Session: C23 Poster: T225A

The impact of SSM/I incidence angle variations on climate trends in the GSSTF dataset

Kyle Hilburn[†]; Chung-Lin Shie; Frank Wentz
[†] Remote Sensing Systems, USA
Leading author: hilburn@remss.com

Accurate air-sea surface turbulent flux measurements are crucial to understanding the global energy and water cycles. The need for accurate flux datasets led to the development of the Goddard Satellite-based Surface Turbulent Fluxes (GSSTF) dataset. The GSSTF dataset provides sensible heat flux, latent heat flux, surface wind stress, and other relevant air-sea parameters at 1-deg spatial resolution and daily time resolution for the period July 1987 through December 2008. The most recent version of GSSTF, Version 2b, was produced using Remote Sensing Systems (RSS) Version-6 Special Sensor Microwave Imager (SSM/I) brightness temperatures and RSS column-integrated water vapor and surface wind speed retrievals. GSSTF2b has a latent heat flux trend of 9.8%/decade, which is much larger than the value of 1.3%/decade found by Wentz et al. (2007) using the same data. The large latent heat flux trend in GSSTF is driven by a -2.6%/decade trend in the lowest 500-m water vapor retrieval, which is used in the calculation of latent heat flux. This trend is suspicious itself because it is at odds with the trend in total columnar water vapor, which is about 1.2%/decade. Understanding these trends has important implications for the water cycle. Through a collaboration between our two groups, we determined that the trends in lowest 500-m water vapor are due to trends in the incidence angle of SSM/I brightness temperature measurements. The effect of these trends in incidence angle must be removed from the brightness temperatures to get accurate trends in retrieved water vapor. We will provide a detailed characterization of incidence angle variations in the SSM/I dataset, which includes six different satellites. The background physics explaining the relationship between incidence angle and brightness temperature will be provided. The key difficulty in removing the effect of incidence angle variations on brightness temperature lies in the fact that the impacts on brightness temperature are not constant, but are scene dependent. We will describe the simple model we developed, and provide an error budget for the model. We will show how long-term trends and inter-satellite offsets for brightness temperature and water vapor change with application of the incidence angle adjustment.