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Nucleation and growth of new particles in Po Valley, Italy

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Abstract. Aerosol number distribution measurements are reported at San Pietro Capofiume (SPC) station (44°39' N, 11°37' E) for the time period 2002–2005. The station is located in Po Valley, the largest industrial, trading and agricultural area in Italy with a high population density. New particle formation was studied based on observations of the particle size distribution, meteorological and gas phase parameters. The nucleation events were classified according to the event clarity based on the particle number concentrations, and the particle formation and growth rates. Out of a total of 769 operational days from 2002 to 2005 clear events were detected on 36% of the days whilst 33% are clearly non-event days. The event frequency was high during spring and summer months with maximum values in May and July, whereas lower frequency was observed in winter and autumn months. The average particle formation and growth rates were estimated as $\sim 6 \text{ cm}^{-3} \text{ s}^{-1}$ and $\sim 7 \text{ nm h}^{-1}$, respectively. Such high growth and formation rates are typical for polluted areas. Temperature, wind speed, solar radiation, SO_2 and O_3 concentrations were on average higher on nucleation days than on non-event days, whereas relative and absolute humidity and NO_2 concentration were lower; however, seasonal differences were observed. Backtrajectory analysis suggests that during majority of nucleation event days, the air masses originate from northern to eastern directions. We also study previously developed nucleation event correlations with environmental variables and show that they predict Po Valley nucleation events with variable success.

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