24 hours a day each of two satellites is covering the area for ~6 hours and then step back for the next one. The repeat cycle time for each satellite is exactly 12 hours

- Primary objectives of Arctica-M mission:
  - Continuous observation of Arctic and contiguous region
  - Simultaneous images of cloud cover and the Earth's surface in 10 visible and infrared channels
  - Heliogeophysical measurements at orbit altitudes (Electromagnetic solar radiation, corpuscular radiation and terrestrial magnetic fields)
  - The development and maintaining the national data collection system, collection of the hydrometeorlogical data from national and international platforms
  - Two-way radio communication with stations of Roshydromet hydrometeorlogical network

CURRENT HEO SATELLITES

- Arctica-M N1 and N2 payload is similar to those of Russian geostationary satellites and includes:
  - MSU-GS/VE imager in 3 visible channels (1 km spatial resolution) and 7 IR channels (4 km spatial resolution)
  - GGAK-VE Heliogeophysical Measurements Suite
  - Data collection system (DCS)

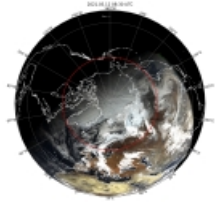
- Both Arctica-M N1 and N2 satellites are functional without limitations

- The ground segment for Arctica-M constellation is based on SRC Planeta/Roshydromet satellite centers, responsible for receiving, processing, disseminating and archiving of satellite data: European (Moscow, Obninsk), Siberian (Novosibirsk) and Far-Eastern (Khabarovsk)

