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Utilization of GOES Rapid-Scan Wind Data for Tropical Cyclone Predictability Experiments

Christopher S. Velden
University of Wisconsin – CIMSS
1225 West Dayton St., room 229
Madison, WI 53706
Phone: (608) 262-9168 fax: (608) 262-5974 email: chrisv@ssec.wisc.edu

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LONG-TERM GOALS

The overarching goal is to obtain special data sets of GOES rapid-scan (RS) atmospheric motion vectors (AMV) to assimilate and test for improvements in NAVY global numerical model (NOGAPS) forecasts of tropical cyclones (TC) using targeting information provided by NRL-MRY. There is the potential for forecast benefits with the GOES R/S-AMV since the higher image frequency yields more accurate observations in comparison to routinely-produced GOES AMV data. This is the motivation for this investigation.

OBJECTIVES

The proposed two-year effort will focus on the collection and processing of the RS datasets by CIMSS during two, 3-month focused periods of Atlantic TC activity in 2005 and 2006. These experimental and advanced datasets will be used 1) to demonstrate targeting concepts, 2) for satellite data assimilation trials, and 3) to test for predictability impacts on NOGAPS forecasts of TC tracks and intensity.

APPROACH

RS-AMV from GOES-12 VIS and IR imagery (7.5 minute image intervals) are being provided for this study using the CIMSS automated processing algorithm. The CIMSS PI contacts the NOAA/NESDIS Satellite Operations Center to alert them for requests of special RS schedules to be invoked during targeted TCs (based on NRL-MRY guidance on potential targets of opportunity from NOGAPS adjoint singular vector approaches). When the requests for the GOES-12 R/S are approved, RS-AMV datasets are derived by CIMSS every hour the R/S data are available. These datasets are being archived at CIMSS.

To-date, AMV assimilation has not generally benefited from good knowledge of observation errors. New quality control (QC) indices under development at CIMSS will be applied to the RS-AMV after the 3-month production period. This information will result in improved QC estimates of AMV accuracy and estimated correlated error, which in turn can be employed to improve super-ob or thinning procedures used to assimilate the AMV into NOGAPS.

A comprehensive evaluation of the RS-AMV data will be conducted using NOGAPS predictions of targeted TCs to determine observation impact on measures of forecast quality. Of special interest will be experiments where the R/S datasets are partitioned and only assimilated into the NRL targeted regions to assess the sensitivity of targeted observing approaches on NOGAPS TC track/intensity forecasts.

WORK COMPLETED

GOES-12 R/S AMV datasets have been successfully collected during several major Atlantic hurricanes in 2005. These storms include hurricanes Dennis, Emily, Katrina, Ophelia and Rita. Processing will continue on targeted TCs through October. An example of GOES-12 R/S-AMV during hurricane Rita is shown in Figure 1. Also shown are the concurrent analysis sensitivity regions as predicted by NRL singular vectors. A web site with real time and collected/archived datasets produced for this study can be found at:

