

**Spatial distributions and inter-hemispheric gradients
observed for NMHCs and OVOCs during CONTRAST and
compared to models and previous research missions**

Eric Apel

Nicola Blake

Rebecca Hornbrook

Alan Hills

Daniel Riemer

Laura Pan

Shawn Honomichl

+others

Doug Kinnison

Jean-Francois Lamarque

Simone Tilmes

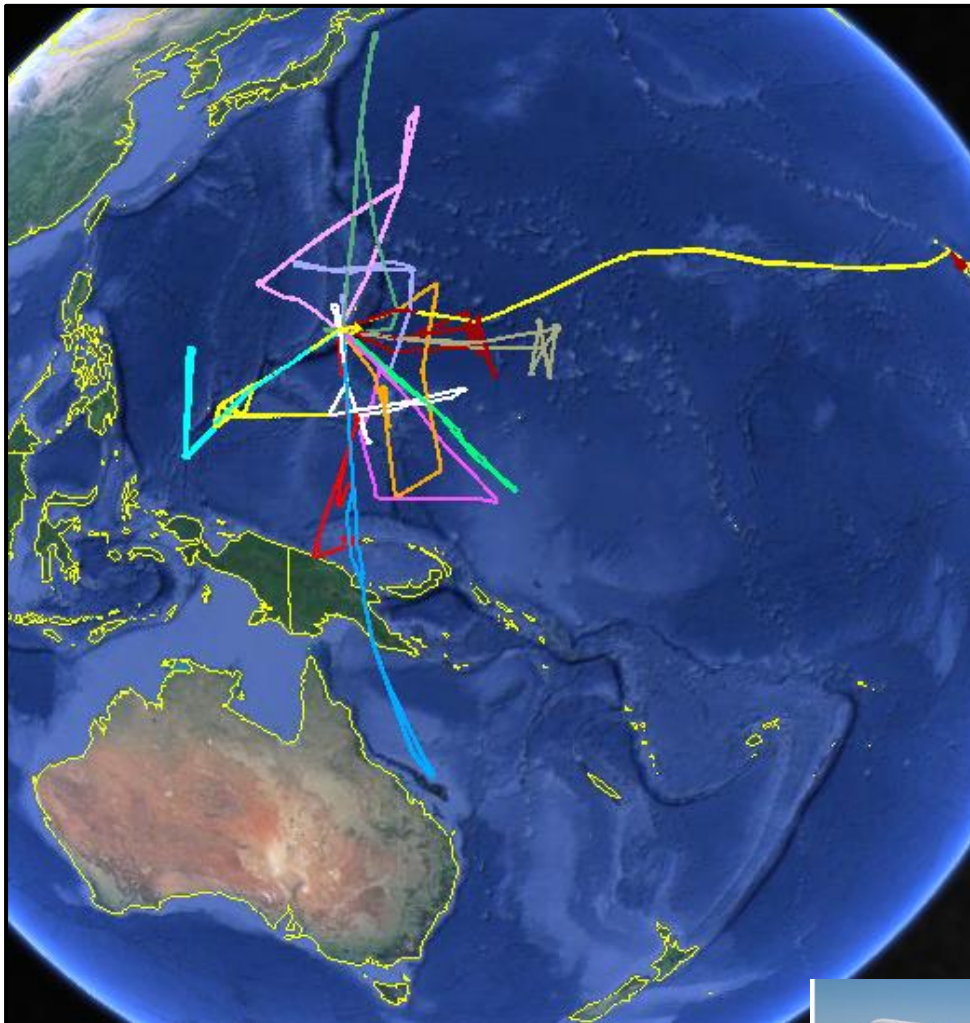
