



The current state of regional import/export budget and air quality modelling in the Po Valley

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Due to its strategical role in the Italian economy and to the high population density, the Po Valley area has been subject of many studies concerning weather and air quality. Moreover, the topographical features of the Valley, surrounded to the South, the West and the North by high mountain ranges, give rise to a local climate characterised by low wind speeds, enhanced diurnal cycle and also by severe haze and fog conditions. The Po Valley is also characterized by a high pollution level, due mainly to a dense transportation traffic along the main connection highways and to industrial activity. Using models to study air quality in this region can also help understanding the influence that the pollution from the Po Valley can have on the surrounding European regions, which is one of the goals of the CityZen project. The import/export budget of the Po Valley hot spot has been evaluated running the model BOLCHEM, an atmospheric dynamic and composition model in which meteorology and chemistry are coupled online, at a resolution of about 50x50 km² over an European area for the year 2007. A tracer has been used in this numerical experiment that does not react, is not removed by dry or wet deposition and has the same emission pattern as CO. The influence of pollutants released in the Po Valley on the air quality of the surrounding area due to transport has been quantified selecting emissions inside and switching off the emissions outside. The reverse (switching off emissions inside and keeping active the ones outside) has been made to evaluate the import of pollutants from the surrounding region, identified as the European area. The budget study shows that the contribution from outside of passive non reacting species can be often larger than the contribution from the inner sources, for the Po Valley hot spot. Nevertheless the occurrence of cases characterised by intense transport from the Po Valley area have been observed and can lead to the presence of pollutants over the Adriatic or Tyrrhenian Sea, and could be detected also in Central Europe.

A second experiment was conducted using BOLCHEM in the same European area and for the year 2007, in order to compare the modelled concentration of O₃ and PM₁₀ with data obtained from Airbase. A complete description of the data base can be found at the website <http://www.eea.europa.eu/data-and-maps/data/airbase-the-european-air-quality-database-2>. In general the mean difference between BOLCHEM and the data showed a significant seasonal dependence and the root mean square error is largest when the individual average concentrations of the species are largest. The behaviour of the correlations is highly different for PM (no significant seasonal variation and values around 30%) and O₃ (significant seasonal variation, from 70% during fall to 30% during winter). The PM correlation is expected to be always lower than O₃ since the latter is more reactive and mixable than the first and therefore being able to model PM concentration at the same space-time resolution as that of the station is on average more challenging. The values of correlations both for PM and O₃ are in agreement with the values found in a previous study by Thunis et al., 2009. Moreover the results obtained here are in agreement with the state of the art of modeling as it is shown in the work done within the GEMS project (<http://gems.ecmwf.int/>).