Ultra Stable Microwave Radiometers for Future Sea Surface Salinity Missions

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Measurements of sea surface salinity (SSS) are important in understanding the response of the ocean to the global water cycle and climate changes. Future SSS missions will require SSS measurements with an accuracy of 0.1 psu (parts per thousand) and with a spatial resolution less than 50 km. This will require the L-band radiometers to have low noise with calibration stabilities of $\leq$ 0.05 K over 2-3 days.

We are currently engaged in a research task to develop and demonstrate an L-band microwave radiometer, which has low noise and calibration stability better than 0.05 K over periods from 2 to 8 days. The approach we are following is to develop mathematical models of the radiometer performance, which will allow optimization of the key parameters and components to achieve the best possible stability. Individual components, including the noise diodes, Dicke switches, and digitization circuits will be tested to select the ones to meet these stability requirements. One interesting problem is to determine the optimum noise diode calibration and reference switching sequence and the system requirements to maximize the radiometer sensitivity and calibration stability. A breadboard of the radiometer system will be built and tested to demonstrate the components and techniques required to achieve this stability.

Results of the initial mathematical models will be presented as well as results from some of our initial stability tests demonstrating some of the techniques used to achieve this stability. Also, results from cold sky observations using our Passive Active L/S-band (PALS) instrument will be shown to demonstrate that with proper temperature control of key calibration components, it is possible to achieve a stability of 0.05 K for three days.