Geophysical Research Abstracts
Vol. 13, EGU2011-10773, 2011
EGU General Assembly 2011

Space-based observations of NH_3: spatial patterns, seasonal trends and in situ evaluation

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Ammonia plays an important role in many biogeochemical processes, yet atmospheric mixing ratios are not well known. Recently, methods have been developed for retrieving NH_3 from space-based observations, but they have not been compared to in situ measurements. We have conducted a field campaign combining co-located surface measurements and satellite special observations from the Tropospheric Emission Spectrometer (TES). Our study includes 25 surface monitoring sites spanning 350 km across eastern North Carolina, a region with large seasonal and spatial variability in NH_3. From the TES spectra, we retrieve a NH_3 representative volume mixing ratio (RVMR), and we restrict our analysis to times when the region of the atmosphere observed by TES is representative of the surface measurement. We find that the TES NH_3 RVMR qualitatively captures the seasonal and spatial variability found in eastern North Carolina. Both surface measurements and TES NH_3 show a strong correspondence with the number of livestock facilities within 10 km of the observation. Furthermore, we find that TES NH_3 RVMR captures the month-to-month variability present in the surface observations. The high correspondence with in situ measurements and vast spatial coverage make TES NH_3 RVMR a valuable tool for understanding regional and global NH_3 fluxes. Accordingly, we use TES global survey observations from 2006-2009 to examine seasonal patterns in NH_3 for world regions.