

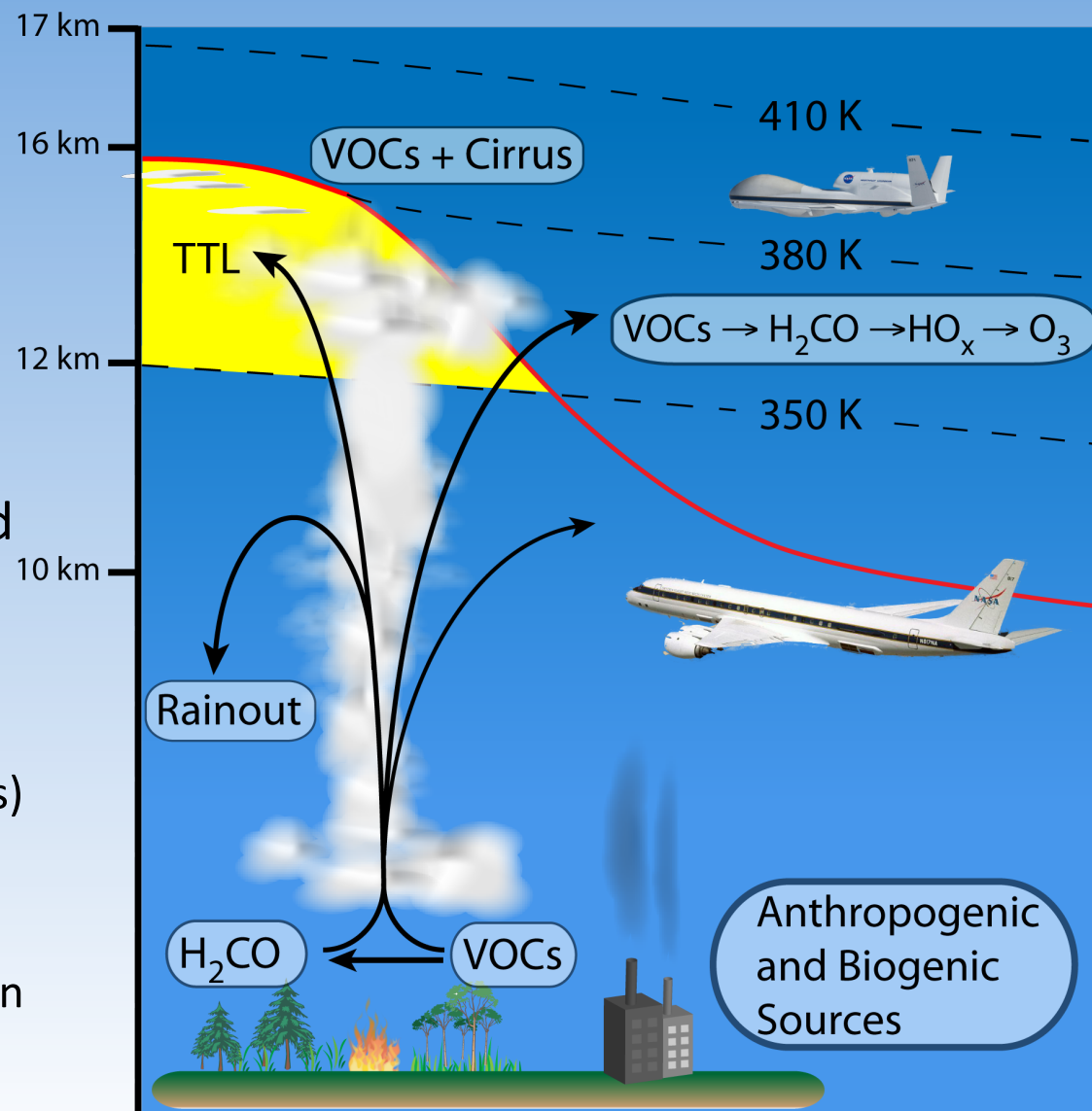
Vertical Transport of Formaldehyde by Thunderstorms

