



Is formation of new particles from nucleation enhanced at high altitudes? A review of three mountain sites long term observations and airborne studies

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Nucleation and growth of newly formed particles were predicted to be a major contributor to free tropospheric particle number and cloud condensation nuclei concentrations by global models (Spracklen et al. 2006, Merikanto et al. 2009). Reasons for nucleation to be promoted at high altitudes could be that the condensational sink of precursor gases and temperatures are lower compared to low altitudes, whereas radiation is higher. However, very few measurements are available to confirm and validate simulations. In order to study the occurrence and characteristics of the nucleation process at high altitudes, data were gathered and analysed from three altitude stations (and three continents) at various altitudes among which the highest in the world (CHC, Bolivia, 5240 m a.s.l.; NCO-P, Nepal, 5079 m a.s.l. and puy de Dôme, France, 1465 m a.s.l.). On the three stations, nucleation was investigated from the very first nucleation stages (0.8 nm ions and 2 nm particles) of the process. Very recent observations showed that the frequency of new particle formation (NPF) events at CHC is one of the highest reported so far (63.9%) and shows a clear seasonal dependency with maxima up to 100% during the dry season and frequent occurrence of multiple nucleation events. These features will be compared to those of nucleation events observed at the two other stations in the past. Finally, additional information will be provided on the vertical distribution of nanoparticles in the atmosphere from 40 vertical profiles performed during airborne studies.