

Retrieving Cloud Properties and TOA Radiative Fluxes over Snow and Ice Surfaces During PIC3

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Objectives

- Support PIC3 flights, operations, and scientific goals
- Assess and improve satellite retrievals of Arctic cloud properties

Approach

- Provide time satellite imagery and analyses on web site
 - near-real time from GOES
 - 2-hour delay from MODIS, CALIPSO, AVHRR
 - several day delay from CERES & CloudSat
- Perform retrievals using various sets of channels on operational & research satellite imagers
 - Daytime, $SZA < 80^\circ$, use both emitted & reflected spectral radiances
 - Night: use only emitted spectral radiances: 3.8, 6.7, 7.1, 8.5, 11, 12, 13.3
- Compare retrievals with PIC3 aircraft & surface observations



Web Support

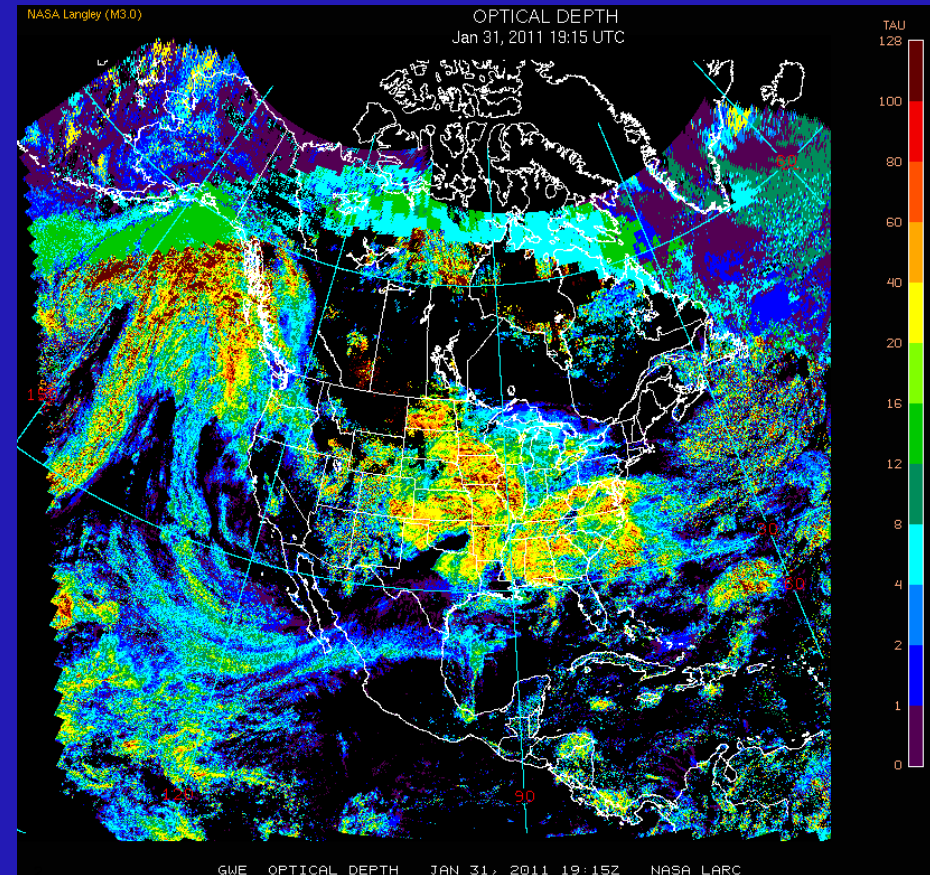
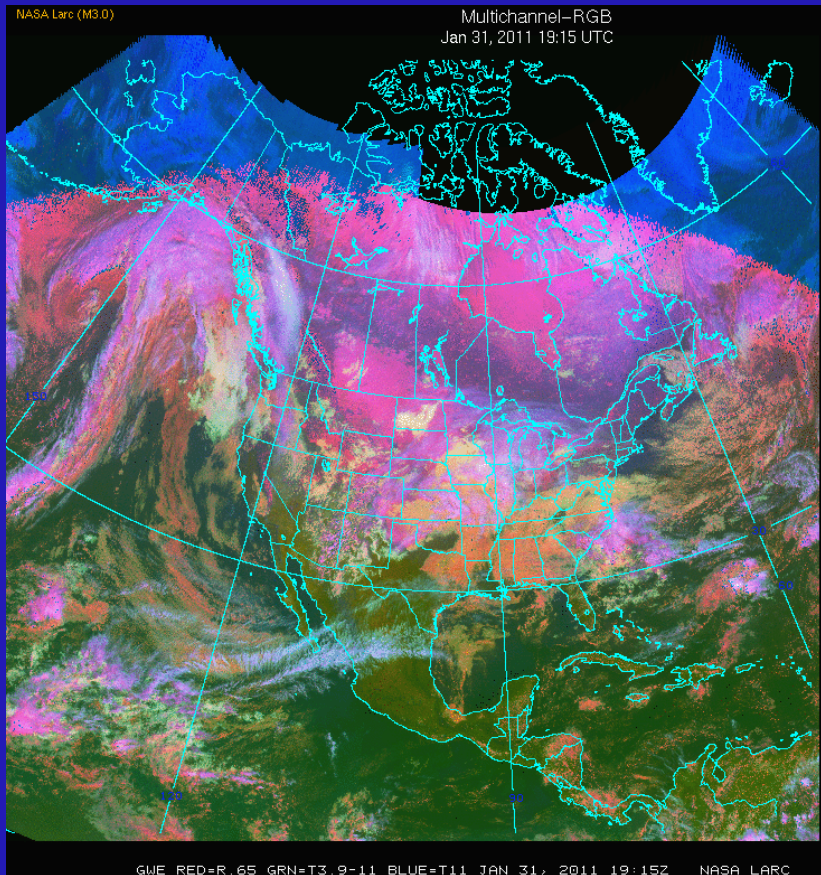
- Near-real time imagery & properties from GOES (every 15 – 30 min)
 - limited spectral information
 - flight mission planning & execution
- Aqua & Terra
 - MODIS 2 hours after overpass:
 - YK: 5 overpasses each/day
 - Jan: twilight/night
 - Mar: 2-3 day, 2-3 night
 - BW: 9 overpasses each/day
 - Jan: night
 - 4 day, 5 night
 - CERES several days, same sampling as MODIS
- CALIPSO/CloudSat & other satellite overpass predictor
 - flight planning for matching
- Flight track matching of radiances & products
 - plots & ASCII files of satellite results



