

# Daytime Multilayered Cloud Detection With MODIS

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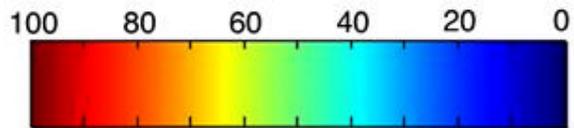
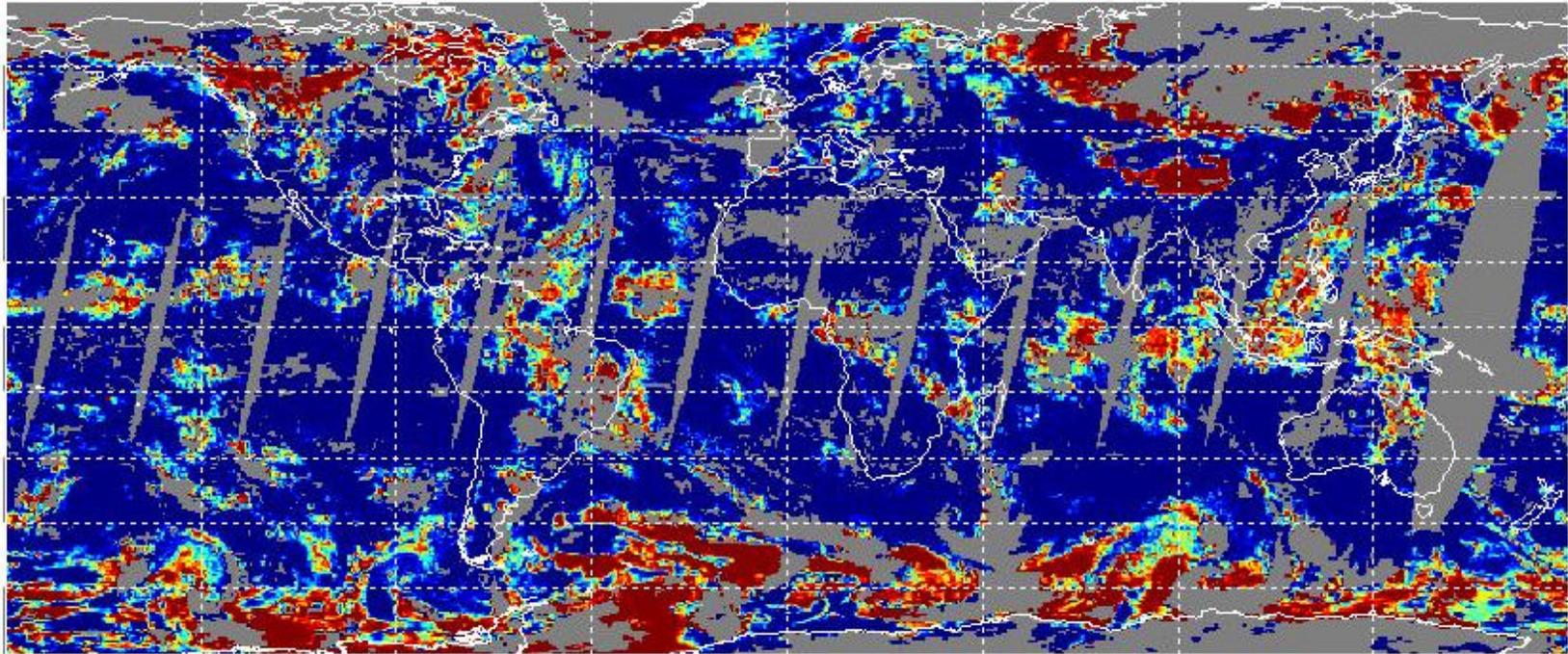
Dep't of Atmospheric and Oceanic Sciences  
University of Wisconsin-Madison



*MODIS Science Team Meeting  
July 22 2002*

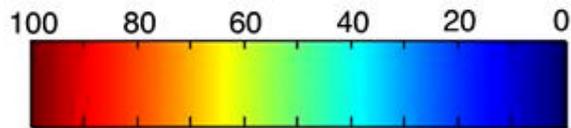
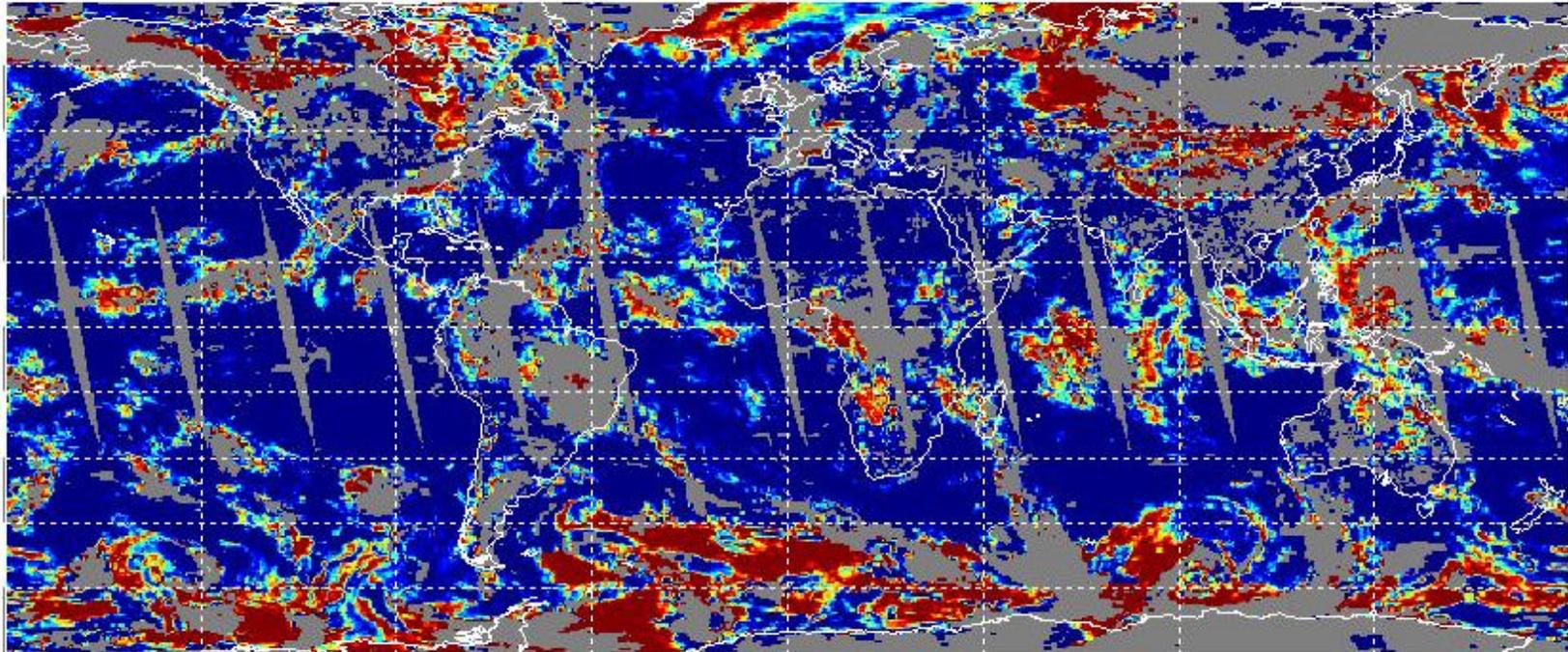


