

Retrospective Forcing and Near Real-Time Forcing in the South American LDAS

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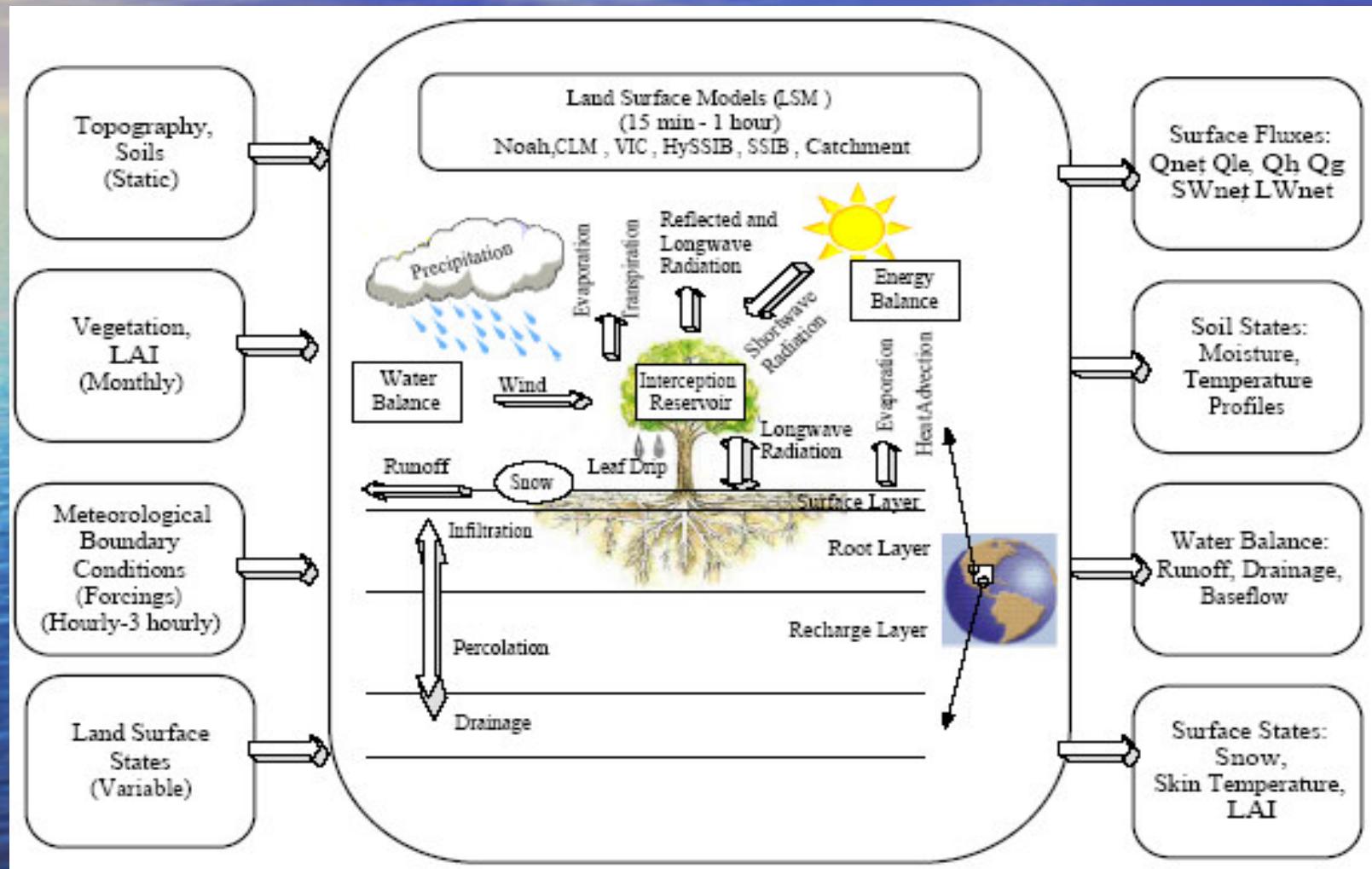


Background

- SALDAS project seeks to provide accurate, near-real-time and retrospective land surface states over South America
- Quality of land surface model (LSM) output is closely tied to the quality of the meteorological forcing data used to drive the model
- Model and observation-based data used to create high-quality forcing data used by NOAH, SSiB, SiB2 and CLM LSMs
 - Retrospective (2000-2004, CPTEC)
 - Real-time (2002-Present, CPTEC)



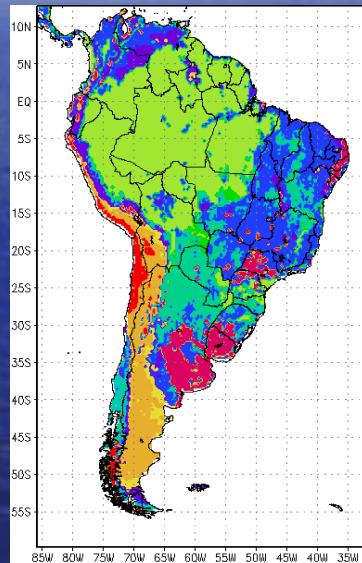
Background



Forcing Data Specifics

- 3-Hourly files
- 1/8th Degree (~12.5 km) over Equator

SALDAS Domain



- GRIB format
- C-shell scripts, Fortran programs used to automatically generate and archive forcing
- Quality controlled, adjusted for terrain height
- 15 Model and observation-based fields



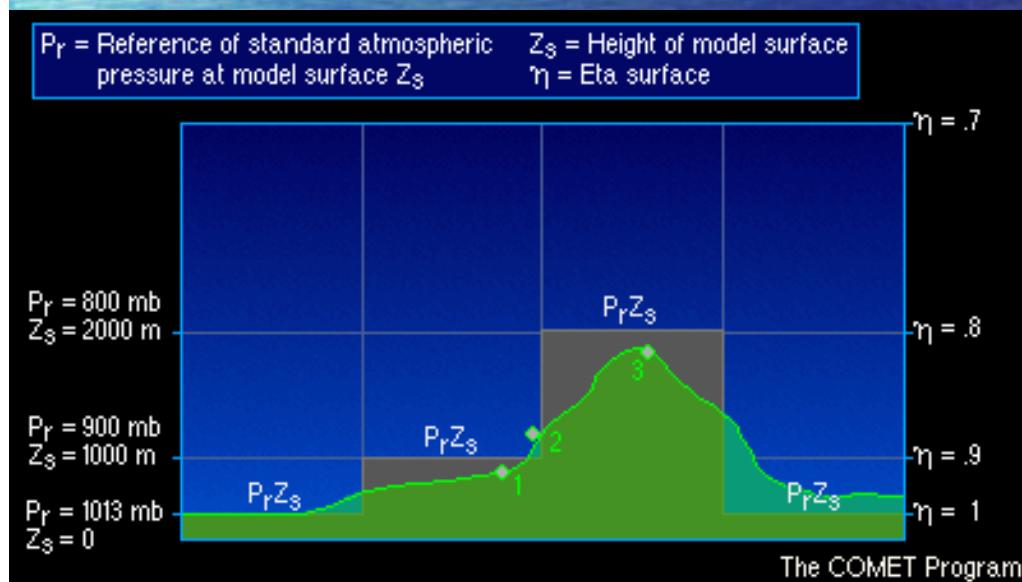
Atmospheric Forcing Fields

- Model-Based Estimates of Standard Climate Station Data
 - Temperature (2 m assuming grass)
 - Specific Humidity (2 m assuming grass)
 - U East-West Wind Component (10 m assuming grass)
 - V North-South Wind Component (10 m assuming grass)
 - Surface Pressure (0 m assuming grass)
- Observation-Based Data
 - Downward Shortwave Radiation
 - Precipitation



Atmospheric Forcing Fields

- Model-Based Estimates of Above Ground Data
 - Temperature
 - Specific Humidity
 - U East-West Wind Component
 - V North-South Wind Component
 - Surface Pressure
 - Downward Longwave Radiation
 - Height, h , above ground at which data applies
 - Altitude assumed for location



- ETA coordinate represents topography as steps



Forcing File Creation

CPTEC ETA South American Regional Reanalysis SARR
CPTEC ETA Operational Data Assimilation System ODAS

- Observations not always available, so CPTEC/SARR and CPTEC/ODAS data used as base

Current stage:

SARR, 6 hourly, 40km, 2000-2004 (*planned 1979-2007 20Km*)

Next step:

