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Impacts of emission reduction strategies conducted at regional and continental scales, on the long-term and punctually

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Ozone is a secondary pollutant made from photochemical reactions involving chiefly anthropogenic precursors emitted from a variety of sources such as road transport, industrial activities, energy production, distribution of fossil fuels... Nowadays, the majority of large cities still experiments photochemical events with ozone concentrations exceeding the information and health recommendation thresholds. This exposition to high levels of ozone is linked to local ozone production but also to an increasing background level which leads to a growing frequency of threshold exceedances. In the Mediterranean basin, numerous sites are exposed to this duality, as it is the case in the Marseilles area in the south of France which combines fast ozone production and high background levels. Thus, for the majority of sites, the question of the respective part of long-range transport versus local production is frequently asked. In this paper, we aim to assess the impacts of emission reduction strategies conducted at continental and at regional scales. The main results point out the complementarity of these two levels of action. A second point we get interested in is the efficiency of punctual and local measures, so-called emergency measures.

Photochemical episodes simulations were conducted on the Berre-Marseilles region (France), chosen because of its high density of anthropogenic activities, its elevated frequency of ozone events, and the large 3D measurement database obtained on this site during the ESCOMPTE campaign (2001). We used the 3D chemistry-transport model CHIMERE to simulate a large number of representative pollution episodes,

characterized by different meteorological situations, in order to obtain statistic and extrapolating results. The model configuration was validated using specific statistical indexes based on model/measurement confrontation. Boundary conditions were provided by the continental simulations calculated with the CHIMERE model. Several prospective emission scenarios for year 2010 were performed using a set of inventories representing the probable regional emission situation for this year. At this step the boundary conditions were kept identical to the reference simulation. The results show that regional emission reductions impact significantly the peak values and allowed to reduce by half the number of exceeding alert thresholds. However, its action is strongly limited in decreasing the background values. In a second step, the continental simulation also used 2010 projected emissions. The efficiency of such a modification was quantified. We show that the control of emissions at the continental scale affects in a complementarity way the ozone concentrations, as it allows to reduce by 25-30% the cumulated ozone values (indicator of the background level) on the whole regional domain. But, though the combination of regional and continental controls acts in a significant way on the peak and background values, the simulations show that the ozone problematic will not be solved in 2010. This confirms the necessity to reinforce the long-term action with emergency measures. However, the scenario results show that the current french legislation is not severe enough and unadapted to face a phenomenon of such an extent. At last, we have drawn up an air quality balance sheet for 8 selected primary and secondary pollutants (NOx, CO, benzene, SO2, O3, PAN, HNO3 and HCHO). We quantified the impacts of emission reductions on their peak values and discussed the effects of regional versus continental controls.