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The Effect of using a New Parameterization of Nucleation in the WRF-Chem model on the Cluster Formation Rate and Particle Number Concentration in a Passive Volcanic Plume

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Volcanic eruption is one of the main natural sources of atmospheric particles. In particular, evidence of New Particle Formation (NPF) from volcanic emission is reported in previous studies (Boulon et al., 2011; Sahyoun et al., 2019), which also suggests an essential role of sulfuric acid in this process. In addition, Rose et al. (2019) highlighted a significant contribution of the particles formed in the volcanic plume of the piton de la Fournaise to the budget of potential CCN at the Maïdo observatory, located ~40 km from the vent of the volcano. Therefore, it is predicted that the number and size of the cloud droplets, cloud growing and precipitation processes might be affected by the frequency of occurrence and characteristics of volcanically induced NPF in both local and regional scales, because volcanic plumes can extend far from the vent and even lower heights under the influence of the wind field and atmospheric dispersion.

Following the study of Planche et al. (2020), the effect of using the New Parameterization of Nucleation (NPN) derived from the measurements performed in the passive volcanic emission plume of Etna (37.748˚ N, 14.99˚ E; Italy) (Sahyoun et al., 2019) in the WRF-Chem model (Weather Research and Forecasting Model coupled with Chemistry) is assessed, with a specific focus on the cluster formation rate and particle number concentration including CCN. In particular, results obtained with the NPN are compared to the predictions obtained with the default model settings, and further with observations.

In the next step, the resulting aerosol fields will be used to further evaluate the influence of the newly formed and grown particles on cloud formation and properties in a 3D cloud-scale model using a detailed microphysics scheme (DESCAM; Flossmann and Wobrock, 2010; Planche et al. 2010; 2014) .