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Regional Scale Air Quality Numerical Simulations: performances and improvement road map (an attempt)

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Air quality numerical simulations carried out at regional level can represent an important tool for local Administrators and Government in particular dealing with the still open problem of high particulate matter concentrations in winter and high ozone concentrations in summer. In Friuli Venezia Giulia (Italy) regional scale air quality numerical simulations are carried out operatively both under the point of view of diagnosis (air quality assessment to integrate the information obtained through local monitoring network) and source apportionment (evaluate the differential contribution of different emission sectors to orient air quality management policies against PM and ozone high values). Air quality numerical simulations are carried out even to obtain pollution forecasts to face atmospheric high pollution episodes both under the point of view of adaptation (increase awareness, in particular for sensitive or fragile people) and of mitigation actions (emergency responses like road traffic reduction and stop of inefficient combustion devices).
In order to deal with the above mentioned tasks, a continuous improvement procedure has to be implement to increase the performances of regional air quality numerical simulations.
In Friuli Venezia Giulia the continuous improvement procedure operates in two complementary sides of the task: one dealing with the improvement of "native" numerical simulation outputs, the other dealing with the post processing of outputs to obtain a better fitting of observations.
The improvement of "native" air quality numerical simulation has been faced dealing with a refinement of emission inventories, in particular operating with the domestic heating emissions derived by domestic wood combustion. Domestic wood combustion, in fact, emits a significant amount of primary and re-condensing particulate matter during night time in a moment when atmosphere is prone to stagnation. These late evening emissions have to be correctly reproduced in numerical models if we want to correctly reproduce the night time burst in PM concentrations.
The improvement of air quality numerical outputs by way of statistical techniques has been faced through standard techniques like seasonal static linear corrections and Kalman filter. Kalman filter improved significantly the performances of ozone numerical simulations but produced less amazing results for PM, in particular when compared with a more simple and crude static linear correction. The reason of this behavior comes from the fact that high PM concentration episodes in Friuli Venezia Giulia are often caused by meteorological conditions that last for a few days and are often washed away by a sudden change in meteorological conditions. This episodic behavior reduces the statistical power of Kalman filter which performs better in smooth and persistent transitions.
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