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Seasonality of carbon and water exchange in mediterranean shrubland ecosystems

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In this work we have compared the carbon and water fluxes of four different Mediterranean shrubland ecosystems, located in the Southeast of Andalusia, in Spain. These ecosystems are in a climatic, altitudinal, and vegetation cover gradient ranging from an alpine shrubland at 2300 m a.s.l., annual average air temperature of 5.5ºC, and annual precipitation of 800 mm, to a semiarid steppe at 60 m a.s.l., annual average air temperature of 20.2 ºC, and annual precipitation of 191 mm. The vegetation cover from the four sites ranged from 63% to 23%. These gradients allowed us to study the effect that different ranges of meteorological variables, within the Mediterranean climate, may have on the behaviour of the carbon and water balances of shrubland ecosystems. We consider shrubland ecosystems as those ecosystems with a predominant vegetation of shrubs or perennial grasses that are part of the first stages of the succession of Mediterranean ecosystems. The importance of studying these ecosystems is highlighted by the fact that they are widespread in the Mediterranean basin, as a result of thousands of years of human intervention.

We have compared the seasonality of the water and carbon fluxes of the four ecosystems during years 2007 and 2008, measured with Eddy covariance systems, in order to be able to establish the main drivers responsible for this seasonality. We have observed that, as expected, the more humid and cooler ecosystems have a growing season ranging from April to July or October (depending on temperature and precipitation), being radiation, temperature, and absence of snow the main drivers for triggering the biological activity. As for the more arid and warmer ecosystems, the growing season ranges from October to April-May, being the water availability the main driver for triggering the biological activity. Moreover, we have compared the water and carbon fluxes to determine how the water fluxes are conditioning the carbon exchange of these ecosystems. To do so we have partitioned the NECB into gross ecosystem production (GEP) and ecosystem respiration (Reco). We have analysed the water use efficiency (WUE), and the light use efficiency (LUE) of the different ecosystems, and preliminary results show that the more arid ecosystems have a higher WUE in the growing season than the more humid ecosystems, as well as the LUE. Therefore, in a future climate change scenario of less precipitation and higher temperatures, it will be expected that the vegetation from the more arid environments will have a higher resilience than the vegetation from the more humid environments.