GOES-R Validation: Field Campaigns, Gap Filling and Sustaining Measurements

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World Weather Building, Camp Springs, MD
27 October, 2010

GOES-R Validation: Field Campaigns, Gap Filling and Sustaining Measurements

- **Purpose:**
  - Response to AWG TAC and GOES-R ADEB
  - AWG Baseline BOE is for Algorithm Development and Cal/Val Tools
  - No Val BOE for Option 2 Products
  - GOES-R cannot assume leveraged assets used today will be available at-launch without a longer term investment strategy
  - Augmented funding from GOES-R Program of $3-6M requests coordinated proposals from the AWG Team Leads
  - Opportunity to refine and update the AWG Team Val Plans for Pre-launch and Post-launch Product (L2+) Validation
  - ADEB Recommendations (for more Comprehensive Product Validation)- eg, NCOMP, SST, LST, Hydrology (Precipitation)

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Opportunities:

- Field Campaigns (leveraging JPSS, NASA- incl NAMMA, GRIP, GPM, Earth Venture airborne missions (Air Quality, Hurricane), NSF (PREDICT, DC3), other NOAA, DOE (MC3E), international (HyMex)
- Sustaining Measurements (augmented funding for in situ measurements – eg, GPSMet-Seth Gutman, GPM-Chris Williams)
- Visiting Scientist Program:
  - Participate in field campaigns (Brad Pierce-CalNex 2010, Canadian fog experiment- Jim Gurka)
  - Scientific collaboration/data analysis (WMO WWRP RDPs-Winter Olympics in Vancouver 2010, Sochi 2014
  - EUMETSAT SAFs- Andy Heidinger-Clouds, John Mecikalski- CI
  - GOES- R Proving Ground- DeMaria-NHC, Feltz and others-SPC/HWT)

GOES-R Algorithm Development Executive Board Recommendation

- "**FINDING 1:** Insufficient Validation. Reporting of measurement validation lacked completeness and was rarely independent.

- **RECOMMENDATION 1:** Continue to pursue more complete data sets even after 100% delivery. Measurement validation must be conducted with thoroughness and completeness within a sustained validation/verification framework and should consider using "human in the loop." This recommendation was made in our previous report .
  - AWG teams should leverage participation in targeted field campaigns where there is a potentially rich source of detailed validation data to validate, refine, and improve their algorithms. Campaigns planned by NOAA, NASA, NSF, DOE etc are good candidates as well as international campaigns in Europe under the SEVERI (ABI proxy) coverage umbrella (sjg).

2010 TAC Guidance

- Field campaigns for validation of GOES-R sensor measurements and derived products must be planned as soon as possible. The detailed Basis of Estimate should take into account other planned validation campaigns and assets as much as possible. Coordination with other programs requires early commitment.

2009 TAC Guidance

- **Planned validation campaigns with Aircraft and ARM sites should proceed. (from 2008 Guidance)**
  - Plan to develop detailed Basis of Estimate with GOES-R Senior Scientist to leverage activities with JPSS, other NOAA, NASA, and NSF planned field campaigns. GOES-R BOE for validation campaigns will be completed by May 2011.

2008 TAC Guidance

- **Plan validation campaigns with PSE. Aircraft and ARM sites. Determine schedule and cost.**
- Recommend that forward retrieval terms calculated for an overall physical consistency check for ABI products. Radiometric consistency check for all products.
- The different scales and scan rates impact on the different products. Does one size fit all? Temporal slew considered?
- Higher level management to consider a synergistic approach to merging LEO/GEO products. Analyze which system is providing primary/secondary value added improvement. Develop a test bed approach to exploit synergistic data.
- The program office needs to develop an outreach activity for the data/products.

2007 TAC Guidance

- The importance of visualization was a common thread throughout portions of the TAC's deliberations. It was recognized that there needed to be a common framework for visualization.

- Need to enhance coordination of the vast Proxy Data activities.

