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Surface solar radiation modelling over 1900-2014: comparison between the regional climate model MAR and reanalyses

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Many studies show that the surface solar radiation has underwent large variations over the second half of the 20th century as a result of variations in cloud cover and aerosol loading in the atmosphere. However, it is difficult to build strong conclusions before the 1950s because of the observations scarcity.

The evolution of the surface solar radiation has been reconstructed over 1900-2014 using the regional model MAR (« Modèle Atmosphérique Régional ») which has recently been chosen to be part of the EURO-CORDEX project, thanks to the CORDEX.be project. Simulations were performed at a horizontal resolution of 5 km over a domain of 600 x 550 km^2 covering Belgium. Boundary conditions were provided by four reanalysis products: ERA-interim (1979-2014) completed by the ERA40 (1958-1978), NCEP/NCAR-v1 (1948-2014), ERA-20C (1900-2010) and 20CRV2C (1900-2010). Surface solar radiation measurements from the Global Energy Balance Archive and cloud cover observations from Belgocontrol covering 1966-2007 were used for the evaluation of the MAR model and the forcing reanalyses.

Results show that MAR produces much better results than the reanalyses. The driving reanalyses can generate divergent trends while they assimilate observations and are supposed to represent the same climate.