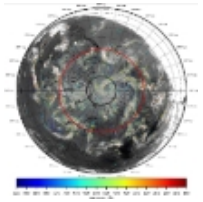
CURRENT HEO SATELLITES

Weather forecasting

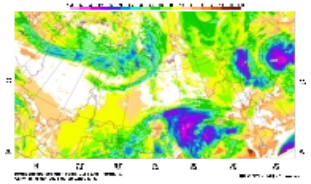
Animated maps



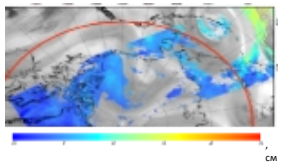
AMVs



Cloud top temperature, cloud top height

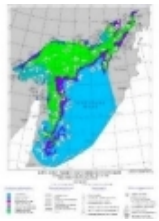


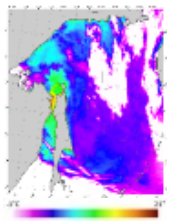
Total water content



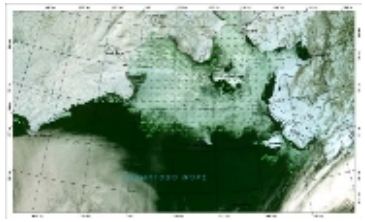
Sea and ice analysis

Ice cover and temperature maps

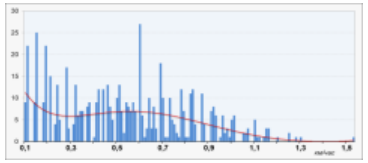




Ice drift

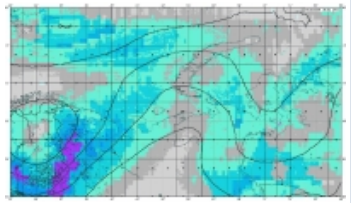


Ice drift velocity

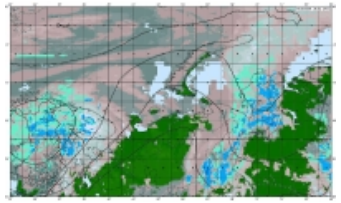


Aviation-related products

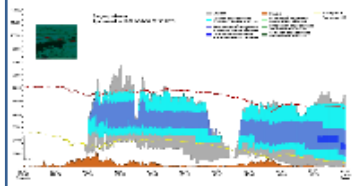
Near-surface wind gusts speed



Precipitation area and intensity

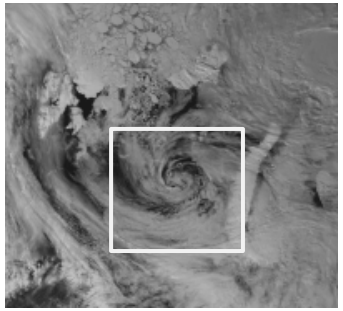


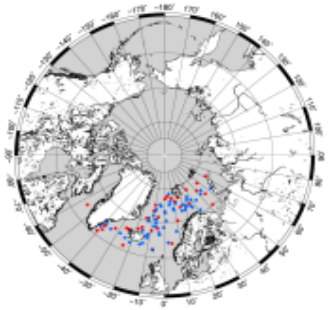
Vertical sections of clouds and ice



Natural hazards

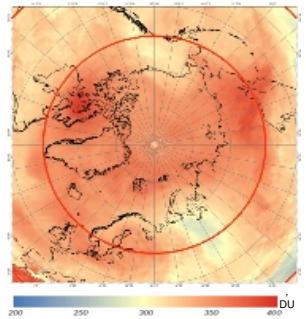
Polar mesoscale cyclones



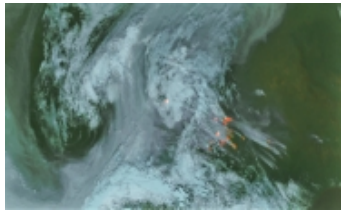


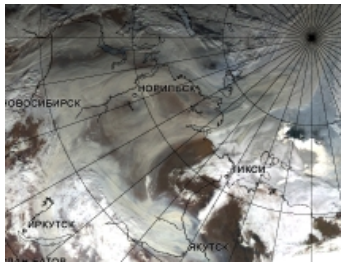
Ecological applications

Total ozone content



Forest fires

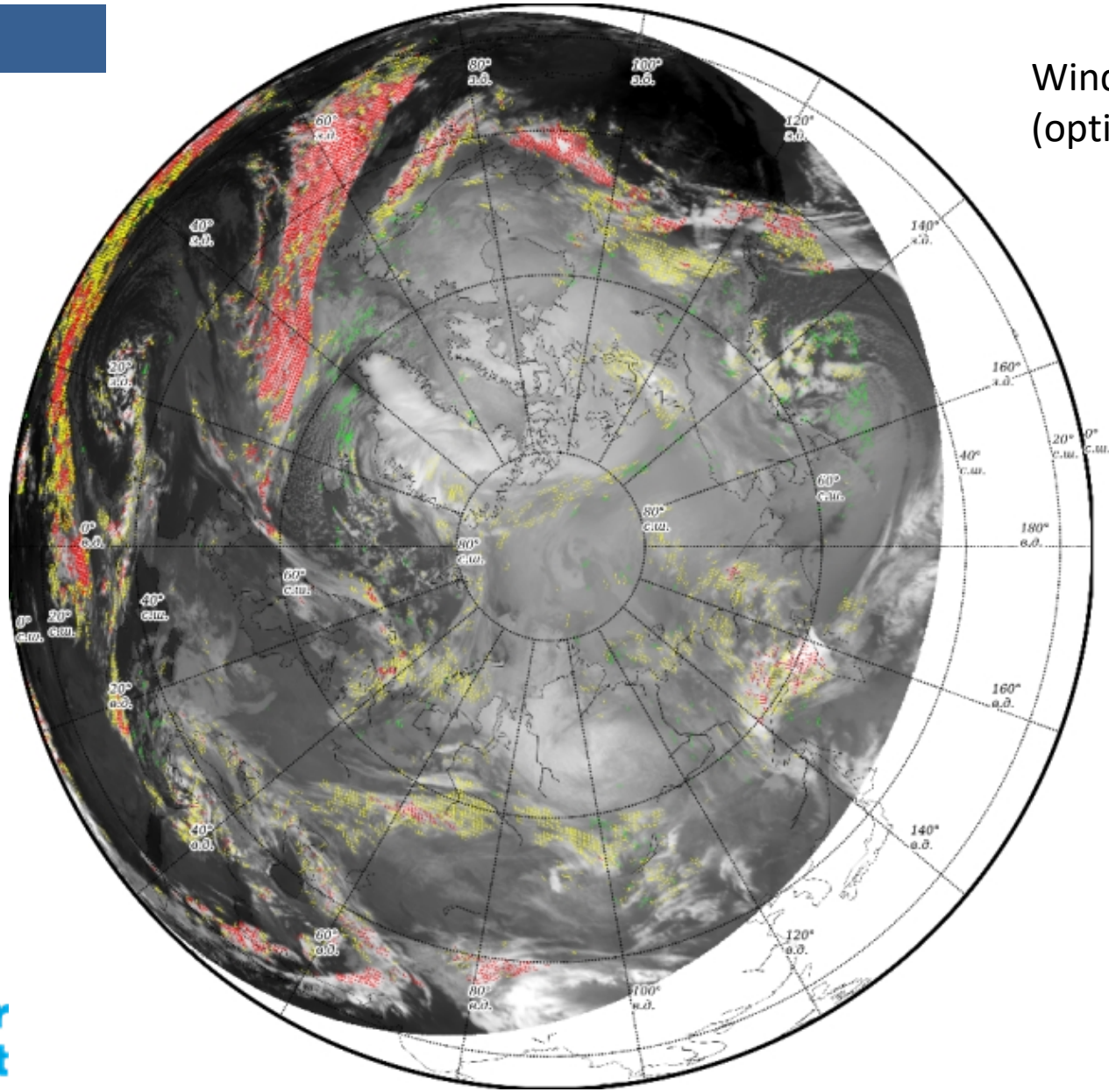




Coordination Group for Meteorological Satellites

CGMS

CURRENT HEO SATELLITES



Wind vectors map from Arctica-M N1
(optical flow algorithm)

