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Physically plausible prescription of land surface model soil moisture

Mathias Hauser, René Orth, Wim Thiery, and Sonia Seneviratne
ETH Zürich, Zürich, Switzerland

Land surface hydrology is an important control of surface weather and climate, especially under extreme dry or wet conditions where it can amplify heat waves or floods, respectively.
Prescribing soil moisture in land surface models is a valuable technique to investigate this link between hydrology and climate. It has been used for example to assess the influence of soil moisture on temperature variability, mean and extremes (Seneviratne et al. 2006, 2013, Lorenz et al., 2015). However, perturbing the soil moisture content artificially can lead to a violation of the energy and water balances. Here we present a new method for prescribing soil moisture which ensures water and energy balance closure by using only water from runoff and a reservoir term. If water is available, the method prevents soil moisture decrease below climatological values.

Results from simulations with the Community Land Model (CLM) indicate that our new method allows to avoid soil moisture deficits in many regions of the world. We show the influence of the irrigation-supported soil moisture content on mean and extreme temperatures and contrast our findings with that of earlier studies. Additionally, we will assess how long into the 21st century the new method will be able to maintain present-day climatological soil moisture levels for different regions.

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