P1.28 CLEAR SKY ATMOSPHERIC MOTION VECTORS DERIVED FROM THE GOES SOUNDER AND SIMULATED GOES-R HYPERSPECTRAL MOISTURE RETRIEVALS

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Introduction

Image triplets of constant pressure level moisture analyses derived from geostationary satellite retrievals are used to calculate clear sky atmospheric motion vectors (AMV). This new AMV approach adapts the existing automated cloud (or water vapor) feature tracking algorithm developed at CIMSS and now employed operationally at NESDIS. The modified method eliminates the often imprecise wind vector height assignment, since the altitude of the tracked moisture surfaces is already provided by the retrieval output.

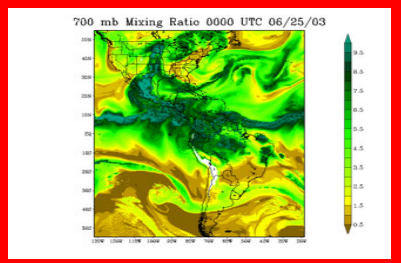
There are two sources of moisture analyses: 1) real data from the current GOES sounders, and 2) simulated data from a geostationary hyper-spectral sounder.

Summary

The initial proof of concept for deriving clear sky AMV from constant pressure moisture analysis has been demonstrated. Preliminary results from both the current GOES Sounder retrievals and simulated future GOES-R hyperspectral sounder retrievals show the preparedness of the adapted code to derive AMVs of quality comparable to current operational products.

Future Work

A full disk hyperspectral retrieval AMV case is in its beginning stages. An illustration of the size and location of the domain is shown below. It represents a geostationary sounder footprint. We anticipate the size of the simulation will demand upgraded hardware requirements and new data staging techniques.



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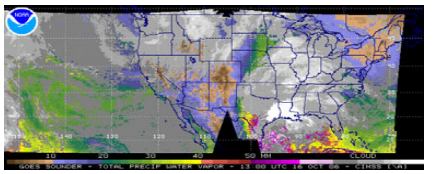
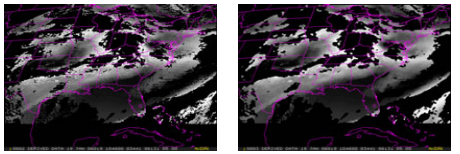
GOES Sounder Retrieval AMV

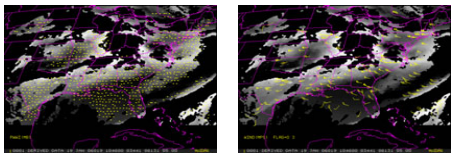
GOES East and West sounders provide real-time retrievals of temperature and moisture in cloud-free regions on an hourly basis. A single field of view retrieval with a nominal spatial resolution of 10 km is used for the case studies. Example coverage is shown below.



GOES sounder retrieved moisture is analyzed at 31 pressure levels, and these resulting fields are converted to imagery for feature tracking purposes. Levels that exhibit a strong water vapor signal and have some gradient are analyzed. Winds can be derived in clear sky by tracking the advecting moisture features in an image triplet created from 3 successive analyses.

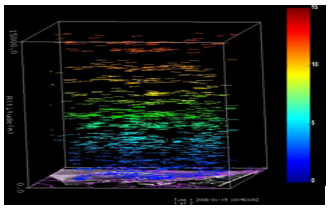


The above images are representative inputs into the targeting and tracking system. These images are from 19 January, 2006, 10:46 UTC, at 500mb. A cloud mask has been applied and can be seen as black in the images. The left image is the raw image with cloud mask. The right image has been passed through a 3x3 median filter. This eliminates the problem of tracking single cloudy pixels. The images have also been enhanced to ensure maximum brightness contrast.



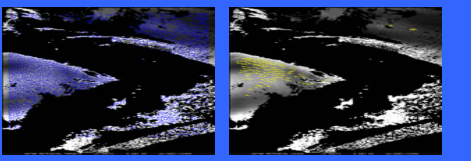
Results of the targeting and tracking algorithm may be seen on the figures above. Again, the images are from 19 January, 2006, 10:46 UTC, at 500mb. The left image consists of target locations. The right side image shows the resultant traceable AMV field. Each target is tracked in an image one hour before and one hour after the middle image time. An AMV is then calculated.

The goal of this new approach is to produce vertical profiles of AMV. Below is a 3-dimensional representation of the vertical nature of the sounder winds (vertical height is in km) .

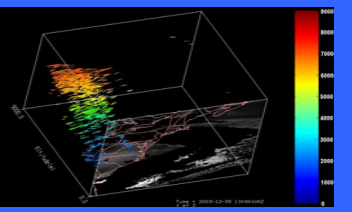
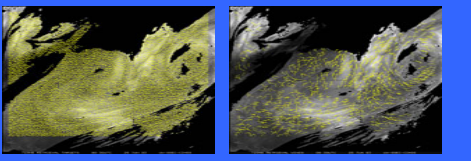
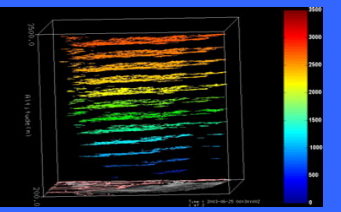


Simulated Hyperspectral Retrieval AMV

Moisture fields can also be derived from simulated hyperspectral satellite retrievals such as the Geostationary Imaging Transform Spectrometer (GIFTS). High resolution mesoscale models are used to generated simulated atmospheres (in our case, the Weather Research and Forecasting Model (WRF) is employed. Top of Atmosphere radiances (TOA) are calculated from the WRF simulations and the GIFTS forward radiative transfer model. Single field of view water vapor retrievals, analyzed at 101 pressure levels, are generated using a statistical approach. Targeting and tracking of clear-sky AMV is nearly identical to the method described previously.



The WRF model was used to simulate a strong extratropical cyclone that developed along the east coast of the United States on 5 December, 2003. The above plots show a representative layer at 407mb. The extensive cloud shield (black areas) limits the AMV production in this case. Below is the IDV representation of the vertical AMV distribution in this case.



A second WRF model simulation was initialized at 0000 UTC, 24 June 2003, and run for 30 hours. Retrievals every 30 minutes were generated. This simulation was run to assess the coverage of marine boundary layer AMV. Targets/AMVs are plotted below for the 729mb level. Also included is the IDV plot from 683mb to 986mb showing the good vertical distribution of AMVs in the MBL.