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Influence of NPF events on the CCN concentration at a high-altitude site in southern Europe

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The Cloud Condensation Nuclei (CCN) budget, the aerosol particles population that could become cloud droplets, can be influenced by primary aerosol particles emitted by different sources (anthropogenic or biogenic) or by secondary particles that have undergone growth processes or chemical transformations. Aerosol particles originated by nucleation of precursor gases in the atmosphere have been identified as an important source of CCN particles. The influence of New Particle Formation (NPF) events to CCN concentrations is highly dependent on the environment where it takes place. Specifically, the study of the influence of NPF events on CCN concentration at high-altitude sites, where atmospheric conditions favor the formation of clouds, is a very interesting scientific goal.

This study presents CCN measurements combined with aerosol size distribution at a high-altitude station in the South East of Spain: a remote high mountain site (Sierra Nevada; SNS, 2500 m a.s.l.). Due to its high altitude, the aerosol particles over SNS station are often representative of pristine free troposphere conditions, especially in winter and nighttime. During summer, SNS station is frequently influenced by transport of pollutants from Granada city to Sierra Nevada station as a result of mixing layer growth and the activation of the mountain-valley breeze phenomenon as well as by NPF events at midday (De Arruda Moreira et al., 2019; Casquero-Vera et al., 2020).

In this study, we analyze the influence of NPF events to CCN concentrations during summer 2019 at the SNS high-altitude station. The study period (from June to August of 2019) was characterized by 67 NPF events, 16 undefined events and 13 non-events days. Following Rose et al. (2017) criteria, only those NPF events referred as type I, i.e. with clear particle growth from smallest sizes, were selected to investigate the contribution of NPF events on CCN concentrations. In this sense, we selected the 15 clearest NPF events for this analysis.

Results show clear differences in the diurnal evolution of CCN concentration between NPF event and non-event days, demonstrating the large influence of NPF to CCN concentrations, especially at high supersaturations (Rejano et al., 2021). NPF events have been estimated to increase the CCN concentrations by 175% at SS=0.5%, evidencing NPF events as one of the major CCN source at this mountain site

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