MODIS Frequency of Co-occurrence  
Water Phase with  $253\text{ K} < T_{\text{cld}} < 268\text{ K}$   
05 Nov. 2000 - Daytime Only



frequency of occurrence in percent (%)

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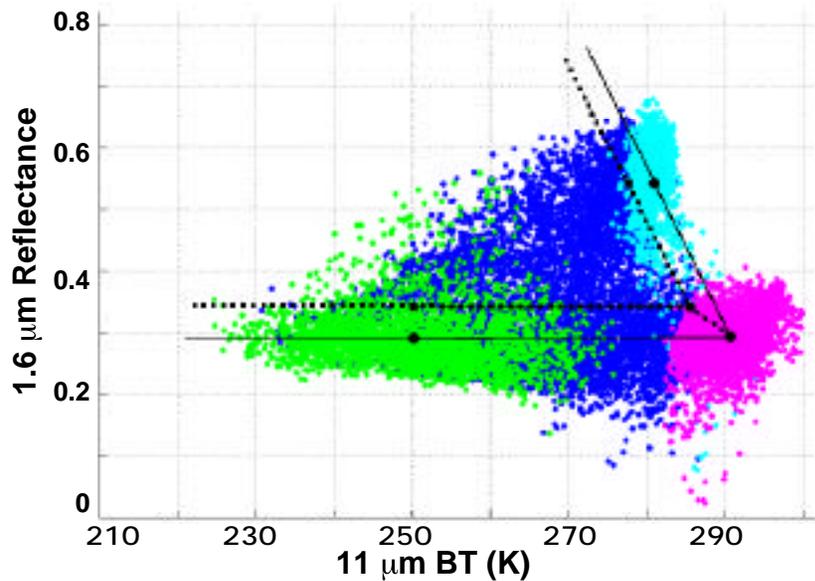
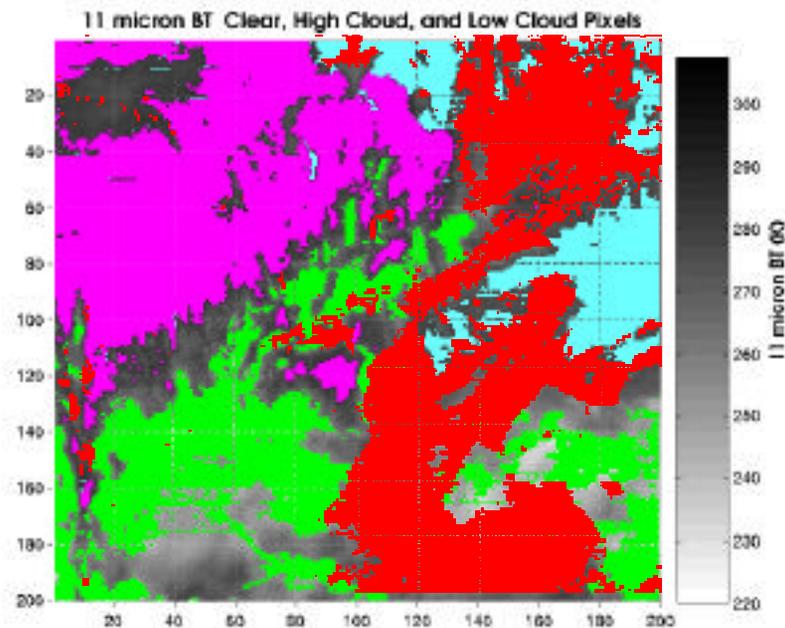
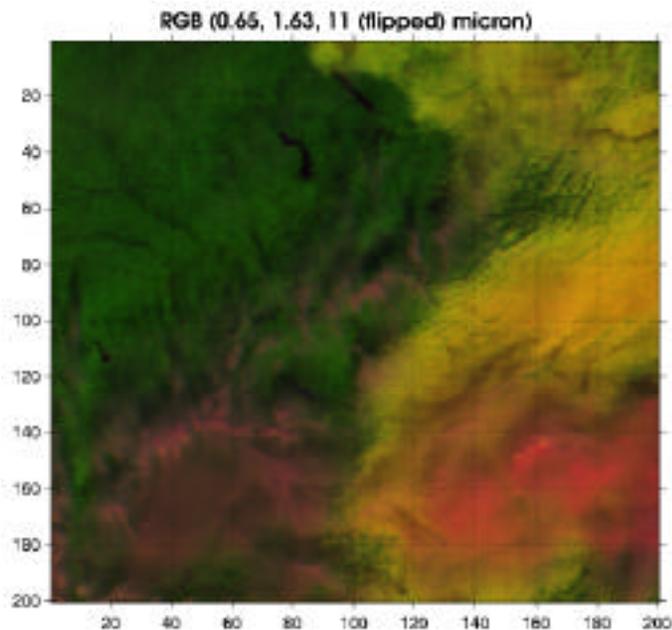
## MODIS Daytime Cloud Overlap Technique

Assumption: At most 2 cloud layers in data array

For a 200x200 pixel (1km resolution) array of MODIS data:

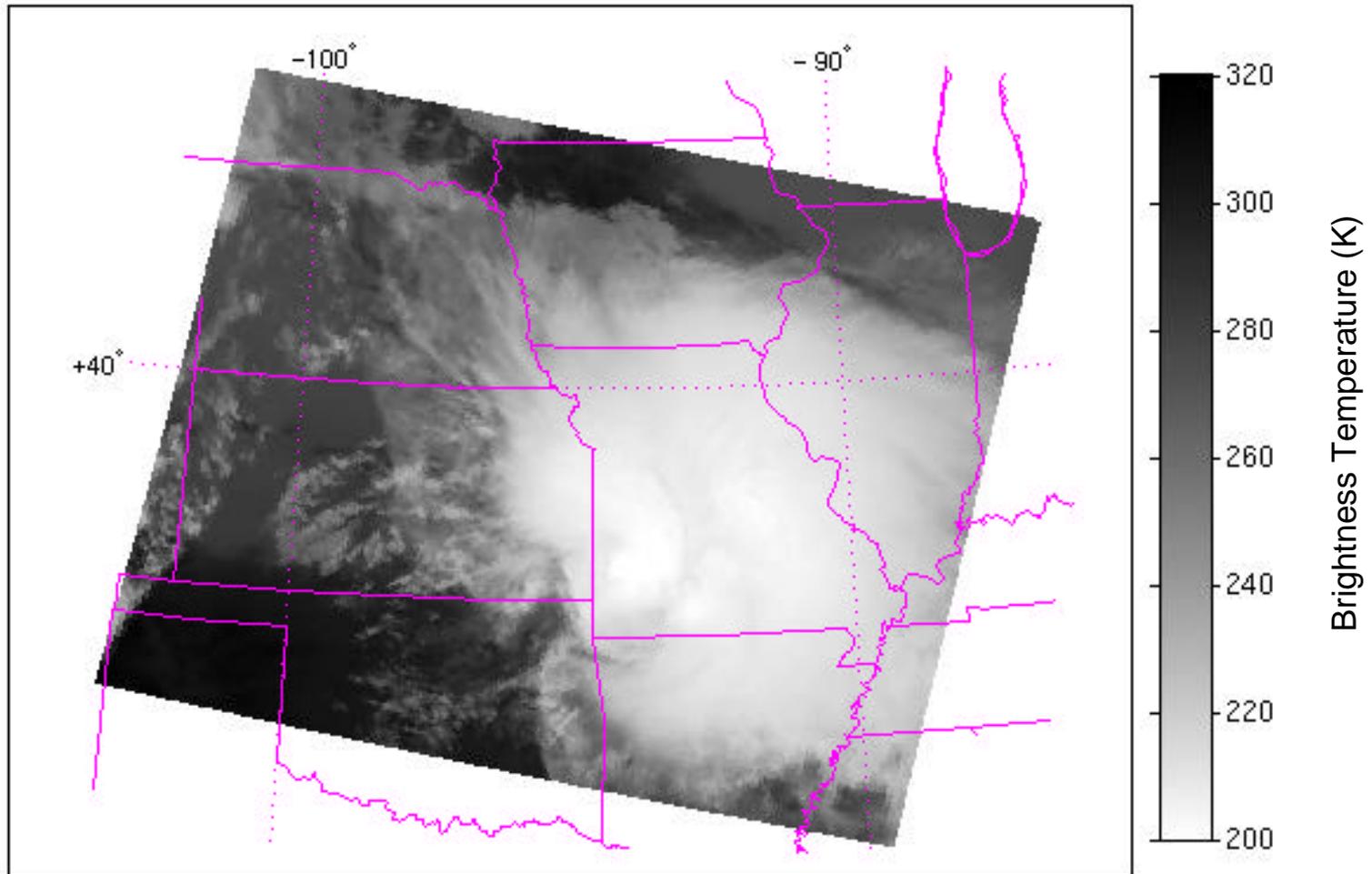
- Identify clear pixels from MODIS cloud mask
- Identify unambiguous ice pixels and water pixels from 8.5- and 11- $\mu\text{m}$  bispectral cloud phase technique
- Classify unambiguous ice/water pixels as belonging to the higher/lower cloud layer
- Classify remaining pixels as overlapped

