Evaluation of vertically resolved water winds from AIRS using Hurricane Katrina

Hartmut H. Aumann, Edwin C. Dobkowski and David T. Gregorich

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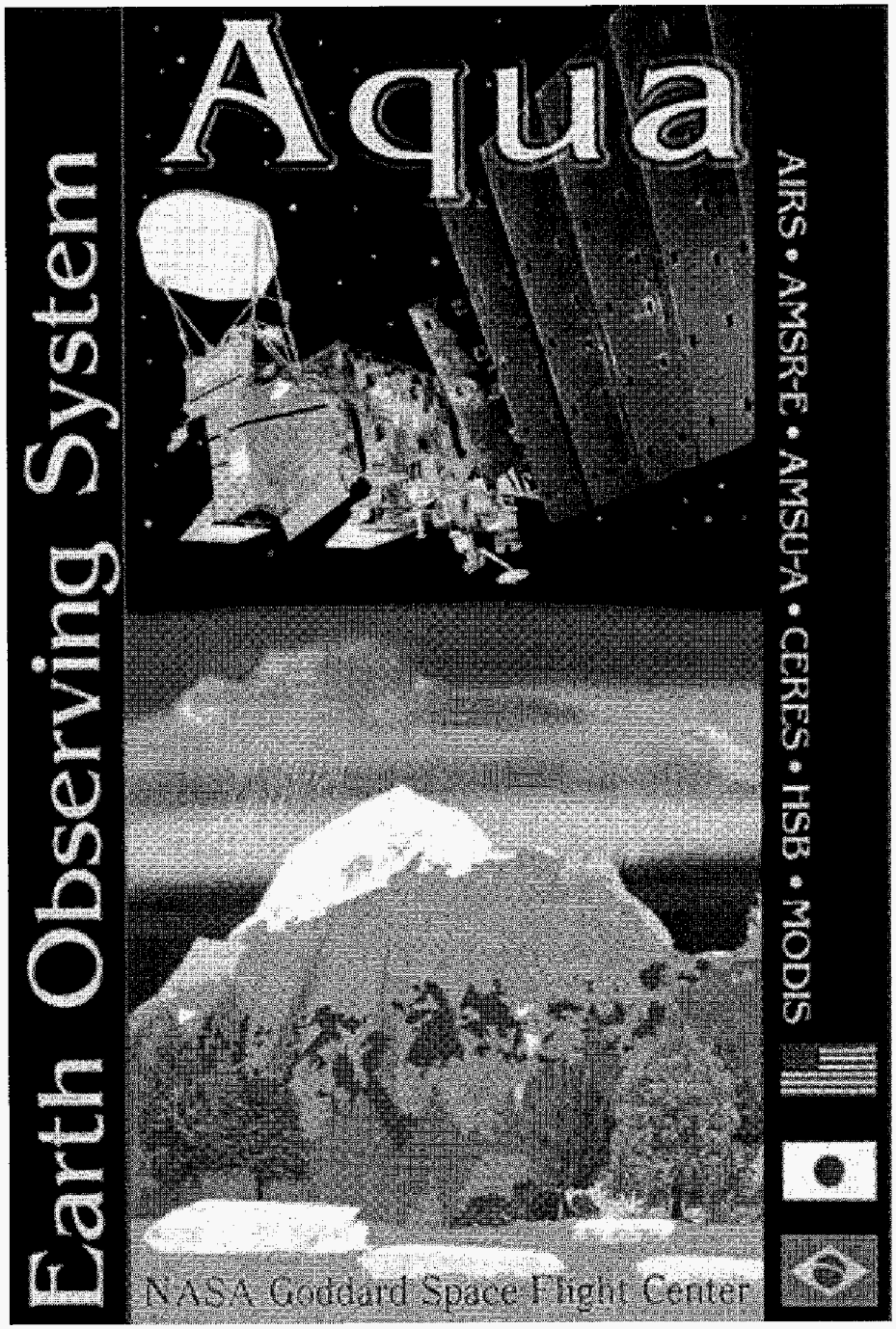
AIRS/AMSU/HSB

Spacecraft:	**EOS Aqua**
Instruments:	**AIRS, AMSU, HSB, MODIS, CERES, AMSR-E**
Launch Date:	**May 4, 2002**
Launch Vehicle:	**Boeing Delta II Intermediate ELV**
Mission Life:	**5 years**
Team Leader:	**Moustafa Chahine**

<u>AIRS Project Objectives</u>

1. **Support Weather Forecasting**
2. **Climate Research**
3. **Atmospheric Composition and Processes**



ABSTRACT

The knowledge of wind velocity as a function of altitude is key to weather forecast improvements.