21/03/2026

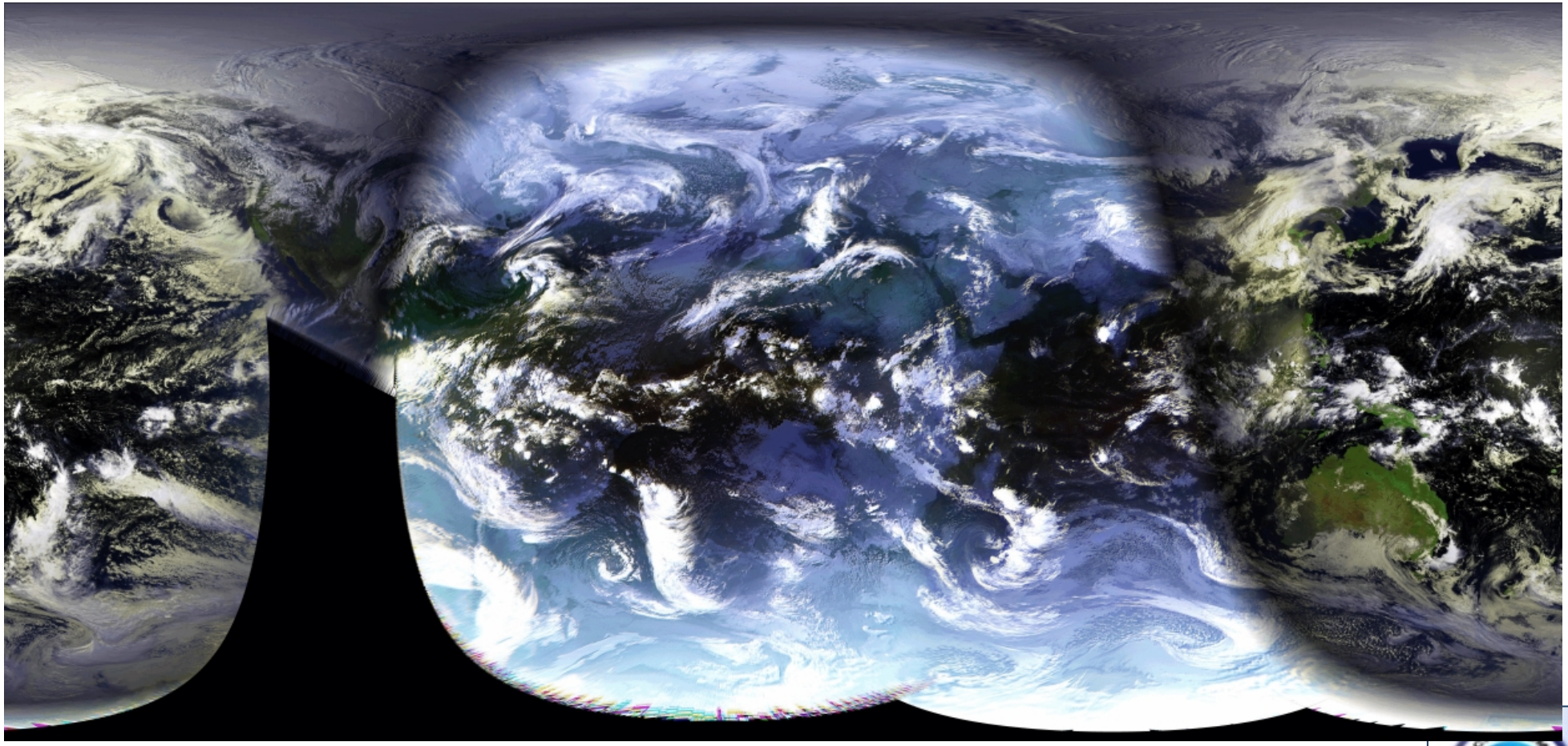
0:15 UTC

Coordination Group for Meteorological Satellit

CGMS

CURRENT GEO/HEO SATELLITES

Global cloud animation combined of Electro-L N2, N3, N4 and Arctica-M N1, N2 VIS & IR data.