Elliot Atlas

Sue Schauffler

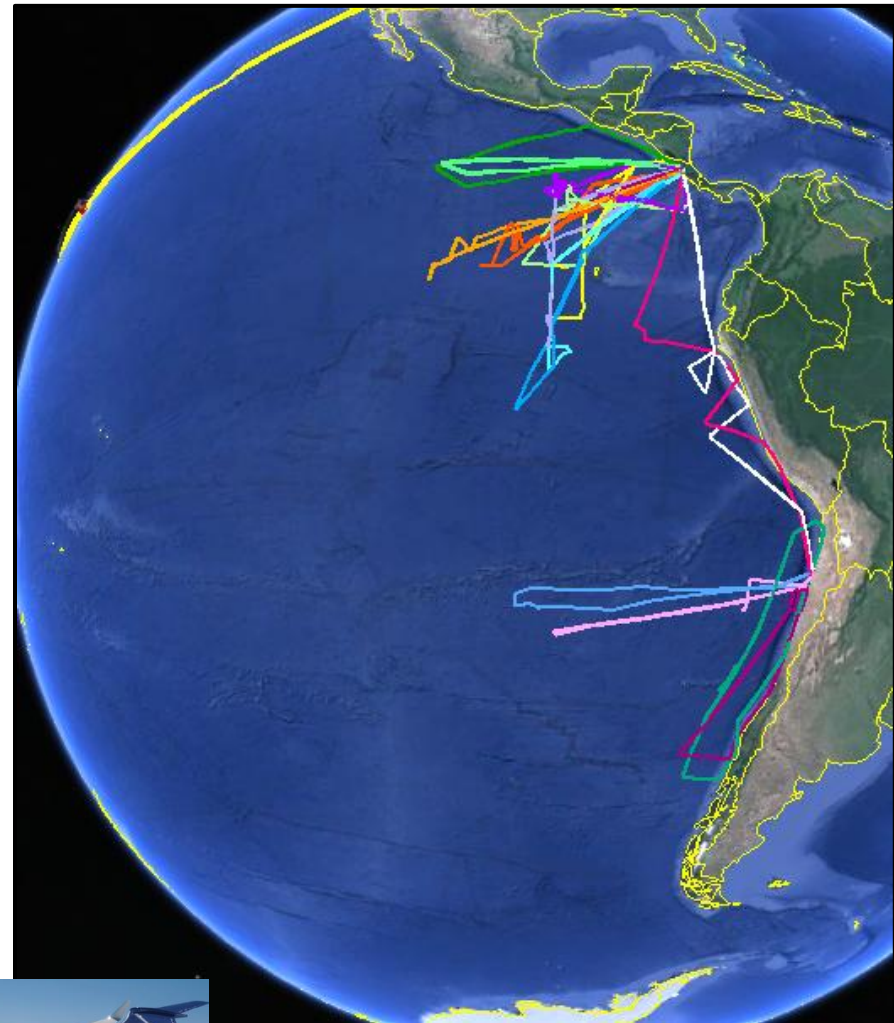


Data Coverage: Western and Eastern Tropical Pacific OVOCs and NMHCs

All **CONTRAST** Flights, Jan - Feb 2014



