A COLLABORATIVE EFFORT TO IMPROVE SURFACE RADIATIVE FORCING OVER THE AMAZON BASIN

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Abstract. To improve the understanding of the hydrological cycle in the Amazon region, information on radiative fluxes is needed for modeling and predicting the surface hydrological and energy budgets on time scales from diurnal to interannual, and on spatial scales as required by climate, meso-scale, and local scale models. Such information is also needed to improve surface parameterizations, and to test their implications for global climate and weather forecast models. Several groups at INPE and University of Maryland have been working on developing such capabilities.
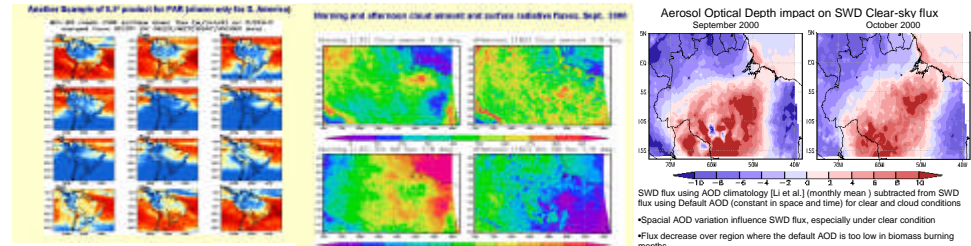
Ground observations for validation of radiation assessment are available under the support of the Brazilian Ministry of Science and Technology to CPTEC/INPE. They come from two networks of about 100 stations. Observations from SONDA will also be available. Large-Scale Biosphere-Atmosphere Experiment in Amazonia profits of operational data and campaign measurements. Intercomparison of the various SRB models and systematic storage of detailed time series of results is in progress.

At CPTEC-INPE, Cachoeira Paulista (DSA-CPTEC-INPE), a solar radiation model development effort in support of various climate research activities is in progress (Ceballos et al., 2004). These include soil water balance assessment in Brazil, evaluation of solar radiation forecast by the CPTEC ETA model and in ocean-atmosphere interaction. Basic products are hourly, daily and monthly (total and visible) mean irradiance over Brazil with spatial resolution of 0.04°, representative of about 12 km. Continuous readout of GOES 12 (formerly 8) Imager, NOAA-n and MODIS (Terra and Aqua) full-resolution imagery allows for operational satellite products generation and storage (1998-2005 interval for solar radiation estimates). Data released at URL http://satelite.cptec.inpe.br
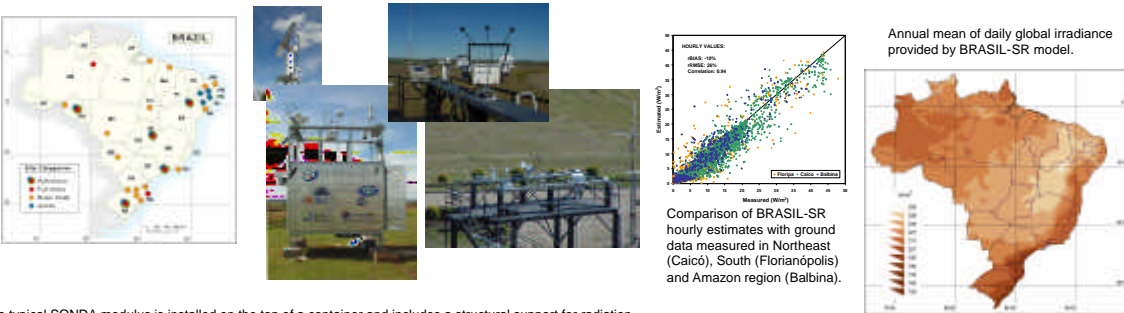
At the University of Maryland, under the LBA activity (R. T. Pinker), capabilities were developed to assess the surface spectral radiation budget at various spatial and temporal resolutions that meet climate modeling as well as high resolution hydrological modeling needs. Time scales range from hourly to monthly. Parameters provided at the surface and TOA are: total and diffuse short-wave fluxes, Photosynthetically Active Radiation (PAR), and Near-Infra-Red (NIR) radiation. About ten years at 0.50 for North and South America from GOES and METEOSAT using optimal interpolation techniques to merge the observations. Three years at 1/80 for the Amazon Basin from pixel level GOES data spanning three years during the LBA project. Results data are released at the URL http://www.atmos.umd.edu/~srb/lba/weblba.htm
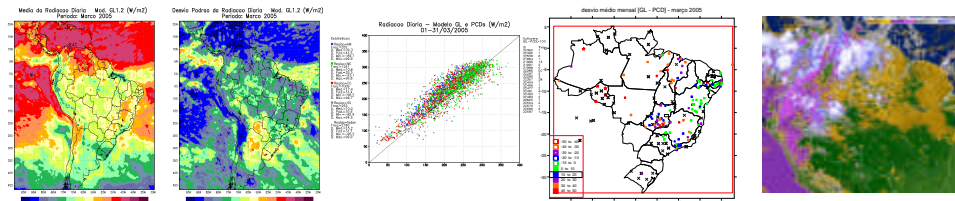
Model GL1.2: Daily global irradiance over South America (monthly mean and standard deviation of daily values). Comparison of daily values with a network of about 100 Brazilian automatic stations. Distribution of deviation of monthly mean related to network. **Last picture**: cloud classification in Amazon region, based on multispectral GOES imagery.

