MODIS BU-BNU LAI data set

1. Intent of This Document and POC

1a) This document is intended for users who wish to compare satellite derived observations with climate model output in the context of the CMIP5/IPCC historical experiments. Users are not expected to be experts in satellite derived Earth system observational data. This document summarizes essential information needed for comparing this dataset to climate model output. References are provided at the end of this document to additional information.

This NASA dataset is provided as part of an experimental activity to increase the usability of NASA satellite observational data for the modeling and model analysis communities. This is not a standard NASA satellite instrument product, but does represent an effort on behalf of data experts to identify a product that is appropriate for routine model evaluation. The data may have been reprocessed, reformatted, or created solely for comparisons with climate model output. Community feedback to improve and validate the dataset for modeling usage is appreciated. Email comments to HQ-CLIMATE-OBS@mail.nasa.gov .

Dataset File Name (as it appears on the ESG):

LAI_MODIS_2000feb-2009dec.ext

1b) Technical point of contact for this dataset:

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2. Data Field Description

CF variable name, units:	Monthly LAI (m^2/ m^2)
Spatial resolution:	0.5°x0.5°
Temporal resolution and extent:	monthly, from 02/2000 to 12/2009
Coverage:	global

3. Data Origin

The operational MODIS Leaf Area Index algorithm ingests up to seven atmosphere-corrected surface spectral bi-directional reflectance factors (BRFs) and their uncertainties and outputs the most probable values for piexel LAI and their respective dispersions (Myneni et al., 2002). The theoretical basis of the algorithm is given in Knyazikhin et al. (1998) and the implementation aspects are discussed in Knyazikhin et al. (1999). A look-up-table method is used to achieve inversion of the three-dimensional radiative transfer problem. When this method fails to localize a solution, a back-up method based on relations between the normalized vegetation

index (NDVI) and LAI (Knyazikhin et al., 1998; Myneni et al., 1997) are utilized together with a biome classification map.

Due to the presence of cloud and seasonal snow cover, instrument problems and the uncertainties of algorithm, the standard Terra MODIS LAI products are processed to generate MODIS BU-BNU LAI products on a global scale using a two-step integrated method (Yuan et al., 2011). First, a modified temporal spatial filter (mTSF) based on TSF method developed by Fang et al. (2007; 2008) is applied to fill the gaps of the MODIS LAI data and process the lower quality data according to the quality control (QC) and filled value information by making the best use of the high quality data. Then the TIMESAT Savitzky-Golay (SG) filter (Jönsson and Eklundh, 2004) - as post processing - is applied to generate the final improved MODIS BU-BNU LAI products.

The improved MODIS LAI data sets were resampled to the mothly 0.5°x0.5° data sets for the CMIP5 project.

4. Validation and Uncertainty Estimate

For the standard MODIS LAI product, validation information can be found in Yang et al., (2006a,b) and Garrigues et al., (2008a,b). For the MODIS BU-BNU LAI product, as for a direct validation comparison, a total of 44 LAI reference maps which contain true LAI values were collected over a subset of 26 sites (Fig. 1) from VALERI, BigFoot (Cohen et al., 2006), Boston University (Yang et al., 2006) and SMEX02 (Anderson et al., 2004). The scatter plot is shown in Fig. 2. The accuracy of the MODIS BU-BNU LAI is 0.66 LAI, that is, on average, the product differs from field measured LAI scaled to 1 km resolution by 0.66 LAI units.

