Land Surface Evapotranspiration Metadata

Title

A continuous satellite-derived global record of land surface evapotranspiration from 1983 to 2006

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Overview

We applied a satellite remote sensing–based evapotranspiration (ET) algorithm to assess global terrestrial ET from 1983 to 2006. The algorithm quantifies canopy transpiration and soil evaporation using a modified Penman-Monteith approach with biome-specific canopy conductance determined from the normalized difference vegetation index (NDVI) and quantifies open water evaporation using a Priestley-Taylor approach. These algorithms were applied globally using advanced very high resolution radiometer (AVHRR) GIMMS NDVI, NCEP/NCAR Reanalysis (NNR) daily surface meteorology, and NASA/GEWEX Surface Radiation Budget Release−3.0 solar radiation inputs. We used observations from 34 FLUXNET tower sites to parameterize an NDVI-based canopy conductance model and then validated the global ET algorithm using measurements from 48 additional, independent flux towers. Two sets of monthly ET estimates at the tower level, driven by in situ meteorological measurements and meteorology interpolated from coarse resolution NNR meteorology reanalysis, agree favorably (root mean square error (RMSE) = 13.0–15.3 mm month^{-1} ; R^2= 0.80–0.84) with observed tower fluxes from globally representative land cover types. The global ET results capture observed spatial and temporal variations at the global scale and also compare favorably (RMSE = 186.3 mm yr^{-1}; R^2= 0.80) with ET inferred from basin-scale water balance calculations for 261 basins covering 61%of the global vegetated area. The results of this study provide a relatively long term global ET record with well-quantified accuracy for assessing ET climatologies, terrestrial water, and energy budgets and long-term water cycle changes.

Data sets

Global 1 Degree Resolution

- Data set Variable – Monthly Land Surface Evapotranspiration (mm/month)
    - January through December
- Temporal Extent – Monthly Data from 1983 through 2006 inclusive
- HDF5 and ASCII

Global 8 Kilometer Resolution

- Data set Variable – Monthly Land Surface Evapotranspiration (mm/month)
  - January through December
- Temporal Extent – Monthly Data from 1983 through 2006 inclusive
- Binary and (HDF5…Coming Soon)

Resolution

- 1 Degree
- 8 Kilometer

Format

ASCII

Data of each month are saved in a single ASCII text file. Data of each year are zipped into a single zip file.

Binary

Individual data elements are each stored as IEEE single precision 32-bit (4-byte per value, Little-Endian) float variables. Missing data are marked as -9999.0. The size of each data file is: sizeof(float) * months of the year * cols * rows (bytes). The first 12 floating-point data elements are the monthly ET values for pixel (row 1, col 1). The second 12 data elements are the monthly ET values for pixel (row 1, col 2), and so on.

HDF5

The data are saved in the Hierarchical Data Format (HDF5). Data of each year are saved in a single HDF5 file. There are two HDF5 groups in each HDF5 file, i.e. "DATA" and "METADATA". Group "DATA" includes 12 HDF5 datasets storing the monthly gridded data and 2 HDF5 datasets storing the coordinates of grid cell centers. The attributes of each HDF5 dataset include detailed description and statistics for the data of each month. Group "METADATA" provides detailed description on this data set.

Projections/Extent

8 Kilometers

Geographic Projection – Decimal Degrees

The region covers from -179.9954° to 180.0046° longitudinally and from 89.2234° to -62.8494° latitudinally with a cell size of 0.07272727°. Therefore, there are 4,950 columns and 2,091 rows. The center of the first cell is (-179.959°, 89.187°), while the center of the second cell is (-179.886°, 89.187°). The center of the last cell is (179.968°, -62.813°).

1 Degree

Geographic Projection – Decimal Degrees

The region covers from -180° to 180° longitudinally and from 90° to -90° latitudinally with a cell size of 1.0°.