GOES

- 24/7 analyses of North America: Barrow, VZA ~ 80°, Yknife, VZA ~ 75°
- tendency to overestimate COD over snow during daytime, night ??

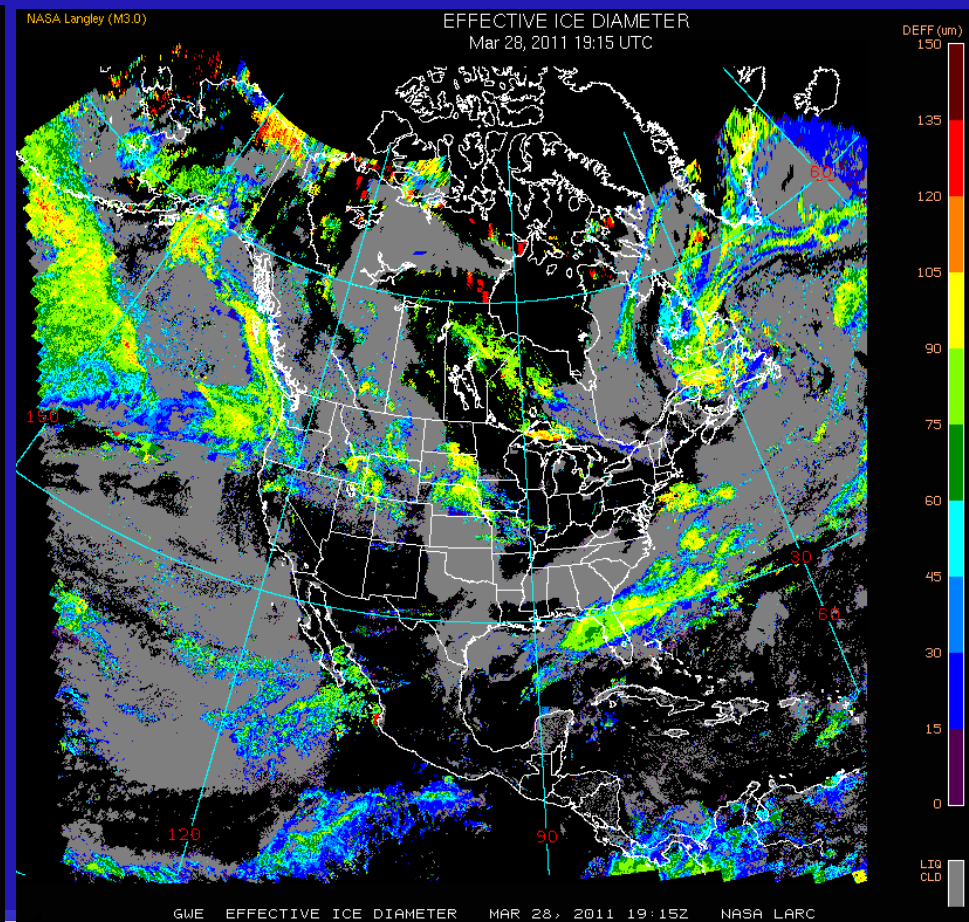
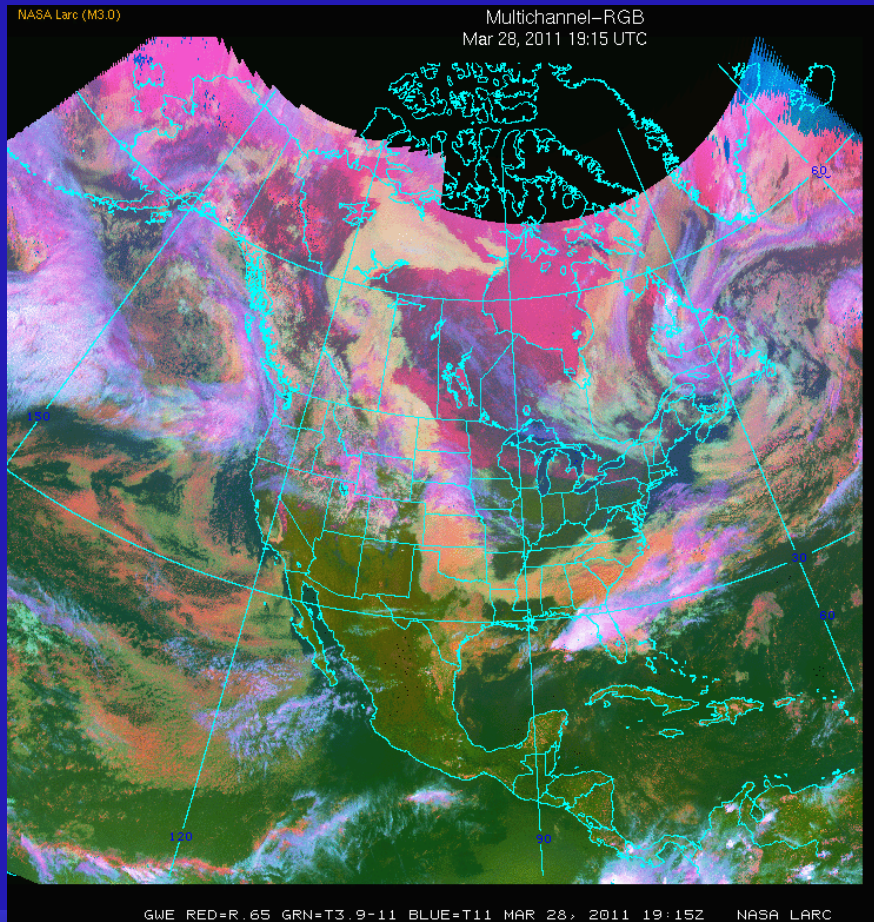
1915 UTC, Jan 31, 2011



