**VICMATLAB**

VICMATLAB: a collection of Matlab scripts for creating input files and analyzing outputs for VIC and the Lohmann routing model. Has options for VIC4.2 and VIC5 classic and image drivers.

**Soil parameter file**

The Harmonized World Soils Database (HWSD) is a 30 arc-second raster database with soil parameter data for the whole world. However, the accuracy can be quite poor in some regions, and some variables are more likely to be reported than others, so you should use pedotransfer functions to map from variables like soil texture to parameters like hydraulic conductivity.

**Vegetation parameter file**

Aside from land cover types and fractional areas for grid cells, the vegetation parameter file contains information about rooting depths and rooting distributions for each land cover type. There are also several optional parameters for the vegetation parameter file: blowing snow, LAI, vegetation cover, and albedo.

Choose a land cover classification that suits your needs. This can be used to build the vegetation parameter and vegetation library files. For example, MODIS Combined Land Cover Product (MCD12Q1) IGBP classification has global scale mapping. [https://lpdaac.usgs.gov/dataset\_discovery/modis/modis\_pro ducts\_table/mcd12q1](https://lpdaac.usgs.gov/dataset_discovery/modis/modis_pro%20ducts_table/mcd12q1). Also, there are existing land cover parameterizations for land surface models. NCAR NOAH LSM has parameterizations: [http://www.ral.ucar.edu/research/land/technology/noahmp/ HRLDAS-v3.6/VEGPARM.TBL](http://www.ral.ucar.edu/research/land/technology/noahmp/%20HRLDAS-v3.6/VEGPARM.TBL)

**Vegetation library file**

Parameters for each possible land cover class, whether or not they actually occur in the study region. It is referenced by the vegetation parameter file.

Requires monthly climatology information for albedo and LAI. There are products available from MODIS.

LAI: https://lpdaac.usgs.gov/dataset\_discovery/modis/modis\_pro ducts\_table/mod15a2

Albedo: http://modis- atmos.gsfc.nasa.gov/ALBEDO/index.html

There are also remote sensing datasets available for vegetation height, surface roughness, etc. But there are often large errors with derived data, which can lead to modeling errors.

**Elevation band file**

Optional, partitions grid cells into different elevations for more accurate orographic effects. There are plenty of elevation datasets available. SRTM, GMTED, HydroSHEDS, NED, etc.

SRTM: http://www2.jpl.nasa.gov/srtm/

GMTED: https://lta.cr.usgs.gov/GMTED2010

HydroSHEDS: http://www.hydrosheds.org/

NED: https://lta.cr.usgs.gov/NED

**Meteorological forcing files**

Requires at least: max and min daily temperature, surface wind speed, and precipitation. can also take other variables, such as surface albedo, atmospheric density, and downward longwave and shortwave radiation. Subdaily data are required for energy balance equations/energy balance mode. Met. forcing variables are key for model accuracy. There are some global datasets available:

*Temperature*

ERA-Interim: http://www.ecmwf.int/en/research/climate-reanalysis/era-interim

MERRA-2: https://gmao.gsfc.nasa.gov/reanalysis/MERRA-2/

CSFR: https://www.ncdc.noaa.gov/data-access/model-data/model-datasets/climate-forecast-

system-version2-cfsv2#CFS

Princeton dataset: http://hydrology.princeton.edu/data.pgf.php

Reanalysis data

*Precipitation*

CHIRPS: http://chg.geog.ucsb.edu/data/chirps/

IMERG: https://disc.gsfc.nasa.gov/datareleases/imerg\_data\_release

CMORPH: http://www.cpc.ncep.noaa.gov/products/janowiak/cmorph\_description.html

GPCC: https://www.esrl.noaa.gov/psd/data/gridded/data.gpcc.html

Reanalysis data

*Wind (station data)*

GSOD: https://data.noaa.gov/dataset/global-surface-summary-of-the-day-gsod

GHCN: https://www.ncdc.noaa.gov/data-access/land-based-station-data/land-based- datasets/global-historical-climatology-network-ghcn

Typically, the met. forcing data are available at relatively high temporal resolution, but low spatial resolution. It seems like VIC might distribute precipitation through a grid cell as a function of rain intensity, accounting for orographic effects (see slide 16 from Markert, 2017).

**Simulation modes: water balance, energy balance, frozen soil.**

Frozen soil simulations are important for cold regions (high latitudes or elevations) because frozen soils impede infiltration of water and alter spring soil moisture content and streamflow timing. Frozen soil calculations require solving the energy balance equations.

**State file**

The user can save the last model conditions (SMC) to file. The state file defines the initial soil moisture conditions. Since it is used for stopping and restarting VIC simulations, it is necessary for sequential data assimilation. This is also a way to save computation time because model spin-up only has to be performed once.

**Lake and wetland model**

**Carbon cycle model**

**References**

Markert, 2017. VIC Data Inputs and Optional Processes.

https://ntrs.nasa.gov/archive/nasa/casi.ntrs.nasa.gov/20170002800.pdf