Hourly GEO clouds for TISA

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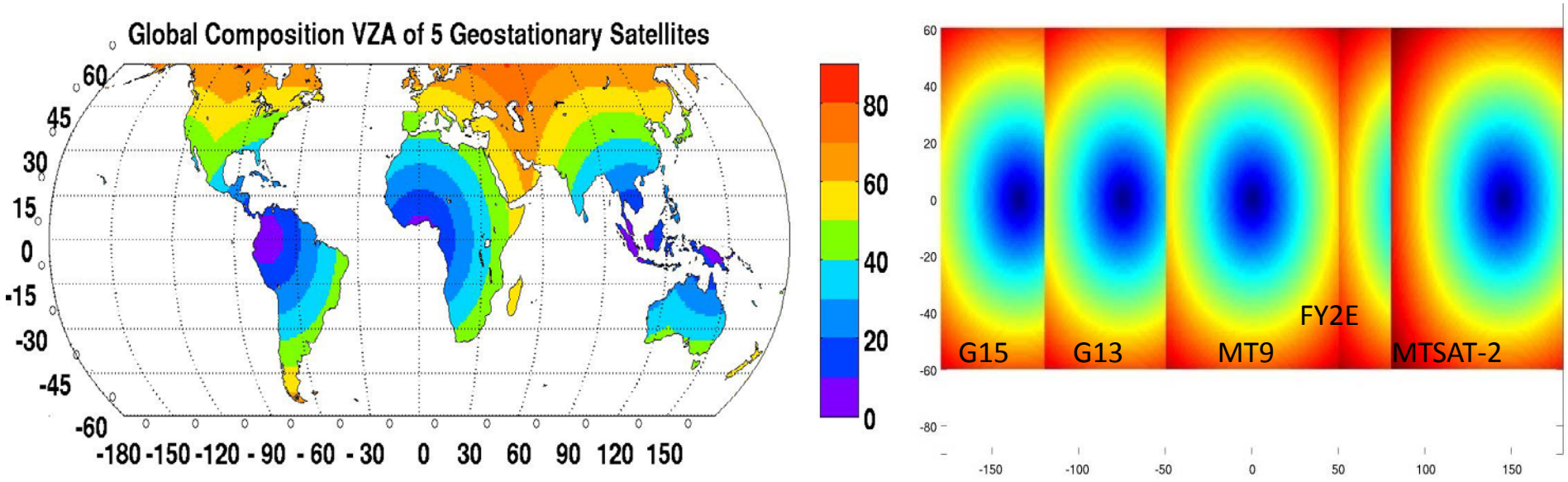
CERES STM , 1-3 May , 2012, Newport News, VA

Introduction

- Available geostationary satellites provide up to 1-hour global monitoring between ~60°S and ~60°N.



- The CERES cloud retrieval algorithm (VISST/SIST) from MODIS adapted for the geostationary satellite data processing
  - The modular frame-work allows individual researchers/team-members to plug & play. e.g. mask, multi-layer, background / clear-sky, terminator, retrievals, etc.
  - Used as a test bed for MODIS offline processing and debugging – CERES
  - Easy adaptability to meet different applications– contrail studies, field experiments etc.

Current Status

- Retrieving Global GEO Cloud Properties
  - GOES-15, GOES-13, MET-9, FY2E, and MTSAT-2R
  - 1-hourly at 8-10 km resolution
  - Using GFS Soundings (supports MERRA data)

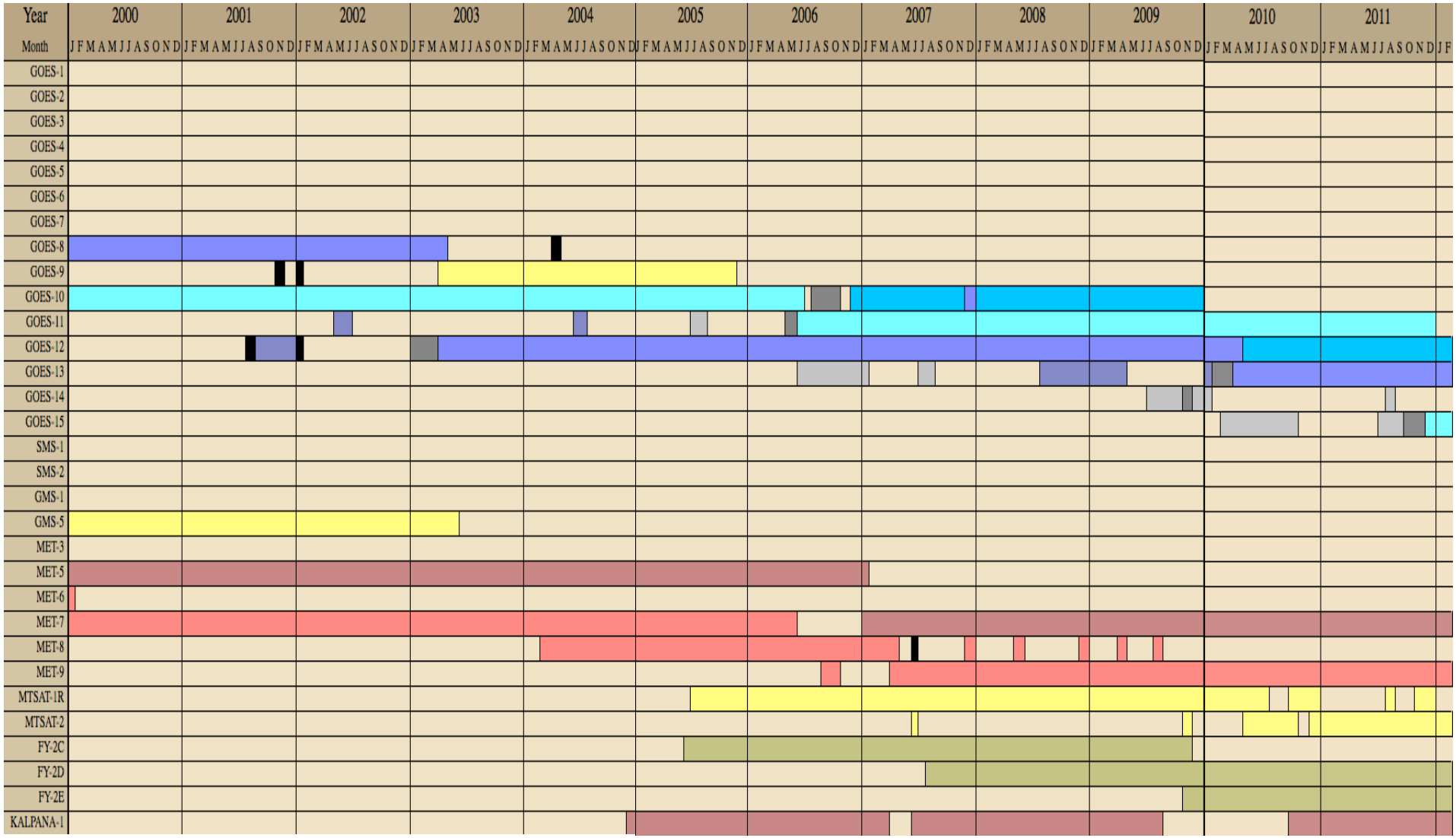
Calibration

To apply same algorithm across different geo-satellites, with varying response function, normalize all imagers to 1 or 2 "well-calibrated" reference POES imagers **– need redundancy!** *Minnis et al., JTech, 2002, 2008*

- Aqua MODIS calibration standard

• Satellite Calibration Provided by Dave Doelling's Calibration Group
Doelling et al., LGRS, 2012

Global Satellite Coverage 2000 - 2012

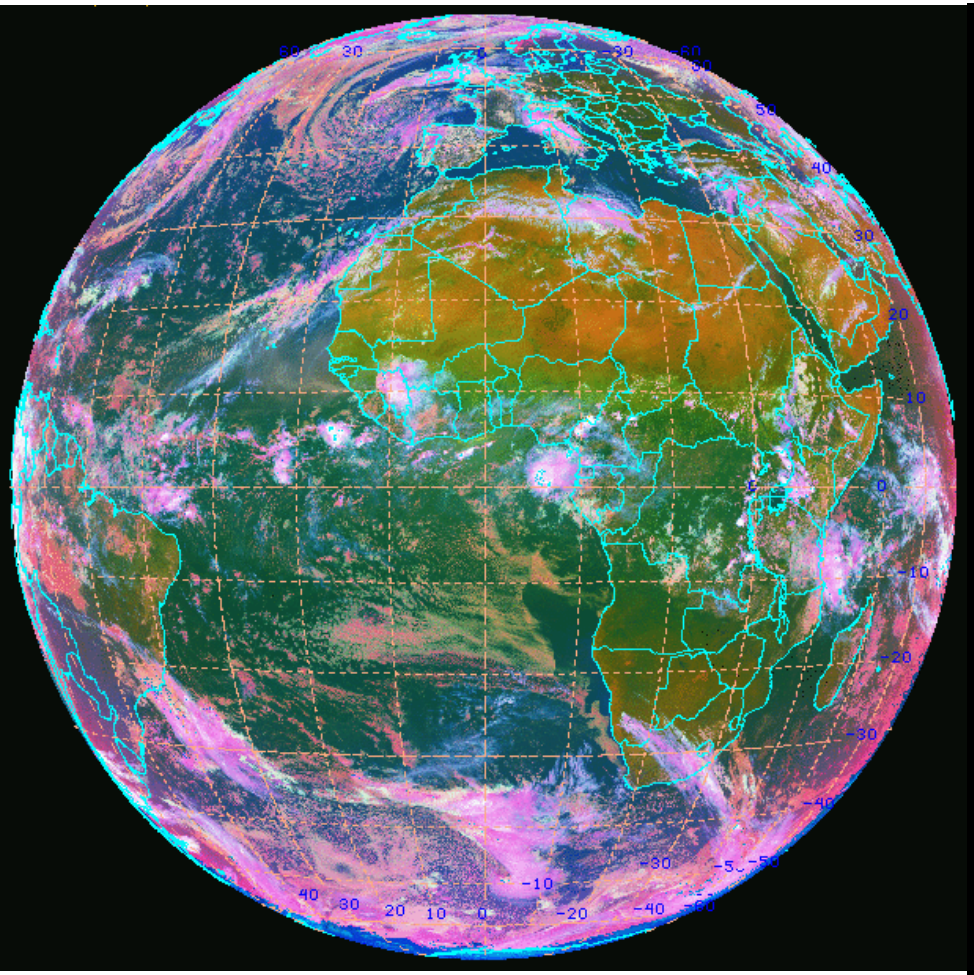


GEO Satellite Channels (μm)

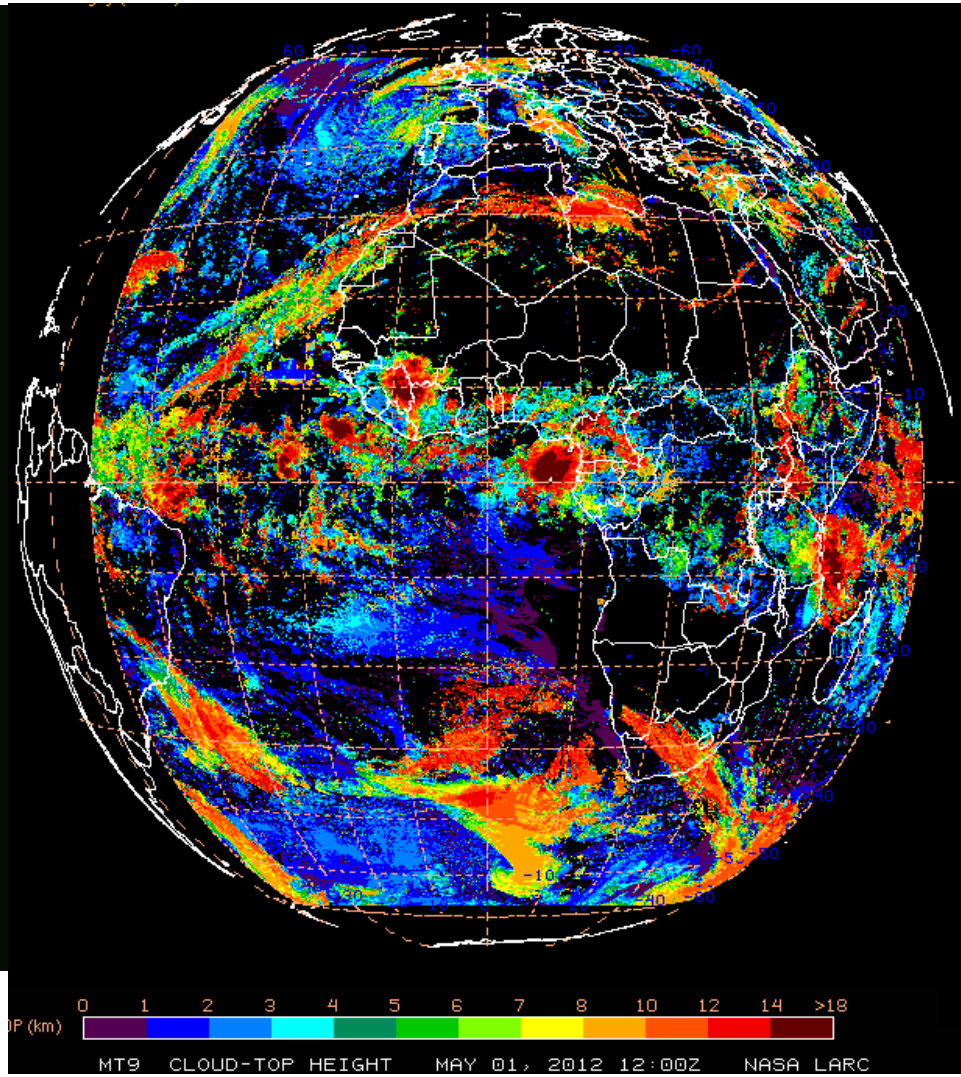
Satellite	VIS .6-.75	NIR 1.6	SIR 3.7-3.9	WV 6.2-6.9	Phase 8.7	IR 10.7-11, 11.5	SW 12	CO2 13.3-13.4
GOES 8-11	X		X	X		X	X	
GOES 12-15	X		X	X		X		X
MET 5,7	X			X		X		
MET 8,9	X	X	X	X	X	X	X	X
GMS 5	X			X		X	X	
MTSAT 1,2	X		X	X		X	X	
FY2 C-E	X		X	X		X	X	
Kalpana-1	X			X		X		

Meteosat-9 Processing, 1200 UTC, 1 May 2012

RGB



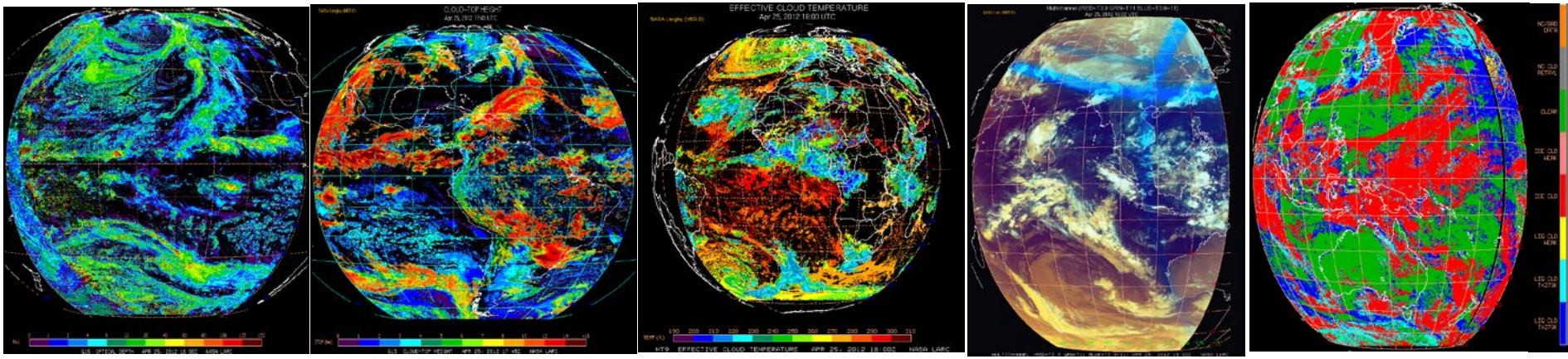
Cloud top Height (km)

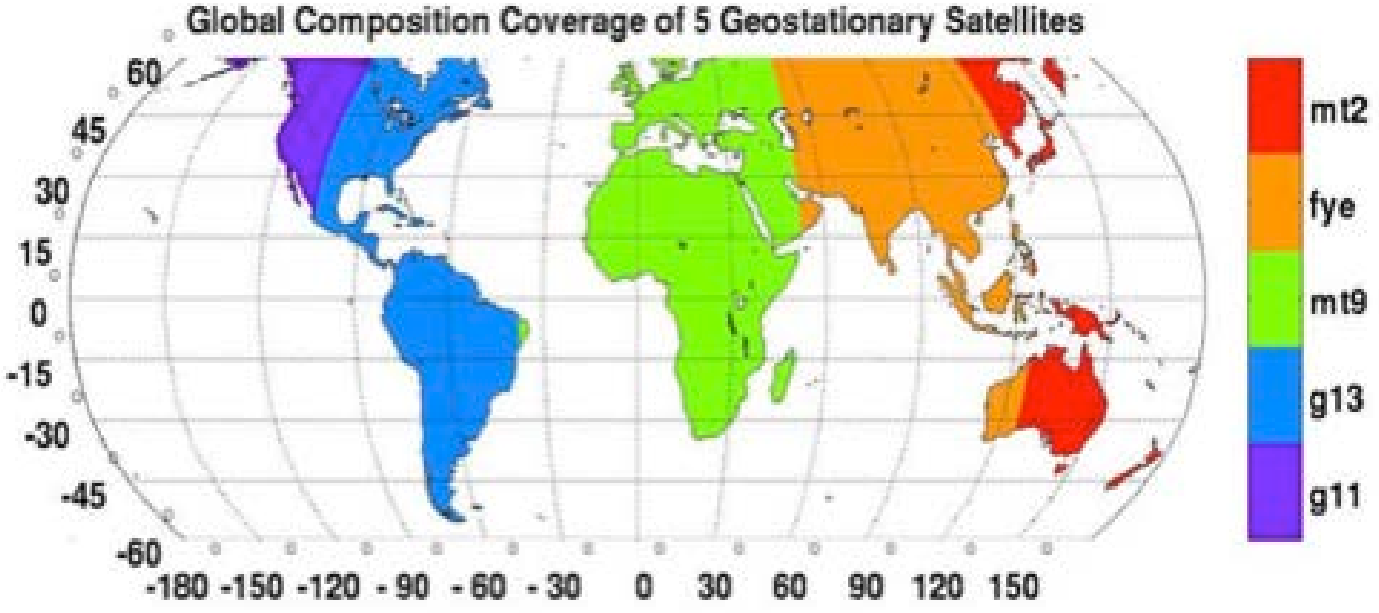


- Processing stops at 60° latitude and ± 50° longitude

GLOBAL GEOSTATIONARY CLOUD PRODUCTS
18 UTC, 25 April 2012

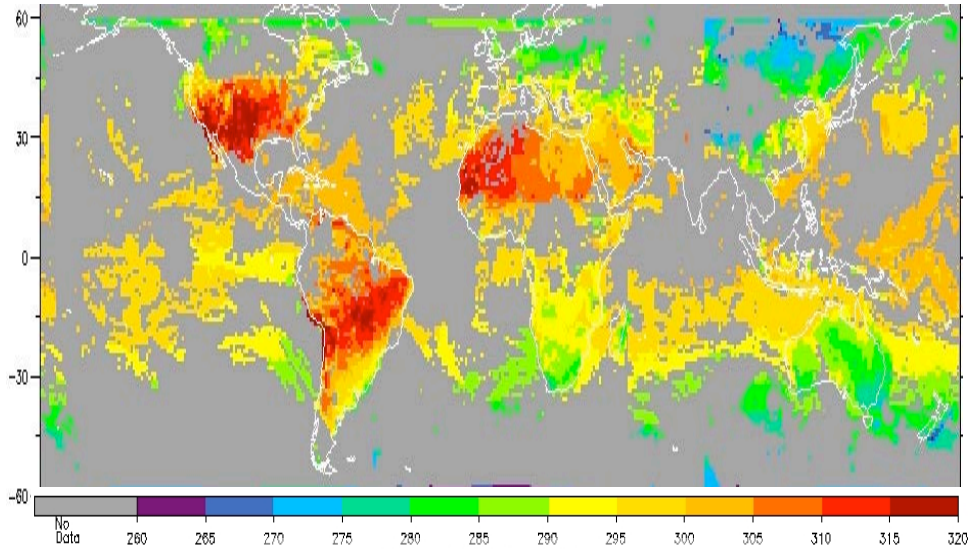
G15-TAU G13-ZTOP MET9-CTEMP FY2E - RGB MTSAT- PHASE



