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Large scale drought impacts hydrology around the globe

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The ability to simulate the climate system has improved over time, however, current state-of-the-art climate models still show systematic regional biases over land. In order to improve these regional biases, an accurate soil moisture content is essential, as it can substantially influence surface temperature, precipitation and even large scale atmospheric circulation. In previous studies, the impact of a soil moisture anomaly was often investigated locally and non-local impacts are could not be distinguished.
In this study, we implement a large scale drying perturbation in a global climate model (EC-earth) for specific regions only. We show to what extent large scale drought affects its peripheries. Moreover, the perturbation affects precipitation far-away from the local perturbation. By implementing moisture tracking, we visualize how the atmospheric water content changes due to reduced continental evaporation. It is shown that the reduction in evaporation, mainly occurring on the Northern Hemisphere, significantly affects the atmospheric water content over the tropics. Generally, reductions in ‘continental water’ in the atmospheric column are partly compensated by increased amounts of water evaporated from oceans. The cumulative impact on atmospheric water content was found to be mainly responsible for the far-away changes in precipitation that are observed in the model experiments. Hence, this unique experiment shows how continentally evaporated water is transported through the atmosphere and via soil moisture perturbations we visualize how the atmospheric hydrology responds.