The Validation of High Resolution Sea Surface Temperature Data Sets

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INTRODUCTION

Previous studies are now identifying the need for high resolution SST data sets. Comparisons between low and high resolution SST data sets are indicating large differences seen in areas of high variability associated with coastal upwelling and Western Boundary Currents (Vazquez-Cuervo, et al., 2009). Coastal weather forecast offices (WFO)s have identified need for high resolution SST product to help with forecast issues

NASA's Short Term Prediction and Research Transition Activity (SPoRT), in collaboration with the Jet Propulsion Laboratory, has developed a 1km Sea Surface Temperature (SST) Data Set to be used in Numerical Weather Forecasting and other near-real time applications. To validate the approach a tool was developed that collocated the SST composite maps with drifting and fixed buoys. Root mean squares (RMS) and MEAN differences were calculated for the following test cases:

1) Atlantic - December 2008
2) Hurricane - August 15 to September 15 2008
3) Pacific - June to July 2009

The test cases were decided upon based on scenarios where creating 1km composites would be problematic and/or represent times of high SST gradients. The June-July time period off the California Coast is known for persistent cloud cover, while August-September of 2008 was a period of intense hurricane activity.

An enhanced SST product was developed using data from NASA's Moderate Resolution Imaging

Spectroradiometer (MODIS) and the Advanced Microwave Scanning Radiometer (AMSRE) that is produced as part of the data sets for the Group for High Resolution Sea Surface Temperature (GHRSST). This enhanced approach had several advantages over the previous approach, including using the quality flags and biases contained as part of the GHRSST data streams. Additionally the microwave SST data from AMSRE were incorporated to reduce the latency of the composite. Different composite methodologies were tested based on the application of quality flags and biases For each version of the composite, a set of temporally and spatially averaged RMS and MEAN differences was calculated against the SST data from drifting and fixed buoys.

RESULTS

The Hurricane test case region is shown in Figure 1 for September 15, 2008. Clearly visible is the cooling associated with the passage of Hurricane Ike. Figure 2 (a,b) shows the spatially averaged RMS and MEAN differences for the Hurricane test for Aqua Night. V03 is the original compositing approach (Haines et al., 2007) V52 is the enhanced approach using a quality flag of 4-5, V52a applies the highest quality flag of 5 but does not remove the bias, V52c applies the quality flag of 5 and removes the bias, and V63 uses OSTIA data to fill in data gaps.

