

Cloud and Precipitation Observation Mission with Active Sensors

*Nobuhiro Takahashi¹, Yukari Takayabu³, Kinji Furukawa², Riko Oki², Kosuke Yamamoto², Yuki Kaneko²

1. Institute for Space-Earth Environmental Research, Nagoya University, 2. Japan Aerospace Exploration Agency, 3. The Atmosphere and Ocean Research Institute, the University of Tokyo

Important issues in the researches on the climate change, including the global warming issues, include improving the accuracy of future predictions and accurately assessing impacts (understanding long-term trends and current conditions). A spaceborne radar mission targeting advanced cloud and precipitation observation is proposed.

The feature (novelty) of this mission is that it is a new (almost for the first time) observation regarding the dynamic cloud-precipitation processes, and it is expected to greatly improve the understanding of the global cloud and precipitation systems in collaboration numerical model study. In addition, this mission also enables the continuation of long-term accurate precipitation observations and it leads long-term trend of precipitation together with TRMM and GPM. It also aims to grasp the global water cycle accurately.

This mission also aims to provide the fundamental information and improvements for the operational global precipitation map such as GSMaP, which is widely used for weather and disaster prevention. Based on scientific and operational needs, the proposed sensor is a precipitation radar called DPR-2 that is upgraded the dual-frequency precipitation radar (DPR) onboard the GPM core satellite by considering that the heritages of the DPR and TRMM/PR and add the technological progresses to the DPR. Or, we propose the development of Ku-band Doppler radar which is similar to the Ku-band radar of GPM/DPR but add Doppler measurement capability with larger antenna size. The Ku-band radar specifications are based on KuPR with GPM, and the sensitivity is improved up to about 10dB by introducing GaN and flexible observation method.

This proposal is based on the collaborative observation of clouds and precipitation by radars and lidars at multiple frequencies in international framework with NASA.

Tentative specifications of the satellite and radar are as follows:

Satellite orbit: non sun-synchronous orbit or sun-synchronous orbit

Orbit altitude: 400 km(TBD)

Satellite mass: 1500 kg (TBD)

Onboard sensor: Ku-band precipitation radar

-Frequency: Ku-band

-Sensor mass: 400 kg

-Power consumption: 500 W

-Design life: 5 years (TBD)

-Horizontal (vertical) resolution: 5 x 2.5 km (horizontal: with Doppler measurement) or 5 x 5 km

(horizontal: without Doppler measurement), 250 m (vertical), High spatial resolution observation can be achieved by spatial oversampling.

-Swath width: 50-380km (variable)

-Doppler velocity measurement function is only nadir direction

The selection of the Doppler measurement function is coordinated with NASA.

Keywords: Cloud-Precipitation process, Spaceborne Radar

