MODIS Near-IR Water Vapor and Cirrus Reflectance Algorithms & Recent Updates for Collection 5

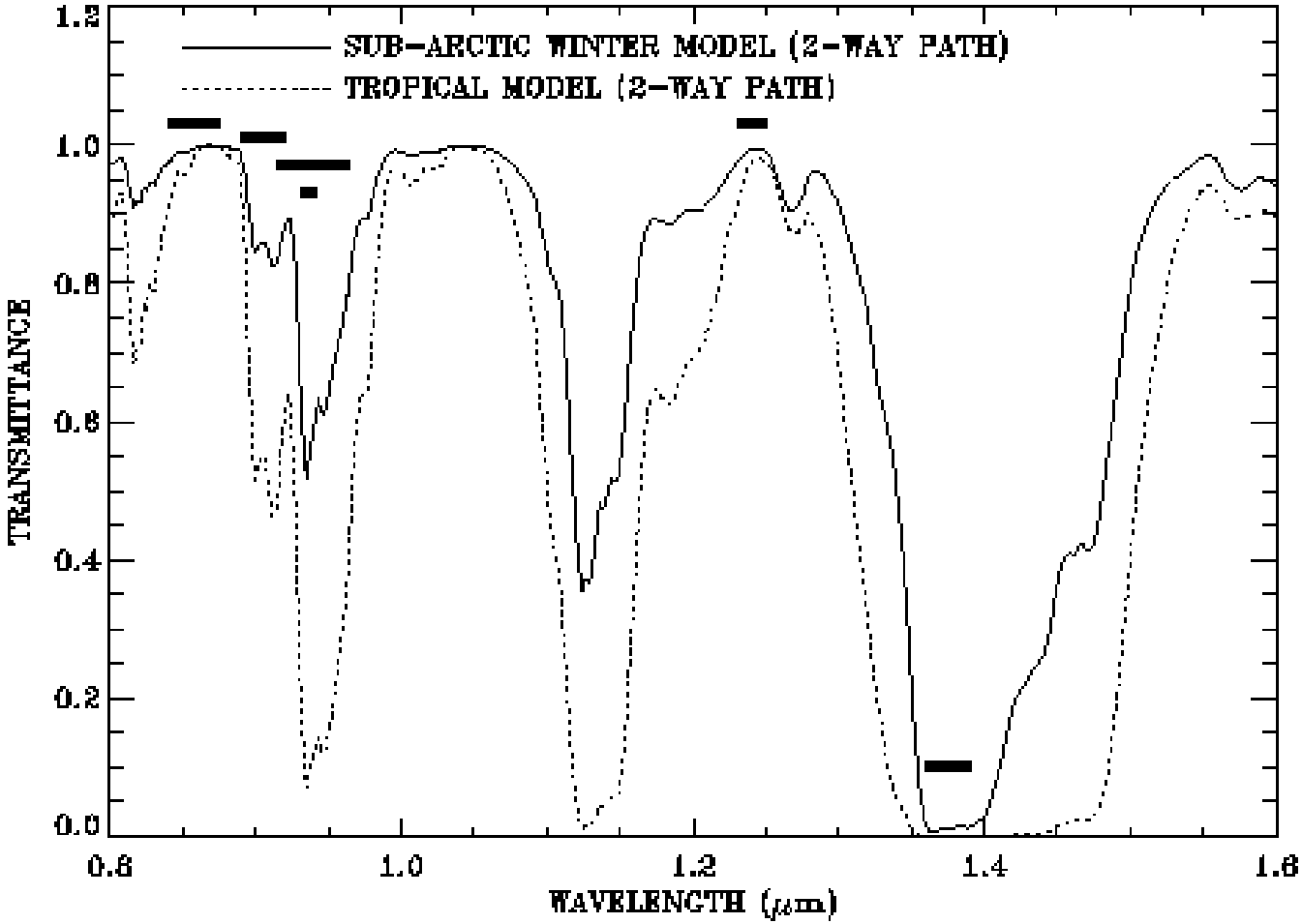
Bo-Cai Gao

Remote Sensing Division, Code 7232, Naval Research Laboratory, Washington, DC

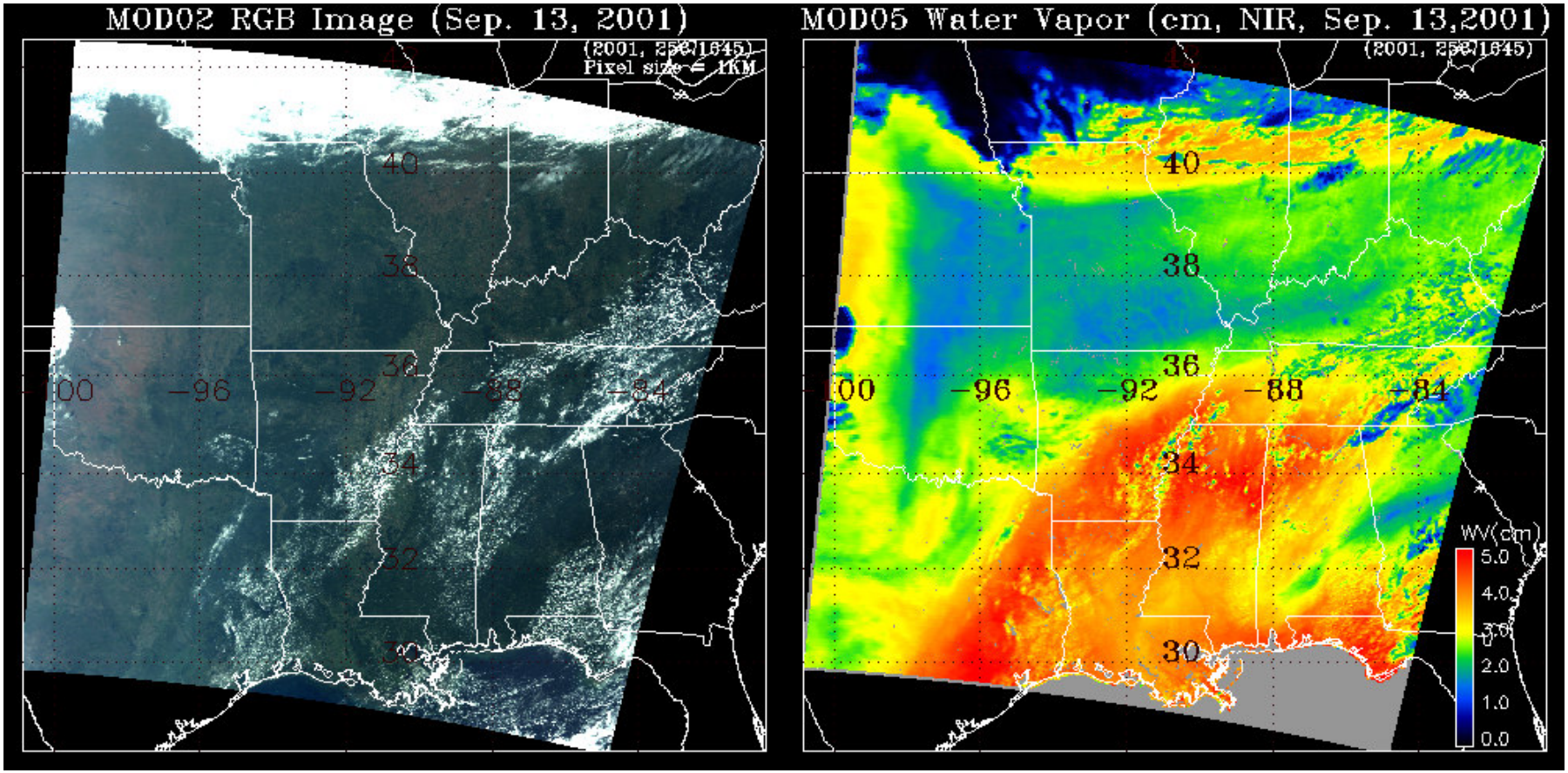
INTRODUCTION

- MODIS has five channels located near 1 μm for remote sensing of water vapor. MODIS also has a narrow channel centered at 1.375 μm for remote sensing of high clouds.
- Today, I will briefly describe the MODIS near-IR water vapor algorithm and the cirrus reflectance algorithm, and present sample results.
- I will also report the recent upgrades to both algorithms – mainly fixing bugs related to QA parameters.