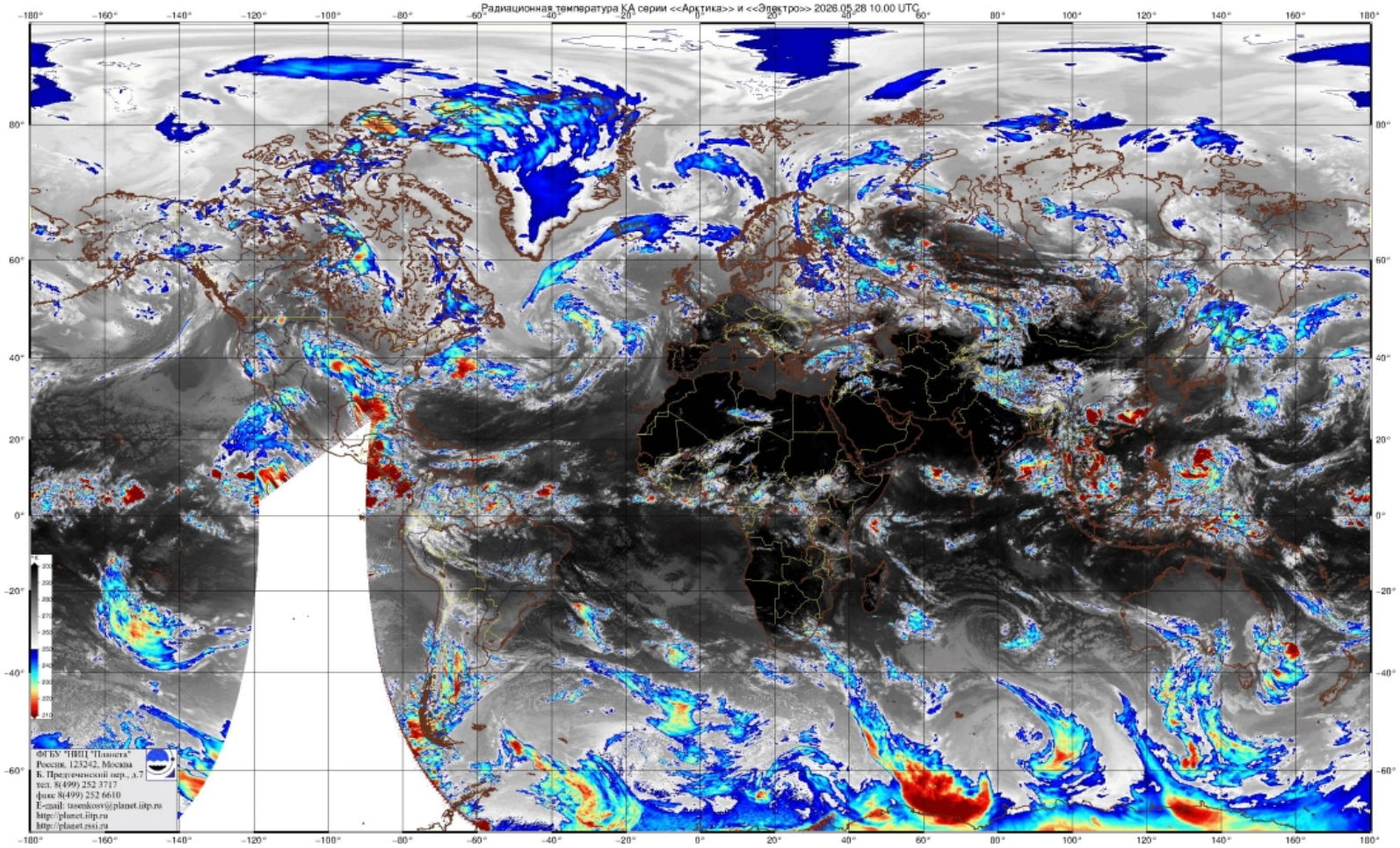
28-29/05/2026

Coordination Group for Meteorological Satellites

CGMS

CURRENT GEO/HEO SATELLITES

Global cloud top temperature animation combined of Electro-L N2, N3, N4 and Arctica-M N1, N2 IR data



