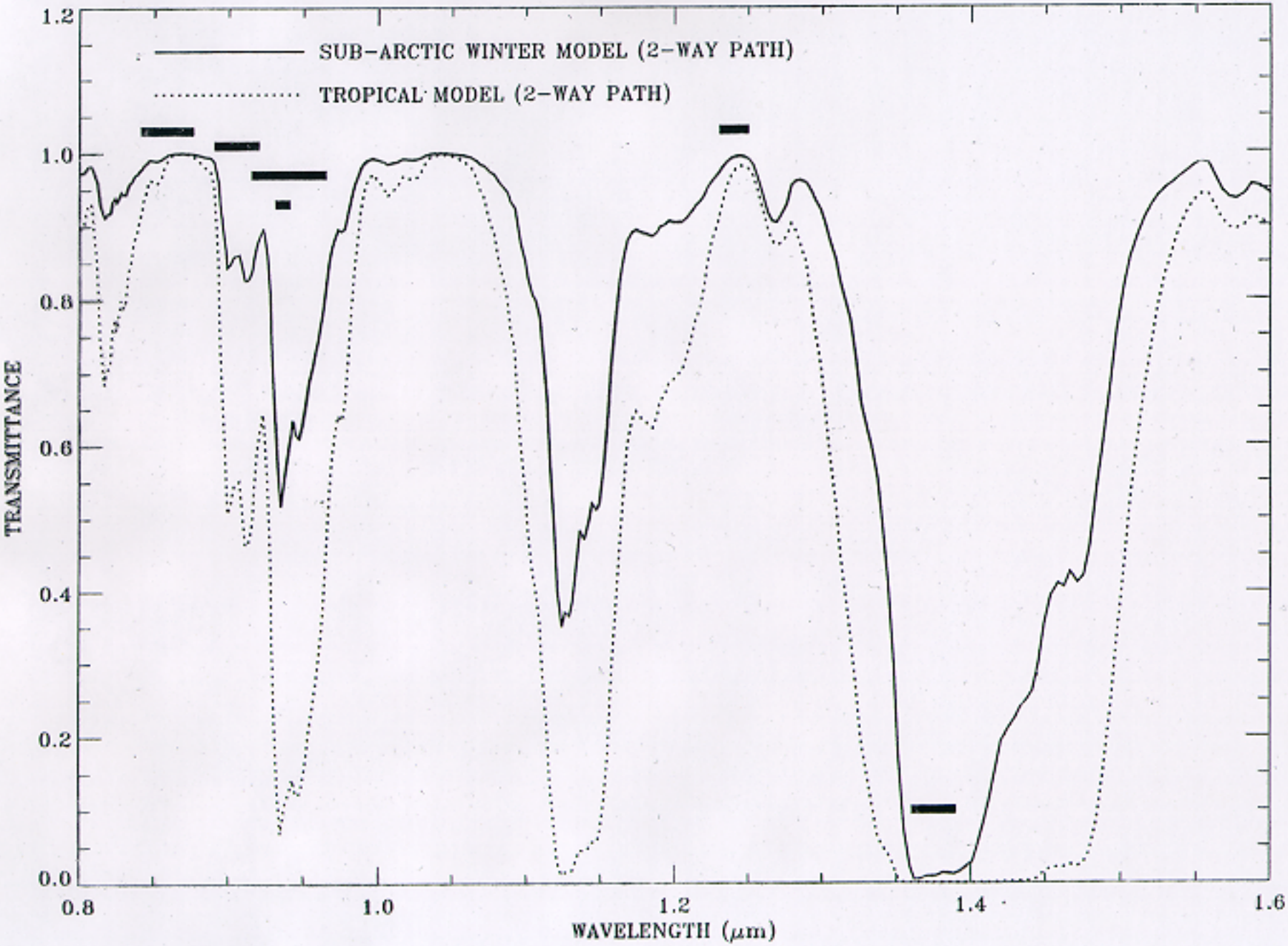
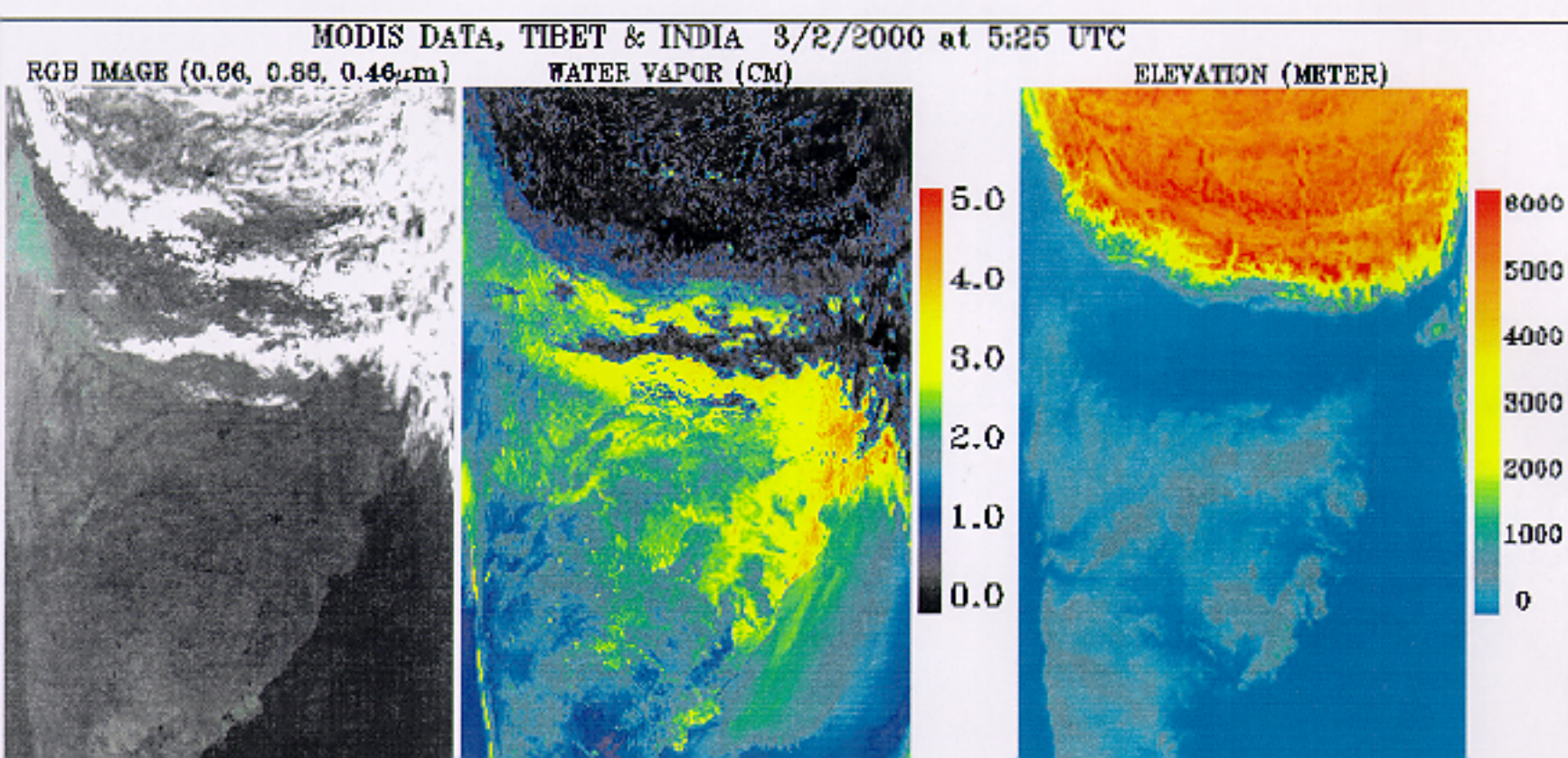
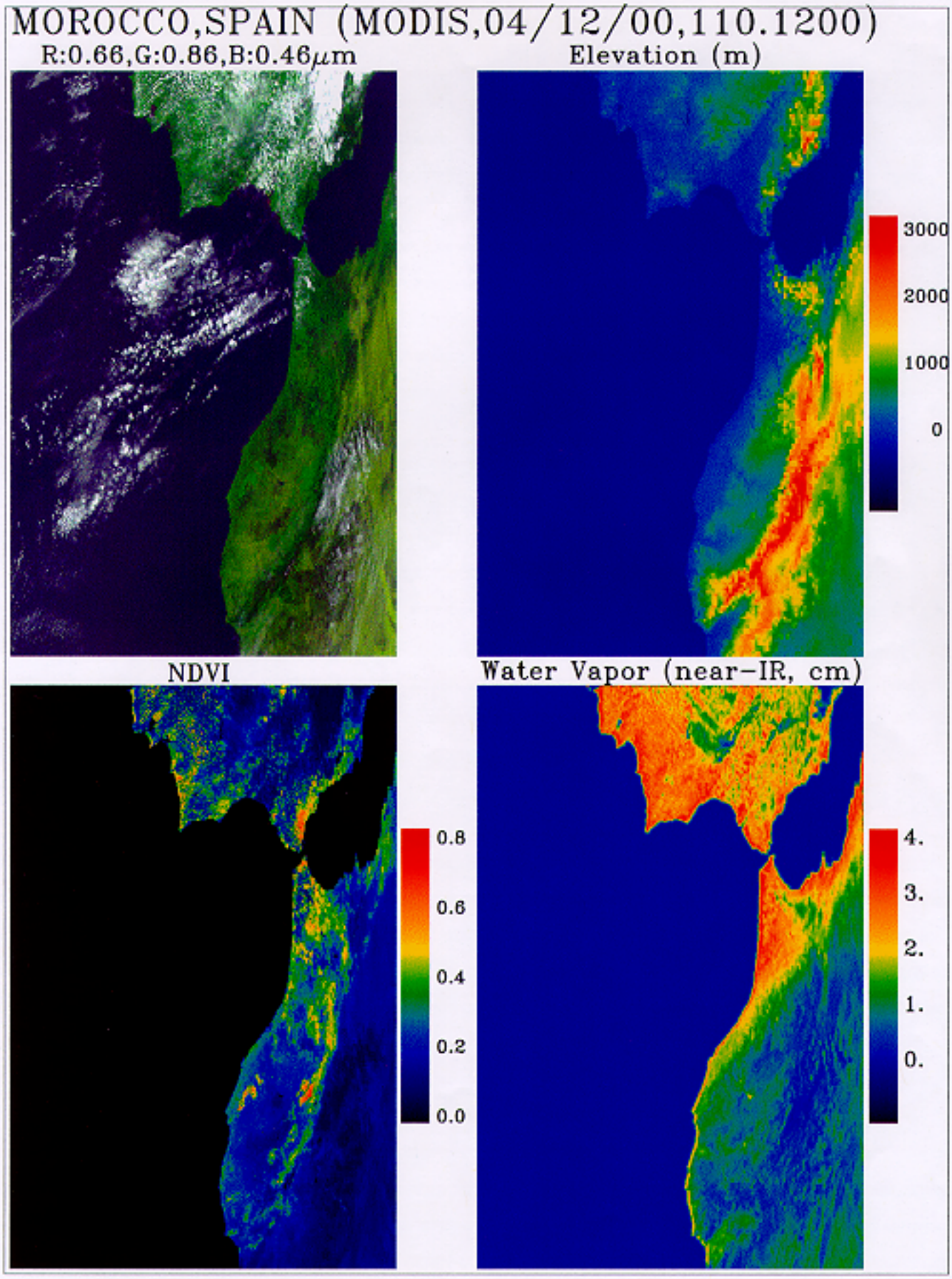
MORE RECENT RESULTS FROM MODIS NEAR-IR WATER VAPOR AND THIN CIRRUS ALGORITHMS

