

# Outline: Definition of a Day

- Current definition and aggregation algorithm
- What's the problem ?
- The picture a year ago
- Proposed new definition and aggregation algorithm
- What it solves
- What's required to get there

# Current Definition of a Day

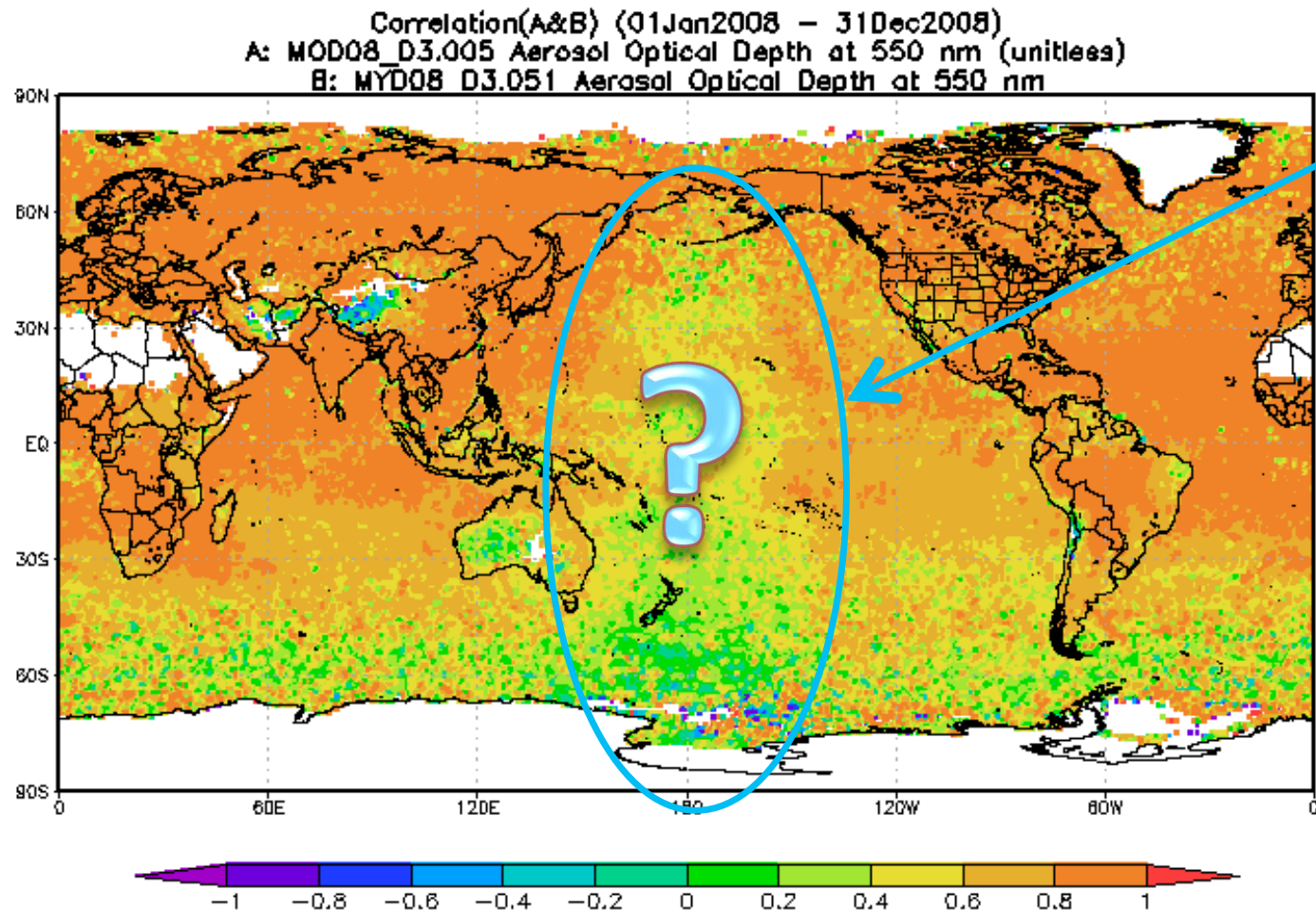
- The 'Greenwich Day' uses a simple 24 hour temporal cutoff
- Daily aggregation starts with a clean sheet @ GMT midnight
- MODIS paints the canvas from East to West for 24 hours, starting and ending abruptly
- Simple, except
  - Aqua starts recording daylight measurements a bit EAST of the Date Line
  - Terra starts recording daylight measurements a bit WEST of the Date Line
- So, if your study region is just west of the Date Line
  - Aqua will pass nearby pretty early in the current 'Greenwich Day'
  - Terra may not pass nearby during daylight until the end of the 'Greenwich Day'

