Significance of formaldehyde in the upper troposphere: perspective from recent studies

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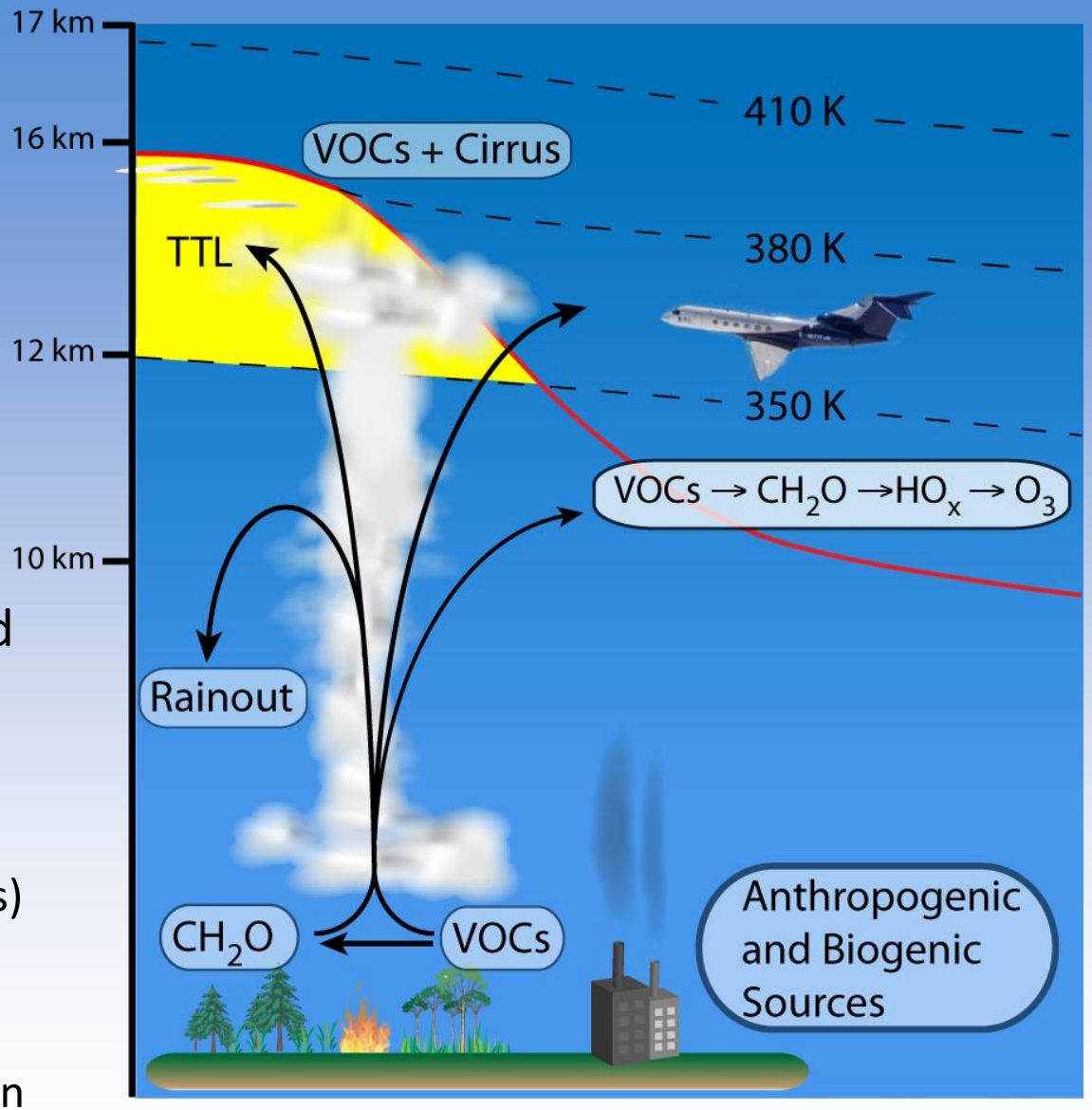
