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- Title and Author Search

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[Volumes and Issues](#) [Contents of Issue 20](#)

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The representation of dust transport and missing urban sources as major issues for the simulation of PM episodes in a Mediterranean area

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Abstract. Due to its adverse effects on human health, atmospheric particulate matter (PM) constitutes a growing challenge for air quality management. It is also a complex subject of study. The understanding of its atmospheric evolution is indeed made difficult by the wide number of sources and the numerous processes that govern its evolution in the troposphere. As a consequence, the representation of particulate matter in chemistry-transport models needs to be permanently evaluated and enhanced in order to refine our comprehension of PM pollution events and to propose consistent environmental policies. The study presented here focuses on two successive summer particulate pollution episodes that occurred on the French Mediterranean coast. We identify and analyze the constitutive elements of the first and more massive episode and we discuss their representation within a eulerian model.

The results show that the model fails in reproducing the variability and the amplitude of dust import from western Africa, and that it constitutes a strong bias in PM daily forecasts. We then focus on the lack of diurnal variability in the model, which is attributed to missing urban sources in standard emission inventories, and notably the resuspension of particles by urban road traffic. Through a sensitivity study based on PM and NO_x measurements, we assess the sensitivity of PM to local emissions and the need to reconsider road traffic PM sources. In parallel, by coupling the CHIMERE-DUST model outputs to our simulation, we show that the representation of transcontinental dust transport allows a much better representation of atmospheric particles in southern France, and that it is needed in the frame of air quality management for the quantification of the anthropogenic part of particulate matter pollution.

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