# So What's the Problem ?

*What's in a day?*

*Gregory Leptoukh et al, May 2011*

# MODIS vs. MODIS



MODIS-Terra vs. MODIS-Aqua: Map of AOD temporal correlation, 2008

# AOD MODIS Terra vs. Aqua in Pacific

## Over the dateline

## Away from the dateline

Scatter Plot

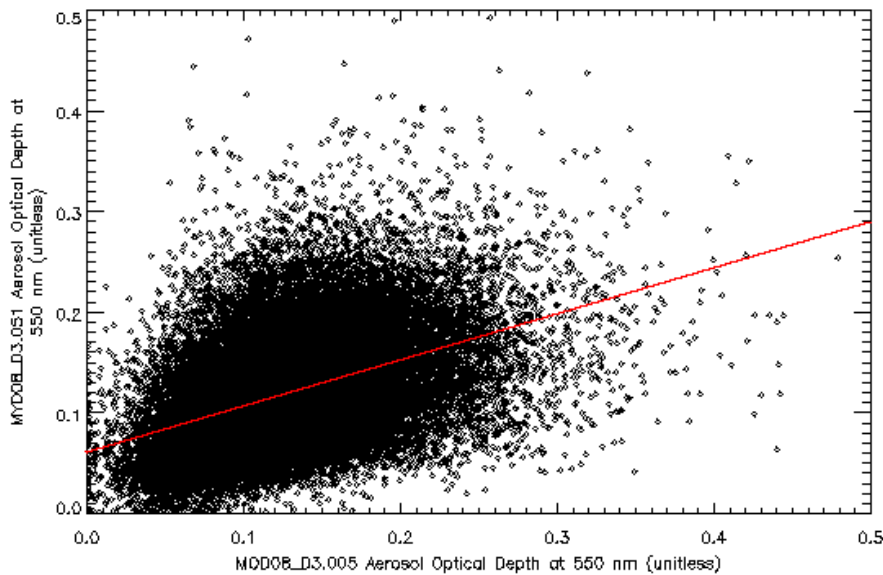
Time: 01Jan2008–31Dec2008 Area: (10S–10N, 170E–170W)

Y = 0.4563X + 0.0624

Correlation: r = 0.4459

RMS Error = 0.0487

count = 37643



$R^2 = 0.45$   
RMS = 0.05

Scatter Plot

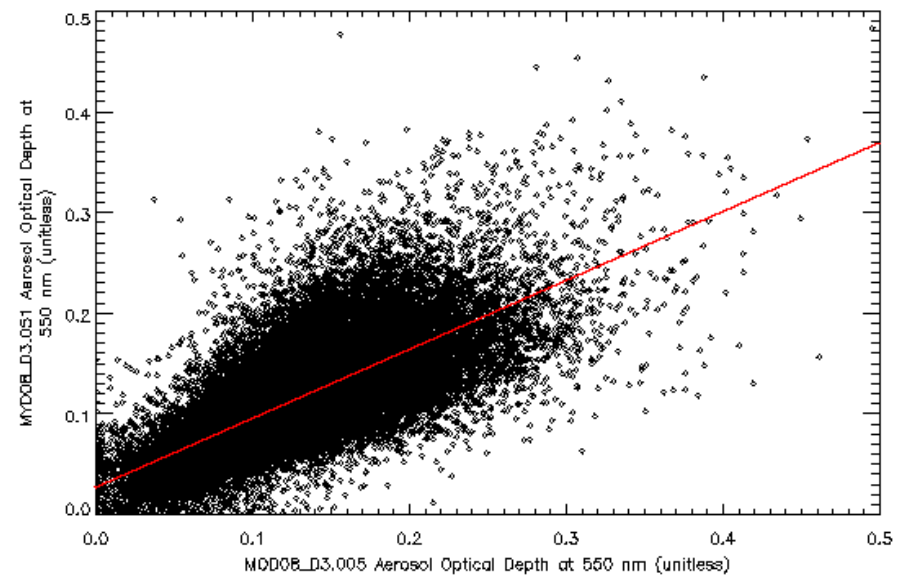
Time: 01Jan2008–31Dec2008 Area: (10S–10N, 140W–120W)