GOES

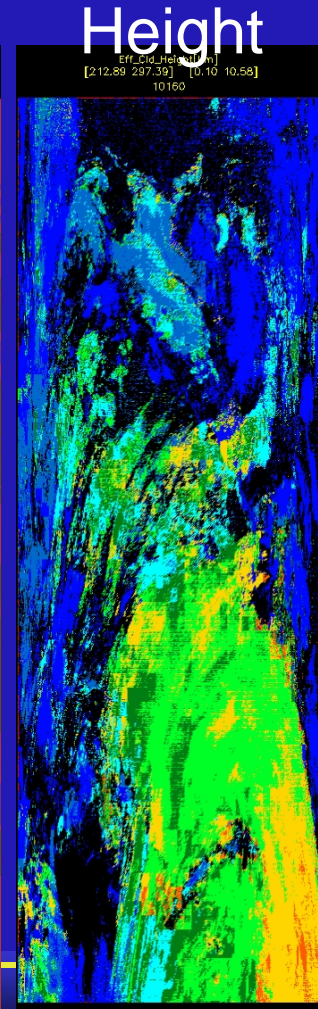
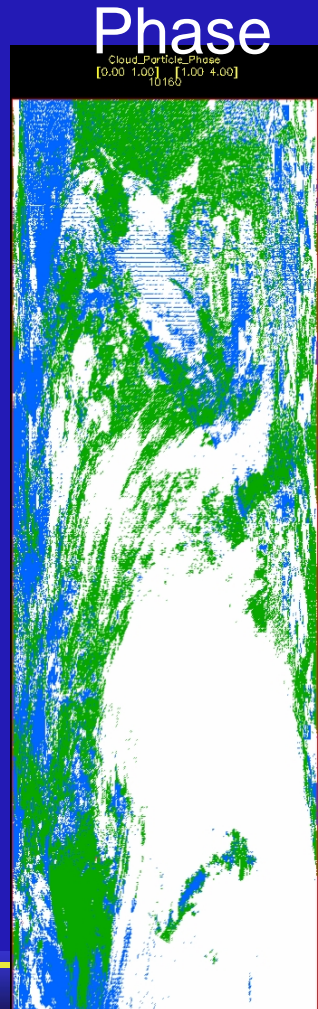
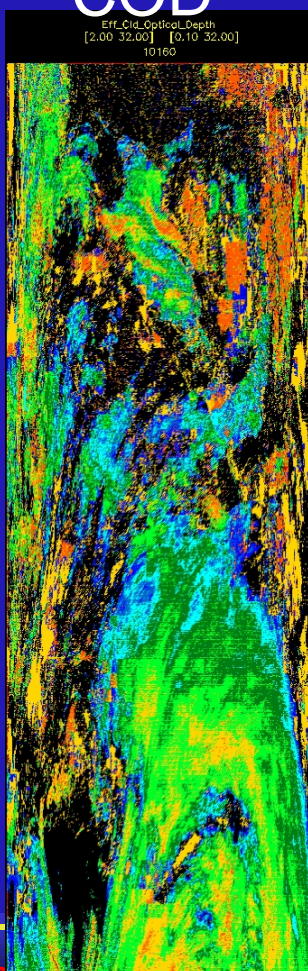
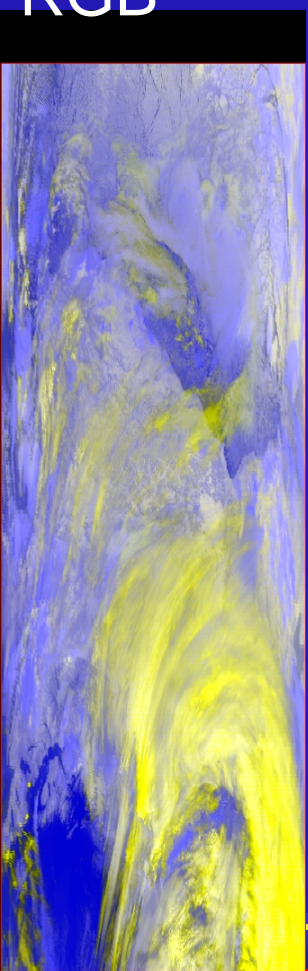
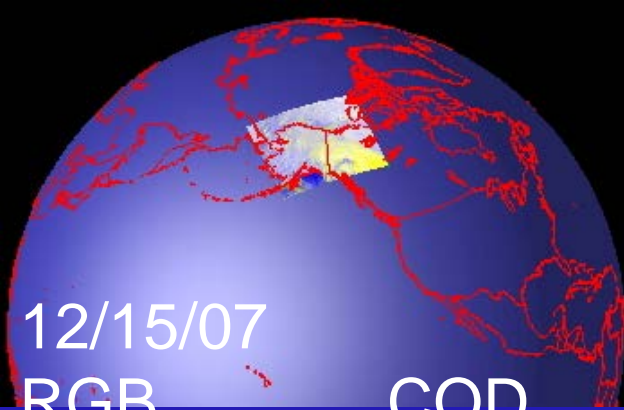
- AVHRR retrievals similar to GOES: limited channels

