



# Nighttime Retrieval of Cloud Microphysical Properties for GOES-R

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## Full Disk

1 August 2006 2300UTC

SIST applied after  $T_{cloud}$  and cloud phase determined by other candidate GOES-R algorithms (see P1.3 Heidinger)

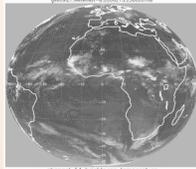
From inputs:

- SEVIRI 3.9-, 10.8- $\mu\text{m}$  and 12- $\mu\text{m}$  channels
- $T_{cloud}$  and Phase

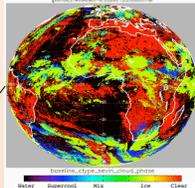
Algorithm computes:

- Optical Depth,  $\tau$
- Effective particle radius,  $r_{eff}$
- Liquid water path, LWP
- Ice water path, IWP

### IR Temperature

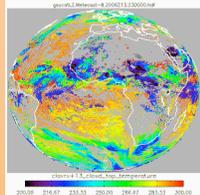


### Cloud Phase



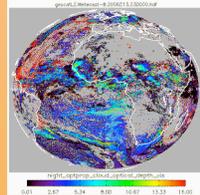
SIST

### Cloud Temperature

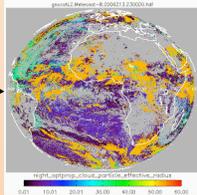


3.9  $\mu\text{m}$   
12  $\mu\text{m}$

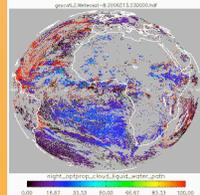
### Cloud Optical Depth



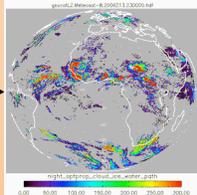
### Effective Radius



### Liquid Water Path



### Ice Water Path



Retrieval technique performs well globally, although validation as well as comparison with non-modified SIST and other algorithms has not yet been done.

## Introduction & Methodology

This poster presents first results from new SIST retrievals conducted on 3.9-, 10.8- and 12- $\mu\text{m}$  SEVIRI nighttime imagery that is being used as a proxy for Advanced Baseline Imager (ABI) data. SIST-derived cloud properties are being calculated within the GOES-R cloud application team's developmental framework, GEOCAT. Alterations to SIST, include using a new option that allows  $T_{cloud}$  and cloud thermodynamic phase to be determined prior to the invocation of SIST.

**SIST:** Solar infrared-Infrared-Split window Technique from NASA Langley

- iterative regression method using cloud emittance parameterizations developed for 7 water and 9 ice cloud models
- minimizes  $\sum [(BTD_{34} - BT_{34})^2 + (BTD_{45} - BT_{45})^2]$

$$\text{where } BTD_{34} = T_{3.9\mu\text{m}} - T_{10.8\mu\text{m}} \text{ and } BTD_{45} = T_{10.8\mu\text{m}} - T_{12\mu\text{m}}$$

observed:  $BTD_{34}$  and  $BTD_{45}$  modeled:  $BT_{34}$  and  $BT_{45}$

(see Minnis, P. et al., 1998: Parameterization of Reflectance and Effective Emittance for Satellite Remote Sensing of Cloud Properties. *J. Atmos. Sci.*)

**Data:** SEVIRI as proxy for ABI

**Framework:** GEOCAT

Modifications to SIST to allow usage within GOES-R cloud application:

- Allow  $T_{cloud}$  to be input from other GOES-R algorithm, thereby reducing 1 iterative step
- Allow phase to be input, thereby reducing number of model calculations
- USE RTM calculations already performed by GEOCAT, reducing calculation time

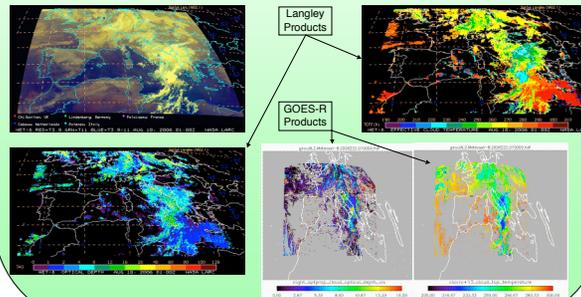
**Result:** Streamlined version of SIST specific to GOES-R application

## Future Work

- Examine case studies and full disk retrievals in detail to assess impacts of varying  $T_{cloud}$
- Investigate small  $r_{eff}$  for water clouds and any defaulting of large  $r_{eff}$  for ice clouds
- Validation and comparison with
  - SEVIRI retrievals done at Langley with full SIST
  - other SEVIRI retrievals
  - verify day/night transition
- Timing studies and potential of using SIST for twilight

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## Example Validation Dataset



## Case Study

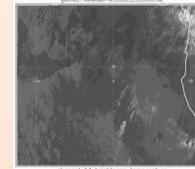
2 August 2006 0200UTC

Same application as full disk but a close-up look off the coast of West-Central Africa (Gabon). Mixed scene with thin cirrus overlying stratus and broken stratus.

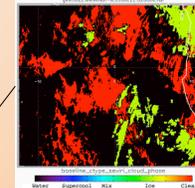
Input  $T_{cloud}$  and phase can impact SIST retrievals.

- Generally, all parameters look consistent and reasonable
- Impact of cloudy edge pixels on  $T_{cloud}$  and parameters retrieved using  $T_{cloud}$  needs evaluation
- Water cloud  $r_{eff}$  could be underestimated due to change in interpolation scheme

### IR Temperature

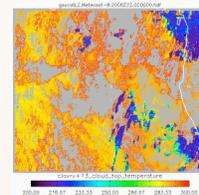


### Cloud Phase



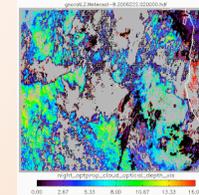
SIST

### Cloud Temperature

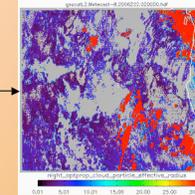


3.9  $\mu\text{m}$   
12  $\mu\text{m}$

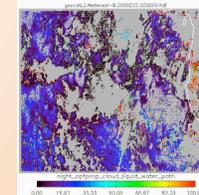
### Cloud Optical Depth



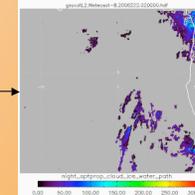
### Effective Radius



### Liquid Water Path



### Ice Water Path



## Conclusion:

Close-up examination verifies that the techniques retrieve reasonable  $\tau$ ,  $r_{eff}$ , LWP and IWP.