New particle formation at rural and mountain stations in north Italy: A comparative study during the joint PEGASOS and Supersito campaign

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Keywords: New particle formation events, Condensational sink, Particle growth, Comparative study
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New particle formation (NPF) events occur frequently in the atmosphere in both clean and polluted environments. It is not, however, yet possible to predict, a priori, rates at which particles are formed and grow, or even to know with certainty which chemical species are involved. To improve the understanding of atmospheric NPF, numerous field measurements, laboratory experiments and models studies are devoted to monitor the gas-phase nucleating vapors and chemical compositions of NPFs. Advanced field measurements are crucial to provide information about the spatial distribution of the rate coefficient in the nucleation parameterizations to assess the impacts of aerosols on climate, weather, air quality, and human health.

Recently, an intensive field campaign (a joint campaign between the Supersito project and the PEGASOS FP7-project) was conducted at San Pietro Capofiume (SPC) (44° 39' N, 11° 37' E; 11 m a.s.l; polluted rural site); and Mt.Cimone (MTC) (44°12’ N, 10°42’ E; 2165 m a.s.l.; mountain site) measurement stations in the Po Valley region from June 9th to July 10th 2012. Simultaneous measurements of NPF at different parts of the Po Valley give us a good opportunity to study the driving factors of NPF at different sectors of the PoValley region. Particle size distribution (PSD) measurements in diameter range from 3 to 600 nm were measured by a twin Differential Mobility Particle Sizer (DMPS) at the SPC site since March 2002 (Hamed et al., 2007). In November 2005, similar DMPS system but with diameter range from 10-500 nm was established at MTC site in the frame of EUSAAR and ACTRIS projects.

Here, we are presenting the NPF analysis for the first time at MTC station, in addition to SPC site, during the joint PEGASOS/Supersito campaign period. As a summary, 28 NPF event days were identified at SPC site while 9 NPF event days at MTC site. Figure 1 shows surface plots of PSD data as measured with a DMPS system from July 1st to July 7th at both SPC and MTC stations. It is clearly seen that NPF events at SPC are more frequent and more intense (in terms of clear formation and growth for several hours) than NPF events at Mt.Cimone site.

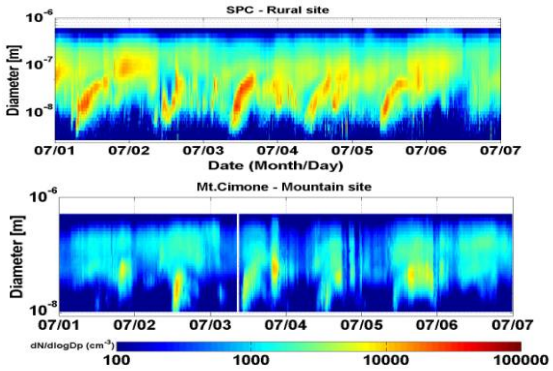

Figure1. Example of one week particle formation bursts observed at SPC (upper panel) and at Mt.Cimone (lower panel), in frame of PEGASOS/Supersito campaign.

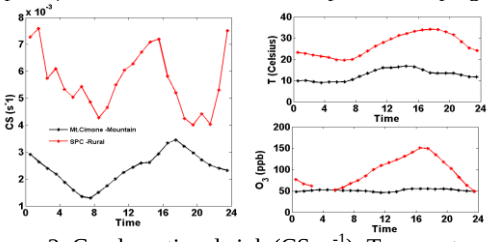

Figure 2. Condensational sink (CS; s^{-1}); Temperature (T; Celsius) and O_3 concentrations (ppb) at Mt.Cimone (black) and SPC (red) on the NPF day of July 3rd.

Our preliminarily results show that CS and T were both lower in MTC than SPC (Fig. 2), which could be possible driving factors of NPF occurrence at MTC site. These two combinations of conditions (low T and low CS), were also shown to favour NPF occurrences at the Finnish boreal station, Hyytiälä (Boy and Kulmala 2002). On the other hand, in SPC both T and O_3 were higher (Fig.2), therefore it is possible that volatile organic compounds (VOCs) and their oxidation products were at higher level in SPC. If VOC oxidation products participate in NPF events at SPC, then that favors NPF events more in SPC than in MTC. The above differences in NPF events hint that different processes are controlling the particle formation events at different parts of Po Valley. More details on characterization of NPF events at PoValley will be discussed in our presentation.

Boy and Kulmala (2002) *Atmos.Chem.Phys.*,***2***,1–16.
Hamed, et al. (2007) *Atmos. Chem. Phys.*,***7***,55-376.