

SATELLITE PRODUCTS AND APPLICATION: ROSHYDROMET ACTIVITIES

Summary and purpose of the WP

The document presents an overview of Roshydromet/SRC PLANETA activities in the area of satellite data routine processing and derivation of operational products. The satellite products are applied by Roshydromet in various application areas, including operational meteorology, NWP, hydrology, agrometeorology, hazards (fires, floods) and pollutions monitoring, climate studies. Examples of some satellite products are demonstrated.

Action proposed: no action required.

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Roshydromet core ground segment capabilities

The major components of the Roshydromet's ground segment are three Main Regional satellite data receiving and processing Centers at different locations: European (Moscow, SRC Planeta), Western-Siberian (Novosibirsk) and Far-Eastern (Khabarovsk). The ground segment also includes the network of APT, HRPT and WEFAX receiving stations. Roshydromet's main satellite Center SRC Planeta (Moscow) performs a scientific and methodological management and coordinates the activities of the above-mentioned acquisition Centers and stations. The radiovisibility circles of these Centers cover the whole territory of Russia as well as Baltic States and major part of Europe.

Current SRC Planeta receiving facilities provide on a regular basis the data acquisition from geostationary (METEOSAT-7 and METEOSAT-5, GOES-E, GOES-W, GOES-9 via METEOSAT-7) and polar-orbiting (Meteor-3M N 1, NOAA series, EOS/Terra/Aqua) satellites. On the base of raw data analysis and processing SRC Planeta produces every day above 50 types of products (namely maps of cloud cover, SST, vegetation, ice, and snow cover, atmospheric temperature/humidity sounding, as well as products related to floods and forest fires monitoring, and detection of water and snow cover pollution, etc.). Satellite informational products are disseminated for more than 60 users.

Current activities within Roshydromet and SRC Planeta are concentrated on providing all operational functions and services (satellite data acquisition, processing, generation and dissemination of products) as well as on the preparation to the forthcoming satellites data handling and fulfillment of their mission objectives. In line with this the ground segment preparation to the launch of oceanographic satellite SICH-1M is underway.

The development of future METEOR and GOMS-Electro ground segments is being continued (receiving stations, hardware, software and communication links). Some elements of future METEOR ground segment have been tested in the framework of METEOR-3M N 1 commissioning phase and exploitation.

Below the progress in SRC Planeta satellite products generation is briefly outlined.

Cloud imagery and cloud analysis

Cloud imageries and cloud cover parameters continue to be one of key output products derived from polar orbiting and geostationary meteorological satellites data. Mosaics of infrared images over Eurasia are constructed from Meteosat 7, Meteosat 5 and GOES-9 data. Similar global mosaics are generated daily on the basis of various compositions of imageries provided by 5 geostationary satellites. On the other hand, some "quantitative" cloud products are derived daily, including estimates of cloud cover fraction, cloud top temperature and height (CTTH). Now the validation of CTTH is being continued. Clouds nephanalysis maps are produced every day on the base of AVHRR NOAA data.

Regional temperature-humidity soundings of the atmosphere from ATOVS/NOAA data

The efforts have been continued at SRC Planeta on the refinement and implementation the ATOVS/NOAA data processing system, intended for the retrieval of atmospheric temperature-humidity vertical profiles. Currently the processing of locally received HRPT ATOVS data is performed using Integrated Processing System (IPS), moreover operational sounding products of local coverage are available once per day. The algorithm and software refinement and updates were focused on the retrieval of the adequate first guess (independent on NWP output products) as well as on the operational evaluation and correction of retrieved profiles. The last version of IPS has been released in January 2003. According to results of IPS testing for February 2003 – November 2003, it enables to retrieve the temperature profiles with mean accuracy (mean RMS error) of 1.5 K within the layer 1000-70 hPa. Moreover the noticeable accuracy improvement (about 0.3-0.4 K) is achieved comparing to NWP output (12-h forecast).

Sea surface temperature maps

World Ocean surface temperature maps are derived regularly (one per ten days period) from the data provided by 5 geostationary satellites. The accuracy of SST retrievals from geostationary satellites IR data is about 1.5 – 2.0K. Sea surface temperature maps for “inner” and “external” seas of Russia are generated from AVHRR NOAA data one time in 2-3 days with accuracy better than 1K (using standard split-window technique).

Ice cover operational mapping

Currently, the ice cover condition maps for Arctic region and others “inner” and “external” seas of Russia are derived daily from the AVHRR (NOAA) and MODIS (Terra, Aqua) low and moderate resolution data. High resolution (38 m) images provided by MSU-E imager (Meteor 3M N1) are used for detailed analysis of ice condition on seas, rivers, lakes, and reservoirs. After the launch of satellite SICH-1M (in this year) it is planned to renew the radar monitoring of ice covers in Arctic and Antarctic regions.

AMSU-A based maps of snow and ice coverage

The newly developed technique of AMSU-A/NOAA data processing permits to produce on regular basis improved snow and ice cover maps, to detect fractional snow cover and melting snow, as well as to identify ice cover in coastal zones.

Precipitation maps

The new technique has been developed for extraction of precipitation related parameters from combined AMSU-A and AVHRR data. This technique enables to identify precipitation zones and to estimate their intensity (weak, moderate, heavy and more than 300 mm/h) as well as to discriminate the precipitation phase (rain, snow, mixed rain/snow). For convective rains two kinds of estimates are generated: the intensity averaged over short time period (about 1 hour) and maximum intensity.

Identification of hail precipitation

The methodology has been developed and implemented to identify the hailstones (with estimating their size) on the base of combined AMSU-A and AVHRR data processing. It enables to generate on regular basis the maps of hail precipitation over European part of

Russia. Now the validation of these maps is being continued against synoptic observations and NWP output products.

Cloud liquid water mapping

The new technique has been developed to infer information on cloud liquid water (CLW) content over various types of underlying surface (water, land) from combined AMSU-A and AVHRR data. Currently the CLW mapping products are regularly generated (2-3 times per week), moreover they relate to clouds over water and land surfaces and cover European part of Russia. The feasibility of CLW estimates has been proved using available independent data.

Forest fires detection

The detection and mapping of forest fires for whole territory of Russia are carried out in fully automatic regime on the base of AVHRR (NOAA) and MODIS (Terra, Aqua) data using standard hot spot technique. High (38 m) and moderate (250 m) resolution images, provided by MSU-E (Meteor 3M N1) and MODIS (Terra, Aqua) respectively, are used for detailed analysis of forest fires, smokes and burnings dynamics.

Monitoring of sea water and snow cover pollution

The multispectral high-resolution images from Meteor 3M N 1 and moderate resolution images provided by MODIS (Terra, Aqua) are applied for regular detection and mapping of pollution areas on snow cover around industrial centers as well as for monitoring and studies of pollution propagation within sea coastal zones. In this line the monitoring of Eastern coastal zone of Black Sea is carried out using all suitable satellite data.