Bo-Cai Gao, Ping Yang, and Yoram J. Kaufman

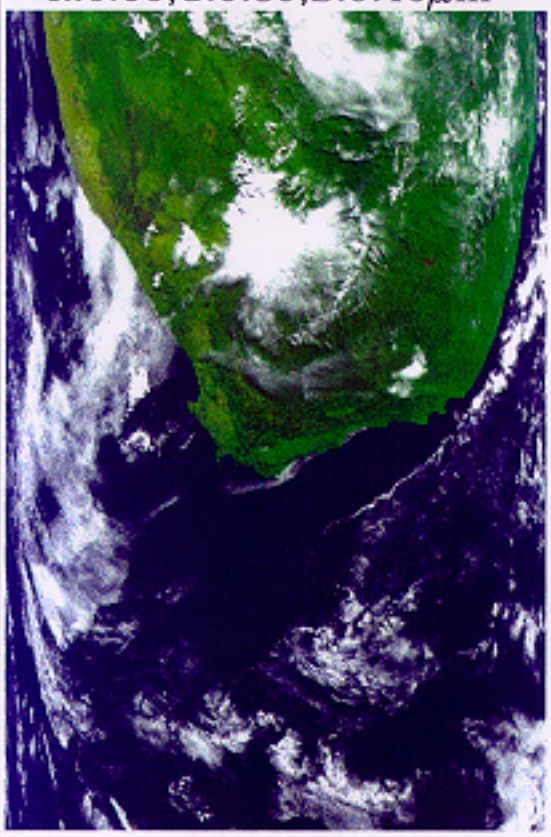

SUB-ARCTIC WINTER MODEL (2-WAY PATH)
TROPICAL MODEL (2-WAY PATH)
TRANSMITTANCE
WAVELENGTH (μm)
1.2
1.0
0.8
0.6
0.4
0.2
0.0
0.8
1.0
1.2
1.4
1.6


MODIS DATA, TIBET & INDIA 3/2/2000 at 5:25 UTC
RGB IMAGE (0.66, 0.86, 0.46μm)
WATER VAPOR (CM)
5.0
4.0
3.0
2.0
1.0
0.0
ELEVATION (METER)
6000
5000
4000
3000
2000
1000
0

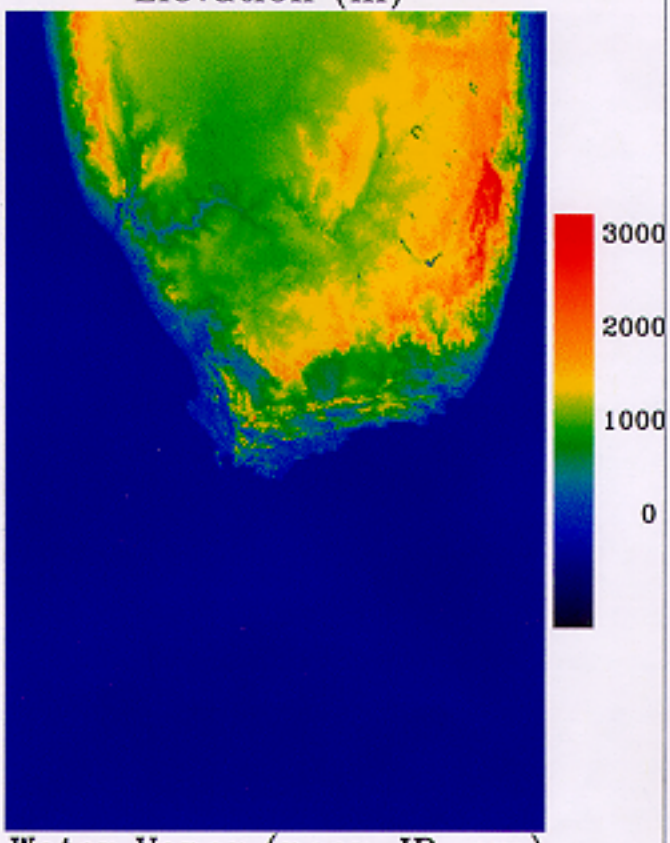

MOROCCO,SPAIN (MODIS,04/12/00,110.1200)
R:0.66,G:0.86,B:0.46μm
Elevation (m)
3000
2000
1000
0
NDVI
0.8
0.6
0.4
0.2
0.0
Water Vapor (near-IR, cm)
4.
3.
2.
1.
0.

S. AFRICA (MODIS,04/12/00; 110.0900)

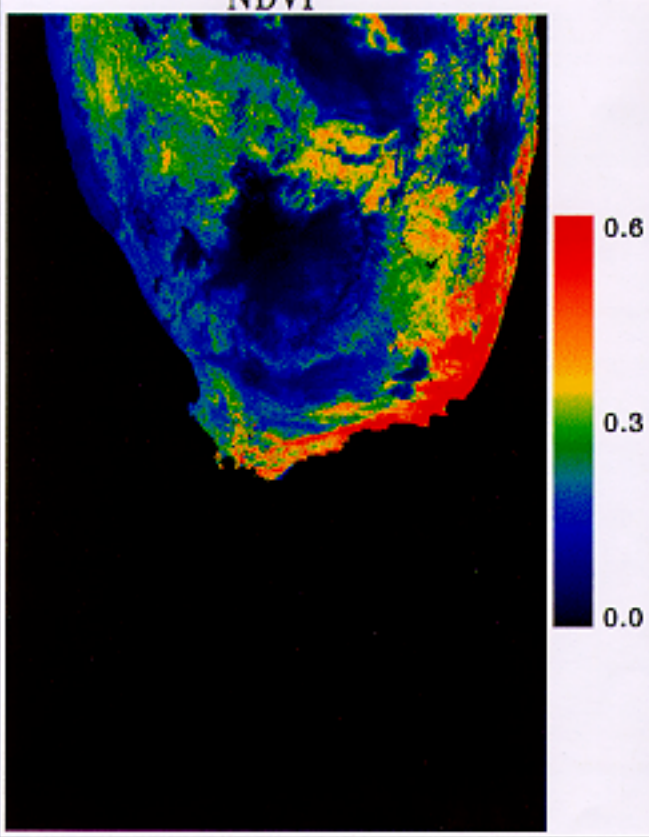
R:0.66,G:0.86,B:0.46μm



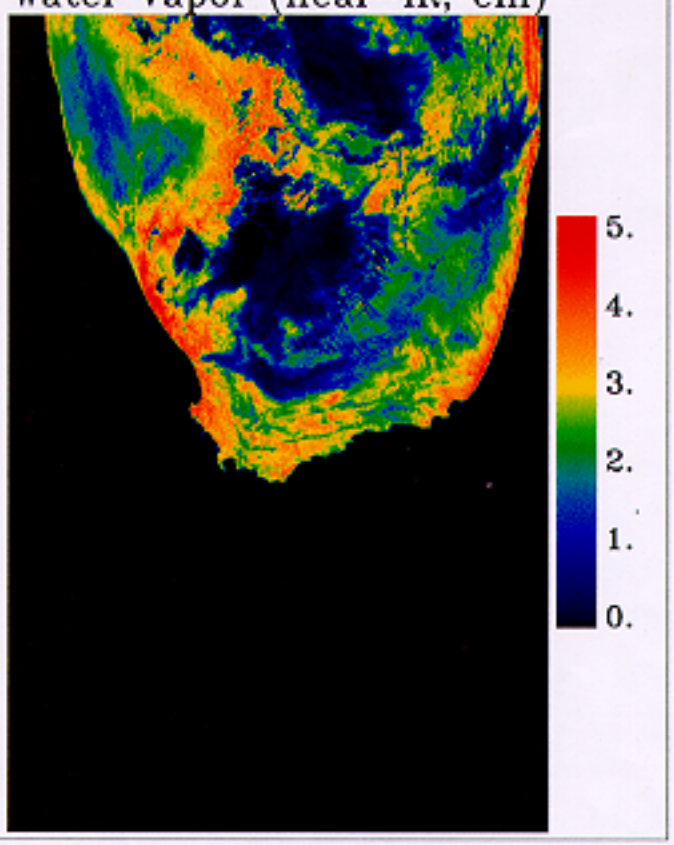
Elevation (m)



NDVI

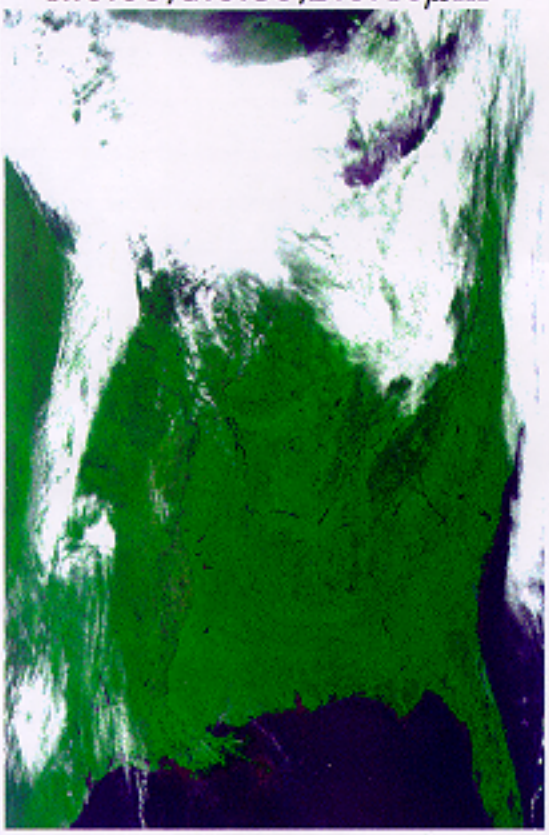


Water Vapor (near-IR, cm)