Y = 0.6842X + 0.0273

Correlation: r = 0.7183

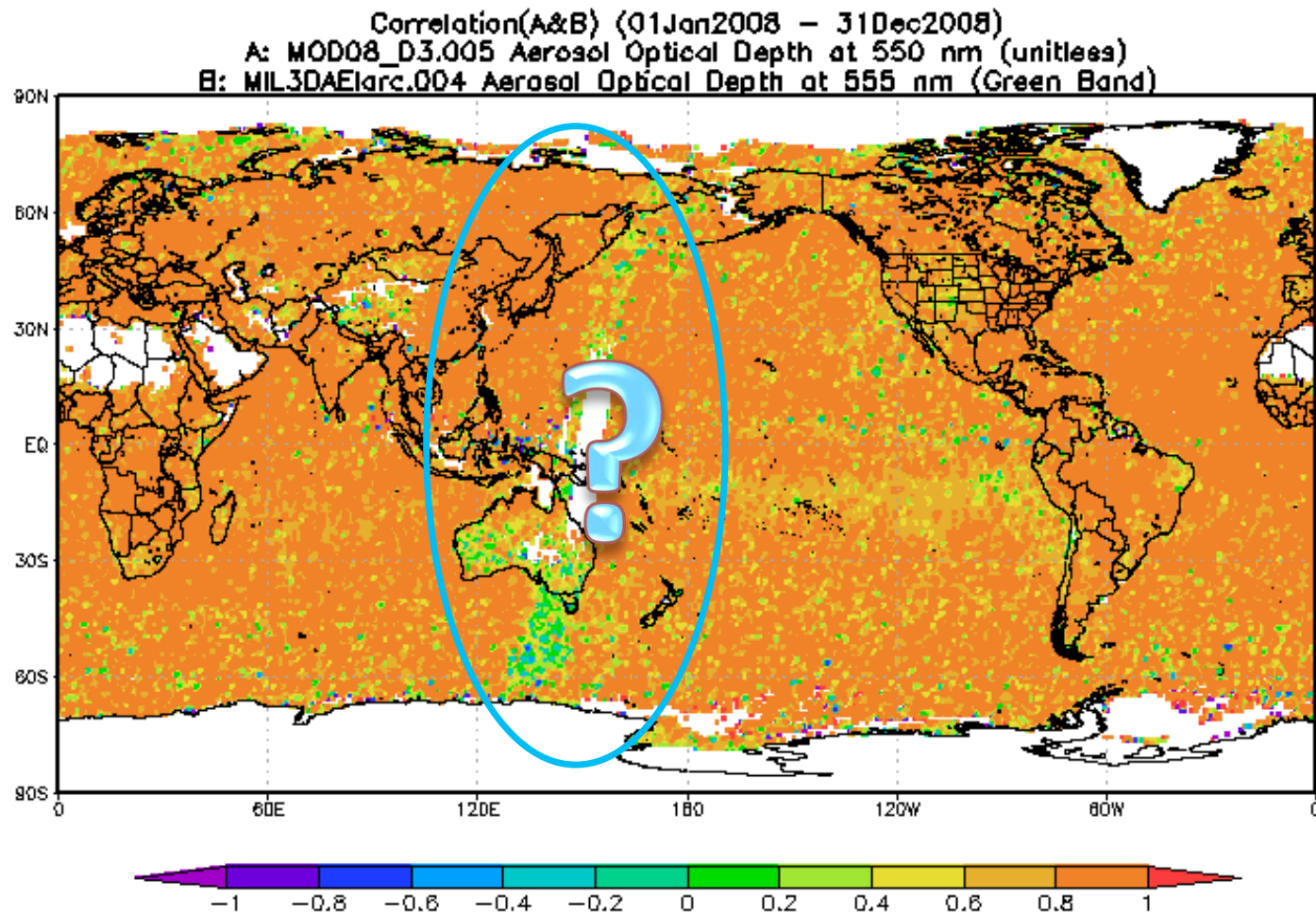
RMS Error = 0.0355

count = 42627