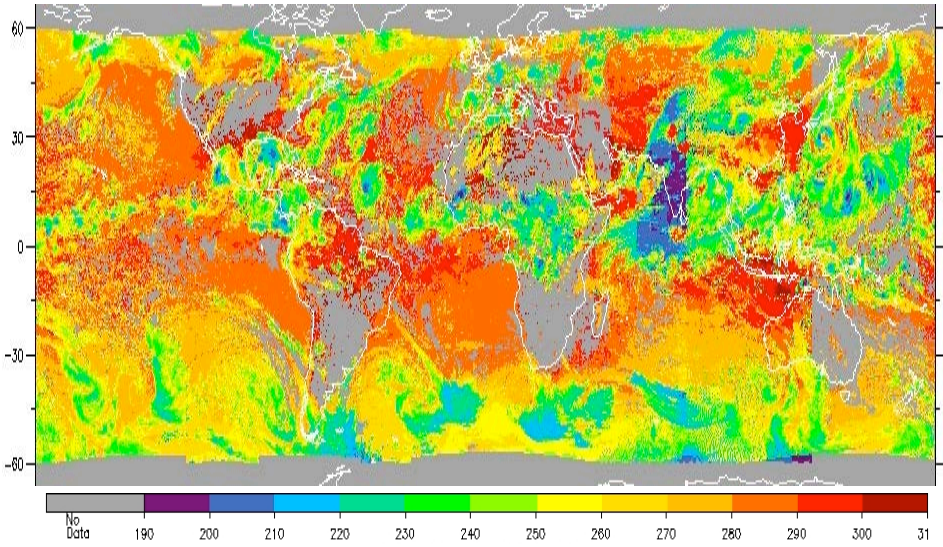


Merged GLOBAL GEO products 18 UTC, 1 September 2011

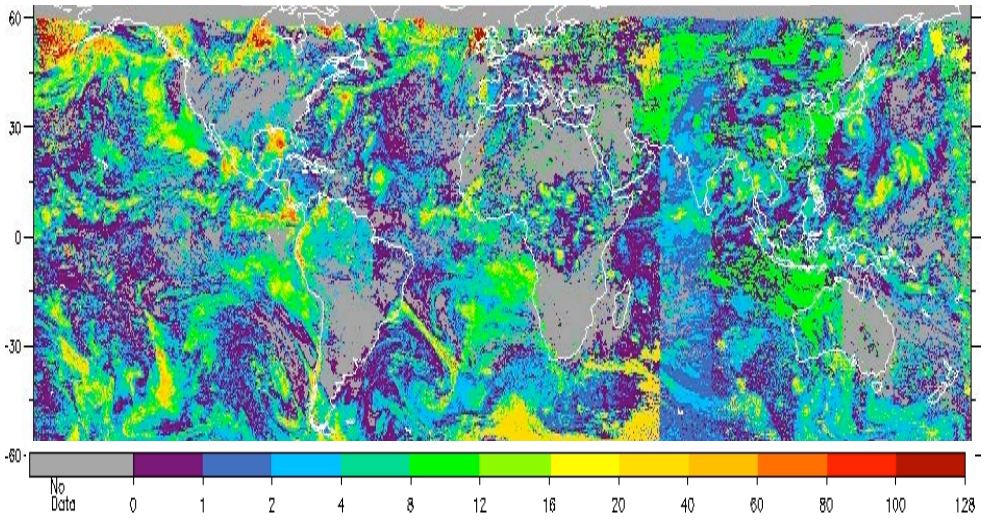
CLEAR AREA SKIN TEMPERATURE



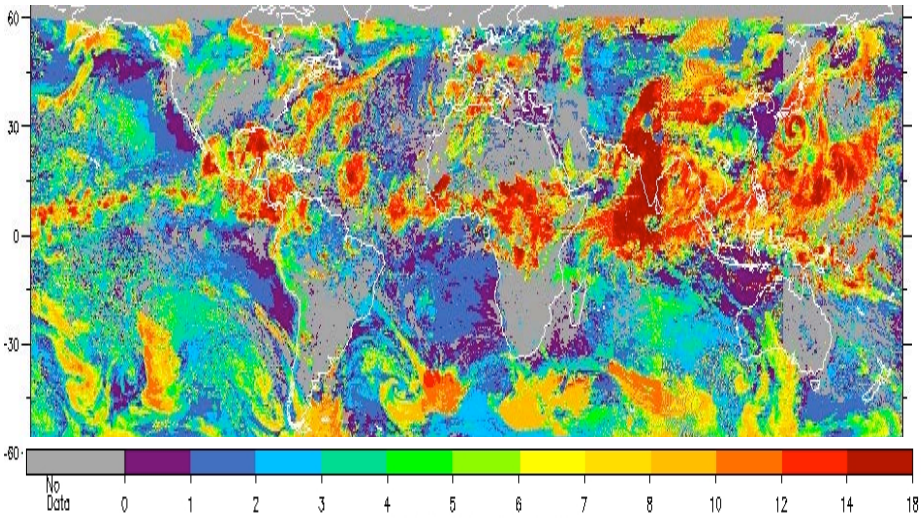
CLOUD TEMPERATURE



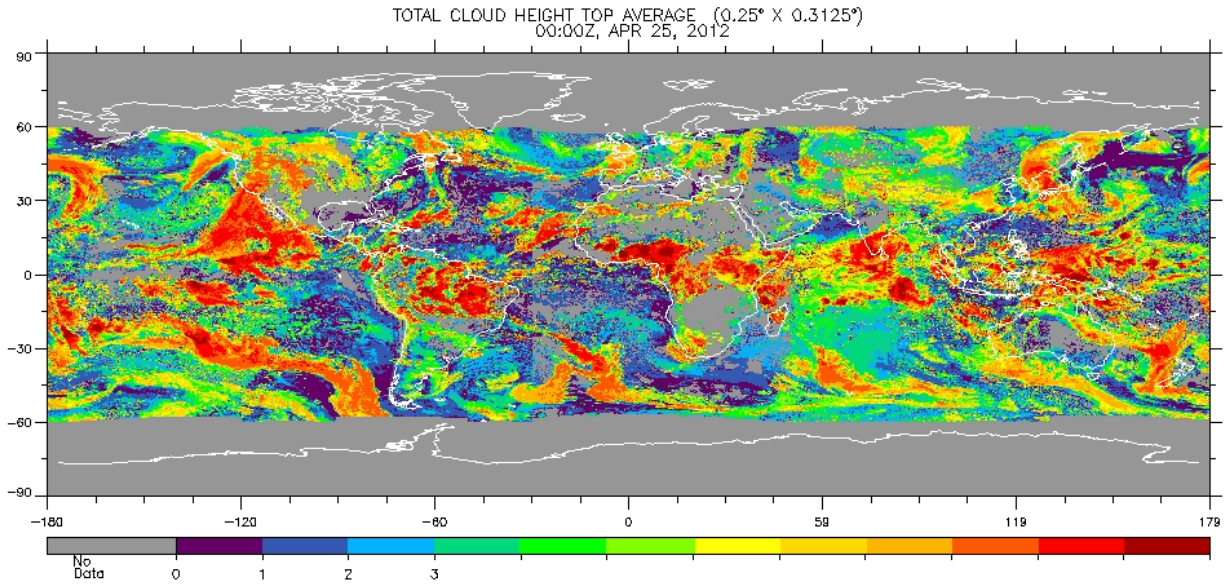
OPTICAL DEPTH



CLOUD TOP HEIGHT

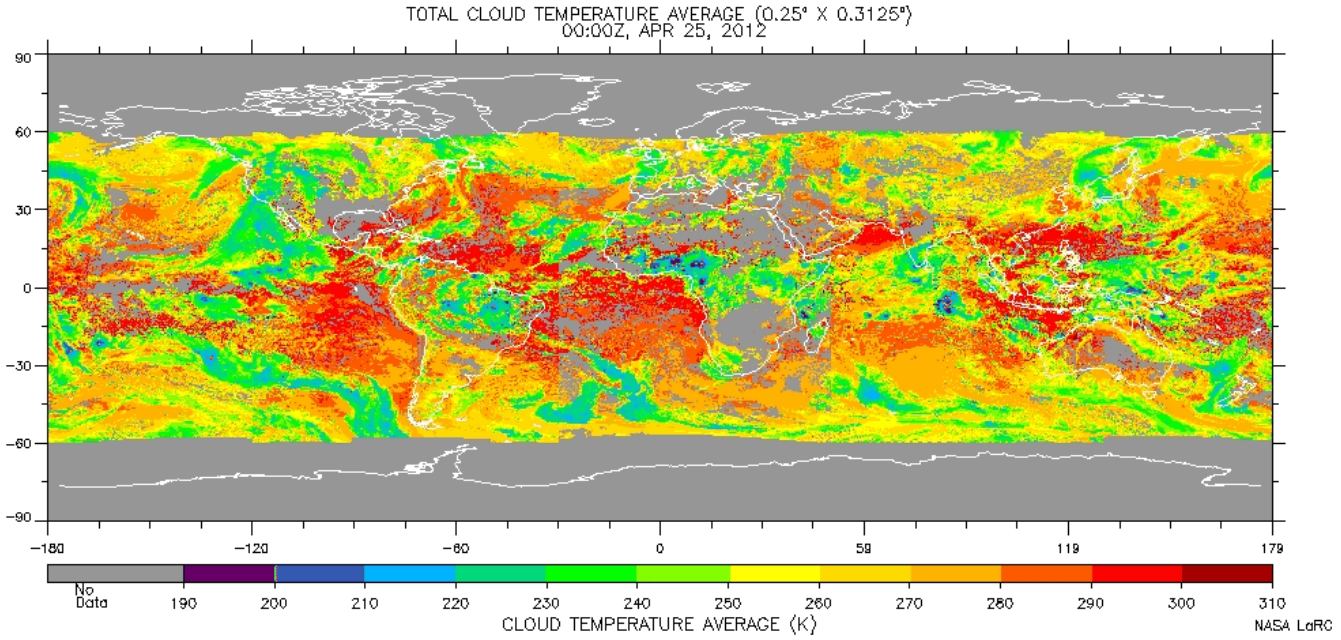


HOURLY MERGED PRODUCTS, 25 April, 2012

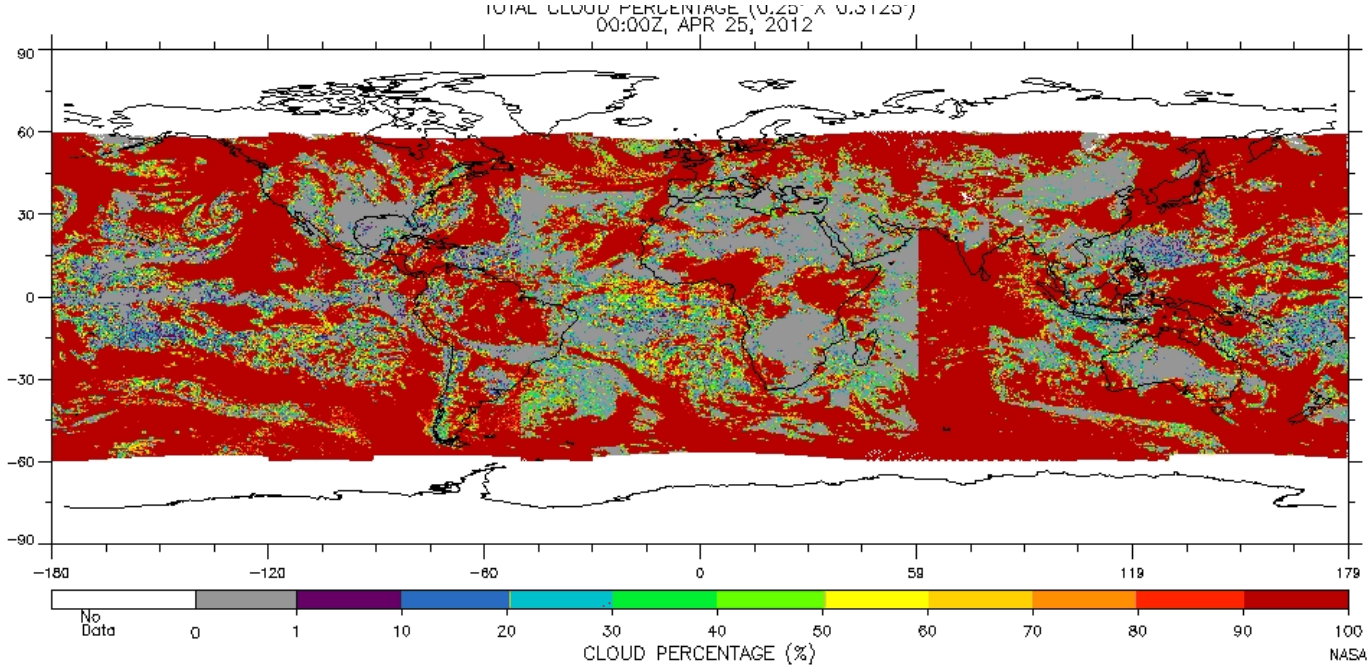


TOTAL
CLOUD HEIGHT

CLOUD
TEMPERATURE

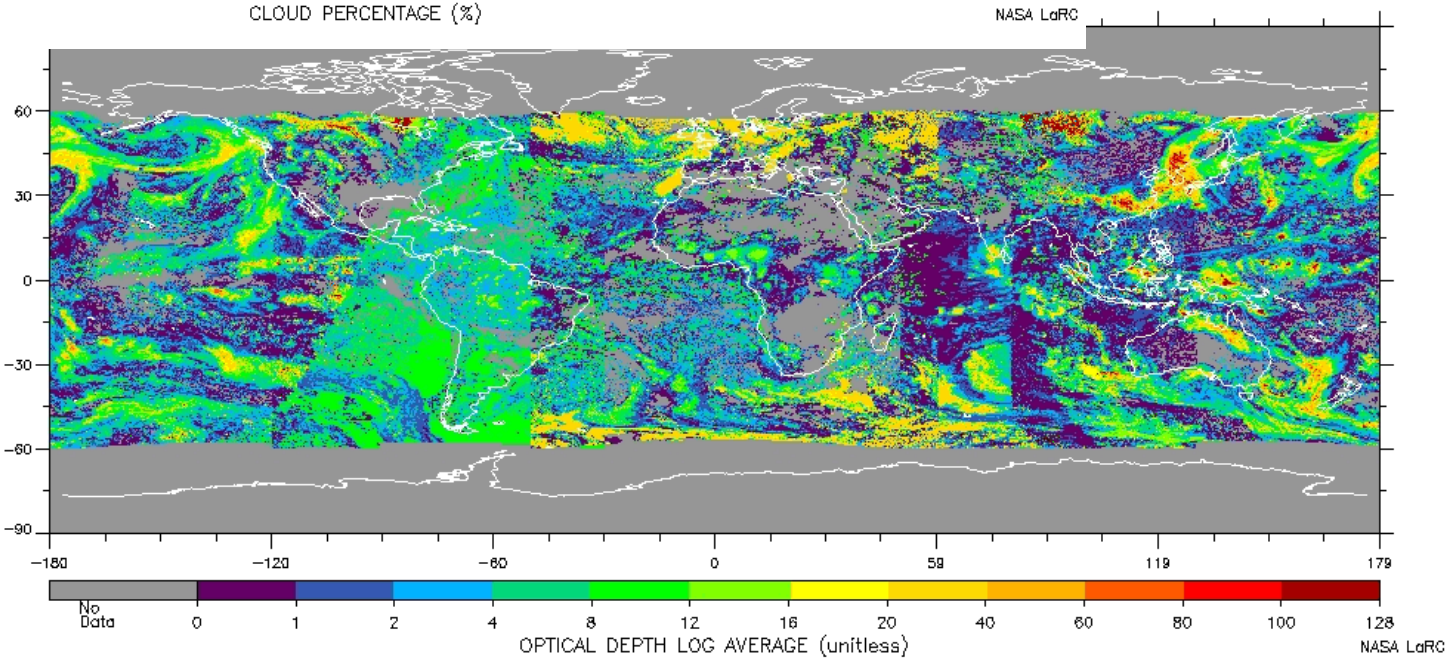


HOURLY MERGED PRODUCTS, 25 April, 2012



CLOUD AMOUNT

OPTICAL DEPTH



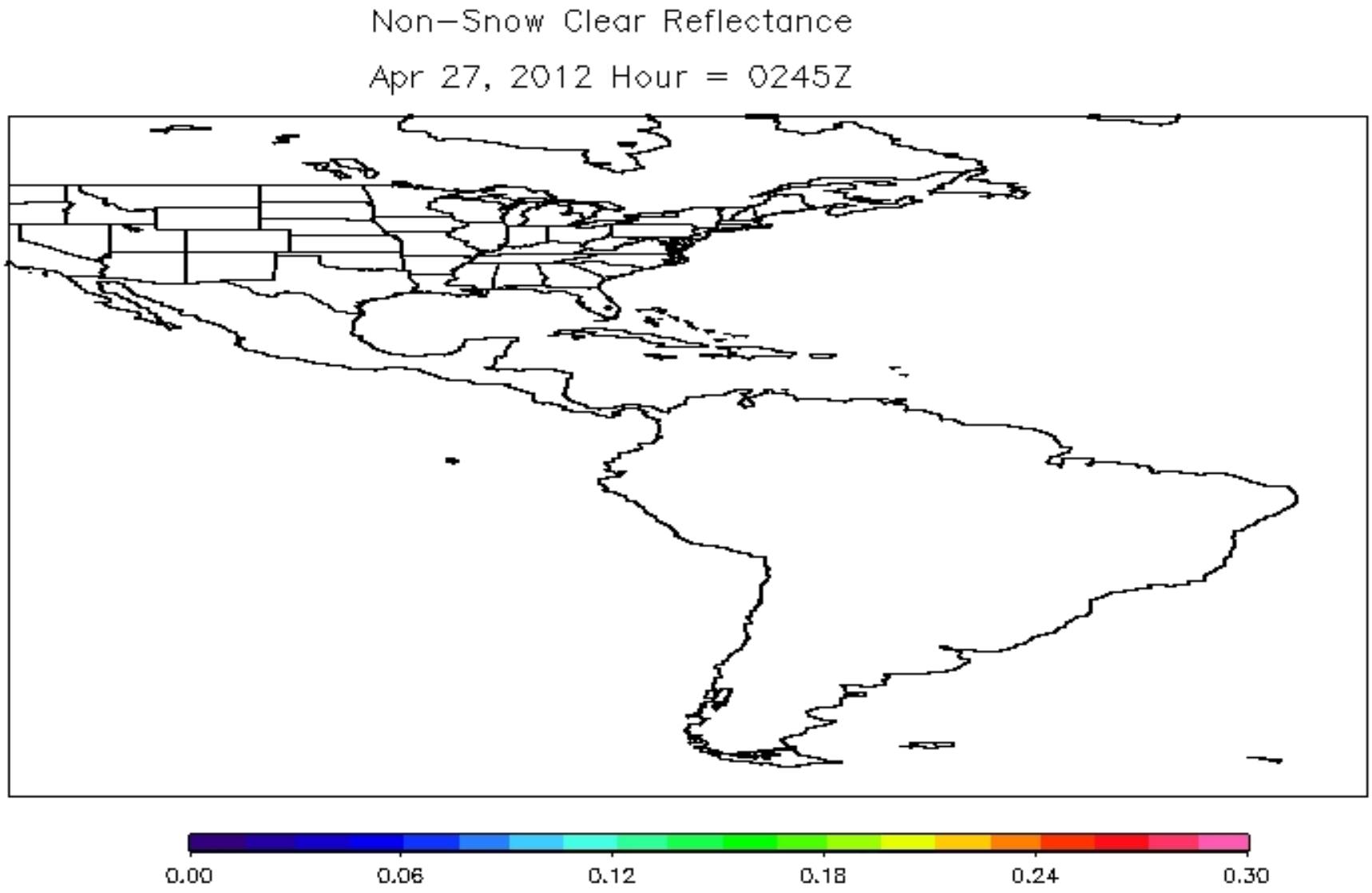