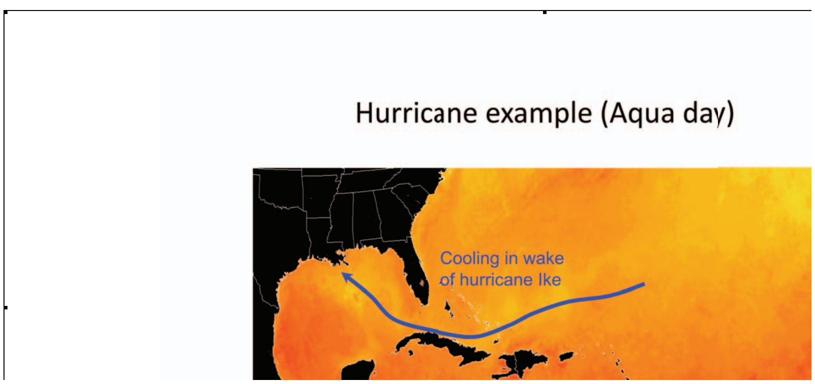

Figure 1: Composite image for September 15, 2008

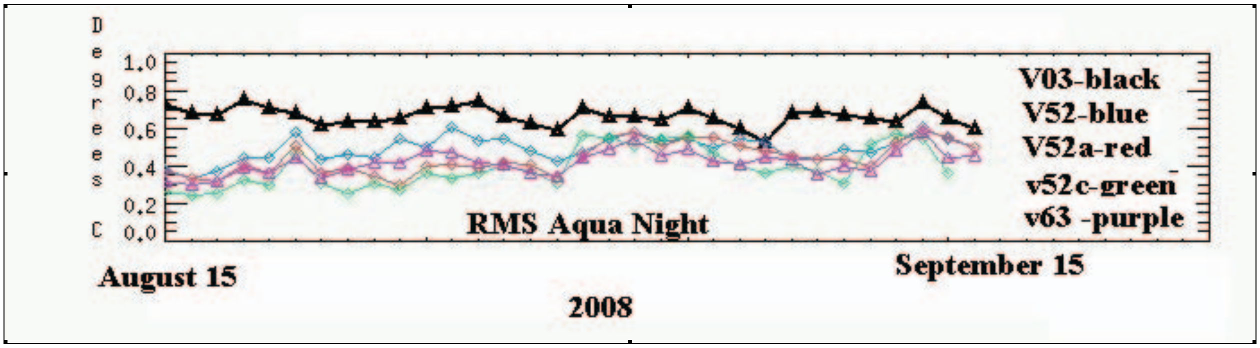

Figure 2: Spatially averaged daily RMS values for V03, V52, V52a, V52c, and V63

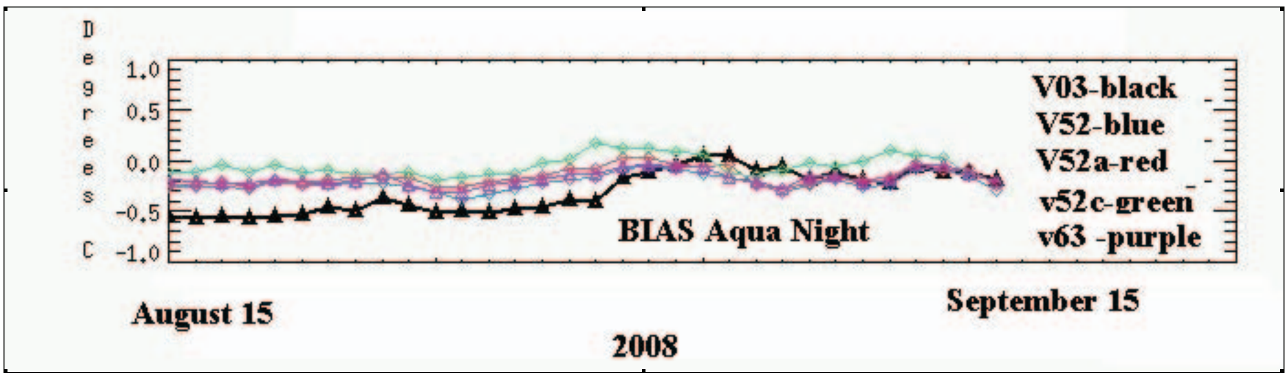

Figure 3: Same as Figure 2 except for MEAN difference (BIAS)

Figure 3 shows the spatially averaged MEAN differences for the Hurricane Aqua Night Case

CONCLUSIONS

Composites of 1km SST products are validated against drifting and fixed buoys. Data streams from MODIS and AMSRE that are generated as part of the GHRSST project are implemented in several versions of the composite. Different quality flags, along with the application of biases in the GHRSST MODIS and AMSRE data, are used in generating several different versions of the composite SST map. In general RMS differences of < 0.5°C and absolute MEAN differences of < 0.1°C can be attained by applying the highest quality flag and removing the biases that are embedded within the GHRSST data streams. In all test cases there were significant improvements over the previous composite methodology.

Results are encouraging for future work and the implementation of such high-resolution SST data sets for coastal applications and numerical weather forecasting. Additional improvements to the compositing approach could lead to even lower RMS values and MEAN differences. Such improvements would be inter-sensor removal of biases and possible use of additional data sets in the compositing approach.

REFERENCES

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