LAND SURFACE MODEL (LSM 1.0) FOR ECOLOGICAL, HYDROLOGICAL, ATMOSPHERIC STUDIES

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Summary:

This data set provides the mean diurnal cycle of precipitation, near-surface thermodynamics, and surface fluxes generated from short-term forecasts from the European Centre for Medium-Range Weather Forecasts (ECMWF) model. The model outputs were 12- to 36-hour short-range forecasts, run at a triangular truncation of T319 and a vertical resolution of 60 levels, from each daily 1200 (UTC) analysis. The version of the forecast model used to prepare this data product was the operational ECMWF model in fall 2000, which included the tiled land-surface scheme (TESSEL) (Van den Hurk et al., 2000) and recent revisions to the convection, radiation, and cloud schemes described by Gregory et al., (2000). The ECMWF model was run for two Large-Scale Biosphere-Atmosphere Experiment in Amazonia (LBA) campaigns conducted in Rondonia, Brazil, during January and February of 1999: the Wet Season Atmospheric Mesoscale Campaign (WETAMC) and the Tropical Rainfall Measuring Mission (TRMM). See Silva Dias et al.,(2002) for additional information regarding the WETAMAC and TRMM campaigns. There are two comma-delimited data files with this data set: the ECMWF model output data and a file containing the mean hourly precipitation observations used to check the model output for biases.

Data Citation:

Cite this data model as follows:

Bonan, G. B. 2005. Land Surface Model (LSM 1.0) for Ecological, Hydrological, Atmospheric Studies. ORNL DAAC, Oak Ridge, Tennessee, USA. http://dx.doi.org/10.3334/ORNLDAAC/807.

References:

Bonan, G.B. 1994. Comparison of two land surface process models using prescribed forcings. Journal of Geophysical Research 99:25803-25818.

Bonan, G.B. 1995. Land-atmosphere CO2 exchange simulated by a land surface process model coupled to an atmospheric general circulation model. Journal of Geophysical Research 100:2817-2831.

Bonan, G.B. 1995. Sensitivity of a GCM simulation to inclusion of inland water surfaces. Journal of Climate 8:2691-2704.

Bonan, G.B. 1996. A land surface model (LSM version 1.0) for ecological, hydrological, and atmospheric studies: technical description and user's guide. NCAR Technical Note NCAR/TN-417+STR. National Center for Atmospheric Research, Boulder, Colorado. 150 pp.

Bonan, G.B. 1996. The NCAR land surface model (LSM version 1.0) coupled to the NCAR Community Climate Model. NCAR Technical Note NCAR/TN-429+STR. National Center for Atmospheric Research, Boulder, Colorado. 171 pp.

Bonan, G.B. 1996. Sensitivity of a GCM simulation to subgrid infiltration and surface runoff. Climate Dynamics 12:279-285.

Kutzbach, J., Bonan, G., Foley, J., and Harrison, S.P. 1996. Vegetation and soil feedbacks on the response of the African monsoon to orbital forcing in the early to middle Holocene. Nature 384:623-626.

Model Product Description:

Model Documentation and User's Guide

The User's Guide companion file (http://daac.ornl.gov/daacdata/model_archive/LSM/comp/NCAR_LSM_Users_Guide.pdf) describes Version 1 of the LSM model.

Part I presents background information regarding how the land surface processes are modeled in terms of biophysical fluxes (latent heat, sensible heat, momentum, reflected solar radiation, emitted longwave radiation) and biogeochemical fluxes (CO_2) that depend on the ecological and hydrologic state of the land.

Part II is an introduction to the overall design of the land surface model, information about running the model, and a brief description of the code. The source code has detailed comments throughout and is the definitive description.

Source Code

There are 75 individual code files provided in one compressed file (LSM_Source_Code.zip). The code consists of two types of files: *.h files are included through the #include pre-processor directive and the *.F files are the main Fortran source files.

The file lsmmain.F is the main driver program for the stand-alone or uncoupled simulations and lsmdrv.F is the main driver program for input/output from/to a coupled atmospheric model.

Input Data Sets

The model requires two input data sets. The first is the surface boundary data set, which defines the time-invariant surface properties. An example (fsurdat_t42) is provided. The second, the initial conditions data set, may contain initial water (snow, vegetation, soil) and temperature (vegetation, ground surface, soil) values. However, by default, the model is initialized to arbitrary conditions so that no initial data file is required to run the model. The example file and scripts are in LSM_Input.zip.

Script Files for Running the LSM model on a UNIX workstation

The Unix script, run_lsmv1.s, will run the model for one day, using the sample input data set and default initial conditions.

The code in hist_read.s shows how to read a LSM history file, extract a particular field, and map the field on the 2-d grid.

This scripts will have to be modified for your Unix system and directory structure. It is suggested that you run the example as an introduction to the model and its output.

Model Output

In either stand-alone mode or coupled to an atmospheric model, the land surface model provides at every time step, surface albedos (direct beam and diffuse for visible and near-infrared wavebands), upward longwave radiation, sensible heat flux, latent heat flux, water vapor flux, and surface stresses. The code in hist_read.s shows how to read a LSM history file. Output data files are described in Part II of the http://daac.ornl.gov/daacdata/model_archive/LSM/comp/NCAR_LSM_Users_Guide.pdf companion file.

Output LSM data have been applied to study various land-atmosphere processes and analyzed to produce value-added products. Several applications are described in Background and Application companion document (http://daac.ornl.gov/daacdata/model_archive/LSM/comp/NCAR_LSM_Bckgrnd_Application_Info.pdf) and typical analysis products are shown in the Analyzed Data companion document (http://daac.ornl.gov/daacdata/model_archive/LSM/comp/NCAR_LSM_Analyzed-Data.pdf.

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