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# Evaluation of drought propagation in Spain using land-surface models. Evaluation of the uncertainties due to forcing data and model structure.

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Spain suffers recurrent water scarcity periods due to recurrent droughts and a high degree of water use. As a consequence, any improvement of drought monitoring and early warning systems will have large benefits for Spanish society.

Here we investigate drought as a precipitation anomaly, which, in turn, influences soil moisture and streamflow anomalies (drought propagation). This propagation process can be studied by correlating standardized indices of precipitation, at several timescales, with one-month standardized indices of soil moisture and streamflow. The timescale that maximizes the correlation is an estimation of the lag of drought propagation. This information can be then exploited to develop early warning systems. However, observations of soil moisture are scarce, and streamflow is heavily influenced by management. Land-surface models (LSM), which physically simulate drought related processes, could thus be used to compensate for the lack of observations and also to understand the processes at play in a natural setting. Nevertheless, due to the same lack of data, their validation is difficult.

In this work we assess how drought propagates from precipitation to soil moisture and streamflow in different Land-Surface Model based simulations. We use two models (LEAFHYDRO and SURFEX-RAPID), run at high resolution and forced by high and low resolution datasets. We then calculate the scales of drought propagation to soil moisture and streamflow, which, in the case of streamflow, we compare with observations and with the hydrological model used as a reference by the Spanish water management authorities (SIMPA). The results show that the models produce very different spatial structures of drought propagation timescales, with the particular model's formulation as the main source of uncertainty. The variations in forcing dataset has a much smaller impact on the resulting uncertainty. As a conclusion, the models we have compared are not yet ready to be used to inform managers of the state of drought and its propagation.