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TITLE: A WRF-Chem flash rate parameterization scheme and LNOx analysis of the 29-30 May 2012 convective event in Oklahoma during DC3

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ABSTRACT BODY: The Deep Convective Clouds and Chemistry (DC3) field campaign in 2012 provided a plethora of aircraft and ground-based observations (e.g., trace gases, lightning and radar) to study deep convective storms, their convective transport of trace gases, and associated lightning occurrence and production of nitrogen oxides (NOx). Based on the measurements taken of the 29-30 May 2012 Oklahoma thunderstorm, an analysis against a Weather Research and Forecasting Chemistry (WRF-Chem) model simulation of the same event at 3-km horizontal resolution was performed. One of the main objectives was to include various flash rate parameterization schemes (FRPSs) in the model and identify which scheme(s) best captured the flash rates observed by the National Lightning Detection Network (NLDN) and Oklahoma Lightning Mapping Array (LMA). The comparison indicates how well the schemes predicted the timing, location, and number of lightning flashes. The FRPSs implemented in the model were based on the simulated thunderstorm's physical features, such as maximum vertical velocity, cloud top height, and updraft volume. Adjustment factors were added to each FRPS to best capture the observed flash trend and a sensitivity study was performed to compare the range in model-simulated lightning-generated nitrogen oxides (LNOx) generated by each FRPS over the storm's lifetime. Based on the best FRPS, model-simulated LNOx was compared against aircraft measured NOx. The trace gas analysis, along with the increased detail in the model specification of the vertical distribution of lightning flashes as suggested by the LMA data, provide guidance in determining the scenario of NO production per intracloud and cloud-to-ground flash that best matches the NOx mixing ratios observed by the aircraft.

KEYWORDS: 3324 ATMOSPHERIC PROCESSES Lightning, 0320 ATMOSPHERIC COMPOSITION AND STRUCTURE Cloud physics and chemistry, 0322 ATMOSPHERIC COMPOSITION AND STRUCTURE Constituent sources and sinks, 3314 ATMOSPHERIC PROCESSES Convective processes.

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