- **The need to maintain aircraft instrument and campaign capabilities for GOES-R validation activity was reaffirmed, as was the use of special instrumented sites such as the DOE ARM CART site**

GLM-CHUVA Proxy Data and Validation Campaign

Dates: **July 2011-June 2012 (IOP January)**

Location: **Sao Paulo, Brazil**

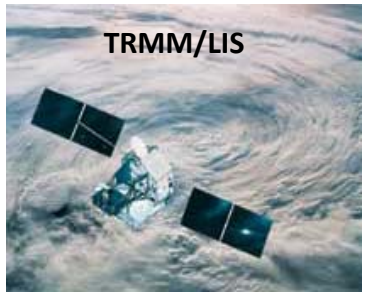
Overarching Objectives:

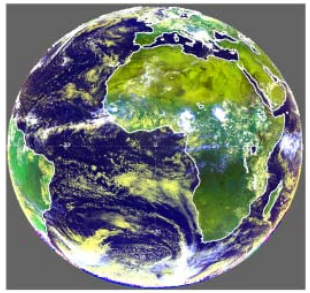
- CHUVA- ("*C*loud processes of t*H*e main precipitation systems in Brazil: A contrib*U*tion to cloud resol*V*ing modeling and to the GPM (Glob*A*l Precipitation Measurement)")
- Cloud precipitation and electrification processes, GLM proxy data

Collaboration with GOES-R Geostationary Lightning Mapper (GLM) Science Team, INPE (CPTEC/USP, ELAT), and EUMETSAT MTG Lightning Imager Science Team

Key Scientific Measurements:

VHF 3-D Lightning Mapping Array (LMA), LINET, TRMM/LIS, MSG SEVERI (ABI proxy data), high speed digital video, VLF lightning networks, dual-pol radar, electric field-change, ancillary meteorological data





MSG/SEVERI

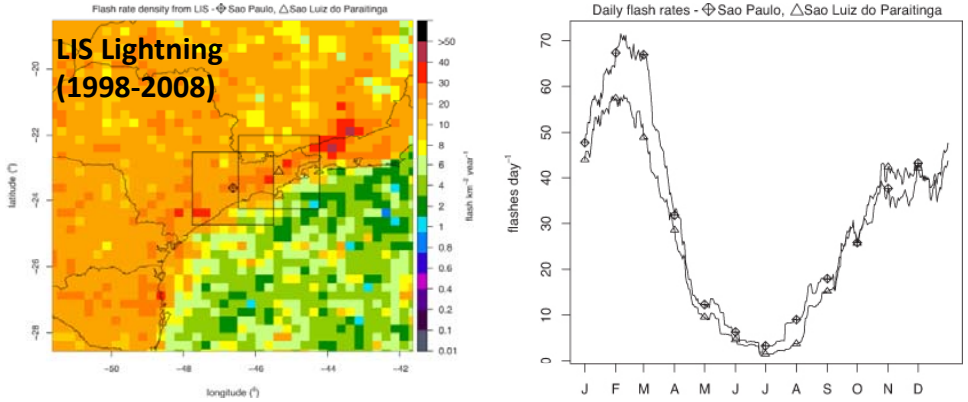


Figure 1 – (a) Lightning flash rate density (fl km^{-2} yr^{-1}) for Southeast Brazil. (b) Daily flash rate (flashes per day) around São Paulo and São Luiz do Paraitinga (flash rate for black squares (2 ¼º) around these cities). Lightning data is from LIS climatology from 1 January 1998 to 31 December 2008 in ¼º resolution.

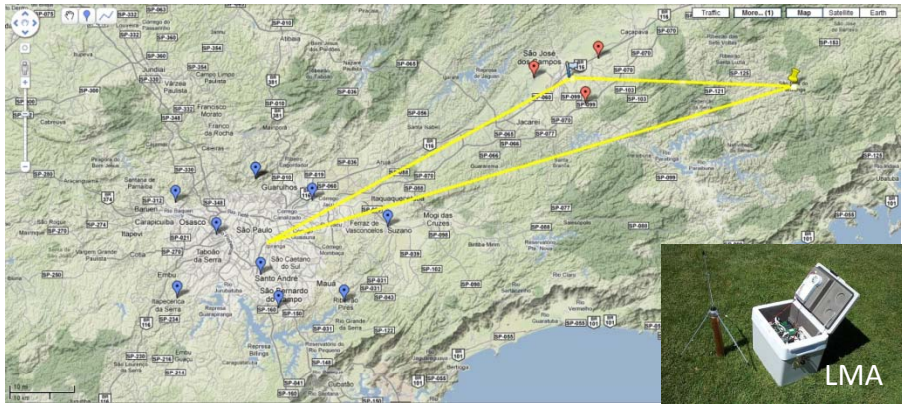
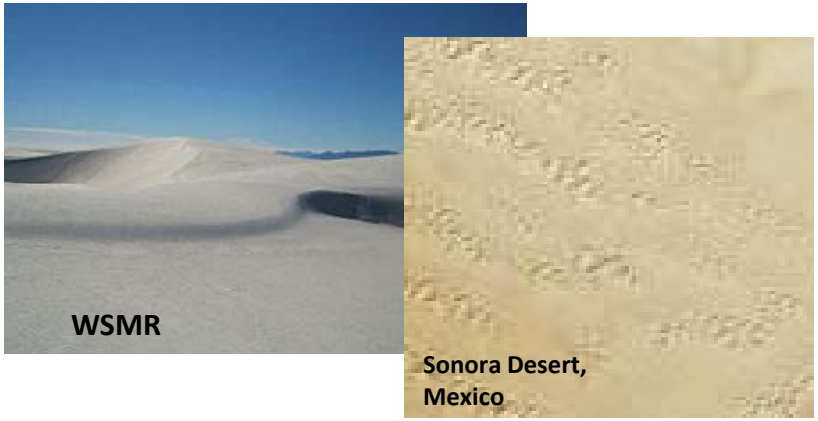