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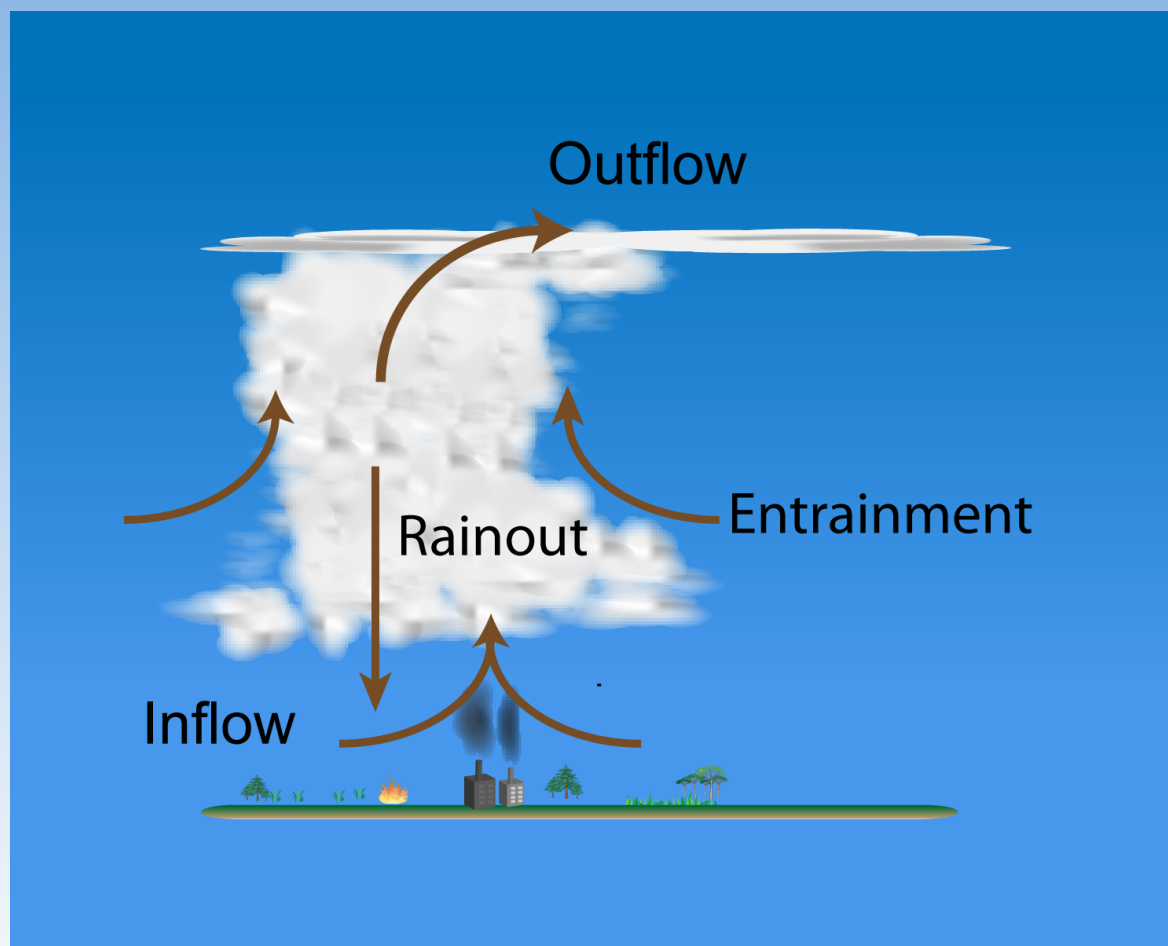
DC3 Science Team Meeting
25-28, February, 2012

Motivation

- Formaldehyde is a high priority measurement objective in the Earth Science Decadal Survey
- Measurements of formaldehyde can be used to help quantify:
 - Convective transport
 - The abundance of volatile organic compounds (VOCs)
 - Pollution effects on cirrus formation
 - HO_x and Ozone production

