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Overview of the Lombardy Region (I) Source Apportionment Study

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The Lombardia Region (RL) is situated in the central part of the Po Plain (I) where the mesoscale climatological conditions are determined to a high degree by the orographical characteristics of this area. Encirclement from three sides (North, West and South) by the mountain chains contributes greatly to the climatological peculiarities that are related from the physical point of view to the dynamic of the air mass in this region. The adverse anemological regime and the persistence of atmospheric stability result in low wind speeds, inversion of the temperature, and shallow inversion layers. Due to these particular geographical and the meteorological conditions associated with a high population density (9 million inhabitants) and the connected anthropogenic activities, RL is one of Europe's most polluted regions with regard to PM and photochemical smog. The 24 hours EU air quality limit for PM10 of 50 ug/m3 is exceeded up to 180 days per year and the yearly limit of 40 ug/m3 is in breach for most urban/urban background areas. In order to efficiently plan abatement strategies, quantitative information is required on the pollution sources and available emission inventories need to be compared with source apportionment results derived by receptor modeling of the chemical composition of PM10 in ambient air and in source emissions.
The European Commission Joint Research Centre (JRC) has embarked on a major integrated project in RL (2006-2010) in collaboration with the air quality authorities (ARPA) to support the design of appropriate air quality and emission reduction strategies in this area. The present paper presents the first results of this project, carried out during typical winter episodes in 2007 at ten measurement stations distributed over the entire RL. The source contributions to PM10 and the associated air toxics (benzo[a]pyrene, Pb, Ni, Cd and As) have been quantified by Chemical Mass Balance and Positive Matrix Factorization based upon the chemical analysis of 700 filters including the bulk compounds OC, EC, nitrate, sulfate and ammonium together with a number of source marker compounds such as levoglucosan, K, Rb, PAH (wood combustion); linear alkanes (fuel/biogenic emissions); (Fe, Cu, Sn, Sb, and Mo (break-ware); Ce, Rh, Pt, and Pd (vehicle exhaust catalysts), Ca, Al, Fe, Mg, K, Ti, Ce, and Sr (soil/dust re-suspension), Na, Cl (road salt); V and Ni (fuel oil); Zn (tire-ware/tire combustion); Fe, Mn, Cr (railroad steel abrasion).
The 76 $\pm$ 33 ug/m3 average PM10 concentration over the whole region was apportioned into 'Secondary Aerosol – mostly inorganics' (30-40%), 'Transport - including re-suspension' (30-40%), and 'Residential Heating – mostly wood burning' (10-18% - 28% in Sondrio) and shows that reduction of industrial emissions of inorganic gaseous PM precursors should not be left out of the regions PM abatement strategy. Minor specific sources were also revealed. A detailed presentation will be given of the obtained data and results for the nine sites in the Po Valley in comparison with the site in the Valtelline Valley (Sondrio).