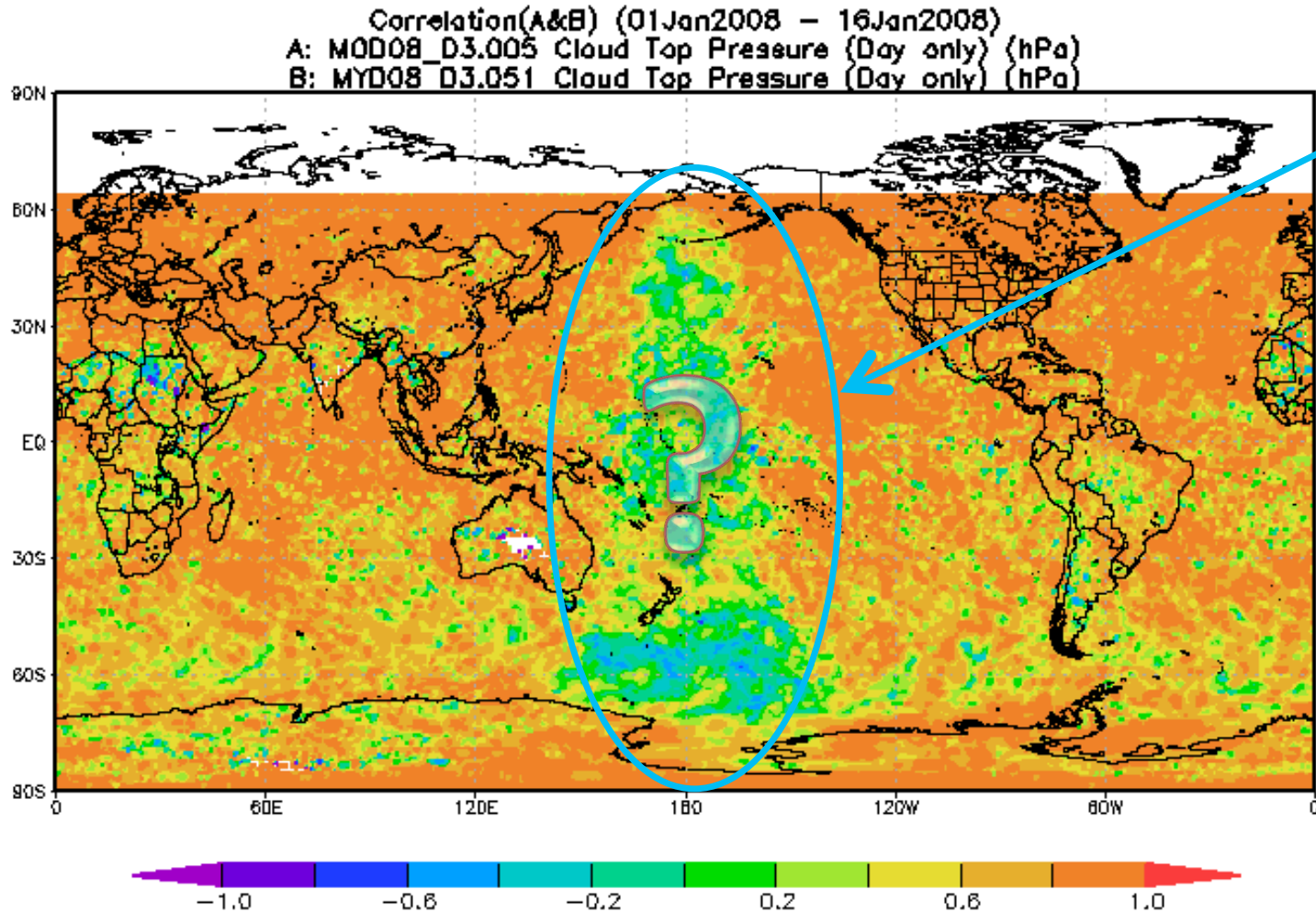
$R^2 = 0.72$   
RMS = 0.036

# MODIS vs. MISR on Terra



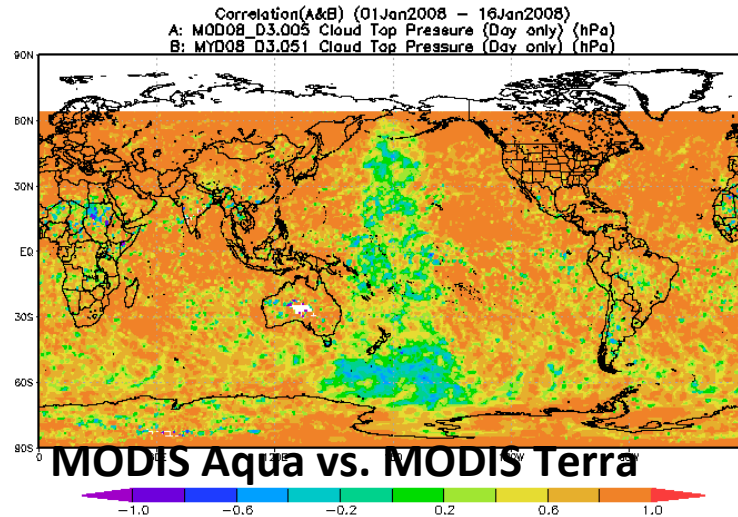