1915 UTC, March 28, 2011



MODIS

- Nighttime cloud retrievals use 3.8, 11, and 12 μm
 - highly dependent on background radiances
- Possibility to use 8.5, 6.7, 7.1 & 13.3 μm



- Measurements of underlying temperatures, radiances would aid the retrievals
- Knowing what is being measured will also help
 - perform comparisons with theory
- CERES SW & LW fluxes will also be available for TOA closure
- Current Re not good



MODIS

Daytime uses 1.24 for COD, 3.8 μm for Re,
 can also use 1.6 & 2.1 μm for Re
 - mixed phase from 1.6/2.1?

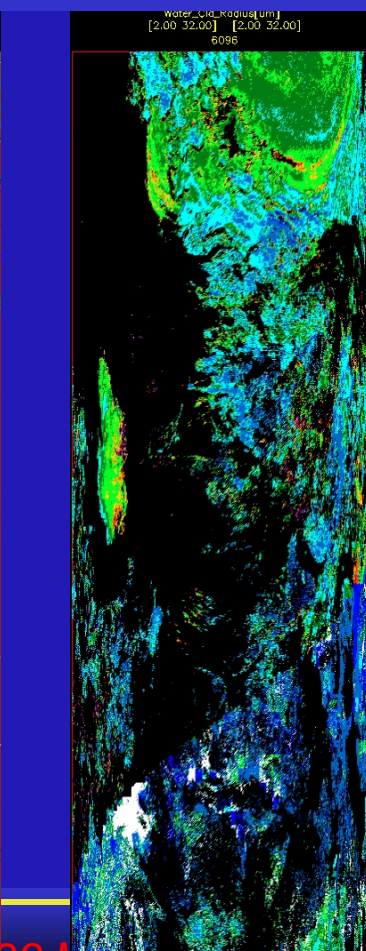
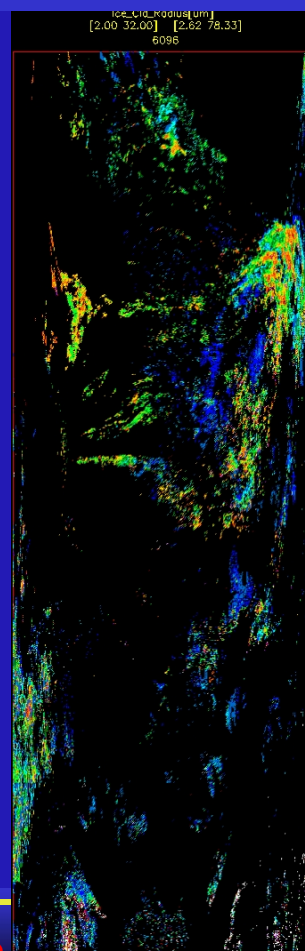
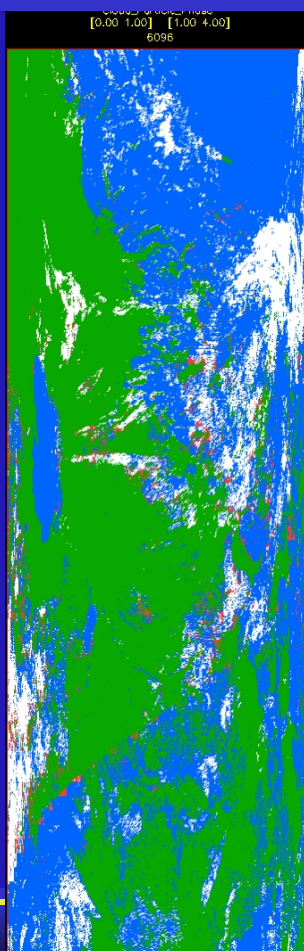
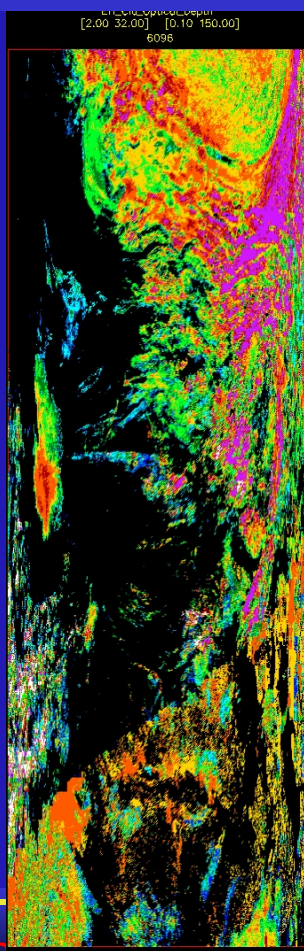
RGB