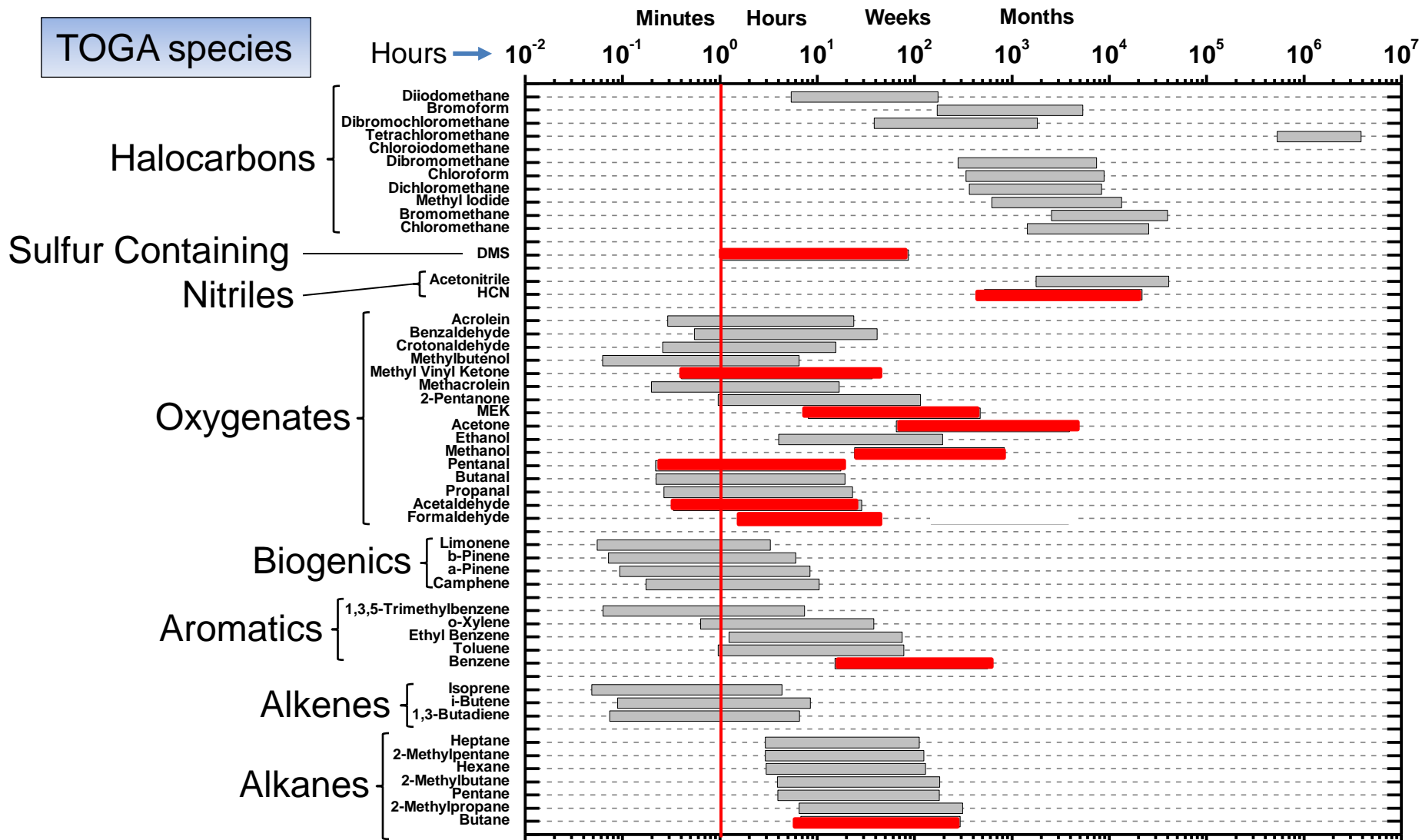
All **TORERO** Flights, Jan - Feb 2012



Species measured and lifetimes

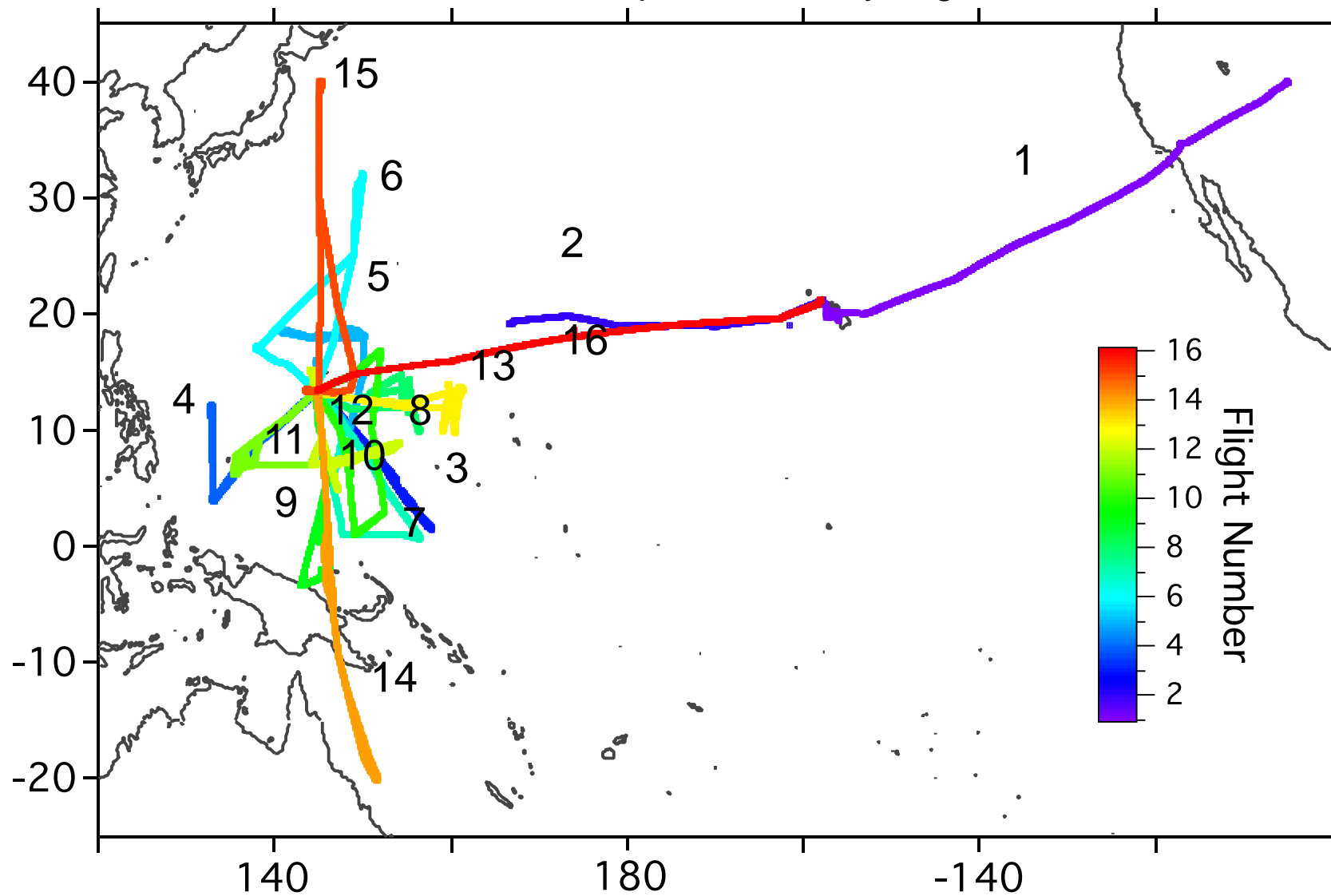