The ability of hyperspectral sounders in principle to measure vertically resolved water winds, which has long been recognized, has been tested with AIRS data.

AIRS retrievals of total column water above 300 mb have been correlated with the radiosonde upper-tropospheric wind velocity and moisture data.

The excellent correlation is illustrated with results obtained from hurricane Katrina and from the western United States.

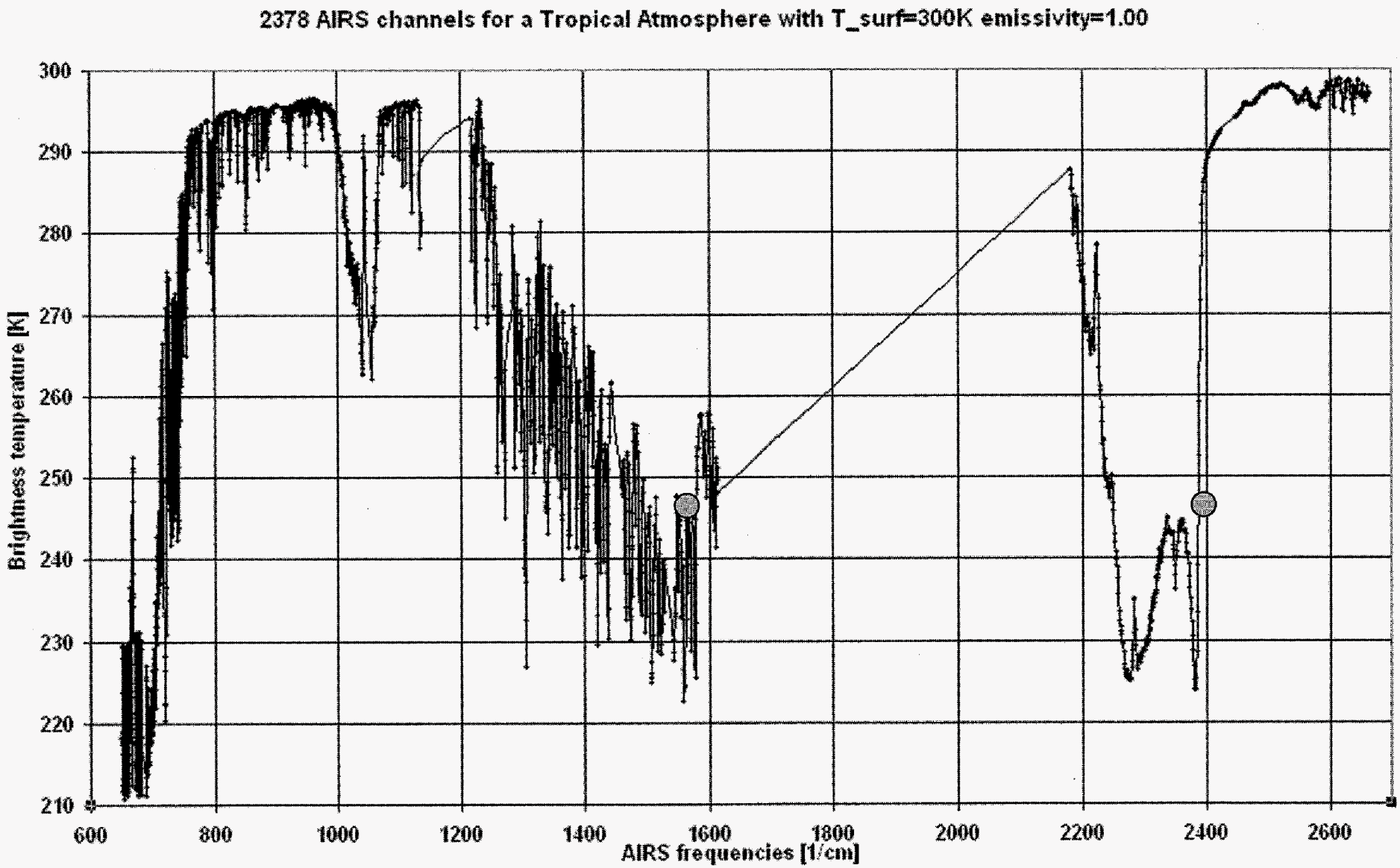
AIRS is a hyperspectral infrared sounder in low Earth orbit It was launched in May 2002.