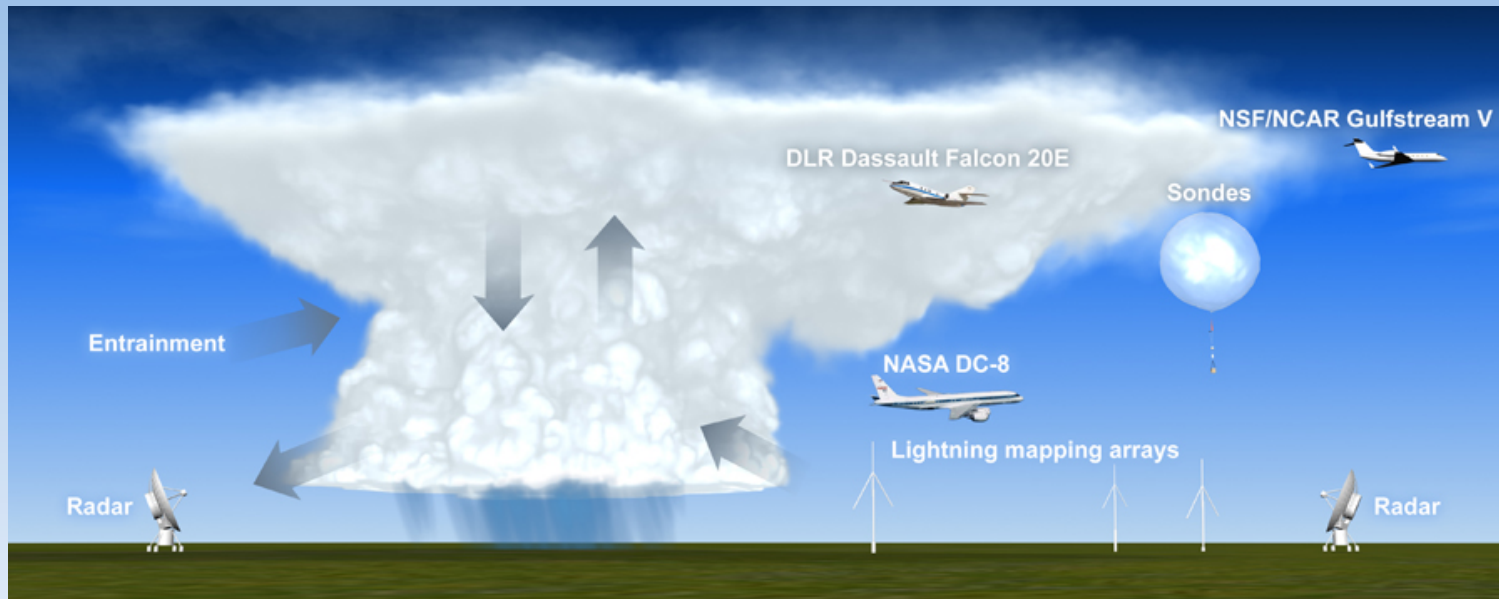


Objective: Quantify the processes that control vertical transport of formaldehyde



Method

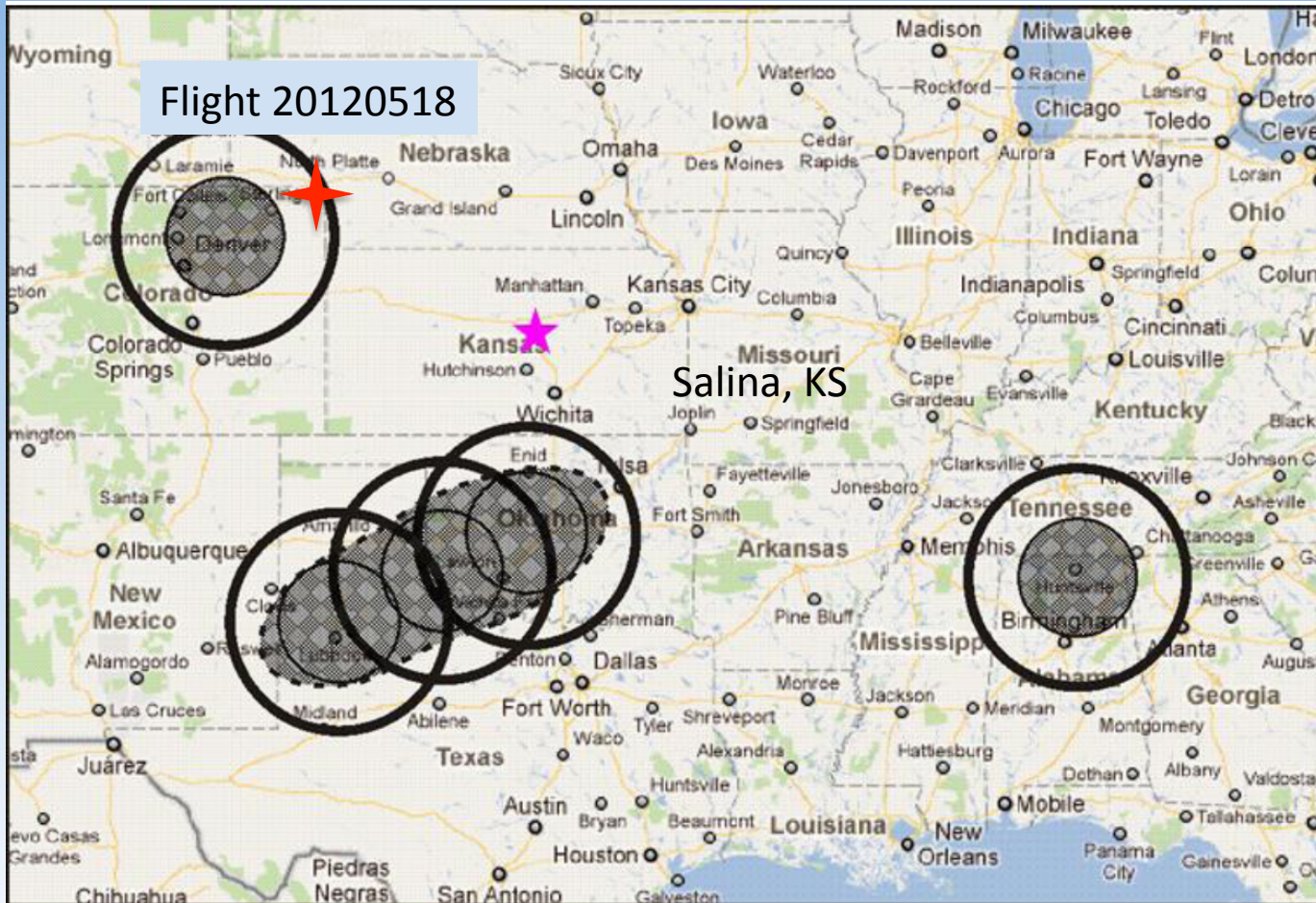
The Deep Convective Clouds and Chemistry (DC3) Experiment provides ideal strategies for quantifying transport and photochemistry.



Use in situ observations from the NASA DC8 to quantify transport.

