Documentation for LPJ-WHyMe v1.3.1

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Data model description and citation:

Wania, R., I. Ross and I.C. Prentice (2010). Implementation and evaluation of a new methane model within a dynamic global vegetation model: LPJ-WHyMe v1.3.1. *Geoscientific Model Development* (accepted).

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Further references:

Wania, R., I. Ross and I. C. Prentice (2009a). Integrating peatlands and permafrost into a dynamic global vegetation model: 1. Evaluation and sensitivity of physical land surface processes, *Global Biogeochemical Cycles*, 23, GB3014, doi:10.1029/2008GB003412.

Wania, R., I. Ross and I. C. Prentice (2009b). Integrating peatlands and permafrost into a dynamic global vegetation model: 2. Evaluation and sensitivity of

vegetation and carbon cycle processes, *Global Biogeochemical Cycles*, 23, GB3015, doi:10.1029/2008GB003413.

Target compute platform:

The model can be run on any platform.

Model build environment:

Fortran 77 and C++. The code can be compiled by using freely available compilers such as ifort, g77 and gcc.

Additional analysis environment requirements:

LPJ-WHyMe produces NetCDF files, which can be viewed and processed in any suitable environment. To analyse the data, we used the *CDO* and *NCO* tools and to view and plot the data we used data visualisation software such as *Ferret* or *NCL*, all of these are freely available software packages and are just listed as examples.

CDO:	`http://www.mad.zmaw.de/Pingo/post/post.cdo.home.html`
NCO:	`http://nco.sourceforge.net/`
Ferret:	`http://ferret.wrc.noaa.gov/Ferret/`
NCL:	`http://www.ncl.ucar.edu/`

Detailed instructions:

First, we provide a list of all the directories and files. The material is split up into five directories, `utils`, `src`, `doc` and `data`.

The `utils` directory

The `utils` directory contains auxiliary code for the use of the input/output driver (lpjio.cpp), which uses NetCDF files as input and output. Written by Ian Ross.

`apply-base.cpp`	C++ auxiliary file.
`Array.cpp`	C++ auxiliary file.
`Array.hh`	C++ header file.
`clamp-value.cpp`	C++ auxiliary file.
`ncminmax.cpp`	C++ auxiliary file.
`Makefile`	File to link and compile the above files.

The `src` directory

The main LPJ-WHyMe source code and driver file are located in this directory.

`lpjmain.f`	Main LPJ-WHyMe code (Fortran 77).
`params.cb`	Common block containing parameter values.
`inputvars.cb`	Common block containing definition of climate input variables.
`soilvars.cb`	Common block containing definition of soil relevant variables.
`vegvars.cb`	Common block containing definition of vegetation relevant variables.
`ch4vars.cb`	Common block containing definition of methane relevant variables.
`lpjio.cpp`	C++ driver for LPJ-WHyMe, used to handle input and output files. (Written by Ian Ross.)
`Makefile`	File to link and compile the code.

The `data` directory

In the subdirectory `global`, we provide the land mask and soil type data on a $1^\circ \times 1^\circ$ resolution for the region 60°S to 90°N. The soil type map is based on the FAO data set, but is overlain by soil organic carbon data from the IGBP-DIS data set [Global Soil Data Task Group, 2000]. As climate input data, we used either a climatology or a time series data set provided by the Climate Research Unit (CRU) at the University of East Anglia, United Kingdom [New et al., 1999, Mitchell and Jones, 2005]. Here, we provide data only for one example grid cell from the CRU CL 1.0 climatology data set, as we cannot distribute the global data sets. The global data are on a $0.5^\circ \times 0.5^\circ$ resolution and can be downloaded at `http://www.cru.uea.ac.uk/cru/data/hrg.htm`.

The subdirectory `example-site` contains data from the Degerö site in Sweden.

`pftin.dat`	Plant functional type parameter file, read by `lpjmain.f`.
`lpj.cfg`	Configuration file giving names of input files and output variables. Description of `lpj.cfg` file format and `lpjio.cpp` driver can be found in `doc/USING-The-netCDF-Driver.txt`.
`lpj_land_mask.nc`	Land/ocean mask.
`lpj_soil_type.nc`	Soil type map.

`tas.nc`	Monthly mean temperature (°C) from the CRU CL 1.0 climatology [New et al., 1999].
`pr.nc`	Monthly mean precipitation (mm per month) from the CRU CL 1.0 climatology [New et al., 1999].
`clt.nc`	Monthly mean cloud cover (%) from the CRU CL 1.0 climatology [New et al., 1999].
`wetdays.nc`	Monthly mean wet days from the CRU CL 1.0 climatology [New et al., 1999].

Running LPJ-WHyMe

To run LPJ-WHyMe using the provided test data:

1. In the `utils` directory, ensure that all paths are set correctly in the `Makefile`. Then type `make`.

2. In the `src` directory, ensure that all paths are set correctly in the `Makefile`. Then type `make`.

3. Copy the pftin.dat and lpj.cfg files into the `data` directory. Run the `lpj-whyme` executable produced in step 2 in the `data` directory.

4. An output file called `out_xxxx.nc`, where xxxx stands for the output year, will be produced in the `data` directory. The units for each variable are given in lpjmain.f or the common block files.

References

Global Soil Data Task Group. *Global gridded surfaces of selected soil characteristics (IGBP-DIS)*. Oak Ridge National Laboratory Distributed Active Archive Center, Oak Ridge, Tennessee, U.S.A., 2000. `http://www.daac.ornl.gov`.

T. D. Mitchell and P. D. Jones. An improved method of constructing a database of monthly climate observations and associated high-resolution grids. *Int. J. Climatol.*, 25(6):693–712, May 2005.

M. New, M. Hulme, and P. D. Jones. Representing twentieth century space-time climate variability. Part 1: Development of a 1961–1990 mean monthly terrestrial climatology. *J. Clim.*, 12:829–856, 1999.