We illustrate the use of AIRS data for the measurement of upper-tropospheric water by using the 2387 cm-1 CO_2 R-branch channel and the 1551 cm-1 water vapor channel.

The 2387 cm-1 channel measures the temperature at 300 mb totally independent of water vapor.

The weighting function of the 1551 cm-1 channel peaks at 300 mb only under moist conditions; the peak shifts downward (higher temperature) for less water and upward (lower temperature) for more water.

The difference between the brightness temperatures bt2387 and bt1551 cancels the local several degree weather related variability of the temperature and measures the component due to the water vapor at 300 mb.



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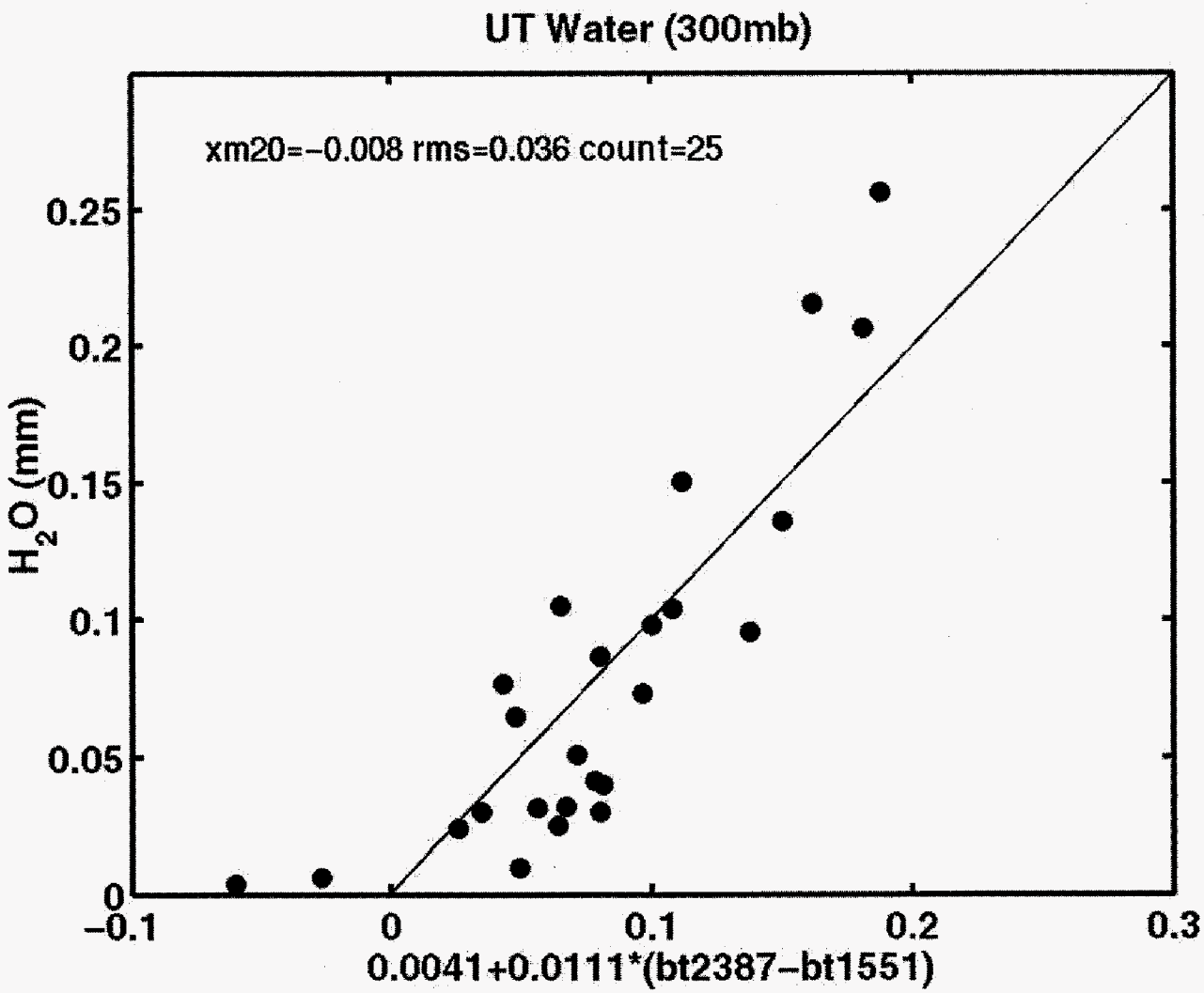
Shown below is the correlation between the water column above 300 mb and the brightness temperature difference bt2387-bt1551 using calculations from climatology profiles with surface brightness temperatures larger than 270K. The excellent correlation can be inverted to make estimates of the water column above 300 mb.



