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Improving simulation of El Niño Impacts on summer cropping systems of the Iberian Peninsula

Mirian Capa-Morocho (1,2), Margarita Ruiz-Ramos (1,2), Belén Rodríguez-Fonseca (1,3,4)

(1) CEI Campus Moncloa, UCM-UPM, Madrid, Spain (mi.capa@upm.es), (2) AgSystems Group. Producción Vegetal: Fitotecnia, Politécnica de Madrid, Madrid, Spain , (3) Departamento de Geofísica y Meteorología, Complutense de Madrid, Madrid, Spain, (4) Instituto de Geociencias (CSIC-UCM), Facultad de CC. Madrid, Spain

El Niño event is a main driver of seasonal climate variability that greatly impacts agriculture and regional economies (Legler et al., 1999). The relationships found between El Niño and yield can be helpful to anticipate yield anomalies (higher or lower than usual) what can help us to adapt crop systems in advance: insurance coverage, changes in sowing dates, choice of species and varieties, as well as changes in the management of fertilization and irrigation and the establishment of an early warning system. In a previous work, we found that the ENSO affects maize yield differently depending on the location in the Iberian Peninsula (Capa et al., 2012), using observed data series for periods ranging from 22 to 46 years. The specific objective of this work is 1) to confirm these results using a longer time series from re-analysis data; 2) to evaluate the yield simulations done with re-analysis regarding observed crops yields and simulations obtained with observed climate data; and 3) to use re-analysis climate data to help to explain the mechanism of the influence of El Niño.

Crop yield was simulated with the ecophysiological crop model CERES-maize, included in DSSAT v.4.5 (Decision Support System for Agrotechnology Transfer). To simulate maize yields, re-analysis daily data of radiation, maximum and minimum temperature and precipitation were used. The re-analysis climate data were obtained from NCEP/NCAR 40-year reanalysis project (NOAA National Center for Environmental Prediction) and ECMWF Data server (European Centre for Medium-Range Weather Forecasts: ERA 40 and ERA Interim). Simulations were made on three locations where site- specific calibrations were done and validated with independent field data: Lugo (northwestern), Getafe (centre) and Albacete (southeastern Spain).

Re-analysis data confirm the preliminary results obtained with observed data (AEMET): El Niño phenomenon affects irrigated maize depending on the location in the Iberian Peninsula. Also confirm that crop yield can be used as an integrated bioclimatic indicator in Lugo. We observed that there is a non stationary relationship between maize yield in the Iberian Peninsula and El Niño. The climate fields that have significant influence on maize yield are maximum and minimum temperature of May. Low maximum and minimum temperature in May increased yield, and these temperatures are positively correlated with El Niño Index of several months before the cycle crop. These interactions and others found will be discussed in detail.

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