28-29/05/2026

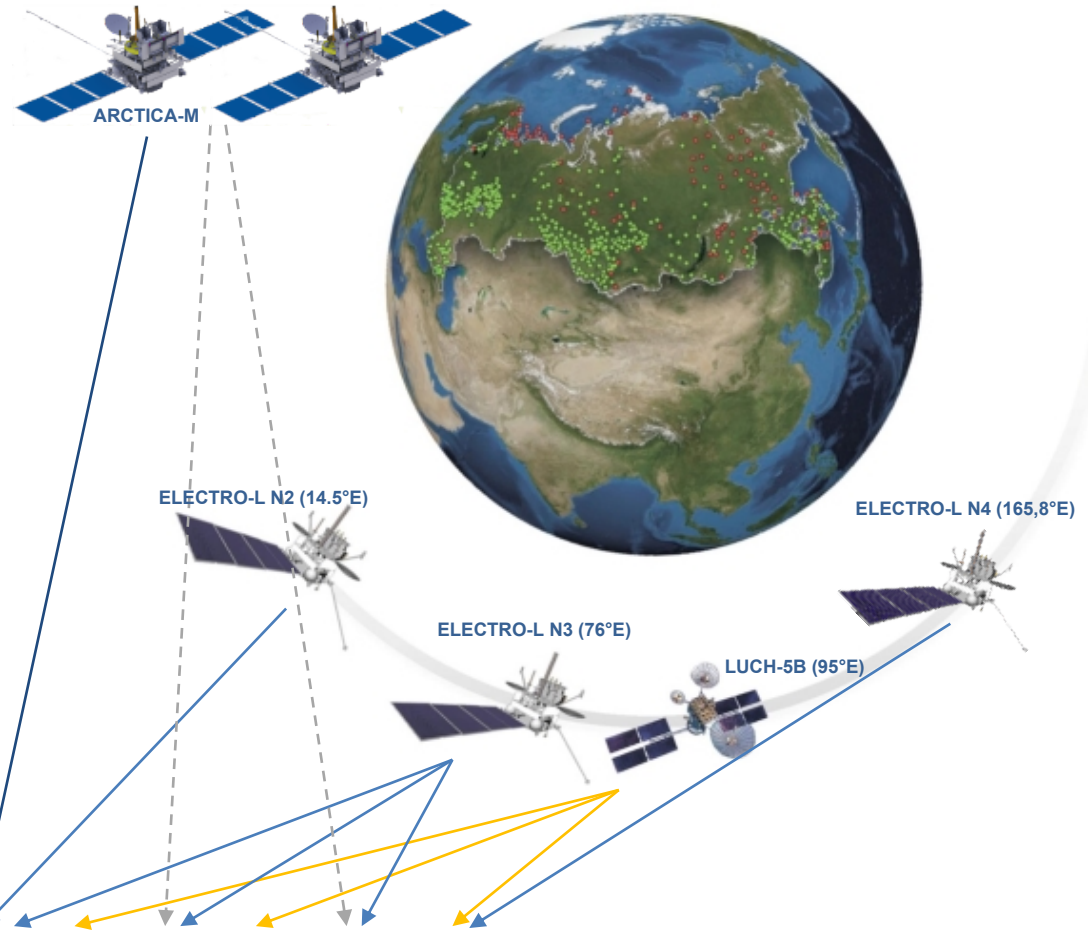
Coordination Group for Meteorological Satellites

CGMS

CURRENT GEO/HEO SATELLITES

DCS comprises of the network of DCPs at Roshydromet' observational sites, relay transponders at Russian satellites of 3 Electro-L, 2 Arctica-M and Luch series, and ground receiving stations at SRC Planeta satellite centers.

Data is currently being collected from 698 Roshydromet's observation network (● ● ●), including 137 difficult to access stations (●).



Coordination Group for Meteorological Satellites

CGMS

CURRENT LEO SATELLITES

- Two Meteor-M series satellites are now operational on sun-synchronous orbit with ~820 km height, 98.8°inclination:
  Meteor-M N2-3 - “morning” orbit, ascending equator crossing time ~ 9:30
  Meteor-M N2-4 - “morning” orbit, ascending equator crossing time ~ 2:30

  Meteor-M N2-2 has been decommissioned since January 2025

- Instrument payload operational for now:
  - MSU-MR Scanning Radiometer (1 km spatial resolution multichannel scanning unit, 6 channels, VIS/IR);
  - KMSS VIS Scanning Imager (6 channels implemented by 3 cameras, 50 m and 100 m spatial resolution);
  - MTVZA-GY Imaging/Sounding Microwave Radiometer (module for temperature and humidity sounding of the atmosphere, 26 channels, 10.6 183 GHz);
  - IKFS-2 - IR Fourier-transform spectrometer (IR atmospheric sounder, spectral range 5-15 mkm, spectral resolution ~ 0.5 cm -1);
  - METEOSAR X-band Synthetic Aperture Radar (onboard only Meteor-M N3 and N2-4);
  - GGAK-M Heliogeophysical Measurements Suite;
  - Data collection system (DCS)
  - COSPAS-SARSAT system

