Geophysical Research Abstracts
Vol. 17, EGU2015-9018, 2015
EGU General Assembly 2015

A framework for integrated, multi-scale model construction and uncertainty assessment

Oliver Schmitz (1), Jean-Luc de Kok (2), Kor de Jong (1), and Derek Karssenberg (1)

(1) Department of Physical Geography, Faculty of Geosciences, Utrecht University, Utrecht, The Netherlands (o.schmitz@uu.nl), (2) Flemish Institute for Technological Research (VITO), Unit Environmental Modelling, Belgium

The component-based software development practice promotes the construction of self-contained modules with defined input and output interfaces. In environmental modelling, we can adopt this development practice to construct more generic, reusable component models. Here, modellers need to implement a state transition function to describe a specific environmental process, and to specify the required external inputs and parameters to simulate the change of real-world processes over time. Depending on the usage of a component model, such as standalone execution or as part of an integrated model, the source of the external input needs to be specified. The required external inputs can thereby be obtained from disk by a file operation in case of a standalone execution; or inputs can be obtained from other component models, when the component model is used in an integrated model. Using different notations to specify input requirements, however, requires a modification of the state transition function per application case of a component model and therefore would reduce its generic nature.

We propose the function object notation as a means to specify input sources of a component model and as a uniform syntax to express input requirements. At component initialisation, the function objects can be parametrised with different external sources. In addition to a uniform syntax, the function object notation allows modellers to specify a request-reply execution flow of the coupled models. We extended the request-reply execution approach to allow for Monte Carlo simulations, and implemented a software framework prototype in Python using the PCRaster module (http://www.pcraster.eu) for field-based modelling.

We demonstrate the usage of the framework by building an exemplary integrated model by coupling components simulating land use change, hydrology and eucalyptus tree growth at different temporal discretisations to obtain the probability for bioenergy plantations in a hypothetical catchment.