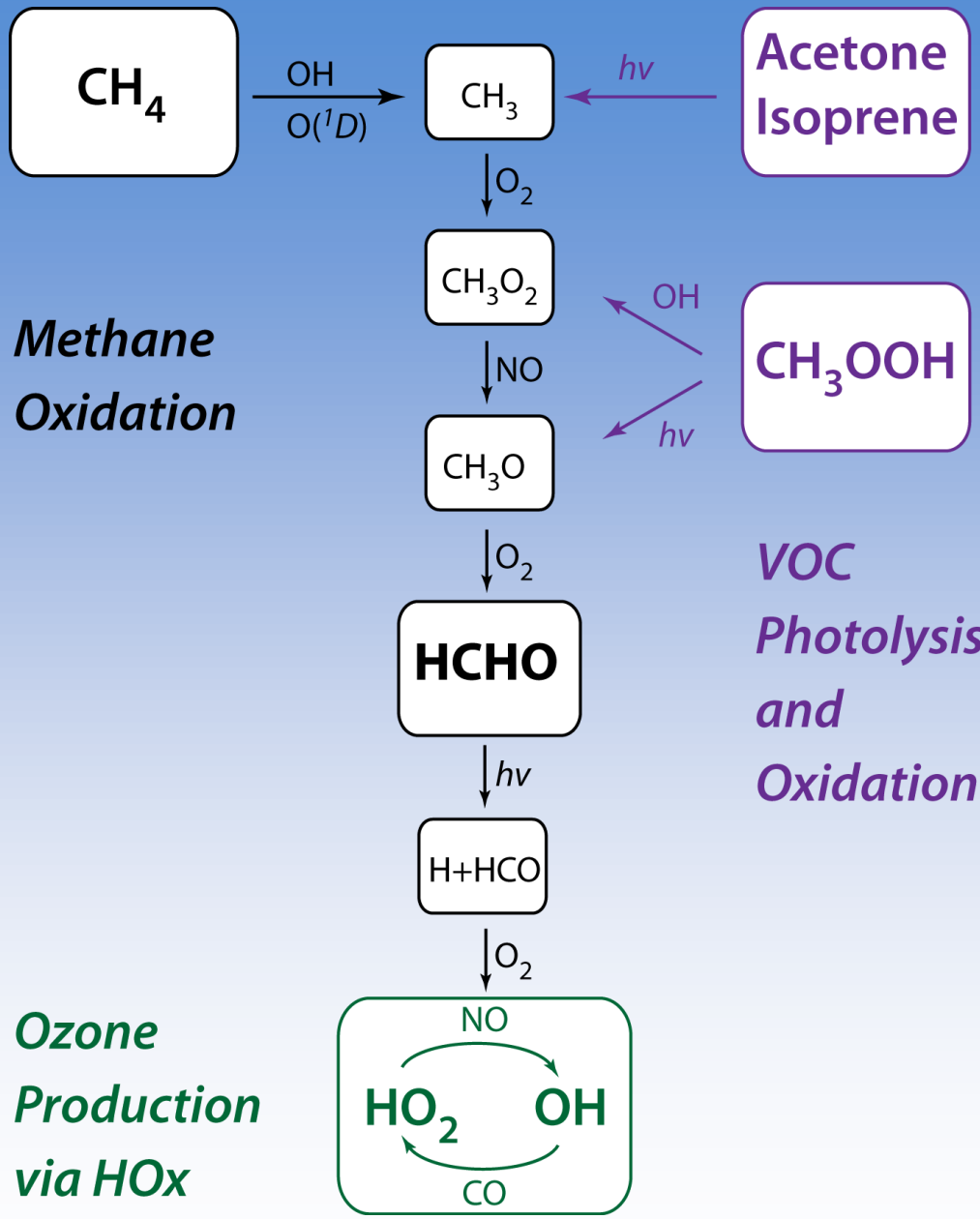
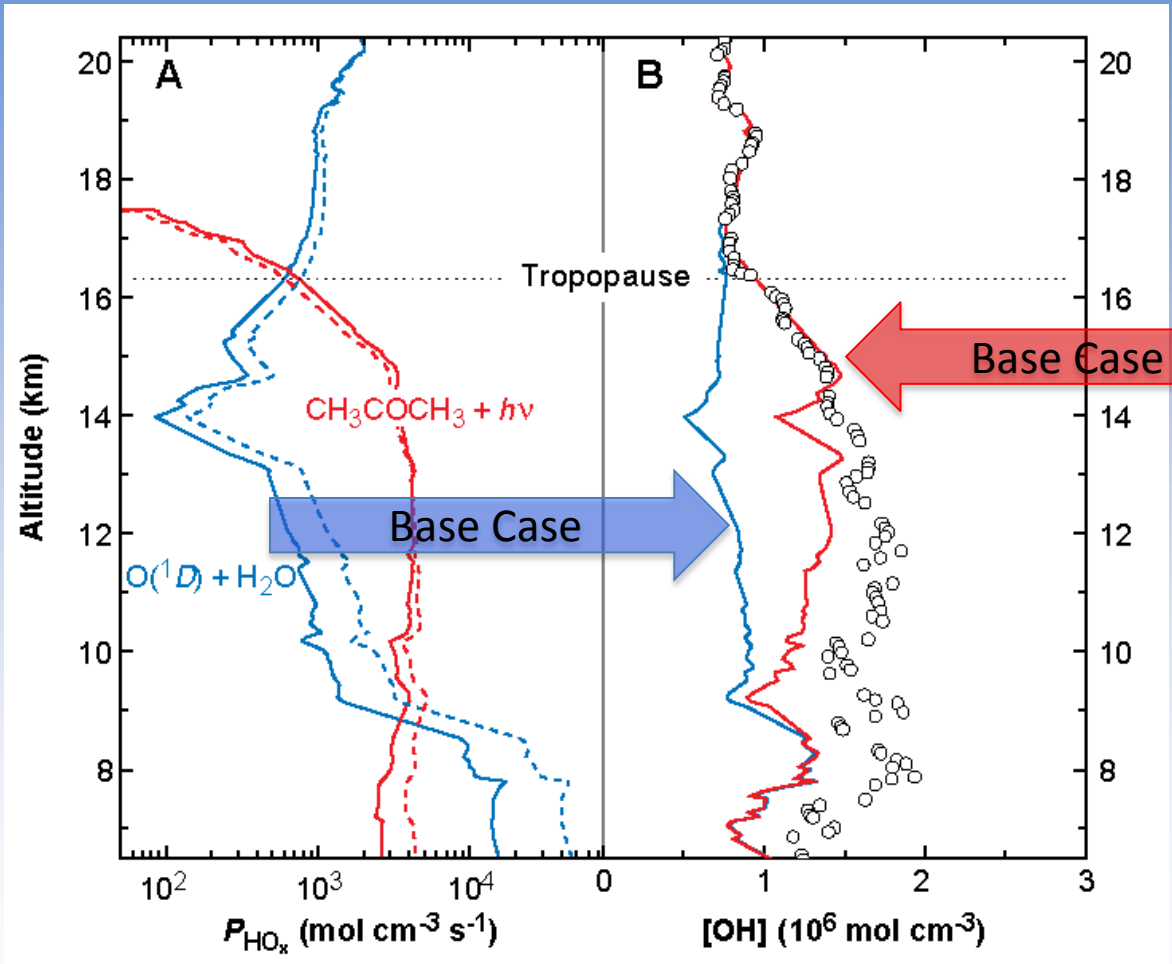
Motivation