Reactivity with OH

10^5 OH (low), 10^7 OH (high), 210K, 310K

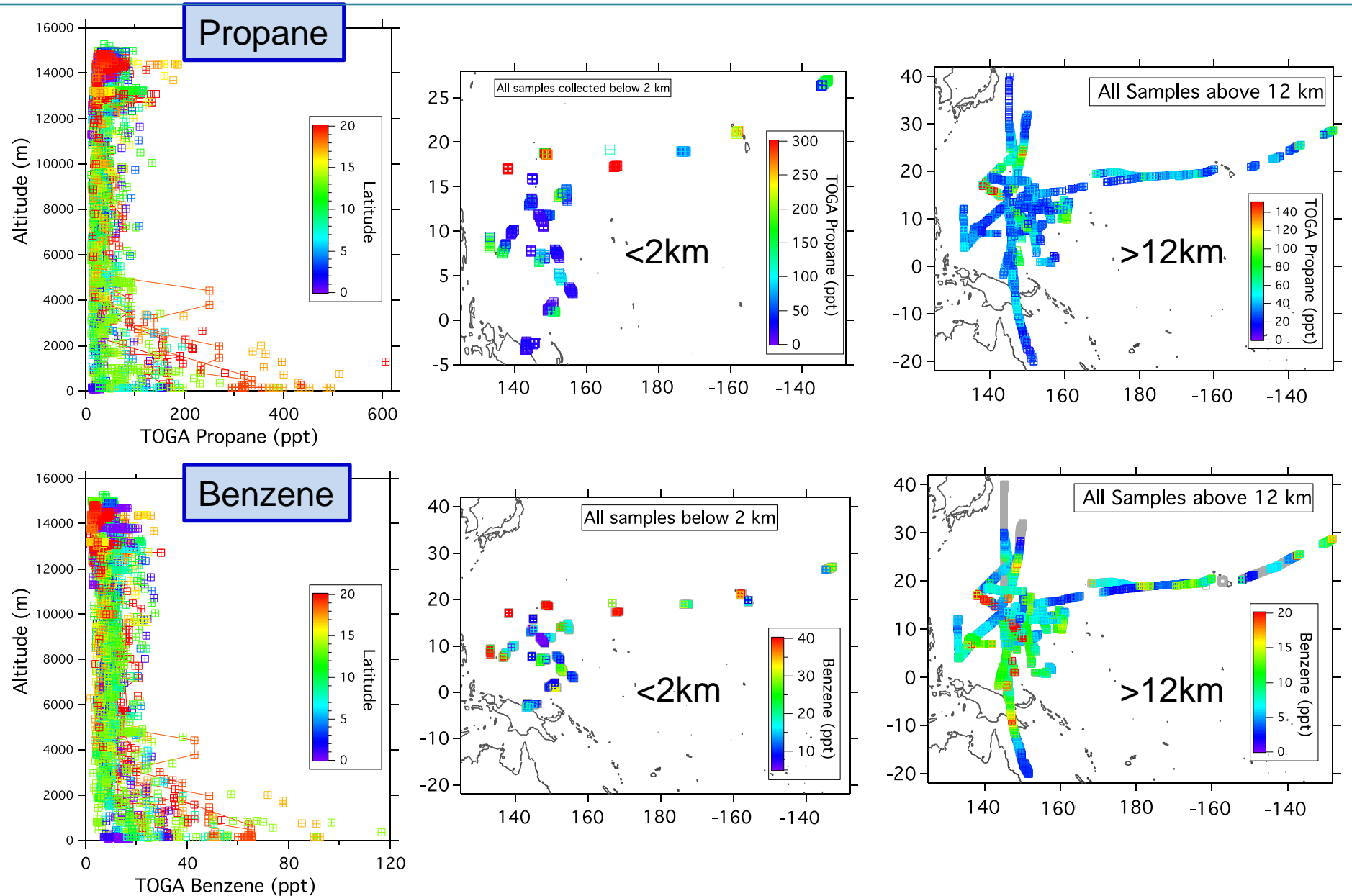


CONTRAST Spatial Distributions

Location of All TOGA Samples Coded by Flight Number



