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Evaluation of NO_2, O_3, PM_{10}, and $PM_{2.5}$ in the city of Buenos Aires, Argentina using WRF-Chem model

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The online-coupled Weather Research and Forecasting model with Chemistry (WRF-Chem v4.0), was applied to evaluate the impact of using different anthropogenic emissions inventories on regional air quality in Argentina. For this purpose, we couple the Argentinian high-resolution emissions inventory (GEAA-AHRI) and the Emissions Database for Global Atmospheric Research – Hemispheric Transport of Air Pollution (EDGAR-HTAP) and introduce them into the model, with a local optimized configuration considering 3 nested domains with a horizontal grid size of 20 x 20 km, 4 x 4 km, and 1.3 x 1.3 km and the MOZART chemical scheme. The model output for NO2, PM10, PM2.5, and O3 concentrations over the innermost domain was compared against the existing surface and satellite-derived observations for the Buenos Aires Metropolitan Area (AMBA) during austral fall 2018. We found an overall good model performance for all simulations, and large discrepancies between the emission inventories, obtaining an improved urban-scale spatio-temporal representation when the high resolution GEAA-AHRI dataset is considered. Our results show that the daytime concentrations of air pollutants are strongly influenced by the shape and shift of the hourly emissions profile before sunrise and after sunset, especially for NO2 where the inclusion of the temporal profile decreased the mean bias by ~80%. Performance criteria for modeled PM10 and PM2.5 were in general satisfied, despite having an average underestimation of observations. When compared to NO2 tropospheric columns derived from TROPOMI, The general magnitude and spatial pattern of the NO2 tropospheric column is in agreement with the mean TROPOMI columns during the modeled period, obtaining correlation coefficients higher than 0.6 for all simulations. Our results highlight the benefits of using a time-dependent and high-resolution local inventory for addressing the background air quality in AMBA. The implementation and validation of local emissions and static fields with high spatial and temporal resolution carried out in this work, establishes a benchmark for forthcoming studies in other regions of South America where different modeling tools for air quality analysis are currently being used to complement the usually sparse and discontinuous air quality networks.