Geophysical Research Abstracts
Vol. 19, EGU2017-15271, 2017
EGU General Assembly 2017

Where is PM gone? Trends and variability of atmospheric PM_{10}, $PM_{2.5}$ and $PM_{10-2.5}$ in the Po valley over the last decade (and more).

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The Po Valley is one of the largest European regions with a remarkably high concentration level of atmospheric pollutants, both for particulate and gaseous compounds. In the last decade stringent regulations on air quality standards and on anthropogenic emissions have been set by the European Commission, leading to an overall improvement in air quality across Europe. In order to assess the decadal pattern and variability in PM across the Po valley we thoroughly investigated the time series of PM_{10}, $PM_{2.5}$ and $PM_{10-2.5}$ from 41, 44 and 15 sites respectively (Bigi & Ghermandi 2014, 2016).
$PM_{2.5}$ and $PM_{10-2.5}$ (PM_{10}) series with a 7 (10) year or longer record have been analysed for long term trend in deseasonalized monthly means, annual quantiles and in monthly frequency distribution by robust statistical methods. A widespread and significant decreasing trend was observed at several sites for all size fractions, with the drop, up to a few percent per year, occurring mainly in winter for $PM_{2.5}$ and throughout the year for PM_{10}.
All series were tested for a significant weekly periodicity (a proxy to estimate the impact of primary anthropogenic emissions) by 3 different statistical methods, yielding positive results for summer $PM_{2.5}$ and PM_{10}, and for both summer and winter PM_{10}–2.5.
Hierarchical cluster analysis showed larger variability for PM_{10} than for $PM_{2.5}$. The former was split in five clusters: two encompassing the metropolitan areas of Turin and Milan and their respective nearby sites and the other three clusters gathering northeast, northwest and central Po Valley sites respectively. $PM_{2.5}$ clusters divide the valley in western, eastern and southern/Apennines foothill sectors.
The trend in atmospheric concentration was compared with the time series of local primary and precursor emissions, vehicular fleet details and fuel sales. A significant basin-wide drop in emissions occurred for gaseous pollutants, contrarily to primary emissions of PM_{10} and $PM_{2.5}$, whose drop was low and spatially restricted.
Overall the decrease in atmospheric $PM_{2.5}$ and PM_{10} seems to originate from a drop in both primary emissions and in precursors of secondary inorganic aerosol emissions, largely ascribed to vehicular traffic. Potentially, the recent increase in biomass burning emissions in winter and the modest decrease in NH_3 weaken an otherwise even larger drop in atmospheric concentrations.

References

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