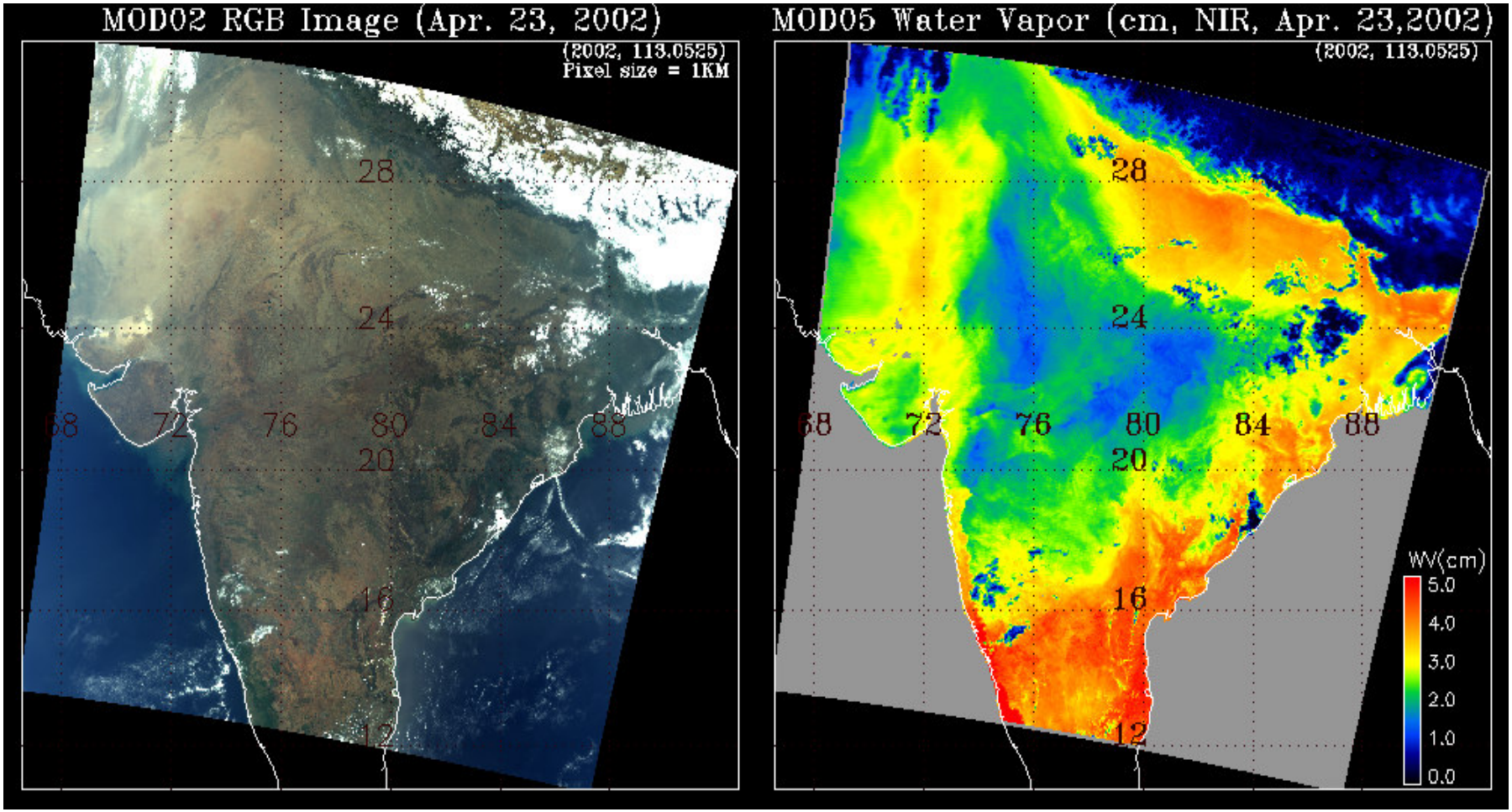
Relevant Channel Positions and Widths



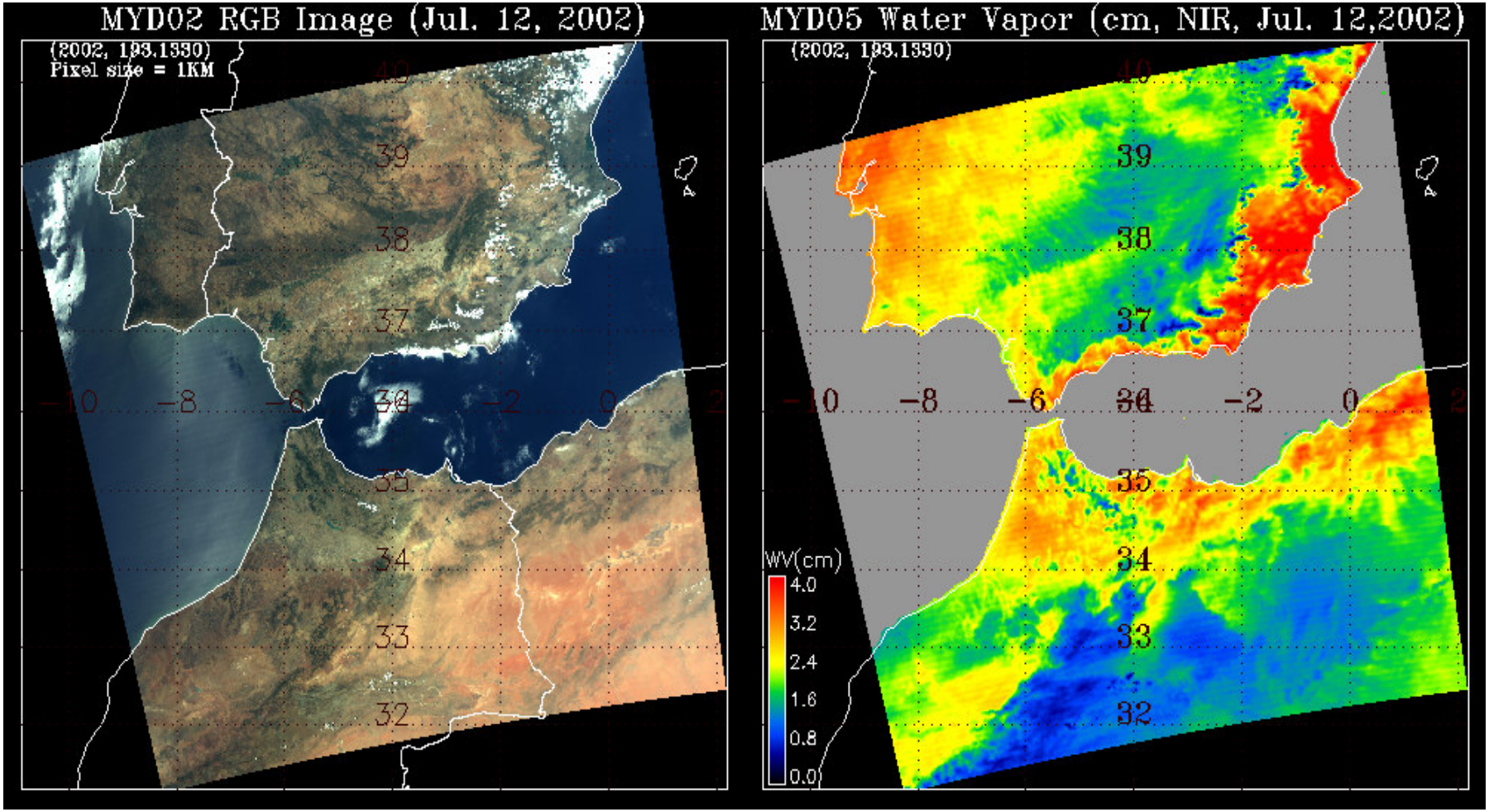
A Sample Terra MODIS Water Vapor Image



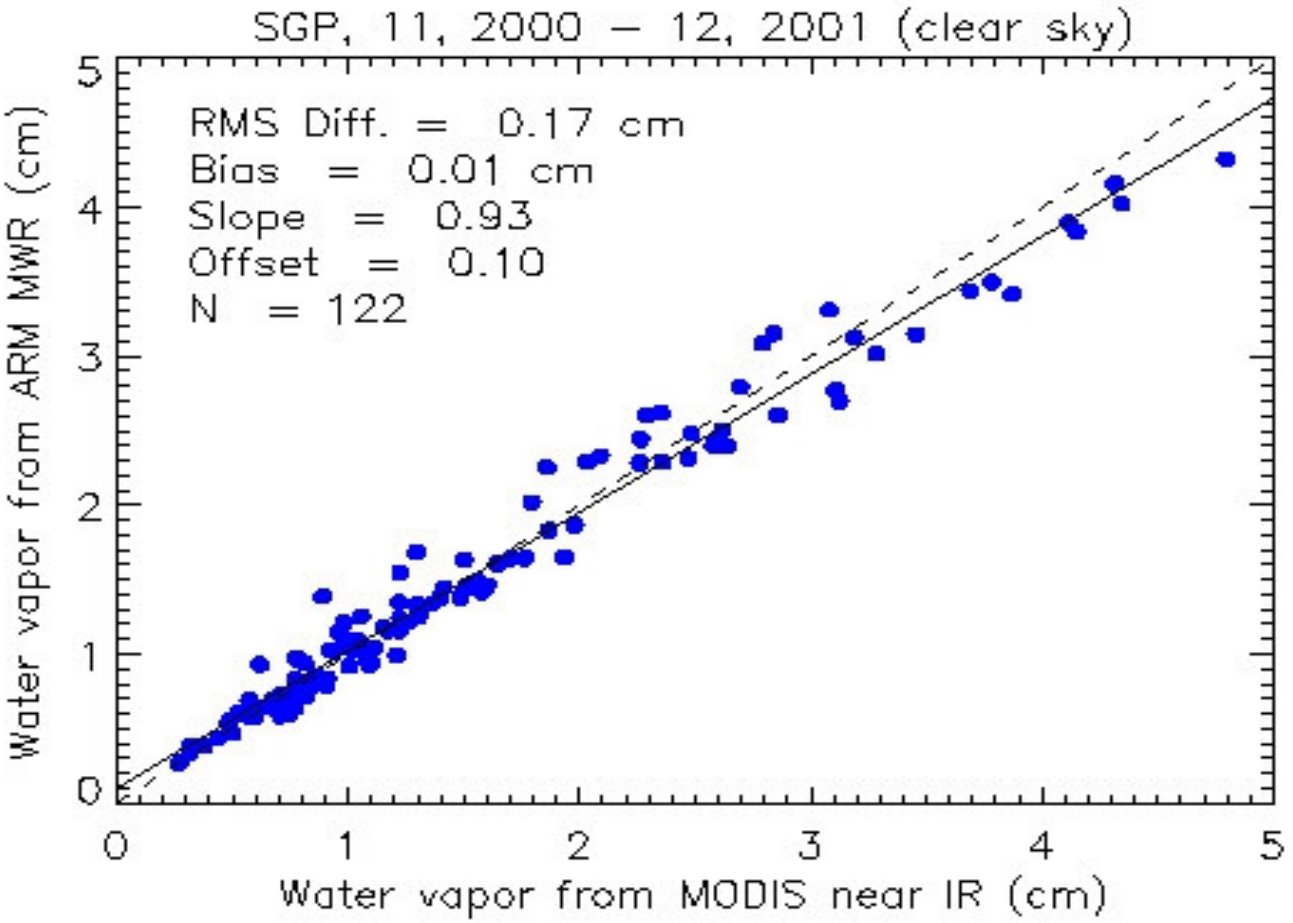
Another Terra MODIS Vapor Image



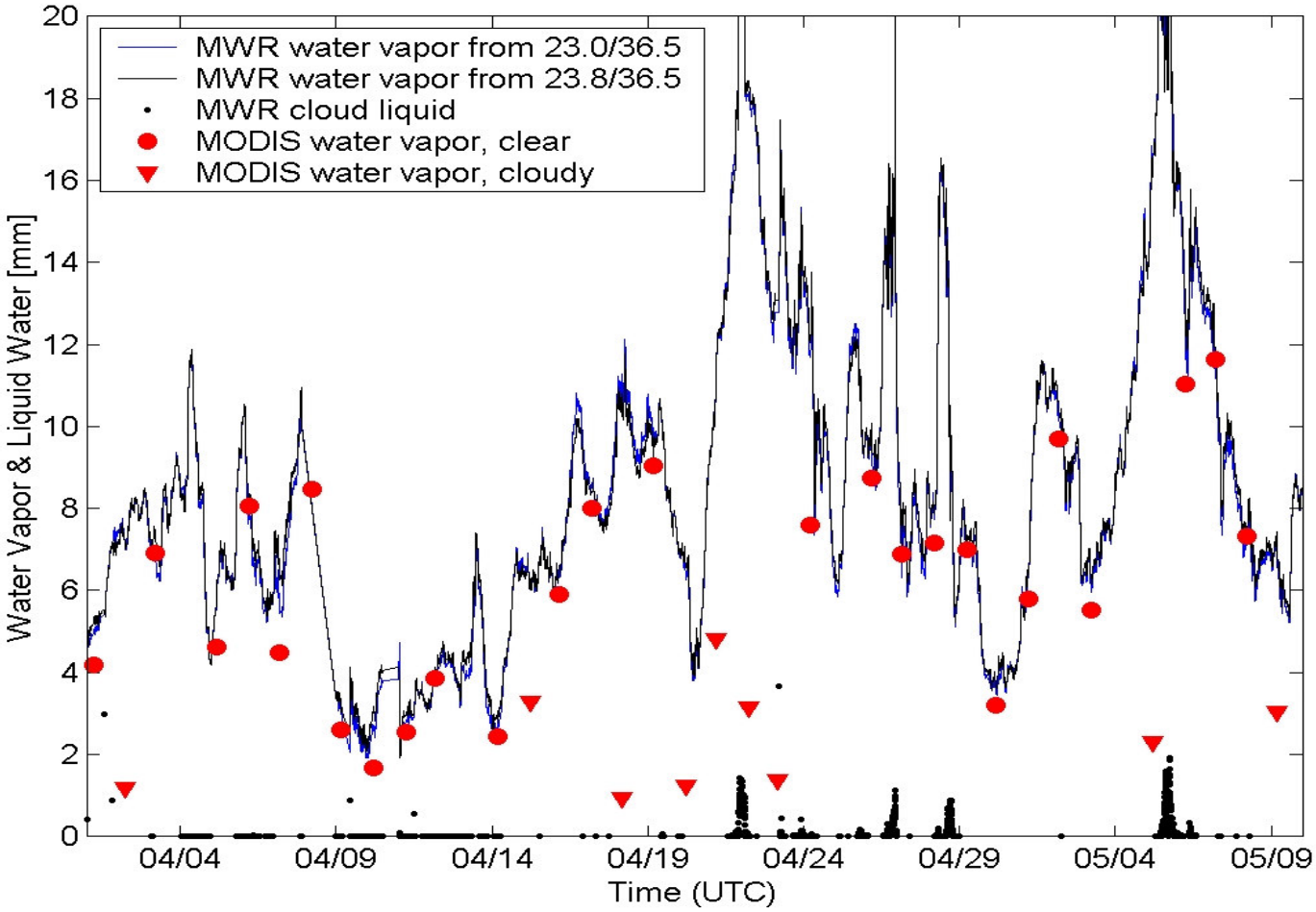
A Sample Aqua MODIS Vapor Image



Validation With MWR Data

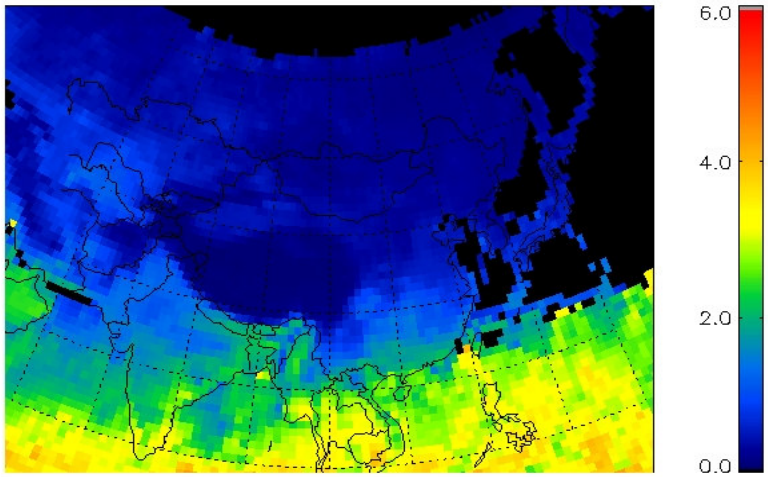


