The air quality forecast about PM2.5 before and during APEC 2014 in Beijing by WRF-CMAQ model system

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In the past year 2014, the APEC meeting was hold in Beijing, where the particulate matter (PM2.5) concentration is high and worried. In such a heavily air-polluted environment, people want access to reasonable air quality predictions, that the government can take necessary short-term emissions reduction measures to improve air quality. According to Wu et al. (2014), the enhanced model domain and the updated emissions inventory will improve the model performance of particulate matter concentration obviously, a new model system, with the enhanced 9km-domain and latest emission inventory in WRF-SMOKE-CMAQ model, was established in October 2014, before APEC. As a result, the model system plays good performance in the whole October: 1) the model catches four air pollution episodes in October, and has a high correlation coefficient of 0.89, 2) the daily forecast of PM2.5 concentration reaches 277 $\mu g\,m^{-3}$ and close to the observed value (320 $\mu g\,m^{-3}$), but still a little underestimated, 3) the mean bias(MB) of the forecast to observed is 1.03 $\mu g\,m^{-3}$ and the normalized mean bias(NMB) is 24.9%, 4) the normalized mean square error (NMSE) between the forecast and observed is 0.137 in October. The forecast results, with well performance, indicate the emissions inventory used in the model system is reasonable as baseline scenario, which scenario without any emission-sources reduction.

From 3 to 12 November, the emission-sources reduction measures(e.g. the traffic restriction, factory cut production and closures) are carried step by step in Beijing and its surrounding areas. Those measures information is collected and used in the SMOKE model with growth/project module, to prepared as a reduced emissions inventory as APEC scenario. The same WRF-CMAQ model system, but be driven by the emission inventory of APEC scenario, was added from 3 November, to forecast the air quality under such emission-sources reduction measures, and evaluate the effect of emission-sources reduction during APEC 2014 in Beijing. According to the forecast results, the daily PM2.5 concentration will reduce from 107 $\mu g\,m^{-3}$ in the baseline to 72 $\mu g\,m^{-3}$ in the APEC scenario, while the observed is 69 $\mu g\,m^{-3}$ on 8 November. From 6 to 10 November, the observation is lower than the forecast results in the baseline scenario, that indicates the emission-sources reduction measures effects in the air quality in Beijing, especially PM2.5 concentration, if we trust the model. We also found that the observation on 7-8 November even lower than the forecast results in the APEC scenario, which indicates the emission reduction efforts more than expected.