

Retrospective Forcing and Near Real-Time Forcing in the South American Land Data Assimilation System (SALDAS)

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South American Land Data Assimilation System (SALDAS)



Goal: combine local observations and parameters with NASA advanced hydrological modeling expertise and capabilities to improve Global and SA NWP, climate and water management through collaboration with various centers (government, universities and research institutes)











Background

- SALDAS project seeks to provide accurate, near-realtime 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, VIC, SiB2 and CLM LSMs
 - Retrospective (2000-2004, CPTEC)
 - Real-time (2002-Present, CPTEC)













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
- Specific Humidity
- U East-West Wind Component
- V North-South Wind Component
- Surface Pressure

(2 m assuming grass)
(2 m assuming grass)
(10 m assuming grass)
(10 m assuming grass)
(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 1979-2005*)
 Next step:
 ODAS, 3 and 6 hourly, 40km, 2002-present (*planned 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





- Corrections of up to 3.7K, 60hPa, 2.24W/m², 0.06 Kg/kg
- 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
 - CPC daily gauge data
 - Combined TRMM-raingauge
 - Sub daily automated surface stations network











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)











Observed Precipitation

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

> TRMM-3B42RT total daily ingestion at 0.25 degree combined with raingauges

SARR 3-hourly precipitation pulses at 40Km

Data interpolated to 1/8th degree

Temporally dissagregate raingauge to 3-hour using SARR hourly weights, conserving the total daily precipitation

Key Points:

*SARR data used only to derive temporal disaggregation weights *Sum of hourly data values equals original daily TRMM/auges total





Forcing Data Archive

SALDAS Retrospective 3-Hourly SALDAS Real Time Hourly SARR 3 Hourly ODAS 3 Hourly ODAS 6 Hourly DSA/GOES Hourly TRMM/gauge Precip



General Data Radiation Precipitation





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
- Five years archived, with continuing production
- Validation effort proceeding











Ongoing activities

An operational implementation of a land surface data assimilation into the CPTEC-INPE ETA/RPSAS atmospheric data assimilation cycle







Ongoing activities

High resolution satellite-based 1Km crop mapping over the LPB





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