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Formation of secondary organic aerosols from biogenic precursors: A case study over an Isoprene emitting forest.

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Characterising the sources and formation patterns of atmospheric aerosols is fundamental to understanding the impact of anthropogenic emissions on the composition and physical properties of the atmosphere. Although, the contribution of urban anthropogenic aerosol particles is important (10 Tg C yr-1), the contribution of biogenic aerosols has been estimated to be as much as 90 Tg C yr-1 (Hallquist et al., 2009.). This large difference highlights the importance of understanding the formation mechanisms and sources of the biogenic aerosol in the atmosphere. An increasing number of studies have shown that the submicron aerosol mass concentration is dominated by organic aerosols in both rural and urban environments. In addition, there have been several studies showing that the combined emissions of both biogenic and anthropogenic VOC emissions can result in a higher yield of secondary organic aerosol (SOA) formation. Biogenic SOA is formed from the oxidation of biogenic volatile organic compounds that are emitted naturally from terrestrial vegetation. The most commonly emitted BVOCs include isoprene and monoterpenes (Kesslmeier and Staudt, 1999, Arneth et al., 2008). Despite their importance, the characterisation of BSOA from laboratory and field experiments is still poor and it is only recently that advances in measurement techniques providing more detailed analysis of these species is being provided. One of the reasons for the difficulty in characterising the abundance of these species, is their high temporal and spatial scales. As part of the ChArMEx (the Chemistry-Aerosol Mediterranean Experiment, http://charmex.lsce.ipsl.fr) experiment (SOP2a/SAFMED+) in July 2014, a number of research flights were performed over two forested areas in the south of France. These forested areas had different characteristics where one has mainly isoprene emitting vegetation, and the other is known to have more monoterpene emitting vegetation. The aims of these research flights were to characterise the gas-phase precursors responsible for the formation of biogenic SOA. The French ATR-42 aircraft was equipped with both gas-phase and aerosol phase measurements providing detailed measurements of aerosol chemistry (PTRMS, AMS) and physical properties (SMPS, CPC). During these measurements, we encountered suitable meteorological conditions to allow us to observe the formation of SOA from isoprene emissions and new particle formation from monoterpene emissions. These results provide an ideal case study that can be used to validate numerical models on the formation of SOA and new particles from biogenic emissions.

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