COD

Phase

Re(ice)

Re(liq)



R

S

28 A

Field Support Web Site Example, FRAM-S Ground Site

AND SPACE ADMINISTRATION

[- Minnis Group Home](#) | [+ Cloud Products](#) | [+ Satellite Imagery](#) | [+ Field Experiments](#) | [+ Related References](#)

- + NASA Home
- + NASA LaRC Home
- + Science Directorate
- + Minnis Group Home

FRAM-S 2009 Experiment - NASA Langley

Cloud Products

- Pixel Level VISST
- Gridded VISST

Satellite Imagery

- MODIS Imagery
- AVHRR Imagery
- GOES Imagery

Viewers / Tools

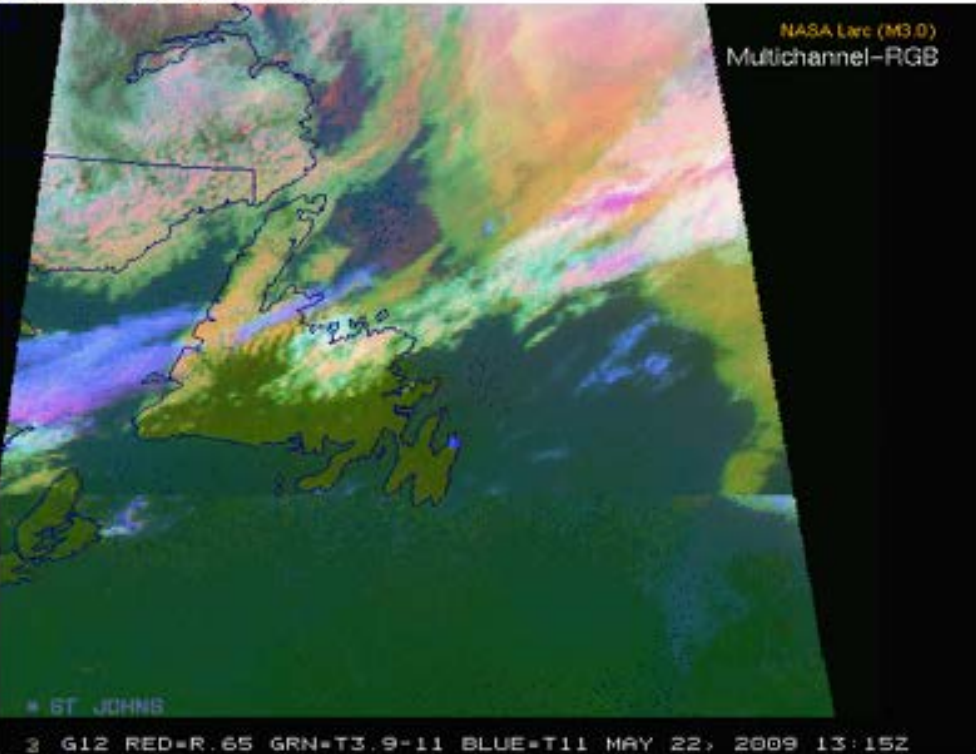
- ATrain Tracker
- Satellite Prediction Tool

Ground Site Cloud Products

- St. Johns

NASA Langley Satellite Support of FRAM-S 2009

Latest GOES-12 Image Processed over the FRAM-S site
Click image to see latest products