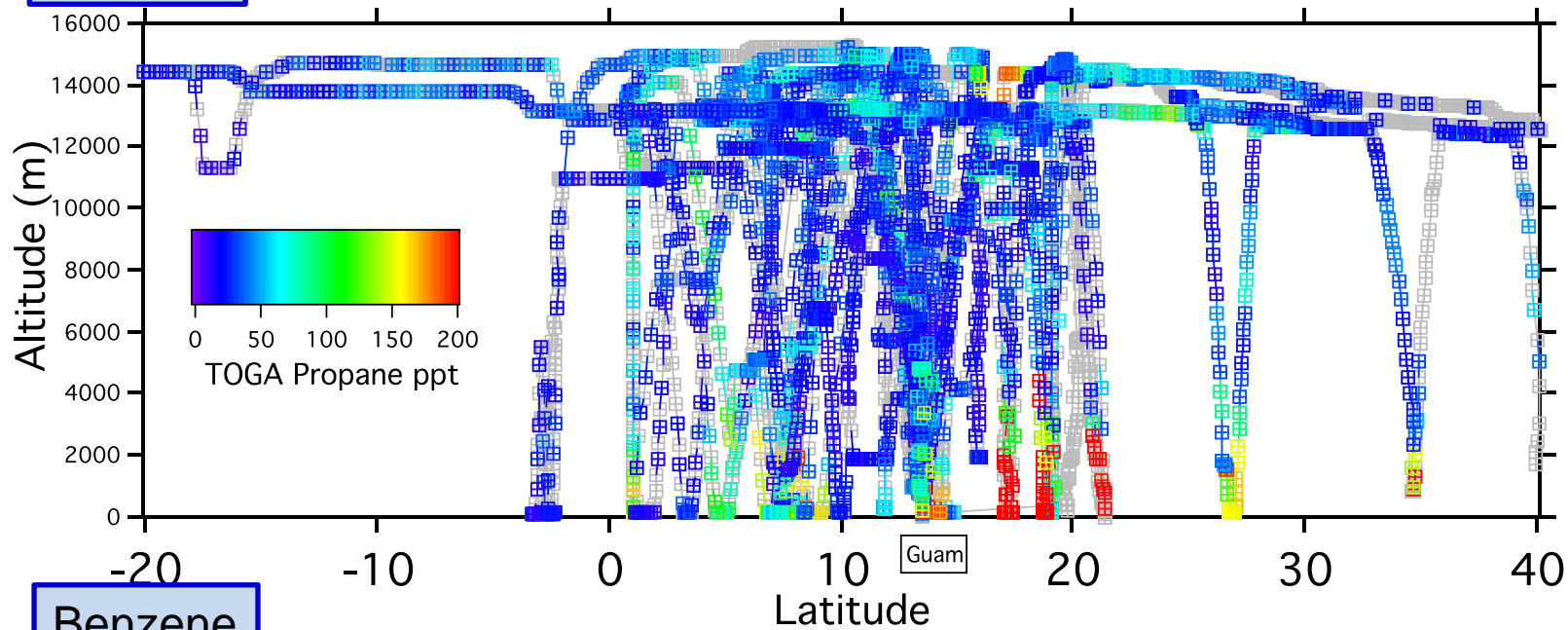
CONTRAST Spatial Distributions - NMHCs



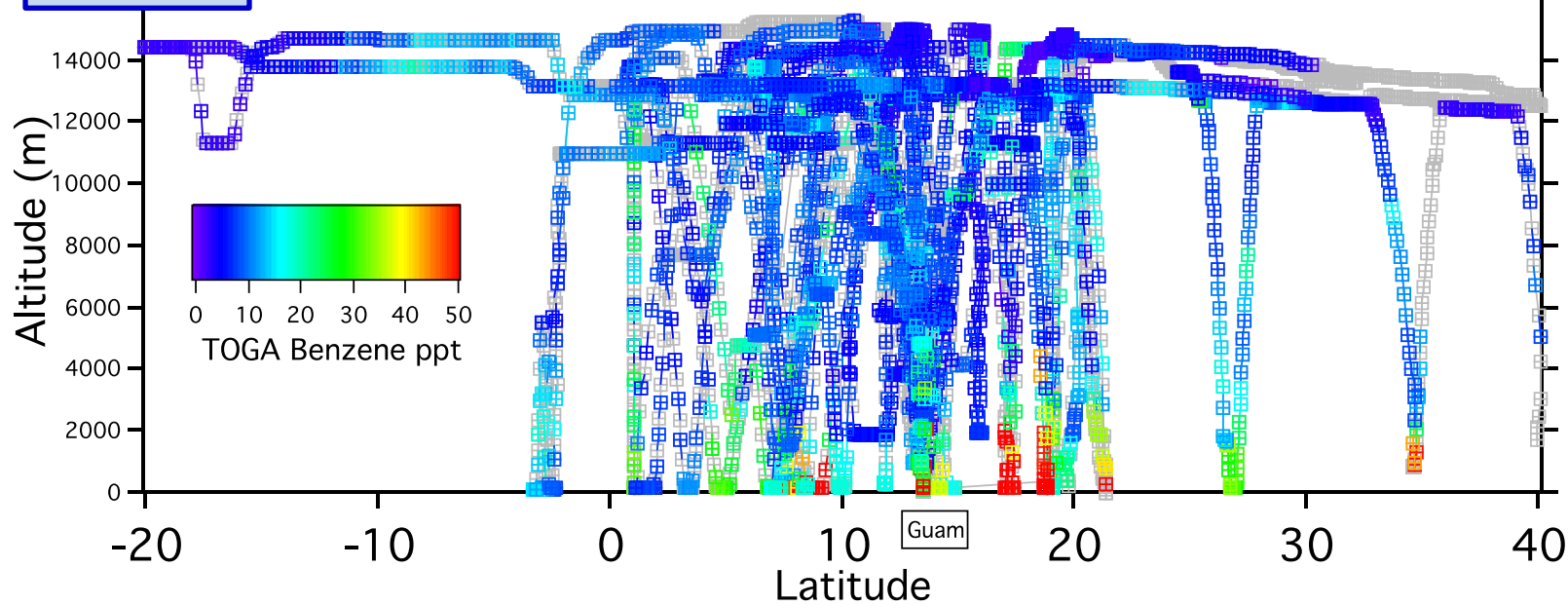
Latitudinal trend obvious only at low altitudes