Validation With Another Set of MWR Data

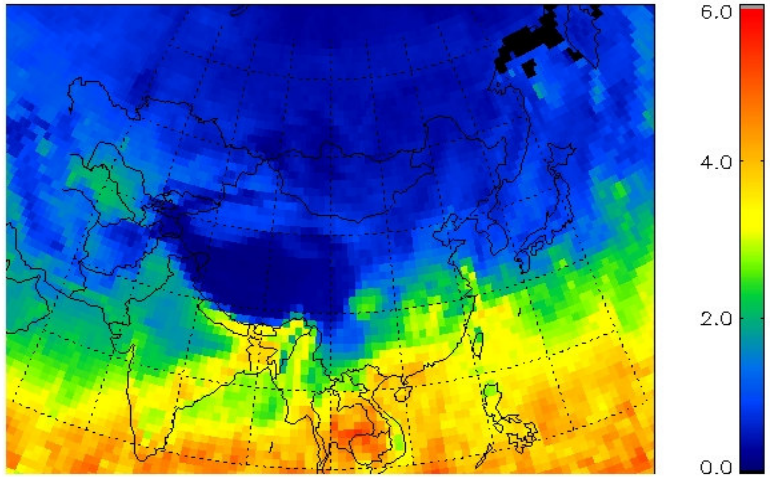


Water Vapor (Asia)

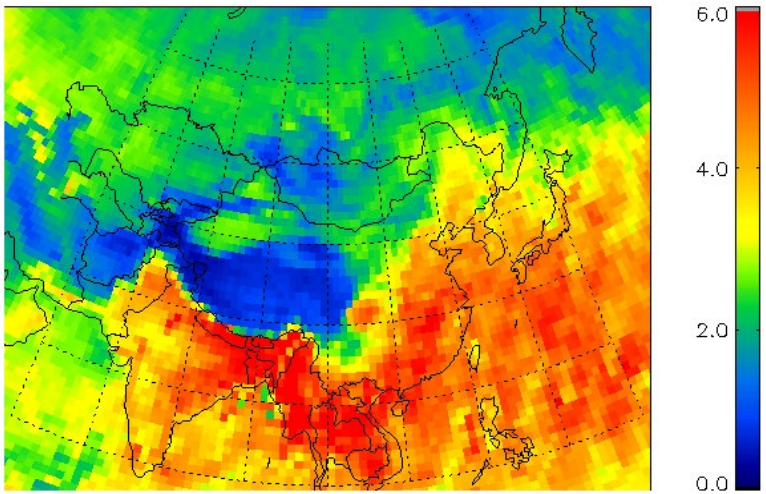
January, 2002



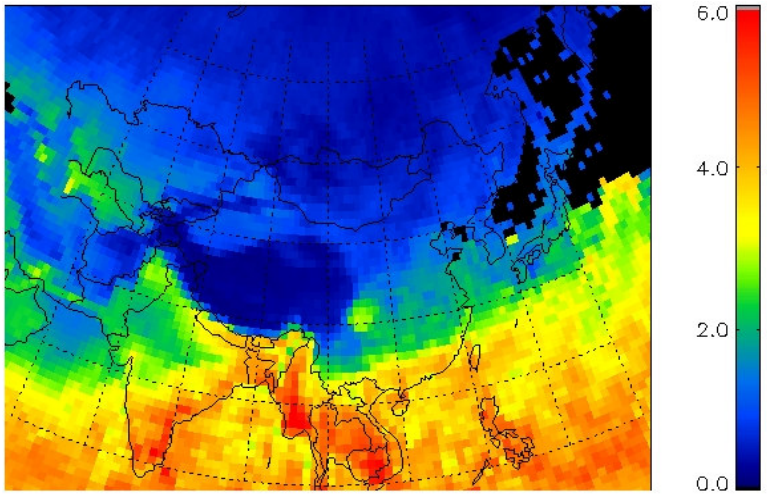
April, 2002



July, 2002



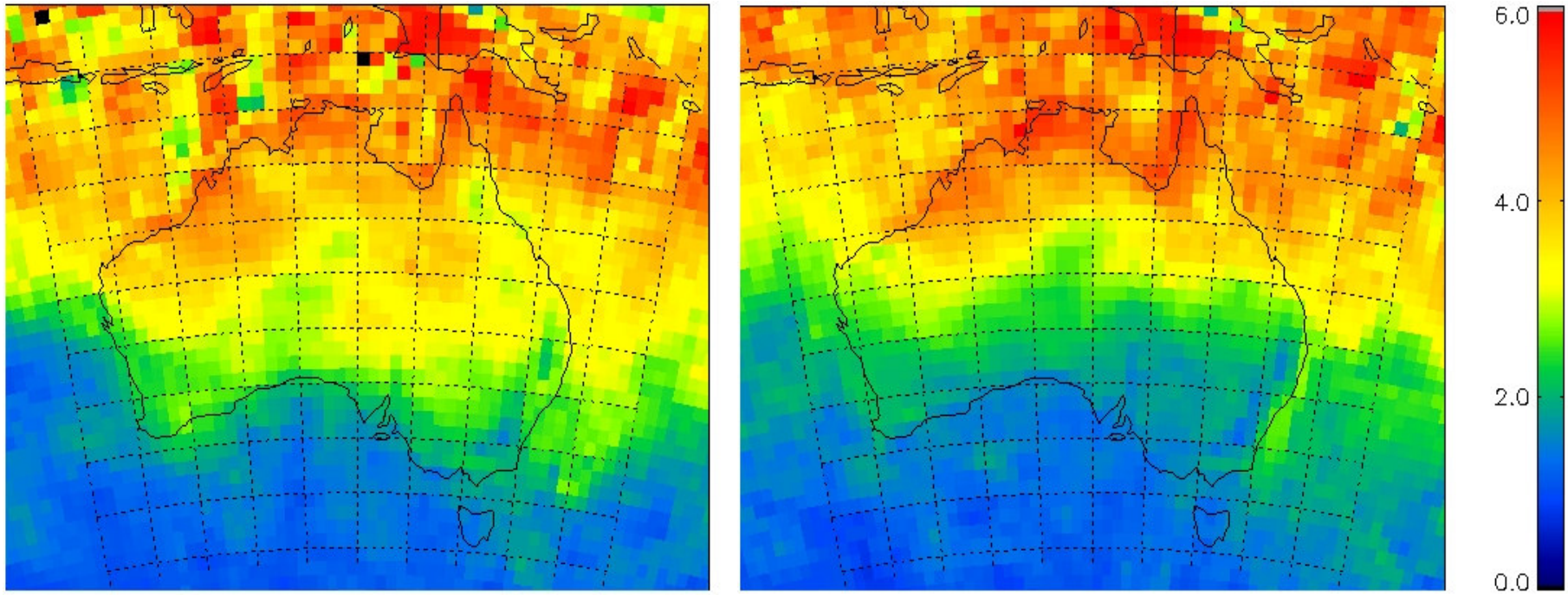
October, 2002



Water Vapor (Australia)

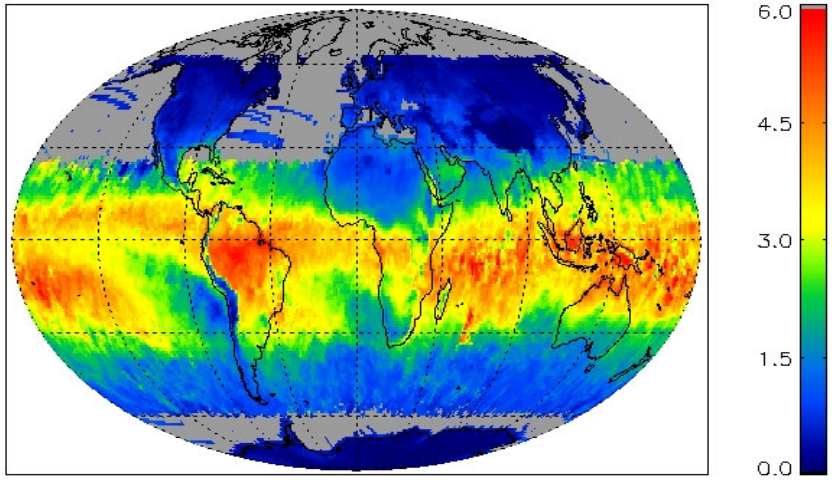
January, 2001

January, 2002



Water Vapor (Global, near-IR)

