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PUBLIC RELEASE OF A TROPICAL CYCLONE MICROWAVE SCATTEROMETER AND RADIOMETER DATA ARCHIVE

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1. INTRODUCTION

In July 2003, Remote Sensing Systems (RSS) implemented a new web site that includes both a continually updated near-real time user interface and a data archive for viewing scatterometer and radiometer microwave data in and around tropical cyclones. The archive contains data from July 1999 through the present in a simple, focused environment specifically designed to aid in user understanding of microwave data sets. A brief description of the radiometer and scatterometer data is followed by a description of the TC archive interface. The functionality of the site will be demonstrated in the presentation.

2. DATA DESCRIPTION

Our tropical cyclone web interface contains various types of microwave data processed at RSS including ocean surface wind vectors derived from scatterometers and rain rates and sea surface temperatures (SST) from passive microwave radiometers. Storm-centered images of 8-degree lat/lon regions are extracted from the satellite data using ATCF location, intensity, and forecast values obtained roughly every hour by FTP from the Naval Research Lab-Monterey.

RSS derives ocean surface wind speeds, columnar water vapor, cloud liquid water, rain rates and SSTs from radiometer observations (Wentz 2000). These ocean products are from currently operating SSM/I instruments on DMSP platforms, AMSR-E on the Aqua platform and the TRMM Microwave Imager (TMI). Central to the web site interface is an Optimally Interpolated Microwave (MW OI) SST daily product at one quarter degree (~25 kilometer) resolution constructed from TMI and AMSR-E SST retrievals. Using a diurnal model, TMI and AMSR-E data are 'normalized' to a daily minimum SST corresponding to approximately 8 AM, local time. These MW OI SSTs represent a significant improvement over weekly, 1 degree (~100 km) NCEP OI (Reynolds) SSTs and have been shown to yield better intensity forecasts (Wentz, 2000). SST anomaly maps are also included in the interface and are created by differencing the MW OI SSTs and the NCEP OI monthly climatology SSTs. These anomaly maps highlight cold-water wakes produced by strong or slow moving storms. SSM/I radiometer rain rates are also included as knowledge of heavy rain locations assists in the interpretation of scatterometer wind directions and ambiguities.

SeaWinds data from both the QuikSCAT and Midori-II platforms are included in the archive and have been interlaced for each storm during the April 10 – October 25th 2003 overlap period. A brief description of the SeaWinds instrument and overall quality is given in Smith (2000). We continue to process SeaWinds observations using a different model function (Ku-2001) than that used (QSCAT-1) to process the JPL science data and the NOAA real-time data shown at the NRL and ORA/NOAA web sites While these two model functions produce very similar results under most wind conditions (less than 0.5 m/s standard deviation for winds 3 – 20 m/s), there are differences pertinent to the tropical cyclone environment. Specifically, the Ku-2001 model function has been adjusted to derive higher wind speeds, the Ku-2001 wind vectors seem to be more likely to turn cross-swath in very heavy rain and we have developed and include a separate rain flag for use in identifying poor quality data. The rain flag (described in Smith 2002) identifies fewer TC environment wind vectors as rain contaminated than the MUDH flag used in the JPL data. We continue to refine and develop our model function to reduce the cross-track tendencies and produce more reliable, validated winds. We process the JPL science data into wind vectors and as a result have a near-real time TC site that is less useful to forecasters (data are produced outside the forecast window) but that is very useful for retrospective analysis and training.

3. SITE LAYOUT AND DESIGN

During development of the site we focused on producing a fast, simple and easy-to-use interface. A user accesses the interface by clicking on the name of an active storm or by clicking the Data Archive button from the Storm Watch section of the RSS home page, www.remss.com.

The interface consists of 5 sub-regions shown in Figure 1a-1e. At the top is a timeline chart (Fig.1a) containing the reported ATCF maximum sustained wind speed, sea level pressure, and the RSS microwave SST at the storm center at 3 or 6-hour intervals. Symbols representing the time of scatterometer wind vector images lie below the plot. This graphical tool is useful for quickly obtaining information about the life cycle of each storm and for identifying the frequency of satellite overpasses. Selecting the symbols navigates the user through the available scatterometer images. The maximum rain-free (using scatterometer rain flag) wind in each scatterometer image is marked on the timeline plot with an X. For some overpass images, the storm center, and thus the strongest winds, are missed by the instrument and result in an under-estimated wind on the timeline chart such as on September 7th and September 9th, 2003 for Hurricane Isabel in Figure 1. The timeline in Figure 1a is for QuikSCAT only. Figure 2 shows the increase in overpass frequency for Isabel

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when the Midori-II SeaWinds instrument collocations are added. The TC archive also contains images from up to 48 hours prior to official storm designation. This allows users to explore the scatterometer images for signs of cyclonic flow in the early stages of development.

