Enhancing Oceanic Retrievals using Microwave Radiometry

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ABSTRACT

The Central Florida Remote Sensing Laboratory, CFRSL, of the School of Electrical Engineering and Computer Science at the University of Central Florida is engaged in research to improve passive microwave remote sensing techniques for inferring oceanic and atmospheric geophysical parameters. This paper presents an overview of research that falls into three major areas, namely; airborne hurricane measurements, satellite ocean salinity retrievals and inter-satellite radiometric calibration.

The knowledge of peak winds in hurricanes is critical to classification of hurricane intensity; therefore, there is a strong interest in the US for operational airborne remote sensing of ocean surface winds for surveillance of tropical storms and hurricanes, especially those which threaten landfall. Presently, the airborne Stepped Frequency Microwave Radiometer (SFMR) is the state-of-the-art remote sensor for providing this information in real-time, during hurricane surveillance flights [1]. At CFRSL, we are collaborating with NASA Marshall Space Flight Center, NOAA Hurricane Research Division, and the University of Michigan to develop the Hurricane Imaging Radiometer (HIRAD), which is a prototype of the next-generation high-flying airborne instrument for monitoring hurricanes. HIRAD is a four-frequency (4 – 6.6 GHz) passive synthetic thinned array radiometer that will provide a wide swath image, which significantly expands the spatial coverage of the nadir viewing SFMR profiler. At 20 km altitude, the HIRAD design produces a worst-case spatial resolution at nadir of 2.5 km at 4 GHz and a cross-track measurement swath of 60 km (± 60 degrees field-of-view) at all 4 frequencies as schematically depicted in Fig. 1.

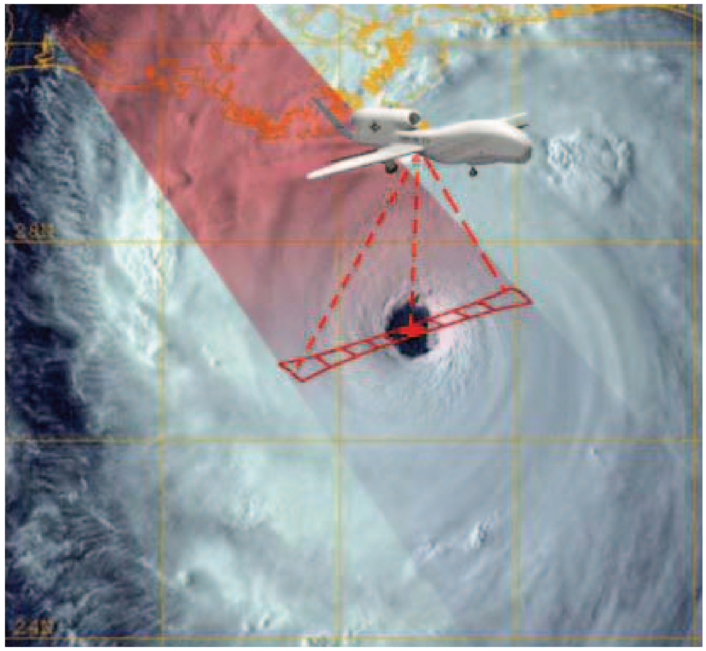

Fig. 1 HIRAD cross-track measured swath.

The CFRSL contribution includes: HIRAD thinned phased array analytical design, advanced surface emissivity modeling, wind speed and rain rate retrieval algorithm development and comprehensive Monte Carlo end-to-end simulation to establish realistic wind speed and rain rate measurement error characterization. Results of these topics will be presented.

Another CFRSL research project is a partnership with the Argentine Space Agency (CONAE) on their Microwave Radiometer (MWR) instrument, expected to be launched in late 2010, on the Aquarius/SAC-D joint NASA/CONAE international science mission. The MWR, a three channel Dicke radiometer operating at 23.8 GHz H-Pol and 36.5 GHz V- & H-Pol will complement Aquarius (NASA's L-band radiometer/scatterometer) by providing simultaneous spatially collocated environmental measurements such as water vapor, cloud liquid water, surface wind speed, rain rate and sea ice concentration. CFRSL's role is to assist CONAE in the pre-launch geophysical retrieval algorithms development and post-launch validation testing. Also, CFRSL will take the lead in post-launch radiometric calibration with the WindSat radiometer. In this paper, preliminary results of MWR rain retrieval algorithm will be presented.

Finally, CFRSL has major responsibility in NASA’s inter-satellite radiometric calibration (X-Cal) team in support of the Global Precipitation Mission (GPM). Our responsibility involves the development of the level-0 prescreen algorithm for GPM constellation radiometers brightness temperature calibration. Results of recent improvements in the dynamic radiometric calibration of the Tropical Rainfall Measuring Mission (TRMM) Microwave Imager (TMI) for the version-7 brightness temperature product (1B11) will be presented [2].

REFERENCES

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[2] Kaushik Gopalan, Linwood Jones, Sayak Biswas, Steve Bilanow, Thomas Wilheit and Takis Kasparis, “A Time-Varying Radiometric Bias Correction for the TRMM Microwave Imager, *IEEE Trans. GeoSci. Rem. Sens*, vol. 99, NO. 1, Oct 2009