January, 2002



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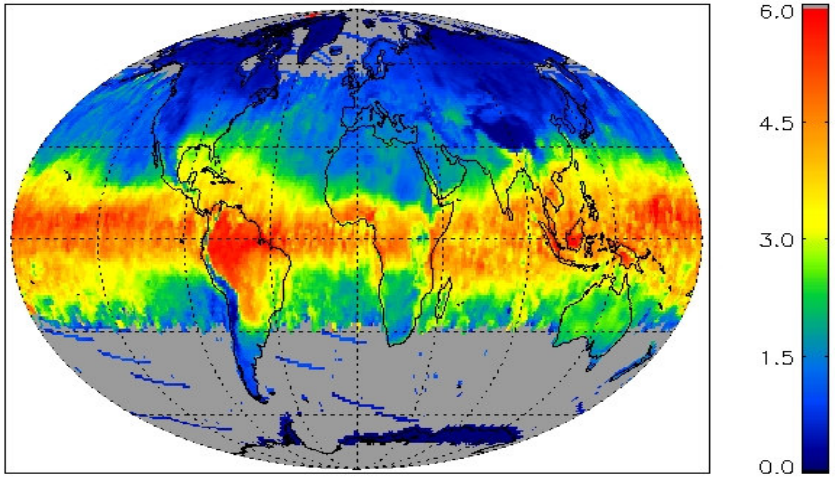
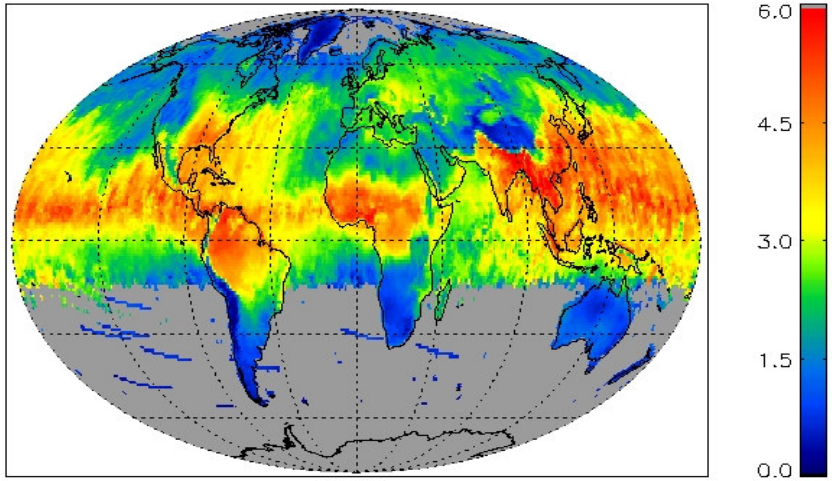
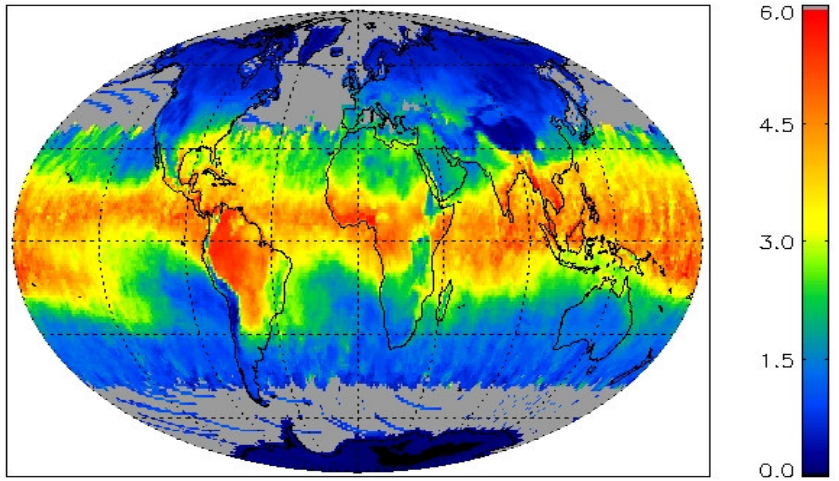


July, 2002

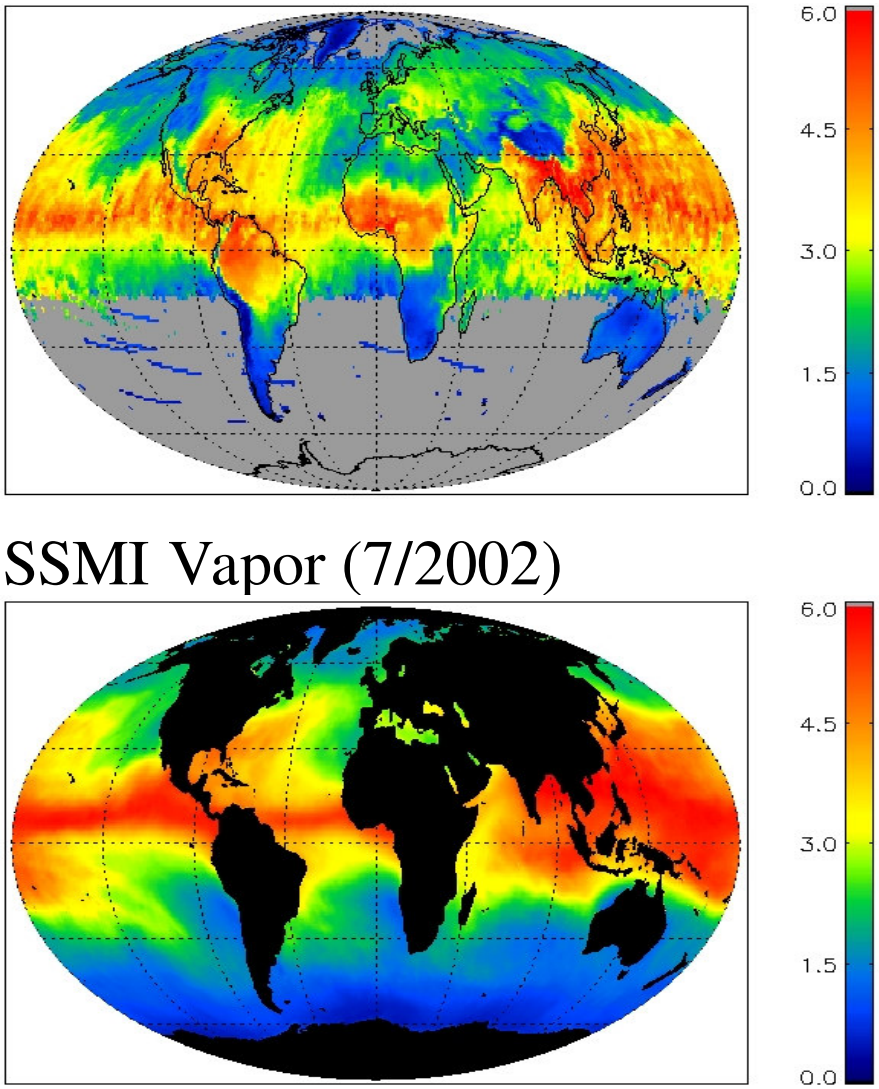


October, 2002



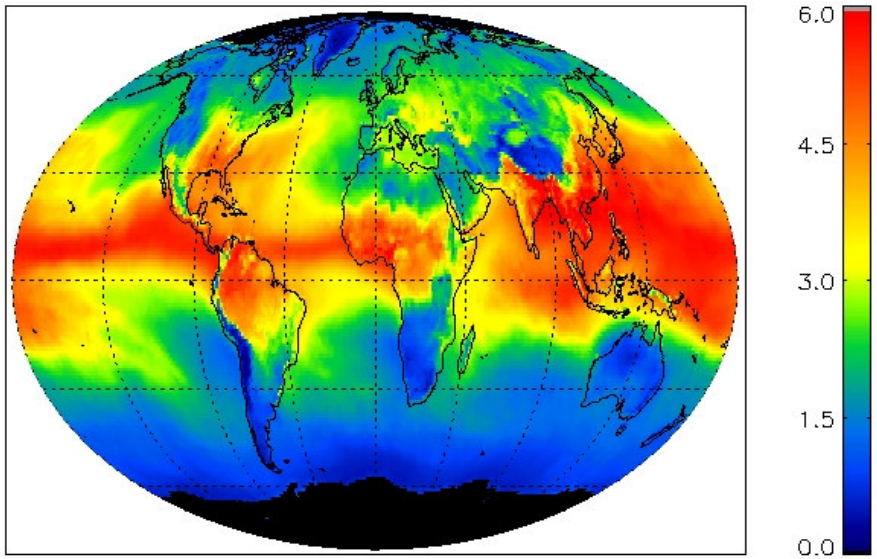
Water Vapor Image (MODIS + SSMI)

MODIS Vapor (7/2002)



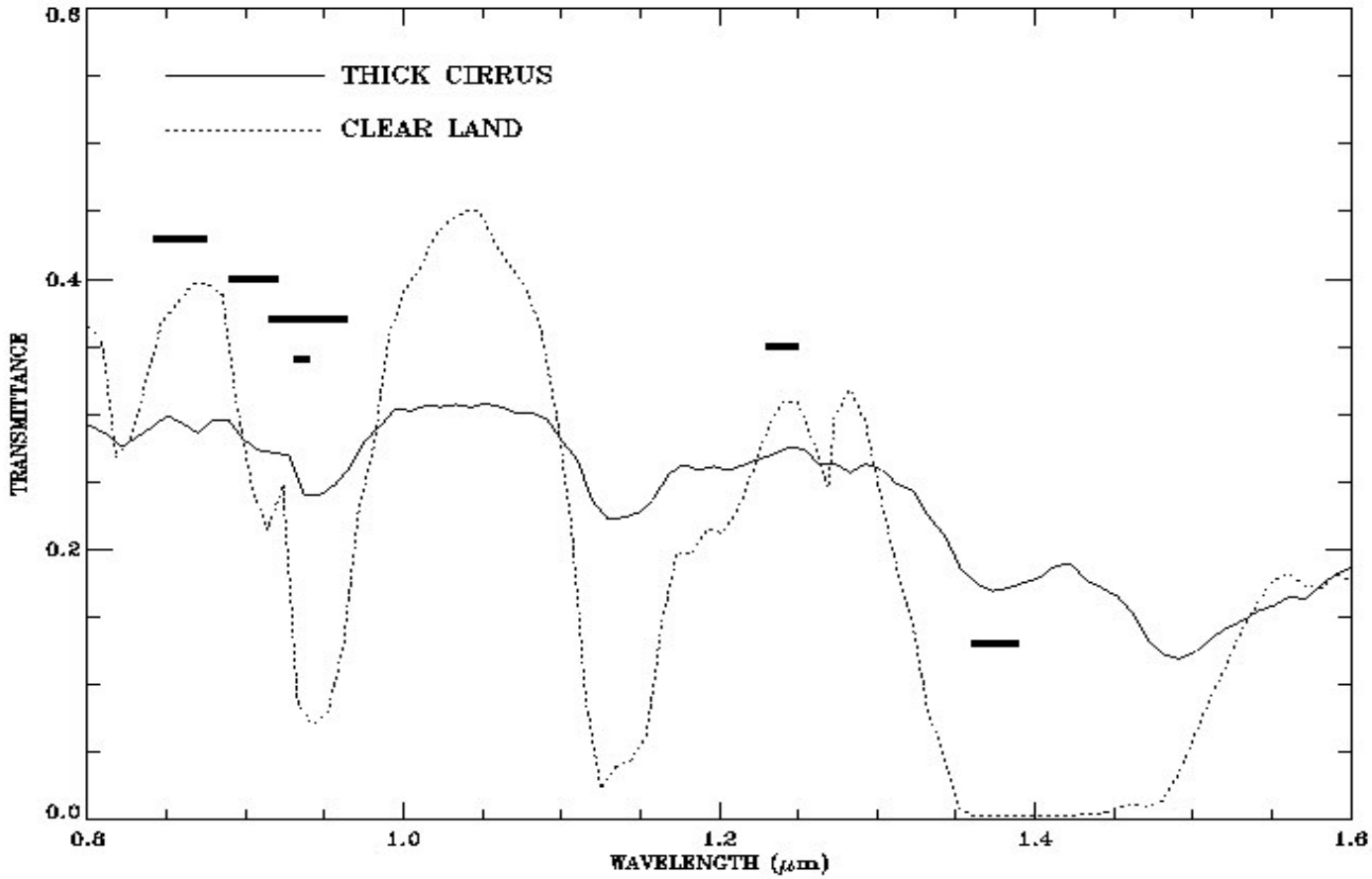
SSMI Vapor (7/2002)