Improvements to the Retrieval Algorithm

Clear-sky Reflectance Dynamic Updating Scheme for GEO

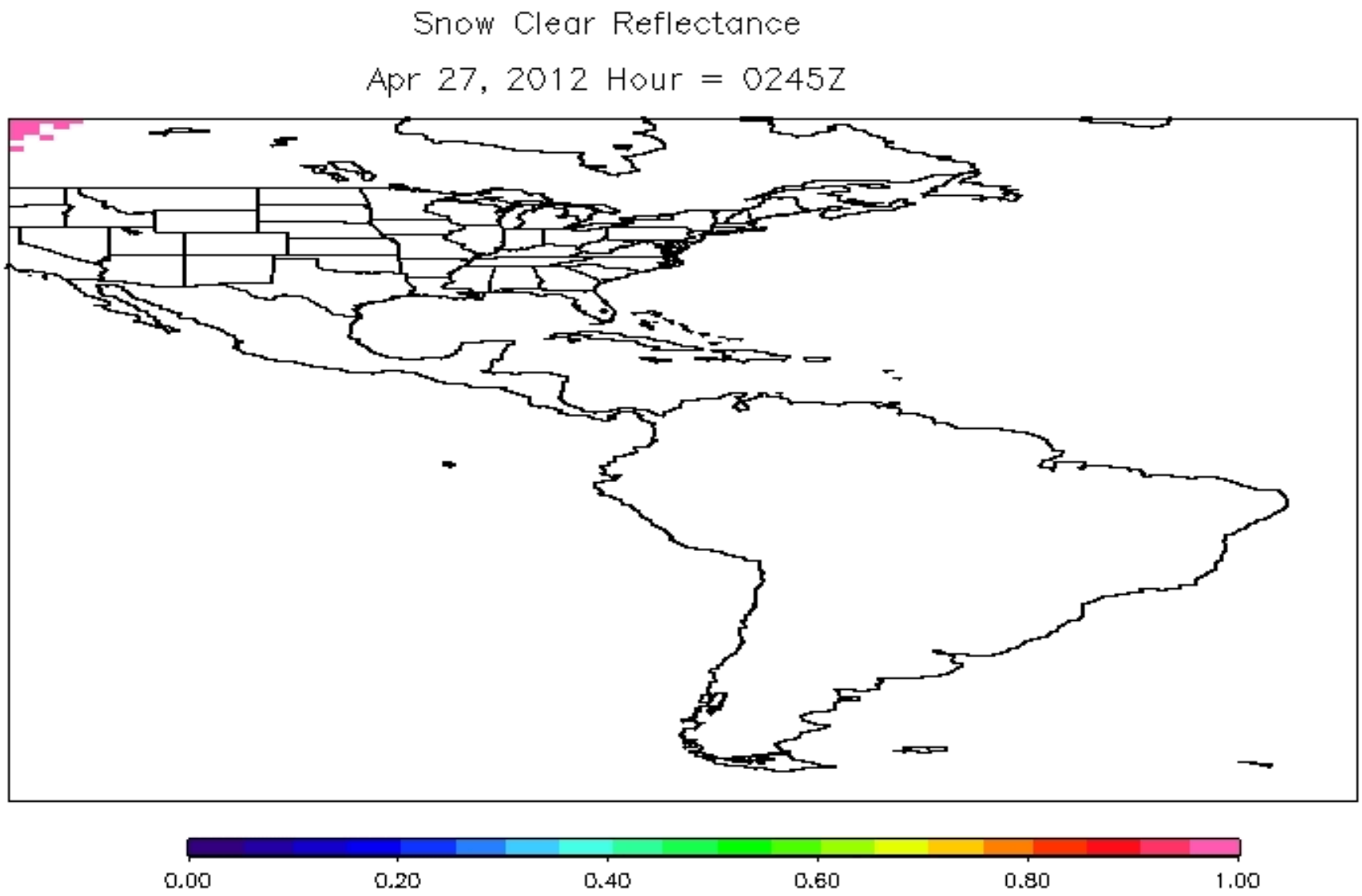
- Accurate and reliable start-up reflectance maps are essential for improved retrievals
  - Initial map produced by processing a month of data up to current day. Calculate monthly mean snow & non-snow (mm_sn & mm_nsn) clear-reflectance maps for each time slot using the cloud mask
  - Use daily snow map to filter snow and non-snow regions

- Updating Scheme
  - Using mm_sn & mm_nsn clear ref as the start-up, reprocess day 1 time-slot n