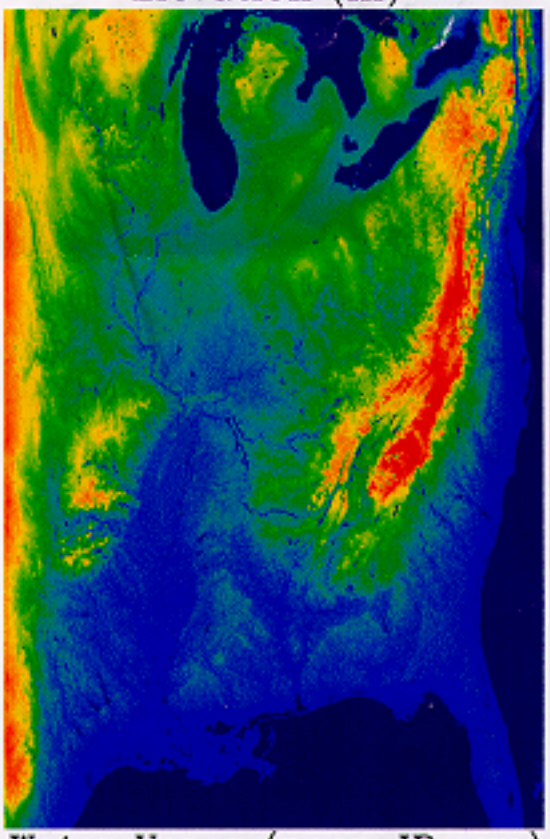


EASTERN HALF OF US (04/12/00;110.1655)

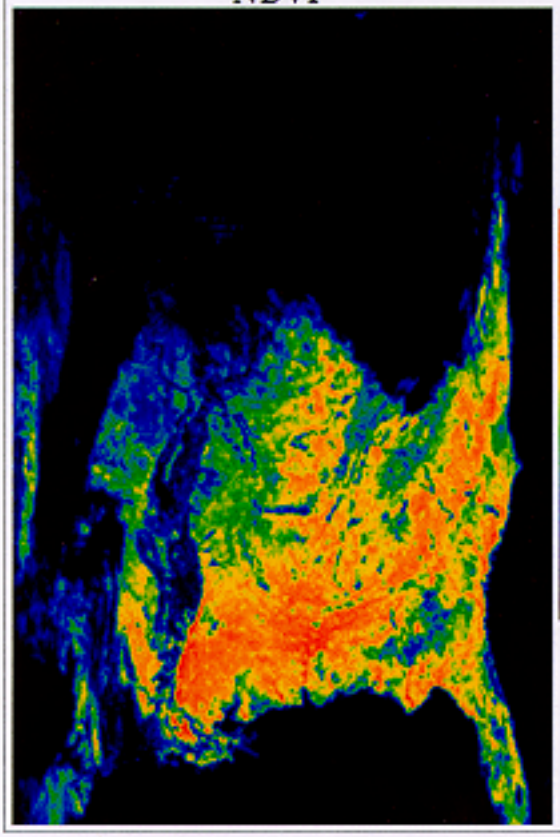
R:0.66,G:0.86,B:0.46μm



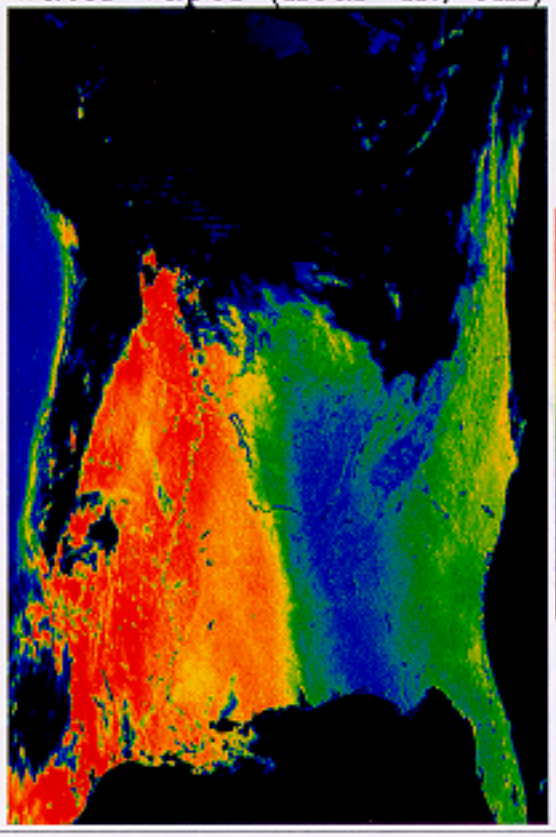
Elevation (m)



NDVI

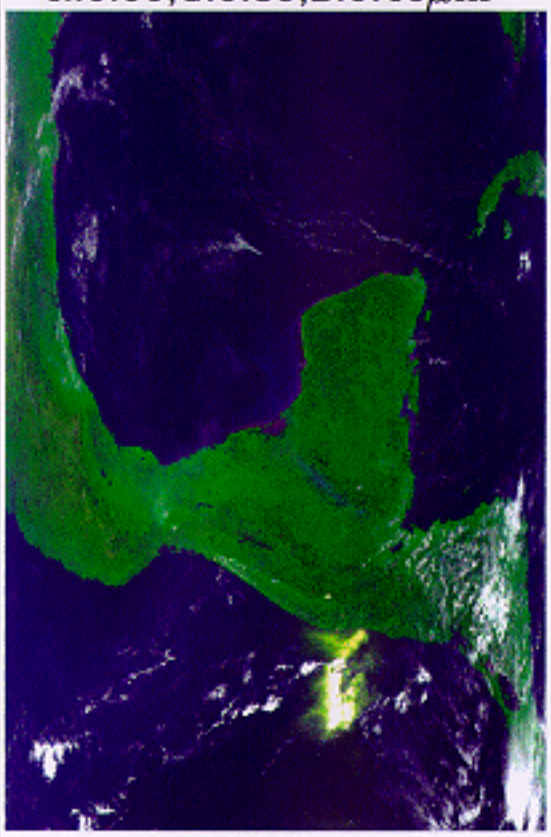


Water Vapor (near-IR, cm)

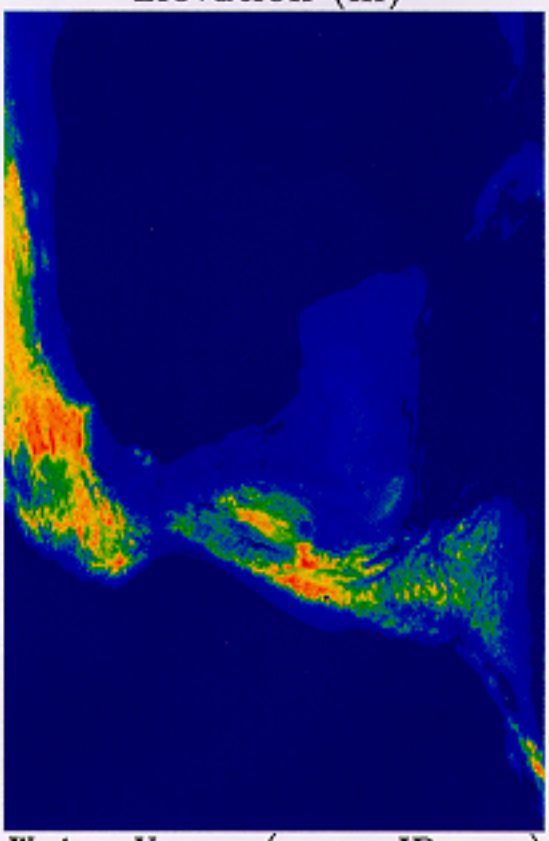


CENTRAL AMERICA (04/12/00, 110.1700)

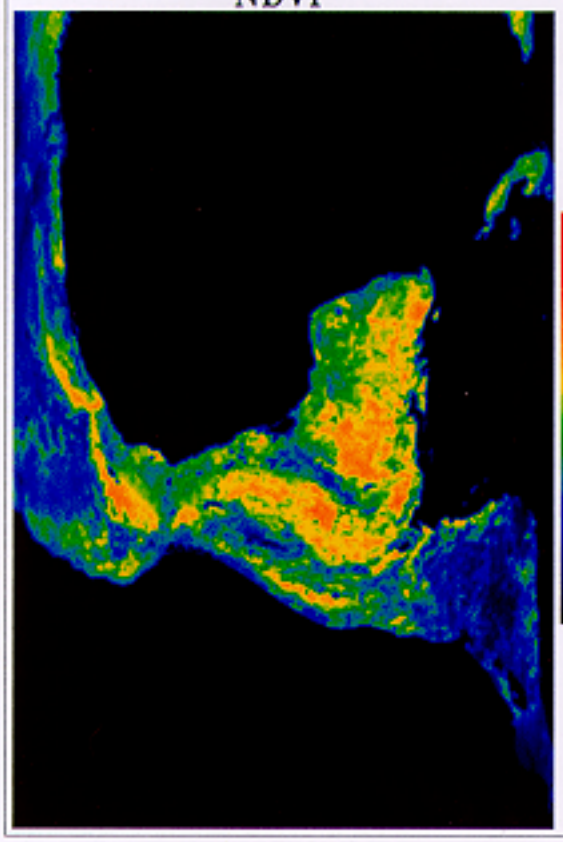
R:0.66,G:0.86,B:0.46μm



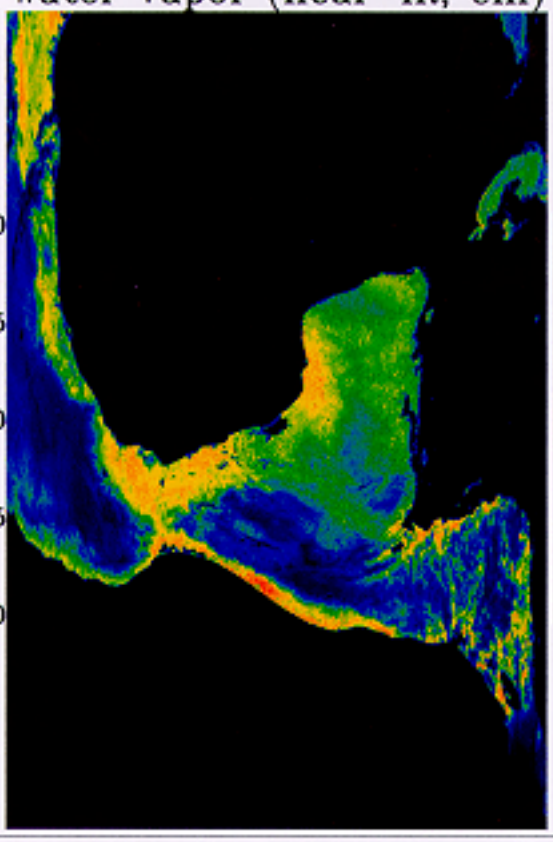
Elevation (m)