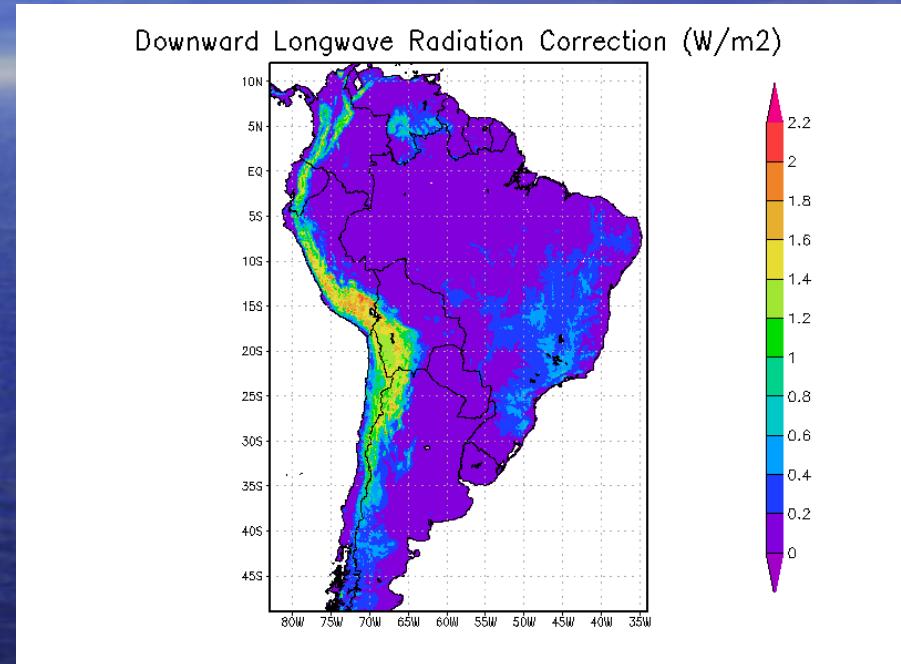
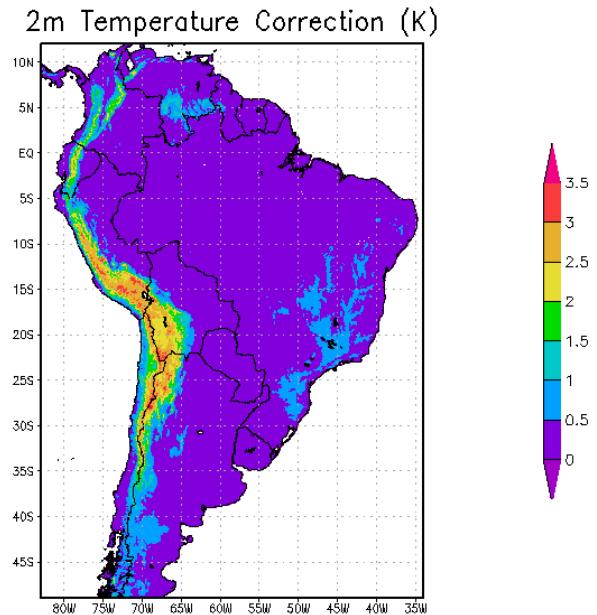
ODAS, 6 hourly, 20km,

- Spatially interpolated to 1/8th degree
- Temporally interpolated to 3-hourly data
- To be quality controlled using ALMA ranges



Terrain Height Adjustment

- ETA temperature, pressure, humidity and longwave radiation adjusted for differences in ETA versus LDAS terrain height



- Temperature and pressure corrected using standard lapse rate
- Specific humidity and longwave radiation corrected by holding relative humidity constant



Observations

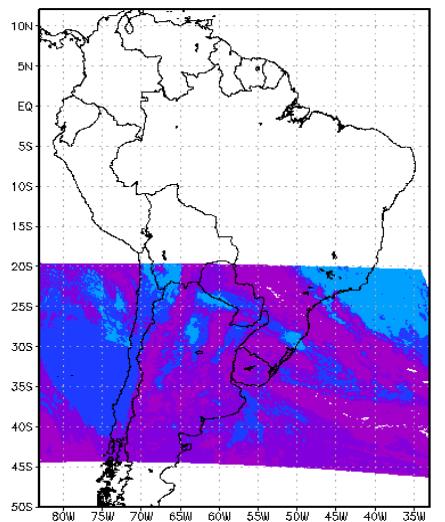
- Model-based data subject to model error, so observations used when possible
- Radiation
 - GOES-CPTEC downward shortwave
 - GOES-CPTEC PAR (not implemented yet)
 - GOES-CPTEC skin temperature (not implemented yet)
- Precipitation
 - TRMM 3B42
 - GPCC + CPTEC/INMET surface observations



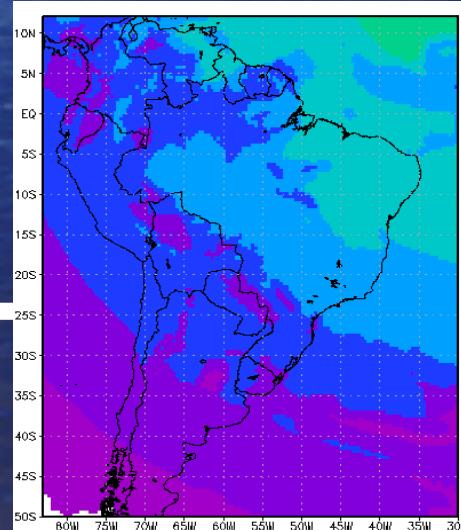
Observed Radiation

- GOES data processed at CPTEC/DSA (Divisao de Satelites Ambientais: Environmental Satellites Division) to create 1/25 degree, hourly, instantaneous surface downward shortwave radiation, PAR and skin temperature fields
 - Interpolated to 1/8th degree
- GOES shortwave radiation is zenith angle corrected, used in place of ETA data when possible

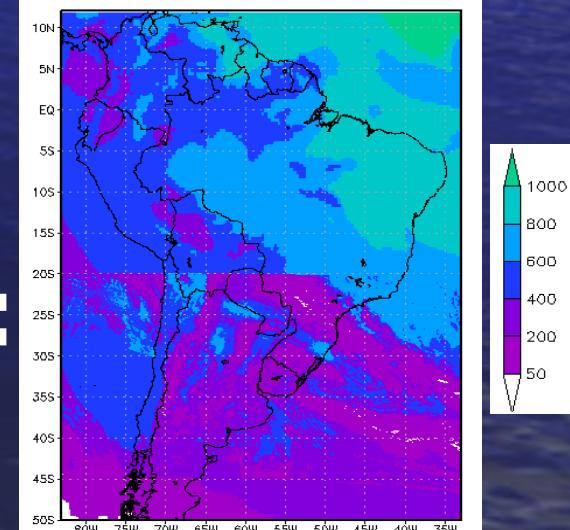
**GL 1.2 GOES downward
shortwave radiation
(W/m²)**



