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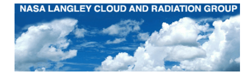

Applications for Near-Real Time Satellite Cloud and Radiation Products

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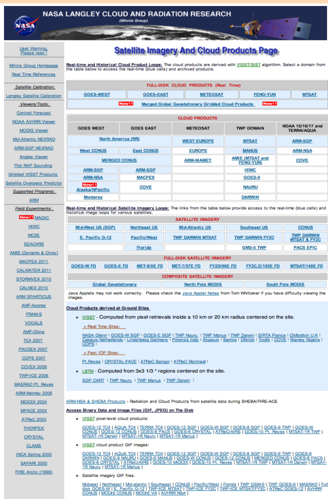
Introduction

With increases in computer capabilities & satellite imager data availability, near-real time (NRT) products generated from satellite data are becoming more common & finding more applications. At NASA LaRC, we have been providing satellite-based cloud and radiation parameters in NRT for over a decade. As these analytical datasets become more widely known, researchers have been using them to improve their nowcasts and forecasts of weather and other atmospheric phenomena. The products, their availability and some of their current applications are summarized in this poster.

Availability

On the web: ***http://cloudsgate2.larc.nasa.gov***



On smartphones: ***http://cloudsgate2.larc.nasa.gov***

Products

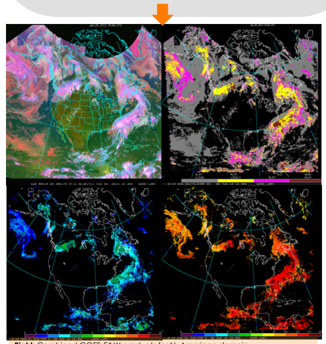
All products are available at pixel level; some are also averaged to particular grids. Averaging is flexible.

Standard, Single-Layer VISST/SIST

	Cloud
0.65, 1.6 µm Reflectances	Mask, Phase
3.7, 6.7, 10.8 µm Temp	Optical Depth, IR emissivity
12 or 13.3 µm Temp	Cloud effective particle size
Broadband Albedo	Liquid/Ice Water Path
Broadband OLR	Effective Temp, height, pressure
Clear-sky Skin Temperature	Top/ Bottom Pressure
Icing Potential**	Top/ Bottom Height
Pixel Lat, Lon	Overshooting tops (new)
Pixel SZA, VZA, RAZ	

Multi-Layer: CO_2 chan only (GOES-12 & later)

Upper & Lower Cloud:
- Multilayer ID (single or 2-layer)
- effective temperature, optical depth, thickness
- effective particle size, ice or liquid water path
- height, top/base height, pressure



Right: Combined GOES-E&W products for N. American domain.
a) RGB, b) multilayer ID, c) Lower cloud height (km), d) Upper level height (km)
ML cloud data useful for many applications.

Other applications

- Field program support: over 35 experiments supported (see website sidebar)
- Surface radiation budget, solar energy — *Pinker et al.* (2008)
- Icing forecast model assimilation
- Cloudy–sky aerosols — *Saide et al.* (2012)
- Potential clear-sky applications: e.g., surface albedo, aerosols, etc.

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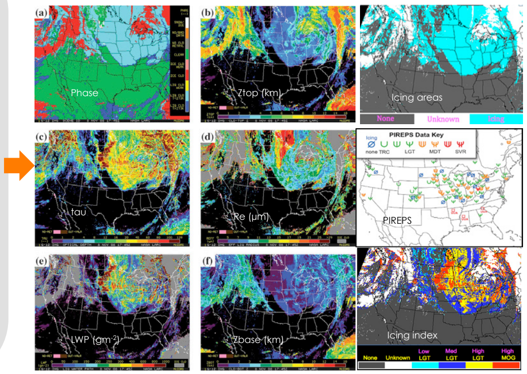
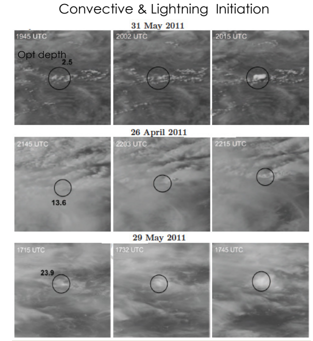
Nowcasting for Aviation Safety & Management