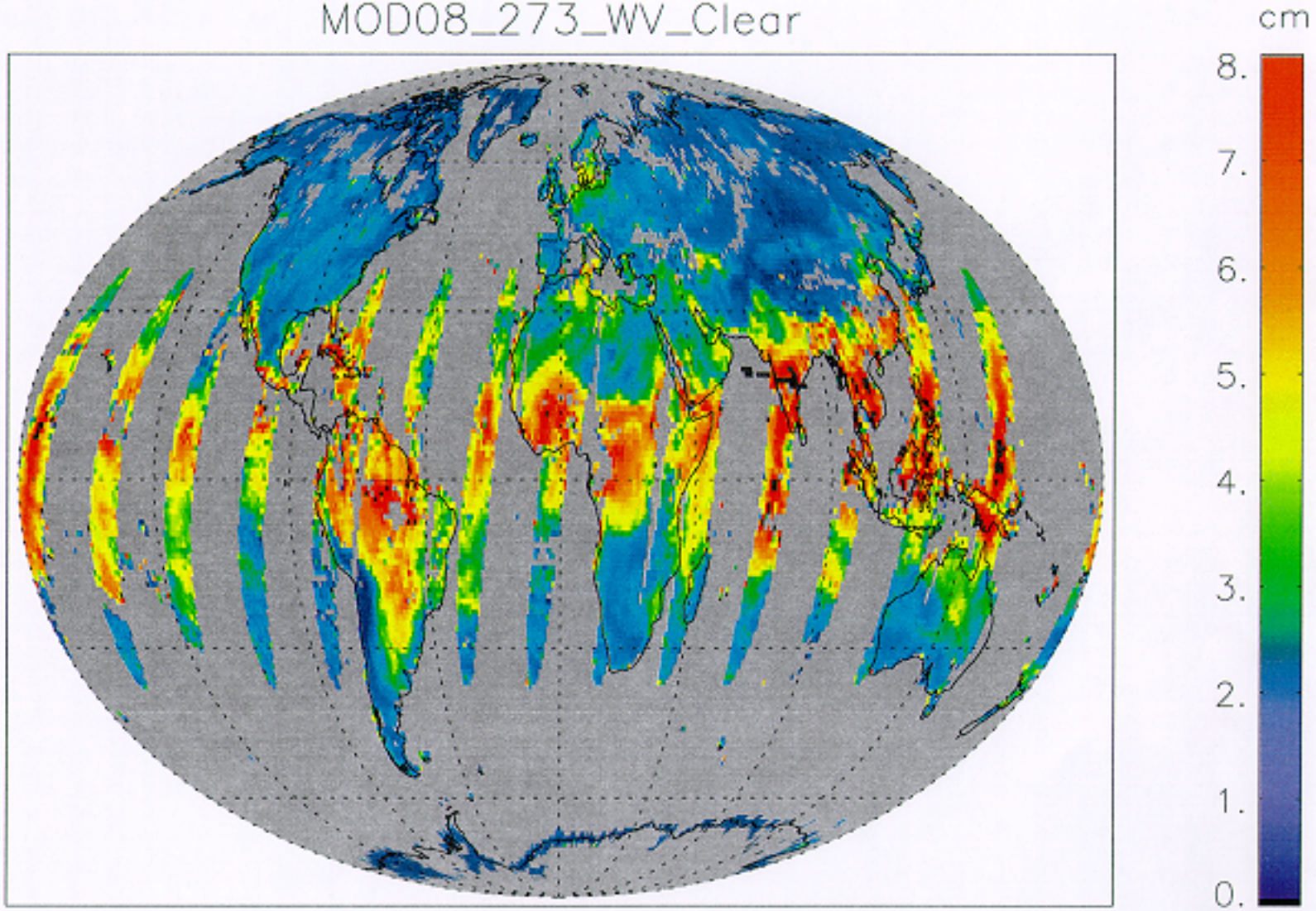


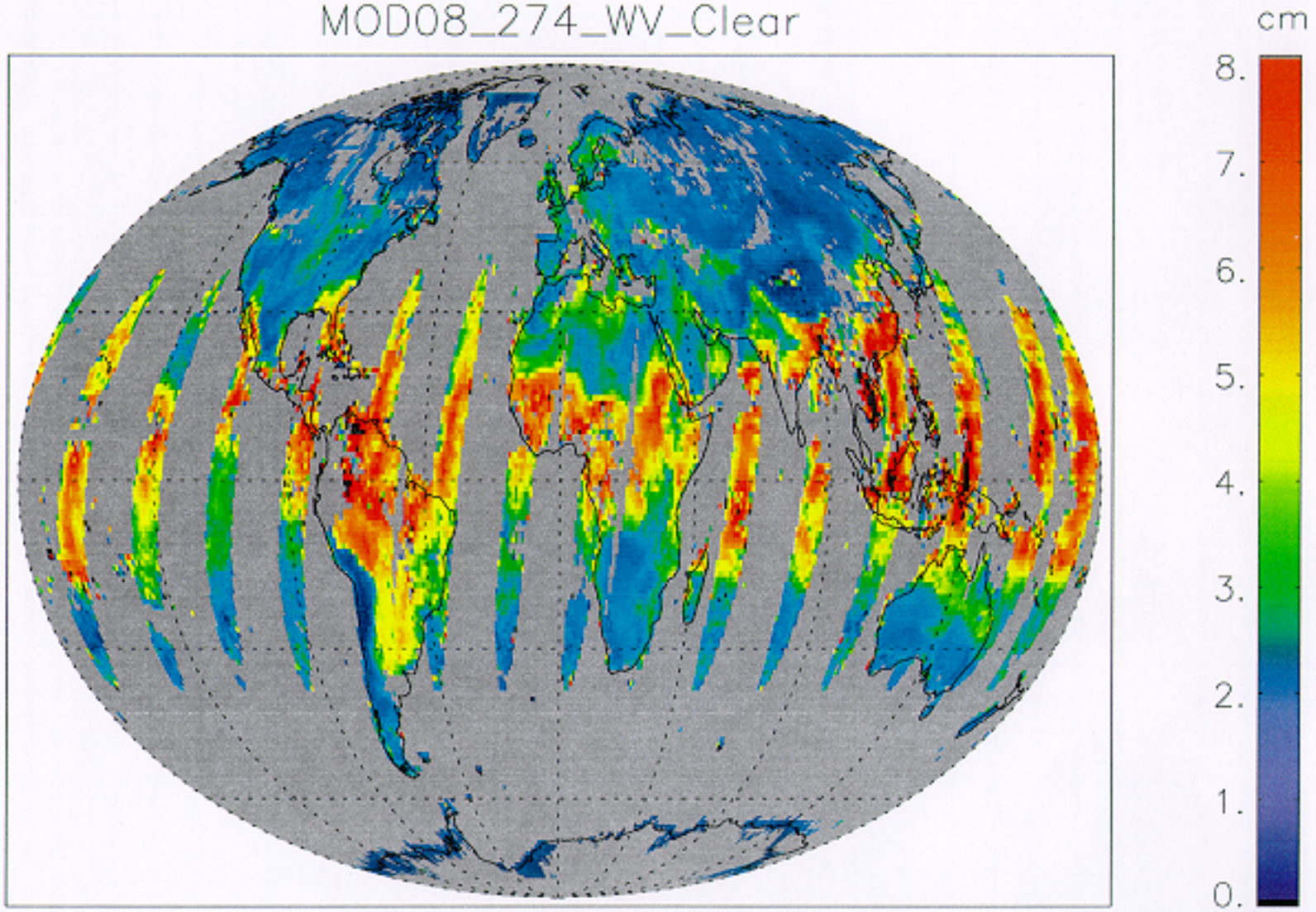
NDVI

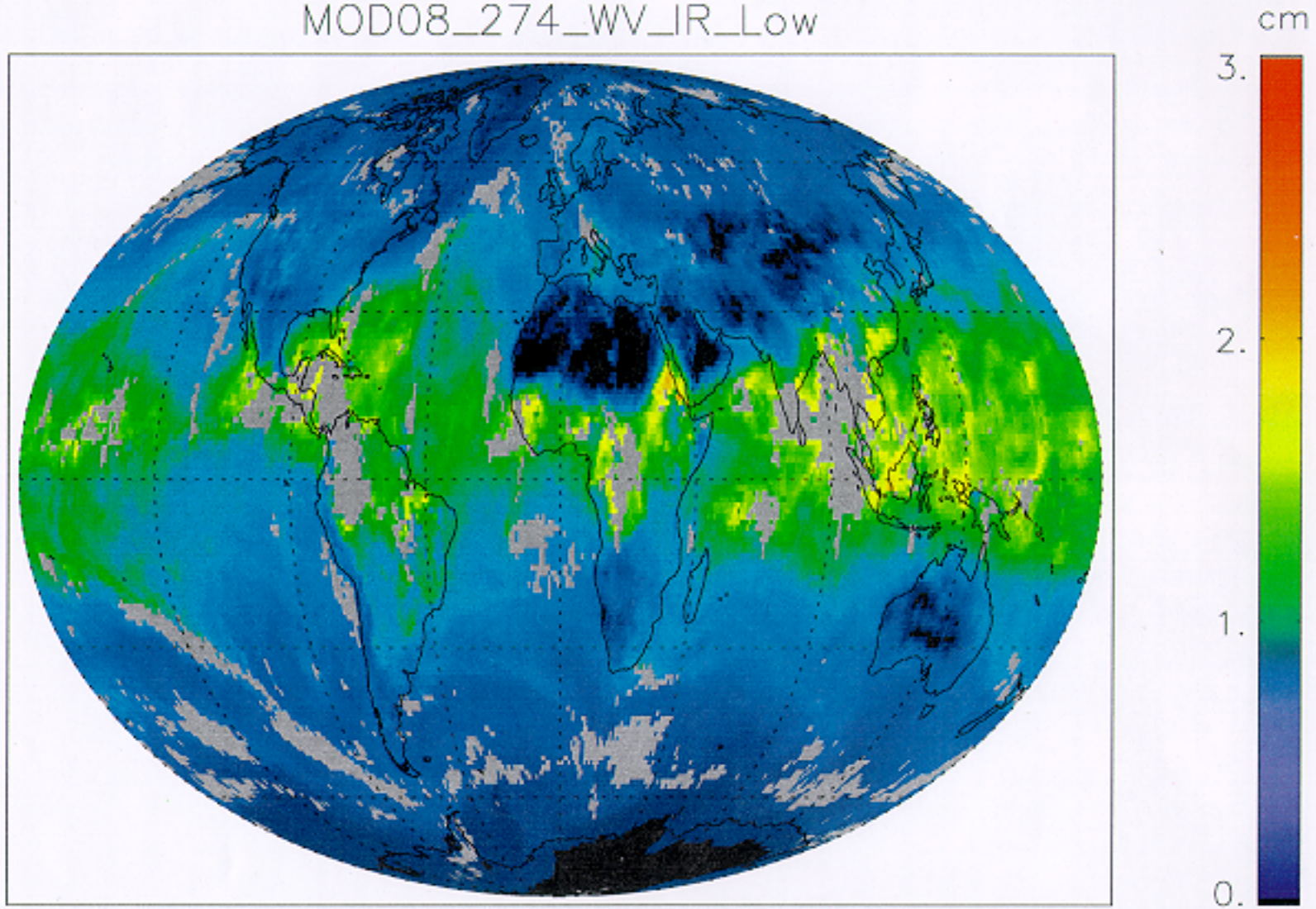


Water Vapor (near-IR, cm)




MOD08_273_WV_Clear
cm
8.
7.
6.
5.
4.
3.
2.
1.
0.


MOD08_274_WV_Clear
cm
8.
7.
6.
5.
4.
3.
2.
1.
0.


MOD08_274_WV_IR_Low
cm
3.
2.
1.
0.

Discussions on MODIS near-IR Water Vapor Retrievals

- Our retrieved water vapor values from MODIS near-IR channels are **~20% – 30%** larger than expected. Possible problems may be due to errors in water vapor line parameters compiled on HITRAN96.

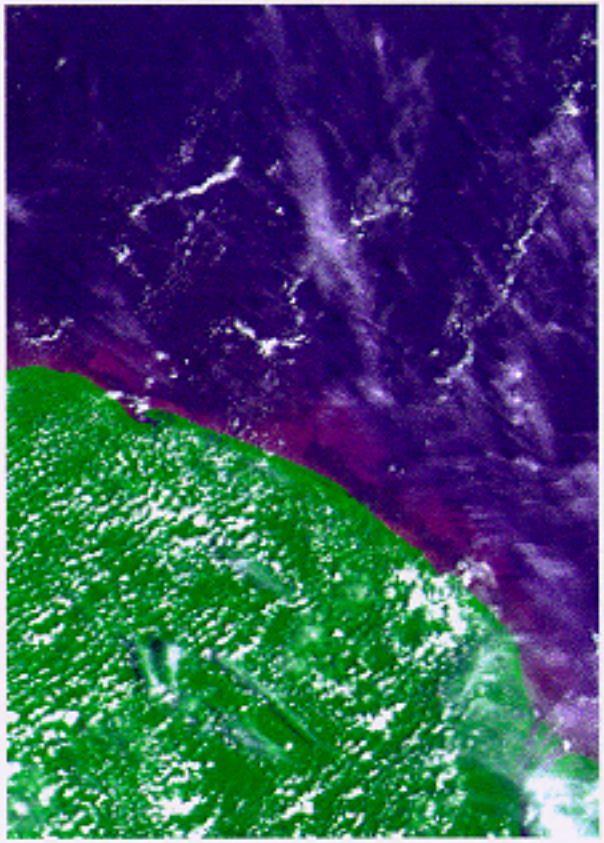
- **HITRAN96** + Water vapor continuum absorption

  HITRAN96-COR, given by **L. Giver et al**. (1999), increased the 0.94-micron water vapor band intensity by **14.4%**. However, when using HITRAN96-COR to simulate AVIRIS spectra at 10 nm spectral