monNSRothC_2.0

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The codes are available at https://github.com/CnrIacBaGit/NSRothC and can be used under the conditions of CC-BY-NC 2.0. When utilizing this codebase, please cite the following publication:
Diele, F., Marangi, C., & Martiradonna, A. (2021). Non-standard discrete RothC models for soil carbon dynamics. Axioms, 10(2), 56.

The complete description of the model and numerical methods is available in the cited publication.

Data from:
Coleman, K., & Jenkinson, D. S. (1996). RothC-26.3-A Model for the turnover of carbon in soil. In Evaluation of soil organic matter models (pp. 237-246). Springer, Berlin, Heidelberg.

The code implements the nonstandard version of the RothC model for simaluting the dynamics of soil organic carbon (SOC) contained in the organic matter.

Five compartments of the soil are considered: DPM (decomposable plant material), RPM (resistant plant material), BIO (microbial biomass), HUM (humified organic matter) and IOM (inert organic matter).

The package includes two main codes: *mainNSRothC.R*, and *rhofun.R*, written in R (version 4.2.2).

mainNSRothC.R

Inputs:

1. Scenario File (*.xls or *.xlsx):

   - The program prompts the user to select an Excel file containing scenario information.

   - Scenario information includes input and output file names and global parameters.

2. Meteorological Data (dataname - Excel File):

   - Contains information such as years, months, temperature, rainfall, potential evapotranspiration (PET), and other climatic factors.

3. Global Parameters (parname - Excel File):

   - Contains global parameters such as the carbon diffusion coefficient in the soil (k), carbon release ratio (r), humus release ratio (eta), clay percentage (clay), soil depth (d), and mean temperature (meantemp).

Outputs:

1. Output Folder:

   - An output folder named OUTPUT_[outname] is created if it doesn't exist already, where [outname] is the name specified in the scenario.

2. Output File - Rate Modifying Factors (RHO_[outname].xls):

   - Contains the calculated rate-modifying factors (ka, kb, kc) computed through the rhofun function for each year and month.

3. Output File - Soil Carbon Dynamics (SOC_[outname].xls):

   - Contains the simulation of soil carbon dynamics over time, categorized by carbon type (DPM, RPM, BIO, HUM), and the total organic carbon in the soil (SOC).

4. Plot - Soil Carbon Dynamics (SOC_[outname].png):

   - A graph is generated representing the soil carbon dynamics over the years.

The **rhofun** function takes climatic variables and soil parameters as input and returns a list of outputs:

a: Rate-modifying factor for temperature.

b: Rate-modifying factor for soil cover and moisture accumulation.

c: Rate-modifying factor for soil cover.

accTSMD: Soil moisture accumulation over time.

Simulation:

The code then performs a simulation over time of soil carbon dynamics using a set of differential equations. Results are saved in output files and visualized through a graph showing the soil carbon dynamics over the years.