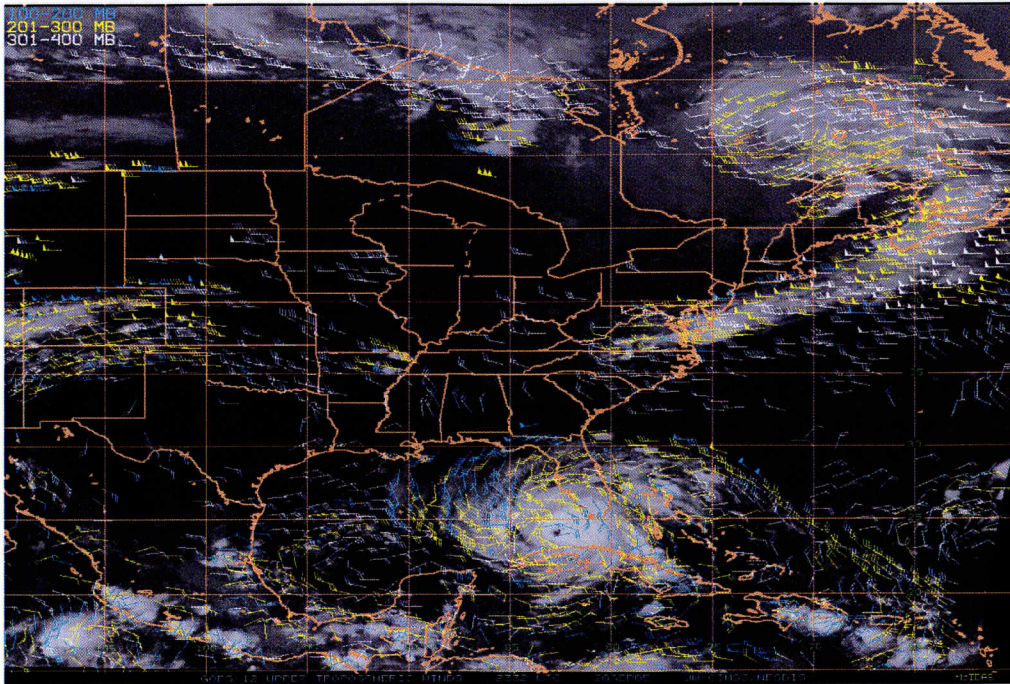
<http://cimss.ssec.wisc.edu/tropic/tropex/index.html>

RESULTS

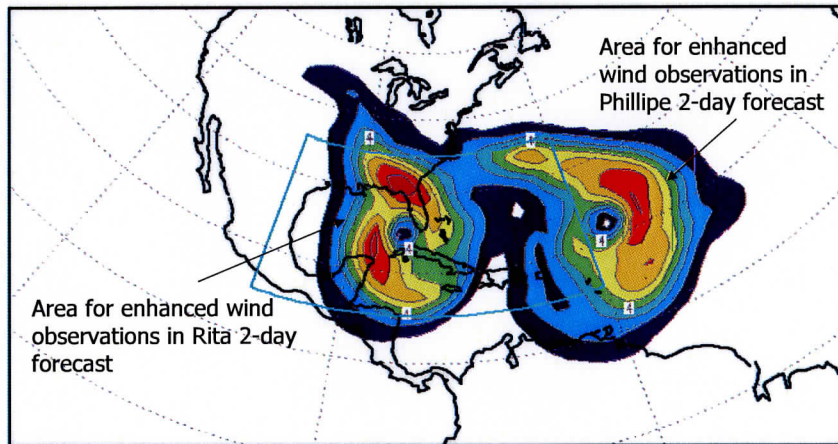
Since funding for this project only arrived 3 months ago, and the data processing phase is still underway, there are no model impact results to report yet.

IMPACT/APPLICATIONS

The basic hypothesis in this study is that regions of TC analyses that are sensitive to initial conditions can be successfully targeted, and when enhanced data are applied to those regions, the numerical forecasts will improve. If this theory is proven in this study, it could have a significant impact on future operational procedures to observe TCs, provide a better understanding of the processes affecting track and motion, and improve their predictability.



SINGULAR VECTOR SENSITIVITY SUMMARY
 SVs 1- 3 Vertically Integrated Sensitivity(10^8 Jkg^{-1})

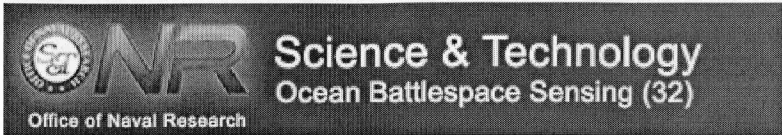


Observation / Assimilation Time: 00UTC 21Sep 2005

NOGAPS Singular Vector $T79L30$ (+96 h,-48h)
 NRL-Monterey

Figure 1

*Top: Example of GOES-12 Rapid-Scan winds produced at CIMSS during Hurricane Rita on September 21, 2005 at 00 GMT. The plot shows the upper-level wind coverage (100-400mb).
 Bottom: Singular vector sensitivity summary provided by NRL-MRY for 21 September 2005 at 00Z. The plot shows the regions where enhanced observations should improve the numerical (NOGAPS) forecasts for both Hurricanes Rita and Philippe.*



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