resolution, I have found that the shapes of the fitted spectra still do not agree with AVIRIS' measurements. This indicates that the distributions of water vapor line intensities for the 0.94-micron band are still not quite right.

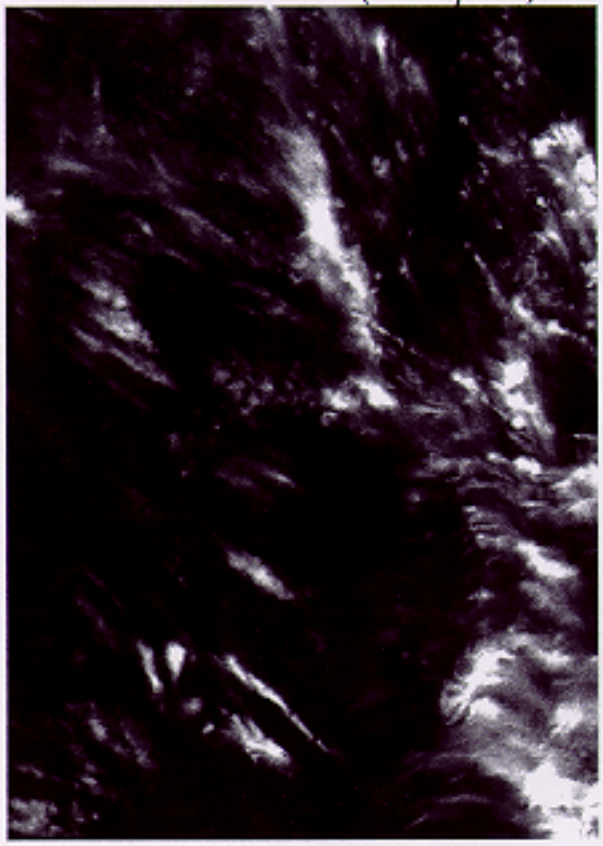
  More recent laboratory measurements by **Belmiloud et al**. (GRL, Nov. 2000) suggested that the integrated 0.94-micron water vapor band intensity in HITRAN96 should be increased by **21.3%**. The line parameters from these measurements are not publicly available yet.

MODIS DATA, SOUTH AMERICA , 2/28/2000 at 14:50

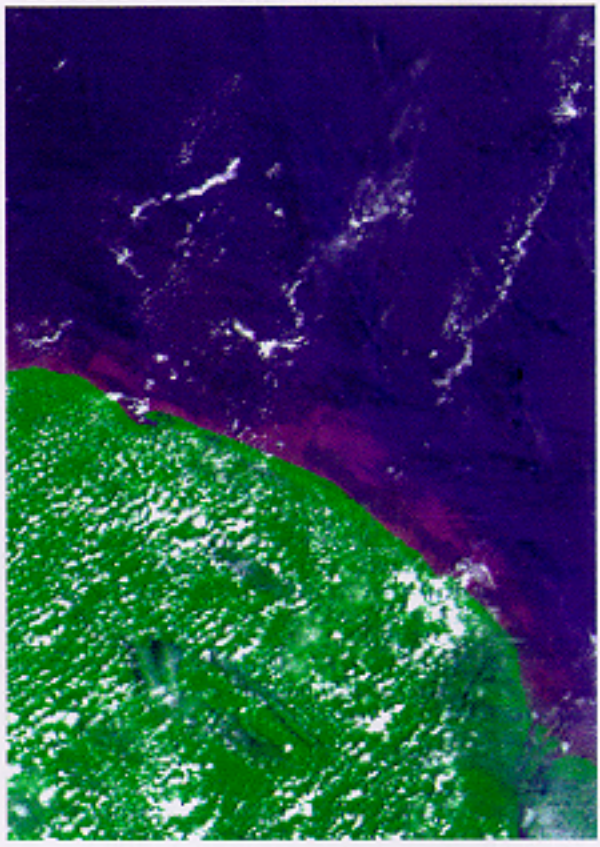
UNCORRECTED IMAGE



CIRRUS IMAGE (1.38μm)

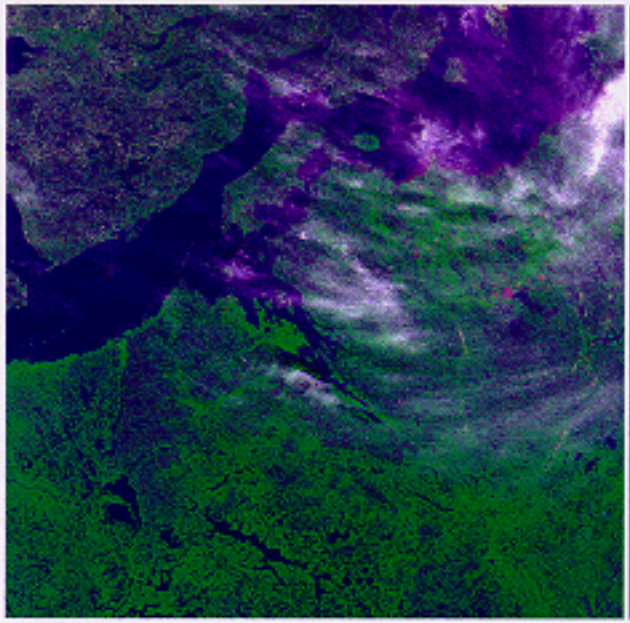


CIRRUS–CORRECTED IMAGE

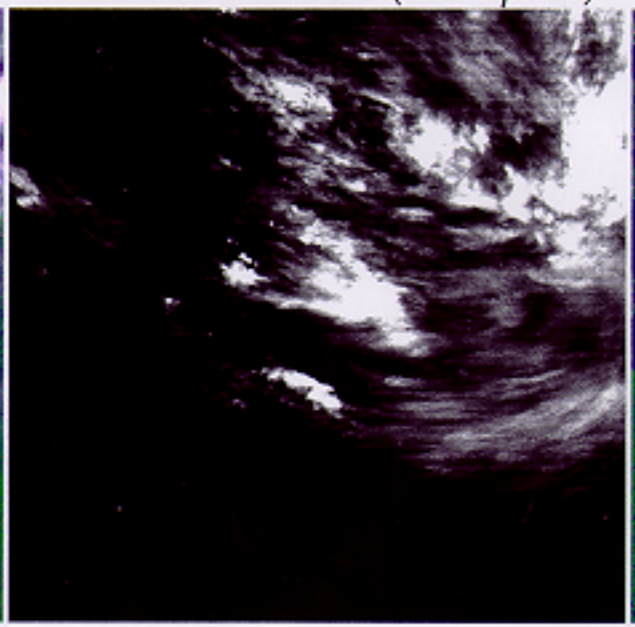


MODIS DATA, CANADA, 9/2/2000 at UTC 19:15 (246.1915)

