# Verifying Large-Scale, High-Resolution Simulations of Clouds for GOES-R Activities

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## Introduction

Producing high quality proxy data sets from NWP simulations for the future GOES-R Advanced Baseline Imager (ABI) are important in developing and testing new products and algorithms. This study evaluates high-resolution simulations of top-of-atmosphere (TOA) radiances in cloudy regions using the GOES-12 imager data to determine whether these proxy data sets have sufficient realism for testing cloud products and algorithms.The Weather Research & Forecasting (WRF) model was used to produce retrospective forecasts on 4 June 2005 that spanned nearly the entire region covered by the GOES-12 imager in full-disk mode.

## Model descriptions

<u>Fast Radiative Transfer Model System</u>

- Multiple scattering: Successive Order of Interaction (SOI) model (Heidinger et al. 2006); solar and IR versions
- Gas optical depthl: Compact-OPTRAN (CRTM – Community Radiative Transfer Model)
- Cloud optical properties: Lookup tables based on Mie calculations and Baum et al. (2006) for ice
- Surface emissivity: over land global monthly mean MODIS 5 km products; over water IRSSEM from CRTM
- Surface reflectance: over land, MODIS 2km products; over water, sea surface relflectance model of Sayer (2007)

<u>WRF model setup</u>

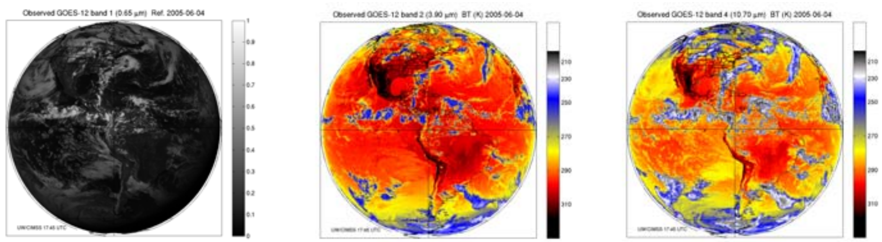
- 6 km horizontal grid spacing for large domain (3100 by 2600 points)
- 50 vertical levels
- Microphysics parameterization: Thompson hybrid one-moment/two-moment scheme (5 species)

## Approach

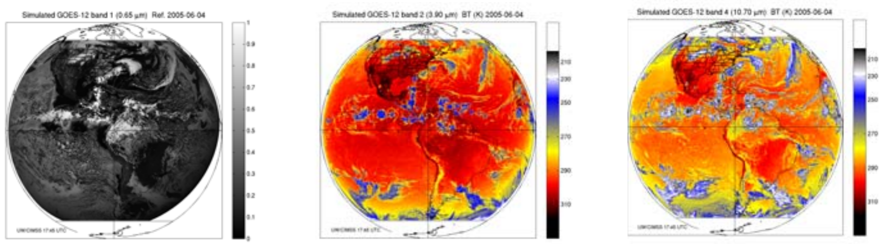
Our validation method examines relationships between different bands and reflectances at 3.9 µm. 2D histograms of visible reflectances (band 1 ) and 10.7 µm brightness temperatures (band 4) can reveal how well the simulations reproduce different cloud types according to height and optical thickness. Comparisons of 3.9 µm reflectanes (band 2) can be used to evaluate the simulated cloud particle sizes. The method of Allen et al. (1990) was used to remove the thermal emission component in the band 2 data, but for simplicity we assumed the scattering of solar radiation is isotropic. The simulated data were remapped to the GOES-12 projection. Comparisons between observed and simulated data were done only for cloud covered pixels.

## Comparison of full-disk imagery

### Observed




### Simulated

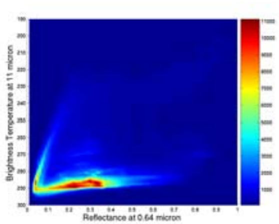



## Results

Observed
3.9 µm reflectance vs. band 4

Observed
Band 1 vs. band 4

Simulated
3.9 µm reflectance vs. band 4




## Conclusions

- To be determined

### References

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