



## **Does observed and simulated cloudiness decadal variability in the Iberian Peninsula explain sunshine behavior?**

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We compare the decadal time evolution and trends of annual total cloud cover (TCC) and sunshine duration (SunDu), as a surrogate of solar radiation, over the Iberian Peninsula (IP) during the 1951-2004 period. As expected, the correlation between these variables is highly negative and significant. Regarding the time evolution, the SunDu series shows a clear dimming period from the 1950s to 1980s, with a subsequent brightening period until present, resulting in an overall slightly negative non-significant trend. The TCC series contrarily shows a significant decrease over the entire analyzed period. Thus, there is a paradox in these behaviors: we detect a decrease of both SunDu and TCC from the 1950s to the 1980s period. This finding is similar to previous results obtained in others areas of the World, so the most plausible explanation for the solar dimming suggested by others is related to large amounts of anthropogenic aerosols (during the dimming decades) that reflected and/or absorbed solar radiation, with a subsequent decrease in total and direct (beam) solar radiation

To complete our study we check these results with the climate simulations obtained with the latest version of the Community Atmosphere Model (CAM3), developed at the National Center for Atmospheric Research (NCAR), which is the atmospheric component of the Community Climate System Model (CCSM). We used five-member

ensemble integrations with a resolution of  $1.4^\circ$  (T85) and forced by global observed time-varying Sea Surface Temperature (SST) plus natural and anthropogenic forcings. The examined variables are vertically-integrated total cloud (CLDTOT) and downwelling solar flux at surface (FSDS). For the IP, the simulated CLDTOT shows a negative and significant trend, consistent with the observations (TCC). On the other hand, FSDS shows, in agreement with the SunDu series, remarkable low values between 1982-1984, with a posterior brightening until the end of the 20<sup>th</sup> century. But contrary to the observations, there is not a decrease in FSDS from the 1950s to the 1980s, and consequently the linear trend over all the period is positive, and significant.