Thorpex Project Year-One Progress Report from CIMSS

Report from PI C. Velden, and Co-I H. Berger

Summary of Goals

The end goal of this THORPEX research is to analyze the potential of rapid-scan (RS) GOES winds to impact the NCEP numerical weather prediction system. The RS winds were obtained as part of the Atlantic THORPEX Regional Campaign (ATReC). The first stage of this research will involve the passive monitoring of the routinely-produced GOES winds for the ATReC period, and then assessing these data against the NCEP GFS model winds. We will closely investigate the quality and assimilation of these winds into the NCEP DA system. A newly developed quality indicator, which includes information on estimated vector expected and correlated error, will be assessed in limited trial runs to ascertain whether this new information results in any positive impact on resultant analyses and forecasts. This will develop a baseline as, if there is positive results and forecast impact potential, we will extend this work to the GOES RS winds derived during ATReC and run regional impact experiments towards achieving our end goal.

New Satellite-Wind Vector QC Indicator and "Expected Error"

Data quality control is important to any numerical model data impact experiment. A promising new quality control method for atmospheric motion vectors (AMV) is that of the "expected error" as proposed by Dr. John Le Marshall and developed at the BoM. This method extends and modifies the current quality indicator (QI) scheme that is used operationally by numerical forecast centers to thin the AMV input. The BoM code linearly regresses several atmospheric parameters against co-located raobs. Some of these parameters include: wind speed, direction, and vector consistency checks, wind and temperature shear, latitude, longitude, and pressure-height. Coefficients from the regressions can then be used to come up with "expected errors" for each derived vector. LeMarshall has also shown that AMVs with low expected error have better quality and also relatively lower correlated error, and therefore these estimated quantities can be used as data usage thresholds (or for observation weighting) for our proposed data impact experiments. We are currently accumulating regression statistics for the month of June for AMVs from each channel of the GOES satellites. A plot showing the expected error versus AMV-raob difference is shown in figure 1a and the QI versus AMV- RAOB difference is in 1b. Although the coefficients have only been generated for a few weeks, the expected error has more skill than the QI at selecting winds with low error as compared to the RAOBS. As the statistics are accumulated for a longer period of time, this skill should improve. The expected error can then be used as quality control for data future data impact experiments.