Coordination Group for Meteorological Satellites

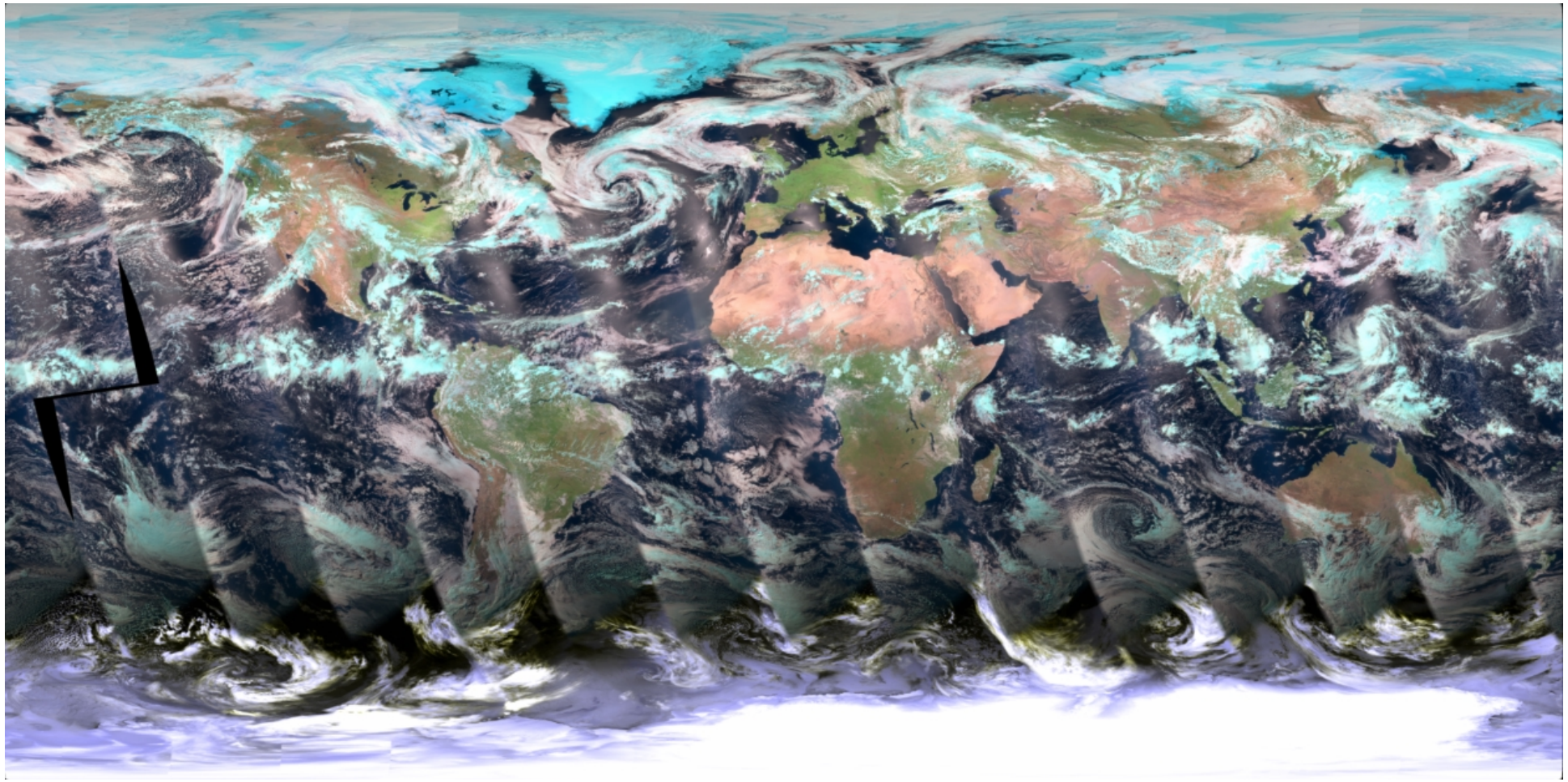
CGMS

CURRENT LEO SATELLITES

- The main objective of Meteor-M mission is to provide global observations of the Earth's surface and the atmosphere for the following purposes:
  - Weather analysis and forecasting on global and regional scales
  - Global climate change monitoring;
  - Sea surface observations;
  - Sea ice observations;
  - Disaster monitoring;
  - Space weather analysis and prediction (solar wind, ionosphere research, Earth's magnetic field, etc.).

- Meteor-M N2-3, N2-4 has three downlink radio lines:
  - 2-channel X-band radio link (8.192 GHz and 8.320 GHz) with 122.88 Mbps data transmission rate in each channel (not operational on Meteor-M N2-3)
  - L-band radio link (1.7 GHz) with 665.4 Kbps data transmission rate (HRPT data transmission);
  - VHF-band radio link (137 MHz) with 80 Kbps data transmission rate (LRPT data transmission).