Tools

HDF5 Tools are available at http://freezethaw.ntsg.umt.edu/tools.htm

Spatial Maps

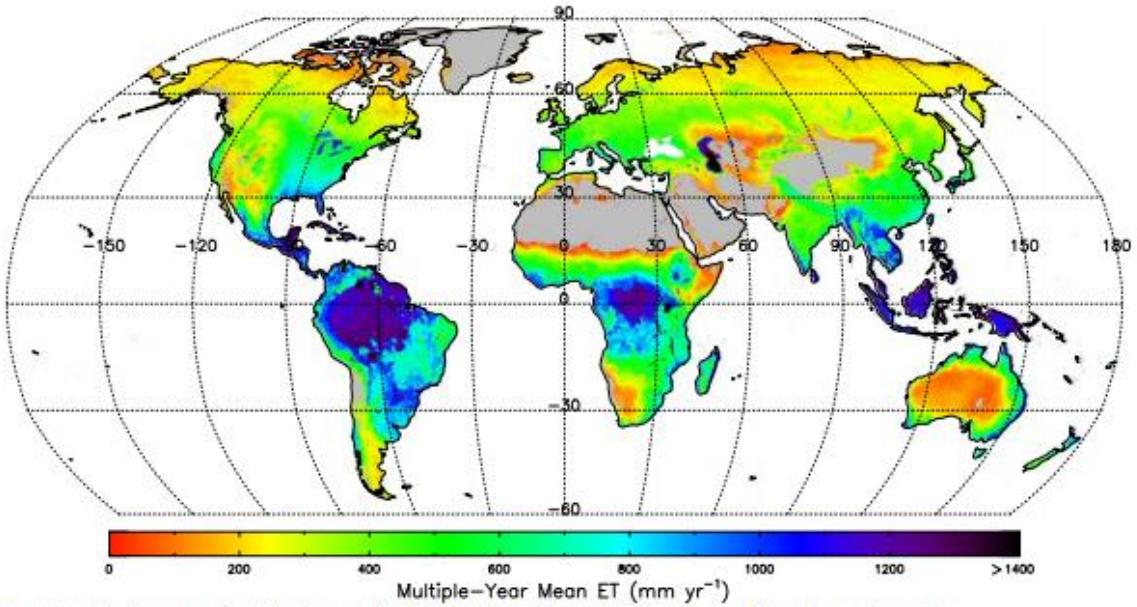

Fig.1 Spatial map of global multi-year (1983-2006) mean annual land surface ET.

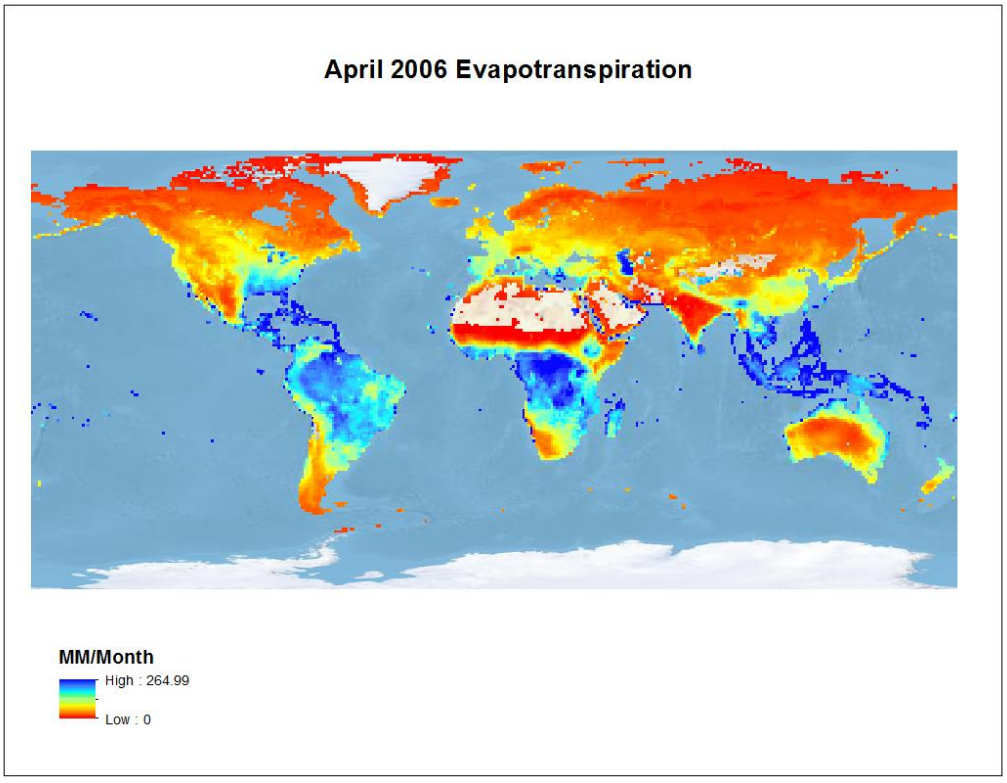

Fig.2 April 2006 land surface ET.

Publications

Zhang, K., J.S. Kimball, R.R. Nemani and S.W. Running. A continuous satellite-derived global record of land surface evapotranspiration from 1983-2006 (2010*), Water Resources Research*, **46**, W09522, doi:10.1029/2009WR008800.

Zhang, K., J.S. Kimball, Q. Mu, L.A. Jones, S.J. Goetz and S.W. Running. Satellite based analysis of northern ET trends and associated changes in the regional water balance from 1983 to 2005 (2009), *Journal of Hydrology*, **379**, 92-110, doi:10.1016/j.jhydrol.2009.09.047.