



Evaporation observations, estimates and driving factors in Spain (1961-2011)

Cesar Azorin-Molina (1), Sergio Martín Vicente Serrano (1), Arturo Sanchez-Lorenzo (2), Juan I. Lopez-Moreno (1), Enrique Moran-Tejeda (1), Jesus Revuelto (1), Francisco Espejo (3), and Tim R. McVicar (4)

(1) Instituto Pirenaico de Ecología, Procesos geoambientales y Cambio Global, Zaragoza, Spain (svicen@ipe.csic.es), (2) Department of Physics, University of Girona, Girona, Spain, (3) Agencia Estatal de Meteorología (AEMET), Spain, (4) CSIRO Land and Water, Canberra, ACT, Australia

We analyzed the spatio-temporal evolution of evaporation observations from Pan evaporimeters (1984-2011; 21 stations) and Piché atmometers (1961-2011; 56 stations) across Spain, and compared both measurements with evaporation estimates obtained by four different physical models (i.e. FAO-Penman-Montieth, FAO-Pan, PenPan and Penman) based on climate data. In this study we observed a positive and statistically significant correlation between Pan and Piché evaporation measurements during the common period (1984-2011; 19 stations), mainly in the warm season. When compared evaporation observations and estimates, we detected positive and statistically significant correlations with the four methods, except for winter months. Among the different physical models, the FAO-Pan displayed better fit with both Piché and Pan evaporation measurements; the PenPan model over-estimated evaporation rates; and the FAO-Penman-Montieth and Penman methods underestimated evaporation. We also observed a better spatial agreement between Pan evaporation and estimates than that obtained by the Piché measurements. Annual and seasonal trends of evaporation estimates show a statistically significant increase for 1961-2011, which do not agree with long-term Piché evaporation trends for the same period; a discontinuity was found around the 1980s. Here we investigated the radiative and aerodynamic driving factors that explain the discontinuity found between evaporation observations and estimates in the 1980s, suggesting that the abrupt increase observed in temperature during last few decades (i.e. global warming) could explain evaporation processes and trends observed in Spain. Further investigations using available Piché evaporation observations for other regions are needed to better understand physical components influencing long-term trends of evaporation.