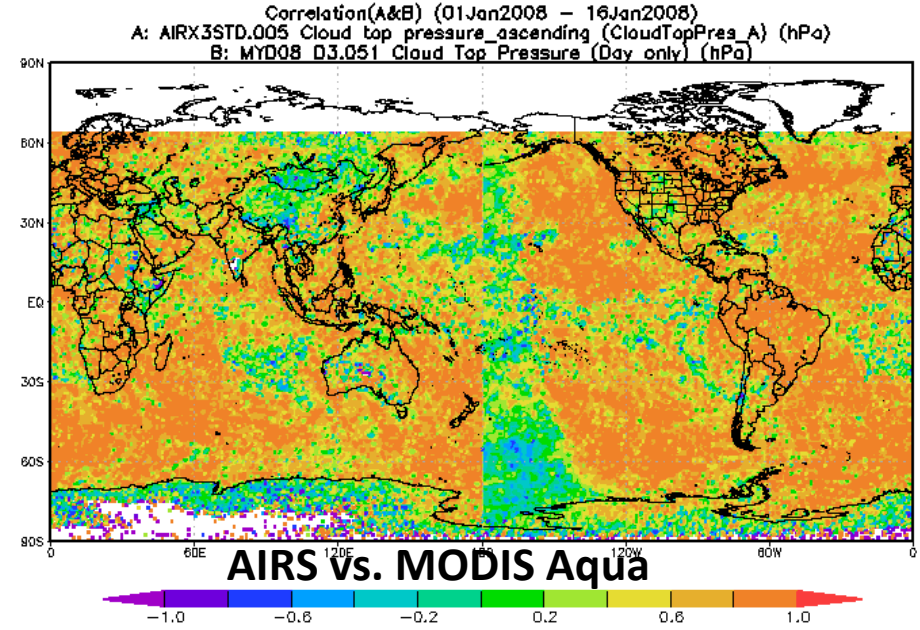
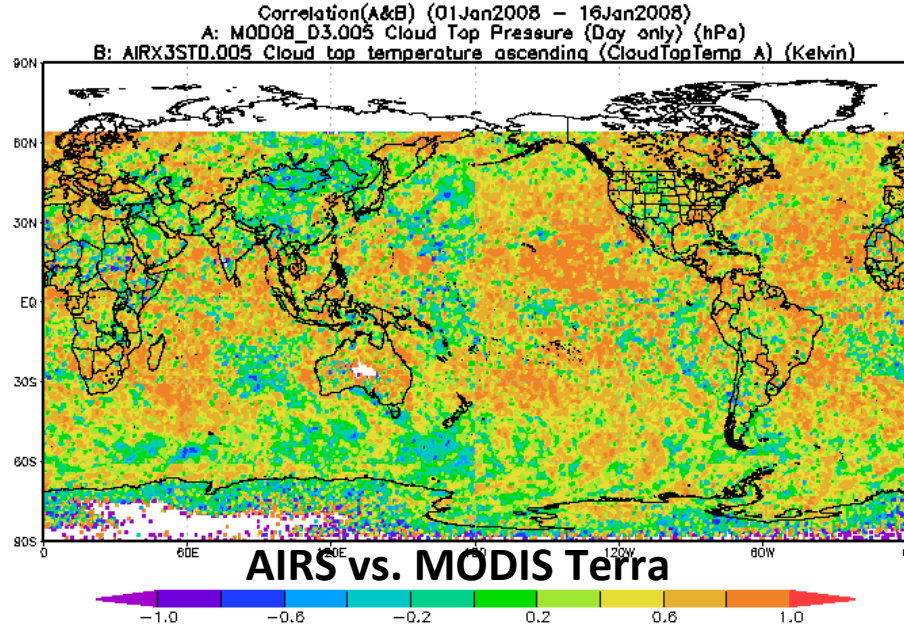
MODIS-Terra vs. MISR-Terra: Map of AOD temporal correlation

# MODIS Cloud Top Pressure





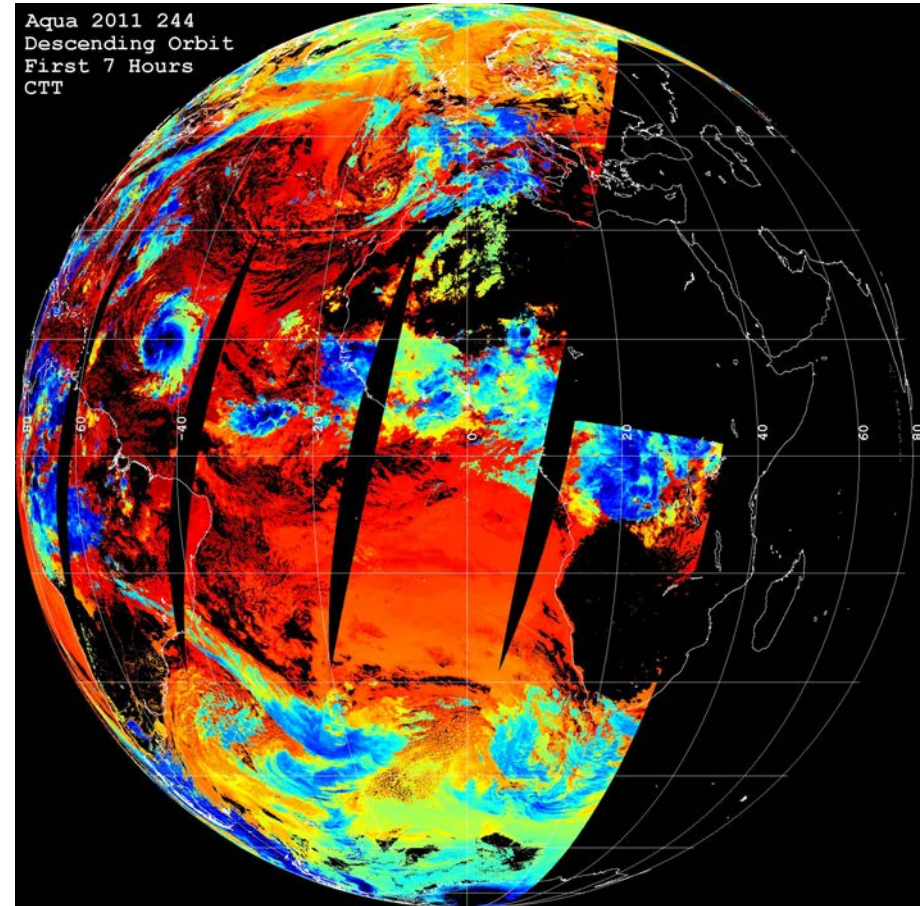
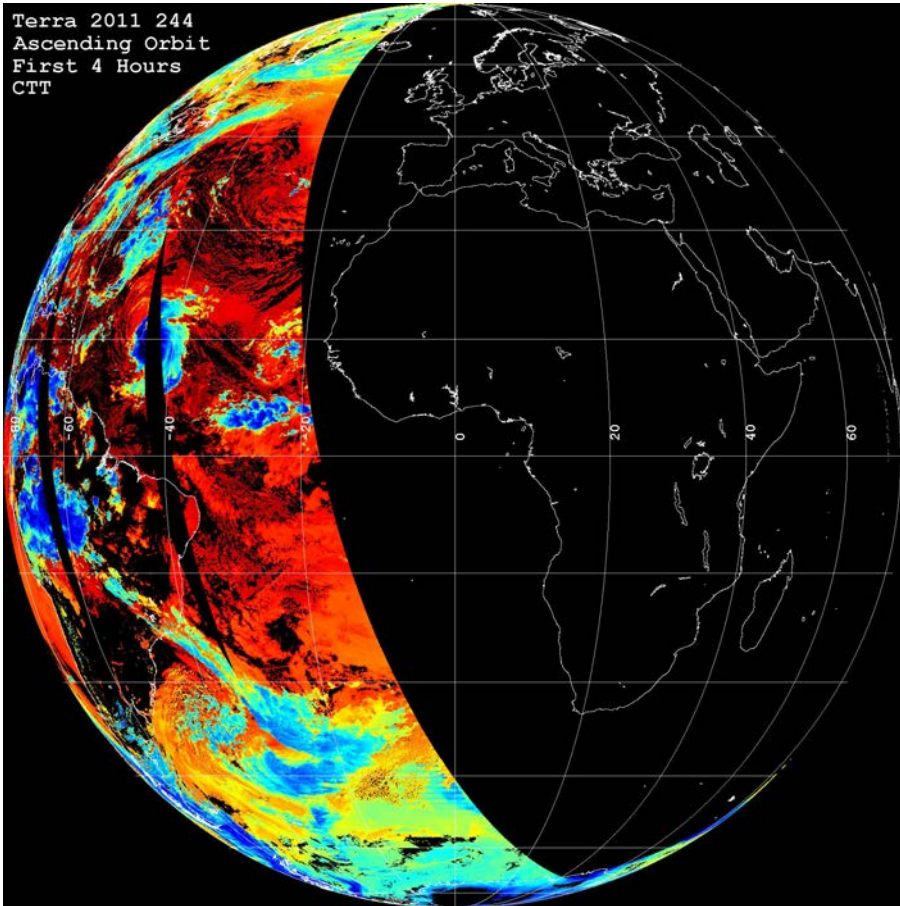
# MODIS Terra & Aqua vs. AIRS Cloud Top Pressure



# So What's the Problem ?

- MODIS orbits repeat every 16 days, not every day, so
  - We have L3 data gaps
  - We locally mix overpasses from today and tomorrow
- Poor MODIS-MODIS correlations near Date Line
- Poor MISR-MODIS correlations near Date Line
- MODIS Definition of Day impacts cross-platform science

# Cloud Top Temperature (Night)



# Proposed Solution

- Longitude boundaries take priority over temporal boundaries
  - Daylight products have a seam between days at the Date Line
  - Night products are discontinuous across Greenwich Meridian
- Identify transition period with orbits that cross boundaries
  - Aqua: First 3 GMT hours
  - Terra: Last 3 GMT hours
- Complete data day starts and ends with a transition period
- Apply pixel level filter to all transition orbit granules
  - Daylight: pixel contributes on proper side of Date Line
  - Night: pixel contributes on proper side of Greenwich Meridian

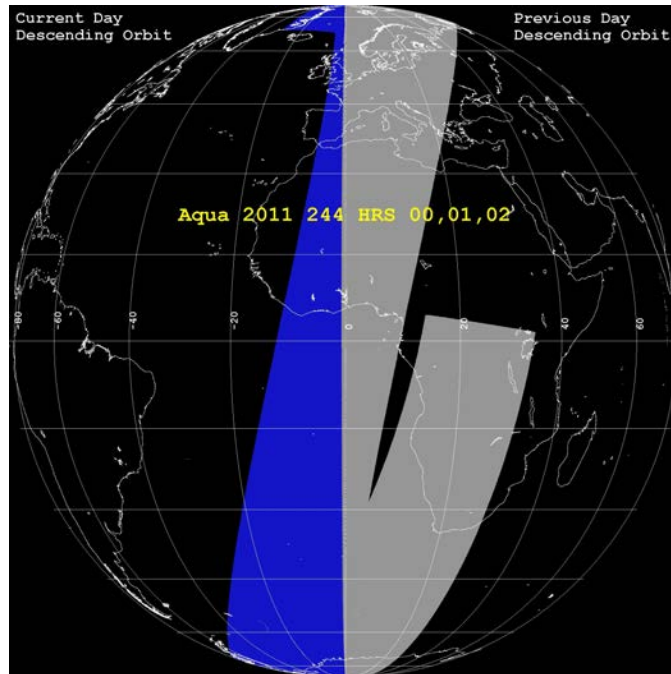
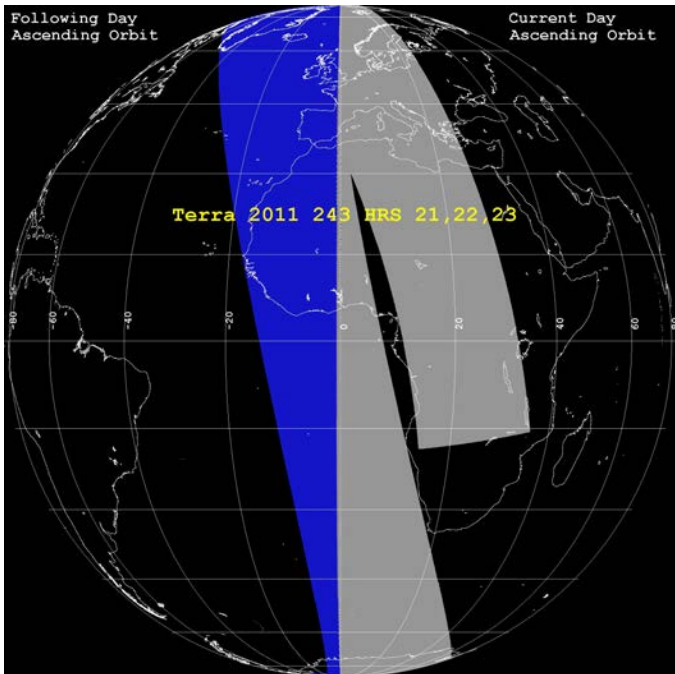
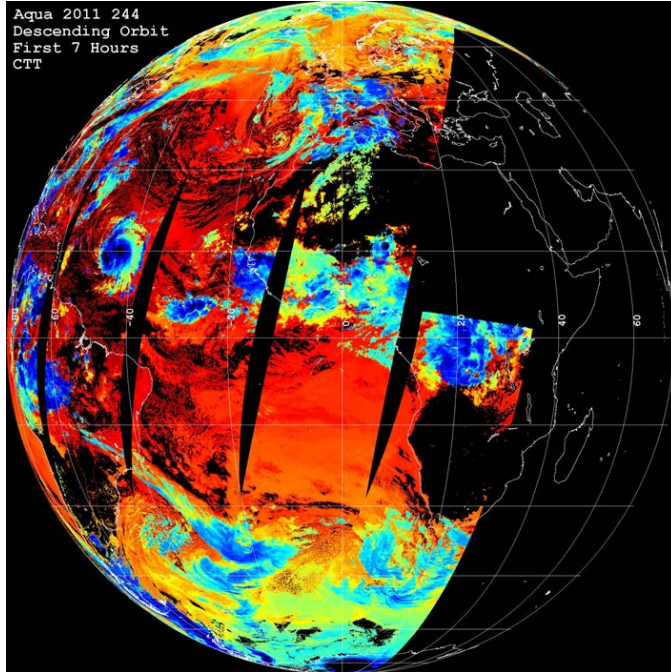
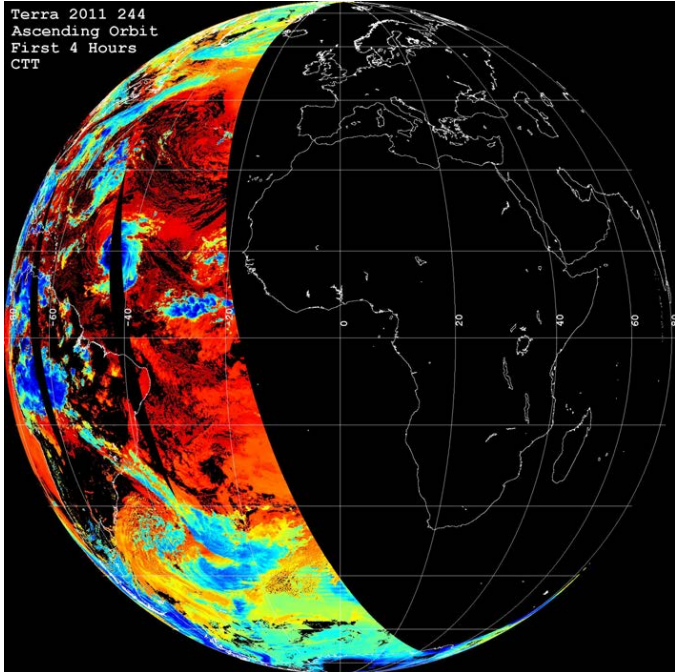
# Algorithm

