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Quantification of NO_x emissions from NO_2 hotspots over China: A satellite perspective

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China is the primary contributor of global anthropogenic NO_x emissions, owing to its massive energy demand driven by strong economic growth. Most of the emissions are emitted by power plants or/and from urban areas, from which have been placed considerable emphasis on promoting emission reduction by Chinese government. Better knowledge of their emissions could help to assess the achieved emission reductions and provide perspectives as to the future effectiveness, which is also a valuable aid for taking regulatory steps. Thus we have developed an unit-based emission inventory of China's coal-fired power plants with high spatial and temporal resolution for the period 1990–2010 in our previous work (Liu et al., in preparation), but developing an emission inventory for each city at the same resolution and accuracy is much more challenging.

Strong power plants and large cities can be identified as NO_2 "hotspots" using satellite-based instruments. It has been demonstrated in previous studies (Beirle et al., Science, 2011) that OMI products can be applied for the determination of megacity NO_x emissions and their lifetime by analyzing the downwind decay of the NO_2 plume. In addition, from the analysis of the OMI time-series, the construction of new, large power plants in China can clearly be identified (Zhang et al, GRL, 2009).

We are working on determining Chinese hotspots emissions and lifetimes of NO_x simultaneously from the observed downwind plume evolution and ECMWF wind fields using the latest OMI product (DOMINO V2.0). However, the method applied to isolated megacities like Riyadh needs to be modified in order to take interferences of several strong NO_x sources within small distances into account.We will present and discuss different approaches to deal with this challenge.

The derived power plant emission will be compared to the bottom-up unit-based emission inventory. The found relation between bottom-up and top-down emissions will be used for the evaluation of top-down NO_x emissions from large Chinese cities.