- 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
  - HOx and Ozone production



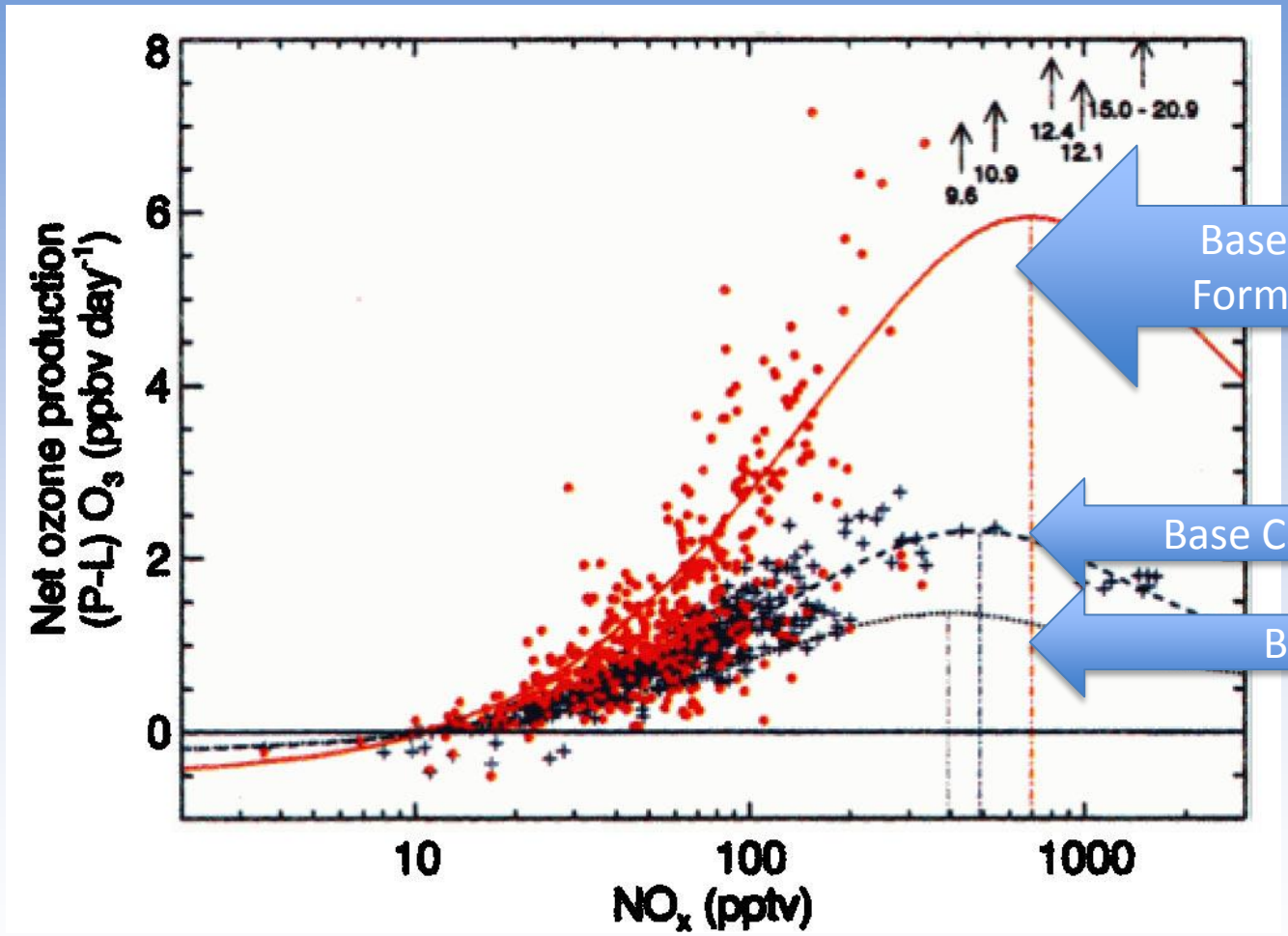

CH4
OH
O(1D)
CH3
hv
Acetone
Isoprene
O2
CH3O2
OH
CH3OOH
NO
hv
CH3O
Methane
Oxidation
O2
HCHO
VOC
Photolysis
and
Oxidation
hv
H+HCO
O2
NO
HO2
OH
CO
Ozone
Production
