

Impacts of weather regimes on PM10 pollution peaks in Rhone-Alpes (France) Impacts of weather regimes on PM10 pollution peaks in Rhone-Alpes (France)

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Pollution in particulate matter is a more and more significant problem, especially in urban areas, and widely publicized when regulatory thresholds are exceeded. Health consequences have to be carefully considered, for both short-term and long-term effects. First, this paper describes the spatial and temporal distribution of PM10 concentrations (particulate matter with a diameter inferior to 10 μm) in urban environments in the Rhone-Alpes administrative area, located in South-east France. Pollution monitoring stations are grouped together by ascending hierarchical classification. The goal is to identify similar patterns on a regional scale. Then, this PM10 distribution is analyzed according to synoptic-scale weather regimes. As the classic analysis between anticyclonic and cyclonic types appears insufficient, particulate matter concentrations are related to weather regimes according to Hess-Brezowsky classification system, which is widely used in Western Europe for numerous climate studies. The latter has been chosen after a review of the existing European classifications, and this analysis is one of the first to be made in France. Results show that strong annual disparities are observed amongst the different urban monitoring stations in Rhone-Alpes on both spatial and temporal scales. More precisely, stations in deep alpine valleys and in the regional capital city Lyon are the most polluted ones. Concerning monthly means, the most polluted months are obviously those in winter, due to the emitting sources considered. Steepest gaps are nonetheless better observed on an hourly basis, with two peaks at the end of the morning and at early evening. When analyzed according to the weather regimes, high pressure area over Central Europe weather regimes are prevailing during information and alert thresholds exceedances. More specifically, six regime types (Grosweatherlagen) are strongly associated with pollution peaks. Two are cyclonic (WZ and NWZ) and their persistence during several consecutive days leads to a decrease in pollution. They are only associated with pollution peaks because they have represented a large part of global circulation during the last few years. By contrast, the most worrying regime types in regard with pollution peaks are anticyclonic : SWA, WA, HM, and BM. Those last two types, when persisting over several days, lead to a steep increase in pollutant concentrations.

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