Precision air pollution control approach for mitigating heavy haze pollution in a city in the regional joint prevention and control- Taking Beijing as an example

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To tackle increased threats posed by regional air pollution problems in China, the State Council of China issued “Regional Join Prevention and Control of Air Pollution” in 2010 to enhance the joint effort in regional environmental protection. The good air quality for the large international events such as 2008 Beijing Olympics, 2010 Shanghai Expo and 2014 Beijing APEC Summit as the results of stringent emission control measures in the city and the regional joint control over the surroundings proves that the short-term measures did fix the air pollution problems in China with the extreme cost by a forced temporary closure of most of factories in the surrounding areas. However, a permanent solution is still a tremendous challenge, especially for curbing the heavy haze of a city on the regular basis. In this work, we develop a precision air pollution control approach (PAPCA) to significantly mitigate heavy haze pollution in a city by combining the high pollutant concentrations (can be either observations or model results), hybrid receptor model (Concentration Weighted Trajectory (CWT)) and 3-D air quality model (WRF-CMAQ) to pinpoint origins of heavy air pollution and optimize the emission control schemes for the targeted areas. In this PAPCA method, the targeted areas with the high potential contributions to the heavy haze were identified by the CWT values and then the WRF-CMAQ model was used to optimize the emission control schemes for the targeted areas with the CWT values as a weighting function to guarantee significant mitigation of the heavy haze at the most effective way. We have applied the PAPCA to two severe haze outbreaks in Beijing in October and November 2013. The results show that the emission control schemes for the targeted areas instead of all surrounding areas can significantly mitigate the heavy haze in Beijing by decreasing the peak concentrations of $PM_{2.5}$ from ~300 g m^{-3} to <100 g m^{-3}. Since the PAPCA method only requires the emission control schemes for the targeted areas instead of all surrounding areas, this can save money with remarkable economic benefits and can be applied to any heavy air pollution events around the world.