**Data Set Description for**

**Parallel Web-Service Climate Model Diagnostic Analyzer (PWSCMDA)**

# Overview

PWSCMDA enables to analyze data from climate models, satellite observations, and reanalysis centers interactively using a web interface via URL <http://cmacws4.jpl.nasa.gov:8080>. Currently, the web services are implemented assuming that model data sets conform to the requirements of the Coupled Model Intercomparison Project Phase 5 (CMIP5) and the observational data sets conform to the Observations for Model Intercomparison Project (Obs4MIPs) standard. The reanalysis data are prepared by applying an editing script to the original reanalysis data downloaded from reanalysis centers to meet a few basic CMIP5 requirements. The analysis tools treat the data sets uniformly between model outputs, observational data and reanalysis data to facilitate a fair comparison.

# Observational data

Most of our observational data are provided by the NASA/Obs4MIPs project, where the observational data sets are published on the Earth System Grid Federation (<http://esg-datanode.jpl.nasa.gov>) using the same format as the CMIP5 model data sets to facilitate a direct comparison between the observation and model. Users of Obs4MIPs data are not assumed to be experts of the instruments that generated these data sets. Technical notes are available to provide users information regarding data origin, uncertainties, and special notes for comparison with the model outputs. See URL <https://www.earthsystemcog.org/projects/obs4mips/> for details about this project. In the following, we describe observational data sets that are being used by our web services.

## Air temperature and specific humidity

## The Atmospheric Infrared Sounder/Advance Microwave Sounding Unit (AIRS/AMSU) on Aqua satellite provides three-dimensional air temperature and specific humidity (water vapor as mass mixing ratio) measurements from 2002/9 through 2011/05. The data covers altitude from surface through 300hPa with 1deg x 1deg horizontal resolution over the globe. The details of the data information may be found in the following technical notes:

<dataInfo/taTechNote_AIRS_L3_RetStd-v5_200209-201105.pdf>

<dataInfo/husTechNote_AIRS_L3_RetStd-v5_200209-201105.pdf>.

## Above 300hPa, the AURA Microwave Limb Sounder (MLS) provides both air temperature and relative humidity with very good vertical resolution, but lower horizontal resolution of 5deg x 2deg. The MLS data starts from 2004/8 after the launch of Aura Satellite. More information are available in the following technical notes:

<dataInfo/taTechNote_MLS_L3_v03-3x_200408-201012.pdf>

<dataInfo/husTechNote_MLS_L3_v03-3x_200408-201012.pdf>.

## Total cloud area fraction

The Moderate Resolution Imaging Spectroradiometer (MODIS) instrument on both Terra and Aqua satellites provides measurements of total cloud area fraction over more than 10 years from 2000/3 through 2011/9. The monthly data covers the globe with 1degx1deg (lon x lat) resolution derived from the level 2 cloud mask at resolution of 25km. See technical notes for details.

<dataInfo/cltTechNote_MODIS_L3_C5_200003-201109.pdf>

## Radiation flux

**A) TOA (top of atmosphere) incident shortwave flux**

The CERES science team provides monthly regional mean TOA (top of atmosphere) incident shortwave radiation derived from the Total Solar Irradiance (TIM) instrument aboard the Solar Radiation and Climate Experiment (SORCE) satellite covering 2000/3 through 2011/6. The horizontal resolution is 1deg x1deg. See technical notes for details.

<dataInfo/rsdtTechNote_CERES-EBAF_L4_Ed2-6_20110809.pdf>

**B) TOA outgoing shortwave and longwave radiation fluxes**

CERES instruments flying on the Terra and Aqua satellites provide (TOA) outgoing shortwave and longwave radiation fluxes covering 2000/03-2011/06 with global horizontal resolution of 1deg x 1deg. The corresponding clear sky fluxes are estimated by using the cloud-free portions of the CERES footprint. See technical notes for details.

<dataInfo/rsutTechNote_CERES-EBAF_L4_Ed2-6_20110809.pdf>

<dataInfo/rlutTechNote_CERES-EBAF_L4_Ed2-6_20110809.pdf>

<dataInfo/rsutcsTechNote_CERES-EBAF_L4_Ed2-6_20110809.pdf>

<dataInfo/rlutcsTechNote_CERES-EBAF_L4_Ed2-6_20110809.pdf>

**C) Surface shortwave and longwave fluxes**

Surface radiative fluxes in this dataset are generated from the CERES Energy Balanced and Filled (EBAF)-Surface Ed2.8 data product using MODIS- derived cloud properties and atmospheric properties (temperature and humidity profiles) given by the Goddard Earth Observing System (GEOS-4 and 5) Data Assimilation System reanalysis. The data has horizontal resolutions of 1deg x 1deg covering 2000/3-2013/11. Please refer to the technical notes:

<dataInfo/Tech-Note_CERES-EBAF-Surface_L3B_Ed2-8.pdf>.

## Precipitation

**A) TRMM precipitation flux**

TRMM Multi-satellite Precipitation Analysis (TMPA) gives monthly precipitation flux at 0.25deg x 0.25deg resolution from 1998/1 through 2011/6. The geographical coverage has range [-50, 50] deg in latitude. See technical notes below for details:

<dataInfo/prTechNote_TMPA_mon_199801-201106.pdf>.

**B) GPCP precipitation flux**

The Satellite-Gauge data set has the identifier “SG” within the Global Precipitation Climatology Project (GPCP). It provides a long record of precipitation flux from 1979/1 through 2011/7 with global coverage at 2.5deg x 2.5deg resolution.