Aerosol Optical Depth impact on SWD Clear-sky flux
September 2000 — October 2000

SWD flux using AOD climatology [Li et al.] (monthly mean) subtracted from SWD flux using Default AOD (constant in space and time) for clear and cloud conditions
• Spacial AOD variation influence SWD flux, especially under clear condition
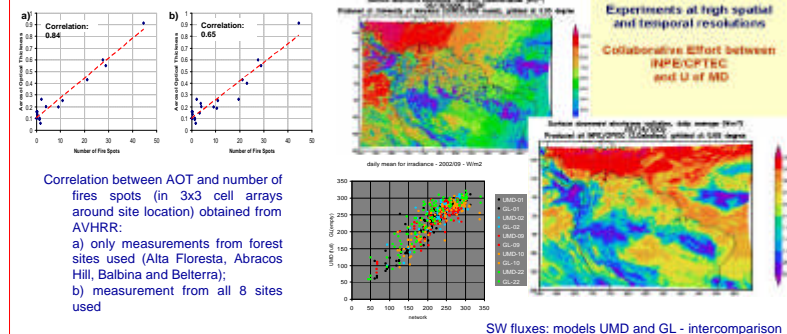• Flux decrease over region where the default AOD is too low in biomass burning months

The Latin America and Brazil component of the UNEP/GEF SWERA (Solar and Wind Energy resource Assessment) project is in progress under CPTEC coordination. It is aimed at the removal of information barriers on solar and wind resources in Brazil and other developing countries (Martins et al., 2005). In progress is also the SONDA project, which aims at establishing a ground network of solar, longwave, wind, and basic meteorological stations in Brazil with the objective of development and validation of atmospheric and satellite models. SONDA network is located in regions corresponding to different typical ecosystems and climates. Data released at URL : www.cptec.inpe.br/sonda/ and www.cpte.inpe.br/swera

Annual mean of daily global irradiance provided by BRASIL-SR model.

Comparison of BRASIL-SR hourly estimates with ground data measured in Northeast (Caicó), South (Florianópolis) and Amazon region (Balbina).

The typical SONDA modulus is installed on the top of a container and includes a structural support for radiation instruments, with a microcomputer, data logger and communication devices for collecting and managing the data. BSRN- and AERONET-associated instruments are also included.

Under the collaborative effort between the different institutions, work is in progress on:
• Improving models in terms of aerosol representation
• Development of large scale information on biomass burning
• Model evaluation against ground observations

Correlation between AOT and number of fires spots (in 3x3 cell arrays around site location) obtained from AVHRR:
a) only measurements from forest sites used (Alta Floresta, Abracos Hill, Balbina and Belterra);
b) measurement from all 8 sites used

SW fluxes: models UMD and GL - intercomparison

• Ceballos, J.C., M.J.Bottino and J.M. de Souza. 2004. A simplified physical model for assessing solar radiation over Brazil using GOES 8 visible imagery. J. of Geophys. Res. Vol 109, D02211, doi:10.1029/2003JD003531.
• Liu, H., R. T. Pinker and B. N. Holben, 2004. A global view of aerosols from merged transport models, satellite and ground observations. JGR-Atmos., in revision.
• Martins, F. R., E. B. Pereira, S. L. Abreu, S. Colle, D. Renné, R. Perez, T. Hamlin. Satellite-derived solar resource maps for Brazil - SWERA project. In: EUROPEAN GEOPHYSICS UNION - 1ST ASSEMBLY, Viena. 2005, Geophysical Research Abstracts, SRef-ID: 1607-7962/gra/EGU05-A-05923, Vol. 7, 05923, 2005