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Open source large-scale high-resolution environmental modelling with GEMS

Rein Baarsma, Koko Alberti, Wouter Marra, and Derek Karssenberg
Department of Physical Geography, Utrecht University, Utrecht, Netherlands (r.j.baarsma@uu.nl)

Many environmental, topographic and climate data sets are freely available at a global scale, creating the opportunities to run environmental models for every location on Earth. Collection of the data necessary to do this and the consequent conversion into a useful format is very demanding however, not to mention the computational demand of a model itself. We developed GEMS (Global Environmental Modelling System), an online application to run environmental models on various scales directly in your browser and share the results with other researchers. GEMS is open-source and uses open-source platforms including Flask, Leaflet, GDAL, MapServer and the PCRaster-Python modelling framework to process spatio-temporal models in real time. With GEMS, users can write, run, and visualize the results of dynamic PCRaster-Python models in a browser. GEMS uses freely available global data to feed the models, and automatically converts the data to the relevant model extent and data format. Currently available data includes the SRTM elevation model, a selection of monthly vegetation data from MODIS, land use classifications from GlobCover, historical climate data from WorldClim, HWSD soil information from WorldGrids, population density from SEDAC and near real-time weather forecasts, most with a $\pm$100m resolution. Furthermore, users can add other or their own datasets using a web coverage service or a custom data provider script. With easy access to a wide range of base datasets and without the data preparation that is usually necessary to run environmental models, building and running a model becomes a matter hours. Furthermore, it is easy to share the resulting maps, timeseries data or model scenarios with other researchers through a web mapping service (WMS). GEMS can be used to provide open access to model results. Additionally, environmental models in GEMS can be employed by users with no extensive experience with writing code, which is for example valuable for using models in education. A laptop will be available to demonstrate both front- and backend for GEMS.