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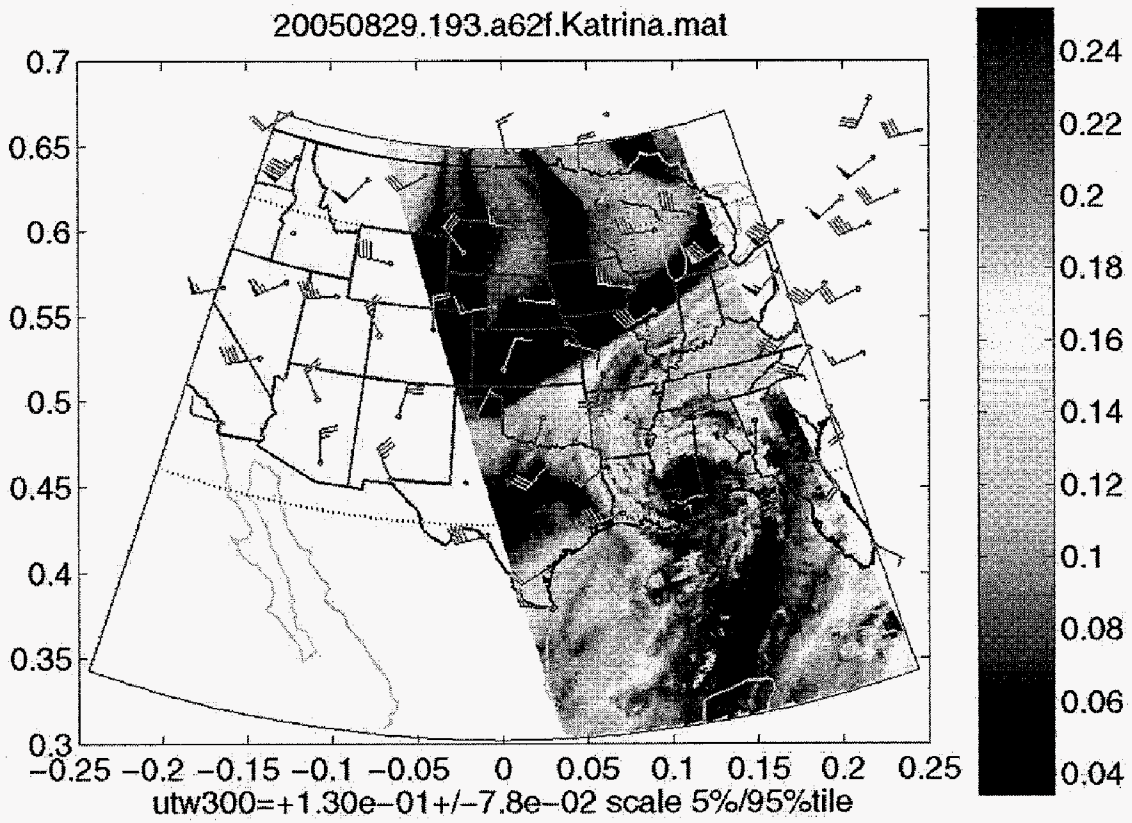
Shown below is an image of the water column above 300 mb (utw300) as derived by the previous techniques for hurricane Katrina. Wind flags derived from rawindsonde data are overlaid on the map



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The next three images are successive AIRS passes over the southwestern USA which show the progression of a very dry lane in the 300 mb water vapor.