Vapor (MODIS + SSMI)

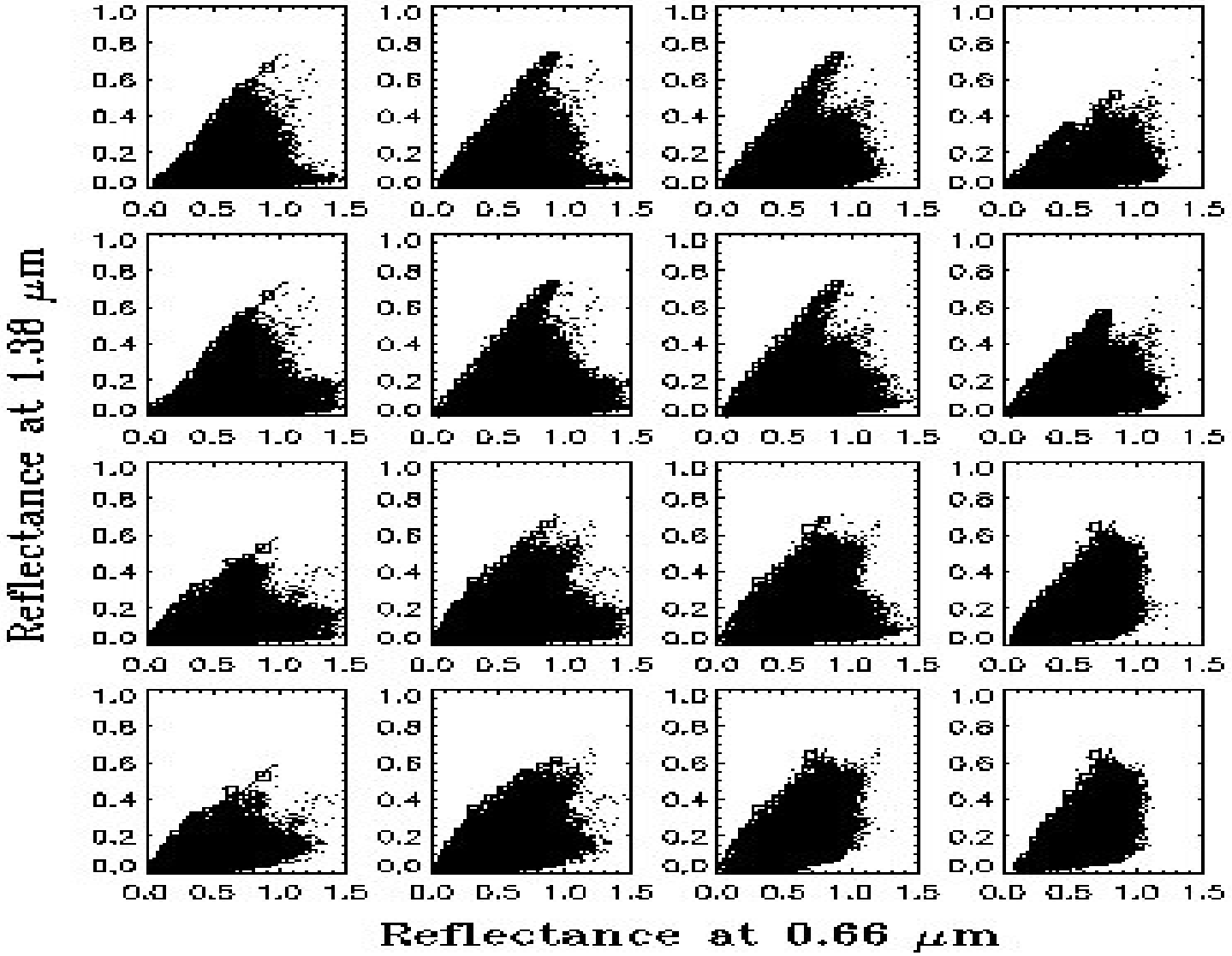


QuickTime™ and a
Animation decompressor
are needed to see this picture.

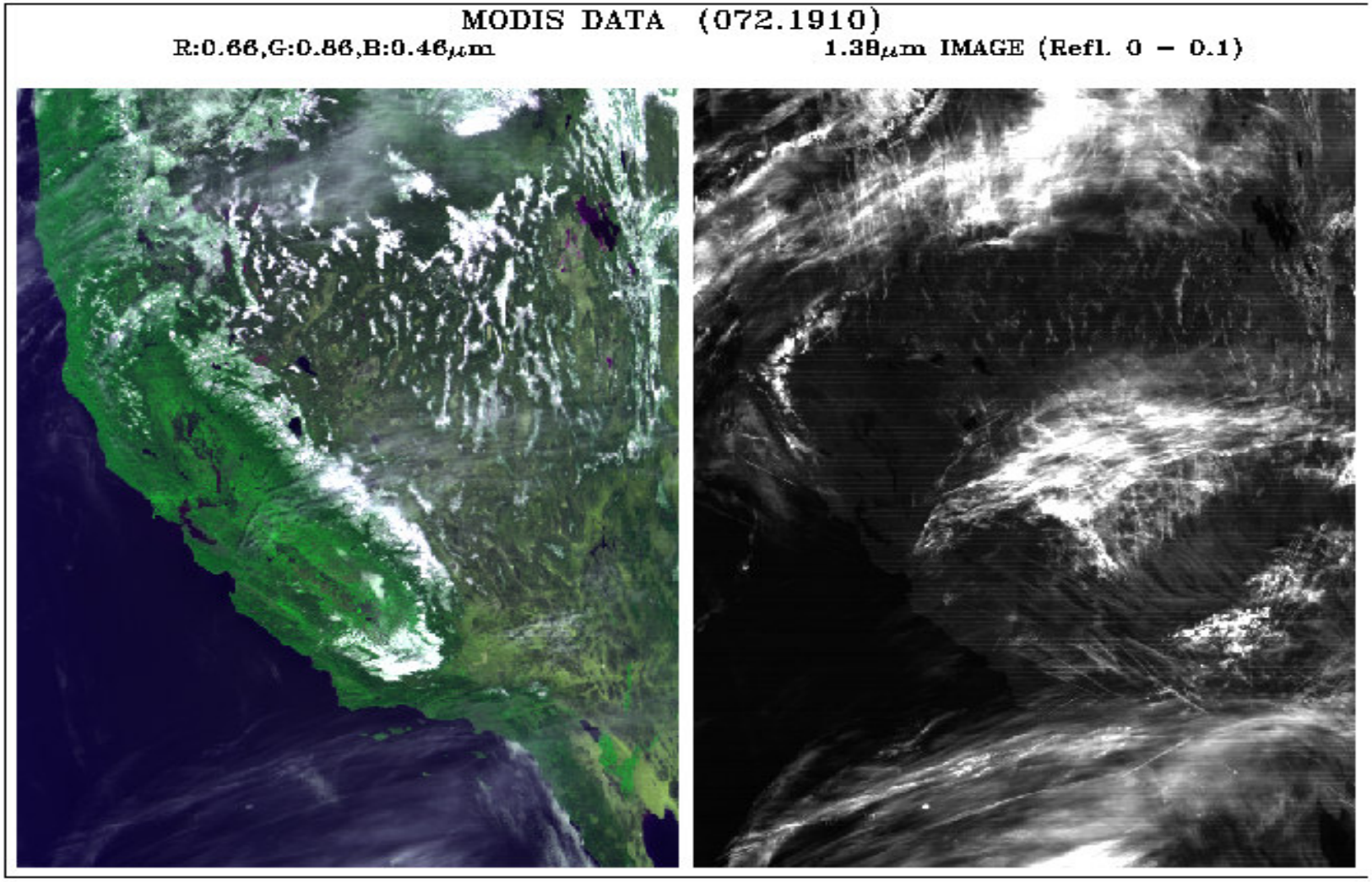
Sample AVIRIS Cloud Spectra & MODIS Channel Positions and Widths