  - Based on cloud-mask results, calculate instantaneous clr-map for slot n using 20% clear filter in a region (1 ° grid box). If the calculated clr-ref differs from the monthly maps by a threshold (variable) update mm_sn & mm_nsn
    - Snow = 5% (coast 10%), Non-snow= 5% (coast 15%)
  - Run day 2 with the updated map. Update the mm_sn & mm_nsn and process day 3 and so forth until current day
  - Currently the update scheme is running every 3 hours for GOES-EAST full disk.

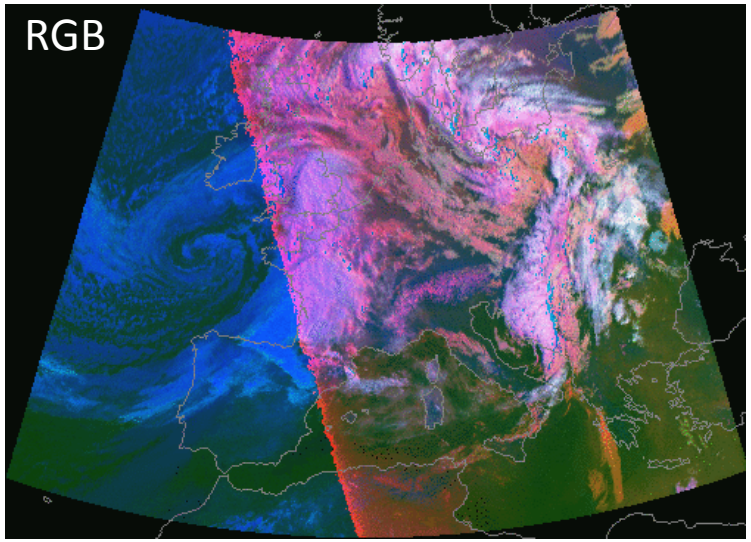
GOES-EAST dynamic CLR-SKY REF (non-snow), 27-29 April, 2012

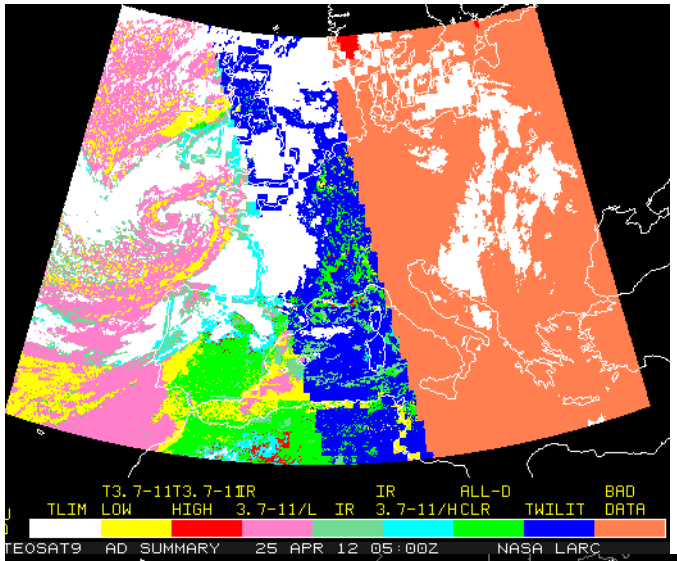


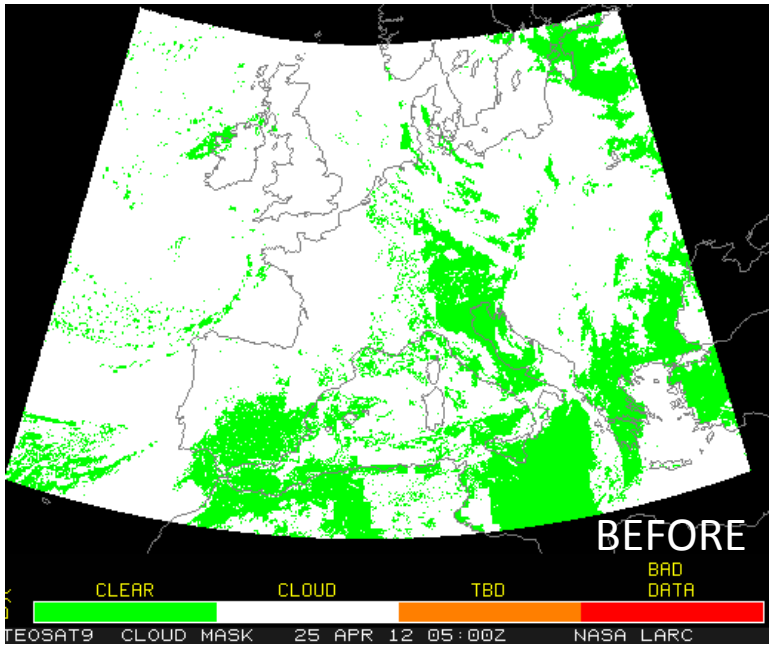
GOES-EAST dynamic CLR-SKY REF (snow), 27-29 April, 2012

