GOES-R Proxy Data Management System

Tong Zhu (CIRA/CSU), Min-Jeong Kim (CIRA), Fuzhong Weng (NOAA/NESDIS), Mitch Goldberg (NOAA/NESDIS), Allen Huang (CIMSS), Manajit Sengupta (CIRA), Daniel Zhou (LaRc), Ben Ruston (NRL), Zhanqing Li (UMD)

Abstract

The GOES-R Algorithm Working Group (AWG) program requested a high quality of proxy data for algorithm developments, testing and assessments. The central tasks in the proxy data management system are the development of observation and simulation based GOES-R proxy data, delivery of simulated GOES-R ABI level 1B format data, the design of a GOES-R Observing System Simulation Experiment (OSSE) framework for demonstrating the potential impacts of GOES-R data on NWP forecasts.

During the last one year, proxy data team generated a series of datasets based on observations and NWP models. The observation datasets include measurements from SEVIRI, GOES-08/10, MODIS, SURFRAD, AERONET, NAST-I, and HIRS-X. Numerical models, like MM5, WRF, and RAMS were used to produce atmospheric profiles. The JCSDA Community Radiative Transfer Model (CRTM) and CIMSS Fast Infrared Radiative Transfer Model have been used to simulate ABI measurements.

Recently, several new proxy datasets have been produced, including: 3 cases of ABI derived from NAST-I with co-incident radiosondes and dropsondes; a 20-day full disk SEVIRI dataset for 2005 with NetCDF format; a 94-day hourly SEVIRI dataset during 2004, 2006 and 2007 AEROSE field campaigns; and a 16-day MODIS NDVI data across the USA for 2001.

Vision

GOES-R AWG application teams will be empowered with a high-quality of GOES-R proxy data sets matched with in-situ measurements for algorithm assessment, developments and validation.

GOES-R Proxy Data Users are:

Proxy Data – from Satellite Observations

Proxy data from observation:
MSG SEVIRI McIDAS data 2005, 36 days, 15-min,
GOES-08 full disk McIDAS data 2001, 365 days, 15-min,
GOES-10 full disk McIDAS data 2001, 365 days, 15-min,
GOES-08 data over 8 SURFRAD sites, 365 days, hourly,
GOES-10 data over 7 SURFRAD sites, 365 days, hourly,
AERONET and MODIS matchup data, 2000, 599 points,
ABI simulated from MODIS, 5 cases, 0.5/1/2 km, 14 ABI bands,
Globe emissivity of ABI 9 IR bands, June 2003, 0.050,
ABI emissivity from HIRS-X monthly mean data, ~5 km, 10 IR bands,
MODIS L1B, 3 days in 2005, global, 1 km, 36 bands,
MODIS land surface emissivity daily, 7 days, 2005

New Proxy Data from Observation:
MSG SEVIRI McIDAS data in 2004, 2006, 2007, 94 days in AEROSE field campaigns time periods, 1-hour, 11 bands, covering 15S-35N, 83W-05E.
ABI simulated from SEVIRI, 6-hour, 15-min, 16 bands,
ABI Proxy Data Set of 11 hurricanes with a total of 456 different scenes; Collected matching Ground Truth Data (Best Track); Tuned CIRA/RAMM Digital Dvorak Tropical Cyclone Intensity Calculation to the TC proxy data,
ABI data from NAST-I and coincident radiosondes and dropsondes, 4 cases.
MSG SEVIRI NetCDF data 2005, 20 days, 15-min (11 bands), 60S-60N, 3-km remapping data converted from McIDAS data.

SEVIRI Data for AEROSE field campaigns -ORA

- MSG SEVIRI data for constructing proxy datasets from the 2004, 2006 and 2007 AEROSE field campaigns. The space domain is defined by the following bounding box (allowing for extra leeway on the eastern boundary for studying dust and smoke outflows):
  [15 S, 35 N] Latitude
  [83 W, 05 E] Longitude
- Time periods of the data are as follows:
  01-Mar, 26-Mar 2004 AEROSE-I
  27-May, 17-Jun 2006 AMMA/AEROSE-II Leg 1
  23-Jun, 14-Jul 2006 AMMA/AEROSE-II Leg 2
  03-May, 27-May 2007 PNE/AEROSE-III
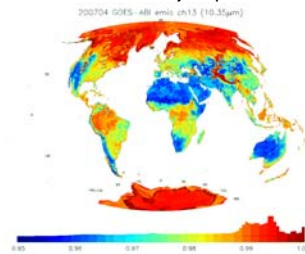- Channel 1 to channel 11;
- 1-hour rate.

SEVIRI Band 1 at 1100 UTC, 3 May, 2007
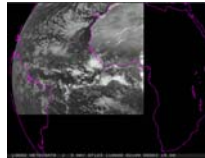
### Emissivity for GOES-R ABI 10 thermal channels - NRL

Four monthly (01, 04, 08 and 10, 2007) global land emissivity for GOES-R ABI 10 thermal channels with high resolution (1 km), interpolated from monthly HIRS-X means.