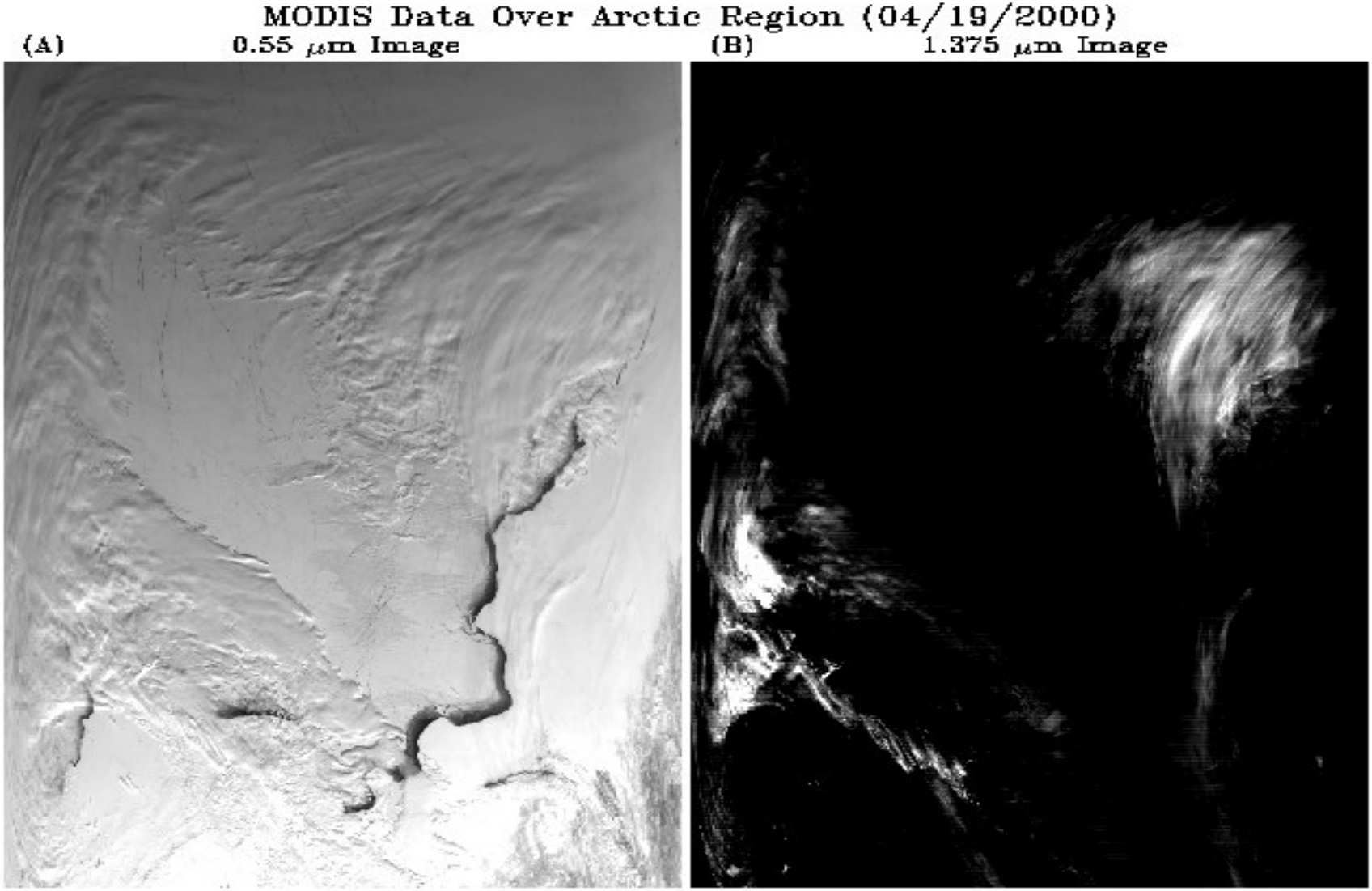
Estimates of 1.375-μm Channel Water Vapor Transmittance



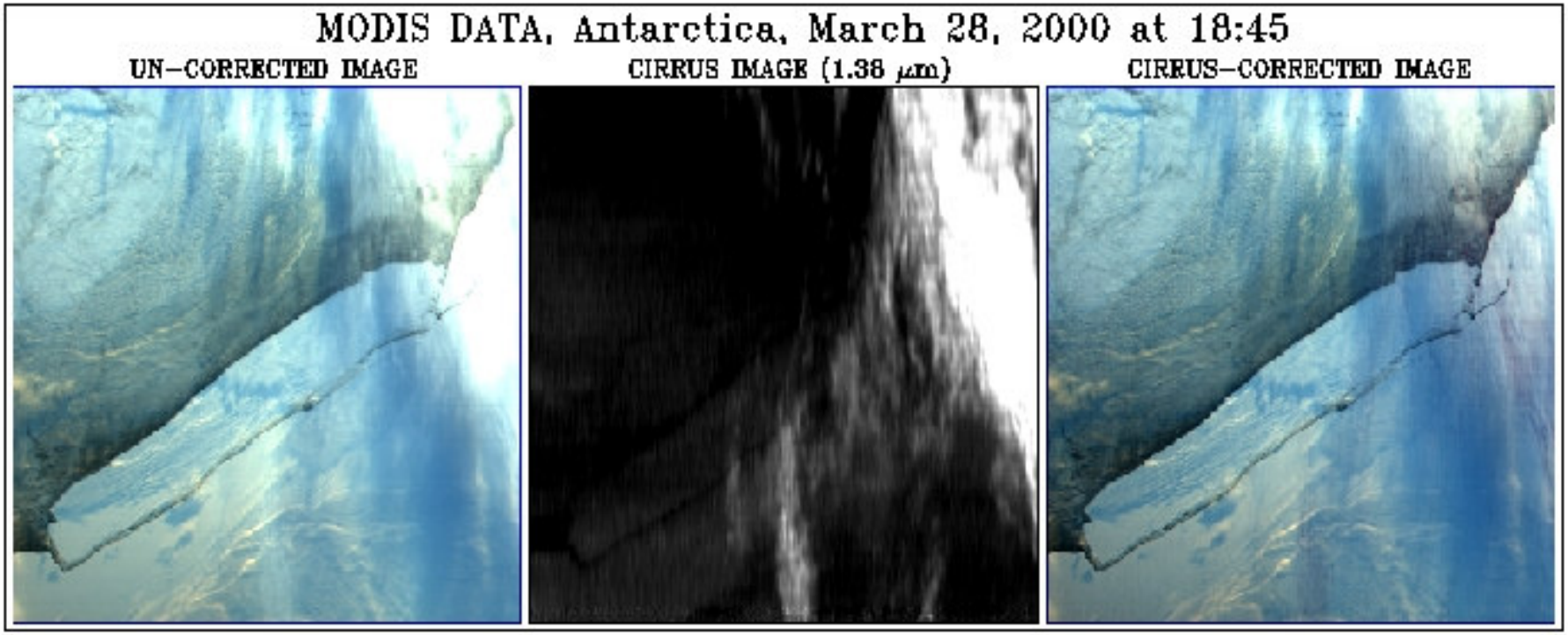
Cirrus Detection Over Western US



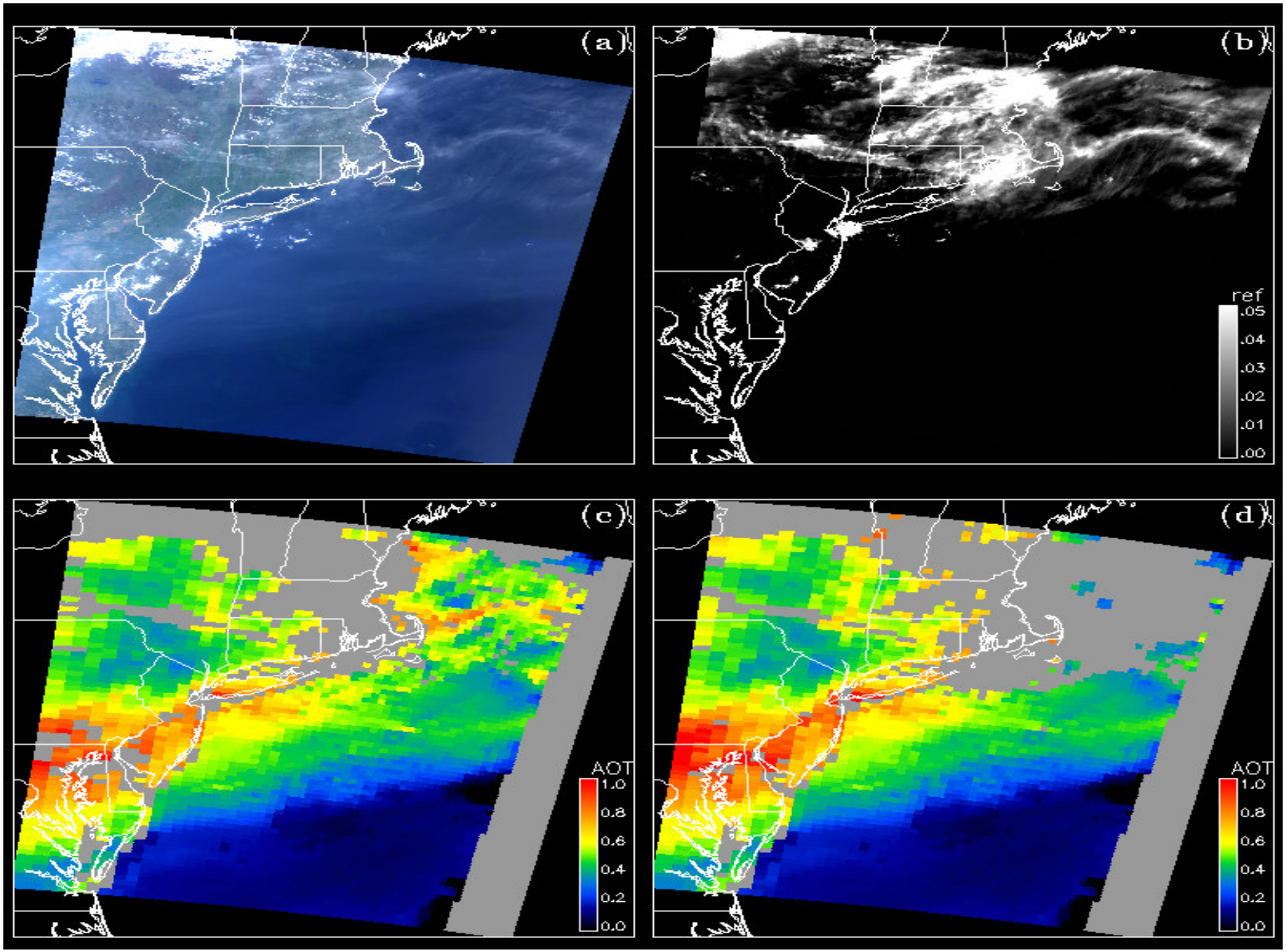
Cirrus Detection Over Polar Region



Cirrus Path Radiance Removal – An Example

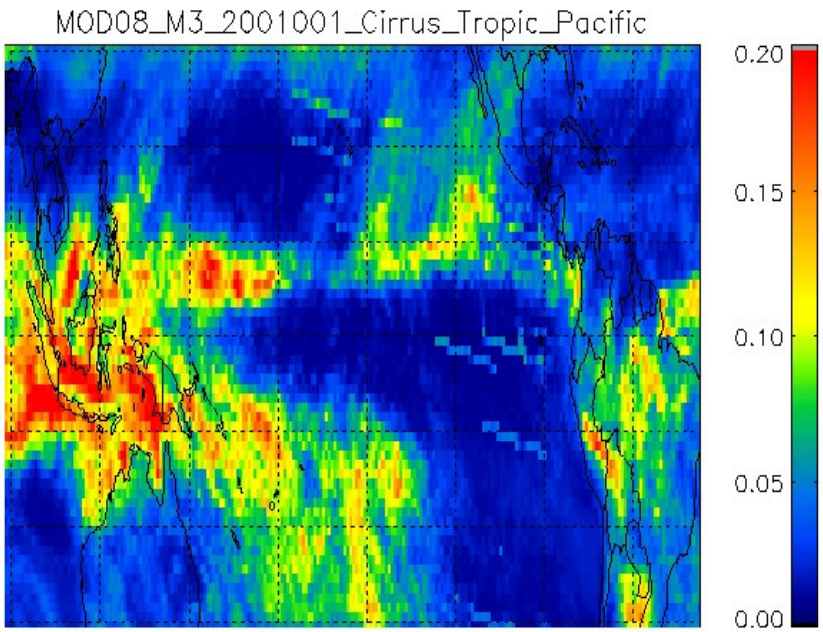


Cirrus Mask For Improving Aerosol Retrievals

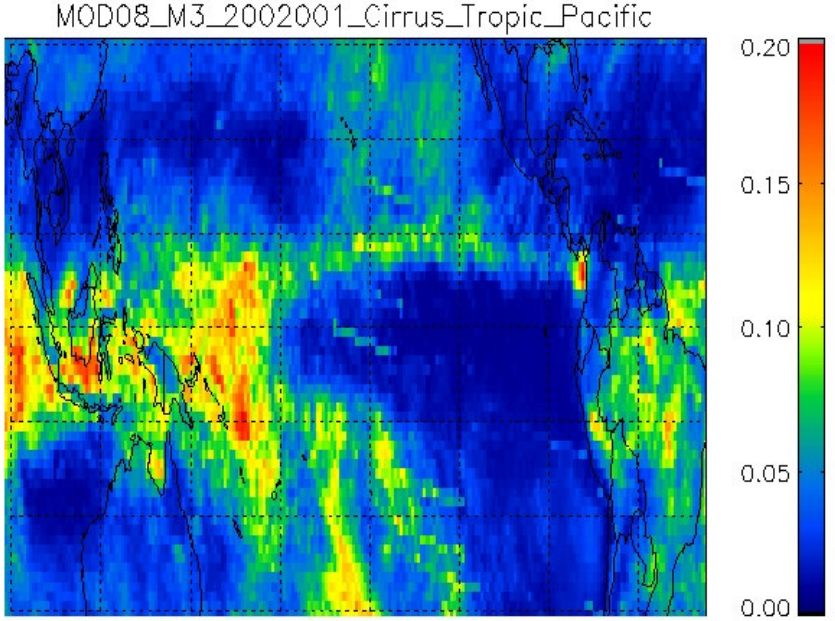


High Cloud (Tropic Pacific)