In Figure 1b, storm center locations are plotted over the daily MW OI SSTs described above. Similar to the timeline, this track can also be used to navigate through the stored images by clicking on the storm center symbols. The date of the displayed SST map matches that of the scatterometer image shown in Figure 1c. Clicking anywhere on the SST map flips the display to the SST anomaly map.

The large storm-centered scatterometer wind vector plot (Fig.1c) displays wind barbs color-coded by wind speed and a plot of all solutions found by the model function (the “ambiguity plot”). We are working on adding additional images for comparison including a backscatter image and the nearest radiometer wind speed image. For SeaWinds on Midori-II, the coincident AMSR-E wind speeds will be displayed. Clicking and flipping between the plots allows a seamless visual comparison without the interruption involved with reloading a page in the browser. Figure 1d is a 30-degree lat/lon regional plot showing the scatterometer winds. Figure 1e shows the nearest (in time) radiometer rain rates. Clicking on the rain rate image will flip between a regional rain rate plot and an 8-degree close-up rain plot that matches the region of the scatterometer winds in Figure 1c.

4. SUMMARY

This simple user interface is a graphical tool to explore microwave data from both scatterometers and radiometers in the tropical cyclone environment. A context-based help page is available to assist users in understanding the functionality of the site and to help them quickly learn to use its features. Please contact RSS with suggestions, questions or comments about this web site or the microwave data we produce.

5. ACKNOWLEDGEMENTS

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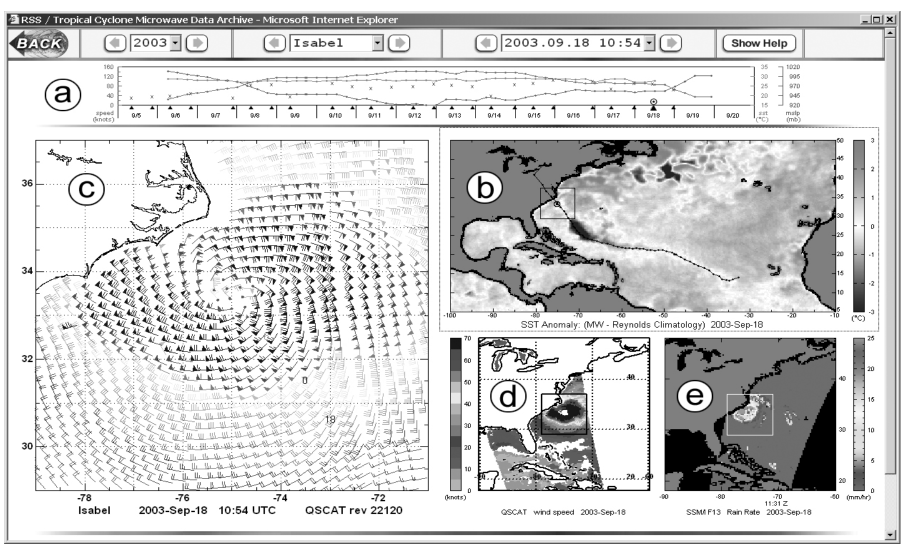

Figure 1. Archive user interface for Hurricane Isabel, September 18, 2003. Regions noted as (a) through (e) are further discussed in the text.

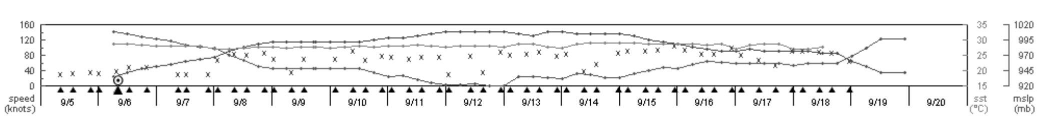

Figure 2. Timeline for Hurricane Isabel containing SeaWinds data from both the QuikSCAT and Midori-II instruments interlaced. Compare overpass frequency with that of only QuikSCAT shown in Figure 1a.