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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Sulfate-nitrate-ammonium aerosols over China: response to 2000–2015 emission changes of sulfur dioxide, nitrogen oxides, and ammonia" *by* Y. Wang et al.

Anonymous Referee #2

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This outstanding paper applies a nested grid chemistry transport model to quantify the sensitivity of the sulfate-nitrate-ammonium (SNA) non-linear aerosol system to Chinese national precursor emissions changes between 2000-2015, a period of rapid economic transformation in the region. The study demonstrates the importance of NH3 emission control (in addition to NOx and SO2) in regulating PM2.5 levels in the region. The relevance of the SNA system non-linearities and temperature dependence for coupled oxidant-aerosol aerosol global radiative forcing and possible mitigation scenarios has previously been quantified (e.g. Shindell et al., Science, 2009; Unger et al., PNAS

2010; Unger, GRL, 2011). Other work has suggested that nitrate aerosols will increase in importance in the future global atmosphere and may even become the dominant aerosol forcing in Europe and Asia (Bellouin et al., JGR, 2011; Bauer et al., ACP, 2007). The present study is unique in that it is the first work that examines the SNA system changes at high spatial resolution over China on short near-term timescales relevant for air quality control policy.

The main limitation of the study is that there are only 2 observational datasets of PM2.5 SNA speciation for the entire Chinese region. Perhaps this work will help draw attention to the critical need for an organized PM2.5 ground based monitoring network in China and free data access to the international scientific community.

I do highly recommend this paper for publication in ACP once the following issues are addressed:

The model overestimate of nitrate aerosol is attributed to underestimation of wet deposition and uncertainty in the NH3 emission inventory. Both sulfate and nitrate wet deposition is underestimated (by 40%), yet the model performs well in simulating the sulfate atmospheric concentrations? Please provide more detail on the likely cause of the discrepancies in the wet deposition rate for such a model that applies assimilated meteorological fields?

How does the large model overestimate of nitrate aerosol affect the policy-relevant sensitivity results presented here?

Could satellite TES tropospheric NH3 observations be used to provide further constraint in future work?

For future work, it would be useful / powerful to assess the role of changing oxidants over the same period on the inorganic aerosol loading.

It would be interesting to quantify the sensitivity to the meteorological year, i.e. force run with another met year in order to constrain this source of uncertainty because all

simulations use year 2007.

Minor comment:

Check spelling of January and February throughout.

Interactive comment on Atmos. Chem. Phys. Discuss., 12, 24243, 2012.