P1.6 SHORT-TERM, SEASONAL AND INTERANNUAL VARIABILITY OF THE VERTICAL DISTRIBUTION OF WATER VAPOR OBSERVED BY AIRS

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1. INTRODUCTION

The Atmospheric Infrared Sounder (AIRS) consists of a suite of instruments (Aumann et al. 2003) on board the Aqua spacecraft which retrieve atmospheric parameters over the globe at radiosonde quality on a daily basis in non-precipitating fields of view with less than 80% cloud cover.

Although quantitative global measurements of water vapor have been available since the 1980's (Grody et al. 1980), the vertical resolution of these measurements was very coarse. AIRS provides global coverage amounting to 324,000 precipitable water vapor profiles with spatial resolution at nadir of 45 km and a vertical resolution in the troposphere of 2 km.

2. DATA

The AIRS Level 2 geophysical standard product files provide temperature and water vapor profiles on 28 layers of standard atmosphere from the surface to 0.1mb. These data are generally of interest to meteorologists and researchers studying localized, time-variable phenomena.

The desire for Level 3 products in the science community is universal among those interested in atmospheric dynamics, climate variability and change, and the hydrological cycle. We have developed Level 3 global gridded products from the Level 2 products, including water vapor to 100 mb. These products are reported on daily, 8-day and monthly temporal scales at 1x1 degree spatial resolution. In addition, water vapor is reported at 12 vertical levels from the surface to 100 mb. They will be available to the scientific community beginning Jan, 2005 from the Goddard Earth Sciences (GES) Data and Information Services Center (DISC) Distributed Active Archive Center (DAAC) as part of the V4.0 delivery by the AIRS Project to that facility. Interested users will find links to documentation and data access pages at the URL

http://daac.gsfc.nasa.gov/atmodyn/airs/

3. EXAMPLES

3.1 LEVEL 3 GLOBAL WATER VAPOR VERTICAL DISTRIBUTION

Figure 1 represents the global distribution of total atmospheric water vapor (preciptable water) from 1000mb to 100mb

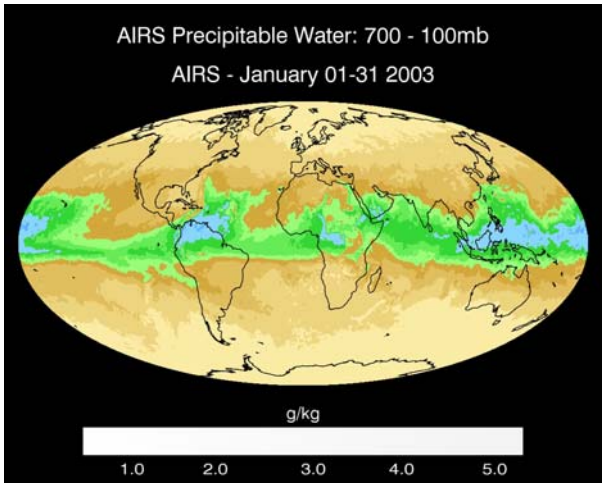

Figure 1. Jan, 2003 monthly average precipitable water vapor above 700mb.

Figure 2 is the global precipitable water vapor distribution from 700mb to 100mb. These images were derived from the AIRS height resolved water vapor level 3 core product. Water vapor is not distributed evenly over the earth's surface and as can be seen in both figures, is concentrated primarily in equatorial regions where the air is warmer, since warm air can hold more moisture.

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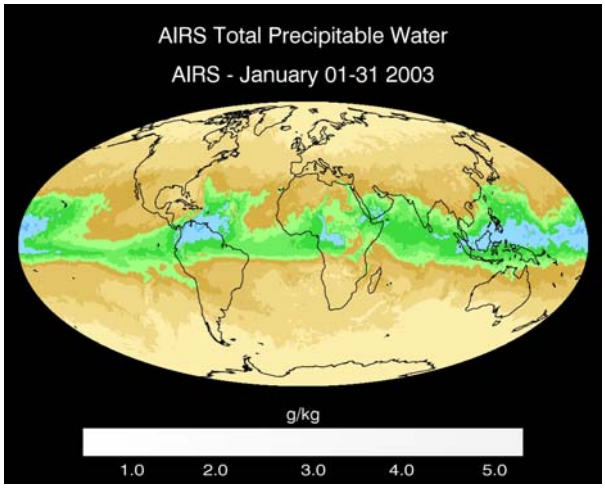

Figure 2. Jan, 2003 monthly average total precipitable water vapor

The distribution of water vapor tends to be even more uneven in the vertical dimension with concentrations varying more than four orders of magnitude with height. (Seidel 2002). Figure 2 shows the dramatic reduction in the vertical resolution of water vapor as measured by the AIRS instrument.

3.2 LEVEL 2 CONUS WATER VAPOR SPATIAL AND TEMPORAL VARIABILITY

Figure 3 shows the precipitable water vapor distribution in early Spring of 2004. Note the restriction of enhanced water vapor to the near-equatorial region. The atmosphere in the mid-latitudes is relatively dry compared to later in the season.

