



Simulation GOES Radiance for OSSE

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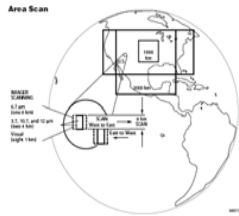
Abstract

Advanced Baseline Imager (ABI) will be flown on the next generation of NOAA Geostationary Operational Environmental Satellite (GOES)-R platform. The sensor will provide enhanced spatial, temporal information for atmospheric moisture, wind and many surface properties. A joint Observation System Simulation Experiments (OSSE) project was started recently to study the impacts of GOES-R ABI measurements on numerical weather prediction.

In this poster, we will present some results of the simulation of GOES radiances based on OSSE nature run output and the evaluation against observations. A case study will be performed to analysis ECMWF T511 natural run results. ABI instrument properties and geometry factors are simulated based on current GOES and MSG SEVIRI sensors. The JCSDA Community Radiative Transfer Model (CRTM) is used to simulate ABI radiances with the natural run atmospheric profiles. The simulated radiances are evaluated by comparing with current GOES observations.

Current GOES-E vs. GOES-R

Current GOES Imager IR band has 4 km horizontal resolution (FOV), GOES Sounder has 10 km resolution. A full disk scan has total 10,080,910 observation points, and takes about 26 min. GOES-R ABI sensor will has 1km/2 km resolution.



GOES-R ABI Band	Central Wavelength (μm)	Current GOES Band
1 (blue)	0.47	
2 (red)	0.64	1 1 km
3	0.86	
4	1.38	
5	1.61	
6	2.26	
7	3.9	2 4 km
8	6.185	
9	6.95	3 4 km
10	7.34	
11	8.5	
12	9.61	
13	10.35	4 4 km
14	11.2	
15	12.3	5 (G08) 4 km
16	13.3	5 (G12) 4 km

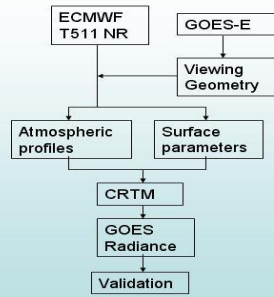
Radiance Simulation Design

Objective

GOES data is simulated to test impact of GOES in simulation experiments in comparison with impact of real data.

OSSE for GOES will serve as a calibration for GOESR OSSE.

Radiance Simulation Flow Chart

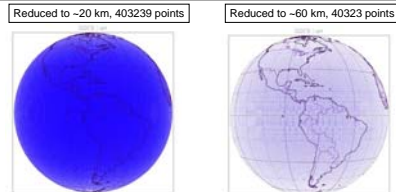


Steps:

- The OSSE Nature Run data is come from ECMWF T511 13-month simulation. The data set contains 91 vertical levels variables, which are then horizontally interpolated to observation points without vertical interpolation. Selected model level data and all surface data are included.
- CRTM model is used to simulate GOES-12 Imager, Sounder, MSG SEVIRI, and GOES-R ABI measurements.
- Perform validations of the simulated radiances with statistical analysis and comparison with real observations.

GOES-EAST Observation Locations

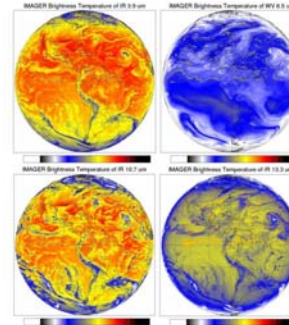
A full disk scan of GOES-12 Imager has total 10,080,910 observation points with 4 km resolution. However, Current NCEP/GSI model only take a thinned 1x1 degree GOES-12 dataset. In this study, we extract GOES-12 Imager observation locations (lon/lat) at 20 km and 60 km resolutions. The Nature Run data is interpolated on to these two different resolution locations.



GOES-12 Imager

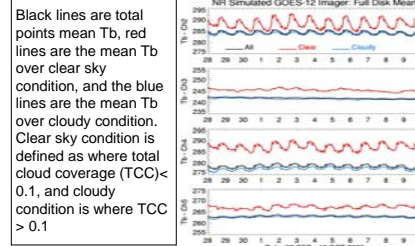
Simulated GOES-12 Imager 4 bands with ECMWF Nature Run output data at 0300 UTC October 1, 2005.

It is found that the water vapor band, 6.5 μm, is most accurate band simulated by CRTM model.



Time series of hourly, full disk mean brightness temperature of the simulated GOES-12 Imager 4 bands from September 28 to October 10, 2005.

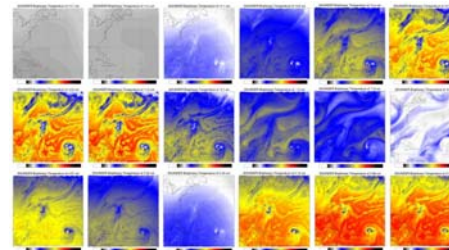
Under clear sky conditions, the brightness temperatures are warmer than that of cloudy conditions. The daily change under clear conditions is apparent.



GOES-12 Sounder

Simulated Radiances

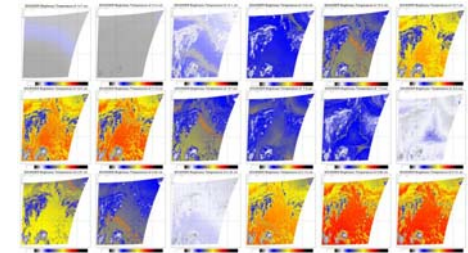
Nature Run simulated GOSE-12 sounder 18 bands



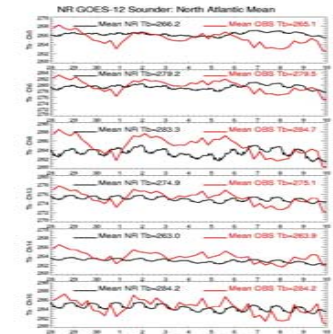
In nature Run, there is hurricane generated on September 27. At 1200 UTC October 1, it is located at about 43 W, 20N. The high moisture air mass associated with the hurricane is shown clearly.

Compare with the observed GOES-12 Sounder

Observed GOES-12 18 bands on 0230 UTC October 01, 2005 for North Atlantic Ocean section.



Time Series of Mean Tb



Observed vs. simulated GOES-12 sounder for the mean Tb over North Atlantic Ocean region.

Black lines are mean Tb from NR simulated, and the red lines are the mean Tb from observation.

Future Work

Simulate GOES-R ABI radiances from Nature Run data,

Perform NWP model simulations to investigate the impacts of GOES-12 and GOES-R measurements.