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Roshydromet space-based observation system: current status and development perspectives

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The report presents an overview of Russian current and future weather and Earth observation satellite systems. According to the Russian Federal Space Program 2006-2016 the efforts are focused on the development and manufacturing the next generation of polar-orbiting (METEOR-M series) and geostationary (ELECTRO-L series) meteorological satellites. The space observation system will consist of three polar-orbiting meteorological and one oceanographic satellites, and three geostationary meteorological satellites. Currently, two spacecrafts of METEOR-M series (Meteor-M №1-2009 and Meteor-M №2-July,2014) and one spacecraft of ELECTRO-L series (Electro-L №1-2011) are already launched. Meteor-M №1 and Electro-L №1 are now considered as experimental. Meteor-M №2 is now in commissioning phase. Along with this two series of environmental satellites is planned to be designed and launched. The first one named Kanopus-V and already launched (2012) is intended for Earth surface monitoring. The series of Resurs-P satellites is being developed to provide detailed Earth surface observations. The Resurs-P №1 satellite was successfully launched in 2013. Basic payload of Meteor-M series satellites consists of: MSU-MR Scanning Radiometer (1 km spatial resolution, 6 channels, VIS/IR); KMSS VIS Scanning Imager (6 channels implemented by 3 cameras, 50 m and 100 m spatial resolution); Severjanin X-band Side-Looking Radar (500 m and 1000 m resolution); MTVZA-GY Imaging/Sounding Microwave Radiometer (26 channels, 10.6-183 GHz); IKFS-2 Infra-Red Fourier-transform Spectrometer (hyperspectral atmospheric sounder, spectral range 5-15 mm, spectral resolution ~ 0.5 cm⁻¹ -on board Meteor-M №2 and succeeding satellites); Data collection system (DCS). Meteor-M №1 has three downlink radio lines including 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). The direct broadcast is operational in L-band in HRPT format. The detailed format description is published at SRC Planeta and WMO websites. Future Meteor-M series of polar-orbiting satellites and their payload, including oceanographic satellite Meteor-M №3 (scheduled for launch in 2020), and forthcoming Meteor-MP series satellites are provided. The geostationary meteorological satellite Electro-L №1 is located at 76E. Along with standard meteorological communication package (DCS and re-transmitters) the key payload consists of MSU-GS imager that provides data in three visible and seven IR channels. The spatial resolution at sub-satellite point is 1 km for visible and 4 km for IR channels. The period between scanning sessions for all channels is 30 min and in the more frequent mode is 15 min. The meteorological data in HRIT format is distributed to some users via SRC Planeta FTP server every 3 hours (standard synoptic hours). According to the Russian Federal Space Program future Electro-L constellation should consist of three similar satellites. Electro-L №2 is scheduled to be placed at 77.8E in the end of 2014. The launch of Electro-L №3 is scheduled in 2015. The payload of Electro-L constellation is similar to Electro-L №1 spacecraft but with improved MSU-GS instrument performance. Arctica-M project of two highly elliptical orbit satellites is outlined. It will provide observations similar to geostationary satellites but over the Arctic region. The payload of Arctica-M satellites will be similar to Electro-L series. The launch of the first Arctica satellite is scheduled for 2015. Roshydromet ground segment consists of three SRC Planeta regional centers, responsible for receiving, processing, disseminating and archiving satellite data: European (Moscow-Obninsk-Dolgoprudny), Siberian (Novosibirsk) and Far-Eastern (Khabarovsk). These centers together give full coverage of the Russia and neighboring territories. It also includes the network of DCP, LRIT and HRIT stations. The main purpose of the segment is to provide data and products for use in operational meteorology, NWP, hydrology, agrometeorology, climate studies and environmental monitoring.