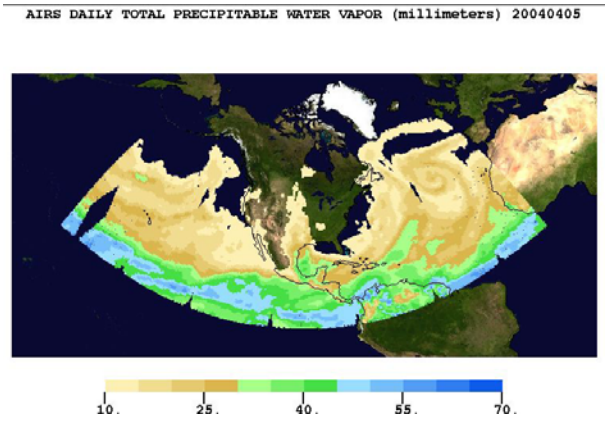

Figure 3. Total column water vapor (mm) 4/5/04.
Extra-tropical disturbance in mid N. Atlantic contains relatively low water vapor.

Figure 4 shows the enhancement of water vapor burden in the mid-latitudes as hurricane season intensifies in both the Eastern Pacific and the Atlantic.

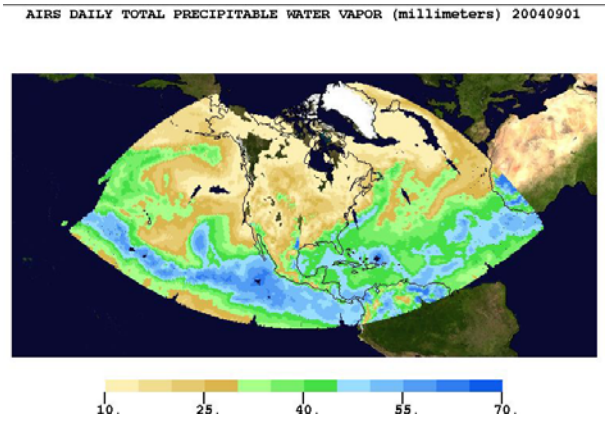

Figure 4. Total column water vapor (mm) 9/1/04
Hurricane Hermine is off the E Coast of the US.
Hurricane Frances is N of the Dominican Republic
Hurricane Howard is S of Baja California
Remnant of Georgette halfway to Hawaii
Missing data in hurricane cores due to areas of intense precipitation.

Figure 5 shows the enhancement of water vapor burden in the mid-latitudes at the peak of the hurricane activity.

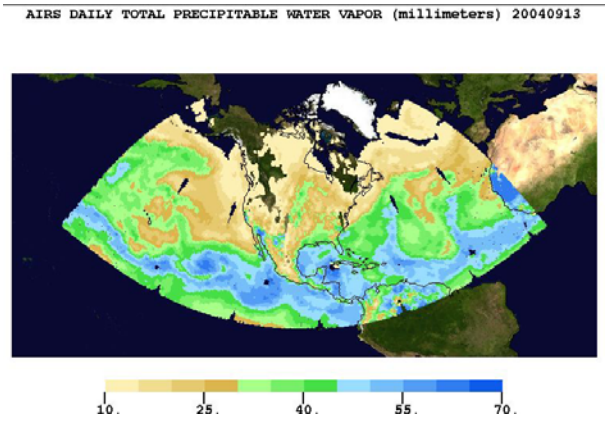

Figure 5. Total column water vapor (mm) 9/13/04.
Hurricane Ivan entering Gulf of Mexico between Yucatan and Cuba
Hurricane Jeanne at the Windward Islands
Hurricane Isis is S of Baja California
Remnant of Howard farther West in Pacific

Figure 6 shows the beginning of the decline of mid-latitude water vapor.

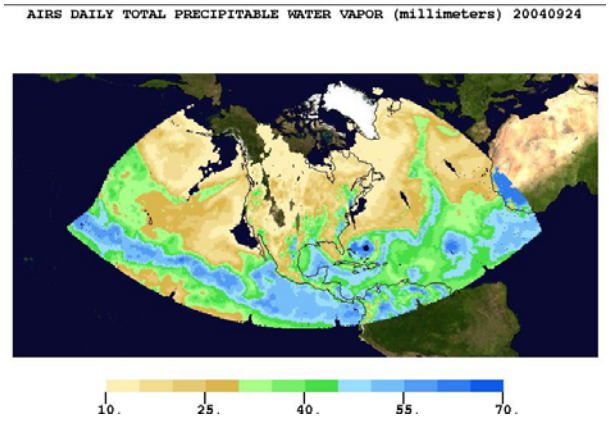

Figure 6. Total column water vapor (mm) 9/24/04.
Hurricane Jeanne is off Florida E Coast
Hurricane Karl forming in mid-Atlantic

4. SUMMARY

We have demonstrated the insight into global and regional distribution and variability of water vapor which is now provided to researchers through AIRS data products

5. ACKNOWLEDGEMENTS

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6. REFERENCES

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