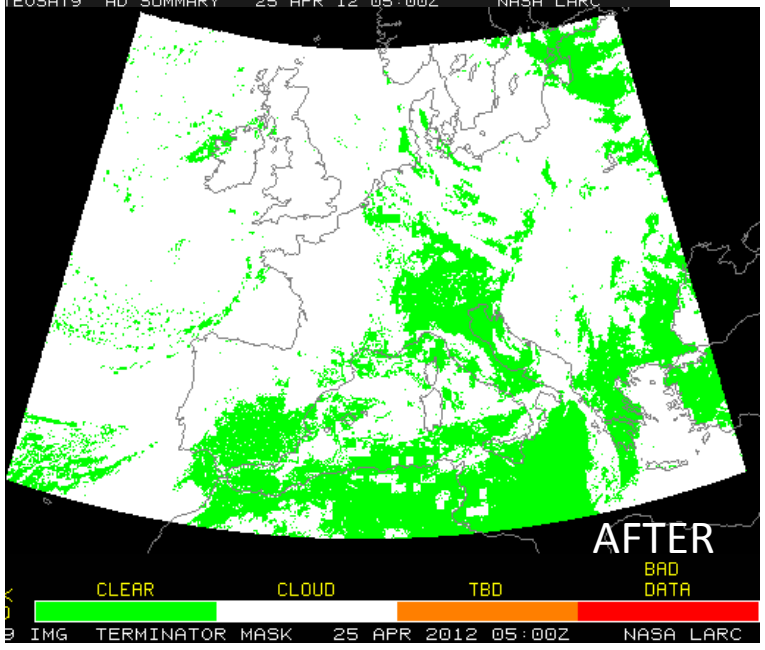


Improvements to the cloud mask across the TERMINATOR region.
5 UTC, 25 April, 2012 MSG.





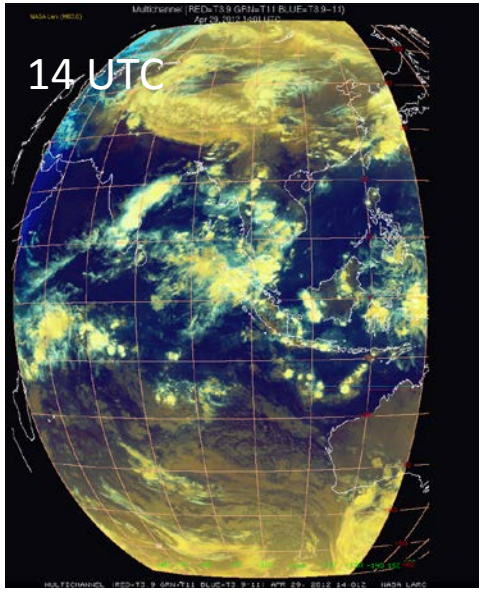


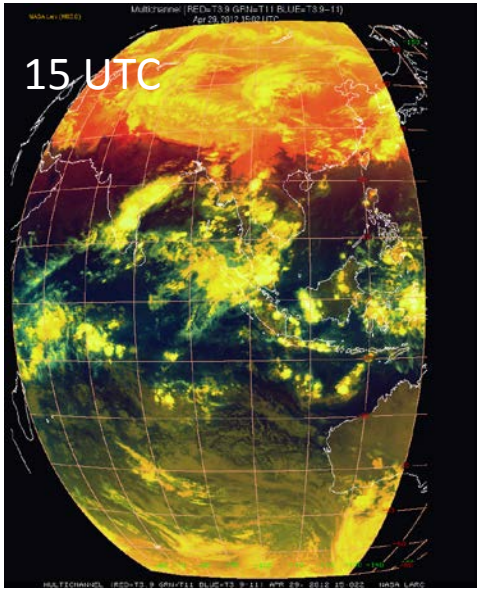


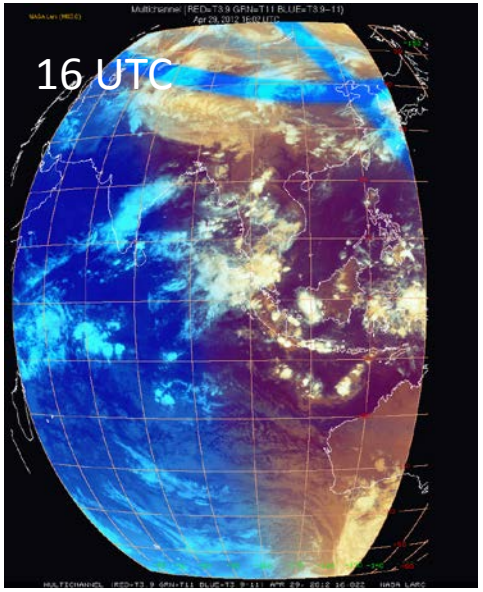
See presentation by Chris Yost in the CLOUDS working group for more information

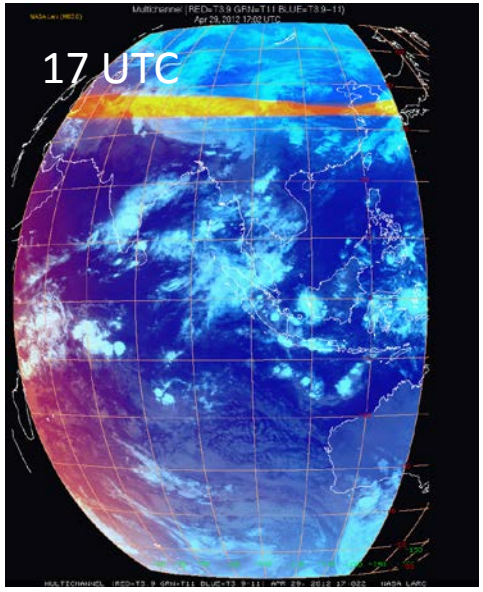
SATELLITE COVERAGE ISSUES

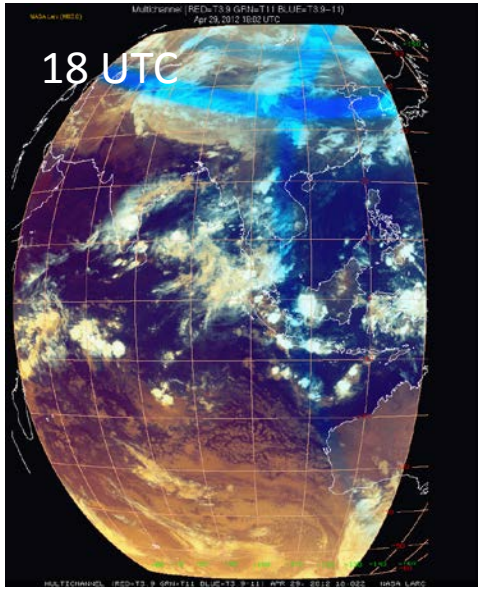
The FENG-YUNG series has bad 3.8 µm data between 15 – 18 UTC

