

Meteorological and chemical factors triggering an exceptional PM pollution episode in wintertime in the Po Valley, Italy

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Keywords: PM, atmospheric aerosol, pollution episode.

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An exceptional pollution episode interested the Po Valley (Northern Italy) from 15th to 19th February 2012, and was responsible for very high PM concentrations (Figure 1), principally in its western and southern parts. In particular in Parma and Milan, PM₁₀ concentrations reached about 250 µg/m³. From the meteorological point of view the Po Valley was interested by heavy snowfalls from 1st to 12th February in particular in its southern area. A period characterized by atmospheric stagnation followed until 19th, but interrupted from an outbreak of northerly dry winds on the lee side of the Alps (foehn) on 15th and 16th. Observed PM concentrations started to increase from 15th February, reaching a maximum on 19th February. Starting from 20th February, PM concentrations significantly decreased in the entire Po Valley due to the rainfall.

The present work deals with the results of chemical analyses performed on PM₁ and PM_{2.5} samples collected at urban and rural background sites in southern Po Valley. Moreover, the aerosol mass closure on the chemical species was calculated for the analyzed period. The results for Bologna urban background station are shown in Fig 2.

Furthermore it has been analyzed the Particles Number Concentrations (PNC) observed in the urban and rural background sites in Bologna measured by Optical Particle Counters (FAI-Instruments OPC Multichannel Monitor) in a range between 280 nm and 10 µm.

The analysis of meteorological factors and of the chemical dataset indicates that a gradual accumulation of aerosols progressed from 15th to 19th February mainly due to lowering of mixing height, while the factors responsible for the second maximum observed after 16th February are more complex. The chemical composition in this second period was characterized by a large fraction of ammonium nitrate particles (up to 70%) suggesting that chemical processes beside the meteorological factors came into play. In this study it was examined the following possible explanation for the peak concentrations of PM: a) contribution of transboundary transport of pollutants, b) manure spreading on agricultural land and consequent increase of ammonia concentration in atmosphere, c) snow melting and releasing of aerosol precursors in the atmosphere.

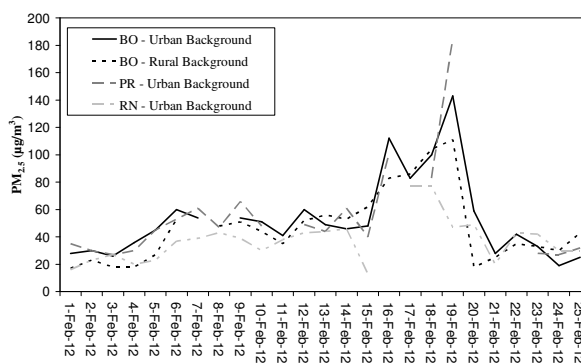


Figure 1. PM_{2.5} mass concentrations in four cities of Po Valley in February 2012.

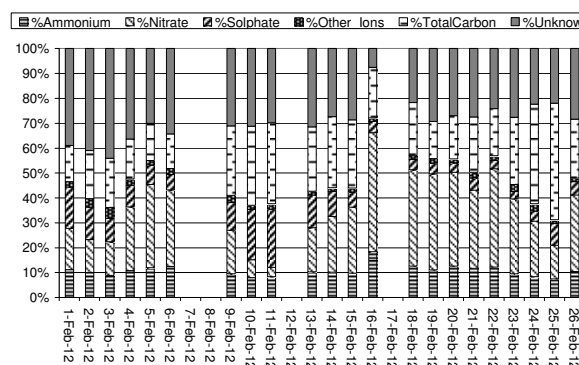


Figure 2. Aerosol mass closure on the chemical species, PM_{2.5} samples collected in Bologna urban background site in February 2012.

This research was conducted as part of the "Supersito" Project, which was supported and financed by Emilia-Romagna Region and Regional Agency for Prevention and Environment under Deliberation Regional Government n. 428/10.