Source Characterization

General Findings

Source characterization was not a top priority for DC3 but characterization of the different regions that were targeted for convective studies (CO, TX/OK, AL) was included in the white paper. (Didn't go to AL as much as planned)

Only one flight (the last GV local flight) was specifically designed to study oil and gas emissions from the TX pan handle region– so it has an upwind leg to constrain background - has potential to help constrain emissions.

However, DC3 did do a significant number of low altitude passes in the BL (both DC-8 and GV). Look at overall patterns and assess variability of different regional areas for source characterization. Compare with known data, models?

Sources
For DC3 some discussion on definition of source – one definition is "Inflow" to storms…
We note that many (most?) inflow BL legs were inhomogeneous – and as such probably contribute to the variable nature of many (most?) storm outflow legs. But how much?
Need to make link with different (and variable) surface emissions– help interpret inhomogenous outflow better – on case by case basis.

Oil and Gas
DC3 saw significant and widespread influence of oil and gas activities that dominated VOC alkane distributions.
Also evidence of benzene from the same regions.
  – compare to recent western studies on fracking (methanol/benzene etc. as well as alkanes) – Ron and Chuck
  – Barnet shale area near Fort Worth is fracking region.
  – See leaks from former oil drilling areas?
  – What can be learned from methane and CO observations?

Photochemical sources – need to remember when looking at time series of certain gases

Agricultural
DC3 flew over Greely feed lots several times.
Ammonium nitrate was enhanced over feedlots – any way to get estimate of ammonia emissions?

Biogenics
Isoprene
Saw enhancements in bromoform and DMS (correlated with isoprene?) in the continental BL in several areas – evidence for continental sources?
> Compare to CAM-chem, MEGAN models
> Compare to INTEX NA?
> Rice paddy emissions of bromoform and DMS? (Redeker et al.p\)
> Peat bog emission of bromoform (Mace Head)

Fires
TOGA has biomass burning specific tracers – markers for entrainment of High Park fire emissions in June 22 flight.
Use VOC ratios to characterize High Park fire and see how it compares to similar fires - is it representative of BB in general/specific type of fire/special case?

Papers:

Apel/Blake/Campos/Farris –Influence of Oil and Gas Emissions on Storm Inflow and Outflow during DC3. (compare to work being done in Colorado and Utah with fracking activities).

Campos/Farris – Source signatures of methane, CO, and CO2

Hornbrook/Apel – High Park fire/June 22 flight – maybe more BB than "sources"

Vadrevu, Beyersdorf, et al.: spatial variation in CO2 and biogenic species as a function of land cover

Planned components to papers:

Karl F. is interested in using Oil and gas tracers to label high alt air masses

Sorooshian/Shingler– Aerosol growth factors associated with sources such as Ethanol plants - will fold into instrument paper

Gaps:

Study of different (and variable) surface emissions may help interpret inhomogenous outflow better:
  - Case by case basis.
  - Compare same areas with multiple passes – eg DC3 accumulated quite a bit of data over E CO – was this fairly stable over the time of the experiment? Back out a general "regional" composition – help to establish representativeness of outflow composition – even when it is inhomogenous.

Need GIS expert to help characterize source regions – especially agricultural/land use - Maybe consult with NOAA (eg Greg Frost)

Satellite Data – Louisa

Look for outflow plumes in OMI and MOPPITT data – should be large enough scale.
MOPPIT – look at retrieval from close to the surface (new product)

Model Products

Work up TOGA and WAS biomass burning enhancement ratios - would be useful for modeling comparison (Louisa).

CamChem has latest biogenic inventory from MEGAN – compare with DC3 biogenics spatial distributions

Louisa - Could put tracers into the model to look at different fires or source types – artificial tracers to follow air masses where we don't have data at the surface for example.