# 3.013 Satellite evidence of substantial rain-induced soil emissions of ammonia across the Sahel .

Presenting Author:
**Jonathan Hickman**, NASA Goddard Institute for Space Studies, New York, NY 10025, jhickman@gmail.com

Co-Authors:
**Guido van der Werf**, Vrije Universiteit Amsterdam

Abstract:

In regions with distinct dry and wet seasons such as the Sahel, the start of the rainy season triggers a pulse of biogeochemical activity in surface soils known as the Birch effect. Field and lab studies have sometimes, but not always, observed pulses of $NH_3$ after the wetting of dry soils, but the potential regional importance of these emissions remains poorly constrained. Here we use satellite retrievals of atmospheric $NH_3$ using the Infrared Atmospheric Sounding Interferometer (IASI) in combination with satellite-based observations of precipitation, surface soil moisture, and nitric dioxide ($NO_2$) concentrations, to present evidence of substantial precipitation-induced pulses of $NH_3$ across the Sahel at the onset of the rainy season in 2008. In the Sahel, the highest concentrations of $NH_3$ occur in pulses during March and April, when biomass burning emissions estimated for the region by the GFED4s database are low. Changes in $NH_3$ concentrations are significantly correlated with changes in soil moisture during the period from mid-March through April, when the peak $NH_3$ concentrations occur ($r=0.28$, $p=0.02$). The correlation is also present when evaluated on an individual pixel-basis during April ($r=0.16$, $p<0.001$). Using a simple box model, average emissions for the entire Sahel are between 2 and 6 mg $NH_3$ $m^{-2}$ $day^{-1}$ during peaks of the observed pulses, depending on the assumed effective lifetime. These early season pulses are consistent with surface observations from the INDAAF network, which show an uptick in $NH_3$ deposition at the start of the rainy season for sites in the Sahel. The $NH_3$ peaks also broadly correspond to peaks in tropospheric $NO_2$ concentrations, which have previously been attributed to the Birch effect. Box model results suggest that pulses occurring over a 35-day period in March and April are responsible for roughly one fifth of annual $NH_3$ emissions from the Sahel.