Geophysical Research Abstracts
Vol. 19, EGU2017-15441-2, 2017
EGU General Assembly 2017

Modern software approaches applied to a Hydrological model: the GEOtop Open-Source Software Project

Stefano Cozzini (1,3), Stefano Endrizzi (2), Emanuele Cordano (4), Giacomo Bertoldi (5), and Matteo Dall'Amico (6)

(1) CNR/IOM, Trieste, Italy (stefano.cozzini@iom.cnr.it), (3) eXact lab Srl, Trieste, Italy, (2) Independent specialist in hydrology, Zurich, Switzerland, (4) Rendena100, Engineering and Consultancy sole proprietorship, Tione di Trento, Italy., (5) Eurac research, Institute for Alpine Environment, Bolzano/Bozen, Italy,, (6) MobyGIS Srl, Trento, Italy

The GEOtop hydrological scientific package is an integrated hydrological model that simulates the heat and water budgets at and below the soil surface. It describes the three-dimensional water flow in the soil and the energy exchange with the atmosphere, considering the radiative and turbulent fluxes. Furthermore, it reproduces the highly non-linear interactions between the water and energy balance during soil freezing and thawing, and simulates the temporal evolution of snow cover, soil temperature and moisture.
The core components of the package were presented in the 2.0 version (Endrizzi et al, 2014), which was released as Free Software Open-source project. However, despite the high scientific quality of the project, a modern software engineering approach was still missing. Such weakness hindered its scientific potential and its use both as a standalone package and, more importantly, in an integrate way with other hydrological software tools. In this contribution we present our recent software re-engineering efforts to create a robust and stable scientific software package open to the hydrological community, easily usable by researchers and experts, and interoperable with other packages.
The activity takes as a starting point the 2.0 version, scientifically tested and published. This version, together with several test cases based on recent published or available GEOtop applications (Cordano and Rigon, 2013, WRR, Kollet et al, 2016, WRR) provides the baseline code and a certain number of referenced results as benchmark. Comparison and scientific validation can then be performed for each software re-engineering activity performed on the package. To keep track of any single change the package is published on its own github repository geotopmodel.github.io/geotop/ under GPL v3.0 license.
A Continuous Integration mechanism by means of Travis-CI has been enabled on the github repository on master and main development branches. The usage of CMake configuration tool and the suite of tests (easily manageable by means of ctest tools) greatly reduces the burden of the installation and allows us to enhance portability on different compilers and Operating system platforms.
The package was also complemented by several software tools which provide web-based visualization of results based on R plugins, in particular "shiny" (Chang at al, 2016), "geotopbricks" and "geotopOptim2" (Cordano et al, 2016) packages, which allow rapid and efficient scientific validation of new examples and tests.
The software re-engineering activities are still under development. However, our first results are promising enough to eventually reach a robust and stable software project that manages in a flexible way a complex state-of-the-art hydrological model like GEOtop and integrates it into wider workflows.