**SARR downward
shortwave radiation
(W/m²)**

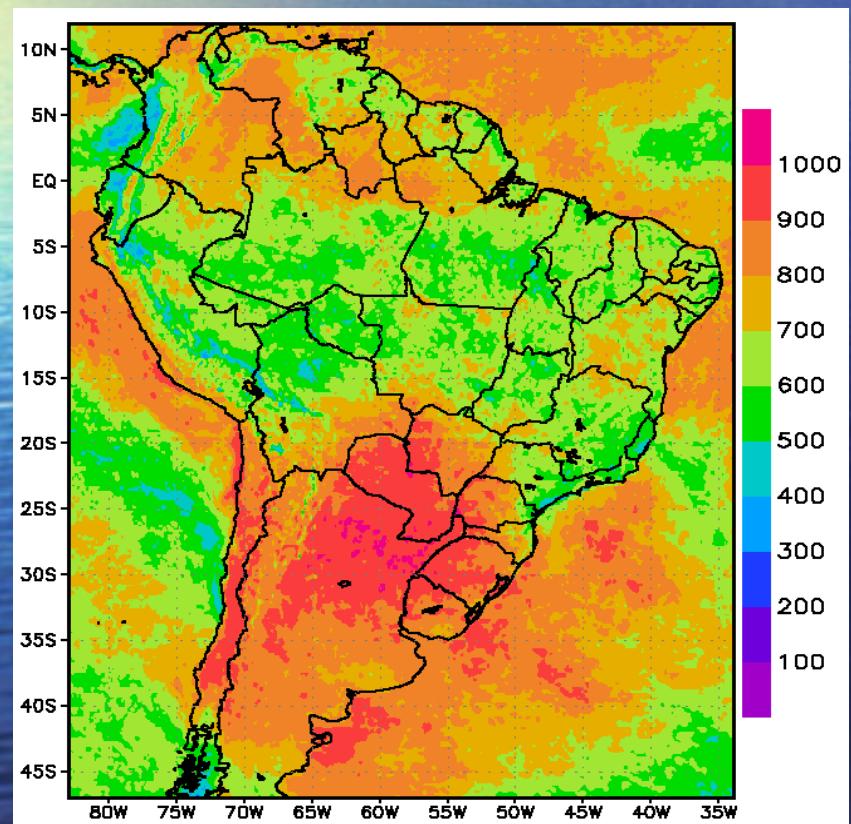


**Merged SALDAS
downward shortwave
radiation (W/m²)**

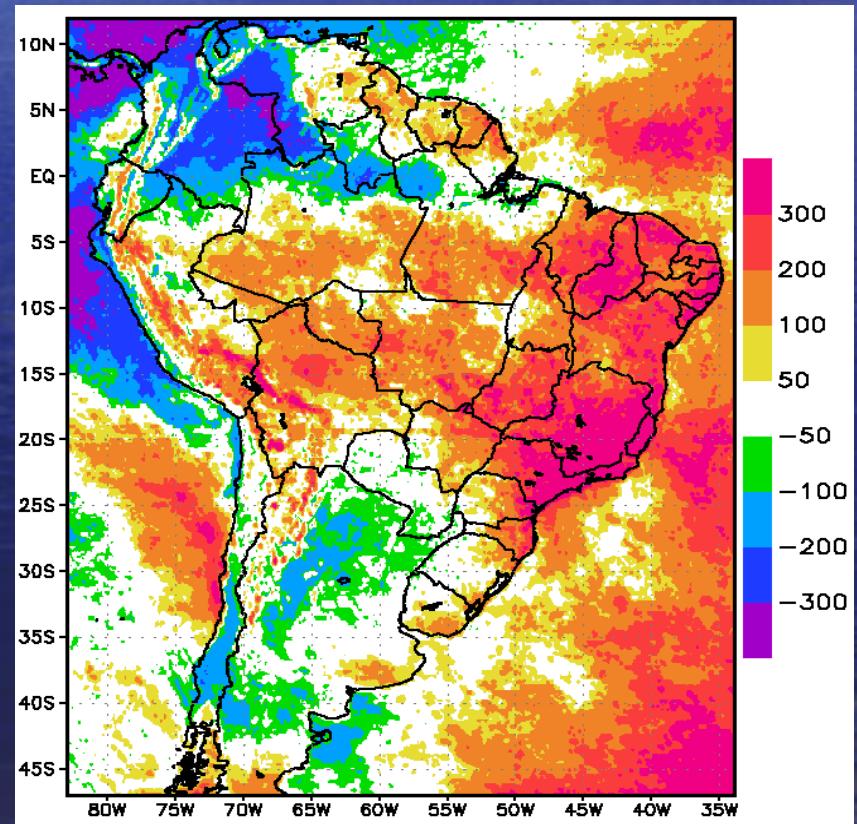


Observed Radiation

Mean GL1.2 (W/m^2)
15Z - January 2004

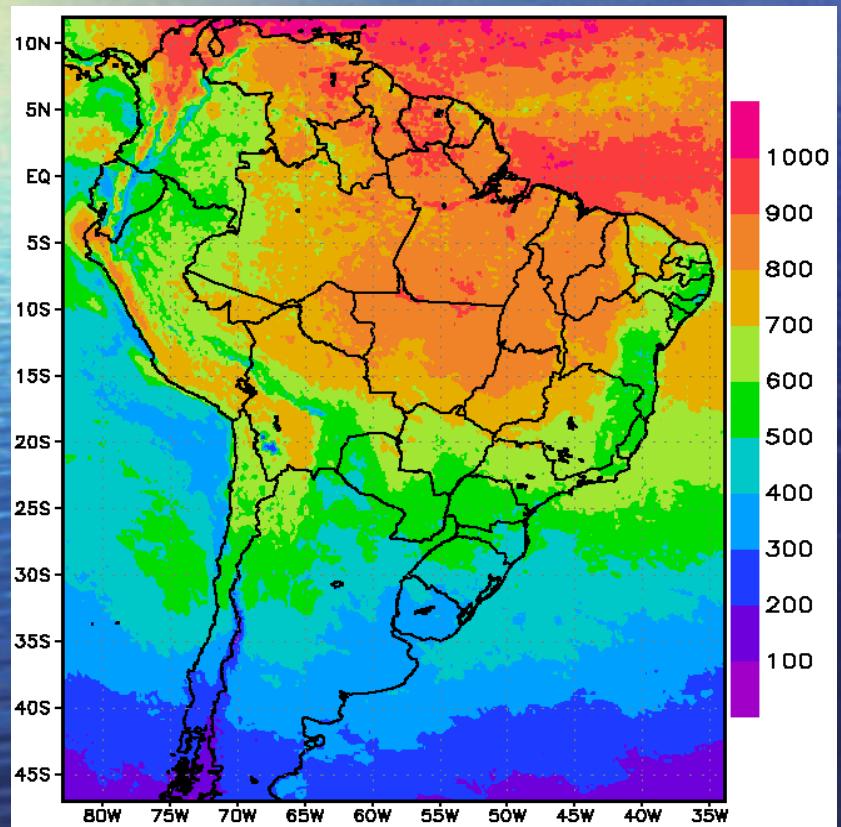


Mean difference
SARR - GL1.2 (W/m^2)
15Z - January 2004

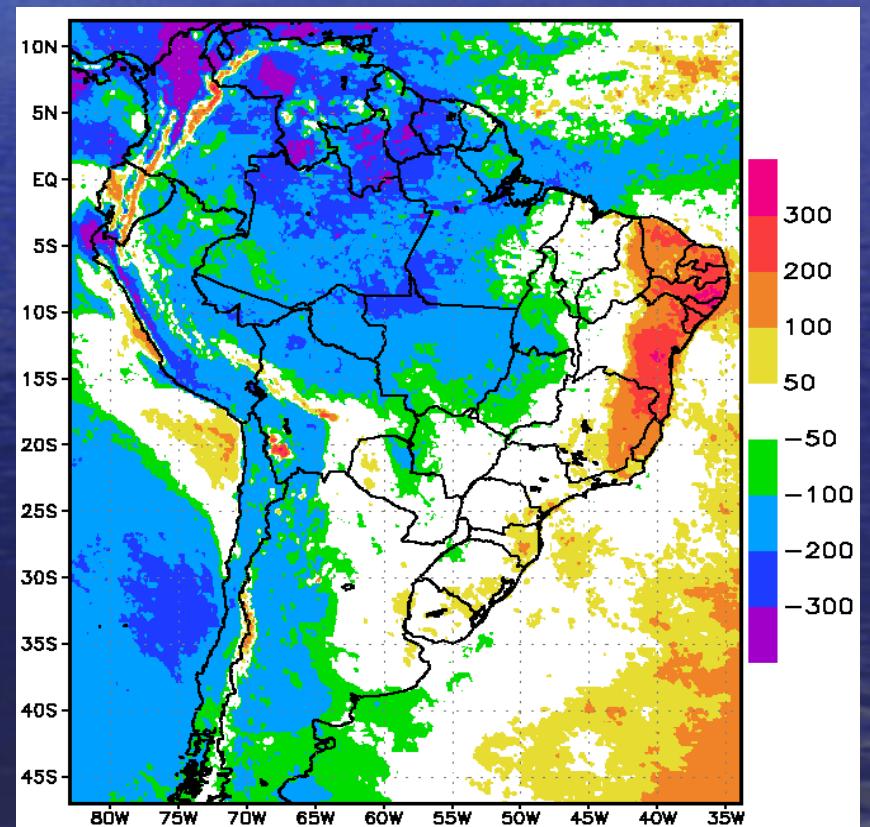


Observed Radiation

Mean GL1.2 (W/m²)
15Z - June 2004



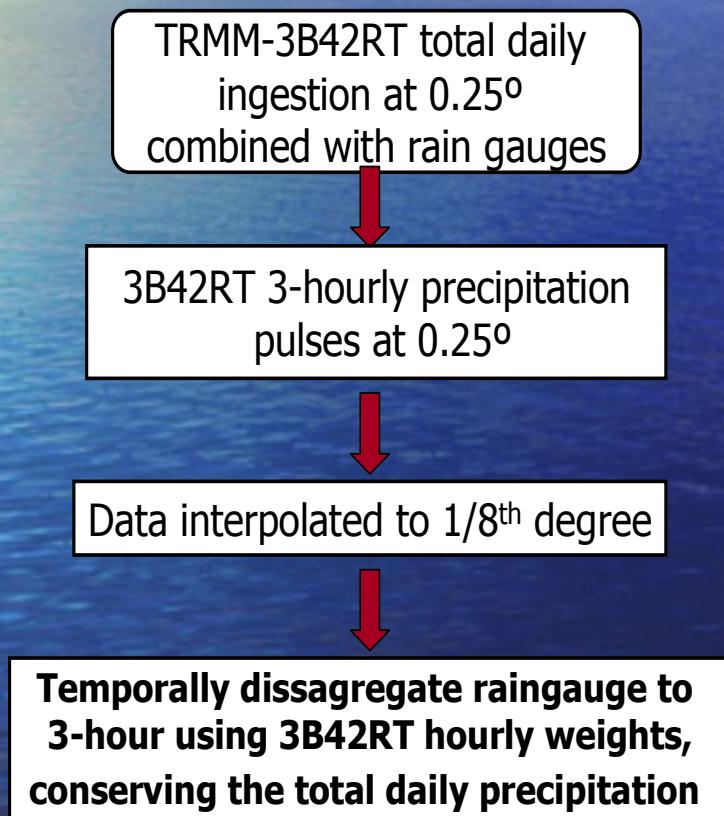
Mean difference
SARR - GL1.2 (W/m²)
15Z - June 2004



Precipitation

- Make use of TRMM and raingauges analysis data to form best available product—a temporally disaggregated 3-hourly value

Temporal Disaggregation Process



- **Description:** Use of rain gauge to correct satellite bias precipitation
- **Spatial Resolution:** 0.25 degree
- **Temporal Resolution:** total daily precipitation
- **Domain:** South America
- **Methodology:** Use TRMM sub-daily precipitation pulses to disaggregate the total daily amounts.