via HOx

Injected VOCs produce HOx



Measurements of HOx in the TTL. Injected VOCs increase OH by a factor of 2 – 3 over background. *Wennberg et al., 1998*

Injected VOCs increase O_3 production



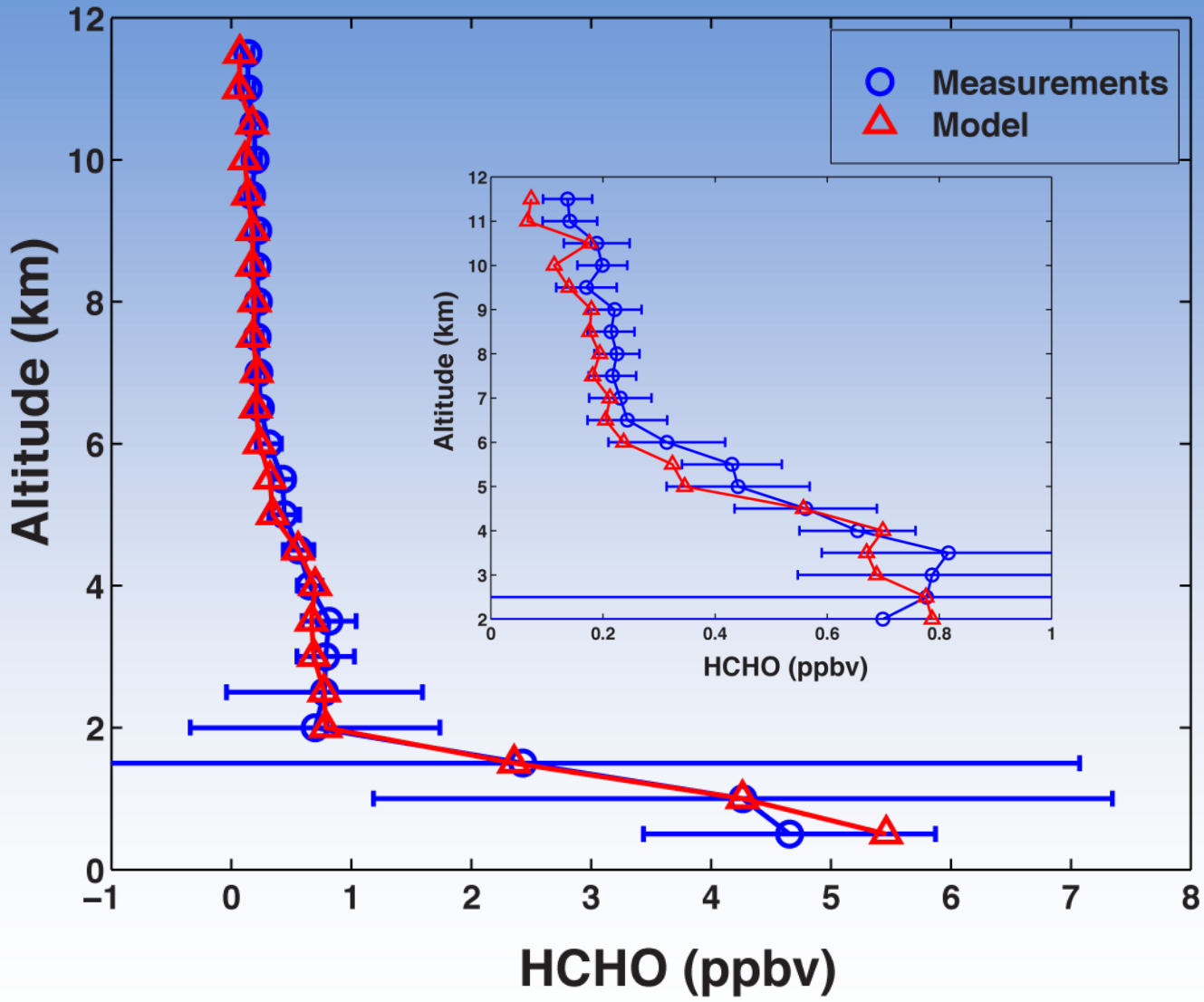
Base Case + Acetone + Formaldehyde & ROOH

