

Model

Rich_Clim_Heat_CD_OM

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2025-12-11

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1 Objectives

The model simulates for a soil profile: water flow, heat transport, solute transport with a convection dispersion module and organic matter transformation. Climatic data are used to define the water flow and heat transport boundary conditions at the soil surface. The model does not consider a crop with its impacts on the energy balance and the water uptake by the root. The model does not consider a mulch at the soil surface with its consequence of water flow and energy balance. There is no preferential flow in this model.

This model can be easily modified either by adding modules to account for other mechanisms or by substitution of a module by another provided that its inputs are satisfied by the modules of the model and its outputs contains the variables eventually needed by the other modules. The **VSOIL-MODELS** helps and guides the user in this task.

2 Modules

- **Richards_KDW** To calculate the terms of the water balance, the water potential, the volumetric water content, the flux of water, the drainage or capillary rise and the evaporation at the soil surface.
- **runoff_PastisKDW** A runoff module allowing to calculate the heigh of water and the runoff when the soil infiltrability is lower than the flux of water applied. The module interacts with the water flow module.
- **climate_from_files** A module to read the climate variables: minimum and maximum daily temperature, rain intensity and global radiation. The module returns the instantaneous temperature and the rain intensity. Examples of files are provided with the module.

- **etp_from_files** A module to read the daily maximum evapotranspiration demands. The daily maximum evapotranspiration is distributed in the day according to day length and latitude. The module returns the mean instantaneous maximum evapotranspiration for the time integration interval. An example of file is provided with the module.
- **bottom_pressure_from_files** The module returns a soil water pressure at the bottom of the profile. The module reads a file. Used in this model.
- **soil_structure_forced** The module returns some characteristics of the soil: bulk density, granulometry, etc. These values are constant all along the run. Some are used by other modules.
- **sprink_solutes_file** The module returns the intensity and the solutes species concentration of irrigations when they occur. An example of file is provided with the module. This file can be empty.
- **spit_climate** The module calculates the evaporation demand applied to the soil and depending of the maximum evapotranspiration and of the presence of a vegetation. It carries out a simplified energy budget at the soil surface to calculate the soil surface temperature.
- **hydraulic_properties_pedo_func** The module offers the choice between several formulations of the hydraulic properties. Pedo-transfert functions (Hypres) are also available in this module. Pedotransfert functions uses outputs of the **soil_structure_forced** module.
- **heat_Pastis** The module calculates the soil temperature profile depending on the climate variables and the water flow.
- **OM_CANTIS** The module calculates the decomposition of the organic matter pools defined in the module CANTIS. It uses some of the outputs of the water flow, solute transport and heat transport modules.
- **CDE_OM** The module calculates the transport of solute species. It accepts the sink and source terms provided by the module simulating the organic matter transformations.
- **organic_fert_CANTIS** Provides organic fertilizers characteristics to be used with the **OM_CANTIS** module. Provides pools amounts, pools C/N ratios, and carbon to dry matter mass ratio of the pools at time where they are inserted in the soil.

Other modules are present but are not used in the examples of simulations. These modules are either *neutral modules* when the mechanisms are not simulated or boundary conditions modules that must be present but are not used by the transport modules: typically the water flow, heat transport and solute transport modules.

3 Test cases

- **waterheatsolutesMO_ColmarPRO** Simulation of Colmar Calcosol-SOERE PRO. Simulation for 6 months of a bare soil without incorporation of fresh organic matter.
- **waterheatsolutesMO_ColmarPRO_RES** Simulation of Colmar Calcosol-SOERE PRO. at the beginning. Simulation for 6 months of a bare soil with incorporation of fresh organic matter at the beginning.