Note:

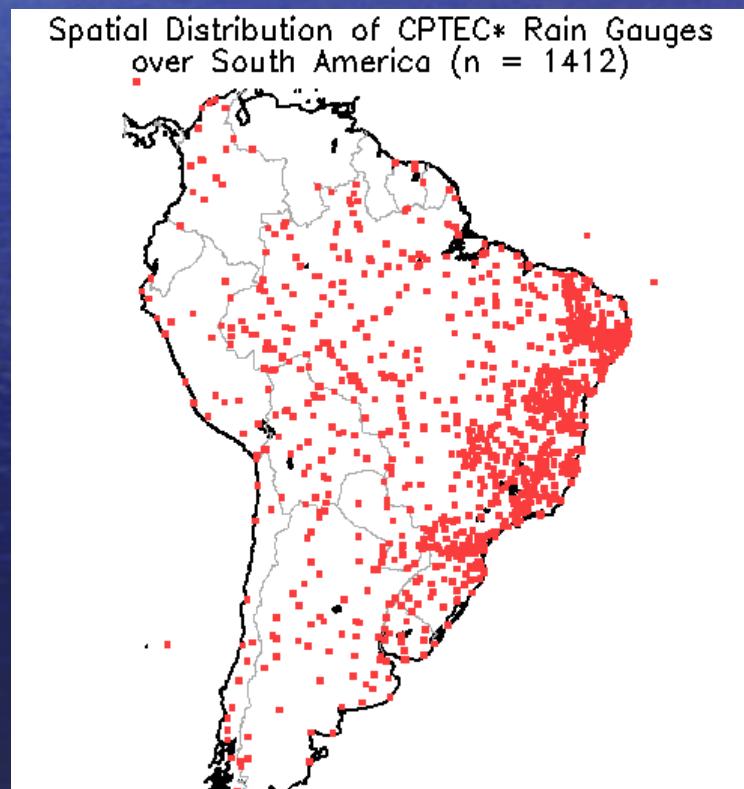
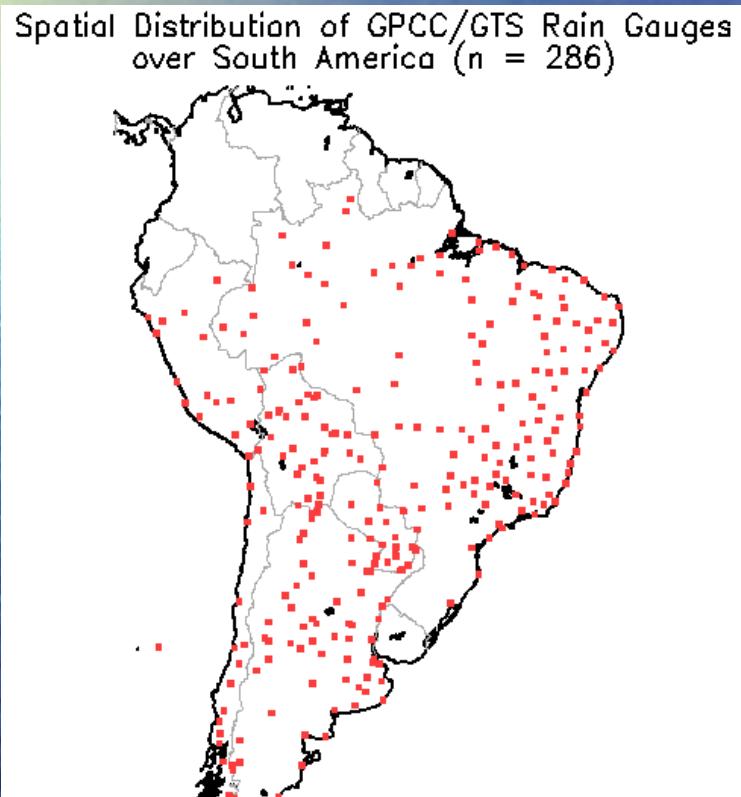
- 3B42RT data used to derive temporal disaggregation weights
- Sum of hourly data values equals original total daily TRMM/gauge



Precipitation

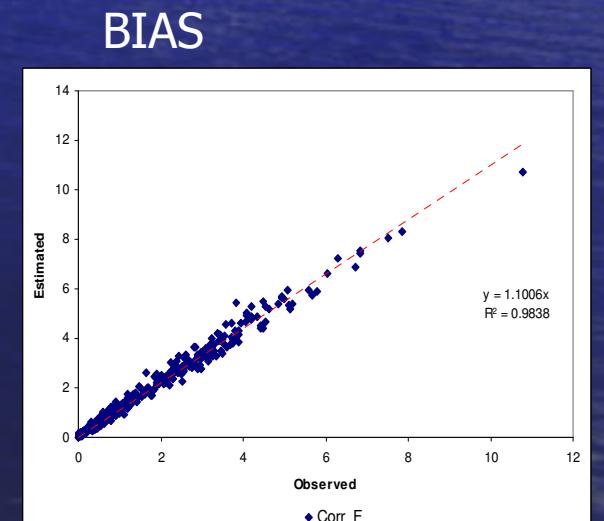
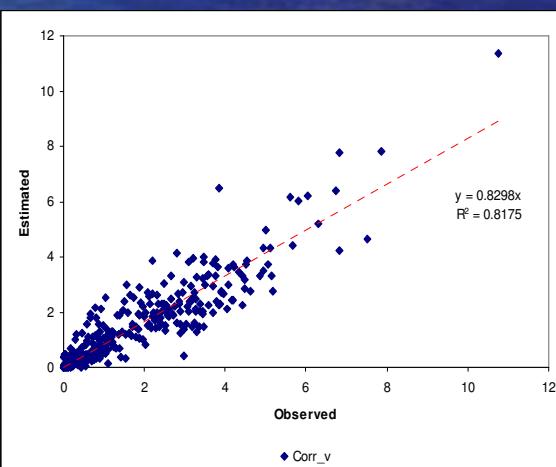
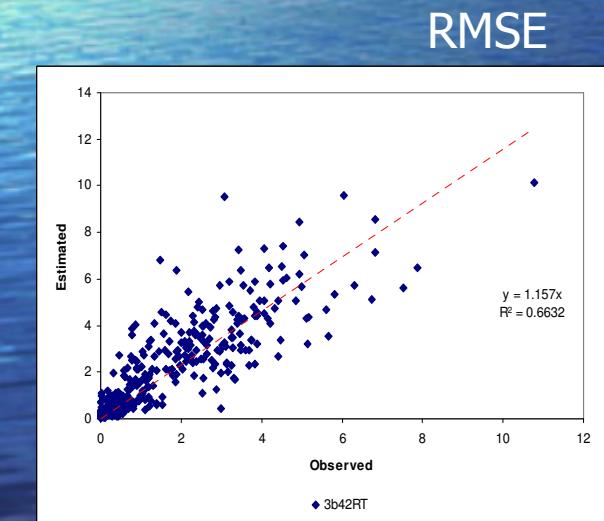
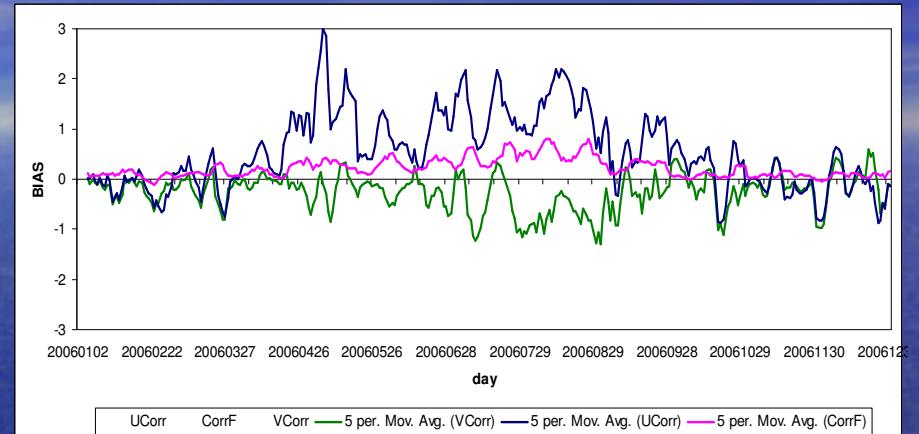
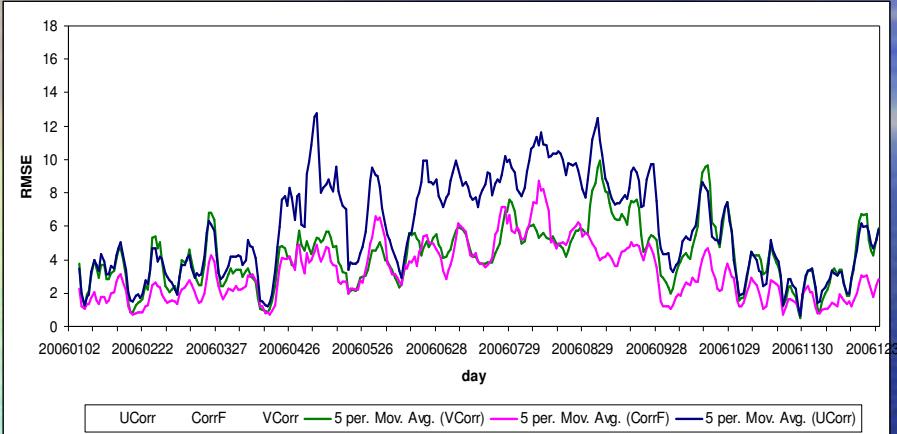
3B42V6 combines 3B42RT with GPCC observed precipitation at monthly scale

SALDAS precipitation combines 3B42RT with CPTEC observed precipitation (GPCC+ other South America sources) at daily scale