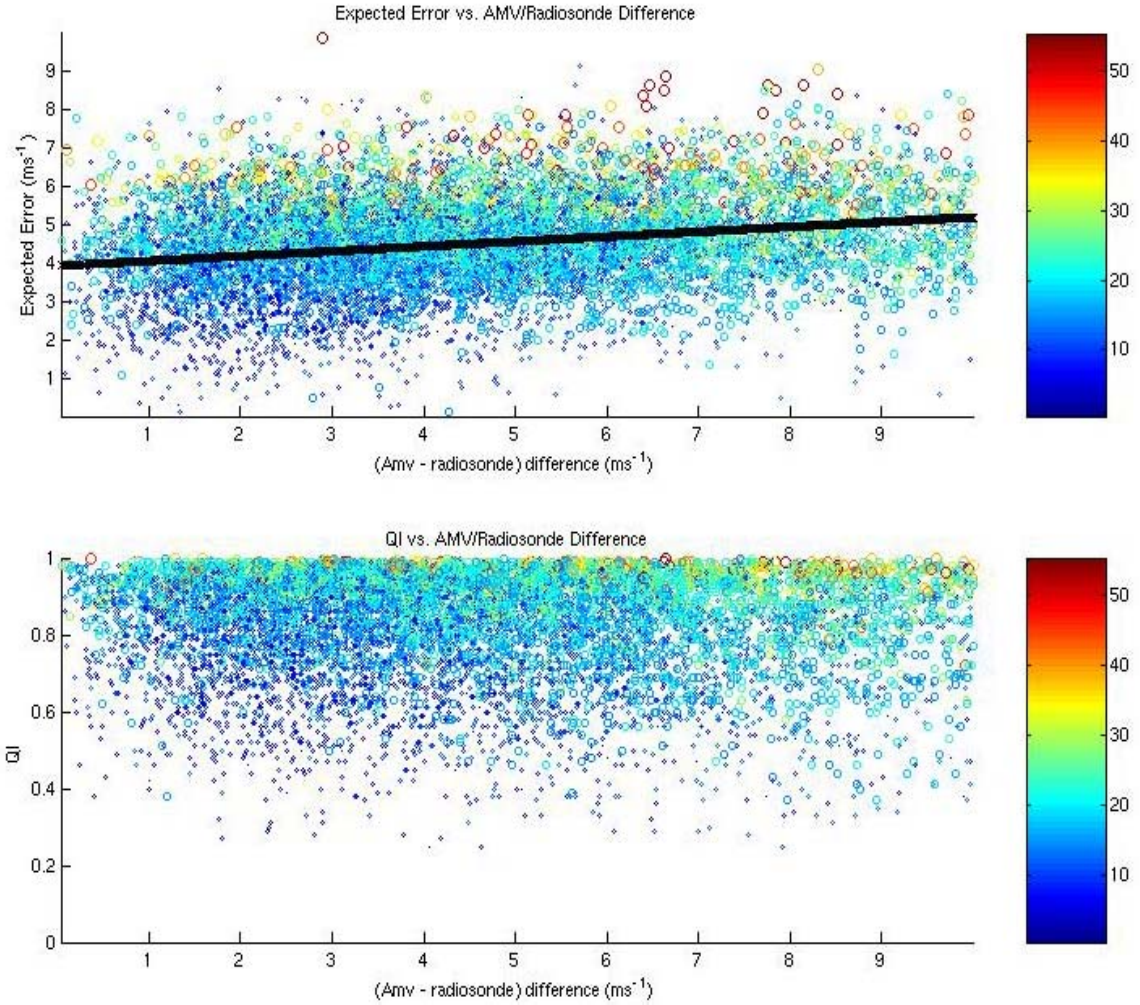

Figure: 1a (top): Expected error versus AMV – RAOB difference for upper-level GOES-E IR wind for several weeks in June, 2005 and b(bottom): QI versus AMV – RAOB difference. The colors represent the RAOB speed of the observation. Although the regression has been training for less than a month, the expected error shows some skill in selecting winds that match the RAOBS.

Passive AMV Monitoring Set-up

Before the GOES AMV data are tested within our proposed impact experiments, it is useful to passively assess the routine (operationally-produced) observations against the model background. We will compare these AMVs to GFS model background analyses run without any AMV input for a period during the ATReC, and calculate various statistics. This monitoring will obtain a baseline performance metric and allow us to compare the quality of the additional (and presumed improved) GOES RS AMV with that of the operational AMV. We will also examine AMV properties (heights, spectral bands, geographic or meteorological regions/regimes, etc.) relative to the model background analysis to look for any peculiar behavioral patterns. This evaluation will help us better understand the data quality and assimilation of both the operational and RS GOES AMV within NCEP's model. We have full network access, and scripts and model code to run the experiments. The code will have to be changed to read in the RS winds so that the various observations can be compared.

Collaboration with NESDIS and NCEP

Co-I Berger visited the NOAA Science Center in December 2004 and May 2005, and discussed our projects with Jim Jung of NESDIS, Zoltan Toth of NCEP, and John LeMarshall of the JCSDA. We will work closely with LeMarshall and his team on this effort, and have been promised help from Jung (and T. Zapotocny here at CIMSS) with the NCEP model experiments.

Future Work

Once the passive monitoring step is completed, and expected error coefficients have been calculated, data impact experiments can be performed to test the impacts of the GOES AMV (both operational and RS) with the new vector quality information on the GFS analyses and forecasts. Decisions about quality control, thinning, and experiment validation will have to be made to fully understand the impacts of the assimilated GOES AMV data.