January, 2001

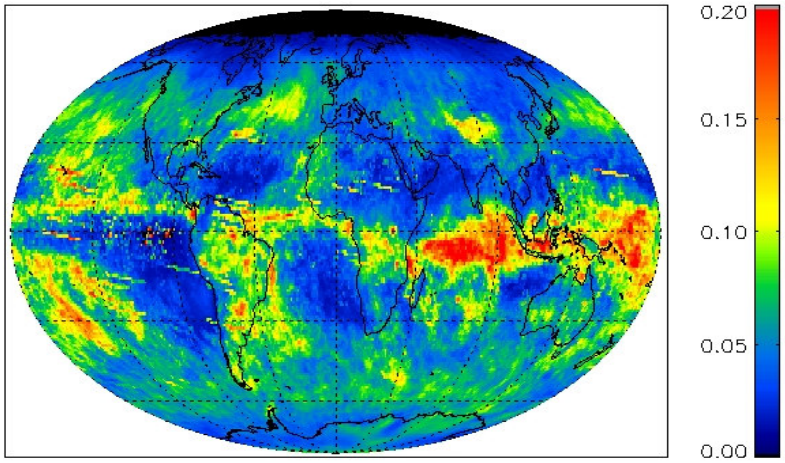


January, 2002

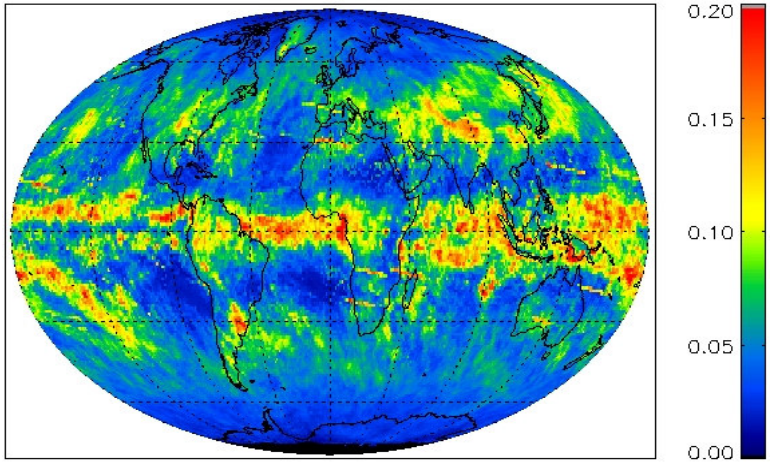


High Cloud (Global)

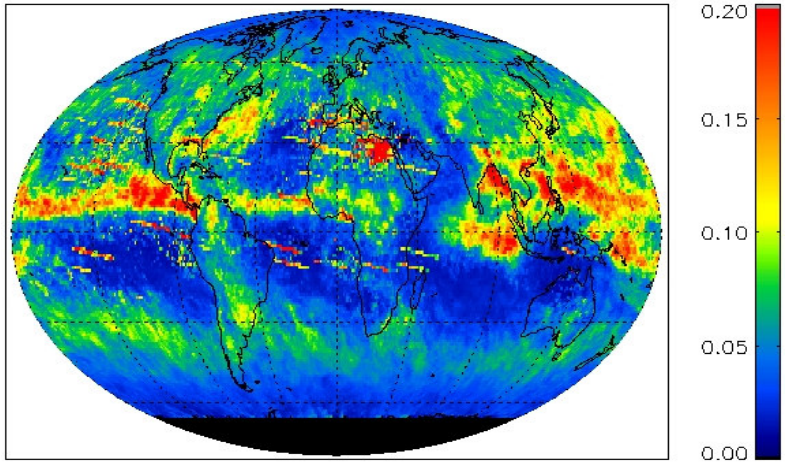
January, 2002



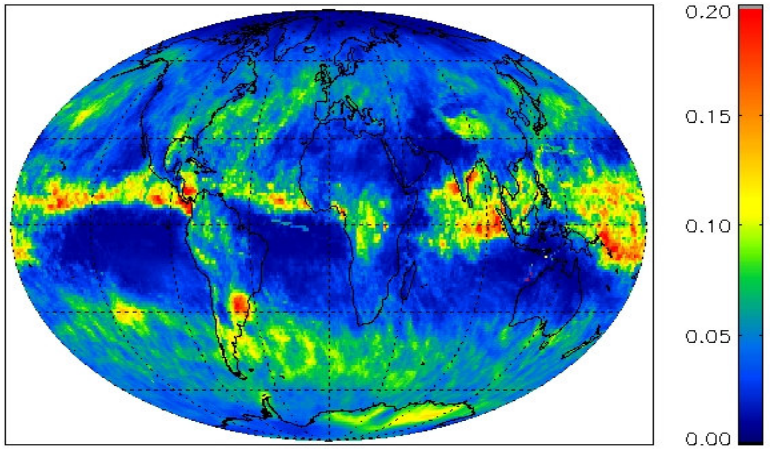
April, 2002



July, 2002



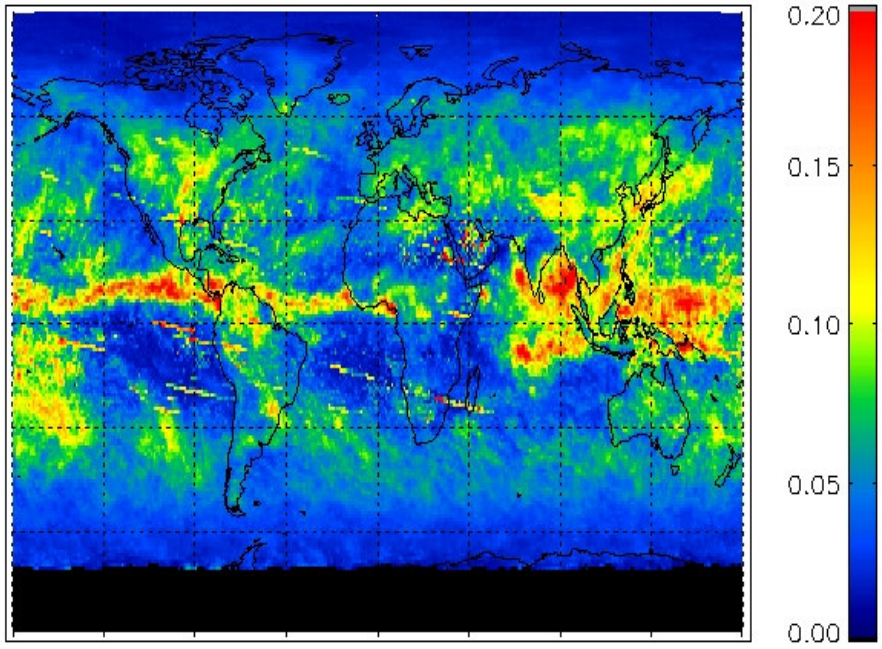
October, 2002



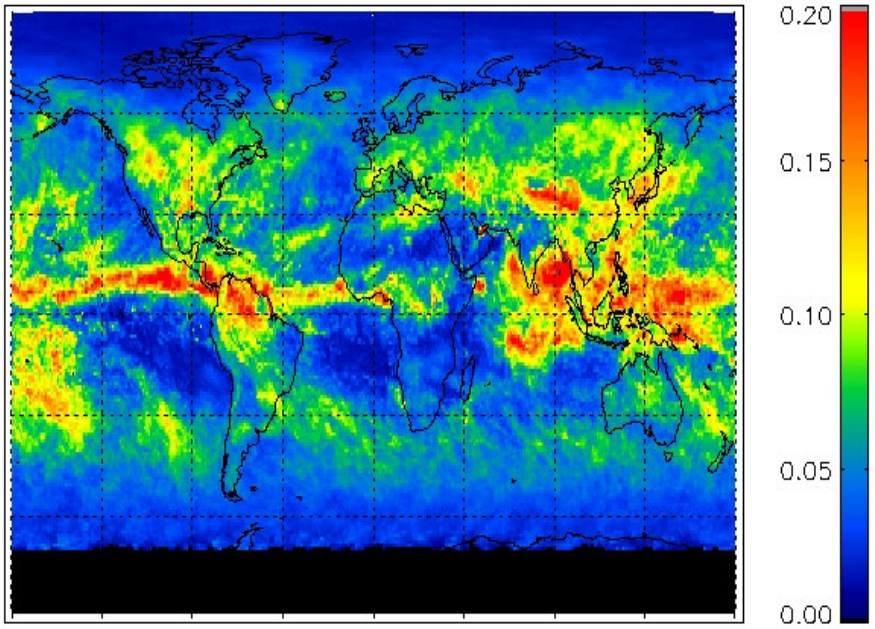
QuickTime™ and a
Animation decompressor
are needed to see this picture.