NASA Langley (M3.0) Multichannel-RGB

ST. JOHNS

3 G12 RED=R.65 GRN=T3.9-11 BLUE=T11 MAY 22, 2009 13:15Z

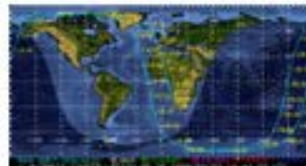
SEARCH LANGLEY

+ GO

NASA Fact

On January 31, 1958,

Current Location of A-Train Satellites (updated every 30 sec)



A-Train



Calipso



CloudSat



- + NASA Home
- + NASA LaRC Home
- + Science Directorate
- + Minnis Group Home

ARM SpartICus Experiment - NASA Langley

- + ARM SpartICus Official Home

Flight Tracks

- + Lear Jet - Cloud Products
- + Lear Jet - Sat. Imagery

Cloud Products

- + GOES-12 SGP
- + GOES-11 SGP
- + GOES-East CONUS
- + GOES-West CONUS
- + Merged CONUS
- + MODIS SGP

Satellite Imagery

- + Mid-West US (SGP)
- + Pacific/West
- + CONUS

Viewers / Tools

- + Plot RUC Sounding
- + ATrain Tracker
- + Satellite Prediction Tool
- + NOAA AVHRR Viewer

