Geophysical Research Abstracts
Vol. 16, EGU2014-3925, 2014
EGU General Assembly 2014

The "Vsoil Platform" : a tool to integrate the various physical, chemical and biological processes contributing to the soil functioning at the local scale.

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Models describing the soil functioning are valuable tools for addressing challenging issues related to agricultural production, soil protection or biogeochemical cycles. Coupling models that address different scientific fields is actually required in order to develop numerical tools able to simulate the complex interactions and feed-backs occurring within a soil profile in interaction with climate and human activities. We present here a component-based modelling platform named "VSoil", that aims at designing, developing, implementing and coupling numerical representation of biogeochemical and physical processes in soil, from the aggregate to the profile scales. The platform consists of four softwares, i) Vsoil_Processes dedicated to the conceptual description of processes and of their inputs and outputs, ii) Vsoil_Modules devoted to the development of numerical representation of elementary processes as modules, iii) Vsoil_Models which permits the coupling of modules to create models, iv) Vsoil_Player for the run of the model and the primary analysis of results. The platform is designed to be a collaborative tool, helping scientists to share not only their models, but also the scientific knowledge on which the models are built. The platform is based on the idea that processes of any kind can be described and characterized by their inputs (state variables required) and their outputs. The links between the processes are automatically detected by the platform softwares. For any process, several numerical representations (modules) can be developed and made available to platform users. When developing modules, the platform takes care of many aspects of the development task so that the user can focus on numerical calculations. Fortran2008 and C++ are the supported languages and existing codes can be easily incorporated into platform modules. Building a model from available modules simply requires selecting the processes being accounted for and for each process a module. During this task, the platform displays available modules and checks the compatibility between the modules. The model (main program) is automatically created when compatible modules have been selected for all the processes. A GUI is automatically generated to help the user providing parameters and initial situations. Numerical results can be immediately visualized, archived and exported. The platform also provides facilities to carry out sensitivity analysis. Parameters estimation and links with databases are being developed. The platform can be freely downloaded from the web site (http://www.inra.fr/sol_virtuel/) with a set of processes, variables, modules and models. However, it is designed so that any user can add its own components. Theses adds-on can be shared with co-workers by means of an export/import mechanism using the e-mail. The adds-on can also be made available to the whole community of platform users when developers asked for. A filtering tool is available to explore the content of the platform (processes, variables, modules, models).