Base Case + Acetone

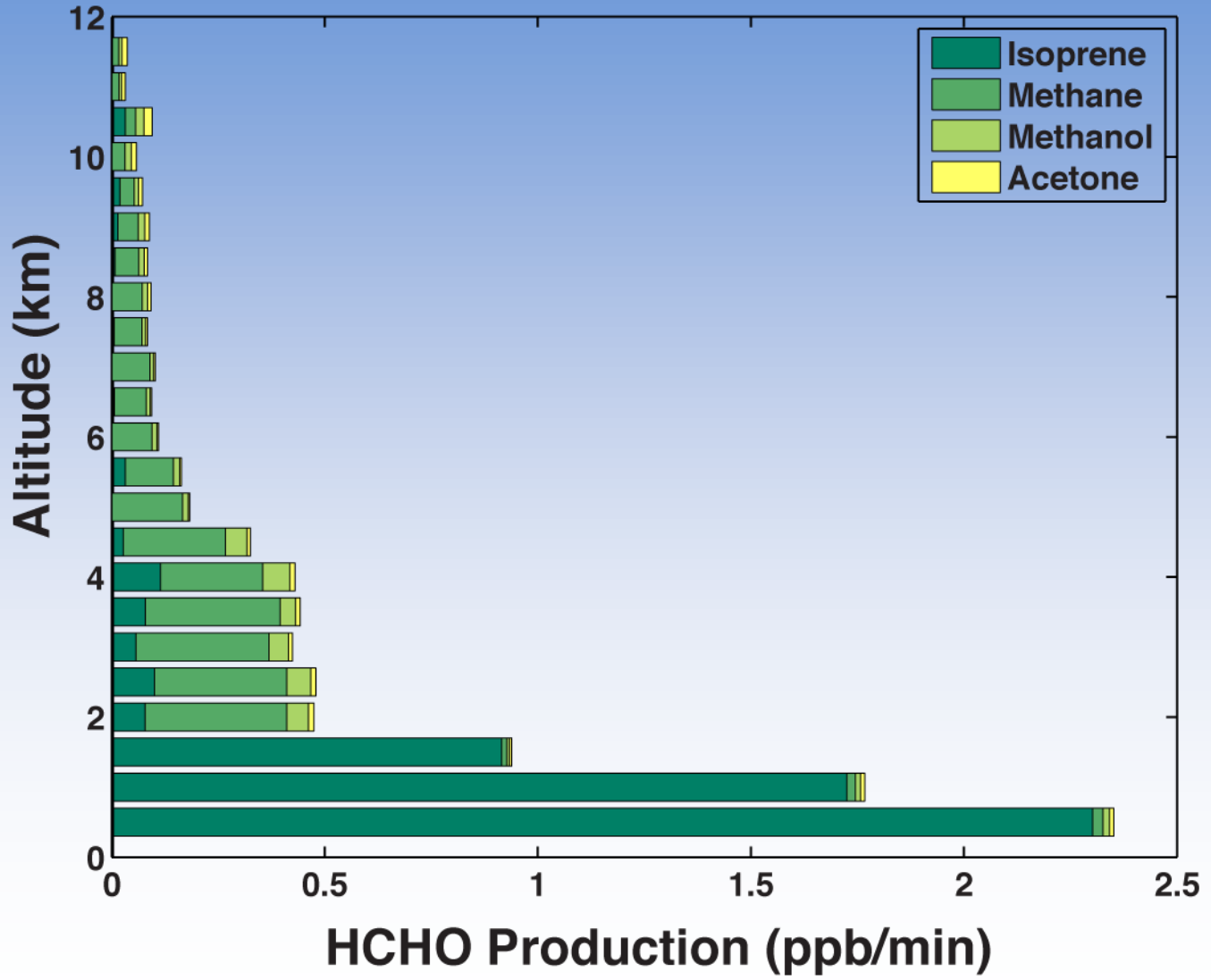
Base Case

Jaegle, GRL 1998

Measurement constrained MCM results



HCHO production terms



Issues

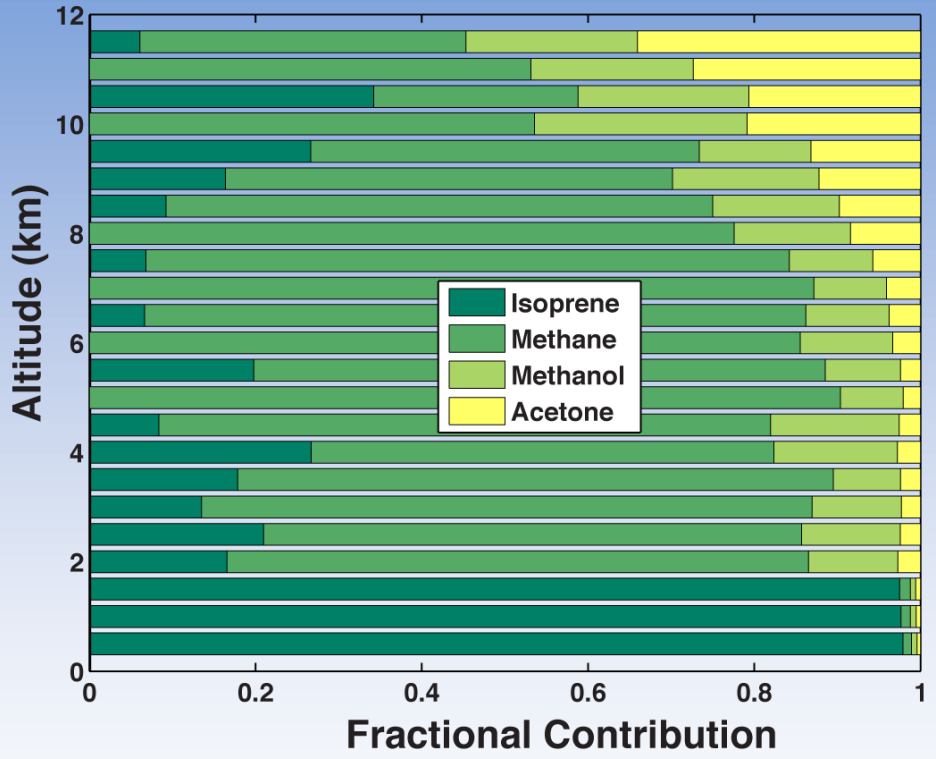
Small amounts of labile sources lead to large HCHO production.

We are sensitive to **recent** convection.

