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Spring precipitation in inland Iberia: land-atmosphere interactions and recycling and amplification processes.

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Inland Iberia, the highest peak of rainfall occurs in May, being critical for agriculture in large water-limited areas. We investigate here the role of the soil moisture – precipitation feedback in the intensification of the water cycle in spring and in the aforementioned maximum of precipitation in the interior of the Iberian Peninsula.

We conducted paired, high-resolution simulations with the WRF-ARW model, using a nested grid that covers the Iberian Peninsula at 5km resolution. Eleven months of May (from May 2000 to May 2010) and eleven months of January (from January 2000 to January 2010) were selected. For each month, we performed two simulations: a control one, where all land-atmosphere fluxes are normally set up, and the corresponding experiment, where evapotranspired water over land in the nested domain is not incorporated into the atmosphere, although the corresponding latent heat flux is considered in the surface energy budget. As expected, precipitation is higher in the control runs with respect to the experiments and, furthermore, this fraction of extra rainfall substantially exceeds the value of the analytical recycling ratio. This suggests that amplification processes, and not only direct recycling, may play an important role in the maximum of precipitation observed in the Iberian spring. We estimated the amplification effect to be as large as the recycling with calculations using analytical methods of separation of both contributions. We also develop here a procedure to quantify the amplification impact using the no-ET experiment and results confirm those obtained analytically.

These results suggest that in the Iberian spring, under favourable synoptic conditions and given a small supply of external moisture that triggers large-scale convection, land-atmosphere interactions can intensify and sustain convective processes in time. Thus there is a large impact of local land-surface fluxes on precipitation and that alterations of anthropogenic nature can potentially influence the precipitation regime significantly.