# 200 by 200 pixels of MODIS Data from 15 Oct. 2000 at 1725Z

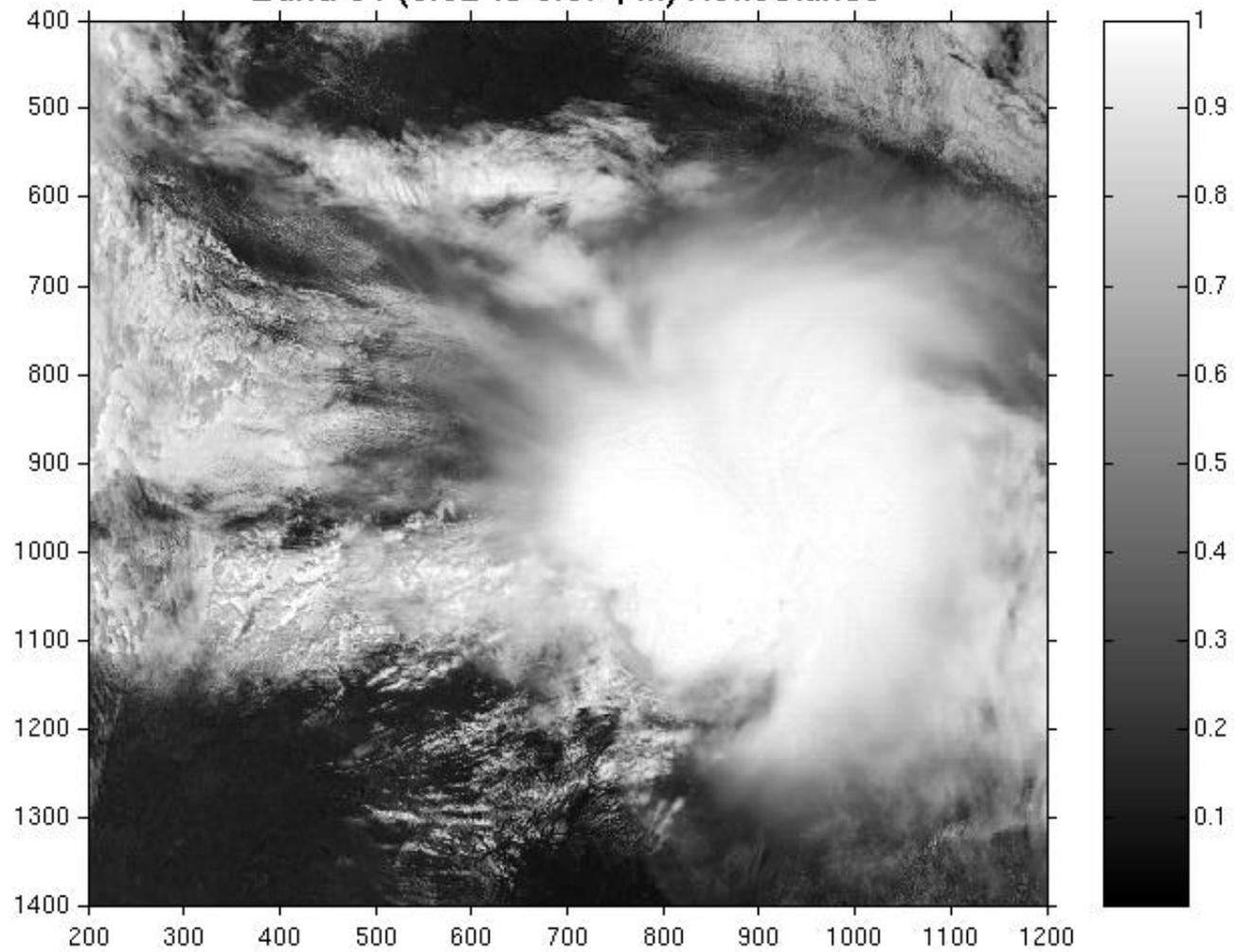


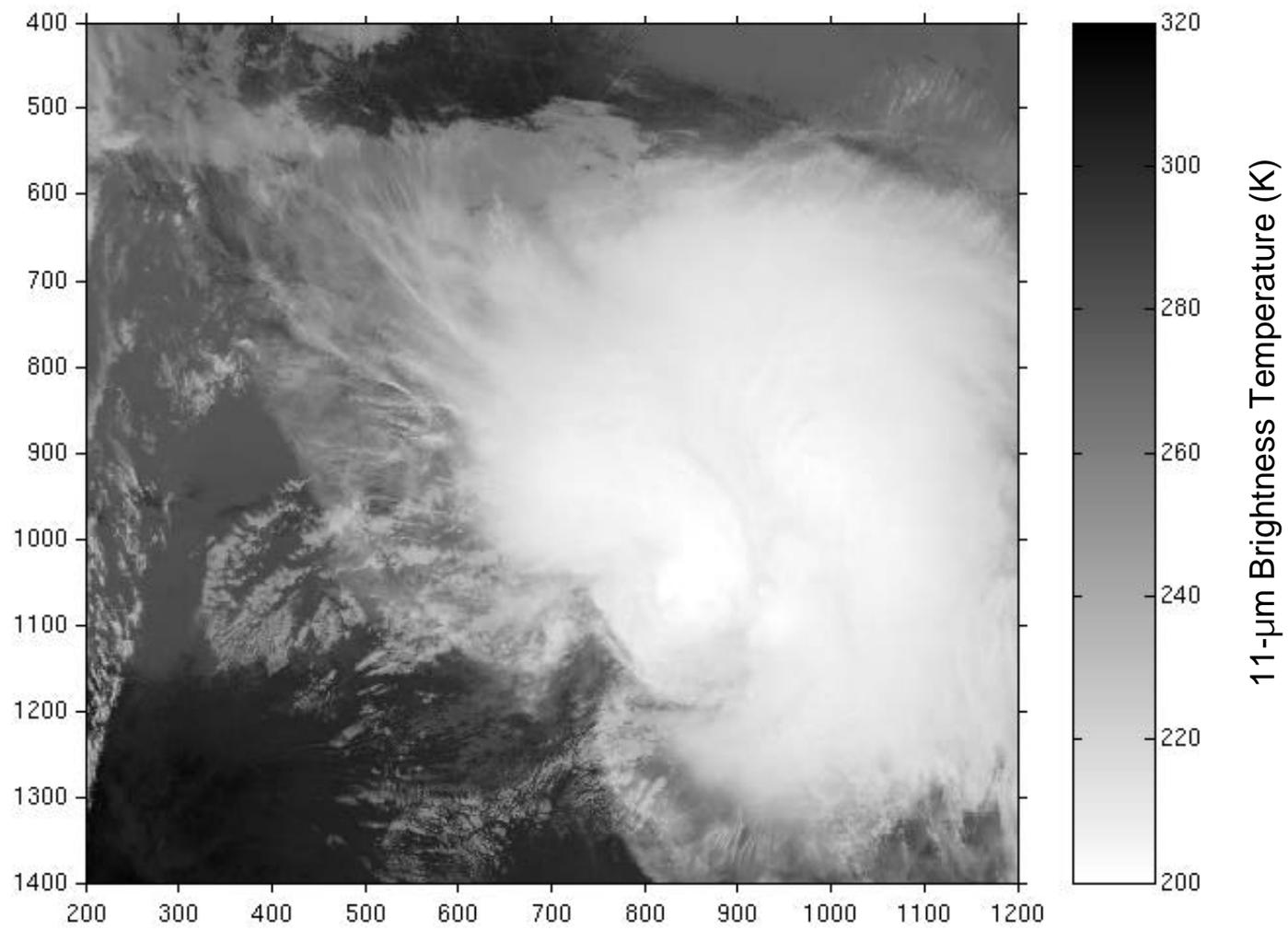
- Water Cloud (from MODIS Phase)
- Ice Cloud (from MODIS Phase)
- Clear (from MODIS Cloud Mask)
- Other (to be determined)

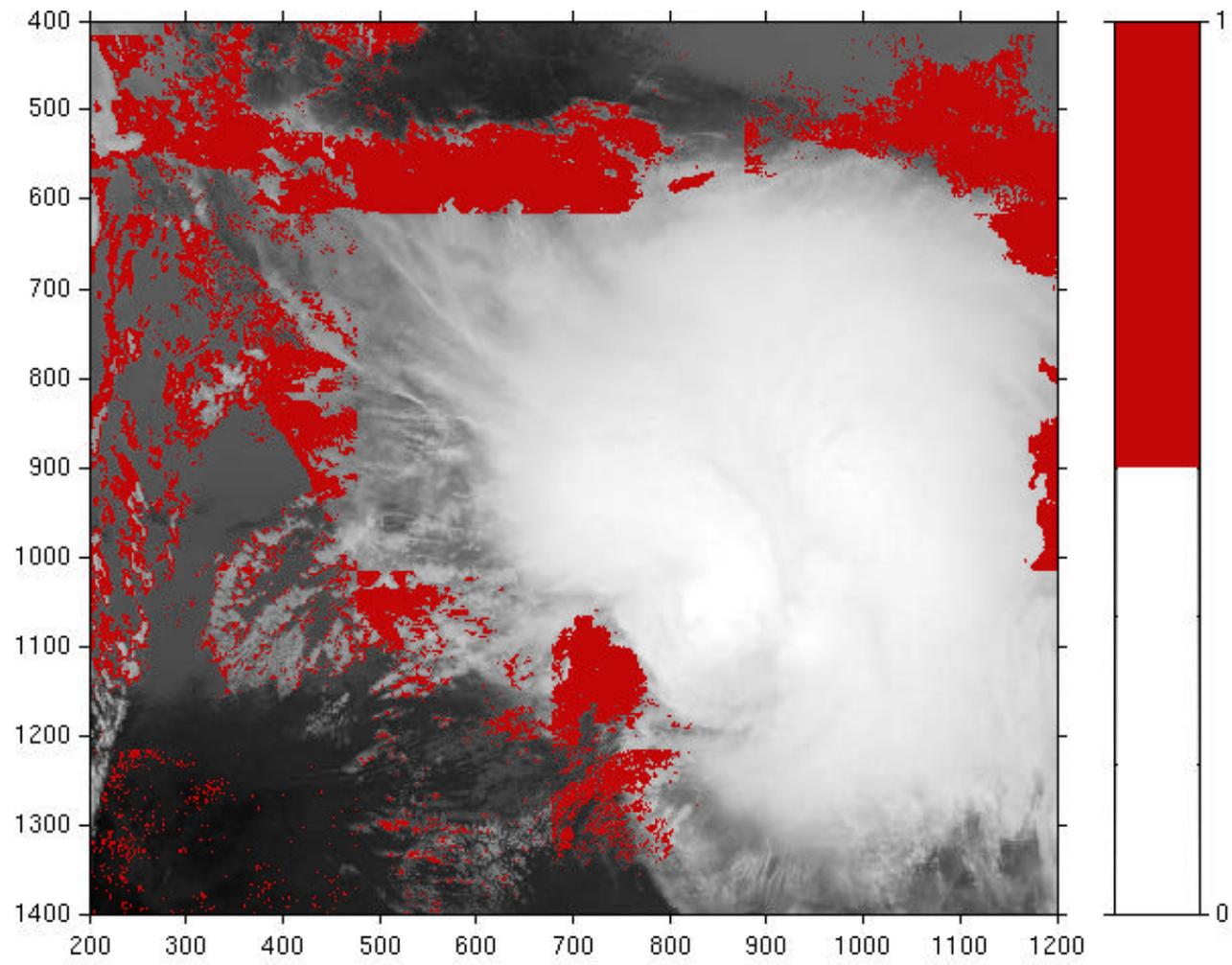
MODIS Band 31 (11  $\mu\text{m}$ ) on 3 June 2001



