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An optimized NO_x emission inventory over East Asia, from PYVAR-CHIMERE inverse modeling tool constrained by OMI satellite observations

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Anthropogenic pollutant emissions over China have largely increased in the last decades, because of the rapid economic development, demographic growth, urbanization, and energy consumption. Measurements of ambient concentration of ozone, PM2.5 and PM10 exceed by far the recommended threshold from WHO for the main Chinese megacities, causing severe health problems. Several studies show that improved knowledge on photo-oxidant (O_3) and PM precursor (NO_x, SO_2, NH3, VOCs) emissions are crucial to better understand, simulate, forecast and then mitigate pollution over China. Efforts have been made by Chinese authorities during the last 10 years to implement control measures in SO_2 and NO_x emissions.

The first effects of NO_x reductions are still not clearly visible. Satellite based observations show a decrease in NO_2 tropospheric column density above North China Plain starting from 2011, but high photochemical ozone formation remains in many Chinese regions such as Beijing. [U+FFF9] In the framework of the PolEASIA project (Pollution in Eastern ASIA: toward better air quality prevision and impacts evaluation) that involves different French (LISA, LSCE, ARIA Technologies) and Chinese partners (CRAES, IAP, PKU), we propose to better quantify pollution precursor emissions (mainly NO_x and NMHCs) and to evaluate the impact on pollutant variability and trends. To achieve this, we use the PYVAR-CHIMERE inverse modeling tool, based on the CHIMERE chemical transport model and a 4D variational assimilation scheme, to derive optimized temporally resolved NO_x gridded emission inventories at continental scale, with a fine spatial resolution of 0.25 and 0.5 degrees, from OMI satellite observations of NO_2 tropospheric columns. First results covering one year of simulations (2015) show that NO and NO_2 emissions (derived from HTAP 2010 inventory) are overestimated over the biggest cities of China, while NO_x emissions are underestimated over some ship lane in the China Sea in agreement with previous works reported in literature. Advantages and current limitations of the new inverse modeling system (PYVAR-CHIMERE) will be also discussed.