



**NEWS Annual Progress Report for July 2008 – July 2009**  
**NASA Contract NNG05GR38G with Remote Sensing Systems**  
**Principal Investigator: Frank J. Wentz**  
**Co-Investigator: Kyle A. Hilburn**

We have continued to make progress during the fourth year of our NEWS investigation, including two papers and a variety of collaborative efforts. Our work is discussed below.

## **1. Project Status and Progress**

We have examined the regional scale water cycle using our Passive Microwave Water Cycle (PMWC) product and compared this with salinity measurements. These results have been presented at meetings (Sec. 2). We have spent a great deal of time examining water vapor transport, trends, and comparisons with Tim Liu's transport product. We have presented these results at meetings and documented our work in a technical report (Sec. 3). We have released an update to our product: the Version-1b PMWC dataset. We have also spent time analyzing SSMIS and WindSat retrievals in order to add them to our product. These new satellites are crucial for making a climate data record because the SSM/I series has only two sensors after 2006 and only one sensor after 2008.

## **2. Collaboration**

We have collaborated with Brian Soden, providing him with special daily wind and rain datasets. Brian has used these to study trends in heavy precipitation and the accompanying circulation changes. We have also been in contact to clarify calibration issues with F14.

We have worked with Tim Liu's transport data and have been in contact with Tim over the last year. We found artifacts in Tim's data that have now been removed in the newer version. We have been comparing Tim's water vapor transport and divergence with the PMWC product that we produce.

We have worked with Chung-Lin Shie. Chung-Lin helped Kyle with the GSSTF data, and Kyle helped Chung-Lin with REMSS data. This work involved some long-distance debugging of Chung-Lin's code, and Kyle involved Stephan Boyer in this process. Stephan is a recent high-school graduate who is getting some scientific experience at REMSS this summer before going to MIT in the fall to study electrical engineering. Kyle showed Stephan how to do data analysis in FORTRAN and how to plot data in IDL. Both of these languages were new to Stephan, but he is a very quick learner! Stephan learned how to read REMSS data and work with GZIP. He learned about rain flagging and other q/c measures. Stephan learned how you go about computing a global average over a long time period from data on an equal latitude-longitude

earth grid. This was Stephan's first time working with a large geospatial dataset. Then, Stephan took his global average code and turned the variables into arrays indexed by satellite in order to find out if the problems came from a specific satellite. Next, Stephan took these arrays and indexed them by longitude and latitude to create maps to see the geographic distribution of the differences. Stephan learned how to plot these maps and about difference maps. Stephan learned about how to use IDL's RGB color tables to create maps with color. At the beginning of the experience, Stephan asked how we could possibly find a bug in someone else's code without seeing the code, but this experience showed him how it's done. These are the same sort of investigative skills that we use to handle our typical user questions.

We have been in contact with Duane Waliser, and this led Kyle to write a technical report about the PMWC dataset (Sec. 3).

Kyle has presented NEWS results at a number of meetings during the last year including: the 2009 European Geosciences Union General Assembly in Vienna, the 2009 American Meteorological Society General Meeting in Phoenix, and the 2008 American Geophysical Union Fall Meeting in San Francisco. The meeting in Vienna was very productive and allowed Kyle to talk to HOAPS scientists. Kyle also presented a talk about "Studying the Oceans and Climate with Microwave Satellite Data" for a seminar at the University of Washington in Seattle in February 2009. The talk had a significant amount of NEWS material.

Kyle has remained active in Google Groups with 8 messages over the last year on the following subjects: delineating continents and oceans, the water cycle over ocean basins, and the state of the global water cycle.

### **3. Publications**

During the last year we have been directly involved with two papers. The first is our contribution to the BAMS "State of the Climate" report:

Levinson, D. H., K. A. Hilburn, and M. C. Kruk, 2009: Global precipitation, in State of the Climate 2008. Peterson, T. C., and M. O. Baringer eds., *Bulletin of the American Meteorological Society*, 90, S22-S25.

Our second paper is a technical report that details our PMWC product:

Hilburn, K. A., (2009), The passive microwave water cycle product, report number 072409, Remote Sensing Systems, 30 pp.

This report details not only our current methodology, but it discusses the various approaches we have tried (notably feature tracking) to deduce water vapor transport.

### **4. Issues and Concerns**

There are no issues or concerns at this time.

## **5. Integration**

We have been in contact with new team member Eric Wood, and we plan to integrate our over-ocean water cycle product with his flux product over land.