We develop a modelling framework for dynamical systems describing water transport within soil–plant–atmosphere interactions using observations of stable isotopes in soil and xylem water. Isotopes in soil and xylem water atmosphere interactions using observations of stable isotopes in soil and xylem water (Fabian Bernhard).

Background

We develop a modelling framework to track water fluxes across multiple pools. They are applied from global to local scales (e.g., Good et al., 2015, Mueller et al., 2008). In addition, observations of fluxes, they complement observations of storage such as volumetric water content of the vadose zone and temperature in the soil–plant–atmosphere continuum (Stumpel et al., 2018, Welfare et al., 2014). Recent measurement schemes allow high-resolution sub-daily observations of soil moisture and temperature on the soil–plant–atmosphere continuum (Stumpel et al., 2018, Welfare et al., 2014).

Objective

We develop a modelling framework for dynamical systems describing water transport and interactions within the soil–plant–atmosphere continuum such that it is believed for stable isotope observations.

Approach

Design criteria of intended modelling framework:
• Multiple target variables including stable isotope observations
• Flexible model components, enabling model simplification and model flexibility in model components,
• Relational transportation and storage relationships between variables present in the system
• Lumping of alternative 2-D models for soil–plant–atmosphere continuum
• Easy use of observed or synthetic data

Analysis

Model structure is described by the inclusion processes in a central aspect of the system under consideration. This allows to assess sensitivity of model structures with respect to alternative models. Comparing of model performance and parameter identifiability of different model alternatives allow to:
• draw conclusions regarding the validity of the simplification of the modelled processes for reproduction of observed data
• 2. assert conclusions are independent of underlying modelling approach.

What degree of model complexity is warranted by water–limited ecosystems? Guzzo et al. (2014), Mueller et al. (2016), Noone et al. (2014) characterized ecosystems with non–dimensional parameters to distinguish between or 1D equilibrium flow and transport is to be implemented based on Talbot and Ogden (2008).

The SKIS model (Saurer et al. 2018) simulates dynamic vapour exchange between the two flow domains towards isotopic equilibrium. Alternative non-equilibrium transport models (e.g., Richards-model, vertically distributed, equilibrium) and Soil Water Isotope Simulator (SWIS) model are applied from global to local scales

Model flexibility:
• e.g. alternative soil storage models

References


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• draw conclusions regarding the validity of the simplification of the modelled processes for reproduction of observed data
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