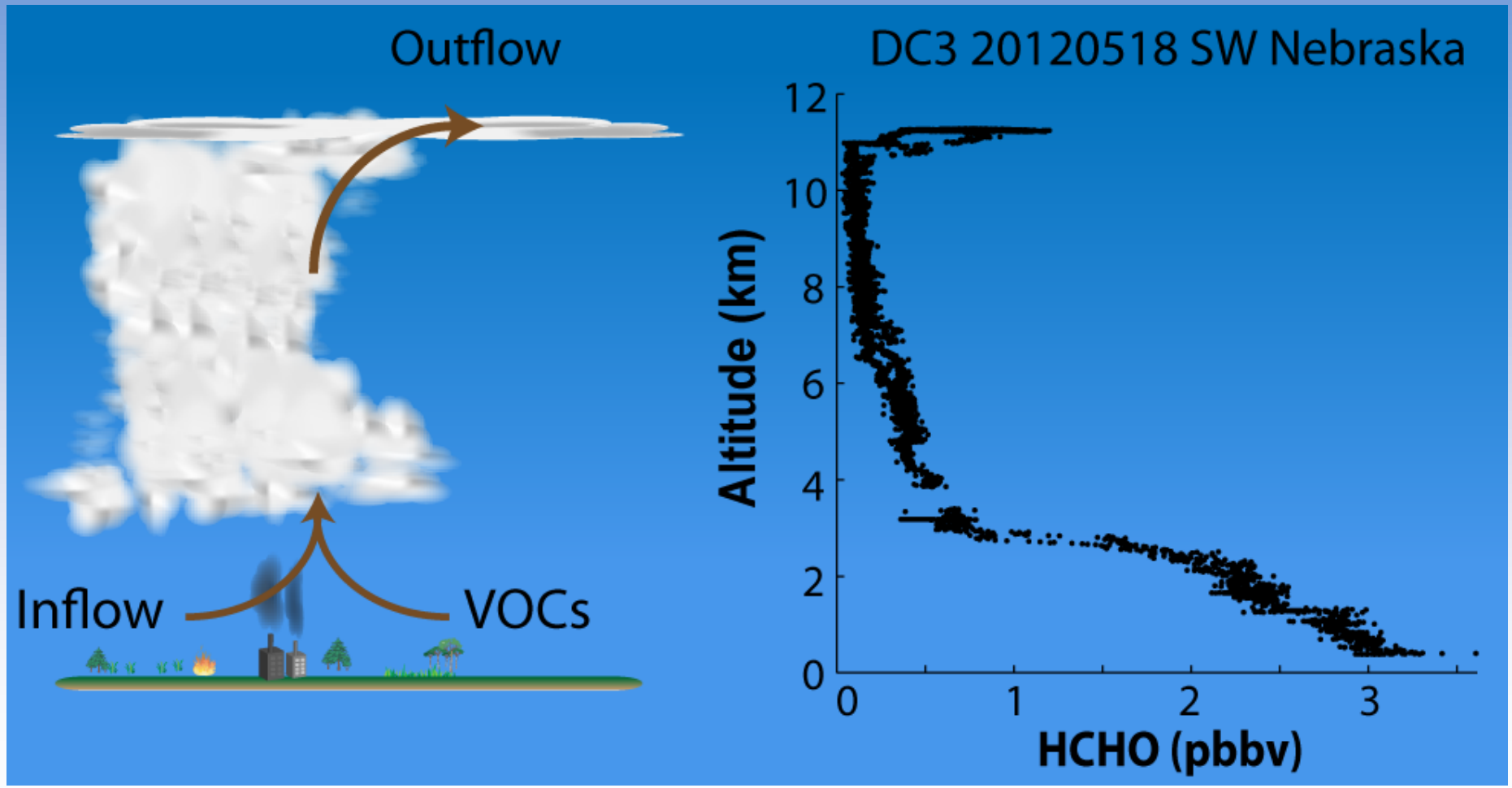
We are also susceptible to biases in source terms:

- Isoprene noise
- Acetone (VOC) offset

Can we identify loss via
Br + HCHO –> HBr + HCO ?

