

DC3 Breakout Session: Outflow aging 0-24 hours After Convection

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Many good cases, but important to do a thorough job on the 21 June MCS

Diagnostics for characterizing the evolution

- Reactive nitrogen partitioning: How much NO_x in UT? How long does it last? What happens to it?
- Radical measurements and checks of it validity; constraints from HO_x precursors (HCs, peroxides, CH₂O, MEK, acetone, HNO₄, MPN, etc.)
- MCS on 21 June: developing understanding of trajectories and impact on time series structure; assessing reasons for differences along flight legs
 - parse time line
 - perform trajectories (Laura, Cameron)
 - 2D O₃ map to assess location & cause of spikes (ends of legs?)
 - Mixing
 - 2 sources: stratosphere and background UT; need approaches to quantify
 - ST Mixing: use tracer-tracer correlations; acquire tropopause product; examine vertical profiles
 - Is mixing eroding away at edges and not affecting the central values? Probably. Depends on the environment the storm is in (shear, stability, etc.).
 - Decay of selected species (hydrocarbons) can constrain the degree of mixing
- Observed and expected ozone evolution as constrained by the observations?
 - Presentation of DIAL images
asd-www.larc.nasa.gov/lidar/dc3/dc3.html) – link this to DC3 web page/field catalog
 - Various plots (3D, different scales, time lengths) for O₃ and aerosol backscatter
 - Need modeling to help understand the gap between storm and aged outflow studies (e.g. 29-30 May)
- Lagrangian type modeling? (Nicola, Jose team, Jennifer O)

- SOA production for 21 June MCS
- Hydrocarbon decay
- HOx radical behavior
- New particle formation and growth

Preliminary findings

- O₃ increases with time during 21 June MCS
 - Evolution of tracers with time (Berkeley group); Testing of reactive nitrogen partitioning during evolution/aging agree with expectations, so far
 - Observe O₃ increases in downwind studies – how much is photochemistry versus stratospheric? Map in NOx-VOC-radical phase space and assess agreement with expectations.
- Discussion of light levels when DC-8 arrived at outflow (21 June MCS)
 - This is opportunity to assess impact of clouds on actinic radiation environment.
 - Discussion of impacts of findings related to aerosols and impact on gas-phase chemistry.
 - Does uptake of gases onto aerosols impact the gas-phase composition? Unlikely.
 - What controls the number and mass of particles in outflow?
 - What is needed to assess 0-24 chemical evolution?
 - Cloudiness along path
 - Some measure of dilution/mixing
 - How well do we expect to model these studies? Assessment of success of model products in locating and quantifying outflow
 - Discussion of location of hindcast outflow versus observations?
 - What products (e.g. satellite) can help inform and constrain the model?
 - Archival of model results? Suggest a mixture of archiving steady state type output, and some, but not all the Lagrangian runs

Other cases?

- 6-7 June

- Good satellite coverage
- Good radar & LMA coverage of the storm
- Chemical measurements maybe not so compelling
- Back trajectories from 7 June flight track don't appear to go back to 6 June storm; Back trajectories from GOME-2 do go back to NE Colorado
- Others?

Listserv use:

- Develop discussion first using high level assumptions and evolve depending on what is found.

Papers:

- 21 June MCS – Chris will shepherd individual pieces (that could/would appear in other papers), Ron Cohen is interested in working on the topic; Steve, Jack, Tom, Jose
 - Suggest that an overview paper that connects all the parts be written that supports the other related papers; Science paper that highlights this important aspect of DC3
 - Papers should try to ensure that related analyses are consistent with each other; group needs to paced so related analyses come along at about the same time
 - Quick analyses can help assess the degree of more detailed analyses required (e.g. hydrocarbon decays, photochemical modeling)
 - 6-7 June analysis will likely appear in one or more other papers
 - Emphasize papers that pull findings together
 - Discussion of role of modelers and observationalists for day 1/day 2 studies;
 - 29-30 May case: Berkeley group
 - Assessment and summary of ozone production in various segments to compare with SOA (Jose)
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- As in INTEX put all data on NO_x/HNO₃ photochemical clock as a starting point and to develop broad, generic point of view (Ron)
 - Discussion of how we came to study MCSs during DC3