



Impact of regional climate change and future emission scenarios on surface O₃ and PM_{2.5} over India

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This work aims to study the changes in surface ozone (O₃) and fine particulate matter (PM_{2.5}) in a world of changing emissions and climate by focusing on India. Stakeholders in India are already aware about air quality issues but anthropogenic emissions are projected to largely increase for some of the pollutants in the short-term (2030) and medium-term (2050) futures in India, especially if no more policy efforts are made. Only the policies in place before 2014/15 have been taken into account while projecting the future emissions. Current policies have led to decrease in emission intensities, however may not be enough for control of absolute emissions in future. In this study, the regional EMEP/MSC-W chemical transport model is used forced by downscaled meteorological fields at a 50 km resolution following the RCP8.5 greenhouse gas concentration scenario.

The reference scenario (for present-day) is evaluated with surface-based measurements. Given the relatively coarse resolution of the meteorological fields used for this comparison with urban observations, the agreement can be considered satisfactory as high correlations with O₃ ($r=0.9$) and PM_{2.5} ($r=0.5$ and $r=0.8$ depending on the data set) are noticed. The bias in PM_{2.5} is limited (lower than 6%) but the model overestimates the O₃ by 35%.

Then, this work shows that in the 2050s, the variation in O₃ linked to the climate change is mainly due to the change in O₃ deposition velocity related to the change in the boundary layer height and, over a few areas, by changes in VOCs. At short term and medium-term, the PM_{2.5} is predicted to increase due to climate change, by up to 6.5% in the 2050s. This climatic variation is mainly explained by increases in dust, organic matter and secondary inorganic aerosols which are affected by the change in wind speed and precipitations. The large increase in anthropogenic emissions will modify the composition of PM_{2.5} over India as the secondary inorganic aerosols will be dominant. The surface PM_{2.5} concentrations will also reach huge levels in the 2030s and in the 2050s for the whole country.