- CO and Formaldehyde to quantify Entrainment
- Photochemical Model to correct for photochemical losses

DC3 Flight Domains

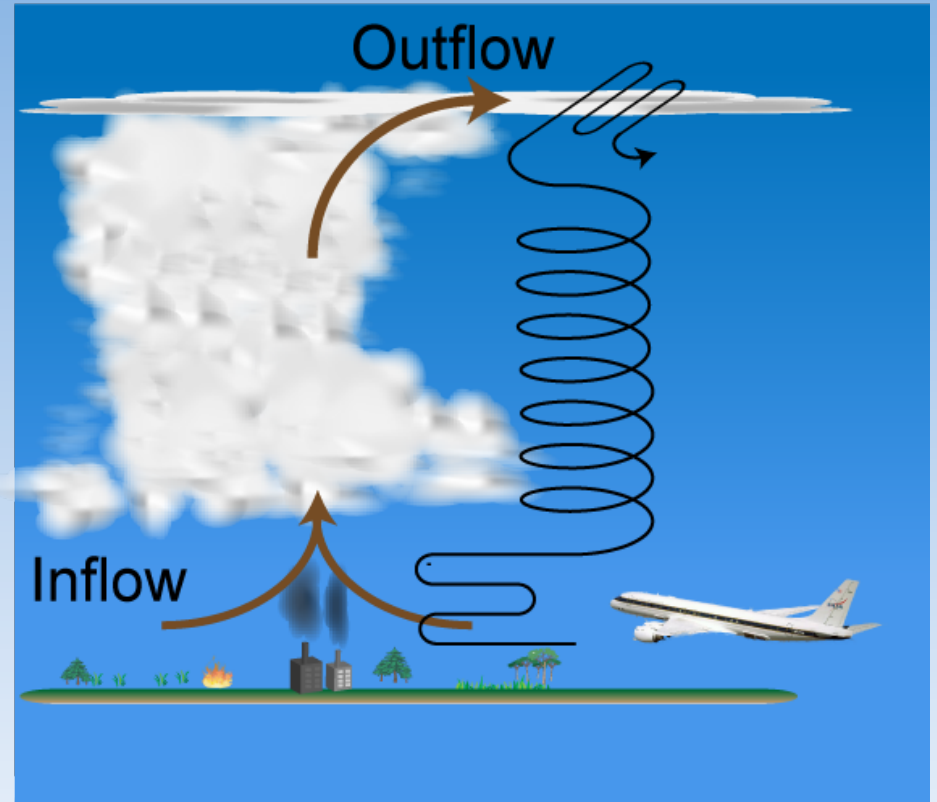


DC3 Storm Chase flight

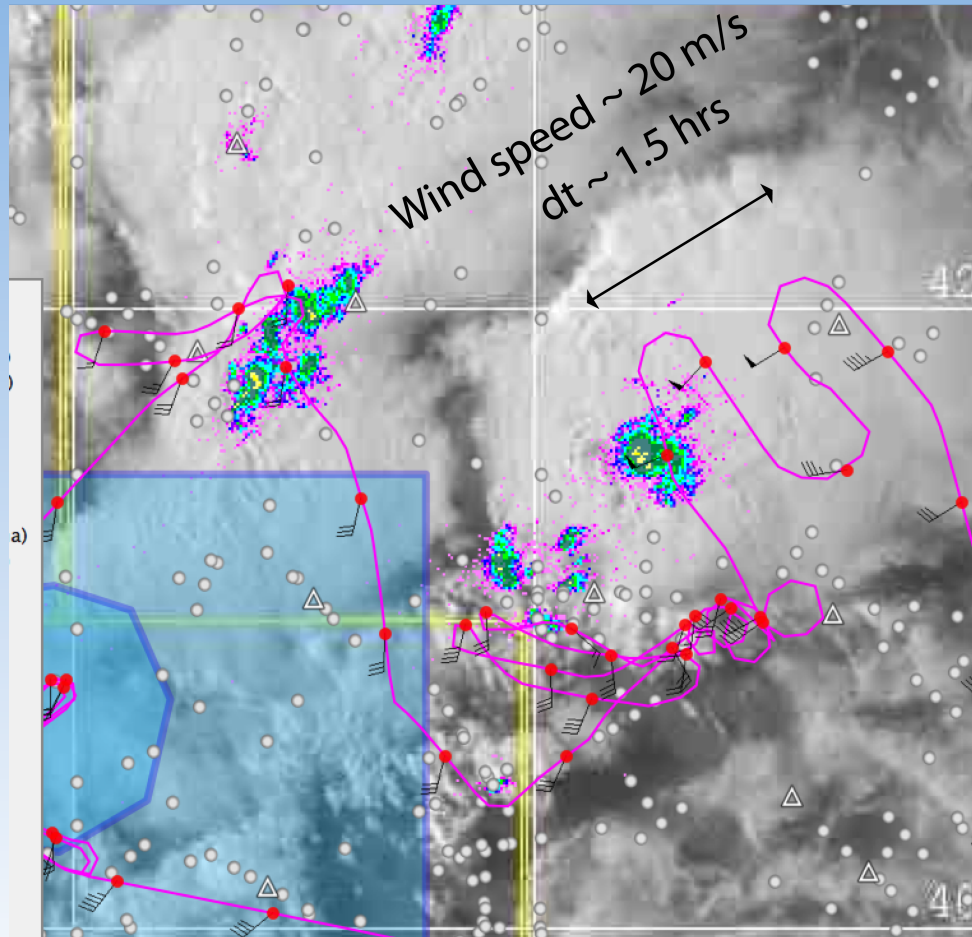
Sample Boundary layer inflow at low altitudes