CONTRAST Spatial Distributions

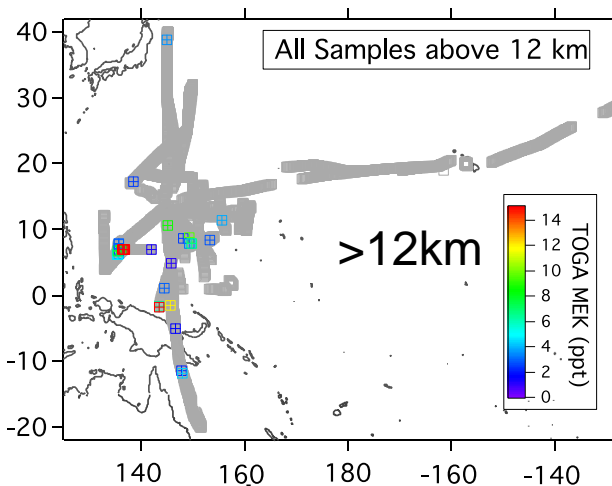
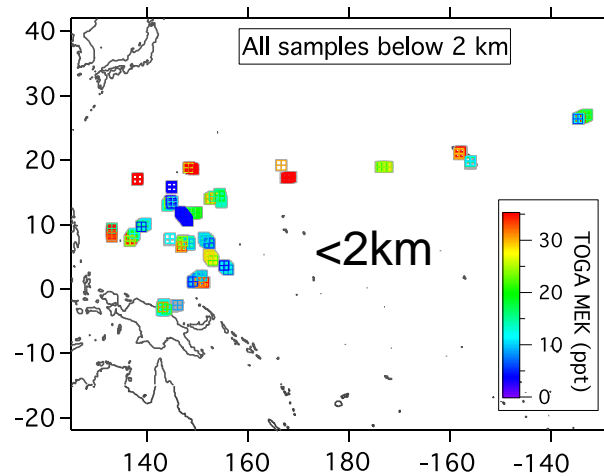
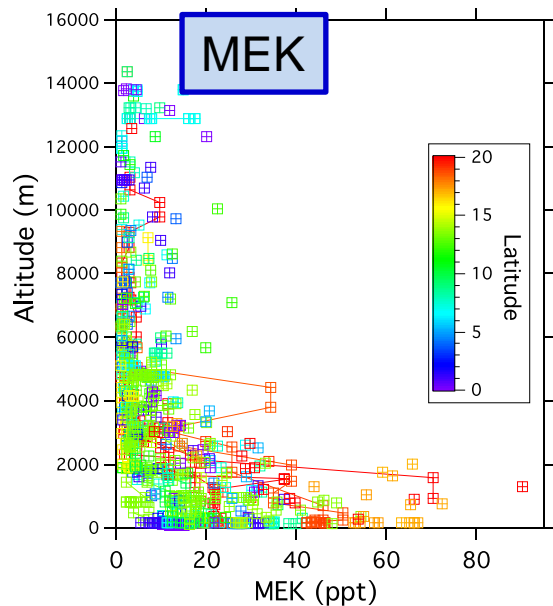
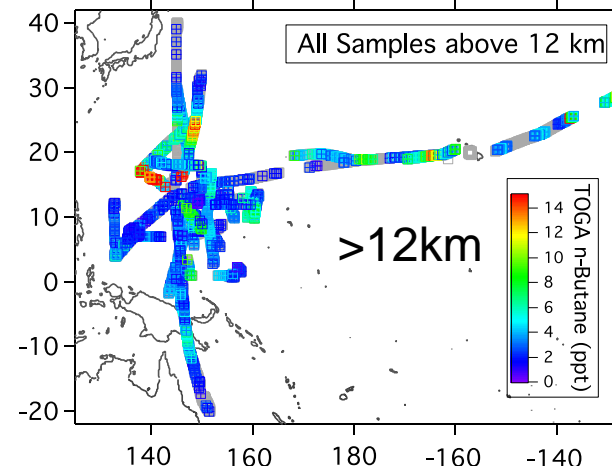
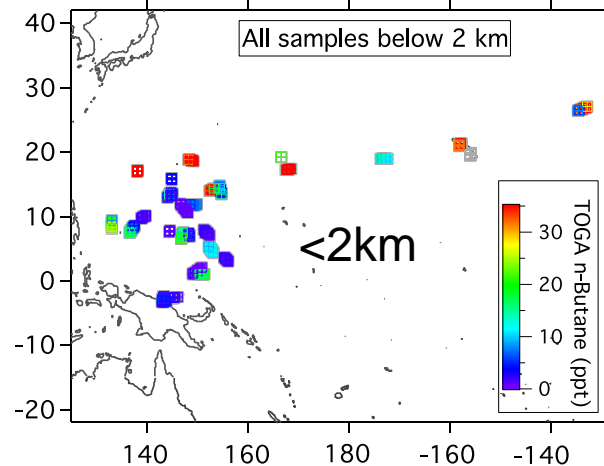
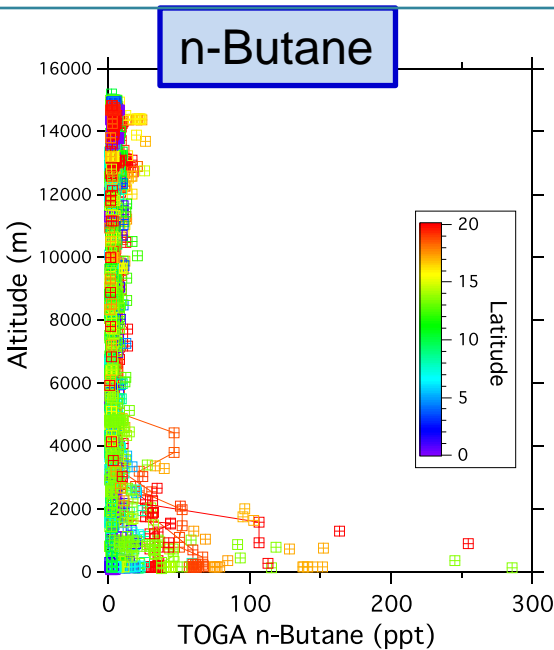
Propane



