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Aerosol chemical composition during new particle formation events in the Po Valley (Italy)

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As part of the QUEST EC project , an intensive measurement campaign was carried out in San Pietro Capofiume a rural site located in the Po Valley from March 13^{th} to April 4^{th}, 2004 to investigate the mechanisms of new particle formation in a polluted environment and to assess the role of aerosol chemical composition in the formation and growth of particles. Continuous measurements of particle size distributions were conducted using a Twin Differential Mobility Particle Sizer (TDMPS) (3 nm-600 nm). Meteorological parameters and trace gas concentrations (NOx, NO, NO2, SO2, O3) were also measured. Size segregated aerosol samples were collected with cascade impactors and in parallel PM10 were sampled with an Hi-Vol sampler. Mass concentration, major inorganic ions, water soluble organic carbon (WSOC) and total carbon (TC) concentrations were measured in size resolved samples while organic functional group analysis by HNMR was performed on Hi Vol filters. Aerosol samples were categorized as *event* (of different intensity) or *non-event* samples. New particle formation was preferentially associated with relatively cleaner air masses: the aerosol mass concentrations during nucleation events ranged between 12.1 and 21.4 μg m^{-3},during non-event periods mass concentration was higher(22.2 -71.1 μg m^{-3}). Impactor analysis, in the case of *non-event* conditions, shows a monomodal distribution strongly centered in the accumulation mode and comprising, in decreasing proportions, NO_3^-, NH_4^+, WSOC and SO_4^{2-}. The *event* aerosol instead shows a bimodal distribution with a strong accumulation mode and a less pronounced coarse mode. SO_4^{2-}, NH_4^+ and WSOC concentrations peak within the accumulation mode, while

NO_3^- is more smoothly distributed also over larger sizes. The coarse mode aerosol exhibits a significant contribution of sea salt, tracing a maritime fingerprint of the air mass. HNMR analysis of WSOC shows that secondary organic aerosol are rich of aliphatic unsaturated oxygenated structures (H-C-C=O), mostly carbonyls in the early stage, then evolving to more oxidised forms (carboxyls).