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A proposal for high resolution observations of the ocean surfaces using a large aperture antenna

EBUCHI, Naoto[1*]

[1]Institute of Low Temperature Science, Hokkaido University

Sea surface observations of a high spatial resolution (approximately 5 km) by a passive and active microwave sensor with a large aperture antenna (5-10 m diameter) are proposed. The microwave sensor with the large aperture antenna will provide us with physical parameters of the air-sea boundary with a high spatial resolution of 5 km, which resolves oceanic phenomena of spatial scales greater than the Rossby radius of deformation (approximately 10 ? 30 km in mid latitudes). The sensor carried on a sun-synchronous polar orbit satellite with an orbital altitude of 7-800 km conically scans the earth's surface with a wide swath of approximately 1600 km, achieving a temporal sampling of 2 times/day. The microwave radiometer (passive) utilizes frequency bands of 1.4, 6.9/7.3, 10.6, 18.7, 23.8, 36.5, 89.0, and 160 GHz (V and H pol.), while the scatterometer (active) is operated in the L-, C-, and Ku-band (VV and HH pol.). The radiometer channels other than 1.4 and 160 GHz are identical to AMSR2 on GCOM-W1. The 1.4 GHz channel is added to observe the sea surface salinity, and the 160 GHz channel is added for observation of solid precipitation. The microwave instrument will measure the physical parameter of the ocean surfaces, such as the sea surface temperature (SST), marine surface vector wind, sea surface salinity (SSS), and sea ice concentration. Typical spatial resolution and temporal sampling would be 5 km and 2 times/day for SST, winds, and sea ice, and 25 km and 5 day average for SSS, respectively. The goal of accuracy is 0.5 K for SST, 1 m/s and 20 deg. for vector winds, 0.2 psu for SSS, and 10 % for sea ice concentration. The microwave sensor will be also applicable to observations of the atmosphere (e.g., integrated water vapor, liquid cloud water, and liquid and solid precipitations), and land (e.g., soil moisture, and snow depth). The sea surface observation with the high spatial resolution and high accuracy will allow us to explore the mesoscale and sub-mesoscale oceanic phenomena, which are difficult to observe conventional techniques and previous spaceborne sensors. The observed data will also be directly applicable to the operational oceanic monitoring and prediction, the safety and economical efficiency of ship routes, fishery and conservations of marine environment, especially in the ocean and seas around Japan, together with operational weather forecasts and disaster preventions.

Keywords: Remote sensing, Observation of oceans from space, Microwave radiometer, Microwave scatterometer, Large aperture antenna, Air-sea interactions