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Characterising and assimilating surface soil moisture drydowns in the ORCHIDEE land-surface model

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The rate at which land surface soils are drying following rain events is an important feature of terrestrial models since it determines, for example, the water availability for vegetation, the occurrences of droughts, and the surface heat exchanges. As such, soil moisture (SM) “drydowns”, i.e. the SM temporal dynamic following a significant rainfall event, are of particular interest when evaluating and calibrating land-surface models. By investigating drydowns, characterized by an exponential decay time scale metric τ, we aim to improve the representation of soil moisture in the ORCHIDEE global land-surface model. In this presentation, we consider τ calculated over a number of ISMN (International Soil Moisture Network) sites found within the footprint of FLUXNET towers. These in-situ sites cover a range of vegetation types and climates. Using the ORCHIDEE land-surface model, we first compare τ from the modelled SM timeseries to the same values computed from the in-situ SM measurements. We then assess the potential of using τ as a data assimilation metric to constrain some parameters of the ORCHIDEE model through a standard Bayesian optimisation procedure; we first select a number of key of water, carbon, and energy parameters through a sensitivity analysis. The optimised soil moisture timeseries are evaluated using the FLUXNET evapotranspiration and GPP data. We conclude by considering the potential of global satellite products like SMOS or the ESA-CCI surface SM satellite data in order to scale up the experiment to a global scale optimisation.