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New surface solar radiation and evaporation datasets in Spain: in search of a better understating of the dimming/brightening

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Previous research on the dimming/brightening phenomena in Spain has been limited to the analysis of the long-term series of sunshine duration (Sanchez-Lorenzo et al., 2007) and cloud cover observations (Sanchez-Lorenzo et al., 2009). This work describes the development of a new dataset of surface radiation in Spain based on the 16 longest daily series provided by the Spanish Meteorology Agency, with the first series starting in the early 1970s, and providing global, diffuse and direct radiation. For the Madrid station an additional effort has been made to digitalize monthly records of global radiation since 1958, which provide the longest series available in Spain up to the present. The results of a temporal analysis of this dataset show an overall agreement with the trends observed using sunshine duration series, confirming the suitability of this latter variable to estimate surface radiation on decadal time scales. The important role of surface solar radiation to drive evaporation is well known, and consequently an agreement between the dimming/brightening phases and the trends in potential evaporation has been observed worldwide (Wild, 2009). Therefore, a dataset consisting of monthly series of potential evaporation has been generated by using records from tanks and Piche atmometers. The pan evaporation data consist of 13 series with records since 1981, meanwhile for Piche measurements there are around 100 series with more than 60 years of data, some of them starting in the beginning of the 20th century. The results show a decrease in pan evaporation (1981-2010 period) that cannot be explained by the observed increase in solar radiation, but may be linked to a decrease in the wind speed. On the other hand, evaporation trends estimated by the Piche evaporimeter provide a better agreement with solar radiation and sunshine time trends. This relationship needs special attention, as Piche evaporimeter is exposed inside a meteorological screen, especially regarding the possible role of water vapour deficit changes in order to explain these trends in evaporation.

References:

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