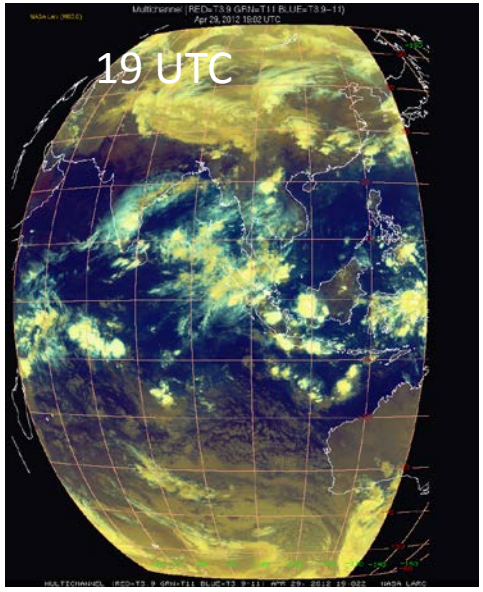




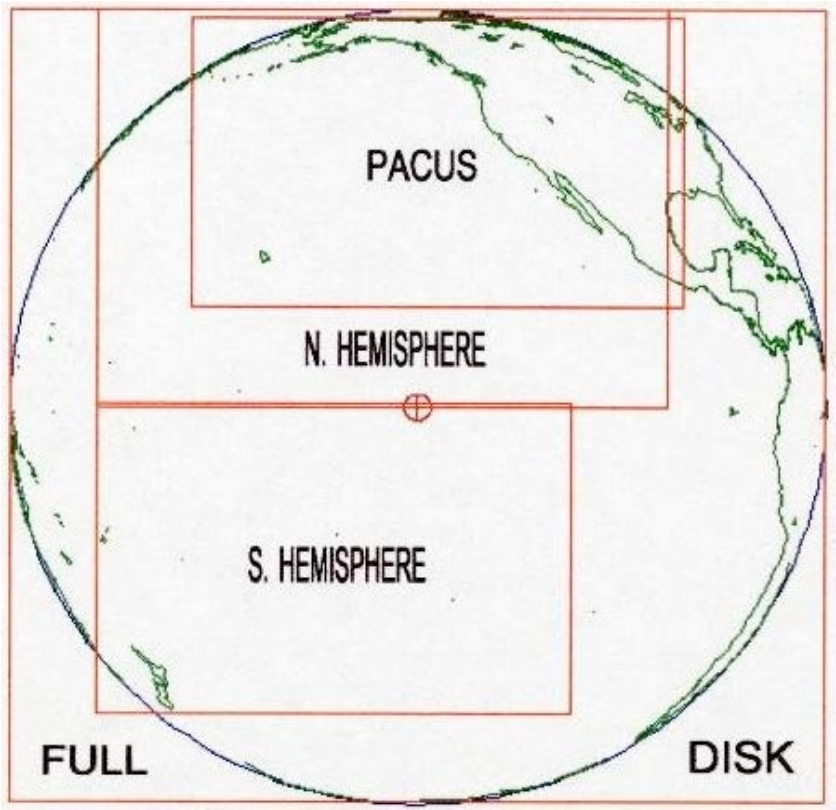


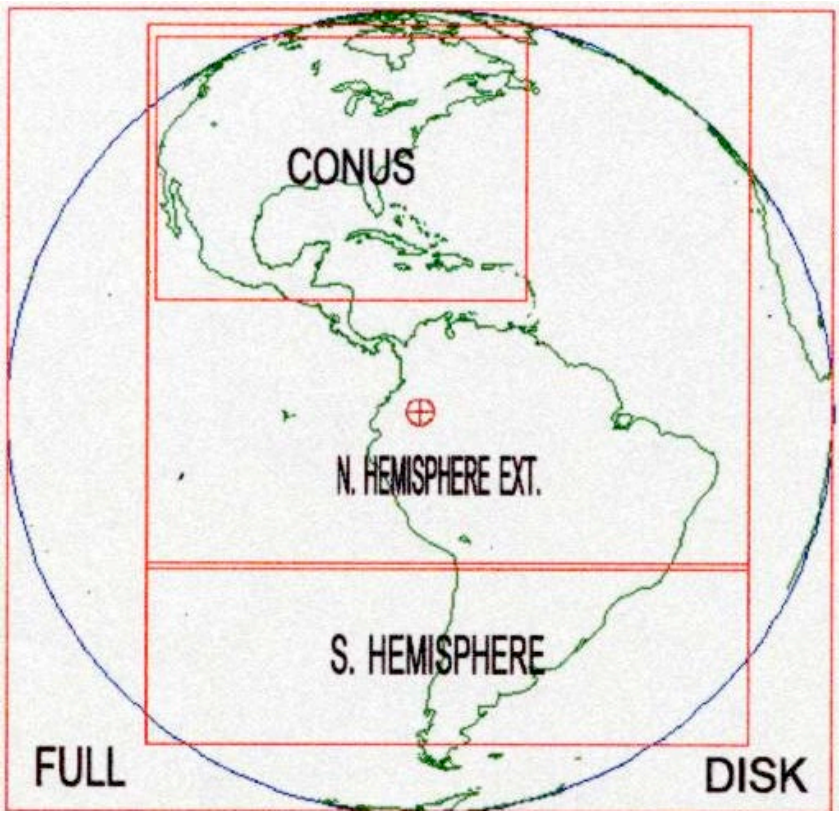






GOES WEST & EAST Imager Routine Scanning Strategy

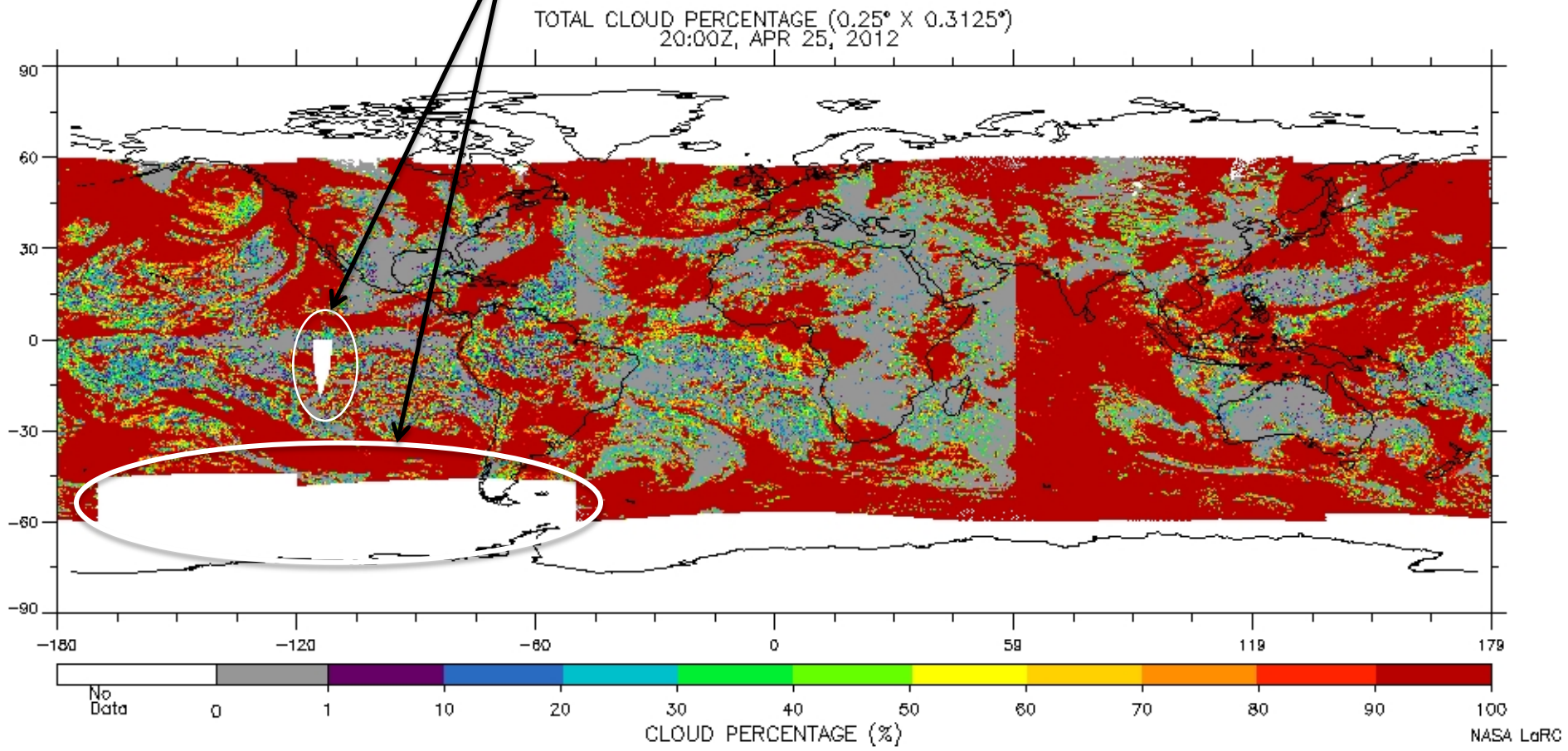




The 3-hr full disk scan covers the full region

The NH and SH scans are merged for other hours

The merged NH /SH scans from GOES-WEST and GOES-EAST have gaps in global coverage



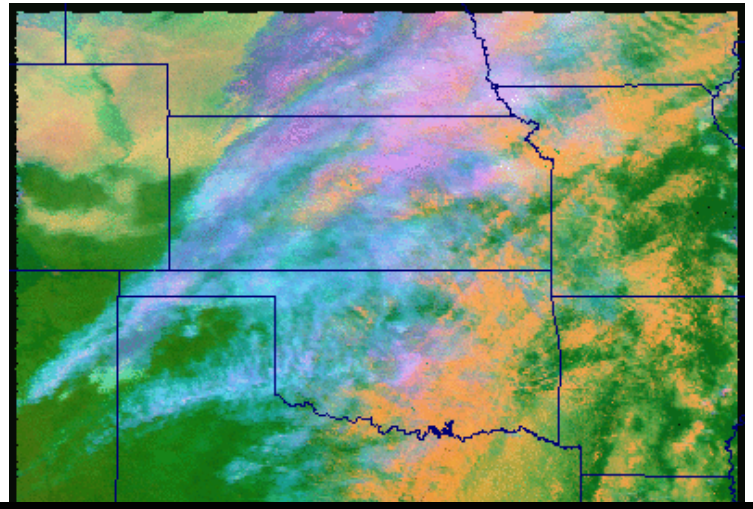
Total Cloud Amount, 20:00 UTC, 25 April, 2012

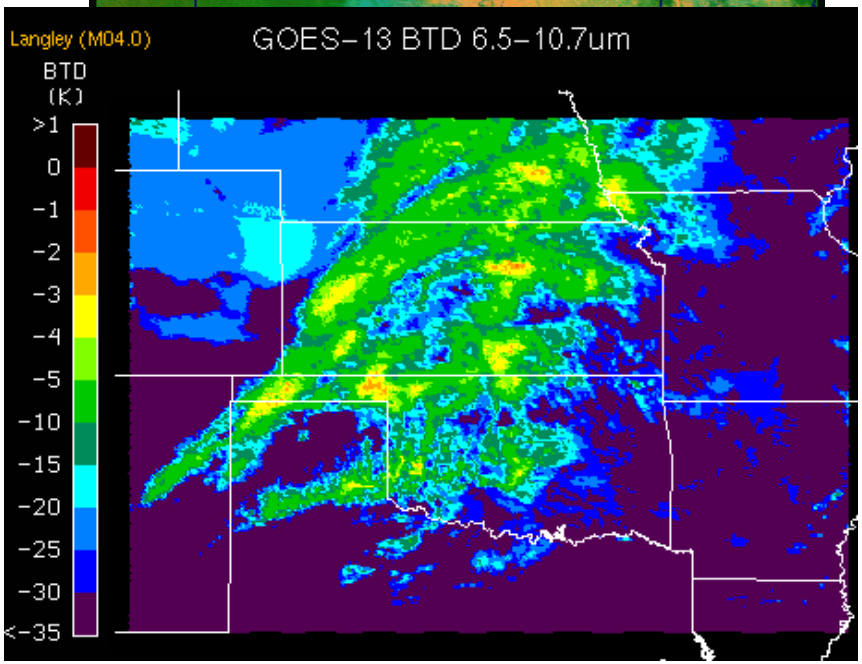
Year	Satellites				
2000	GOES-10	GOES-8	MET-7	MET-5	GMS-5
2001	GOES-10	GOES-8	MET-7	MET-5	GMS-5
2002	GOES-10	GOES-8	MET-7	MET-5	GMS-5
2003	GOES-10	GOES-8/12	MET-7	MET-5	GMS-5/GOES-9
2004	GOES-10	GOES-12	MET-7/8	MET-5	GOES-9
2005	GOES-10	GOES-12	MET-8	MET-5/FY	GOES-9/MTSAT-1R
2006	GOES-10/11	GOES-12	MET-8	FENG-YUN	MTSAT-1R
2007	GOES-11	GOES-12	MET-8/9	FENG-YUN	MTSAT-1R
2008	GOES-11	GOES-12	MET-9	FENG-YUN	MTSAT-1R
2009	GOES-11	GOES-12	MET-9	FENG-YUN	MTSAT-1R
2010	GOES-11	GOES-12/13	MET-9	FENG-YUN	MTSAT-1R/2R
2011	GOES-11/15	GOES-13	MET-9	FENG-YUN	MTSAT-2R

Only VIS and IR channel available on these satellites.

