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The influence of volcano activity on aerosol formation over the Andes

Federico Bianchi, Diego Aliaga, Qiaozhi Zha, Liine Heikkinen, Marcos Andrade, Markku Kulmala, and Claudia Mohr
University of Helsinki, Helsinki, Finland (federico.bianchi@helsinki.fi)

A significant fraction (>50%) of cloud condensation nuclei (CCN) in the atmosphere arises from new particle formation (Dunne et al., 2016). While particle nucleation has been observed almost everywhere in the atmosphere, the mechanisms governing this process are still poorly understood and subject of on-going research. For example, it is still largely unknown which components participate in new-particle formation. Laboratory experiments and quantum chemical calculations have identified potential candidates that may play a role, including sulphuric acid, ions, ammonia, amines and highly oxygenated organic molecules (Kirkby et al., 2011; Almeida et al., 2013; Bianchi et al., 2016; Bianchi et al., 2019).

Here we present observations of the formation and growth of newly formed particles measured during intense volcano activities.

The measurements were conducted at Chacaltaya mountain station (5240 m a.s.l.) in Bolivia. The station is located on top of the Cordillera Real. It has air masses coming from the Amazon forest, La Paz and the Bolivian altiplano.

With the Chemical Ionization Atmospheric Pressure interface Time-Of-Light mass spectrometers (CI-APi-TOF) we measured H_2SO_4, the APi-TOF retrieved the chemical composition of positive and negative ions. Ion and particle size distributions were measured with the NAIS (Neutral cluster and Air Ion Spectrometer) and the SMPS (Scanning Mobility Particle Sizer), respectively. The PSM (Particle Sizer Magnifier) measured particles with a cut off that varied from 1-4 nm. Finally, with the ACSM (Aerosol Chemical Speciation Monitor) and the FIGAERO (Filter Inlet for Gases and AEROsols) we retrieved the aerosol chemical composition. Besides this set of instruments, other parameters were measured at the Chacaltaya GAW station.

During the intensive measurement campaign, air masses coming directly from volcano eruptions were detected by all our instruments. We were therefore able to determine the gas and particle chemical composition of the air mass. In addition to that, we observed several NPF events triggered by air masses coming from volcanic emissions. With this set of instruments, we were able to retrieve the chemical composition of the vapours leading to the formation of new particles. It was found that all the nucleation event observed during the volcano activity were triggered by sulphuric acid and ammonia. In the presentation we will show more details on the chemical and

physical mechanism behind this process.

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