The first image is a night overpass on January 11, 2005 at about 1830Z while the second and third are 12 and 24 hours later (day and night respectively).

Note that in each image the direction of the local wind closely parallels the boundary of the dry lane.

Image of water column above 300 mb (utw300) overlaid with rawindsonde wind flags for night pass (1830Z) on January 11, 2005.

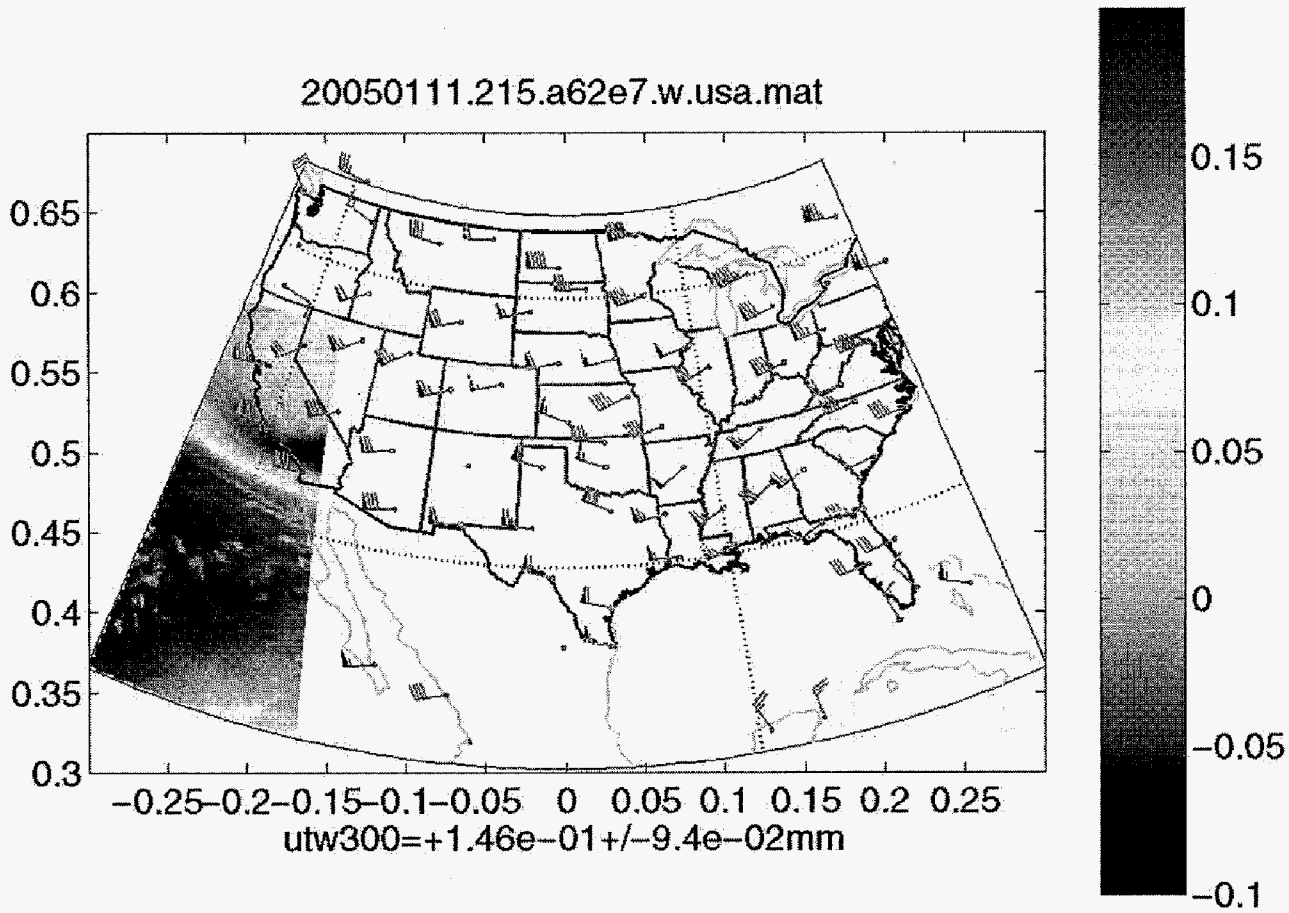

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Image of water column above 300 mb (utw300) overlaid with rawindsonde wind flags for day pass (630Z) on January 12, 2005.