CURRENT LEO SATELLITES



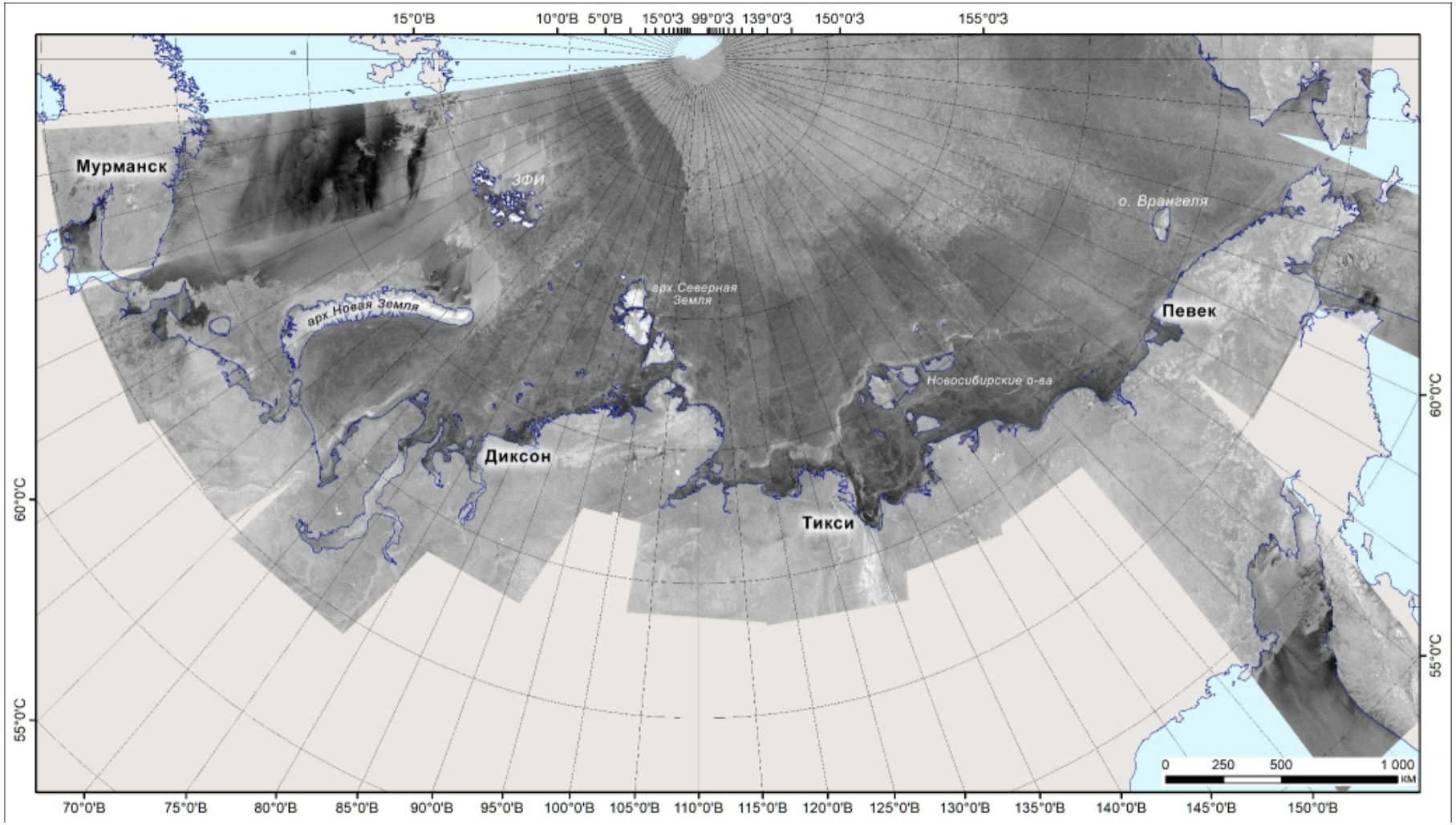
Global coverage of Meteor-M MSU-MR VIS & IR data

28/05/2026

Coordination Group for Meteorological Satellites

CGMS

CURRENT LEO SATELLITES



Arctic ocean coverage of Meteor-M N2-4 METEOSAR for ice conditions analysis along the Northern Sea Route

20-23/03/2026

Coordination Group for Meteorological Satellites

CGMS

CURRENT LEO SATELLITES

- Status of spacecraft:

  Meteor-M N2-3 is operational with limitations: Due to failure of X-band radio link the transmission of global data and SAR data is not supported.

  Meteor-M N2-4 is operational with limitations: METEOSAR is operational only separately of other payload since METEOSAR and other sensors need different spacecraft orientation.

- Meteor-M LEO constellation is planned to consist of 4 spacecrafts (including 1 oceanographical) to provide meteorological data over Russian Federation at least 8 times per day at synoptic times every 3 hours.

FUTURE GEO SATELLITES

Mission	Operator(s)	Orbit	Launch planned	Instruments
Electro-L N6	ROSHYDROMET /ROSCOSMOS	GEO standing point 14,5W	2031	- MSU-GS, - GGAK-VE, - DSC, - COSPAS-SARSAT, - direct broadcast HRIT/LRIT
Electro-L N7	ROSHYDROMET /ROSCOSMOS	GEO standing point 165,8E	2033	
Electro-M N1	ROSHYDROMET /ROSCOSMOS	GEO, standing point TBD	2033	- MSU-GSM imager with ~20 channels, - hyperspectral sounder IKFS-GS, - lightning detector, - radiation balance radiometer, - heliogeophysical complex KGI, - DSC, - COSPAS-SARSAT, - direct broadcast HRIT/LRIT
Electro-M N2	ROSHYDROMET /ROSCOSMOS	GEO, standing point TBD	2034	

- Electro-L N6 and N7 are the serial satellites planed to maintain the current constellation
- New generation GEO satellite series Electro-M with extended useful payload is planned to start on 2033