Precipitation validation

Cross Validation: 90% correction; 10% evaluation



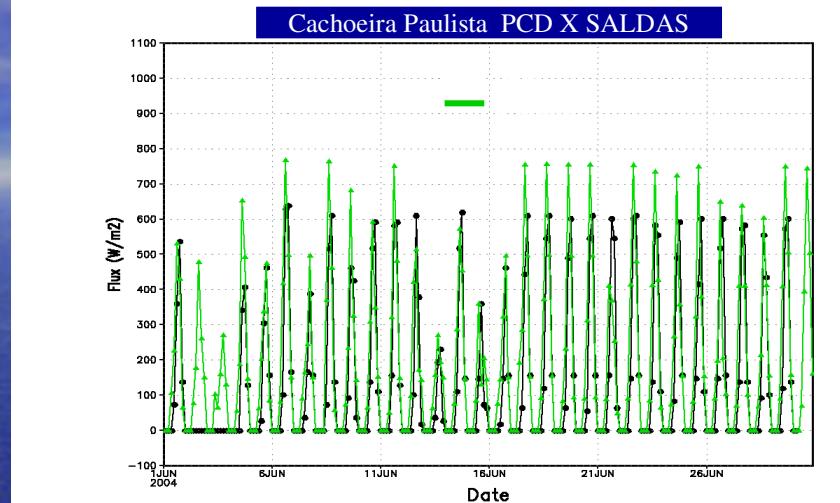
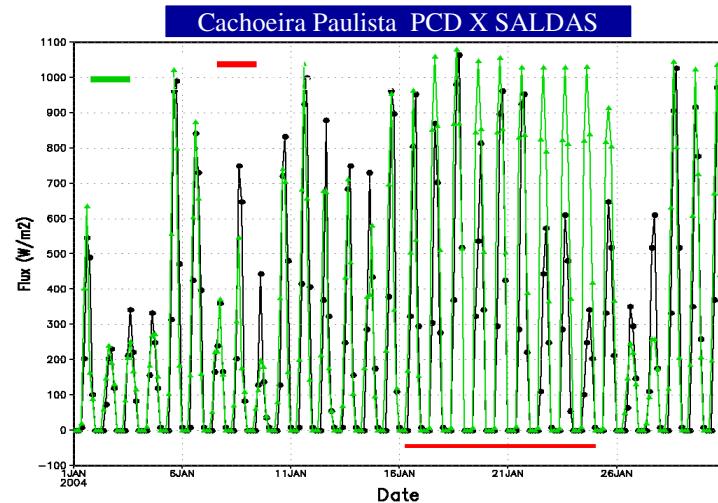
3B42RT

3B42V6

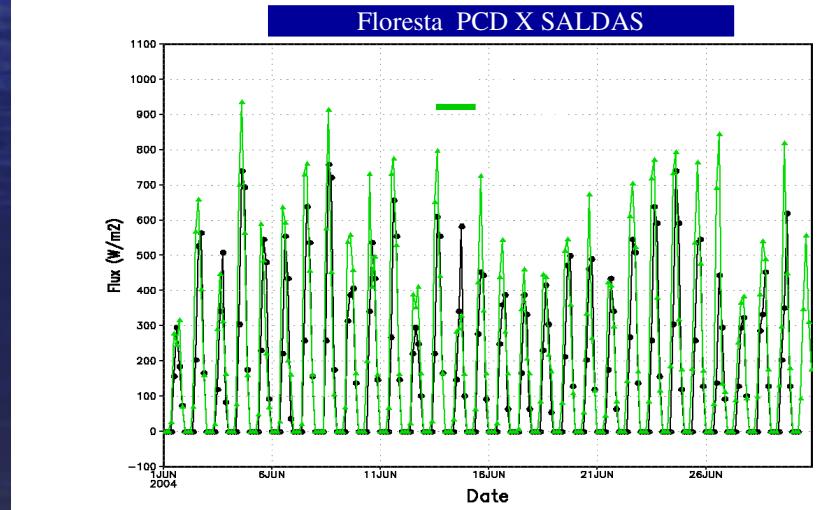
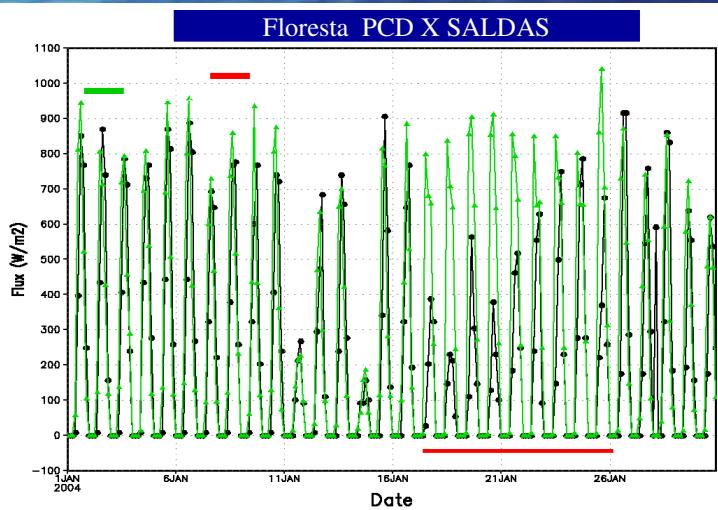
SALDAS PREC



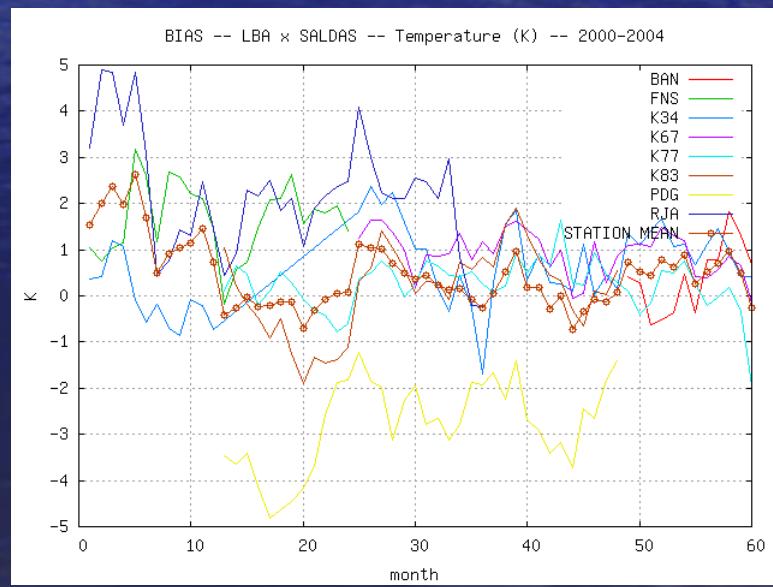
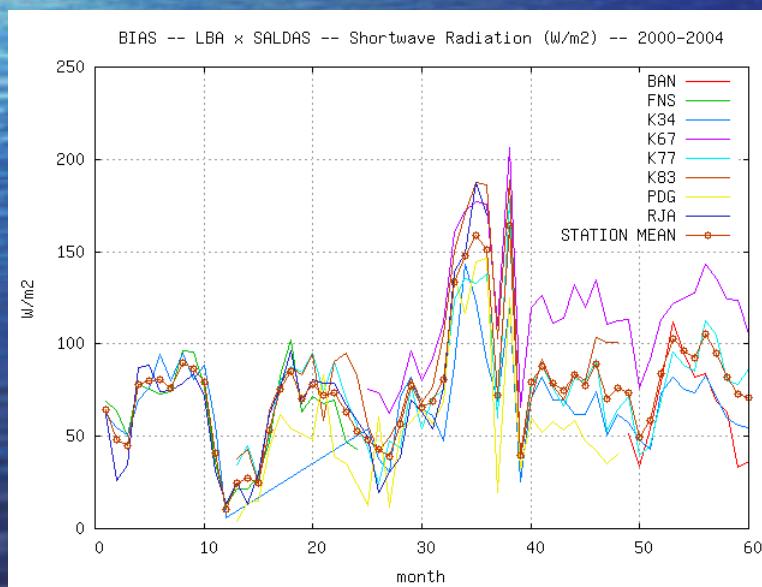
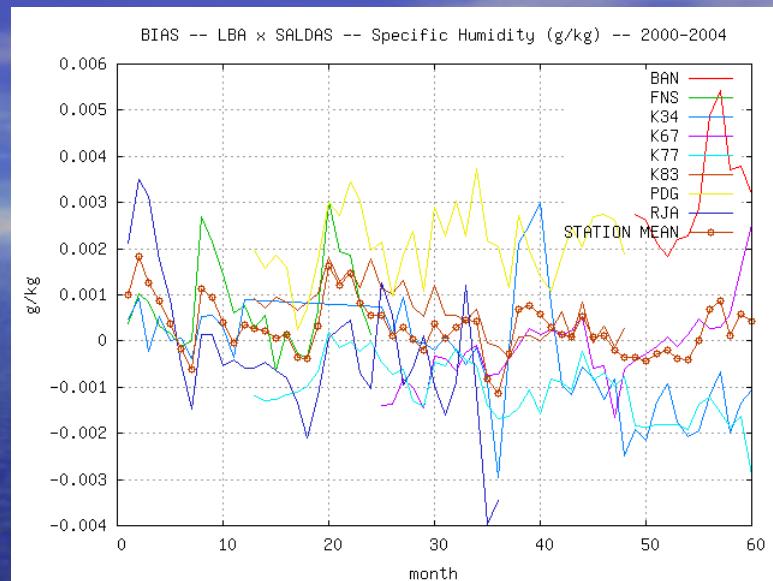
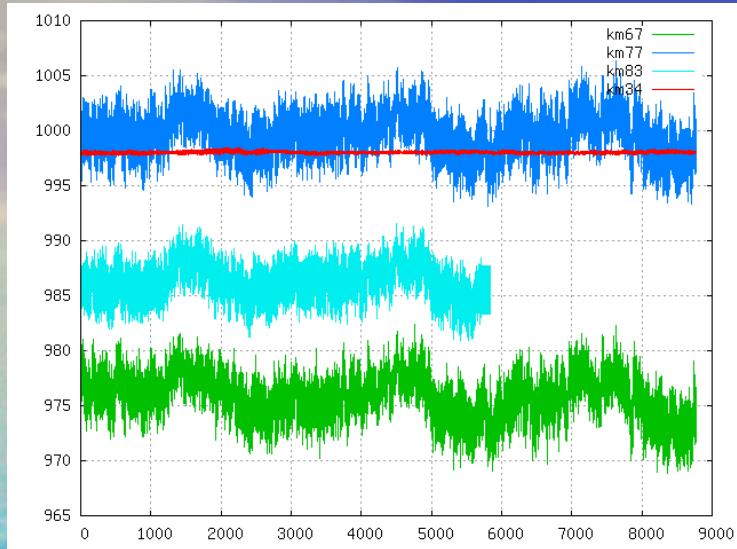
Radiation Validation Southeast Brazil - Humid Subtropical