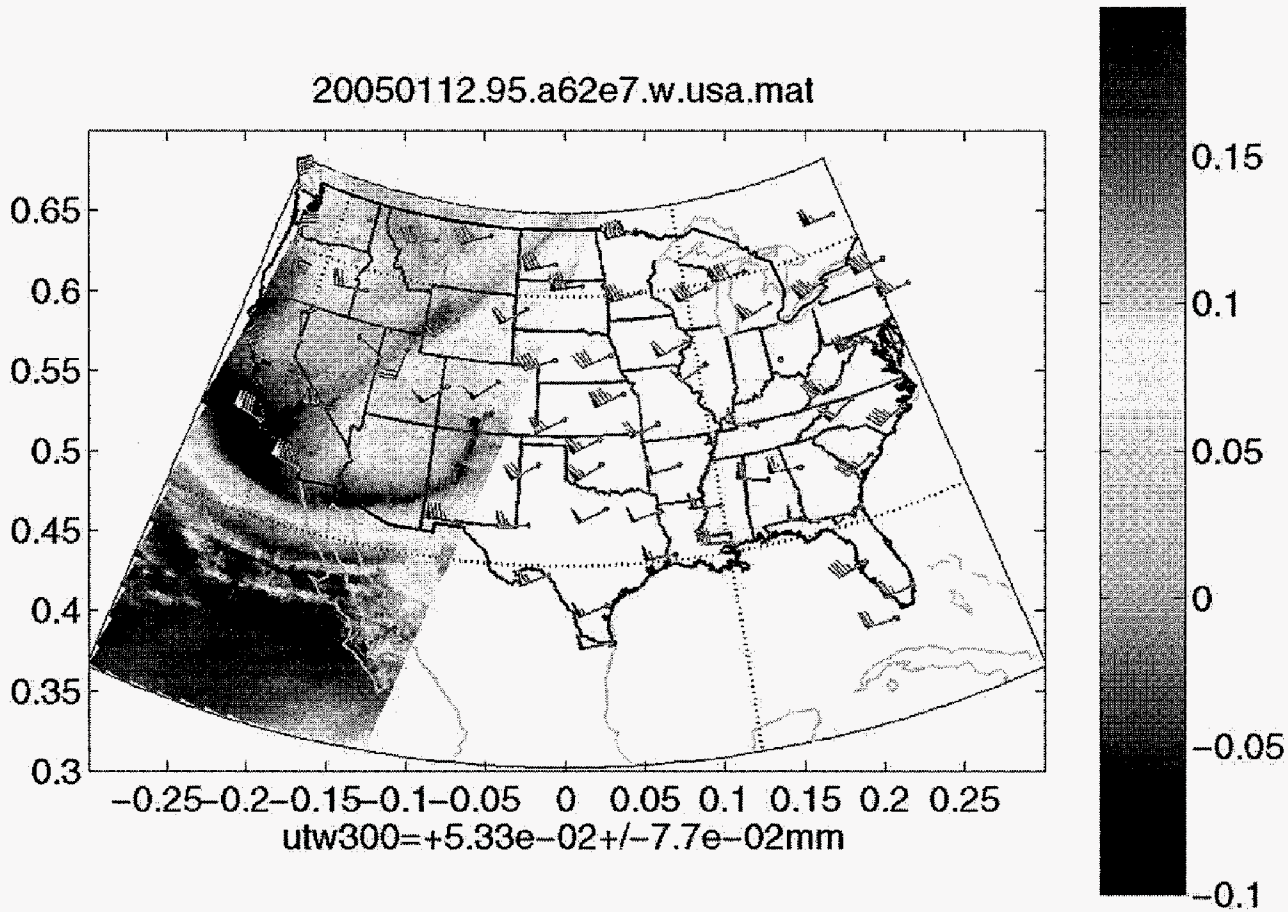

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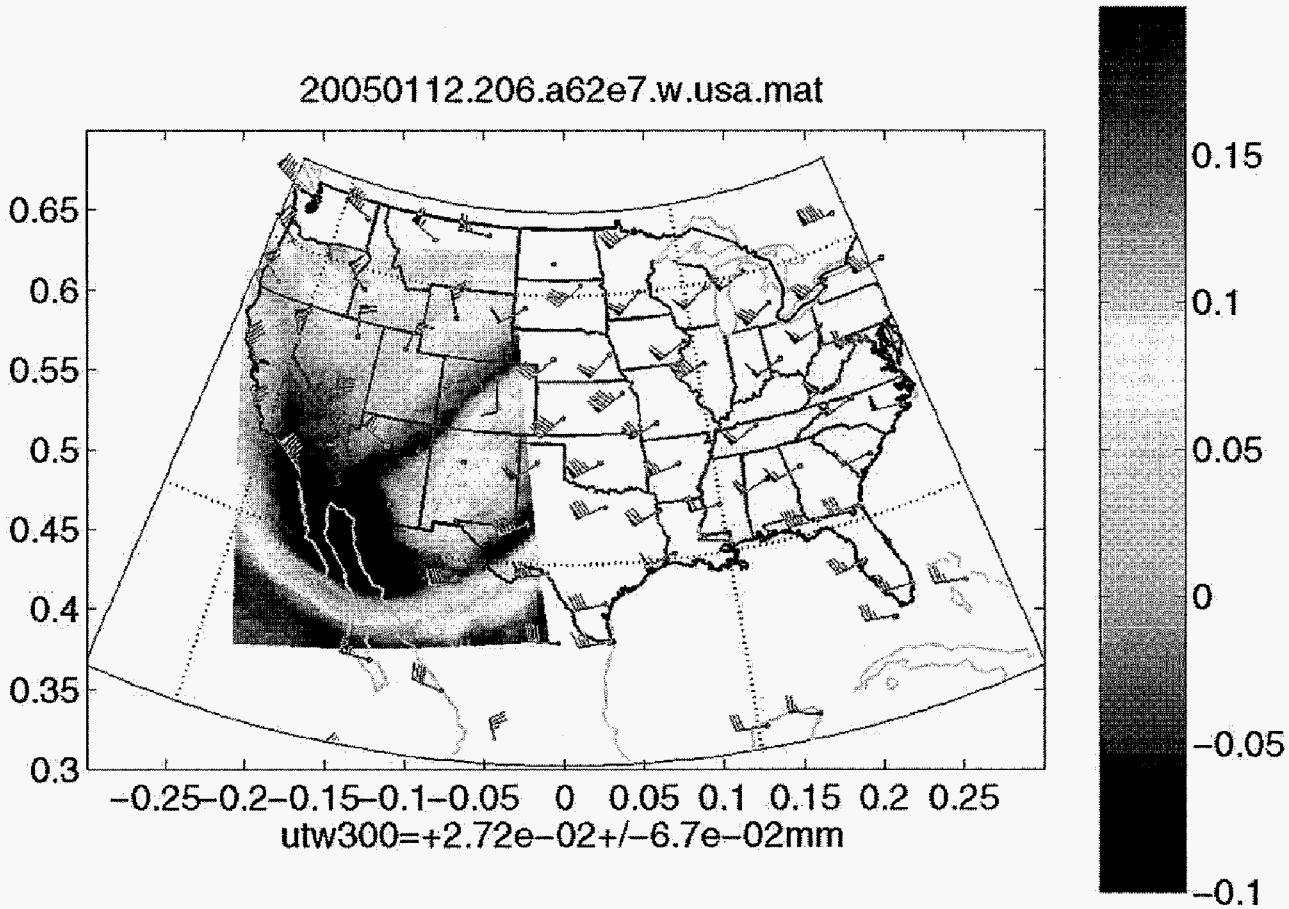
Image of water column above 300 mb (utw300) overlaid with rawindsonde wind flags for night pass (1830Z) on January 12, 2005.



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Summary

The knowledge of wind velocity as a function of altitude is key to weather forecast improvements.

AIRS retrievals of total column water above 300 mb have been correlated with the radiosonde upper-tropospheric wind velocity and moisture data.

The excellent correlation is illustrated with results obtained from hurricane Katrina and from the western United States

The practical application of this technique using AIRS data is the 12 hour repeat coverage. This will be overcome by a hyperspectral sounder in geostationary orbit. .

This work was carried out at the Jet Propulsion Laboratory,
California Institute of Technology, under contract with NASA