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Changes in Secondary Organic Aerosol burden from 1960-2010: a model study with the climate-aerosols ECHAM6-HAM2 model

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Organic aerosols (OA) represent an important fraction of the total aerosol burden and include Primary Organic Aerosols (POA), which are directly emitted into the atmosphere and Secondary Organic Aerosols (SOA), which result from atmospheric oxidation of a number of gaseous precursors. Recent estimates indicate that SOA represent about 50% of the total OA burden (but only about 30 % of the OA surface concentration).
In this study we explore the processes driving the changes in the production and burden of SOA from 1960 to 2010 with the global climate-aerosol model ECHAM6-HAM2. Between the 60s and 00s the global SOA production increases from 24 to 30 Tg/a, the burden increases from 0.56 Tg to 0.64 Tg. The increase takes mainly place in the main source regions of the Northern Hemisphere (tropical forested regions and highly polluted regions in Asia) and in South America.
With a series of sensitivity simulations we distinguish between the roles of climate change (temperature, precipitation, radiation), land use change, changes in emissions of POA, and changes in emissions of anthropogenic precursors of SOA. We find that, while all regions show an increase in burden, the relative importance of each process is strongly region-dependent. In Europe, the increase in SOA is related to climate and land use changes. In Africa, the increase in SOA results from climate change and increase in POA emissions. In Asia, the increase is mainly due to increase in anthropogenic emissions.