The influence on CMAQ modeled wet and dry deposition of advances in the CMAQ systems for meteorology and emissions

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Process level improvements in the CMAQ system have been made to WRF, national emissions, and CMAQ. These include a different convective precipitation option in WRF, the addition of lightning NO production, a mechanistically based diurnal emissions profile for animal NH_3 emissions, and inclusion of bidirectional NH_3 exchange in CMAQ. These process changes are briefly introduced. Then an incremental study that was conducted to quantify the impact of these changes on modeled total nitrogen deposition and ambient aerosol concentrations is described. Evaluation results are presented to quantify the resulting changes on model fields by evaluating model versions against aerosol and wet deposition observations. Preliminary results are that: 1) using the WRF Kain-Fritsch sub-grid convection parameterization with a new convective trigger reduces the bias (over prediction) in the summertime convective precipitation, reducing the summertime wet deposition bias; 2) the inclusion of NO produced from lightning reduces the summertime and annual bias (under prediction) in wet nitrate deposition; 3) the new meteorologically driven diurnal profile of confined animal NH_3 emissions reduces the $PM_{2.5}$ bias and error in the fall (over prediction); and 4) the inclusion of bi-directional NH_3 exchange reduces the spring and fall $PM_{2.5}$ bias (over prediction) and the annual ammonium wet deposition bias (under prediction).

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