Coordination Group for Meteorological Satellites

CGMS

FUTURE LEO SATELLITES

Mission	Operator(s)	Orbit	Launch planned	Instruments
Meteor-M N2-5	ROSHYDROMET /ROSCOSMOS	LEO, ECT TBD	2027	• MSU-MR • MTVZA-GY • IKFS-2 • KMSS • DCS • METEOSAR • GGAK-M2 • COSPAS-SARSAT
Meteor-M N2-6	ROSHYDROMET /ROSCOSMOS	LEO, ECT TBD	2028	
Meteor-M N2-7	ROSHYDROMET /ROSCOSMOS	LEO, ECT TBD	2034	
Meteor-M N2-8	ROSHYDROMET /ROSCOSMOS	LEO, ECT TBD	2035	
Meteor-OP N1	ROSHYDROMET /ROSCOSMOS	LEO, ECT TBD	2036	• MSU-MR-MP (20 channels) • MTVZA-MP • IKFS-3 • SA-MP - atmosphere gas content spectrometer • SCAT-MP - sctterometer • ARMA-MP - radio occultation sounder • KGI-MP - heliogeophysical complex • DCS • COSPAS-SARSAT

- Meteor-M N2-5 - N2-8 will be serial identic satellites to form LEO constellation
- Meteor-OP will start next generation LEO constellation with improved characteristic and new payload incl. scatterometer, radio occultation sounding, greenhouse gas spectrometer

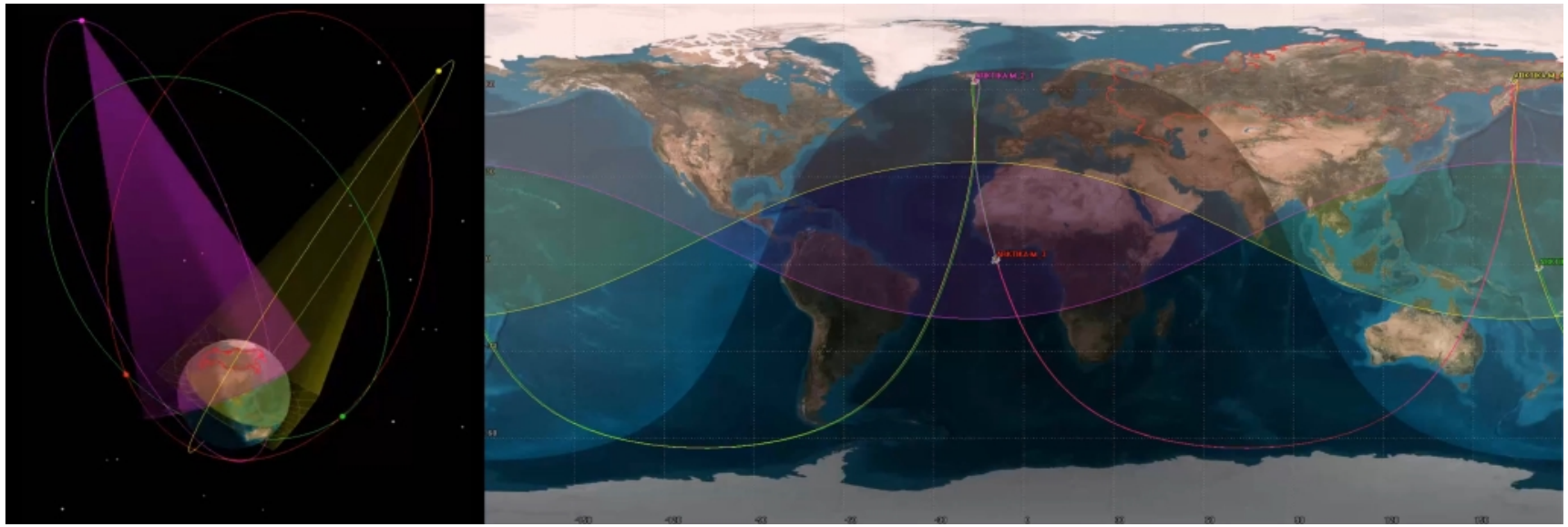
Coordination Group for Meteorological Satellites

CGMS

FUTURE HEO SATELLITES

Mission	Operator(s)	Orbit	Launch planned	Instruments
Arctica-M N3, N4	ROSHYDROMET/ROSCOSMOS	HEO Molnya Orbit	2029	• MSU-GS/HE • GGAK-VE • DSC
Arctica-M N5, N6	ROSHYDROMET/ROSCOSMOS	HEO Molnya Orbit	2030	
Arctica-M N7, N8	ROSHYDROMET/ROSCOSMOS	HEO Molnya Orbit	2035	
Arctica-M N9, N10	ROSHYDROMET/ROSCOSMOS	HEO Molnya Orbit	2036	

- The HEO constellation of 4 spacecraft will allow to double the periodicity of observation from two angles
- The next satellites will be launched to maintain the constellation by exchange of those ending active existence



Coordination Group for Meteorological Satellites

CGMS

CONCLUSIONS

Russian Federation is currently developing a national constellation of both geostationary and polar orbiting meteorological satellites. It is complemented by the satellites at highly elliptical “Molnya” type orbits for frequent coverage of the northern areas.

Thanks for attention!

Coordination Group for Meteorological Satellites

CGMS