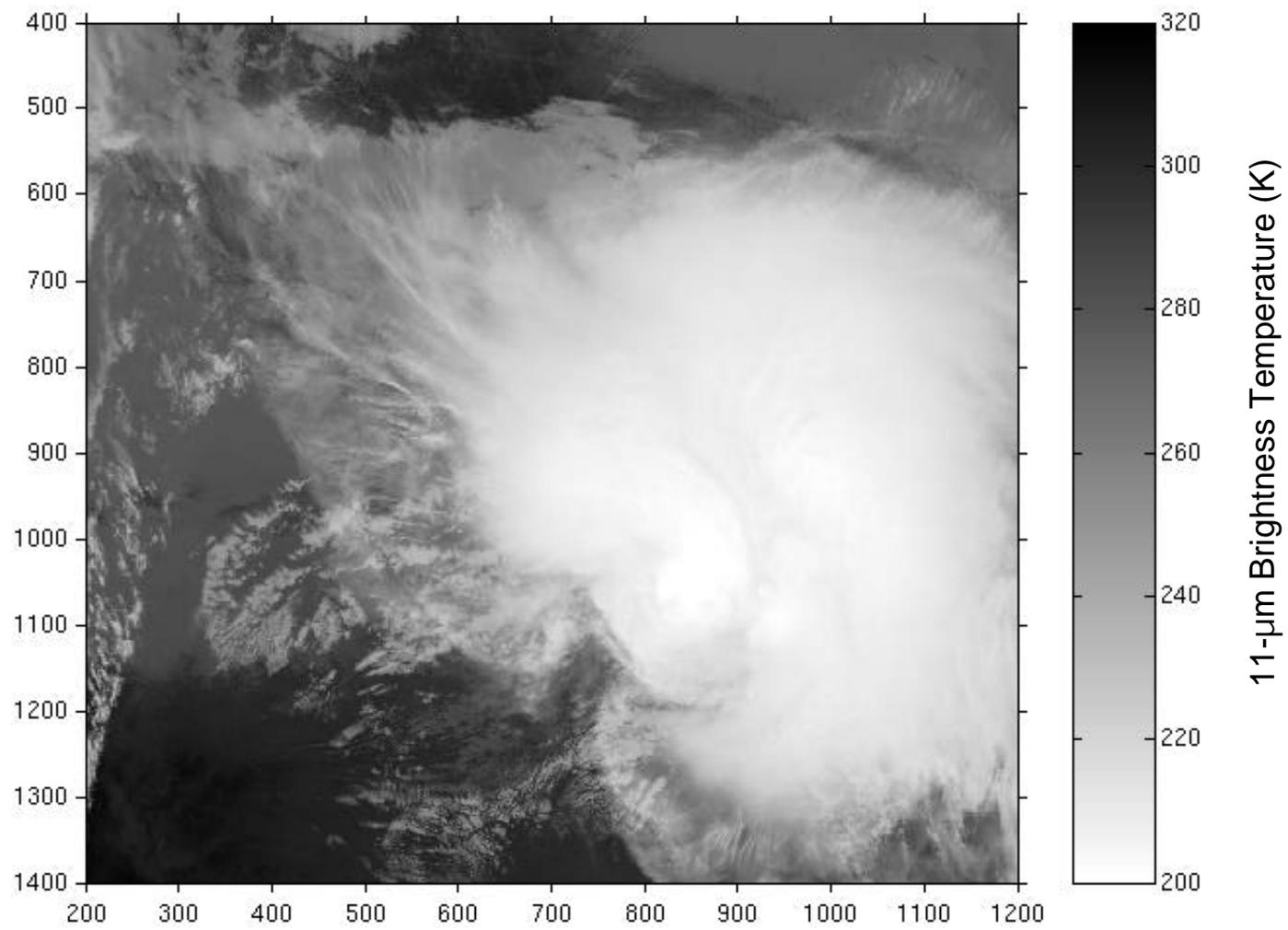
Band 01 (0.62 to 0.67  $\mu\text{m}$ ) Reflectance

