AMSR AND DFS SYNERGY

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1. INTRODUCTION

A combination of spaceborne scatterometer and radiometer provides us with instantaneous observation of various physical parameters of air-sea interface, such as wind speed and direction, water vapor content, sea surface temperature (SST), and rain rate, which are essential to scientific studies of global climate changes. The combined observation also plays an important role in the operational applications, such as weather forecast and disaster prevention. The Japanese earth observation satellite, Advanced Earth Observing Satellite-II (ADEOS-II), which carried a microwave scatterometer, SeaWinds, and a microwave radiometer, Advanced Microwave Scanning Radiometer (AMSR), was launched by the National Space Development Agency of Japan (NASDA) in December 2002, and the simultaneous observation was started. However, ADEOS-II failed in October 2003. A follow-up mission is required to continue the data flow for the operational applications and scientific studies. The Japan Aerospace Exploration Agency (JAXA), National Oceanic and Atmospheric Agency (NOAA), and Jet Propulsion Laboratory (JPL) are now proposing to launch the second satellite of the Global Change Observation Mission-W (GCOM-W2) carrying the Advanced Microwave Scanning Radiometer-3 (AMSR-3) together with Dual Frequency Scatterometer (DFS). This paper reviews sensor and science synergy of microwave scatterometers and radiometers.

2. SENSOR SYNERGISM

The simultaneous operation of the active and passive microwave sensors will contribute to improve sensor algorithms to estimate physical parameters. The radiometer measurements will be used by the scatterometer for rain flagging, corrections for the rain effects on the scatterometer signal, and improving wind retrieval under rain. Several studies have been conducted to investigate the impacts of rain on vector wind measurements by scatterometers [1], [2], [3], [4], [5] and corrections for the rain effect [5], [6], [7]. Scatterometer wind will be able to correct wind direction dependence of the radiometer measurements. Intercomparison of simultaneous measurements of wind speed by SeaWinds and AMSR on ADEOS-II clearly exhibited the systematic errors in the

previous AMSR wind retrieval algorithm [8], [9], [10]. Refinements of the algorithm based on the results have successfully reduced the systematic errors in the retrieved wind [11], [12], [13].

3. SCIENCE SYNERGISM

The simultaneous observation of the water vapor, precipitation and marine surface vector winds will have a significant impact on studies of the water-energy cycle, which is one of the most important scientific topics and social issues. The mission will provide a unique data set to investigate the balance among horizontal convergence/divergence of the water vapor, evaporation from the sea surface, and precipitation [14]. Monitoring these terms is critical to the characterization of the hydrological cycle and climate changes [15], [16], [17]. The combined measurements of the vector wind, water vapor, SST, and rain will also help to monitor tropical climate including tropical convection systems and cloud clusters, the intertropical convergence zone (ITCZ) [18], [19], [20], and the interannual climate anomalies of El Nino/Southern Oscillation (ENSO) [21], [22], [23], which also influences the mid- and high-latitude climate variations. Scientific impacts of the combined mission will further extend to studies concerning various phenomena of the atmosphere and ocean, such as monsoon [24], tropical cyclones [25], [26], ocean-atmosphere coupling mechanism [27] - [35], ocean's response to wind and hydrologic forcing, and operational numerical weather prediction, and also to cryospheric studies and land applications.

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