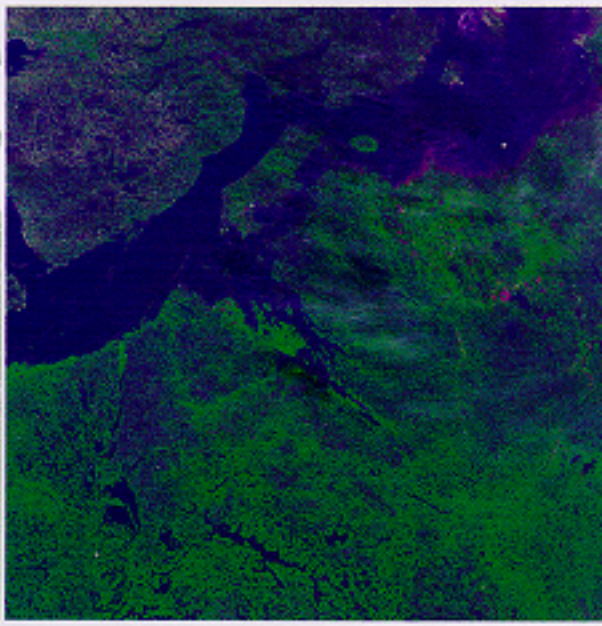
UNCORRECTED IMAGE



CIRRUS IMAGE (1.38μm)



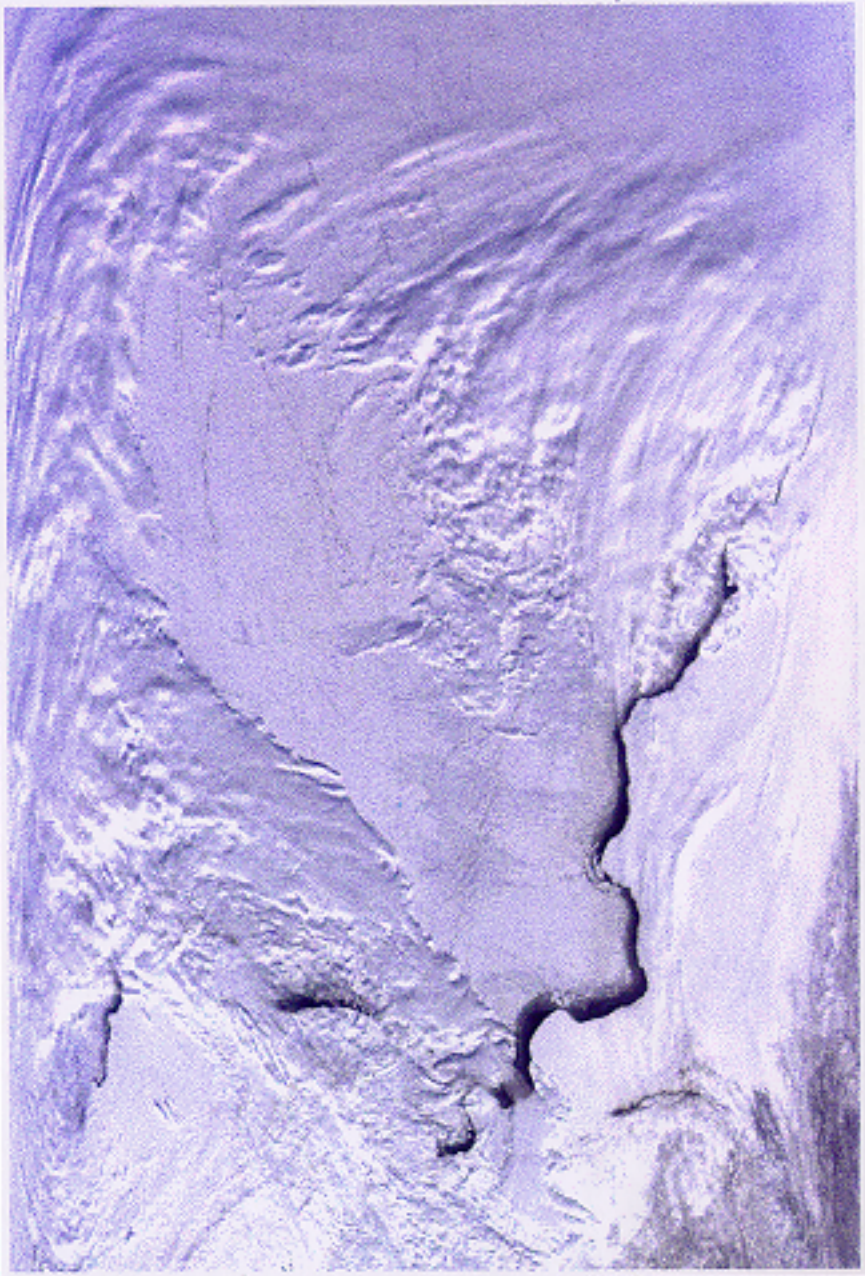
CIRRUS CORRECTED IMAGE



MODIS Data Over Arctic Region (04/19/2000, 110.0510)

R:0.66, G:0.55, B:0.46μm

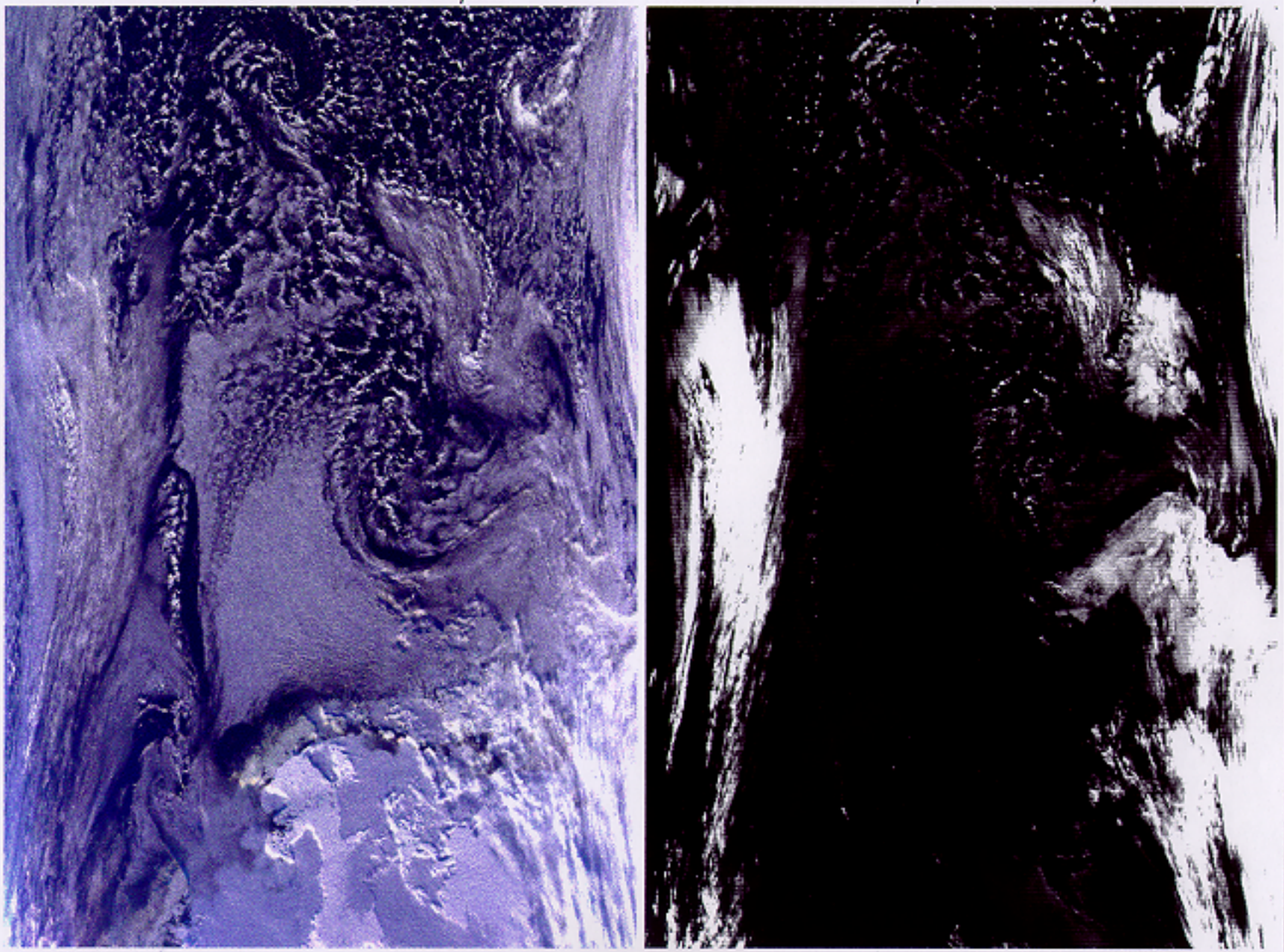
1.38 μm Channel)