**Aqua: Process GMT 00:00 through GMT 03:00 following day**

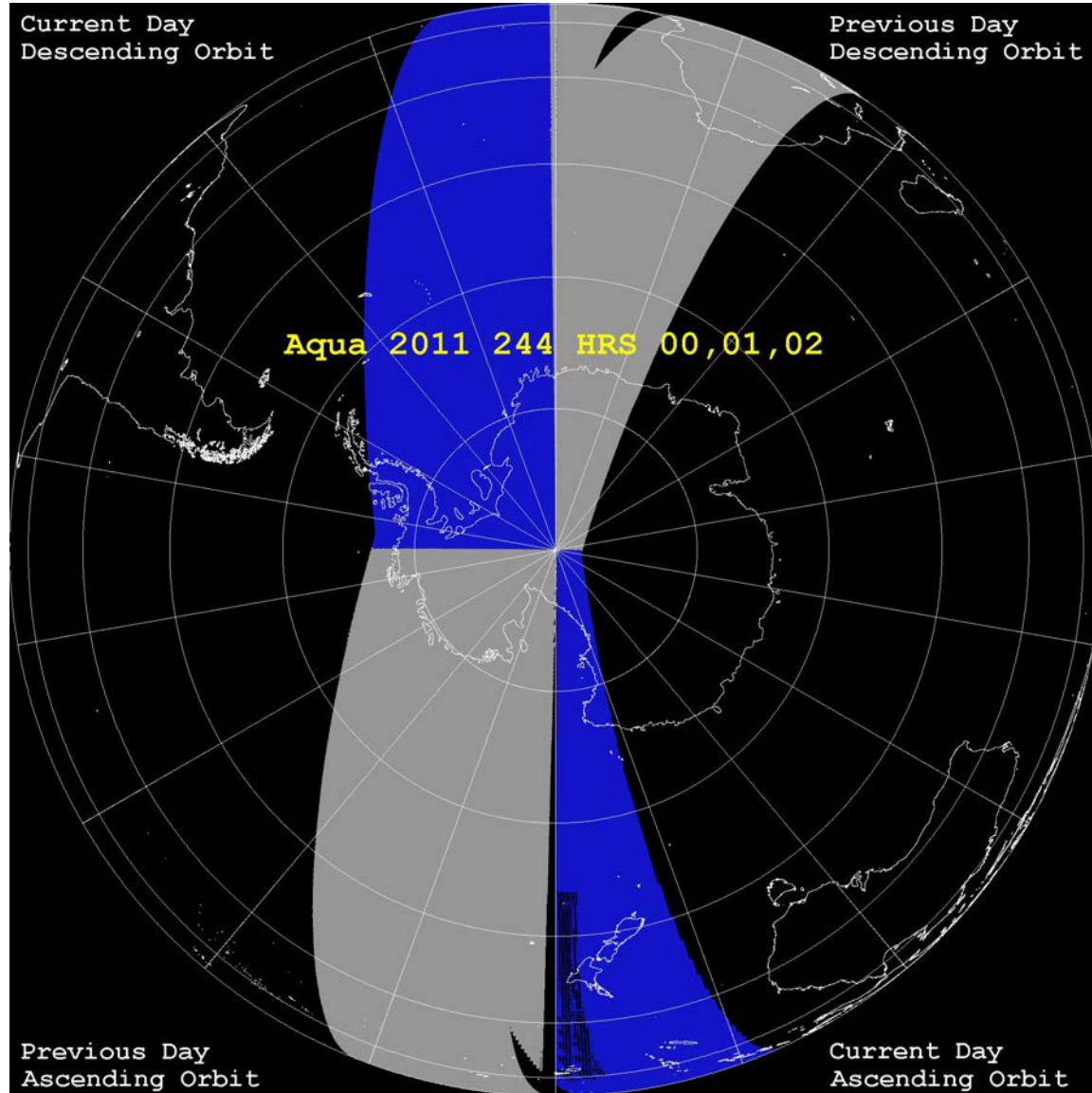
<b>Mission</b>	<b>Day</b>	<b>Granule GMT</b>	<b>Pixel Longitude</b>	<b>Pixel Rule</b>
Aqua	Current	00:00 to 02:55	-180 to -90 and 0 to 90	Exclude
Aqua	Current	00:00 to 02:55	-90 to 0 and 90 to 180	Include
Aqua	Current	03:00 to 23:55	ALL	Include
Aqua	Next	00:00 to 02:55	-180 to -90 and 0 to 90	Include
Aqua	Next	00:00 to 02:55	-90 to 0 and 90 to 180	Exclude

**Terra: Process prior day GMT 21:00 through GMT 24:00 current day**

<b>Mission</b>	<b>Day</b>	<b>Granule GMT</b>	<b>Pixel Longitude</b>	<b>Pixel Rule</b>
Terra	Prior	21:00 to 23:55	-180 to -90 and 0 to 90	Exclude
Terra	Prior	21:00 to 23:55	-90 to 0 and 90 to 180	Include
Terra	Current	00:00 to 20:55	ALL	Include
Terra	Current	21:00 to 23:55	-180 to -90 and 0 to 90	Include
Terra	Current	21:00 to 23:55	-90 to 0 and 90 to 180	Exclude



# View from the South Pole



# What's the Result of a New Definition ?

- Eliminate daily data gaps (except coverage gaps between orbits)
- L2 measurements still contribute with same statistical weight
- Reduced mixing of End of Day with Beginning of Day
  - No data mixing at mid-latitudes (50S to 50N)
  - Consistency with AIRS and MISR at mid-latitudes
  - However, for polar winds, you still want to use L2 !
- Hopefully simple implementation in MODIS L3 processing
- To actually implement new definition
  - Note that we process 1000+ L2 files now to make a daily file
  - Need to process 27 hours to build each daily file
  - Need to define a pixel-level mask for transition orbits (6 hours)