Response to Interactive Comment (ACPD-11, C15005–C15007, 2012)

Interactive Comment：

Dear Authors

Thanks you very much for this nice paper about a very important topic: Ammonia.

Ammonia is the main alkaline component in the atmosphere and it is also very important for atmospheric chemistry such as particle formation. Some processes related to ammonia are fast while other are more slow, so accurate emissions are important for understanding and for model development of atmospheric transport models. It is great to see, that the authors had put efforts into describing the temporal variation in the emissions. We greatly appreciate this. However, the temporal variation seems to be based on fixed monthly values.

Studies from Europe have shown, that a more process based (but simple) description of ammonia emissions is actually possible (e.g. Skjøth et al, 2004). This methodology is under implementation in several atmospheric chemistry models and is further explored in the large scale EU project ECLAIRE. Preliminary studies with four CTM models DEHM, OML-DEP, EMEP and EMEP4UK (e.g Skjøth et al, 2011, Geels et al, 2012, Reis et al, 2012) show that a process driven description of the hourly variation of emissions does affect the overall description of the atmospheric chemistry. Some of these variations are due to management (e.g. Gyldenkærne et al, 2005), while other are entirely due to physics such as volatilization of ammonia as a function of climatic variables (e.g. temperature). Studies from USA use a similar methodology and they were presented at the Nitrogen conference in Edinburg April 2011 by representatives from US-EPA.

We believe that a more process based description of ammonia emissions would be of value to knowledge concerning atmospheric chemistry, especially if it could be applied globally over all major ammonia emission sources including China (e.g. Sutton et al, 2011). Could you please elaborate on this and discuss if such a methodology would make sense or would be possible in the Chinese region?

Highly regards!

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Response: We appreciated it very much for Dr.Skjøth's positive interactive comments and valuable suggestions. It is indeed true that high temporal resolution of emission source is a key component in improving AQM performance. We have carefully read the recommended articles. These studies about characterizing

temporal variations are very helpful and provided important guide for further investigation of temporal profiles in the Pearl River Delta (PRD) region, or even in China (Skjøth et al, 2004; 2011; Gyldenkærne et al, 2005). We will discuss the possibility of the process based description method applied in China or PRD region in the revised revision. However, only in recent decade, the development of highly resolved temporal and spatial air pollutant emission inventory just started in China, mainly focusing on estimating emissions for primary pollutants, such as SO_2, NOx, VOC, and PM, but studies on ammonia emissions with their temporal and spatial characteristics are relatively scarce. The main purpose of this paper is to try to address these knowledge gaps and to characterize spatial and temporal characteristics of major ammonia emission sources as much as possible for air quality modeling use. In this study, we made great efforts to summarize the source temporal profiles, local up-to-date emission factors, and detailed activity data to develop more reliable emission inventory for the PRD region, a pioneer region in conducting regional air quality study and combating air pollution in China. Due to the lack of detailed agricultural registers and practices, reliable input parameters in the function of process driven description, and field NH_3 measurement data in the air quality monitoring network, we are incapable of conducting dynamic temporal variations using this methodology at the current stage. But we believe that the process driven description method for characterizing temporal variations can be very useful, and we will follow this methodology to improve the temporal characteristics of our ammonia emission inventory in the future work if the relevant data become available in this region or China.

Reference:

Skjøth, C. A., Geels, C., Berge, H., Gyldenkærne, S., Fagerli, H., Ellermann, T., Frohn, L. M., Christensen, J., Hansen, K. M., Hansen, K., and Hertel, O.: Spatial and temporal variations in ammonia emissions - a freely accessible model code for Europe: Atmos. Chem. Phys., 11, 5221-5236., 2011

Skjøth, C. A., Hertel, O., Gyldenkærne, S., and Ellermann, T.: Implementing a dynamical ammonia emission parameterization in the large-scale air pollution model ACDEP: J. Geophys. Res., 109, D06306, doi:10.1029/2003JD003895, 2004

Gyldenkærne, S., Ambelas Skjøth, C., Hertel, O., and Ellermann, T.: A dynamical ammonia emission parameterization for use in air pollution models: J. Geophys. Res., 110, D07108, doi:10.1029/2004JD005459, 2005