Figure 2 – Blue balloons show preliminary configuration for the SPLMA network for CHUVA. The red balloons show a second network configuration, centered at INPE (Sao Jose dos Campos). Yellow "push pin" is the São Luiz do Paraitinga CHUVA IOP site.

ABI Vicarious Calibration for L1B Validation and Verification

- **Dates:** **Spring 2011**
- **Location:** White Sands Missile Range (WSMR), NM and Sonora Desert, Mexico
- **Overarching Objectives:**
  - » *Vicarious calibration of GOES-R ABI and GLM for the purpose of long-term monitoring and L1b validation and verification*
  - » *These sites are not perfect Lambertian surfaces, thus*
    - ❖ *Seasonal variability of reflectance is introduced into long-term reflectance time series*
    - ❖ *This variability cannot be removed objectively without knowledge of the surface BRDF characteristics*
    - ❖ *Airborne radiometeric measurements taken over these sites over the course of a diurnal cycle can allow BRDF to be estimated, which can be used to correct anomalies in reflectance times series*



- » *WSMR and Sonora Desert BRDF to be measured in Spring 2011 using ER-2 airborne radiometers – Advanced Visible Infrared Imaging Spectrometer (AVIRIS), MODIS/ASTER Airborne Simulator (MASTER), and NPOESS Airborne Simulator Testbed – Interferometer (NAST-I).*
- » *Flight plans coordinated with NASA Dryden ER-2 team, Mexican Government and WSMR, as well as with MODIS and/or AVHRR instrument underpasses*
- » *WSMR flight support gained from NASA's AERONET facility at WSMR, and Forecast and weather data support from El Paso, Texas NWS Line Office*

NASA-DOE Mid-Latitude Continental Clouds Experiment: MC3E

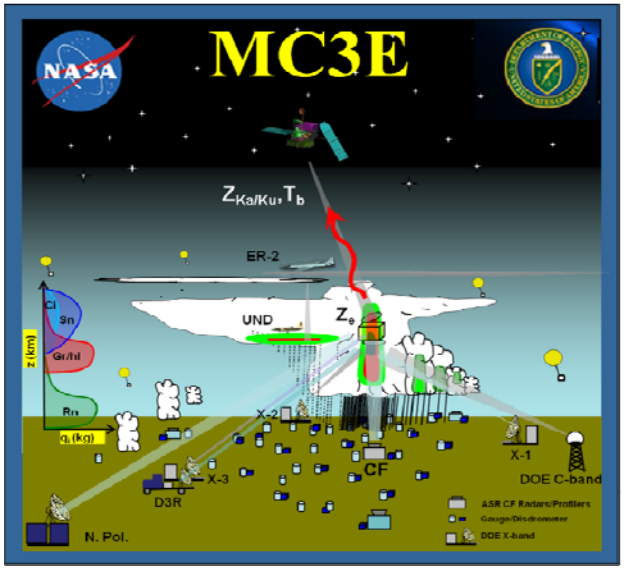
Dates: **15 April – 1 June 2011**

Location: DOE-SGP Central Facility (Ponca City)

Overarching Objectives:

GPM: **Improved rainfall retrievals over mid-latitude land surfaces**

DOE: **Improved simulation of convective cloud properties** (initiation, dynamics, microphysics)



Platforms:

Aircraft (ER-2; HIWRAP, AMPR, COSMIR), Citation (microphysics)

Dual-pol radars -S/C/X/Ku-Ka/W;

Profilers- S/UHF-band, **Disdrometer/rain gauge**

networks; SGP **Flux/Meteo/Radiation**, VHF **LMA, Soundings**

Topics:

1. Multi-platform description of precipitation dynamics/microphysics
2. Dual-frequency PIA, melting layer/mixed phase, and retrievals of DSD
3. Isolation of precipitation from well-characterized surface in radiometer algorithms
4. Regime variability and retrieval algorithm physical-assumptions
5. Consistency of/unified approaches to multi-platform retrievals of DSD
6. Coupled CRM/LSM/RTM validation

NASA-EC ColdEX (GPM Campaign)

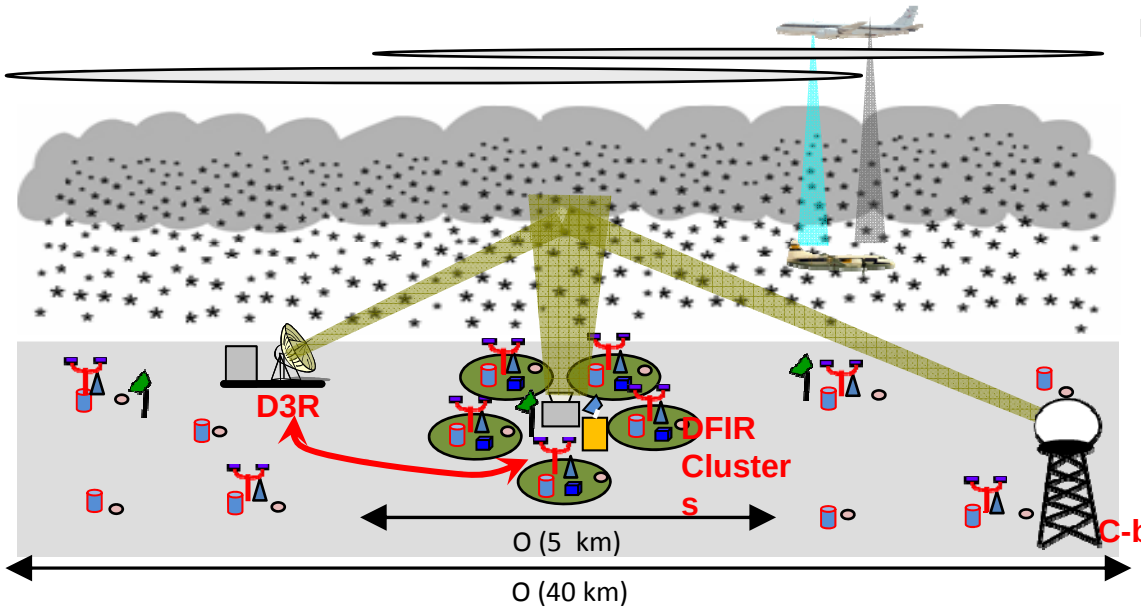
Dates: ~15 Jan. – 29 Feb, 2012

Location: Canadian CARE Site(Hudson Bay/Toronto)

Overarching Objectives:

1. **Quantify retrieval sensitivities to snow physical characteristics, land surface behavior, and tropospheric T/Q profiles.**
2. **Define snowfall bulk and particle physics/process in column as related to microwave extinction properties**
3. **Improve model databases for forward modeling and retrieval development.**
4. **Collect measurements for EC, CSA studies related to PPM/SnowSat**

Location: Env. Canada, Ontario, CARE site:



- **Regimes:** Synoptic and lake-effect snow
- **Platforms:** DC-8, Citation, C/Ka-Ku dual-pol radars, X/W/S vertically pointing radars, disdrometer/ gauge clusters, L-Band snowpack sensors

Deep Convective Clouds and Chemistry Experiment (DC-3)

Dates: May-July 2012

Location: Colorado, Oklahoma, Alabama

Overarching Objectives:

1. Characterize convective transports of fresh emissions and water to the upper troposphere within the first few hours of active convection;
2. Investigate storm dynamics and physics including lightning, and lightning-production of NOx, cloud hydrometeors scavenging of chemical species, surface emission variability, and anvil chemistry
3. Quantify convectively-driven changes in chemistry and composition in the upper troposphere

Locations (Multiple):

1. NE Colorado
2. Central Oklahoma
3. Northern Alabama

Platforms:

1. NSF G-V, NASA DC-8 (Cloud Chemistry, Microphysics, Inflow properties)
2. CSU-CHILL, KOUN, SMART-R, NO-XP, ARMOR, MAX dual-polarimetric radars
3. VHF Lightning Mapping Arrays in CO, OK, AL; Field change network (AL)