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Decadal variations in retrieved aerosol optical depth from sunshine duration measurements over Europe since the late 19th century

William Wandji¹, Antti Lipponen¹, Else van den Besselaar², Arturo Sanchez-Lorenzo³, Martin Wild⁴, and Antti Arola¹

¹Finnish Meteorological Institute, Kuopio, Finland (william.wandji@fmi.fi)

²Royal Netherlands Meteorological Institute, De Bilt, Netherlands

³Department of Physics, University of Extremadura, Badajoz, Spain

⁴ETH Zurich, Institute for Atmospheric and Climate Science, Zurich, Switzerland

A better knowledge of the present-day aerosol forcing requires an accurate estimation of the historical evolution of aerosol optical depth (AOD), which is also crucial to better understand the role played by atmospheric aerosols in the dimming/brightening phenomena that have occurred since the mid-20th century. A physically-based approach using daily sunshine duration and cloud cover measurements is applied over Europe for retrieving AOD (Wandji Nyamsi et al., 2019). Both European Climate Assessment & Dataset (ECA&D) and national meteorological offices/institutes provide suitable measurements, from ~ 1000 ground-based stations, to carry out our study.

The retrieved long-term AOD shows reasonable seasonal and annual variabilities including signals induced by major volcanic eruptions. The trends of atmospheric aerosols and associated increase and decrease of AOD over the periods 1960–1984 and 1985–2010, respectively, are in good agreement with the dimming/brightening periods reported before. In addition, a more dominant decrease in AOD including high variability from the early-1900s to the 1950s is observed, which agrees with some earlier studies reporting “early brightening” for this period. The high inter-annual AOD variability during that period may be partly due to the transition from coal to gas in some European countries and also due to the possible influence of the Word Wars I & II.

References

Wandji Nyamsi, W.; Lipponen, A.; Sanchez-Lorenzo, A.; Wild, M. and Arola, A. (2019), A hybrid method for reconstructing the historical evolution of aerosol optical depth from sunshine duration measurements, submitted.