Gridded VISST Products

- + GOES-11 SGP
- + GOES-12 SGP

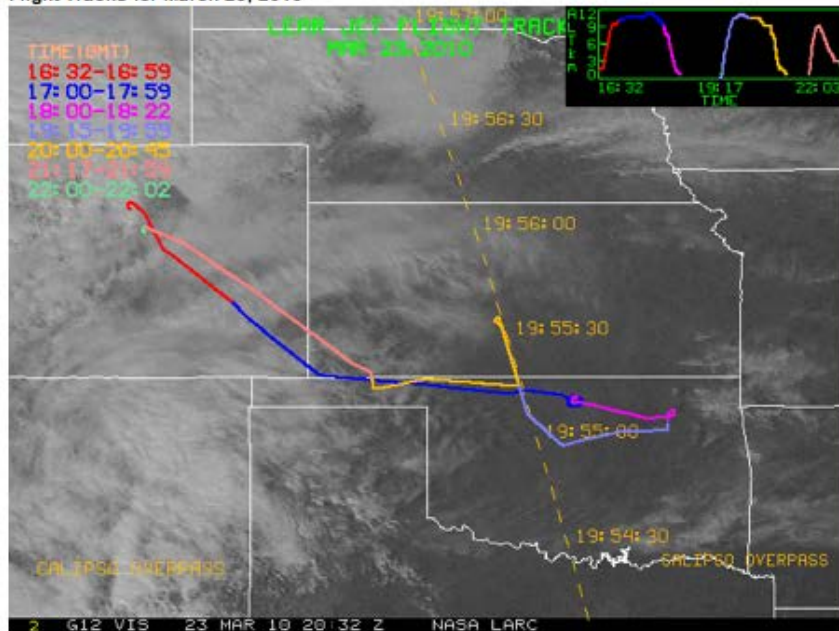
Ground Site Cloud Products

- + GOES-11 SGP
- + GOES-12 SGP

Sparticus Home → Flight Days → Flight Track Imagery

Field experiment ended June 25, 2010

Flight Tracks for March 23, 2010



Complete Flight Path Images: IR 20:32 , VIS 20:32

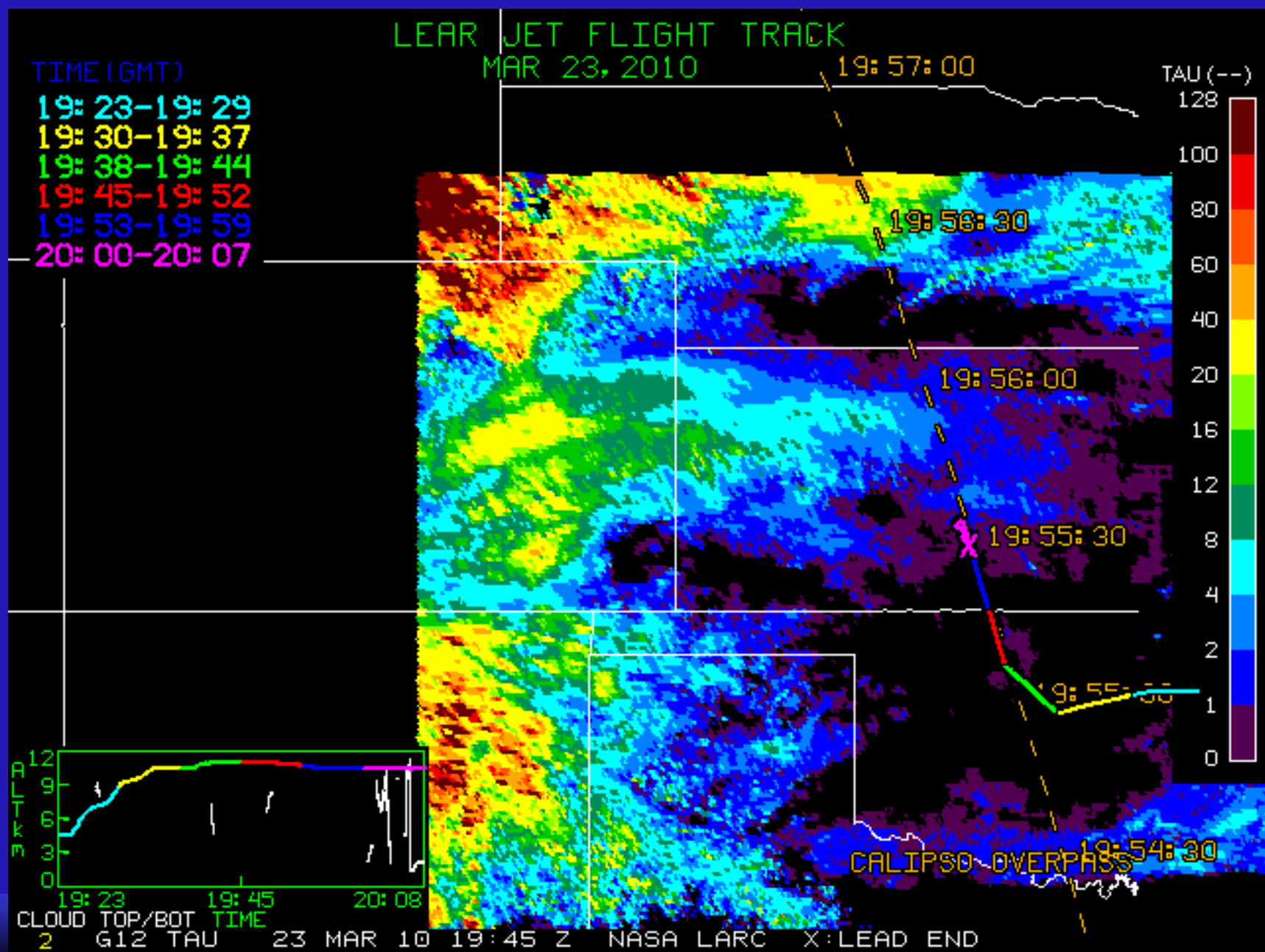
VIS Images: 16:32, 16:45, 17:02, 17:15, 17:32, 17:45, 18:15, 19:15, 19:32, 19:45, 20:02, 20:15, 20:32, 20:45, 21:15, 21:32, 21:45, 22:02, 22:15 • Image Loop

IR Images: 16:32, 16:45, 17:02, 17:15, 17:32, 17:45, 18:15, 19:15, 19:32, 19:45, 20:02, 20:15, 20:32, 20:45, 21:15, 21:32, 21:45, 22:02, 22:15 • Image Loop

Field Support Web Site Example, SPARTICUS Flights

- Matching on every GOES image
- Matching with MODIS
- Variety of tools available

Field Support, Matching CALIPSO w/ SPARTICUS Flights



Summary

- Day-night retrieval capabilities vastly different
 - most ice fog at night? Hard to detect?
 - need measurements at night to know what we are supposed to be detecting
 - mixed phase in daytime tough, though Lubin's approach may work
 - multispectral (1.2, 1.6, 2.1, 3.8 μm) will be available
 - mixed phase at night? ☹️
 - we have a strong interest in improving nighttime retrievals
 - add 6.7, 7.1, 8.5, 13.3 μm channels
- Can provide support for PIC-3
 - website will be made available for entire period
 - on-site support for flight missions?
 - feedback from proposal team?
- Plan to perform comparisons with in situ & sfc obs