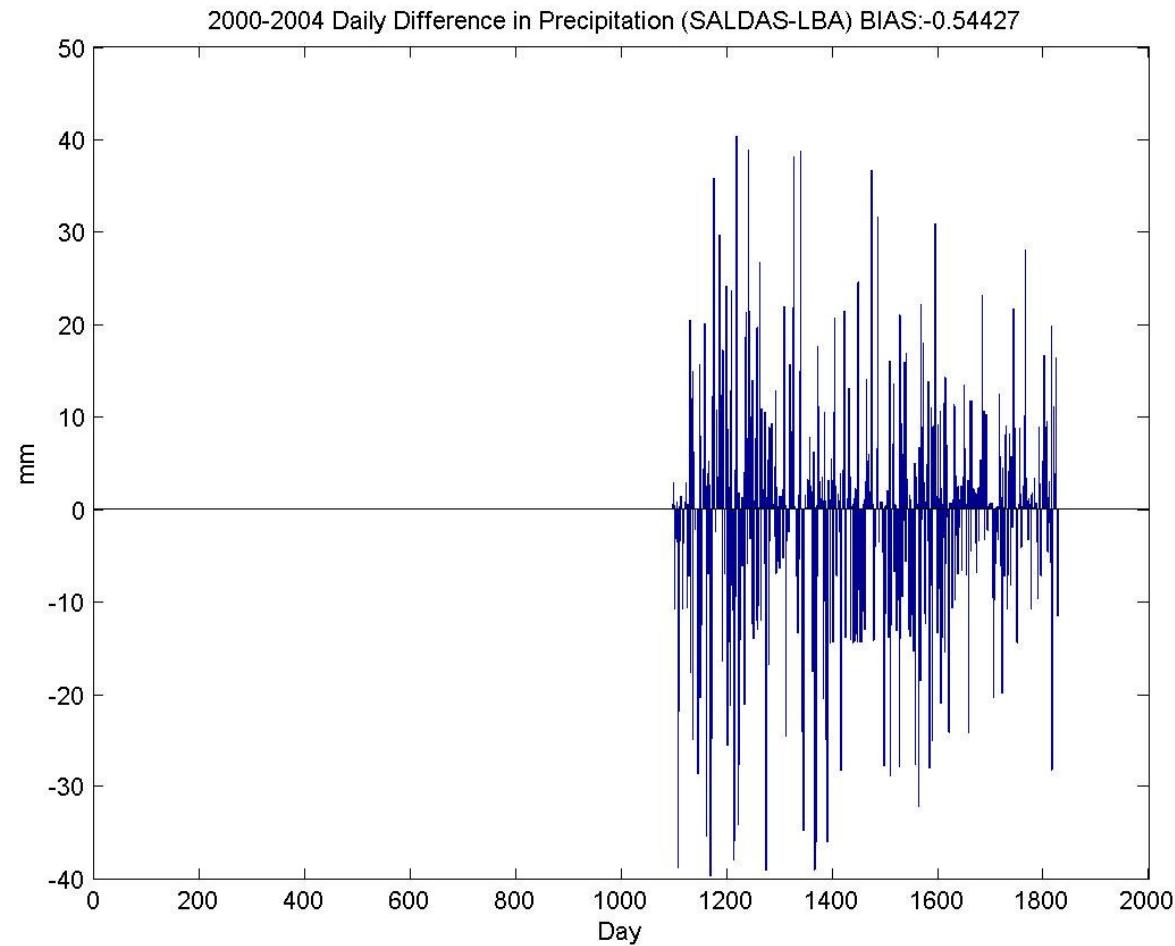
Northeast Brazil – Semi-arid



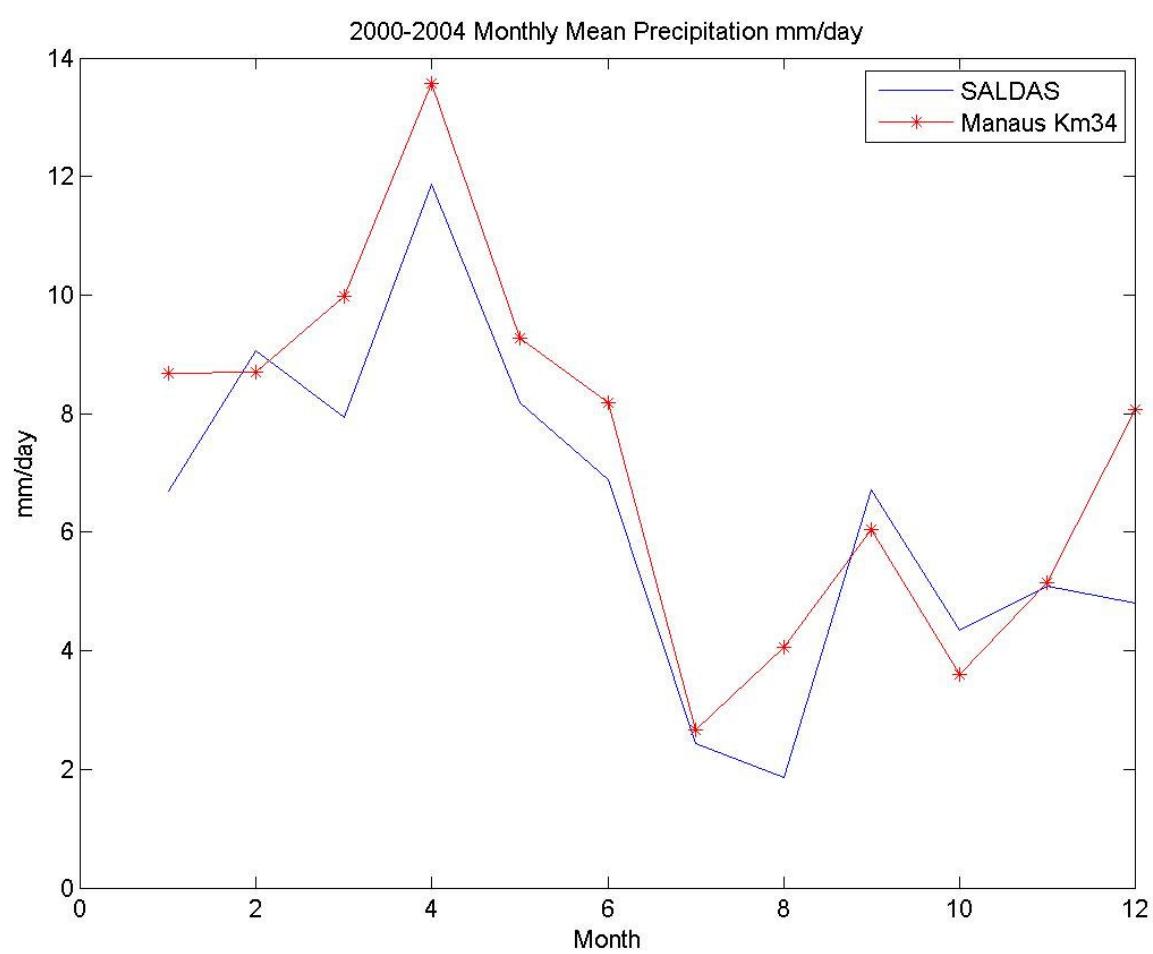
LBA Validation (P, q, SW, T)



