

Observation of Atmospheric Environment over The Arctic and West Siberia using ROSHYDROMET Airplane

*Ryoichi Imasu¹, Toshinobu Machida², Shuji Aoki³, Takashi Yamanouchi⁴, Tsuneo Matsunaga², Hidekazu Matsueda⁵, Yugo Kanaya⁶, Yutaka Matsumi⁷, Taro Shinoda⁷, Hiroshi Tanimoto², Daisuke Goto², Isamu Morino², Yousuke Sawa⁵, Kazuhiro Tsuboi⁵, Yosuke Niwa⁵, Naoki Kaneyasu⁸, Shohei Murayama⁸, Tetsuo Sueyoshi⁴, Masayuki Takigawa⁶, Fumikazu Taketani⁶, Yousuke Sato⁹, Wataru Takeuchi¹⁰, Hitoshi Irie¹¹, YASUKO KASAI¹², Mikhail Strunin¹³, Boris Fomin¹³

1.Atmosphere and Ocean Research Institute, The University of Tokyo, 2.National Institute for Environmental Studies, 3.Graduate School of Science, Tohoku University, 4.National Institute of Polar Research, 5.Meteorological Research Institute, Japan Meteorological Agency, 6.Japan Agency for Marine-Earth Science and Technology, 7.Institute for Space-Earth Environmental Research, 8.National Institute of Advanced Industrial Science and Technology, 9.RIKEN, 10.Institute of Industrial Science, The University of Tokyo, 11.Center of Environmental Remote Sensing, Chiba University, 12.National Institute of Information and Communications Technology, 13.Central Aerological Observatory, ROSHYDROMET

The Arctic, including West Siberia, is the most sensitive region in the world to the global warming. Continuous and synthetic monitoring of the atmospheric environment has been desired in this region. For this and related purposes, airplanes are extremely useful for environmental observation. Recently, the Federal Service for Hydrometeorology and Environmental Monitoring (ROSHYDROMET) has deployed a new airplane, the Yakovlev-42D (photo), a so-called "Airplane-Laboratory", and has entrusted the Central Aerological Observatory (CAO) with its operation. This is the only airplane that can fly over the Arctic and Siberia in Russian domain for scientific studies. On the other hands, Japanese organizations have on-going and future satellite missions, e.g., GOSAT and GCOM-C1. It is expected that the synergetic use of the satellite data and the "Airplane-Laboratory" can contribute to comprehensive monitoring of the Arctic environment. To promote the synergetic operation of the satellites and the airplane, AORI/UT and CAO entered an agreement for scientific cooperation on November 7, 2014, and within the framework, we co-organized a kick-off meeting on 23-24 November 2015 in Moscow and started discussion on its flight schedule and usage of the observational data. The cabin of the "Airplane-Laboratory" is divided into six sectors, i.e. 1) Meteorology, 2) Gas and aerosol (including a lidar), 3) Radiation (including an imager), 4) Radioactivity, 5) Cloud microphysics, and 6) Radar, and each sector is equipped with various types of instruments to measure the gaseous and particulate matters in the troposphere. Many gaseous species, CO₂, CH₄, O₃, NO, NO_x, NO_y, can be measured not only by exclusive sensors for each but also Cavity Ring-Down Spectroscopy (CRDS) operated onboard. Size distribution of aerosols of which size ranging 0.06-3.0 μm can be measured by particle counters, and cloud condensation nuclei (CCN) and black carbon (BC) are also measured simultaneously. As for cloud microphysics, size distribution of cloud particles can be measured by various types of probes as well as detection of cloud crystal habits. The radiometers measure up- and down-welling radiation in the spectral range from ultra violet (UV) to thermal infrared (TIR). Up-looking lidar and down-looking imager whose spectral band covers UV through near infrared (NIR) are also equipped. Russian side expects Japanese community to contribute to calibrate CRDS and Single Particle Soot Photometer (SP2) instruments for more precise measurements of gaseous species and BC. Total flight time was 200 hours in 2014, and 500 hours are scheduled to be allotted in 2015-2033 (totally 20 years). We are negotiating over how much amount of flight time will be allotted to the joint observations with Japanese side in future.

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Yakovlev-42D