Spiral up to outflow region

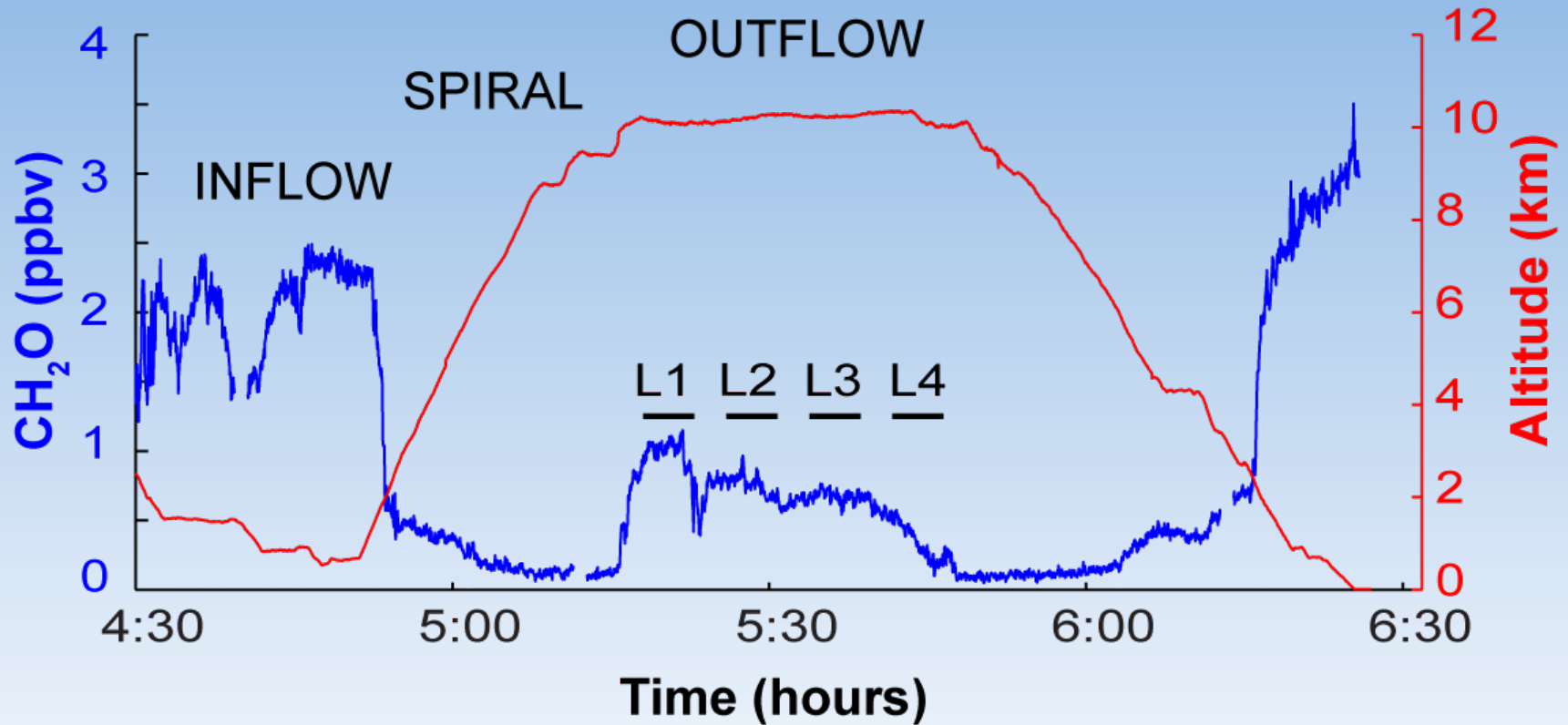
Sample outflow with “ladder” pattern



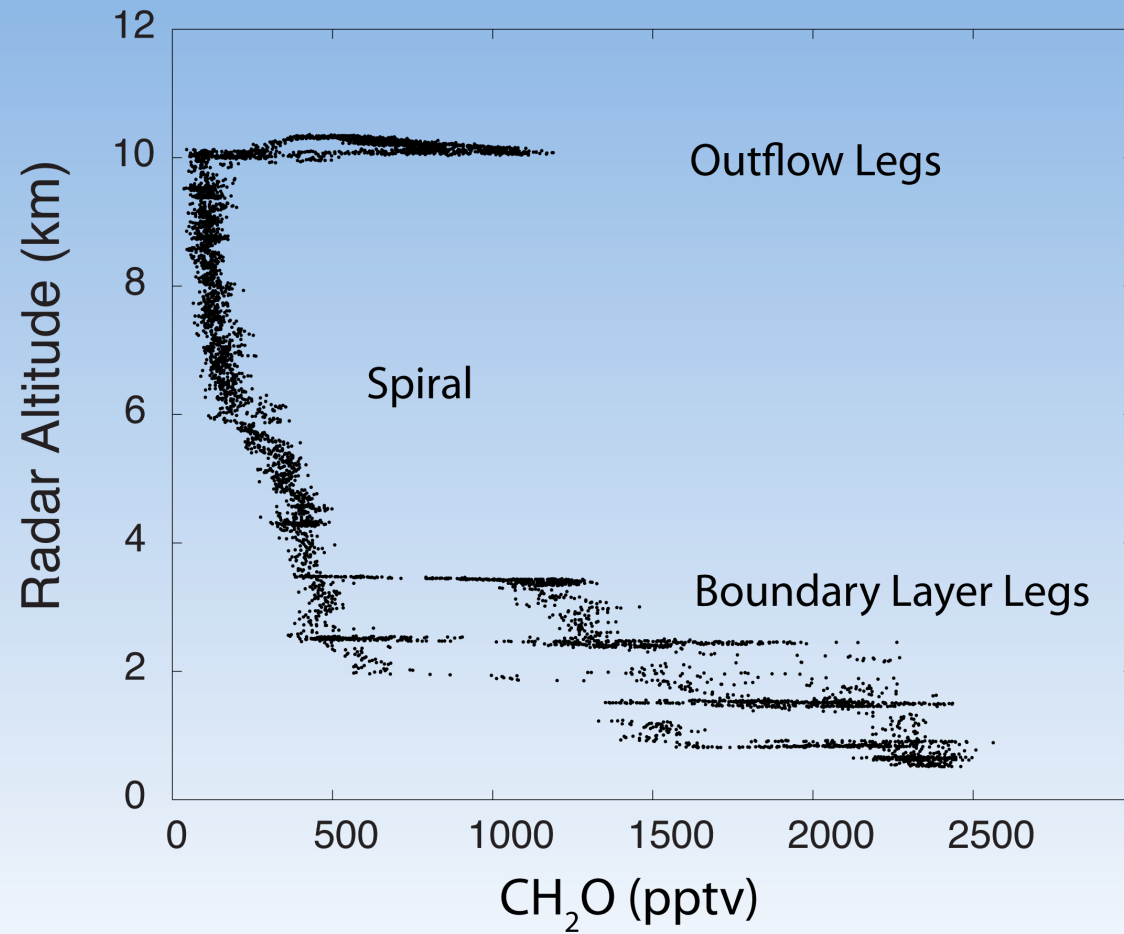
20120518 NE Colorado/SW Nebraska Flight pattern and IR image. Estimate the age of the plume measurements.



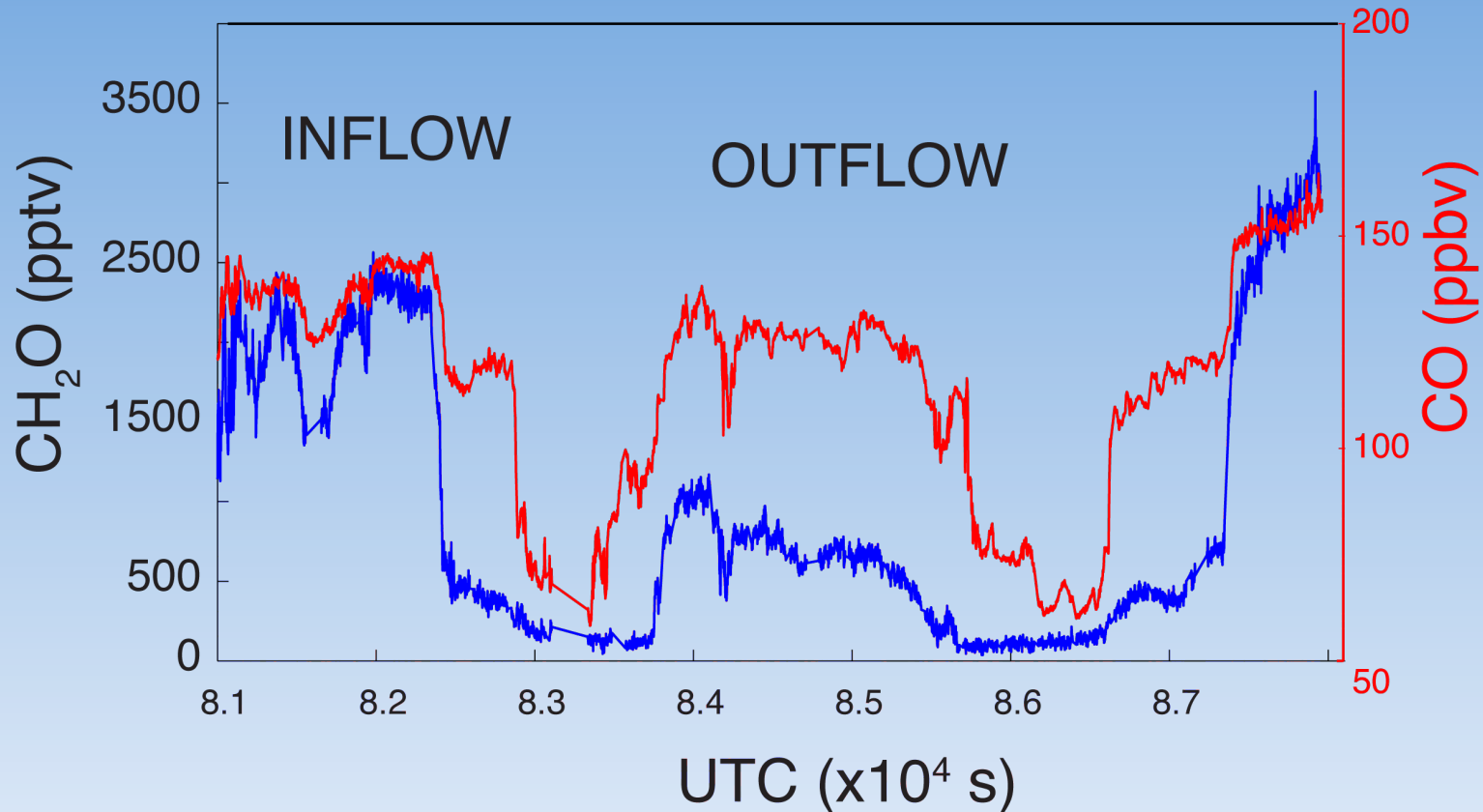
Northeast CO/Southwest NE Time series of the Outflow region



20120518 Profile

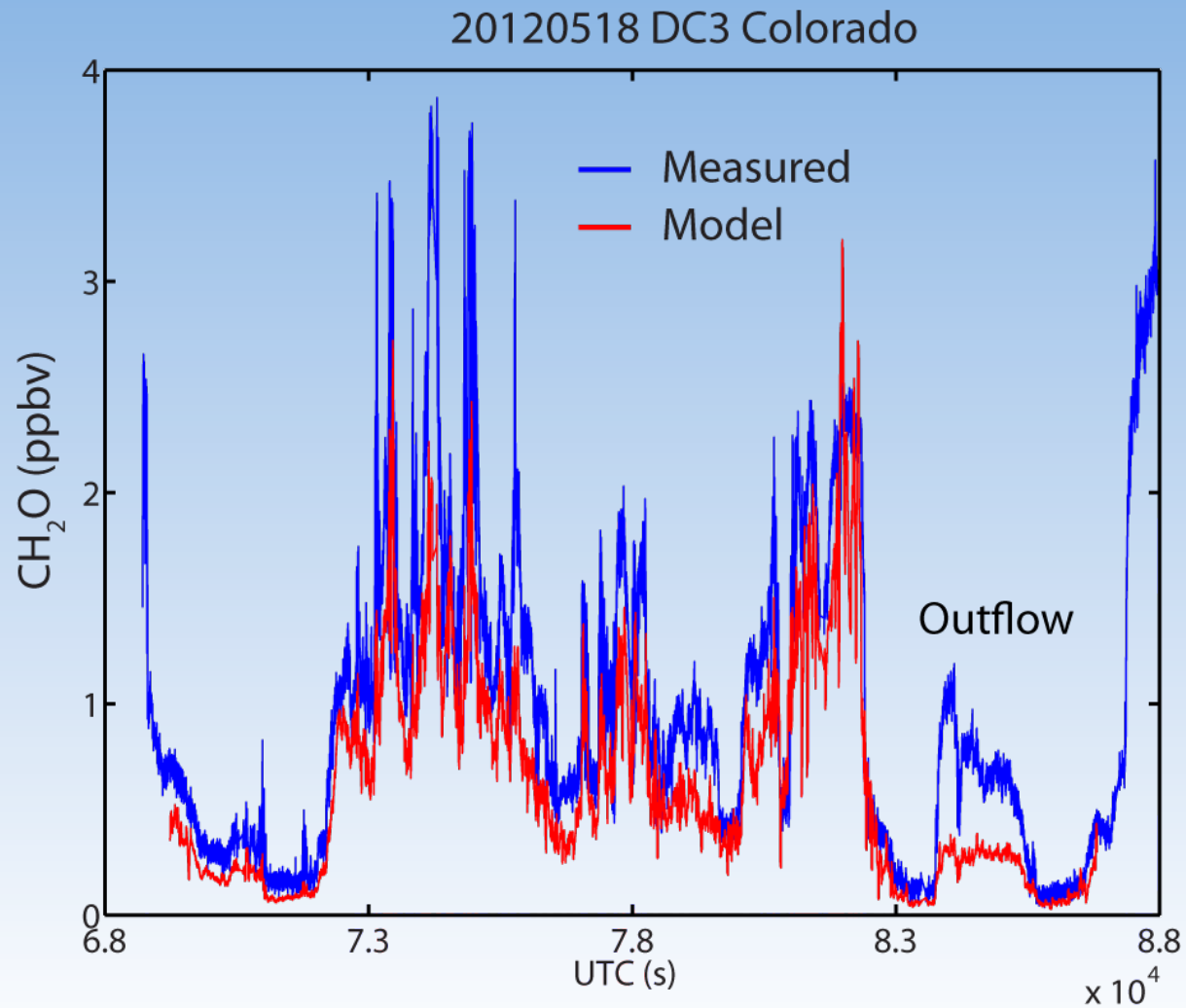


Estimate Entrainment/Dilution Effects with CO

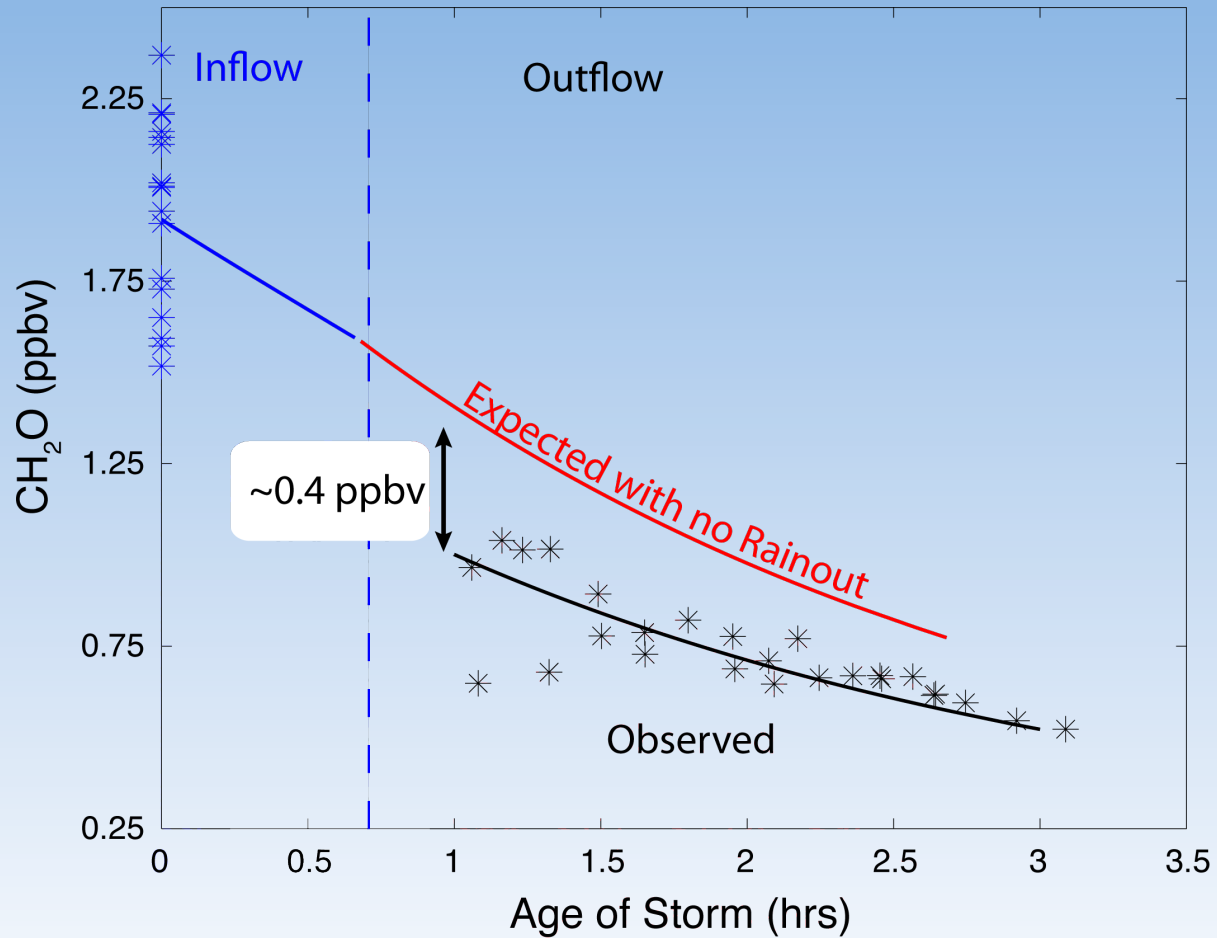


- CH₂O outflow is roughly 40% of the inflow.
- CO shows ~15% dilution in the anvil plume relative to the BL.
- Note “old” outflow indicated by CO

A comparison with a photochemical model indicates that transport is the primary source of formaldehyde in the outflow



Rainout or scavenging accounts for ~20% of the transported formaldehyde



Conclusions

- Formaldehyde is transported efficiently in Thunderstorms.
- Formaldehyde Observations are well described by photochemistry
- Only ~20% of formaldehyde is removed by rainout or other process.
- Thanks to NASA Hal Maring, Ken Jucks, and Jay Al-Saadi for Funding