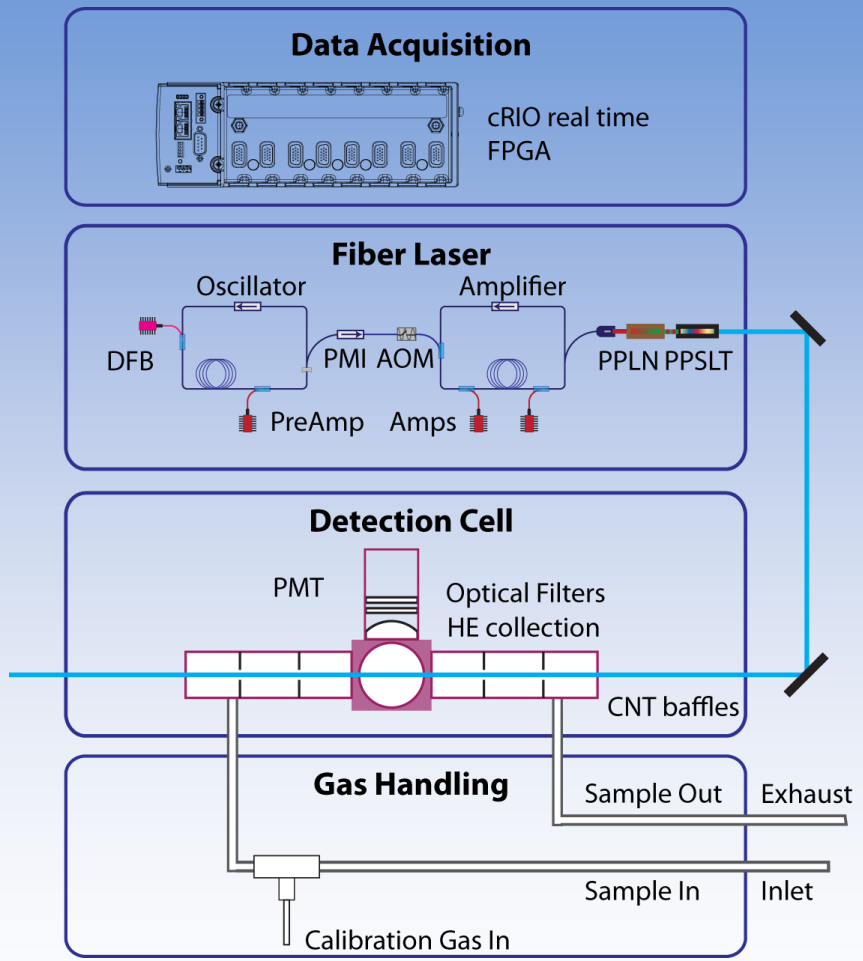


What we expect to see:



In situ airborne formaldehyde (ISAF)

Size: 43 x 38 x 60 cm
Weight: 25 kg
Power: 200 W @ 28 VDC
The configuration for the GV includes a pump (300 W 10 kg) and control interface box (5 kg).



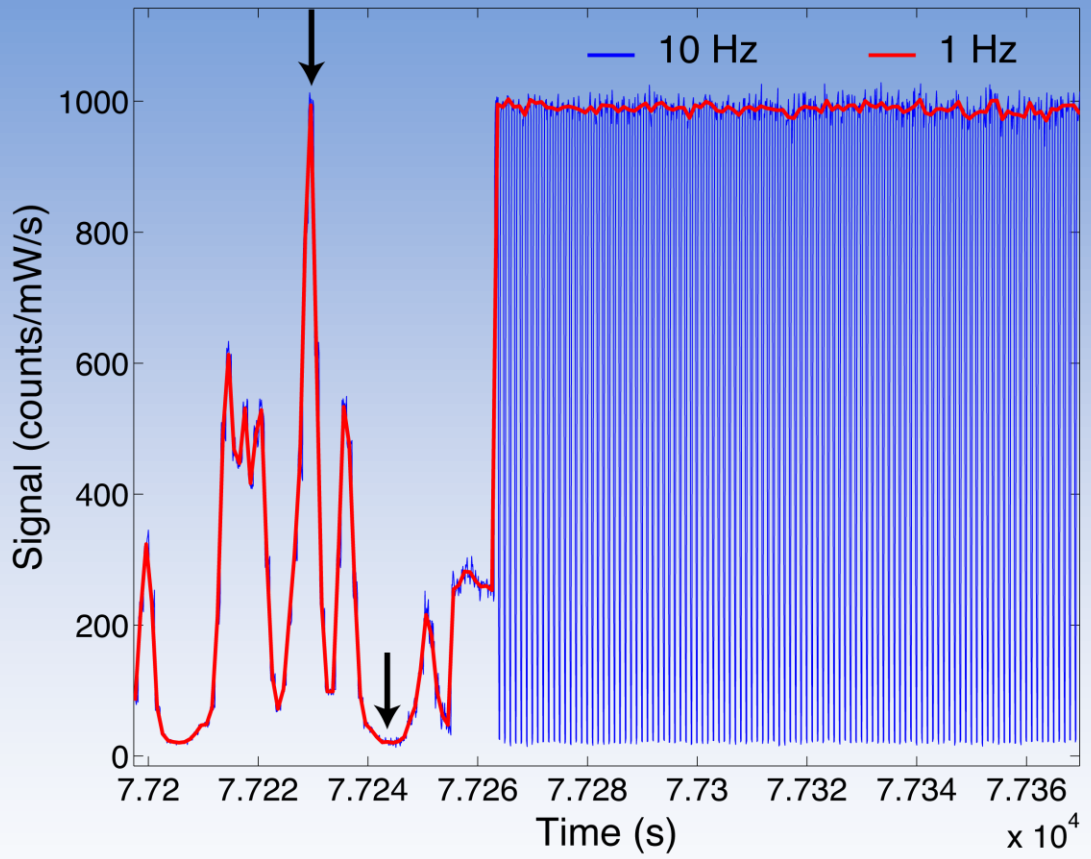
Measuring Formaldehyde

The laser is continuously tuned between a large formaldehyde rotational transition and a non-resonant wavelength.

$\Delta\lambda$ = 0.005 nm

The concentration of formaldehyde is proportional to the difference between the online and the offline signals.

Detection Limit = 10 pptv/s
Accuracy: +/- 10%
Zero uncertainty: +/- 10 pptv
Data rate 10 Hz



Team members

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Dan Anderson (not shown) (UMD)

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