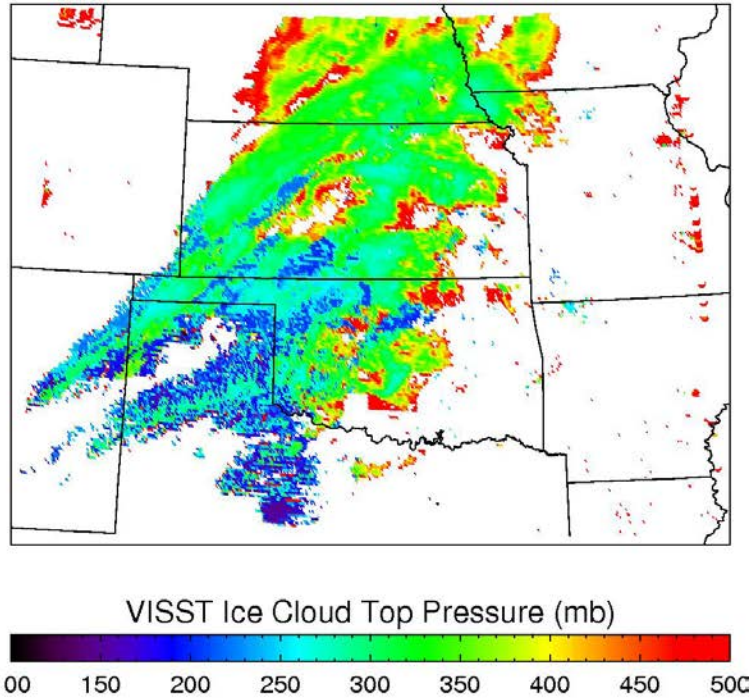
• Use a WV-IR Technique (WIT) to detect thin cirrus at night to give more accurate cloud heights?

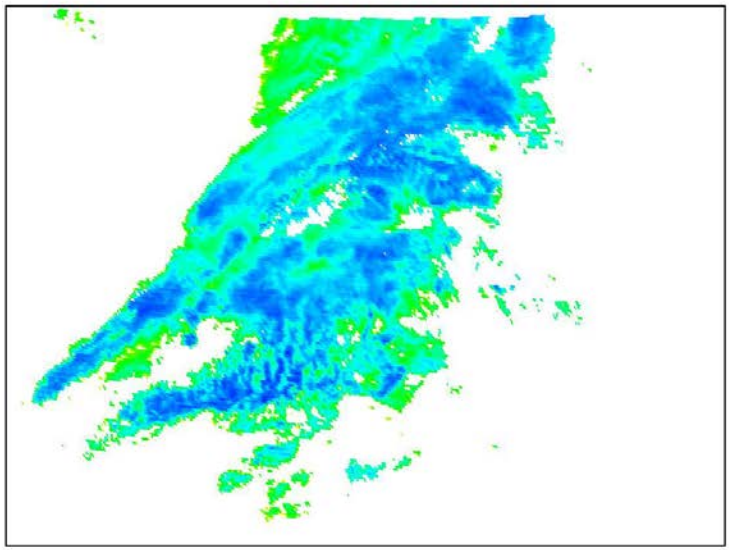
Example of the WIT applied to GOES-13
1645 UTC, 7 March 2012





Retrievals yield cloud-top pressures less than VISST, consistent with CO2 method



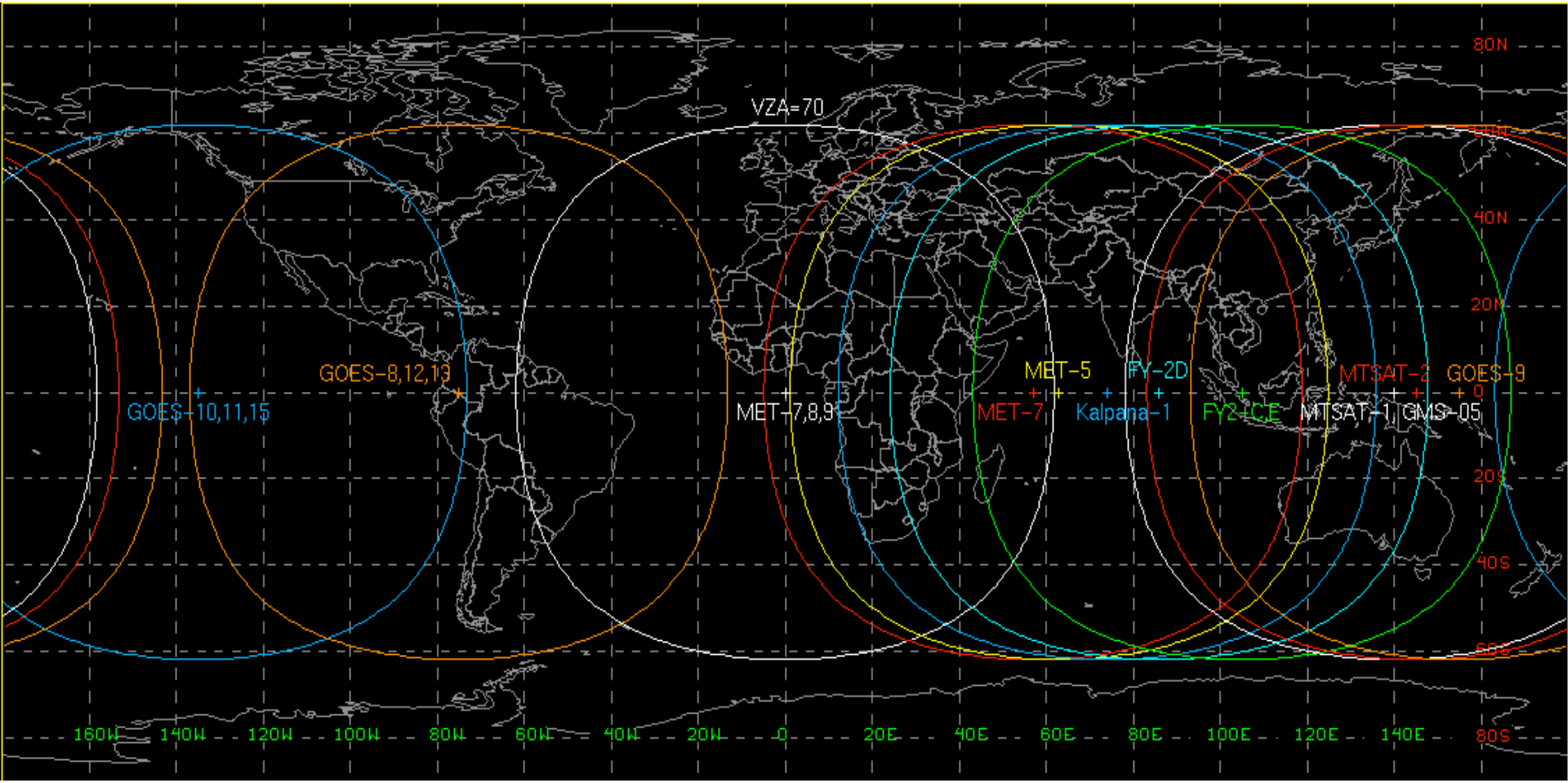


Future Work

- Update GEO Retrieval Code with Applicable CERES Ed-4 Algorithm Enhancements
- Provide the TISA Group with a month of GEO Global Cloud Retrievals to Identify Issues with Output Parameters, Formats, etc. (June, 2012)
- Implement Satellite Specific Correlated-k for All Satellites. GOES and MTSAT are Available Now.
- Update the GEO Retrieval Code to Utilize MOA Soundings (currently works with GFS & MERRA) to be Consistent with CERES. (September, 2012)
- Implement the Dynamic Clear-Sky Reflectance Updating Scheme for all GEO satellites. (July, 2012)
- Obtain Latest Calibration Information from the Calibration Group, and Process a Year of Data (November - December, 2012)
- Minimize Use of Defaults at Night
  - *test theoretical optical depth limits for various emission channels*
- Utilize 6.7 µm Approach When Only VIS/IR Channels are Available

Extra Slides

GEO Satellite coverage, 2000-2011



Task Distribution

- Dynamic Clear Sky Updating
  - Michele Nordeen, Rabi Palikonda
- Cloud Property Retrievals at the Terminator
  - Chris Yost
- Data Ingest/Georeferencing/Automated Data Quality Checks
  - Doug Spangenberg, Konstantin Khlopenkov
- WIT & VISST over snow Algorithm Development and Testing
  - Gang Hong
- Cloud Masking
  - Qing Trepte
- Narrowband2Broadband Conversion Coefficients
  - Mandy Khaiyer
- Cloud Retrieval Code
  - Pat Heck, Sunny Sun-Mack, Rabi Palikonda
- Cloud Thickness Parameterization/Validation
  - Helen Yi
- Code Integration and Management
  - Rabi Palikonda
- Satellite Specific Corr-K Updates
  - Doug Spangenberg
- Data Processing/Validation/Archival
  - By Committee