Airframe Icing Potential



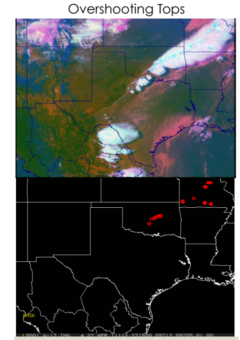
Cloud properties, temperature, phase, height, effective droplet size, optical depth, & LWP define icing probability& intensity for clouds not covered by cirrus. Results compare well with Pilot Reports (PiReps). Areas of unknown have cirrus clouds. Use of multilayered cloud data can reduce unknown areas. *Smith et al.* (2012)

Convective & Lightning Initiation



Convective/lightning initiation (CI/LI) is important for warning air traffic of impending thunderstorm with potential strong turbulence, lightning, and otherwise rough weather. Current methods have difficulty operating when cirrus clouds obscure the underlying cumulus clouds that develop in time. Cloud optical depth, water path, and height can be used with the radiances to detect CI & LI when cirrus is present, expanding capability of previously all-radiance product. *Mecikalski et al.* (2012)

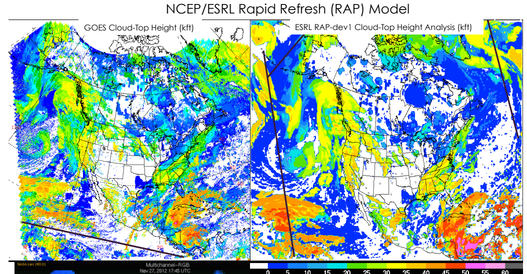
Overshooting Tops

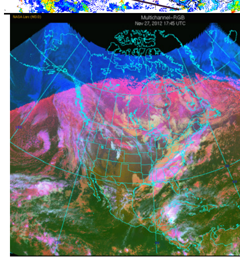


Deep convection sometimes penetrates the stratosphere producing overshooting tops (OTs) that are indicative of severe weather. OTs are identified in GEOSat data using IR BT, BT gradients (texture), and tropopause temperatures, Detected OTs for RGB image (top) are shown in bottom panel as red circles, 2315 UTC, 22 April 2011. *Bedka et al.* (2010)

Assimilation & Forecasting

NCEP/ESRL Rapid Refresh (RAP) Model





Above: Cloud-top heights from GOES at 1745 UTC, 27 Nov 2012 (left) and ESRL RAP dev-1 analysis at 1800 UTC (right) with assimilated GOES cloud-top heights within boundaries of black lines.
Left: GOES-E&W combined RGB image

LaRC cloud top heights from North American domain are assimilated in the operational NCEP RAP and the experimental ESRL RAP hourly analyses. Observations used for cloud clearing in NCEP RAP & clearing and low-cloud building for ESRL RAP versions. ESRL is researching cloud building at all levels to improve representation of clouds in the analyses and to improve forecasts of various parameters.

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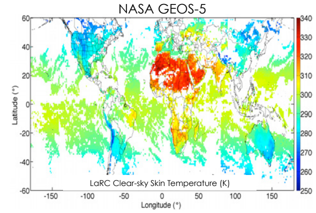
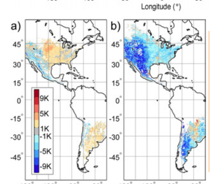
NASA GEOS-5



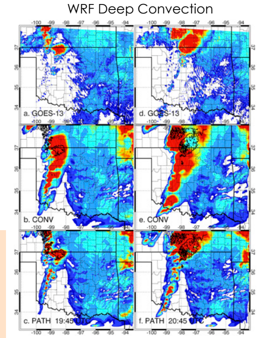


Top: Clear-sky surface skin temperatures (K) from five GEOsat imagers, 12:00 UTC, 15 May 2012

Bottom: Mean difference (K) between GEOS-5 and GOES-13 land surface temperatures for clear-sky conditions at **(a)** 06:00 UTC (nighttime) and **(b)** 18:00 UTC (daytime), averaged over 1 August 2011 to 31 July 2012.

LaRC quasi-global cloud properties and surface skin temperatures are being tested for assimilation into the GMAO GOES-5 NWP model. GEOS-5 surface skin temperatures biased diurnally, but agree well at night. Adjustment of daytime skin temperature computations will facilitate assimilation of the GEOSat retrievals. *Scarino et al.* (2012)

WRF Deep Convection



Above: CWP from GOES (**top**), conventional WRF model (**middle**), and WRF assimilating GOES CWP (**bottom**) at 1945 UTC (**left**) and 2045 UTC (**right**), 10 May 2010. Black contours correspond to GOES CWP = 0.5 kg m^{-2}.

Assimilation of LaRC cloud top heights and cloud water path (CWP) data are being tested at NSSL for the ARM SGP domain. Assimilation improves forecasts of surface radiation and temperature. *Thomas et al.* (2012)

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