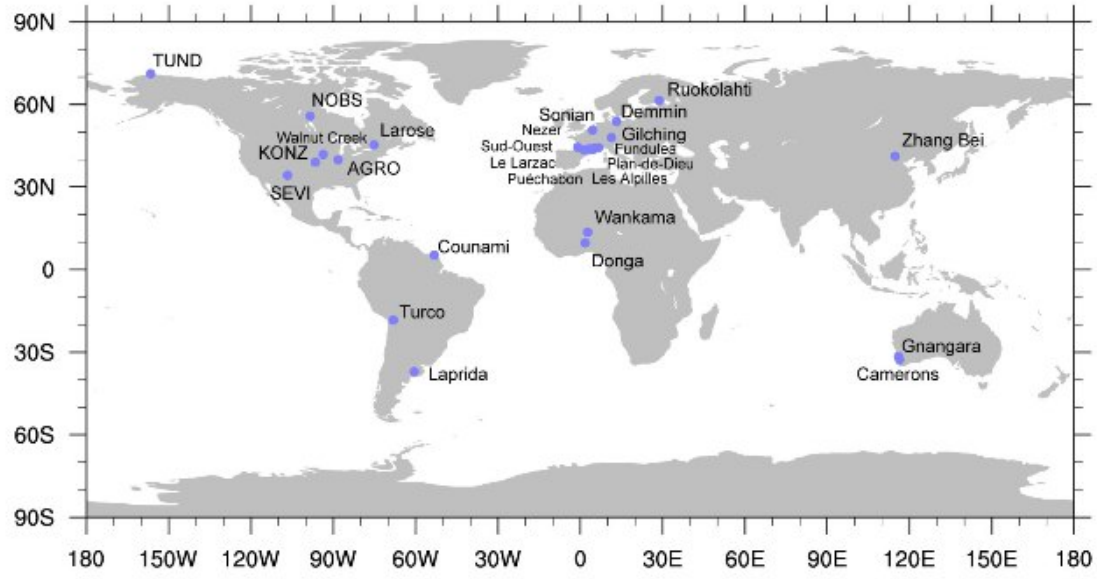

Fig.1: The location of validation sites

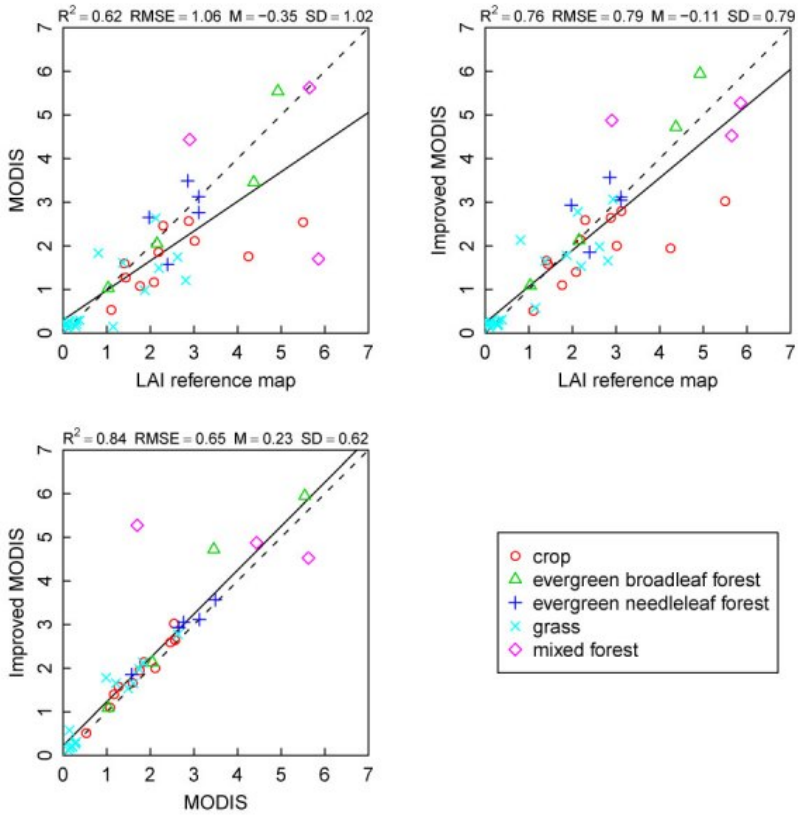

Fig. 2: Scatter plot of direct validation. "M" and "SD" represent the mean and the standard deviation of the difference between the LAI values displayed in the y axis and x axis. The solid line in each plot is the linear fitted line.

5. Considerations for Model-Observation Comparisons

The MODIS BU-BNU LAI data set provided here is derived from the Terra MODIS standard LAI product only (MOD15A2). LAI values equal to ZERO should NOT be used in spatial or temporal averaging process.

6. Instrument Overview

The moderate resolution imaging spectroradiometer (MODIS) is an instrument on board NASA's Terra and Aqua platforms for remote sensing of the Earth's atmosphere, oceans and land surfaces. The Terra platform was launched on December 18, 1999 and the Aqua platform on May 2, 2002. The MODIS instrument has a swath width of 2330 km, orbit height of 705km, and produces global coverage every one to two days. MODIS measures reflected solar and emitted thermal radiation in 36 spectral bands and at three different spatial resolutions (250, 500 and 1000m).

7. References

https://lpdaac.usgs.gov/products/modis_products_table/leaf_area_index_fraction_of_photosynthetically_active_radiation/8_day_l4_global_1km/mod15a2

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