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Bi-directional exchanges of Ammonia in A Soybean Field of North Carolina

Yihua Wu[1], John Walker[2], Christa Peters-Lidard[1]

(1) Hydrological Sciences Branch, NASA, GSFC, Greenbelt, USA (2) National Risk Management Research Laboratory, USEPA, RTP, USA

The biosphere-atmosphere ammonia exchanges have significant impacts on atmospheric chemistry, acidification of ecosystems and biodiversity of terrestrial ecosystems, and can cause regional atmospheric pollution, in addition to shifts in nutrient balance and in composition of plant species. A field experiment on the bi-directional ammonia exchange between the biosphere and atmosphere was conducted in a soybean field, Duplin County, North Carolina in the summer of 2002. Data from 9 days were selected for this study based on data quality control. Driven by diurnal variations of the boundary layer depth and the balance between the emission rate from nearby ground level sources and removal rate from the boundary layer, ammonia concentrations peak a few hours after sunrise and begin to decrease. In general, ammonia concentrations are higher when winds are blowing from the southwest. We hypothesize that these higher atmospheric ammonia concentrations are related to the advection of emissions from hog farms located to the SSW of the site where relatively denser animal production facilities are located. There was a net deposition of ammonia during the period although emissions occurred frequently during the late morning and early afternoon. A new resistance model was developed to simulate ammonia flux in this case. The new model is based on the Multi-Layer BioChemical deposition (MLBC) model (Wu et al, 2003) with the addition of a leaf ammonia compensation point parameterization which considers the effects of leaf temperature, apoplastic concentrations of NH_{4^+} and H^+ as well as their dynamics corresponding to depositions and emissions. The MLBC model considers some biochemical processes, such as photosynthesis, respiration, and membrane passive transport of cuticle. The model was

run with a time interval of 30 minutes. Model results agree reasonably well with the measurements.