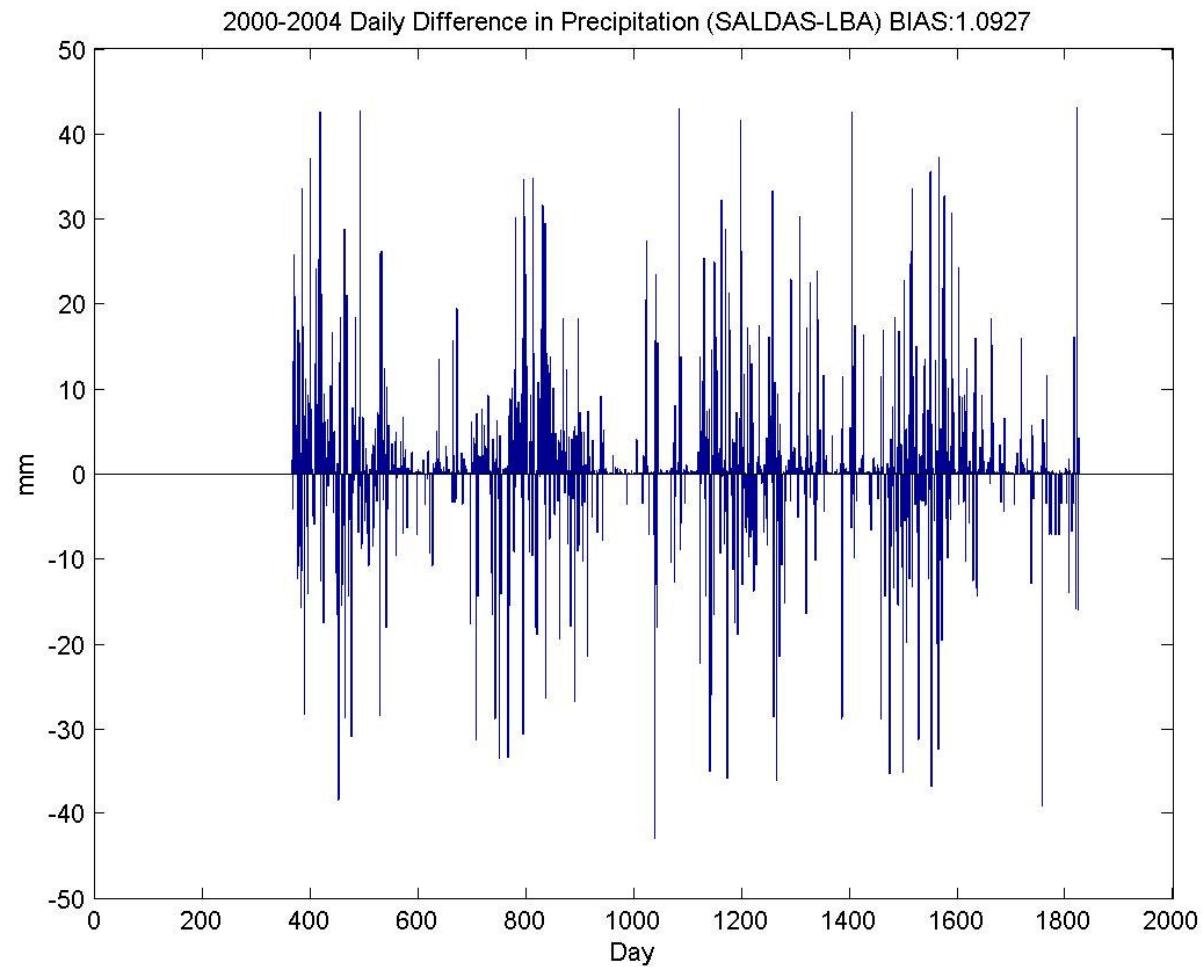
LBA Validation



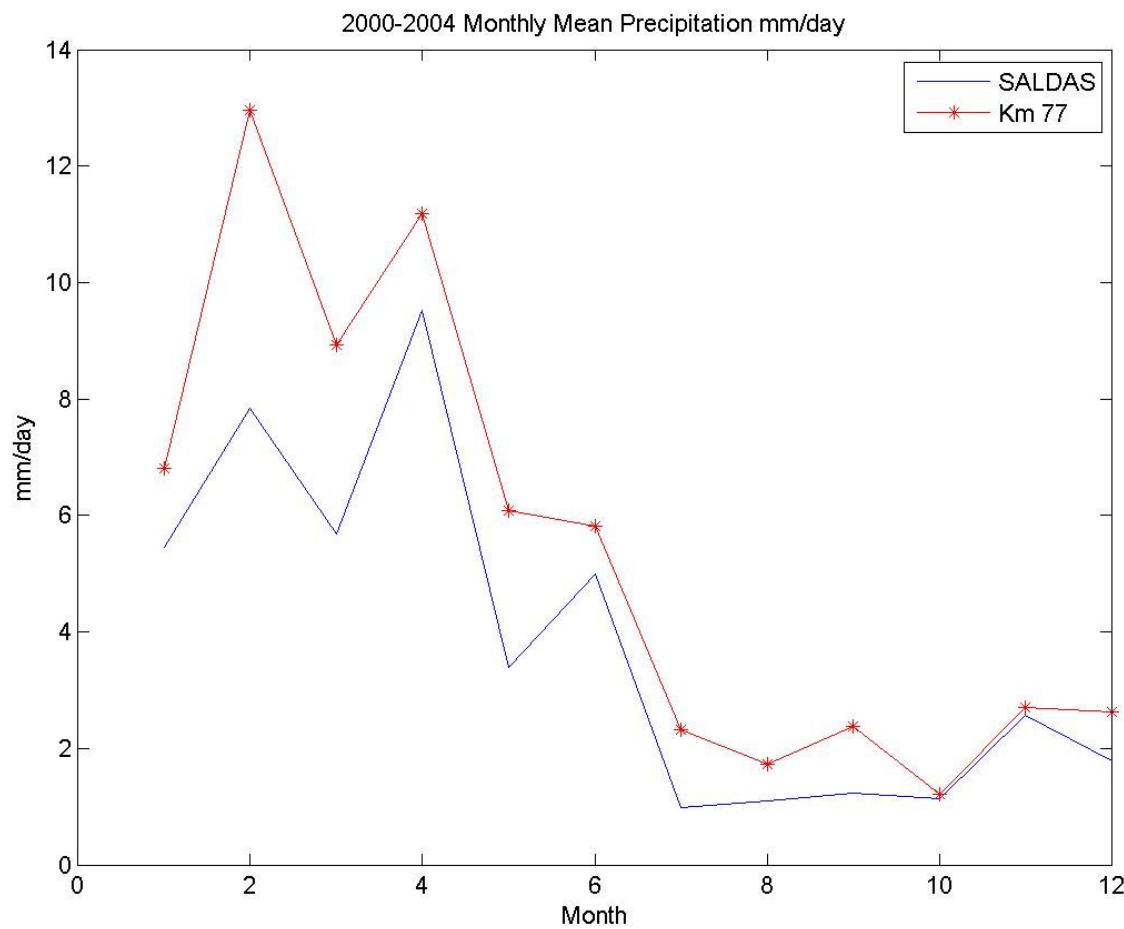
LBA Validation



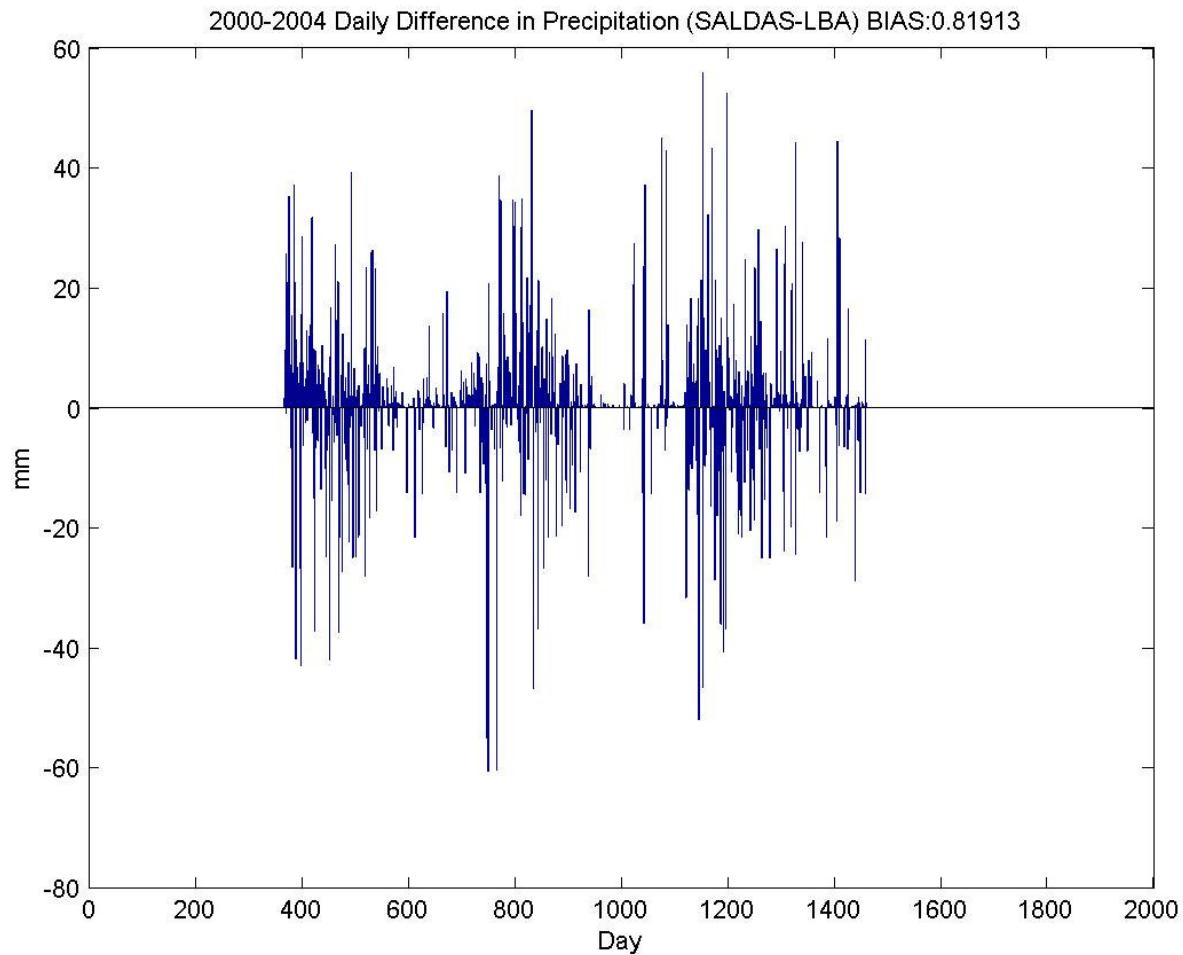
LBA Validation



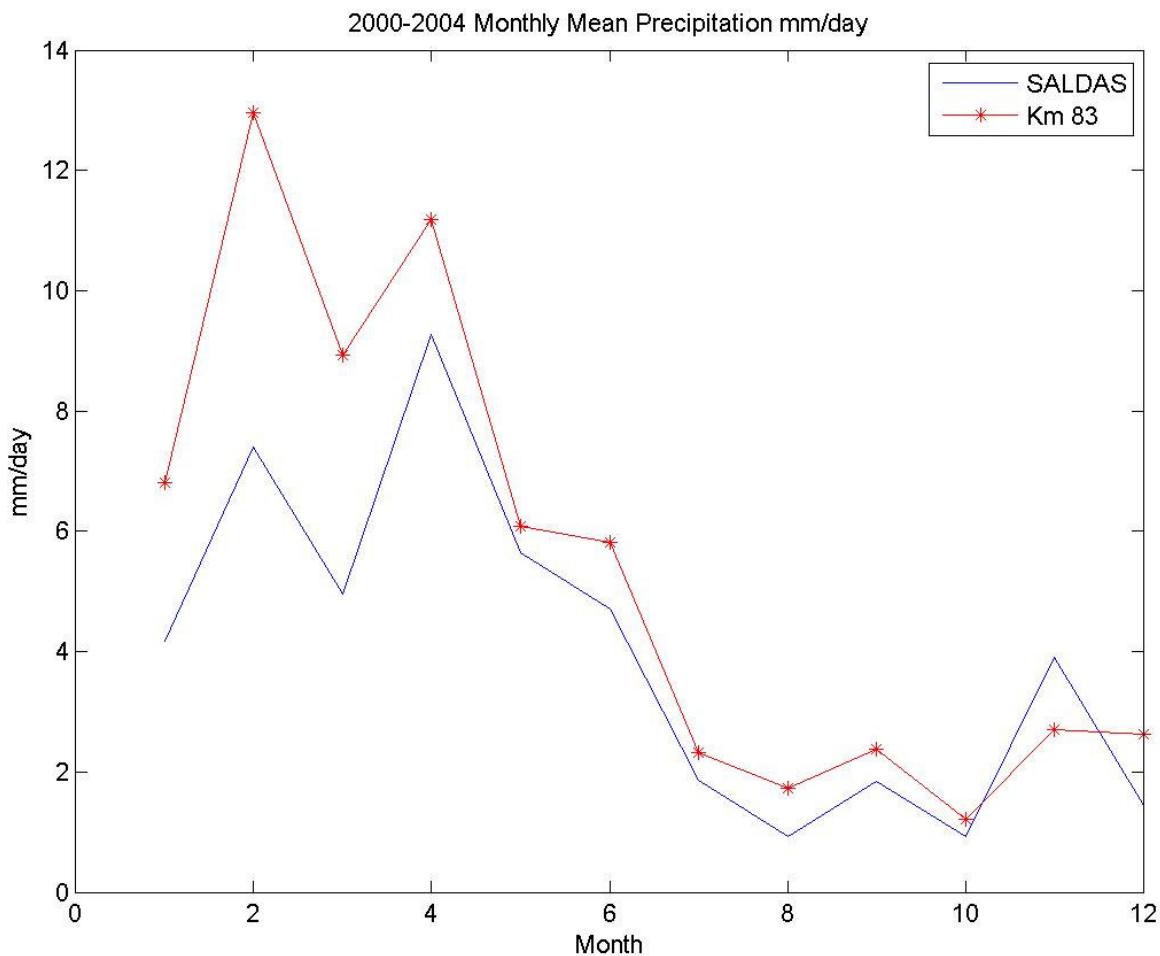
LBA Validation



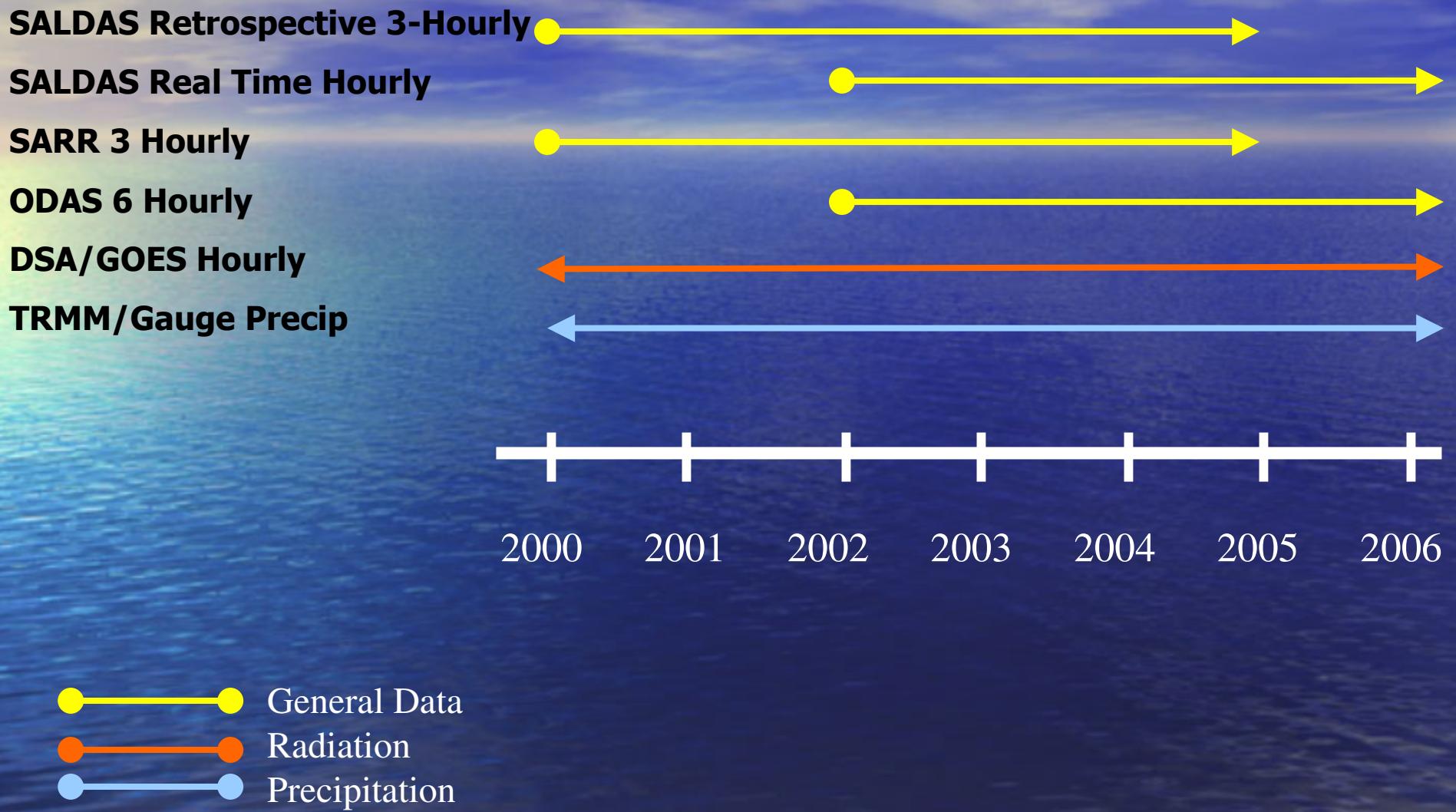
LBA Validation



LBA Validation



Forcing Data Archive



Summary

- Model and observation based data merged to create robust, accurate 1/8th degree 3-hourly forcing data set
 - CPTEC-SARR/ODAS/ETA data serves as base
 - CPTEC-DSA/GOES, TRMM/raingauge data used to augment data set
- Common set of forcing integral to SALDAS LSM intercomparisons (NOAH,SiB3,SSiB...)
- Five years archived, with continuing production
- Validation effort proceeding



Summary

- Current SARR based forcing need improvement over LBA region based upon tower observations:
 - Surf Pressure observations need attention
 - Specific humidity errors up to 0.004 g/Kg
 - Shortwave downward radiation average errors above 100 W/m² when GOES not present
 - Temperature average errors up to 3.5 K with slight decrease after 2002 due to inclusion of LBA campaigns datasets in the atmospheric data assimilation
 - SW is the only variable showing seasonal differences

