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A novel representation of groundwater dynamics in large-scale land surface modelling

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Land surface processes are connected to groundwater dynamics via shallow soil moisture. For example, groundwater affects evapotranspiration (by influencing the variability of soil moisture) and runoff generation mechanisms. However, contemporary Land Surface Models (LSM) generally consider isolated soil columns and free drainage lower boundary condition for simulating hydrology. This is mainly due to the fact that incorporating detailed groundwater dynamics in LSMs usually requires considerable computing resources, especially for large-scale applications (e.g., continental to global). Yet, these simplifications undermine the potential effect of groundwater dynamics on land surface mass and energy fluxes. In this study, we present a novel approach of representing high-resolution groundwater dynamics in LSMs that is computationally efficient for large-scale applications. This new parameterization is incorporated in the Joint UK Land Environment Simulator (JULES) and tested at the continental-scale.