Terra & Aqua Cirrus Reflectance Image Comparison
(May 2004, Collection 4)

Terra



Aqua

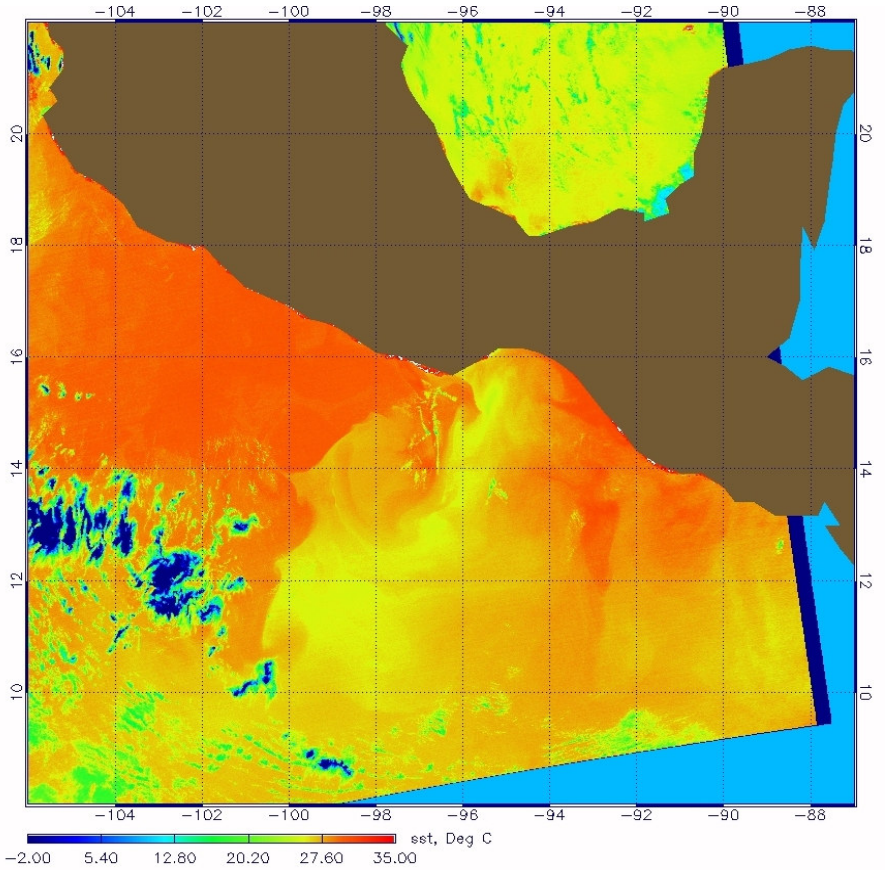


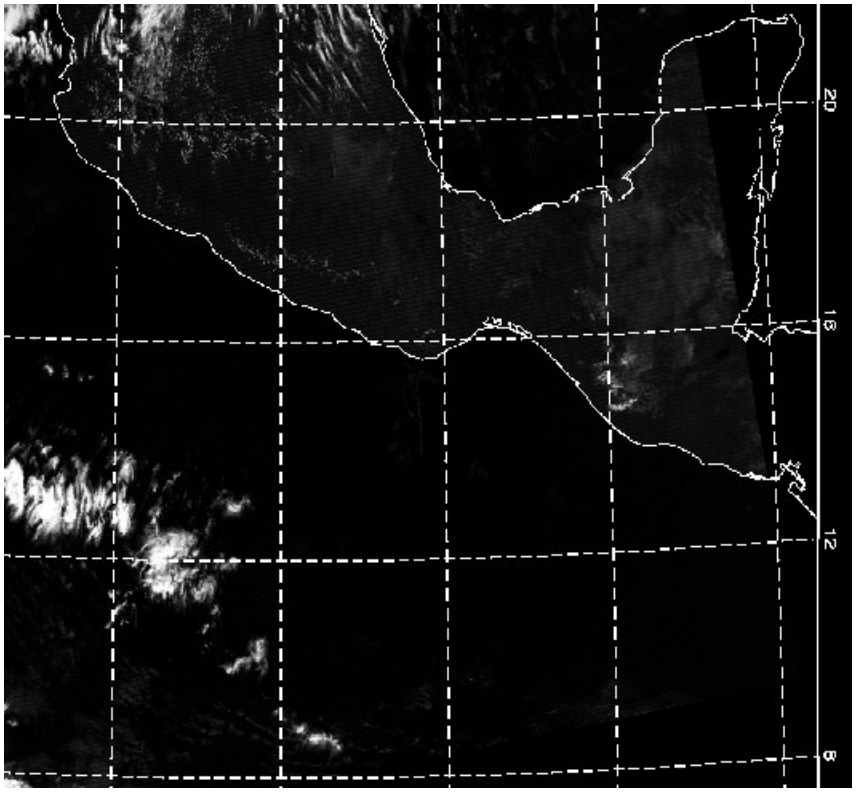
Cirrus Contaminations – A Common Problem

- Because we now have better capability in remote sensing of cirrus clouds using the 1.38-μm channel, we have realized that many MODIS data products, such as those illustrated on the MODIS brochure (NP-2002-1-423-GSFC), are contaminated by cirrus. Here I would like to use MODIS SST as an example.

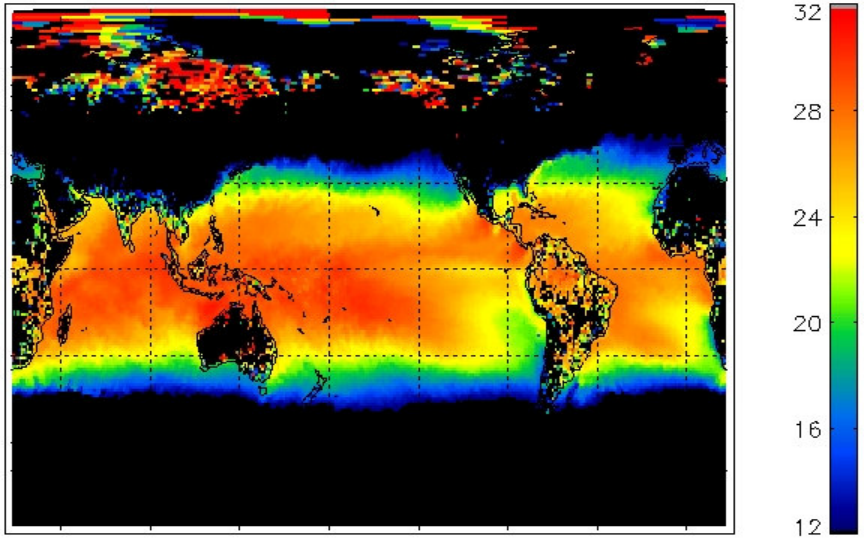
- Other non-MODIS products can also be contaminated by cirrus clouds. For example, the earth surface reflectivity climatology at 340-380 nm from TOMS data has many spatial distribution patterns very similar to those of thin cirrus clouds.

$$SST = C1 + C2*T31 + C3*(T31 - T32) + C4\,(\sec(\theta) - 1)\,(T31 - T32)$$

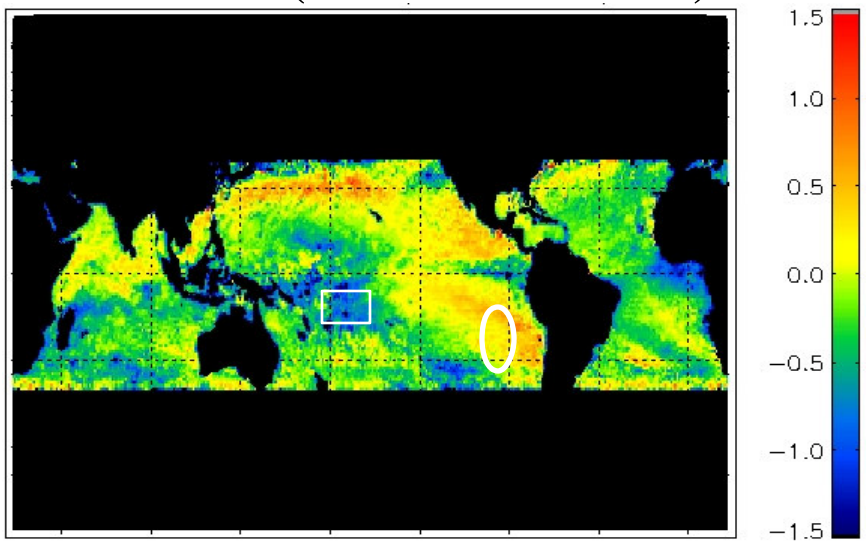




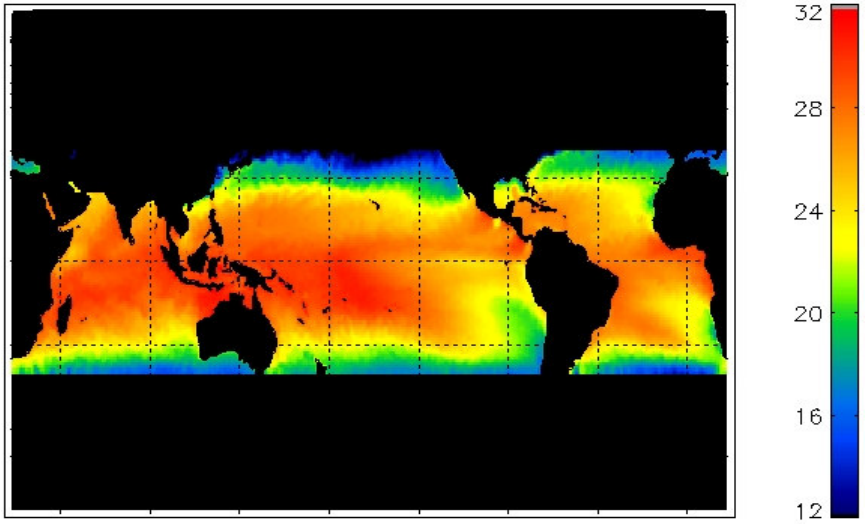
SST (MODIS, 01/2003)



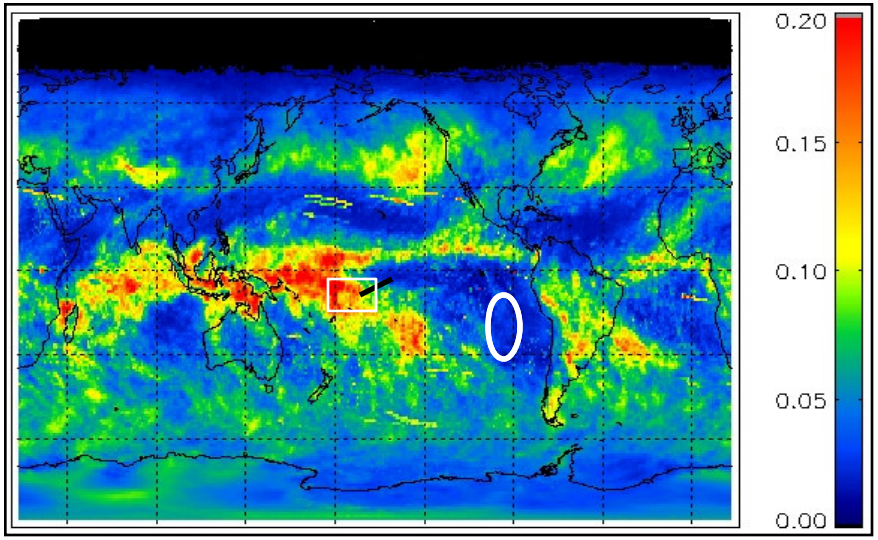
SST DIFF (MODIS – TMI)



SST (TMI, 01/2003)



Cirrus Reflectance (01/2003)



Summary

- Global water vapor and cirrus reflectance products have been derived from MODIS channels in the near-IR spectral region.
- By combining the MODIS near-IR water vapor over land and the SSMI water vapor over oceans, we have created an excellent water vapor data set for climate studies.
- We believe that many MODIS data products are contaminated by cirrus clouds. Cirrus corrections, just like aerosol corrections, are required in order to improve the quality of most MODIS data products for climate related research.