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Variability and trends of reconstructed surface radiation in Switzerland since late 19th century

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In this work we present the reconstructed all-sky surface solar radiation (SSR) variations from 1885 to 2010 in Switzerland, which have been estimated using a homogenous data set of sunshine duration series. The temporal evolution of the mean all-sky SSR annual series is characterized by a period without relevant variations during the first half of the 20th century. Then a decrease from the 1950s to the early 1980s is found, in agreement with the well-known global dimming phenomena. This is followed by a positive trend up to the present, which also matches with the brightening worldwide observed. Cloud cover changes seem to explain the major part of the decadal variability observed in all-sky SSR, at least until the 1970s. In order to study the direct effect of the aerosols, we also estimated clear-sky SSR series for selected sites with collocated homogenous cloud cover observations. Equally, estimated SSR series under overcast conditions are also generated with the aim of studying a possible indirect effect of the aerosols or a change in the cloud types. The results show interesting significant positive (negative) trends under clear-sky (overcast) state, in agreement with previous findings limited to the second half of the 20th century. These results confirm the suitability of traditional sunshine duration and cloudiness observations to detect changes in SSR under clear-sky and overcast conditions, which will allow to extend the analyses to other geographical areas with available long-term series for both variables.