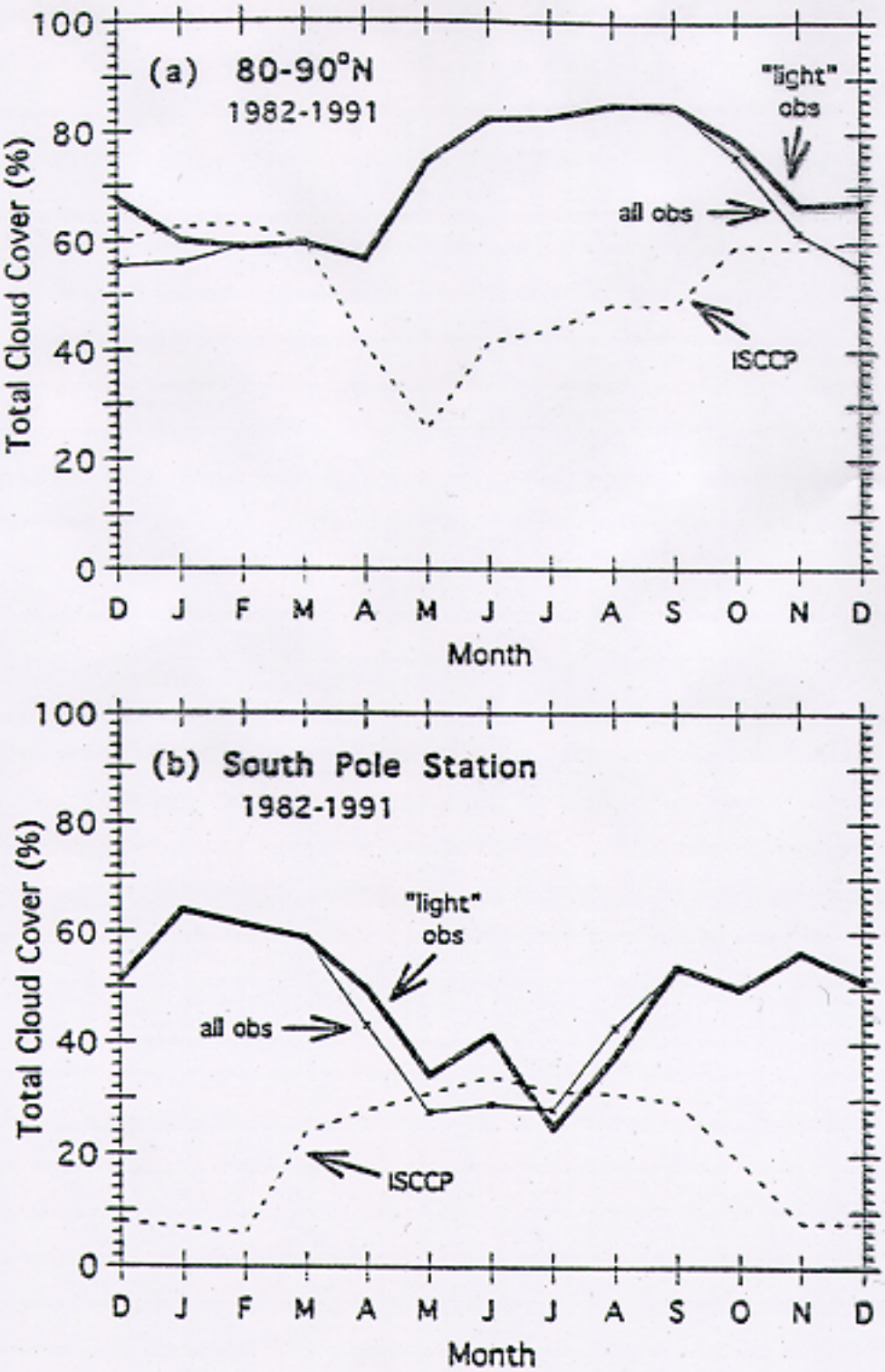
MODIS Data Over Antarctic Region (04/19/2000, 110.0550)

R:0.66, G:0.55, B:0.46μm

1.38 μm Channel)