<dataInfo/GPCP_precip_SG_Technical_Note_120920.pdf>

## Leaf area index

Leaf area index is derived from the operational MODIS Fractional Photosynthetically Active Radiation (FPAR) algorithm ingests up to seven atmosphere-corrected surface spectral bi-directional reflectance factors (BRFs). It has a 0.5deg x 0.5deg resolution over the globe and covers temporally 2000/2-2009/12.

<dataInfo/MODIS-BU-FPAR-data-set.pdf>

## Sea surface temperature

The Advanced Microwave Scanning Radiometer (AMSR-E) for the Earth Observing System is a passive-microwave radiometer carried on NASA’s AQUA satellite. AQUA’s AMSR-E radiometer measures the Earth brightness temperatures at six frequencies in the microwave spectrum. This sea-surface temperature data set covers global (over ocean) with resolution of 1deg x 1deg from 2002/6 through 2010/12.

<dataInfo/tosTechNote_AMSRE_L3_v7_200206-201012.pdf>

## Sea surface wind

Sea surface wind is measured by an active microwave scatterometer on QuikSCAT designed to measure electromagnetic backscatter from a wind roughened ocean surface. This data set used was produced based on the Level 2B along-track gridded 25 km resolution scatterometer wind data and distributed by JPL’s Physical Oceanography DAAC. The zonal (east) and meridional (north) wind components as well as the wind speed are provided from 1999/8 through 2009/10 at resolution of 1deg x 1deg over the ocean. More information may be found in the technical notes.

<dataInfo/uas_QuikSCAT_L2B_v20110531_199908-200910.pdf>

<dataInfo/vas_QuikSCAT_L2B_v20110531_199908-200910.pdf>

<dataInfo/sfcWind_QuikSCAT_L2B_v20110531_199908-200910.pdf>

## Sea surface height

This sea level dataset contains the sea surface height above geoid derived from the AVISO/DUACS altimeter climate data record. The data covers a range of 1992/10 -2010/12 temporally and the global ocean spatially with resolution of 1deg x1deg.

<dataInfo/zosTechNote_AVISO_L4_199210-201012.pdf>

## Mass grids (equivalent water thickness)

The Gravity Recovery and Climate Experiment (GRACE) measures the mass distribution of earth by sensing differential gravity in space using two satellites in formation fly. The mass grids is a two dimensional data set representing an “equivalent water thickness” whose mass accounts for the observed gravity that deviates from a nominal mass distribution. This data set is not currently on Obs4MIPs. The temporal coverage is from 2003/1 through 2011/12. The horizontal resolution is 2.5 deg x 2 deg. For more information regarding GRACE data, please refer to the following URL,

<http://grace.jpl.nasa.gov/data/gracemonthlymassgridsoverview/>.

## Ocean temperature and Salinity

ARGO ocean temperature and salinity data are measured using floats. When a float surfaces, the data are transmitted and the float's position is determined either by Système Argos or by GPS. The Système Argos data are monitored by the Argo Information Centre (AIC) in France and then received by national data centers (DACs). The data has a 1deg x 1 deg horizontal resolution and covers from 2001/1-2013/5. More information can be found at

<http://www.nodc.noaa.gov/GTSPP/>

and in document

<doc/dataInfo/oceanTempAndSalinity.pdf>.

# Climate model data

We obtained data from climate models that participated the CMIP5 project for the Intergovernmental Panel of Climate Change (IPCC) assessment report 5 (AR5). Model data are downloaded from the ESGF via URL

[http://esg-datanode.jpl.nasa.gov/esgf-web-fe/](http://esg-datanode/esgf-web-fe/).

Climate models include atmosphere/ocean coupled general circulation model (AOGCM) and the earth system model (ESM), which are coupled models that include also carbon cycle processes. Model data are generated according to specific experiment designs. We currently have data for “AMIP” and “historical” experiments. “AMIP” experiments are carried out with prescribed sea surface temperature and sea ice. It is useful for model evaluation in uncoupled mode. These results are good candidates for comparison with satellite observations. “historical” experiment simulates current climate and observed climate change in coupled mode. The details of the experiment design may be found in the following document,

<dataInfo/Taylor_CMIP5_design.pdf>.

The model data outputs are required to conform to the CMIP5 standard,

<dataInfo/CMIP5_output_metadata_requirements.pdf>.

The data files are stored in netcdf format with starting and ending time embedded in the data file name in format of “yyyymm”. Physical data are stored in space-time grid with longitude, latitude, altitude, and time grids provided.

The list of output variables are described is in the following document,

<dataInfo/standard_output.pdf>.

# Reanalysis data

Currently, we only have the ERA-Interim reanalysis data from the European Centre for Medium-Range Weather Forecasts (ECMWF). With forecast models and data assimilation systems, ECMWF 'reanalyse's archived observations and creates global data sets describing the recent history of the atmosphere, land surface, and oceans. ERA-Interim is a global atmospheric reanalysis from 1979, continuously updated in real time.

The data assimilation system used to produce ERA-Interim is based on a 2006 release of the IFS (Cy31r2). The system includes a 4-dimensional variational analysis (4D-Var) with a 12-hour analysis window. The spatial resolution of the data set is approximately 80 km (T255 spectral) on 60 vertical levels from the surface up to 0.1 hPa. We currently have sea-surface temperature, relative humidity, and vertical wind data from 1979 through 2014/05 downloaded from

<http://apps.ecmwf.int/datasets/data/interim_full_daily/>

Data information may be found in

<http://www.ecmwf.int/en/research/climate-reanalysis/era-interim>.

# Current data master list

The following is a master file that contains all the data that is in use by current web-services.

Put a link to Benyang’s master file.