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Impact of resolution on aerosol radiative feedbacks with in online-coupled chemistry/climate simulations (WRF-Chem) for EURO-CORDEX compliant domains

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Several studies have shown that a high spatial resolution in atmospheric model runs improves the simulation of some meteorological variables, such as precipitation, particularly extreme events and in regions with complex orography [1]. However, increasing model spatial resolution makes the computational time rise exponentially. Hence, very high resolution experiments on large domains can hamper the execution of climatic runs. This problem shoots up when using online-coupled chemistry climate models, making a careful evaluation of improvements versus costs mandatory.

Under this umbrella, the objective of this work is to investigate the sensitivity of aerosol radiative feedbacks from online-coupled chemistry regional model simulations to the spatial resolution. For that, the WRF-Chem [2] model is used for a case study to simulate the episode occurring between July 25th and August 15th of 2010. It is characterized by a high loading of atmospheric aerosol particles coming mainly from wildfires over large European regions (Russia, Iberian Peninsula). Three spatial resolutions are used defined for Euro-Cordex compliant domains [3]: 0.44º, 0.22º and 0.11º. Anthropogenic emissions come from TNO databases [4]. The analysis focuses on air quality variables (mainly PM10, PM2.5), meteorological variables (temperature, radiation) and other aerosol optical properties (aerosol optical depth).

The CPU time ratio for the different domains is 1 (0.44º), 4(0.22º) and 28(0.11º) (normalized times). Comparison among simulations and observations are analyzed. Preliminary results show the difficulty to justify the much larger computational cost of high-resolution experiments when comparing with observations from a meteorological point of view, despite the finer spatio-temporal detail of the obtained pollutant fields.

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