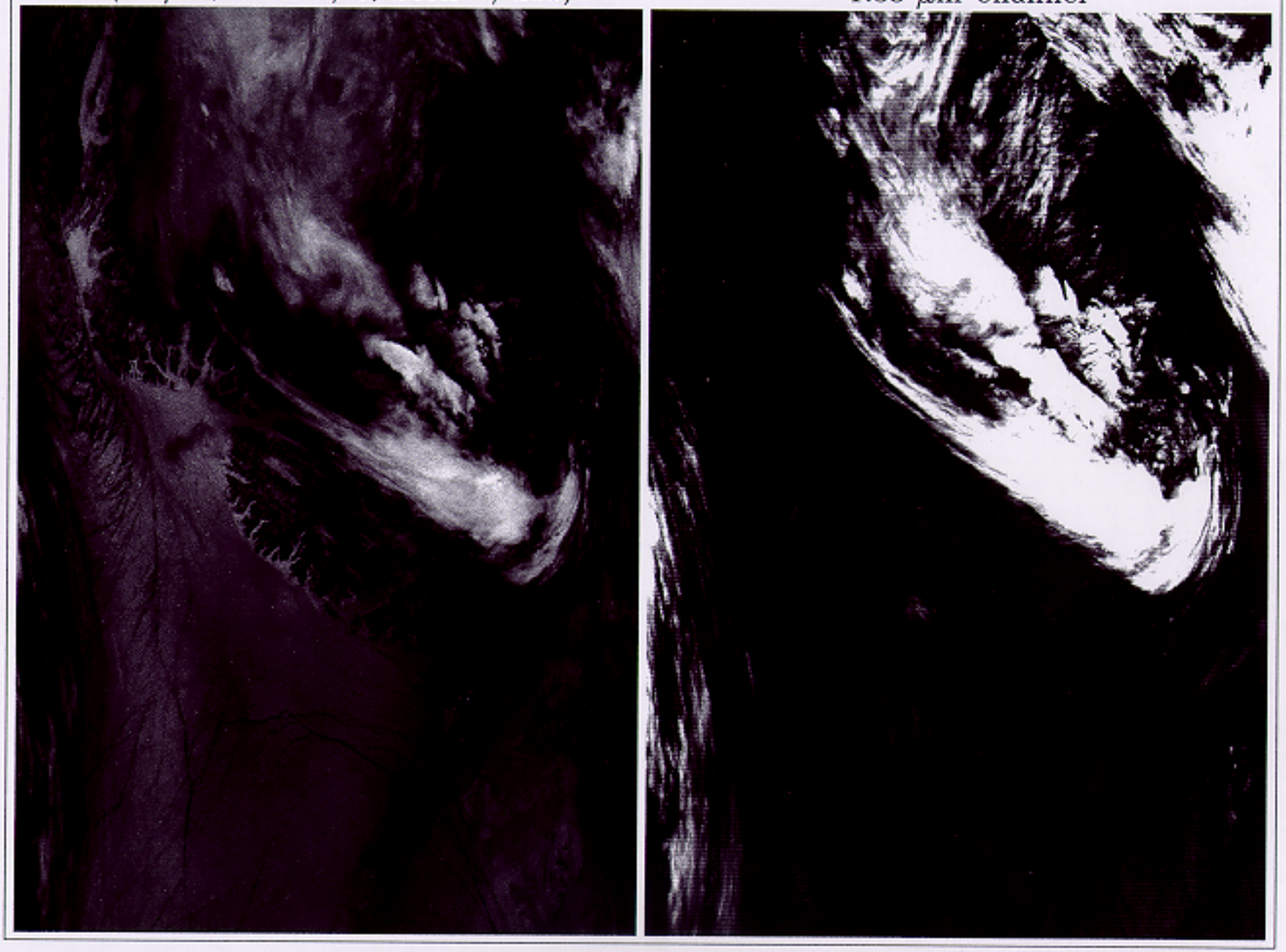
HAHN ET AL. 1995

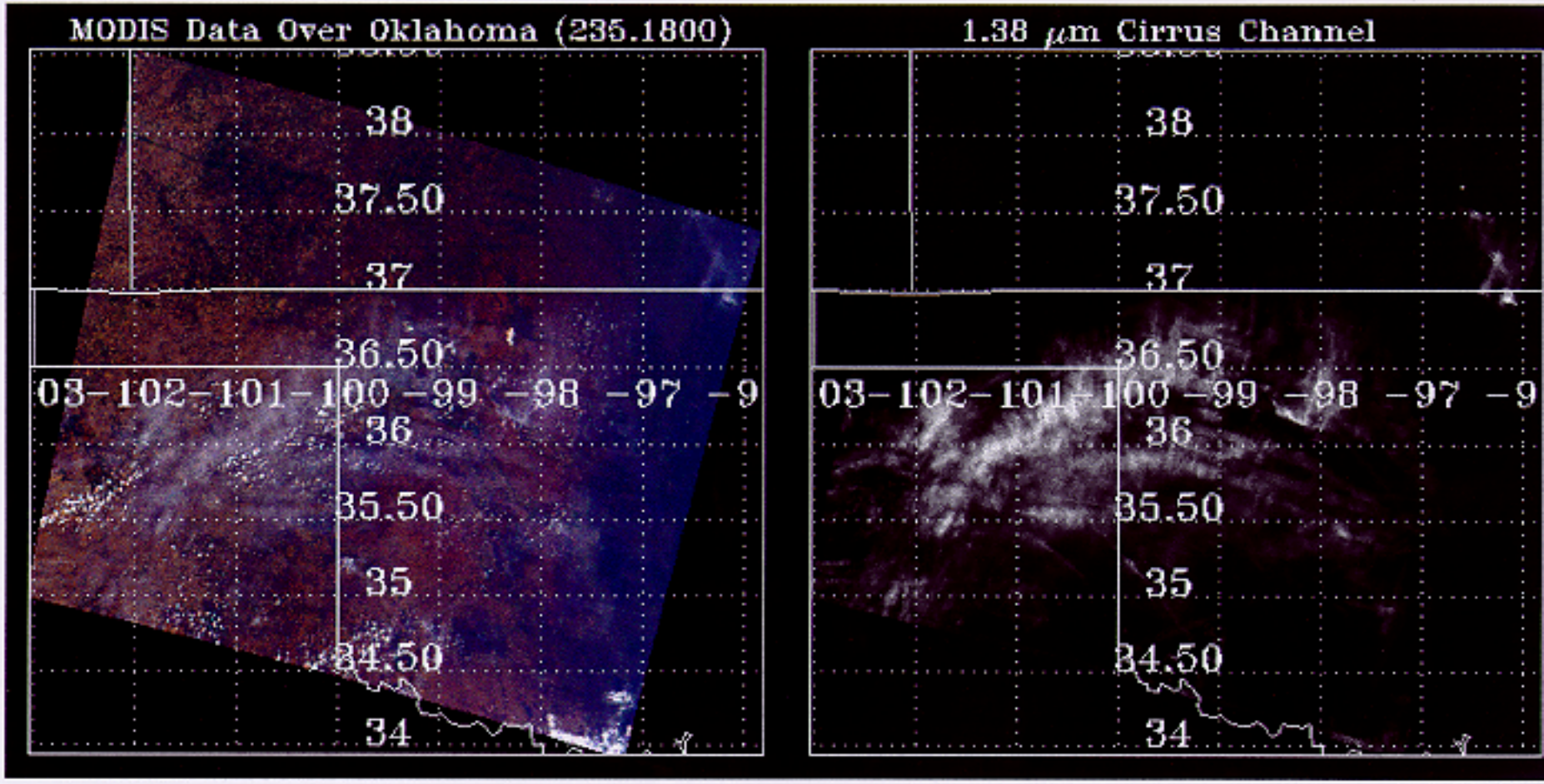


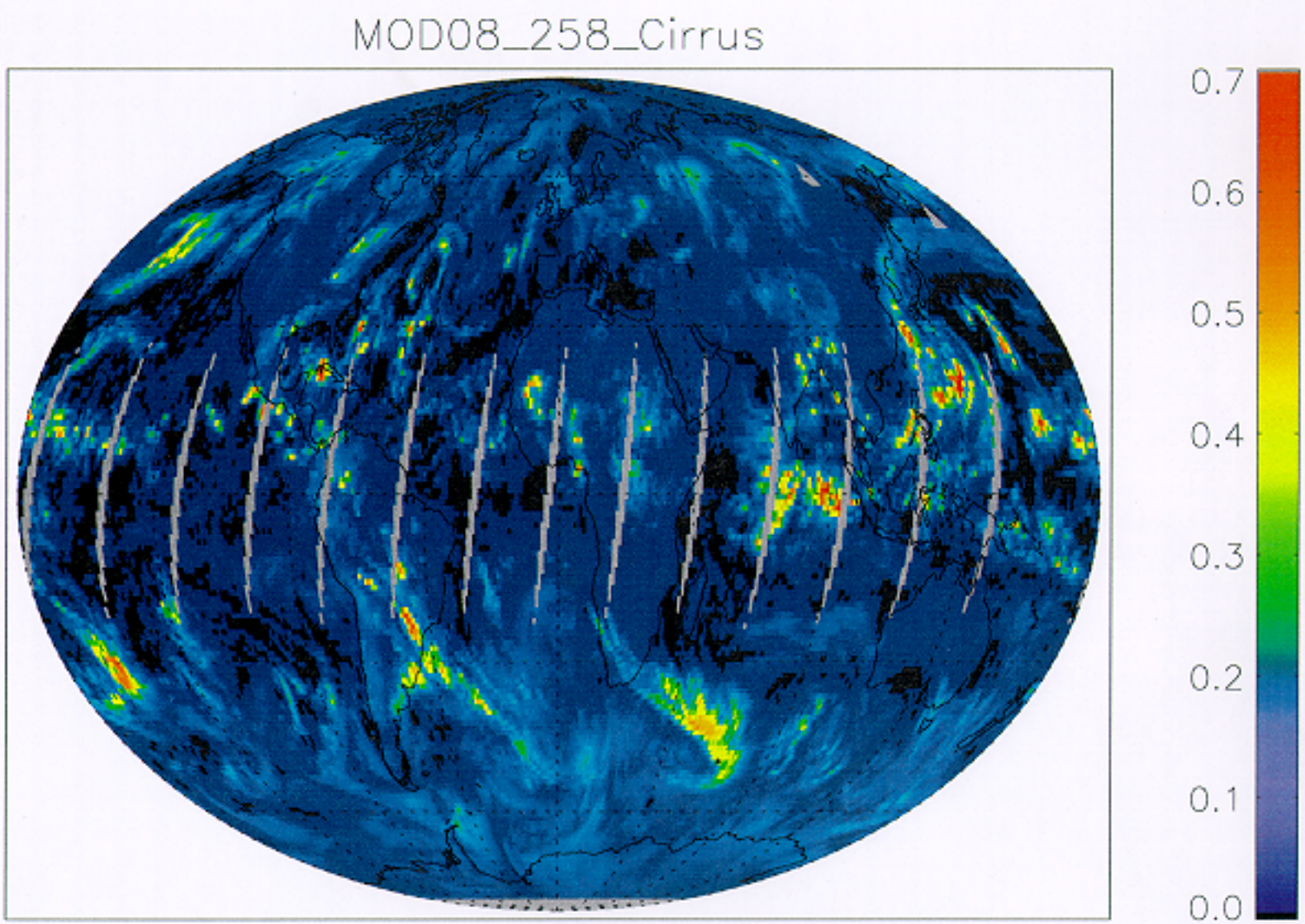
MODIS Data Over Arctic Region (04/19/2000, 110.2315)

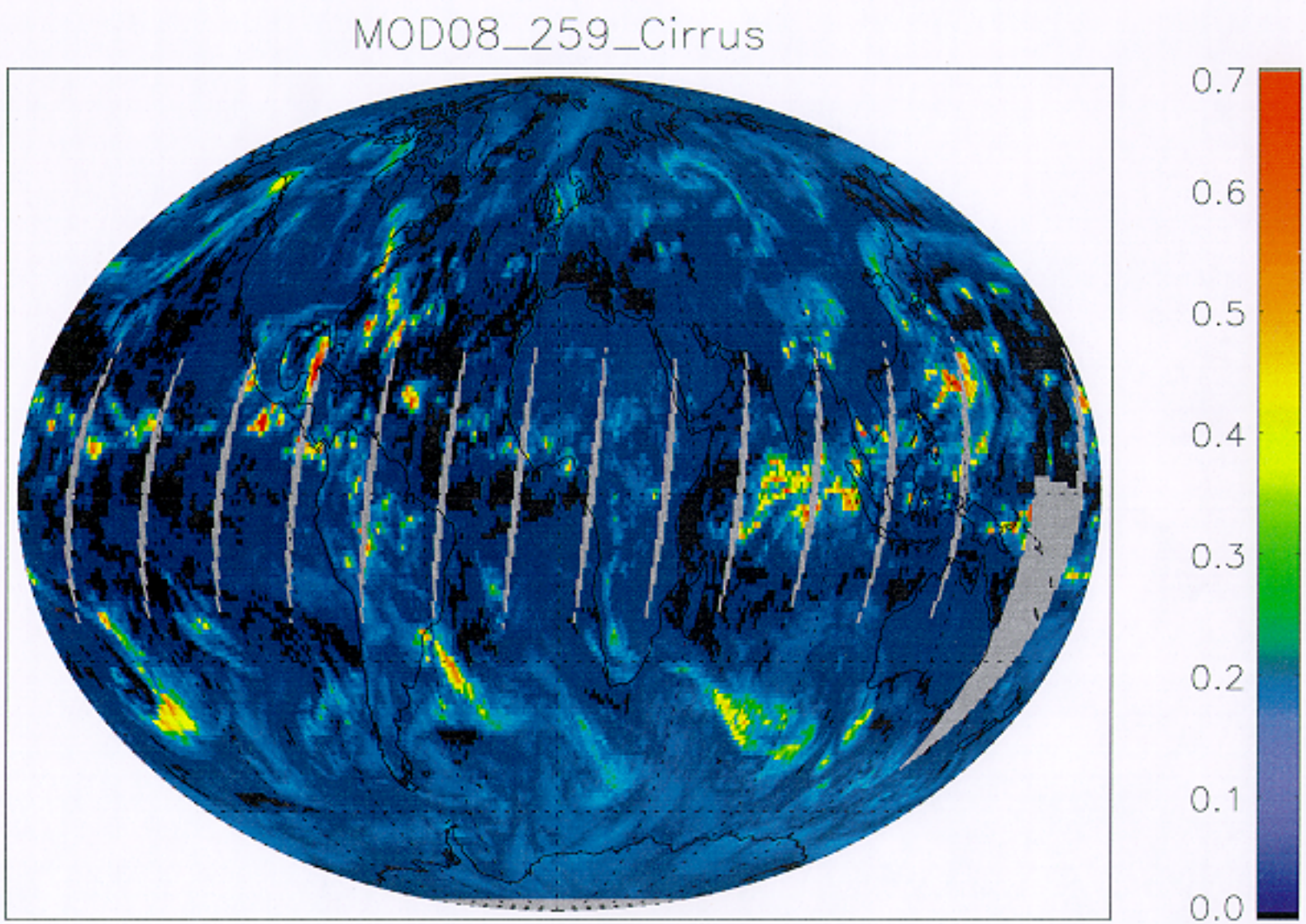
T(11 μm, 250K =⟩ 0, 225K =⟩ 255)

1.38 μm Channel




MODIS Data Over Oklahoma (235.1800)
38
37.50
37
36.50
03-102-101-100 -99 -98 -97 -9
36
35.50
35
34.50
34
1.38 μm Cirrus Channel
38
37.50
37
36.50
03-102-101-100 -99 -98 -97 -9
36
35.50
35
34.50
34


MOD08_258_Cirrus
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0


MOD08_259_Cirrus
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0.0

SUMMARY

- Based on our analysis of spectral imaging data collected by the NASA/JPL AVIRIS instrument, the MODIS 1.375-micron cirrus-detecting channel and near-IR water vapor channels were selected.
- Our preliminary results obtained from MODIS data are quite encouraging. We can make routine derivations of water vapor over land, above clouds, and over oceanic areas with sun glint. We can observe spatial variations of atmospheric water vapor. We can easily detect thin cirrus clouds using the 1.375-micron channel. The cross-talking problem with this channel has been under investigation by the MODIS Calibration and Support Team (MCST). The problem is not present in the Aqua MODIS instrument.
- The 1.375-micron channel and similar channels have been proposed for several future satellite instruments (e.g., Landsat follow on, VIIRS on NPOESS). So far, the 0.94-micron channels have received less attention in the science and engineering communities.
- We expect that our near-IR water vapor and cirrus products derived from MODIS data will have important applications in meteorology and hydrology.