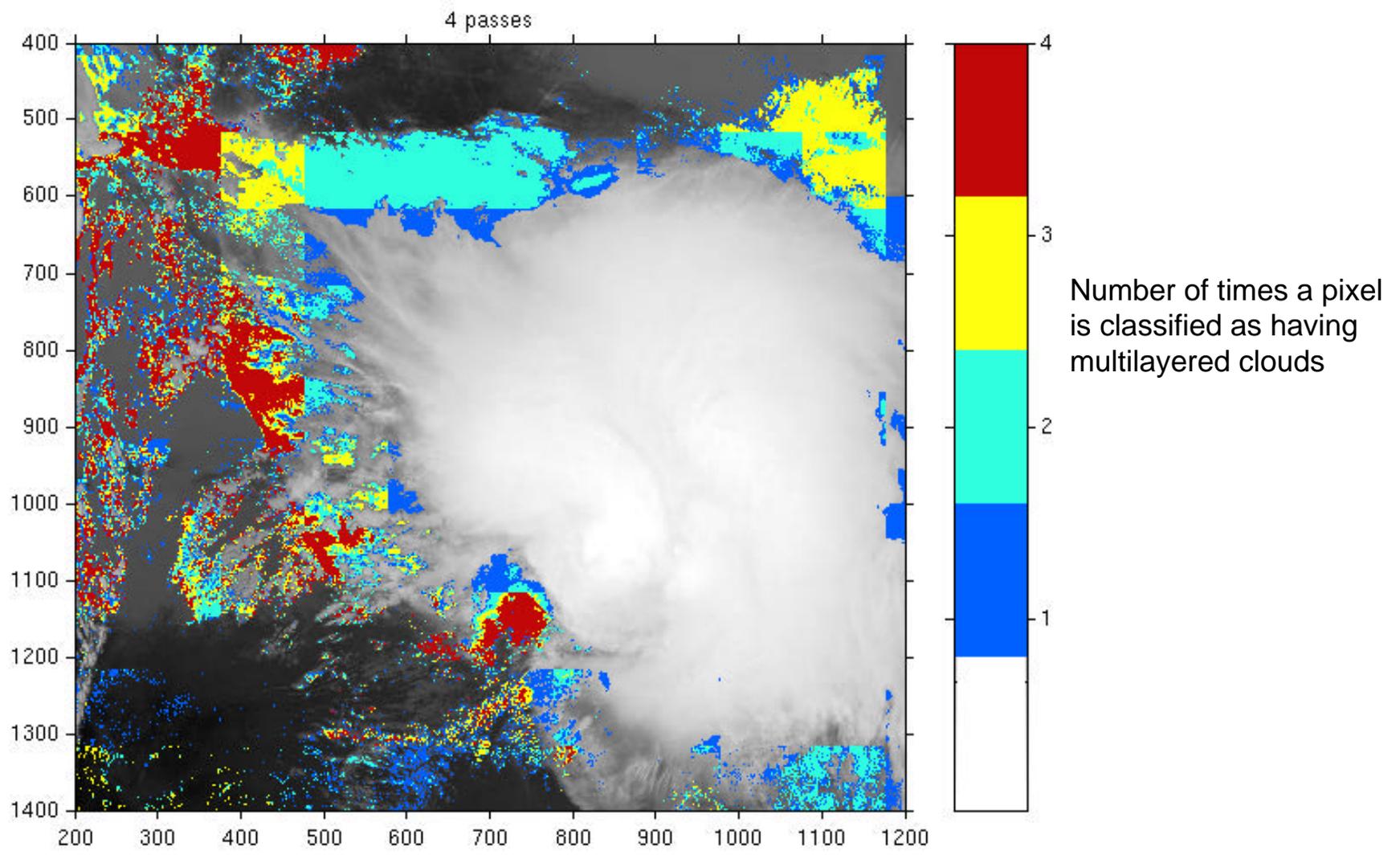


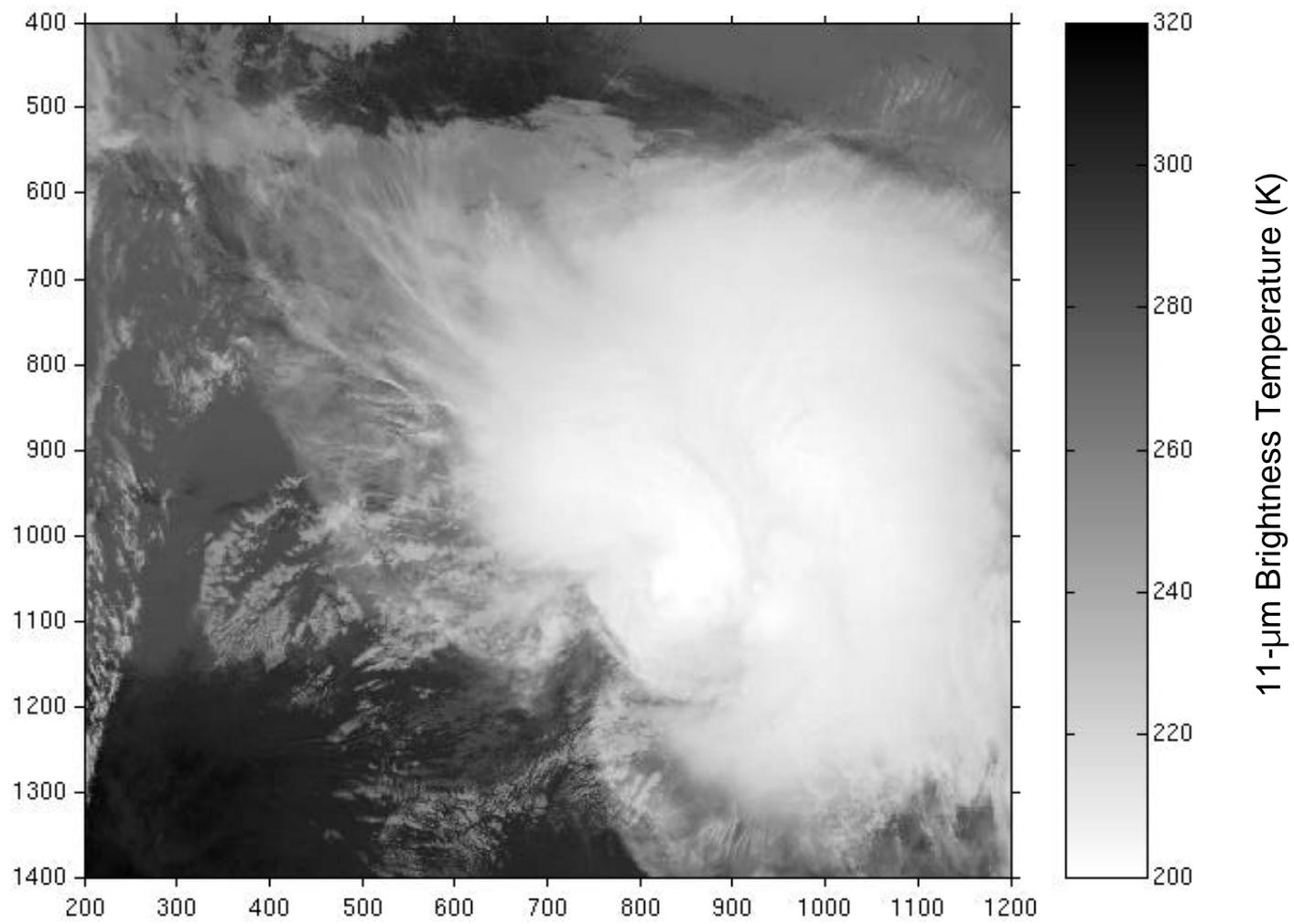


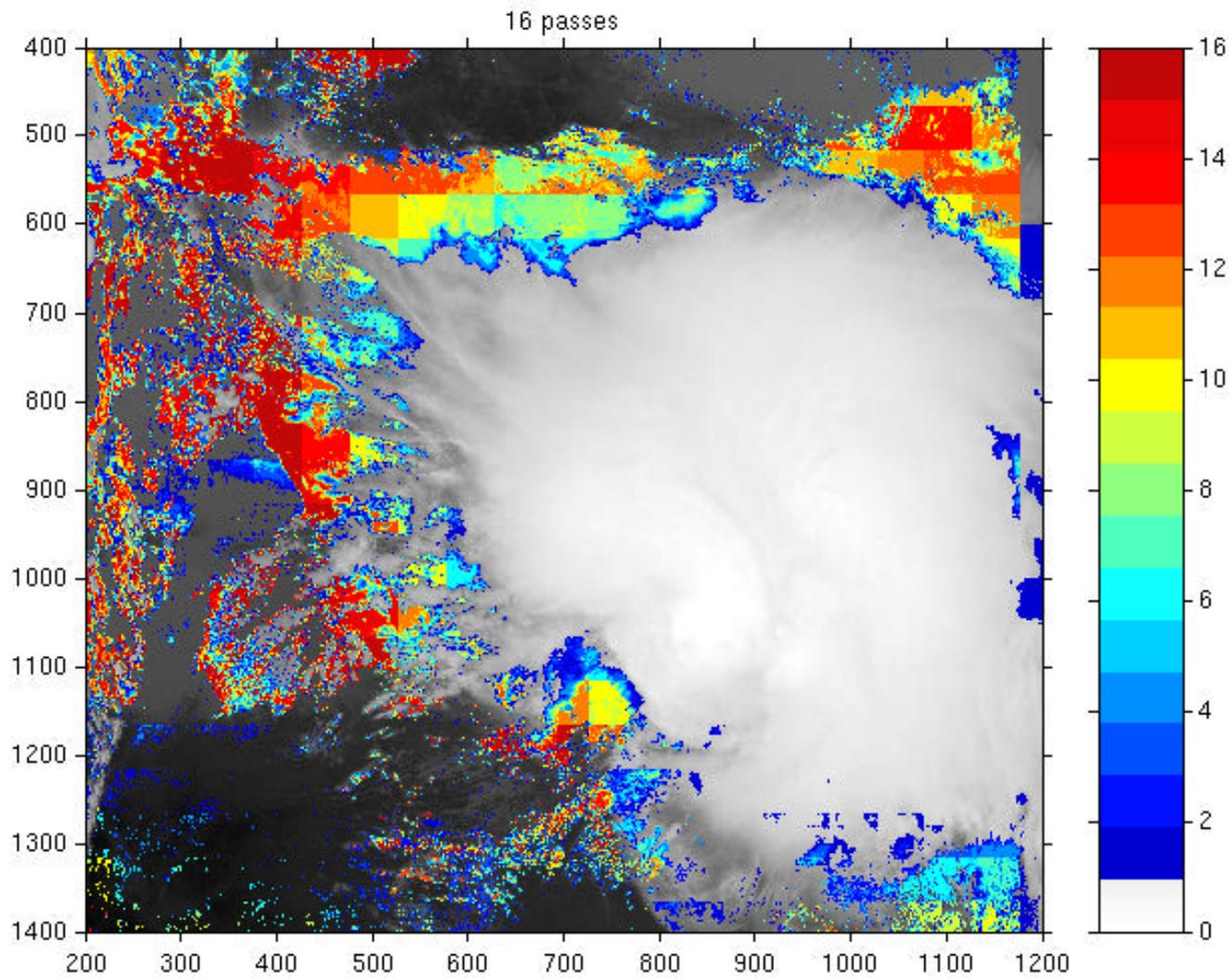


Number of times a pixel is classified as having multilayered clouds

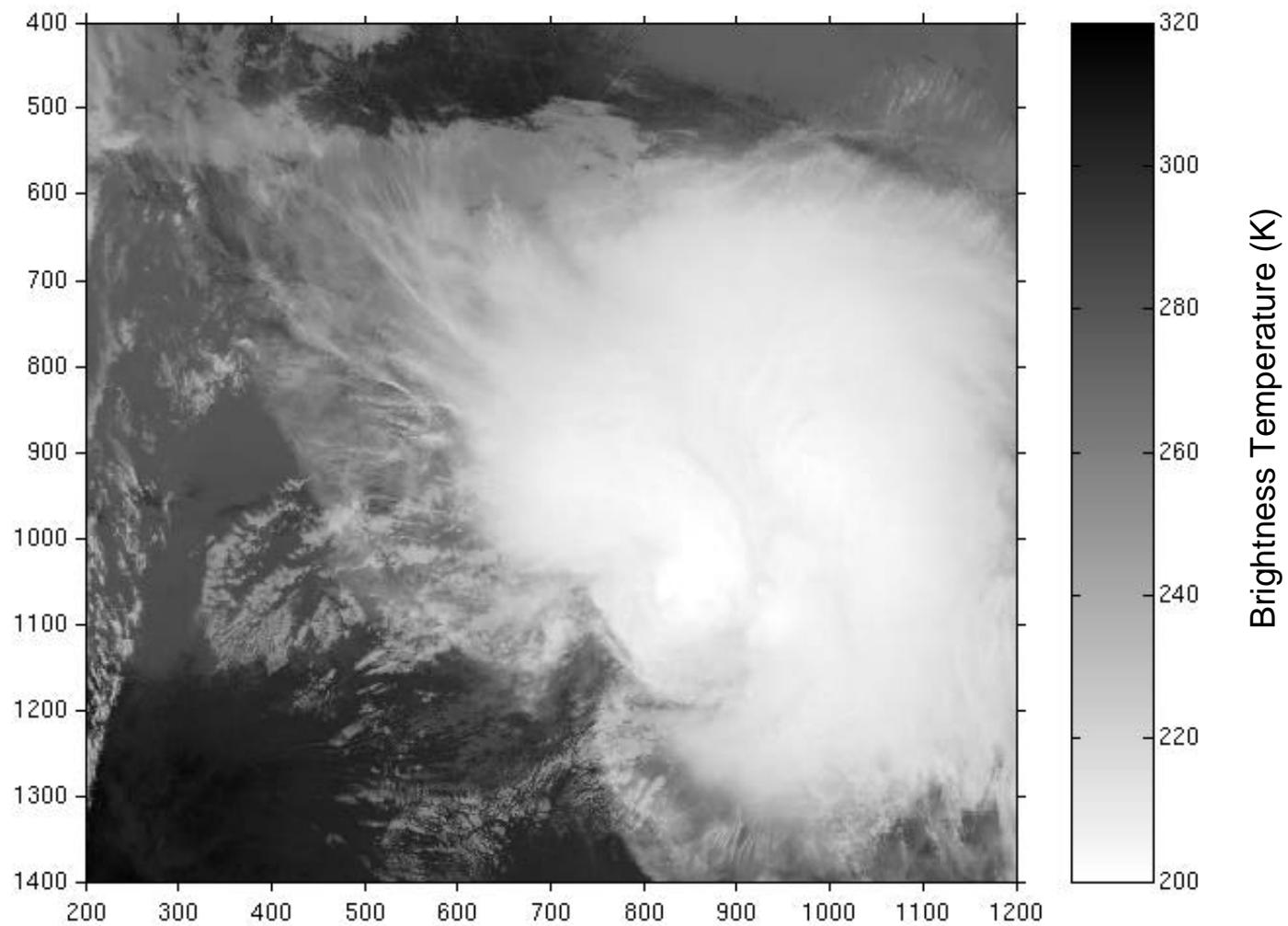


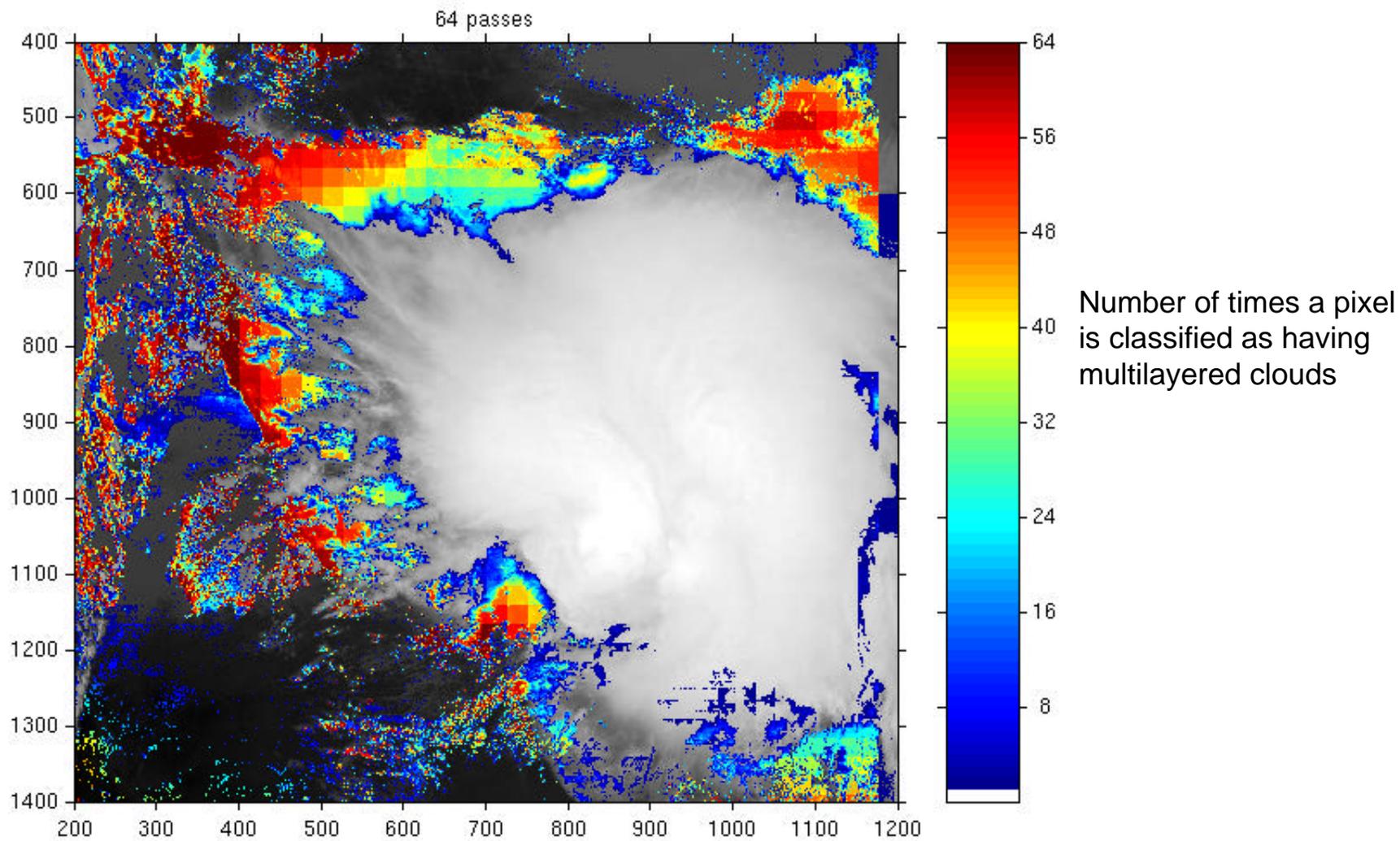


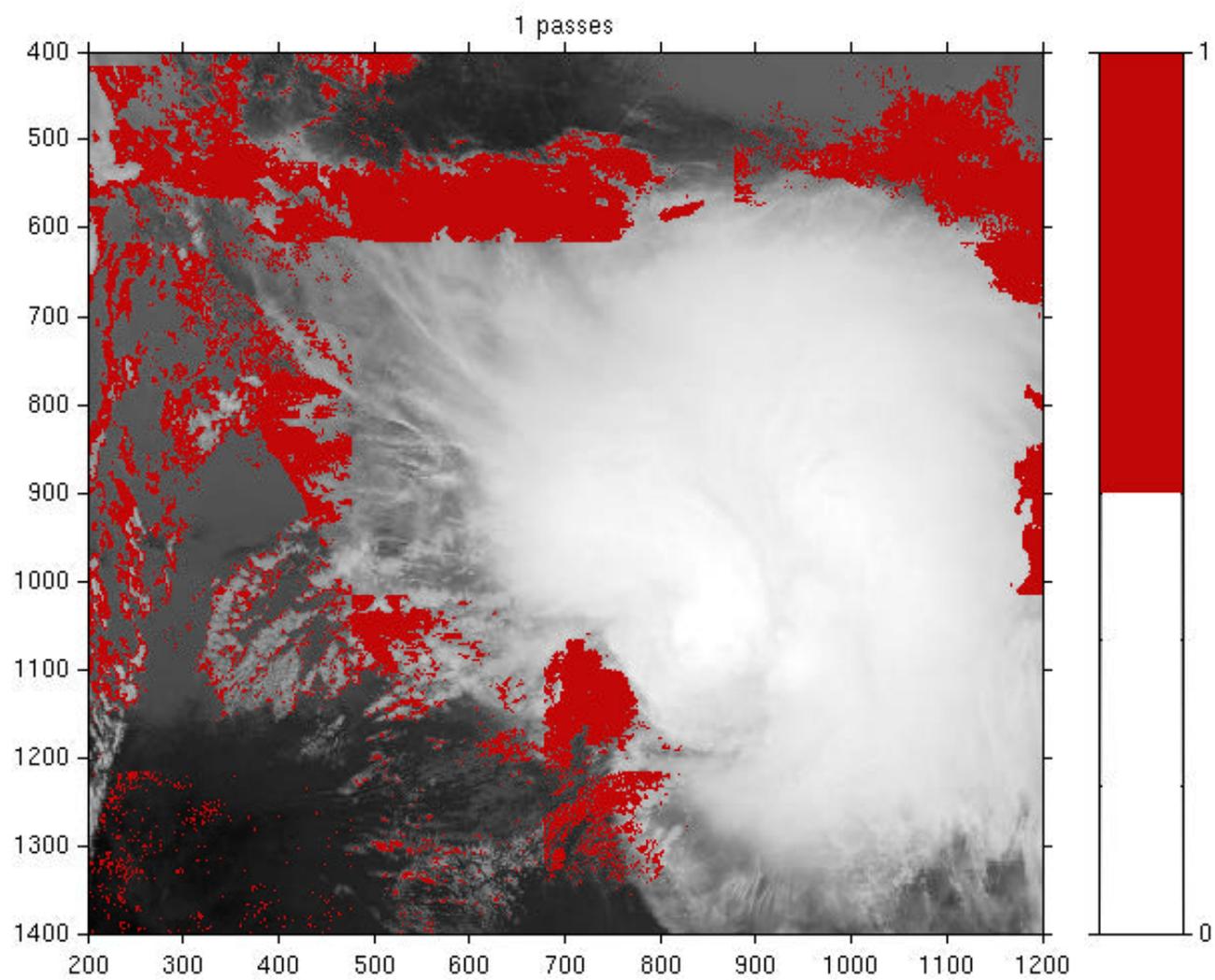




Number of times a pixel  
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multilayered clouds







## Where are we taking this?

Currently, software to process MODIS granule is based on the Matlab COTS product

Requires cloud clearing and cloud phase products

Will apply this approach to daytime MODIS direct broadcast data for both Terra & Aqua (will have to see how 2.1- $\mu\text{m}$  band does as surrogate for 1.6  $\mu\text{m}$ )

Once method becomes more settled, it will be adapted for operational environment

## And in summary...

To improve inference of cloud phase, we are attempting to separate single-layered from multilayered clouds.

The Direct Broadcast data will be used to test the new approach on a daily basis.

When the method becomes more mature, it will be modified for operational use.

Future field experiments will provide (hopefully ) cloud phase independently from depolarization lidar measurements from above cloud top for cloud phase and multilayered cloud comparisons.