ABI CH13 Emissivity for April 2007

NAST-I Retrieved ABI 10 IR Bands Data - LaRc

ABI data generated from NAST-I for three cases on:
- 2 for March 3, 2003: Over Pacific – Hawaii, under mostly clear conditions,
- 1 for March 12, 2003: Over Pacific, under clear and cloudy conditions,
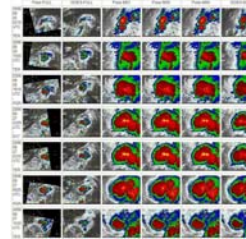- Coincident data: radiosondes and dropsondes.
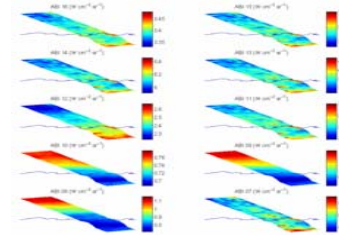
ABI Proxy Data Set of 11 hurricanes - CIRA

Created ABI Proxy Data Set of 11 hurricanes with a total of 456 different scenes;

Find matching Ground Truth Data (Best Track).

Ernesto 2006

2002:
Lili (26)

2003:
Emily (51)
Katrina (68)
Rita (69)
Stan (17)
Wilma (75)
Alpha (10)
Beta (9)

2005:
Ernesto (29)

2005-EP:
Hilary (16)

2006:
Ernesto

Proxy Data II – NWP Model Simulated

Proxy data from NWP models :
Atmospherics profiles, MM5 simulation, 1 day, 10-min, 3 km,
Atmospherics profiles, WRF simulation, 1 day, 40-min, 8 km,
WRF hyperspectral radiance, 1 day, 40-min, 8 km,
ABI simulated from WRF, 1 day, 40-min, 8 km, 9 IR bands,
Atmospheric profiles, RAMS Simulation of Hurricane Lili (2002), 6hr, 5-min, 2 km,
ABI simulation for Hurricane Lili by RAMS, 10 IR bands.
Atmospheric profiles, RAMS Simulation of Lake Effect Snow (LES) on 02/2003, 6hr, 5-min, 2 km,
ABI simulation for LES by RAMS, 10 IR bands

New Proxy Data from NWP:
- Atmospheric profiles, RAMS Simulation of Severe Weather (May 2003), 6hr, 5-min, 2 km, and ABI simulations for the case, 10 IR bands.
- Atmospheric profiles, RAMS Simulation of Lake Effect Snow (Feb 2003), 6hr, 5-min, 2 km, and ABI simulations of this case, 10 IR bands,
- Fire simulation over Eastern Kansas on 08 May, 2003: ABI 3 IR bands data, 2003. 6hr, 5-min, 2 km.

NCSA WRF model simulations - CIMSS

NCSA WRF model simulations:
4-5 June 2005; full-disk (6 km); CONUS (2 km); mesoscale (667 m)
Delivered data to AWG Sounding and Winds teams for 22 UTC 4 June to 00 UTC 5 June
Full disk (15 min), CONUS (5 min), Mesoscale (1 min)

Comparison of simulations to GOES-12 imager observations Full-disk (channels 1 and 3)
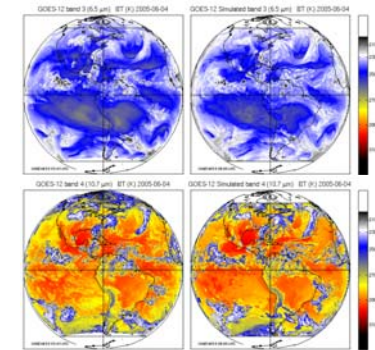
Fire Hot Spots Eastern Kansas 08 May 2003- CIRA

Proxy Radiance & brightness temperature fields
- 3 scenarios:
  – constant temperature no clouds
  – flickering temperature no clouds
  – constant temperature with clouds
- 72 time steps
  – 6 hours each 5 minutes
  – 08 May 2003 RAMS forecast grid 4
- 3 bandwidths: 3.9 µm, 10.35 µm, 11.2 µm

Grid 4:
400 m resolution
Fire Matrix:
9 x 15 fire hot spots
--> 9 rows of increasing fire temperature from 400 K (bottom) to 1200 K (top) in 100 K intervals
--> 15 columns of increasing fire size from 1x1 pixels, 2x1, 2x2, …… 8x1, 8x8 pixels
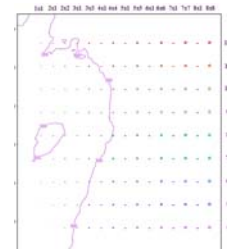
RAMS Model Simulation of Severe Weather- CIRA

Atmospheric profiles, RAMS Simulation of Severe Weather (May 2003)
- 2 km resolution, 6 hour forecast, 5 minute data;
- 10 ABI IR bands;
- atmospheric forecast fields in binary format;
- synthetic ABI images of brightness temperature and radiances in NetCDF, ASCII, Gif (of McIDAS), McIDAS area files.

Simulated ABI measurement for wavelength 10.35 µm on 2305 UTC May 08, 2005