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Comparing modelled and remotely sensed leaf area dynamics in an Aleppo pine semiarid forest

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Much of the Earth's terrestrial surface is subject to arid climatic water stress. In these regions, plant ecosystems are controlled by water availability, inducing a tight interconnection between the hydrological cycle and the vegetation dynamics. For this reason, and to fully reproduce water-controlled ecosystems' behaviour, it is essential to jointly model vegetation and the hydrological cycle. In this work, the performance of a parsimonious dynamic vegetation model, suitable for the inclusion in a conceptual ecohydrological model, is tested in a semi-arid Aleppo Pine forest area in the south-east of Spain. The model simulates gross primary production (GPP) as a function of absorbed photosynthetically active radiation (APAR) and the light use efficiency (LUE). Net primary production (NPP) is then calculated taking into account maintenance respiration. The modelling is focused particularly on simulating foliar biomass, which is obtained from NPP through an allocation equation based on the maximum LAI sustainable by the system, and considering turnover. An analysis of the information offered by MODIS EVI, NDVI, and LAI products was performed in order to investigate vegetation dynamics in the study site and to select the best indices to be used to evaluate the ecohydrological model's performance. EVI is reported in literature (Huete et al., 2002) to be sensitive to canopy structure, particularly to leaf area index (LAI). In accordance with the phenological cycle timing described for the Aleppo pine in similar climates (Muñoz et al., 2003), the EVI showed maximum values in spring and minimum values in winter. Similar results were found applying the aforementioned vegetation model to the study area. Contrasting simulated LAI with the EVI series, a correlation coefficient r = 0.57 was found. Concerning NDVI, its own definition links this index to the "greenness" of the target, so that it appears highly linked to chlorophyll content and vegetation condition, but only indirectly related to LAI. Photosynthetic pigment concentrations are reported to be sensitive to water stress in Aleppo pine (Baquedano and Castillo, 2006) so, to compare the model's results with NDVI, the simulated LAI was corrected by plant water-stress. The resulting correlation coefficient was r = 0.59.