CONTROL ID: 1499297

TITLE: An Overview of the Lightning – Atmospheric Chemistry Aspects of the Deep Convective Clouds and Chemistry (DC3) Experiment *(Invited)*

AUTHORS (FIRST NAME, LAST NAME): Kenneth E Pickering[1], Mary C Barth[2], Kristin Cummings[3], Eric J Bucsela[4], Dale J Allen[3], Andrew John Weinheimer[2], Thomas B Ryerson[5], Heidi Huntrieser[6], Eric C Bruning[7], Donald R MacGorman[8], Michael I Biggerstaff[9], Paul R Krehbiel[10], Ronald J Thomas[10], Steven A Rutledge[11], William John Koshak[12], Lawrence D Carey[13]

INSTITUTIONS (ALL): 1. Atmospheric Chemistry and Dyna, NASA Goddard Space Flight Cent, Greenbelt, MD, United States.
2. Atmospheric Chemistry Division, NCAR, Boulder, CO, United States.
3. Department of Atmospheric and Oceanic Science, University of Maryland, College Park, MD, United States.
4. SRI, Menlo Park, CA, United States.
5. ESRL, NOAA, Boulder, CO, United States.
6. Institute for Atmospheric Physics, DLR, Wessling, Germany.
7. Texas Tech University, Lubbock, TX, United States.
8. NOAA, Norman, OK, United States.
9. University of Oklahoma, Norman, OK, United States.
10. New Mexico Institute of Mining and Technology, Socorro, NM, United States.
11. Colorado State University, Fort Collins, CO, United States.
12. NASA Marshall Space Flight Center, Huntsville, AL, United States.
13. University of Alabama Huntsville, Huntsville, AL, United States.

ABSTRACT BODY: Some of the major goals of the DC3 experiment are to determine the contribution of lightning to NOx (= NO + NO2) in the anvils of observed thunderstorms, examine the relationship of lightning NOx production to flash rates and to lightning channel lengths, and estimate the relative production per flash for cloud-to-ground flashes and intracloud flashes. In addition, the effects of lightning NOx production on photochemistry downwind of thunderstorms is also being examined. This talk will survey the observation types that were conducted during DC3 relevant to these goals and provide an overview of the analysis and modeling techniques, which are being used to achieve them. Observations of NOx were made on three research aircraft during DC3 (the NCAR G-V, the NASA DC-8, and the DLR Falcon) in flights through storm anvils in three study regions (NE Colorado, Central Oklahoma to West Texas, and northern Alabama) where lightning mapping arrays (LMAs) and radar coverage were available.

Analysis techniques include initial comparisons of the aircraft NOx observations in storm anvils relative to flash rates, and calculations of the flux of NOx through the anvils, which are combined with observed flash rates to estimate storm-average lightning NOx production per flash. We plan to run the WRF-Chem model for cloud-resolved simulations of selected observed storms during DC3. Detailed lightning information from the LMAs (flash rates and flash lengths as a function of time and vertical distributions of flash channel segments) will be input to the model along with assumptions concerning NOx production per CG flash and per IC flash. These assumptions will be tested through comparisons with the aircraft NOx data from anvil traverses. In addition, a specially designed retrieval method for lightning NO2 column amounts from the OMI instrument on NASA's Aura satellite has been utilized to estimate NO2 over the region affected by selected DC3 storms. Combined with NOx to NO2 ratios from the aircraft data and WRF-Chem model and observed flash rates, average NOx production per flash can be estimated. Ozone production downwind of observed storms can be estimated from the WRF-Chem simulations and evaluated with the measured ozone on the

downwind flights.

KEYWORDS: [0320] ATMOSPHERIC COMPOSITION AND STRUCTURE / Cloud physics and chemistry, [3324] ATMOSPHERIC PROCESSES / Lightning, [0365] ATMOSPHERIC COMPOSITION AND STRUCTURE / Troposphere: composition and chemistry.

(No Image Selected)

(No Table Selected)

Additional Details

Previously Presented Material: 0%

Contact Details

CONTACT (NAME ONLY): Kenneth Pickering

CONTACT (E-MAIL ONLY): kenneth.e.pickering@nasa.gov

TITLE OF TEAM: