Vertical Transport of Formaldehyde by Thunderstorms in DC3

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DC3 Science Team Meeting

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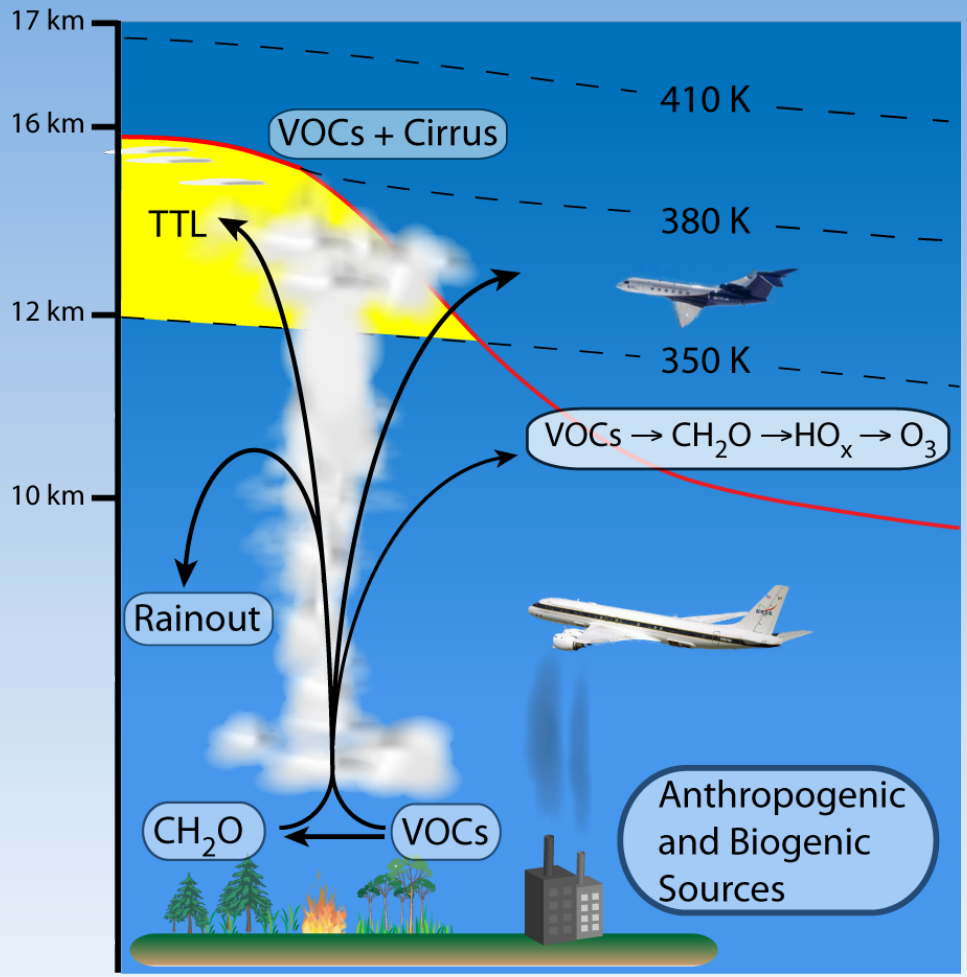
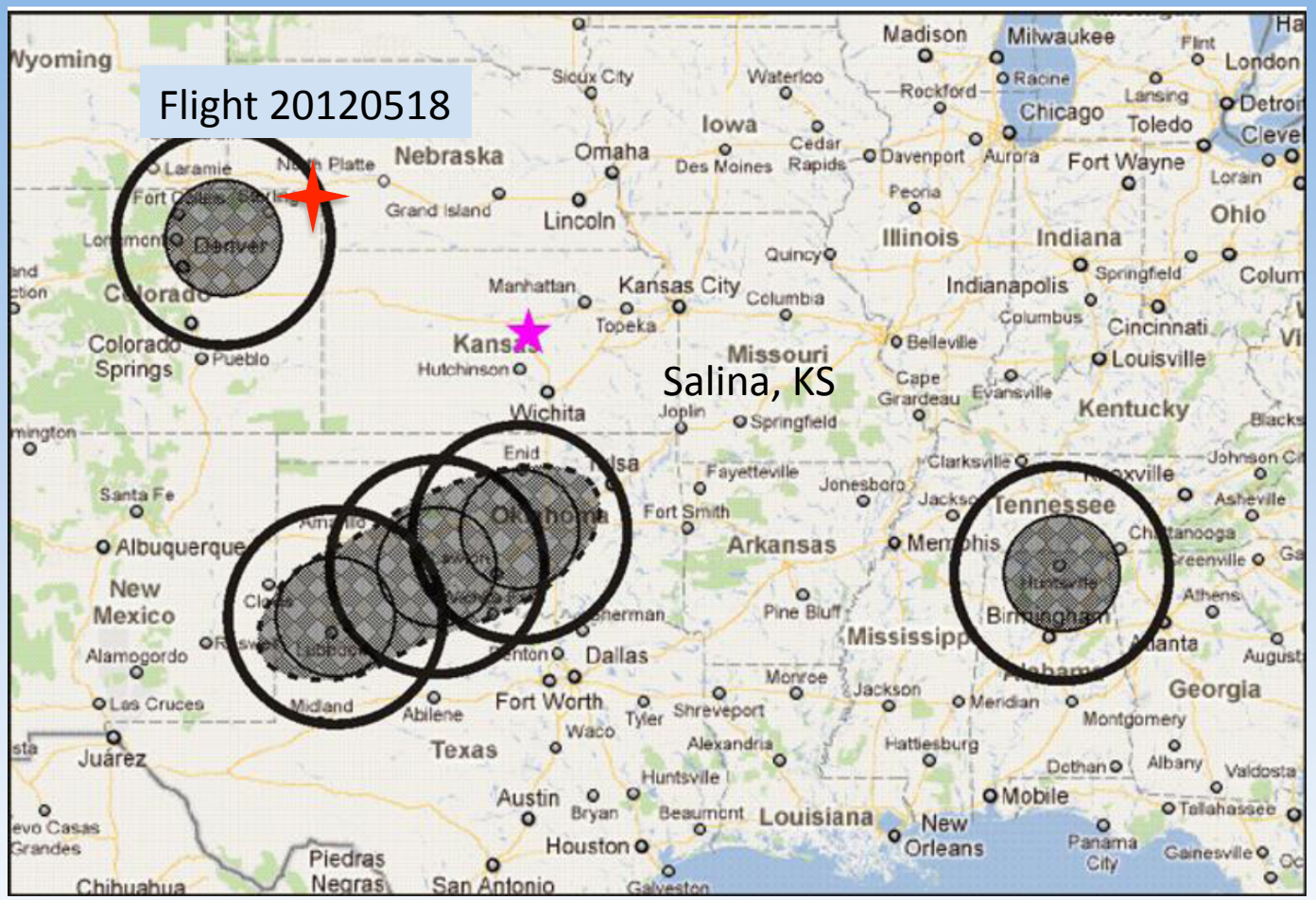
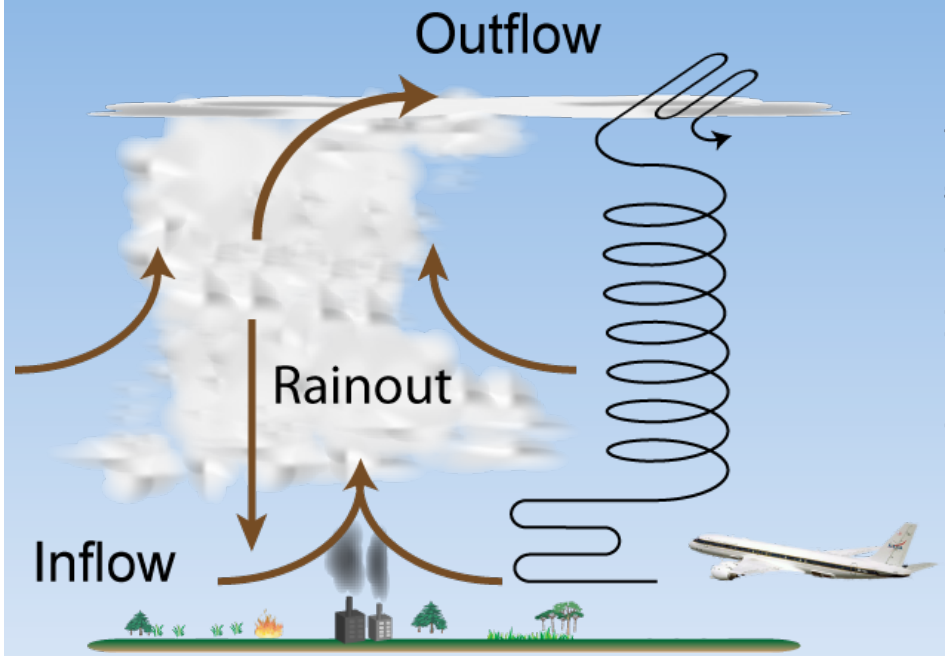
- Measurements of formaldehyde can be used to help quantify:
  - Convective transport
  - The abundance of volatile organic compounds (VOCs)
  - Pollution effects on cirrus formation
  - HOx and Ozone production
- Objective: Quantify the processes that control the transport of formaldehyde

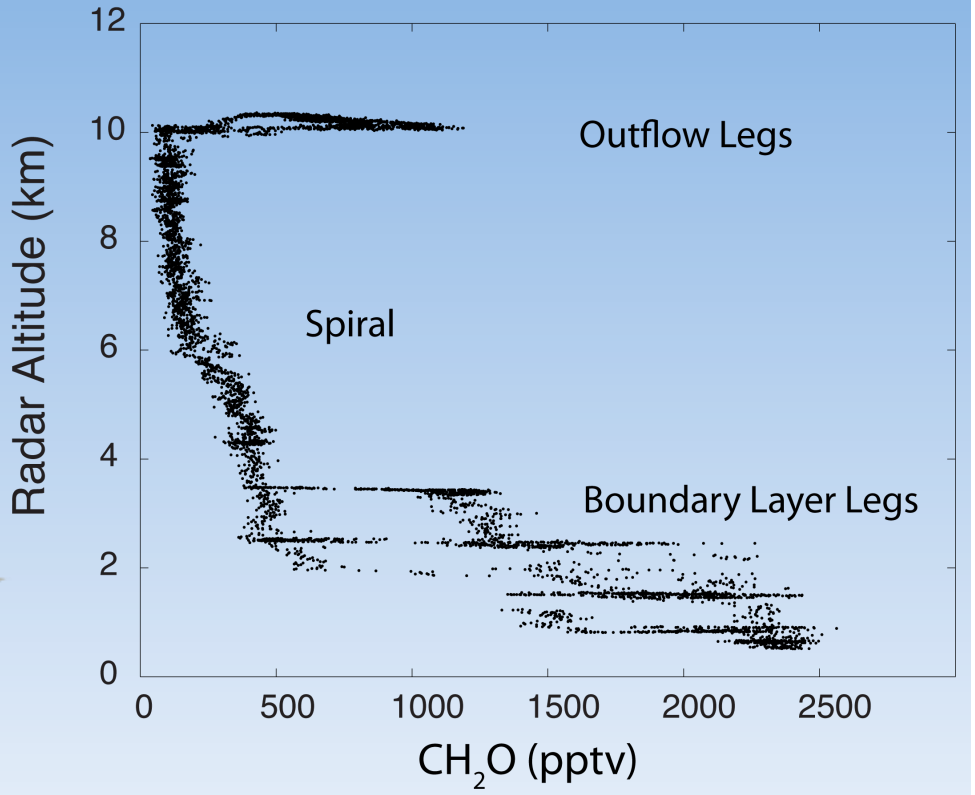


DC3 Flight Domains



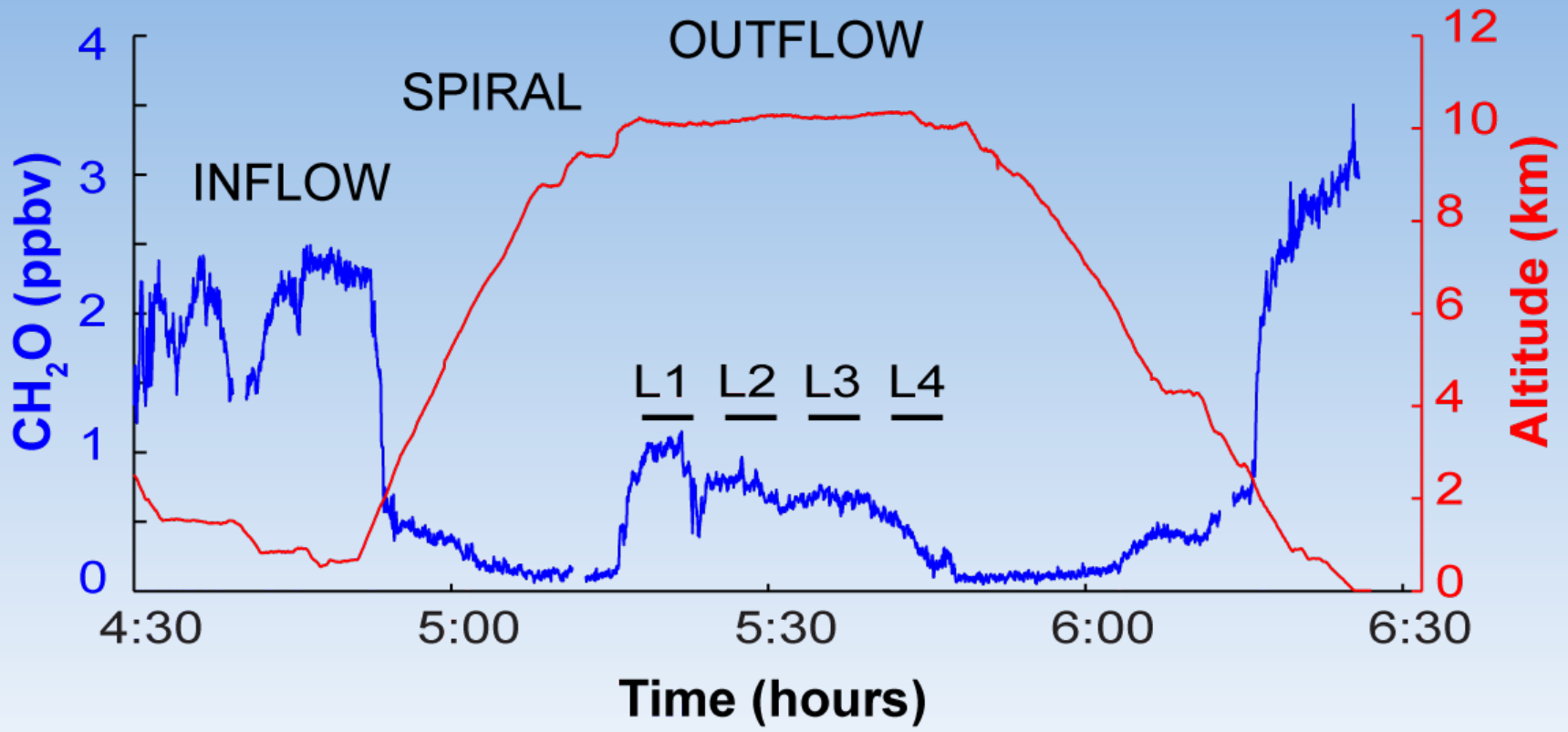
DC3 Storm Chase flight 20120518



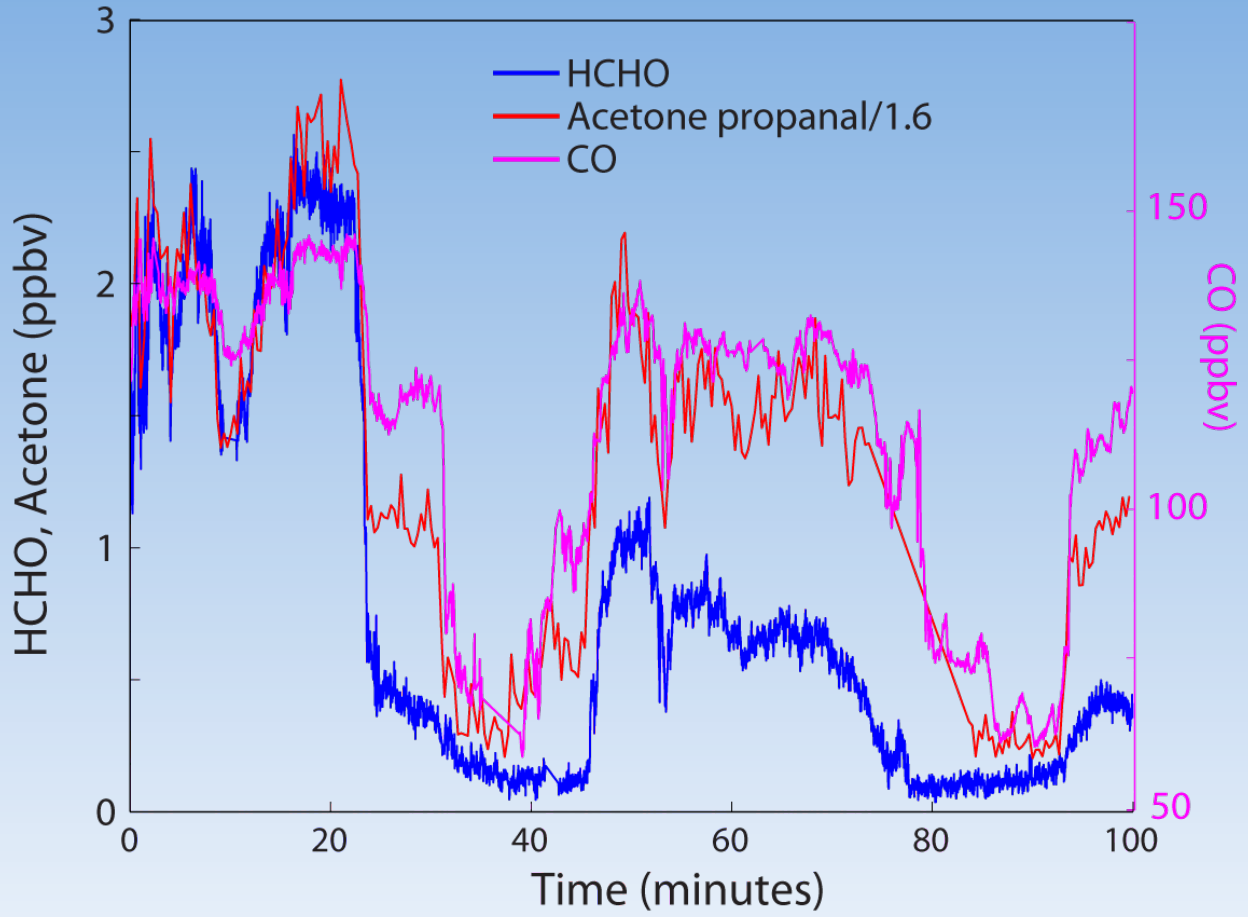


Sample Boundary layer inflow at low altitudes
Spiral up to outflow region
Sample outflow with “ladder” pattern

Northeast CO/Southwest NE
Time series of the Outflow region

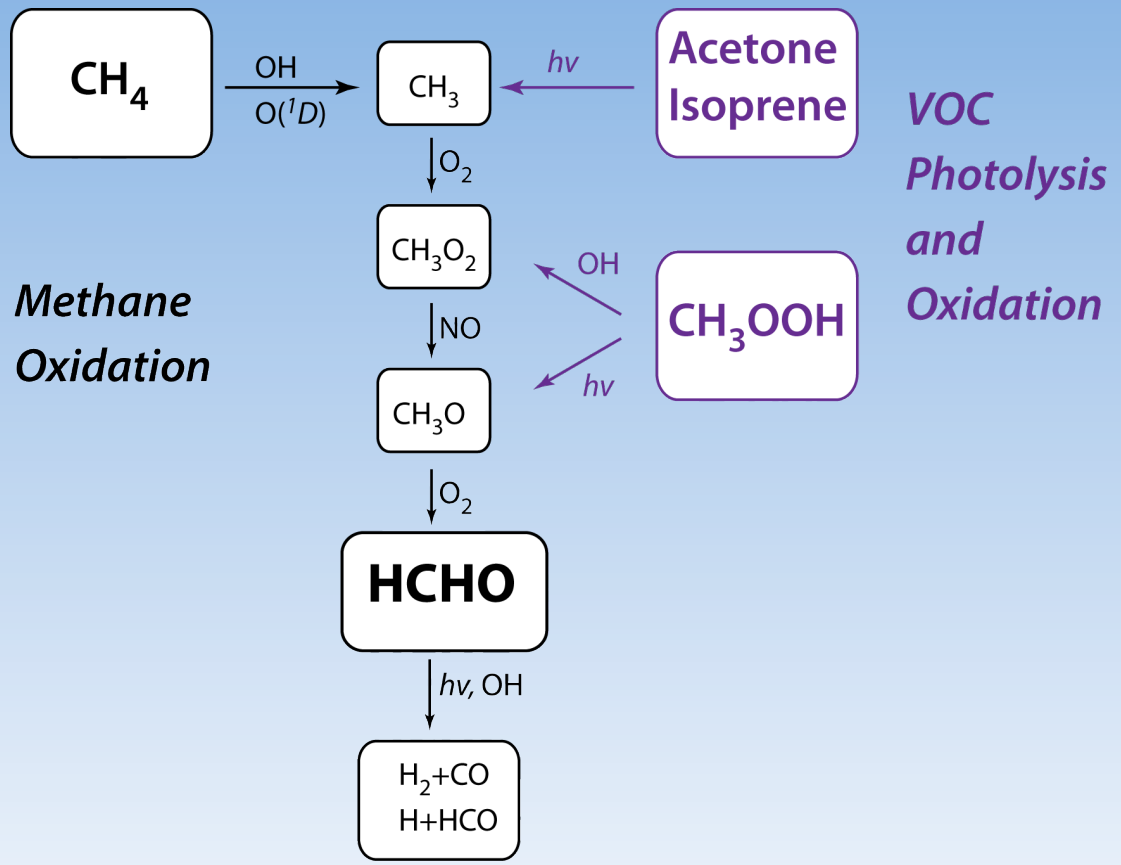


Estimate Entrainment/Dilution Effects with CO and/or Acetone

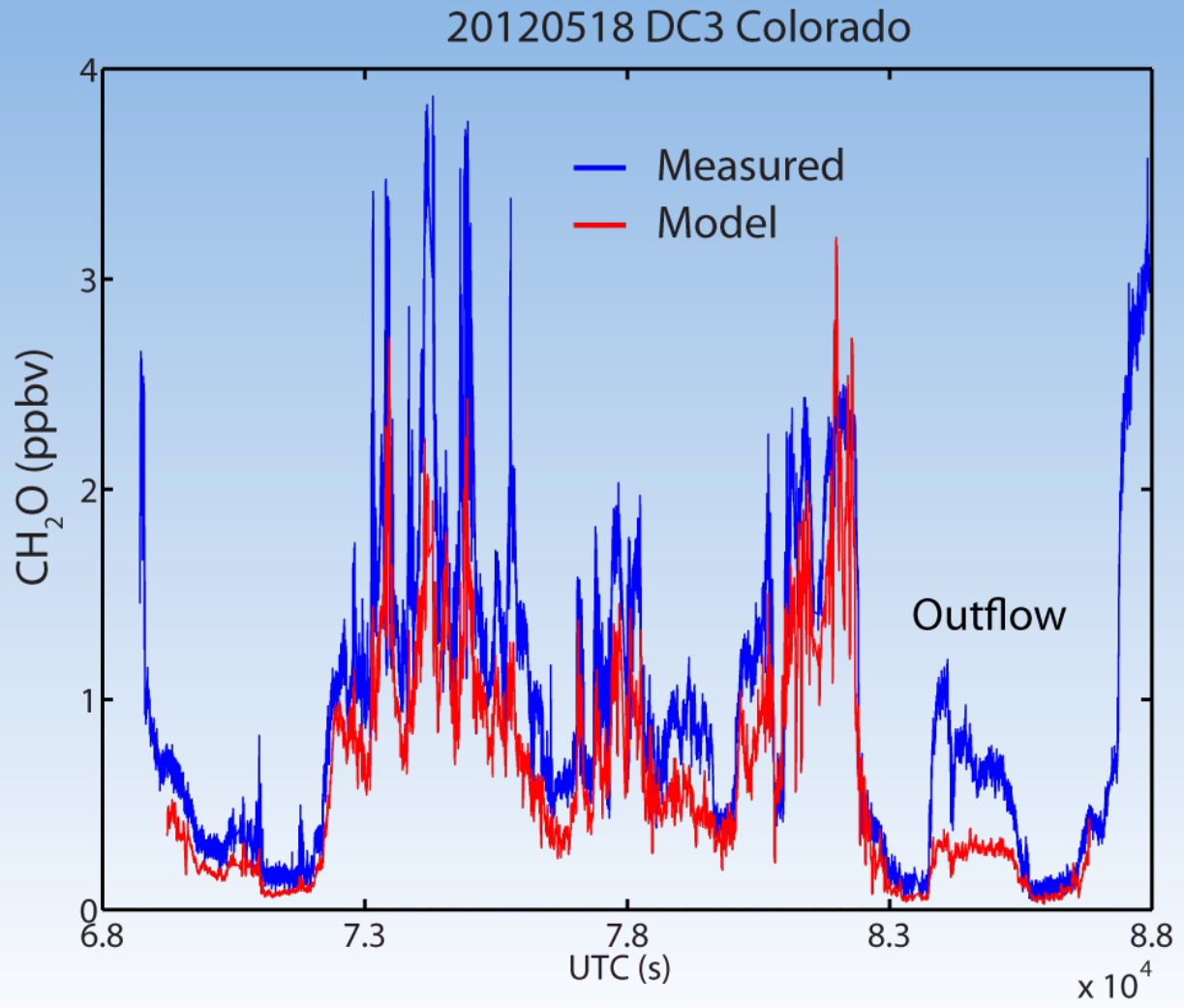


- CH_2O outflow is roughly 45% of the inflow.
- CO and Acetone/Propanal show roughly 20% dilution
- Note “old” outflow indicated by CO and acetone

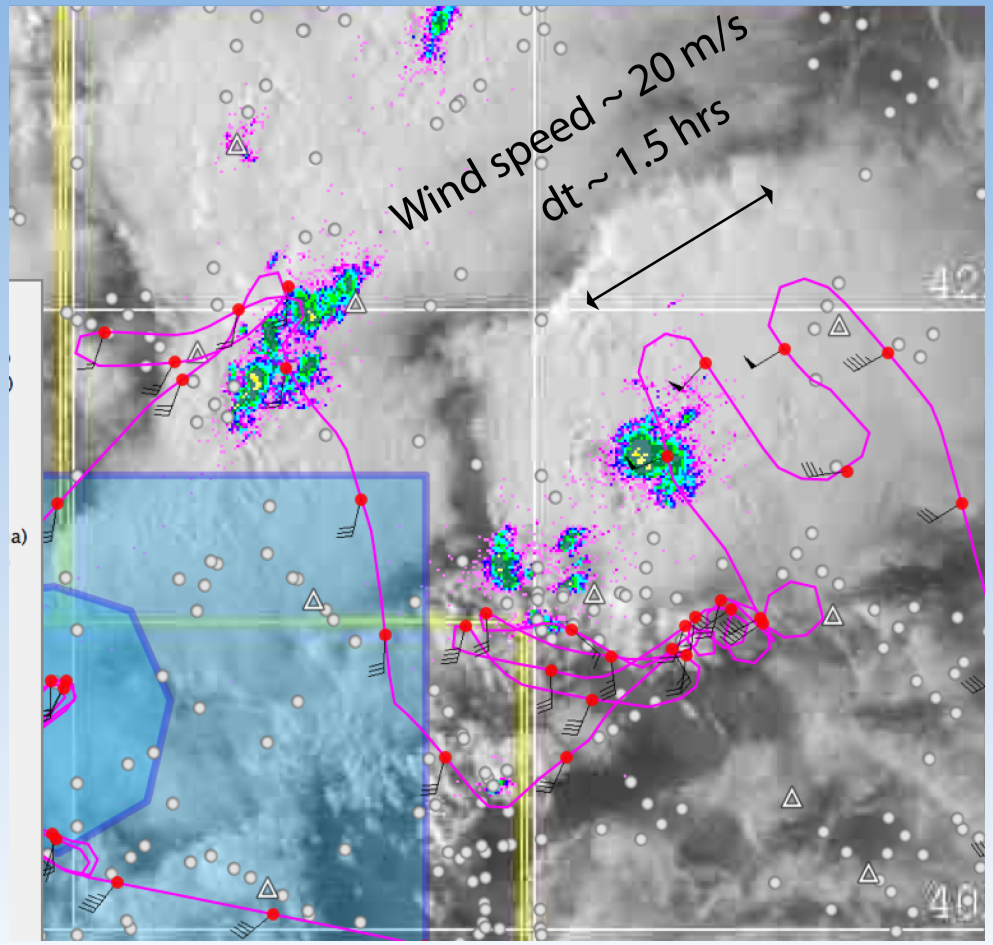
Photochemistry: Use Observations to constrain a time-dependent photochemical model.



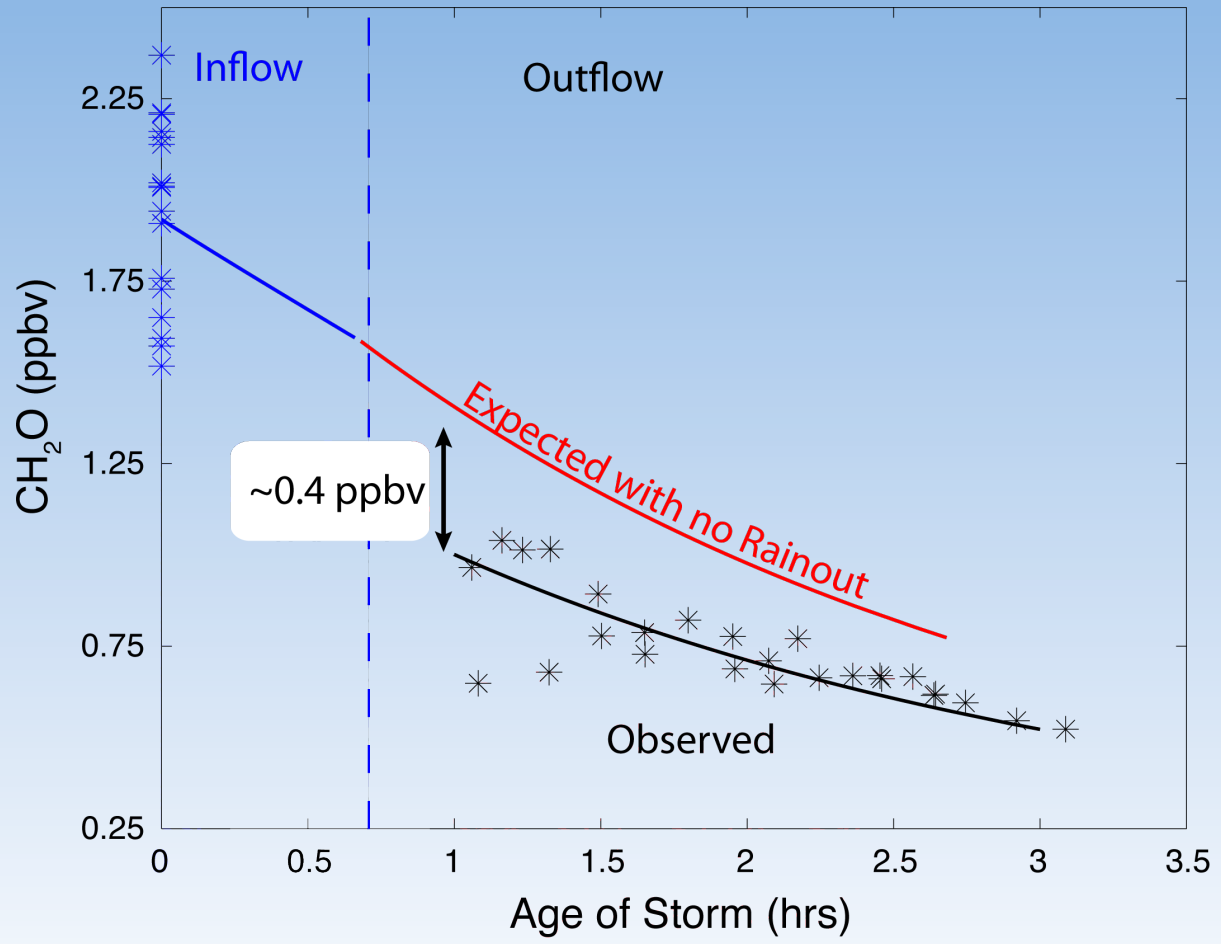
A comparison with a photochemical model verifies that transport is the primary source of formaldehyde in the outflow



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



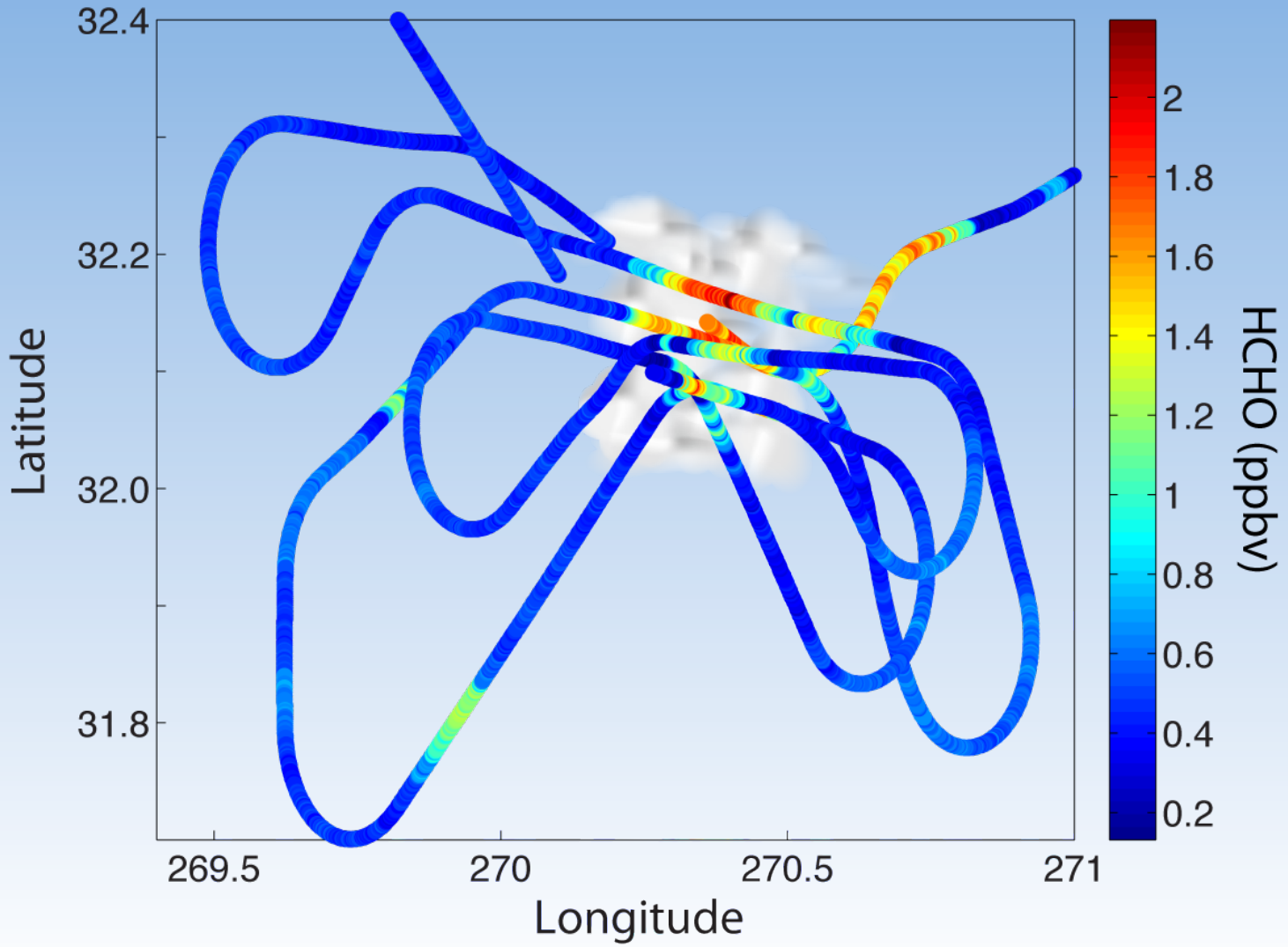
Rainout or scavenging accounts for ~20% of the transported formaldehyde



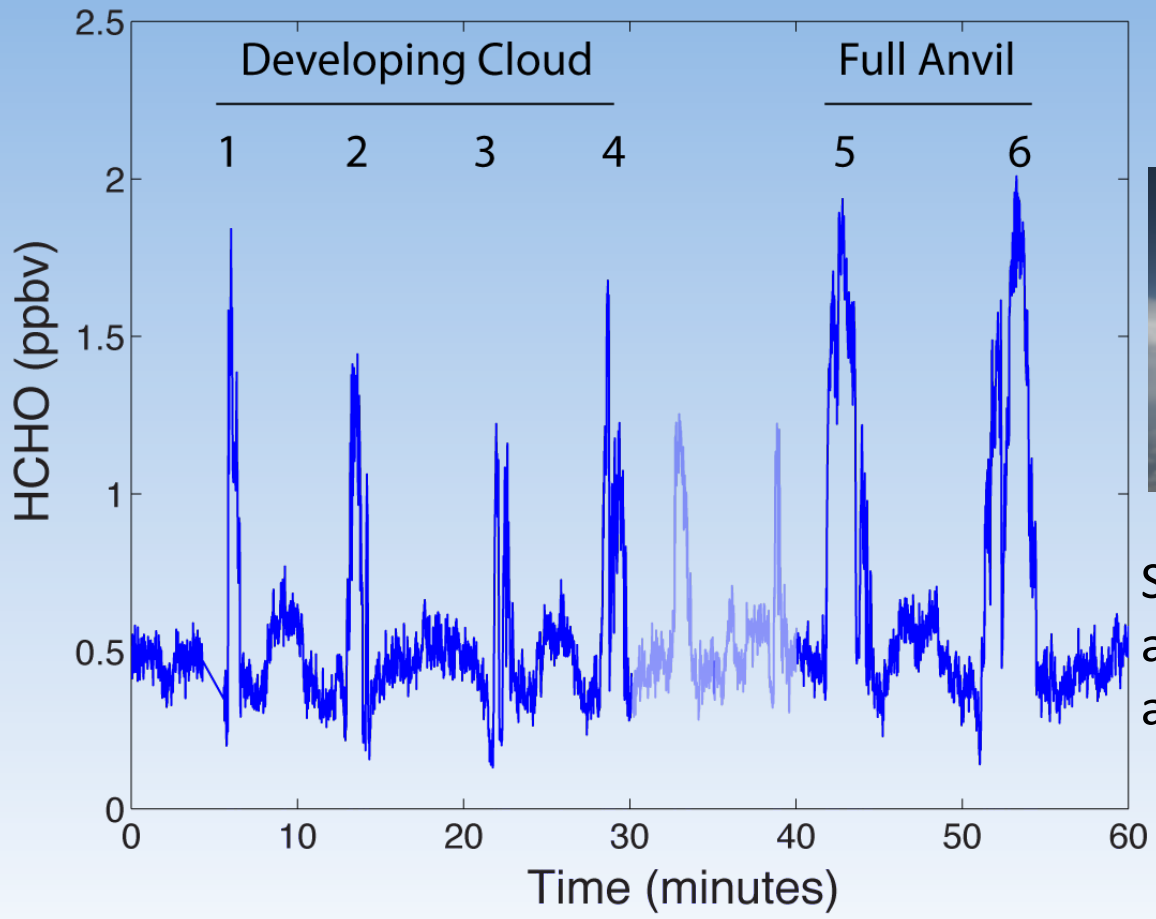
DC3 Measurement Summary

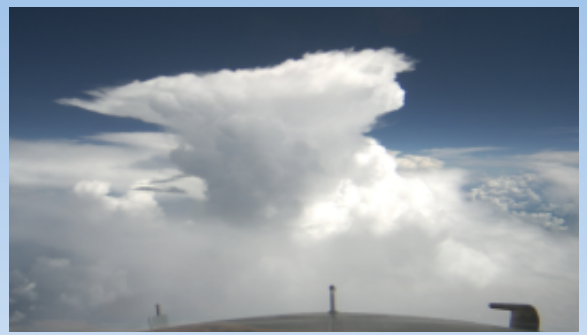
Date	Location	Entrainment	Rainout	Ratio UT/BI
20120518	41N 258W (NE)	18%	22%	45%
20120519	37N 262W (OK)	40%	9%	40%
20120602	41N 256W (CO)	28%	10%	53%
20120606	41N 256W (NE)	33%	22%	38%

SEAC^{4}RS 20130902 “Tammi”
JACKSON, MS



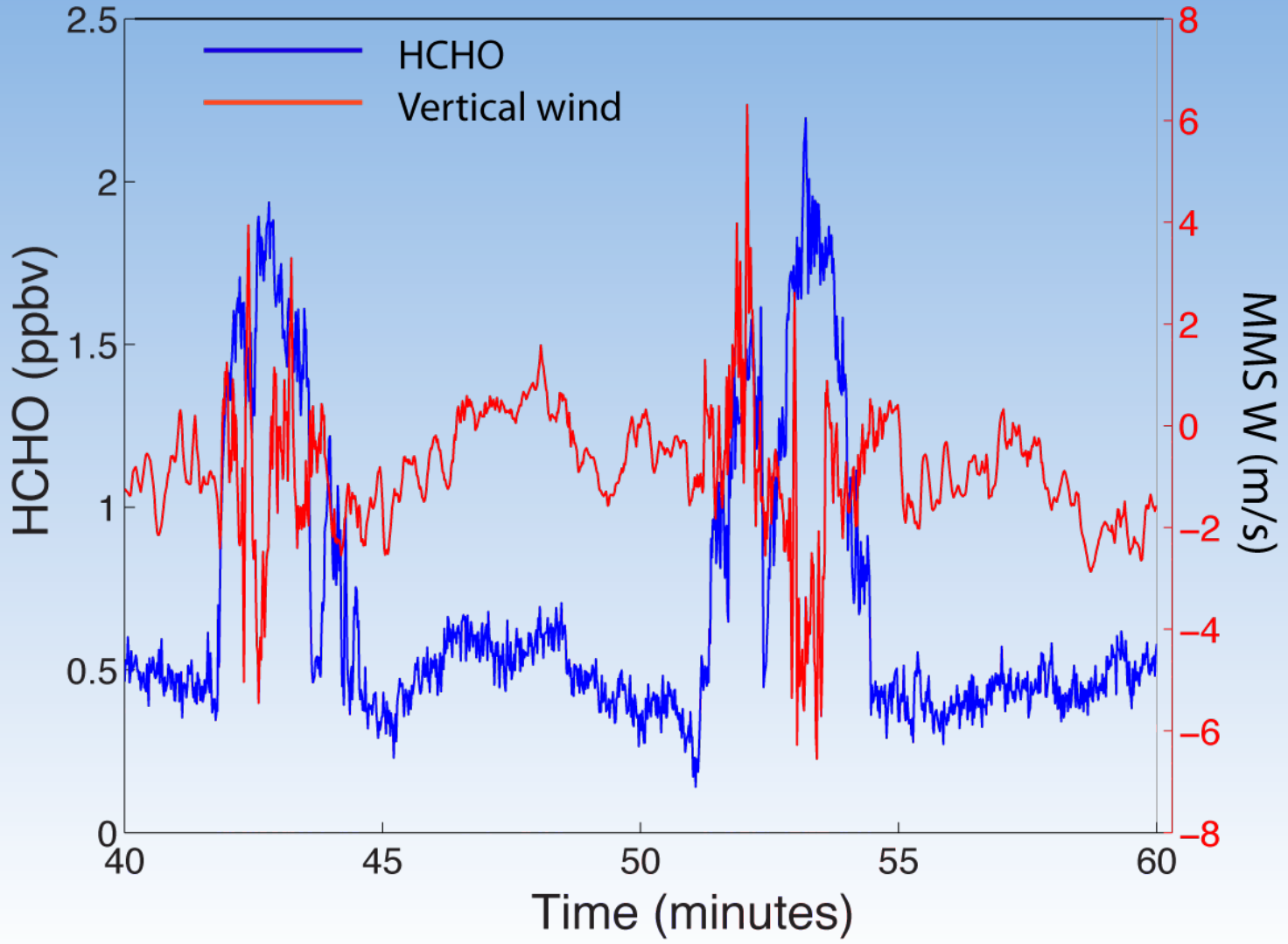
Formaldehyde increases as the anvil develops.
No sign of removal by ice.



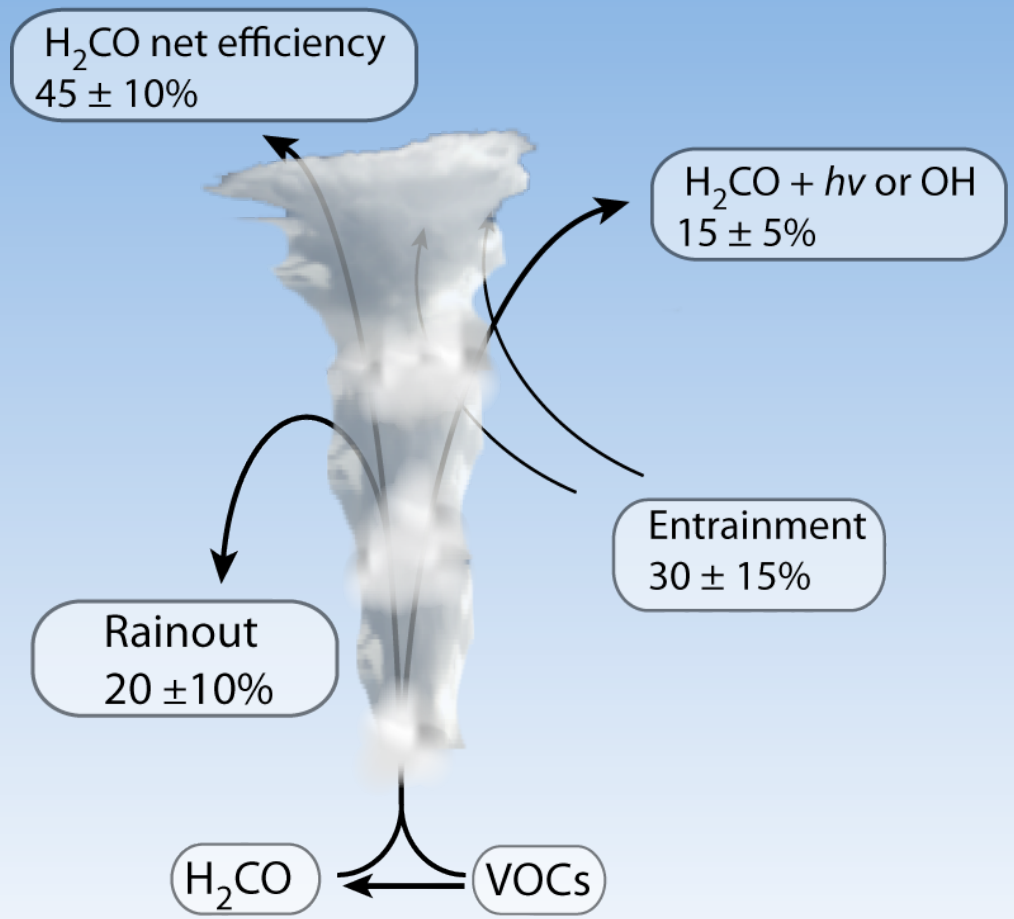


Sample “Tammi” as the anvil develops. Constant altitude = 11 km

Dips in HCHO at the edge of the anvil is likely due to entrainment at midlevels (6 - 8 km).



DC3 HCHO measurements summary



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