An improved high-spatial resolution inventory for ammonia emissions from agricultural fertilization

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It has been established that improved estimates of ammonia (NH_3) emissions and long-term field measurements is required to successfully model and evaluate its role in atmospheric secondary aerosol formation and better estimate nitrogen inputs to aqueous and terrestrial ecosystems. Long-term records for wet deposited ammonium (NH_4^+) are available in the United States but a national network to monitor long term NH_3 concentration trends was implemented only as recently as 2007. Yet, the connection between emissions from various sources and ambient concentrations remains largely uncertain. The need for improved emission estimates from intensive agricultural fertilization (IAF) is recognized as one of the major limitations of current modeling efforts due to coarse spatial resolution (county-level), use of NH_3 emission factors applicable to farming practices in other countries and non-specificity to crop characteristics.

We have developed a new method for a high-spatial resolution NH_3 emission inventory for IAF for the State of Illinois. While current spatial surrogates for IAF do not discern between different intensively managed crop types, our method overcomes this limitation by identifying localized clusters of crop specific emissions. Corn fertilization was identified as the major contributor (~48%) of net NH_3 emissions from IAF followed by Winter Wheat (~15%). Hotspot analysis on the higher spatial resolution inventory indicated localized emissions occurring in central and eastern Illinois. Preliminary spatial autocorrelation studies provided no conclusive evidence for directly relating long term ambient gaseous NH_3 and wet deposited NH_4^+ measurements with improved emission estimates. This points to the need to further closely investigate both the adequacy of the monitoring network and of the emission inventory. In order to understand what improvements in monitoring and emission inventories are needed, we are currently in the process of refining the high-spatial resolution NH_3 emission inventory for IAF to use as a direct input to air quality models and evaluate the impacts at different spatial scales on understanding the fate and transport of NH_3.

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