Benzene



CONTRAST Spatial Distributions – related pairs

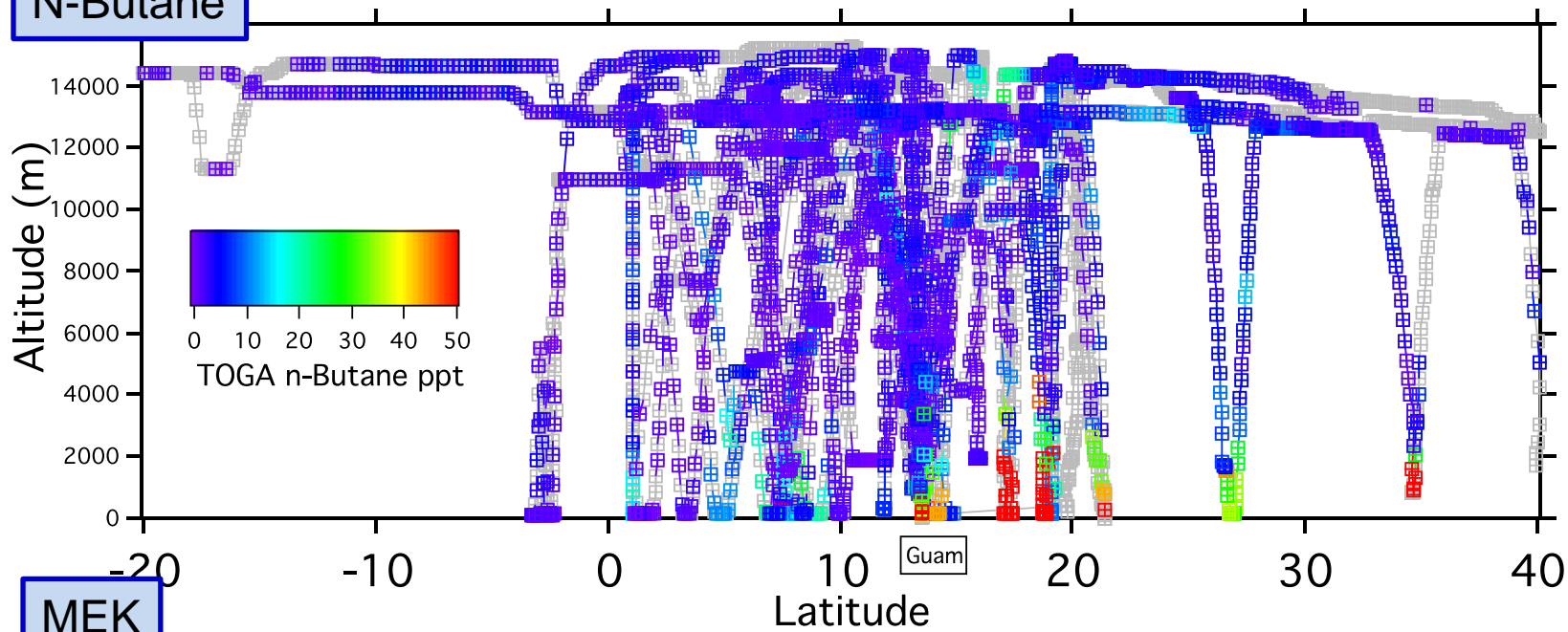


MEK has similar distribution to parent n-butane

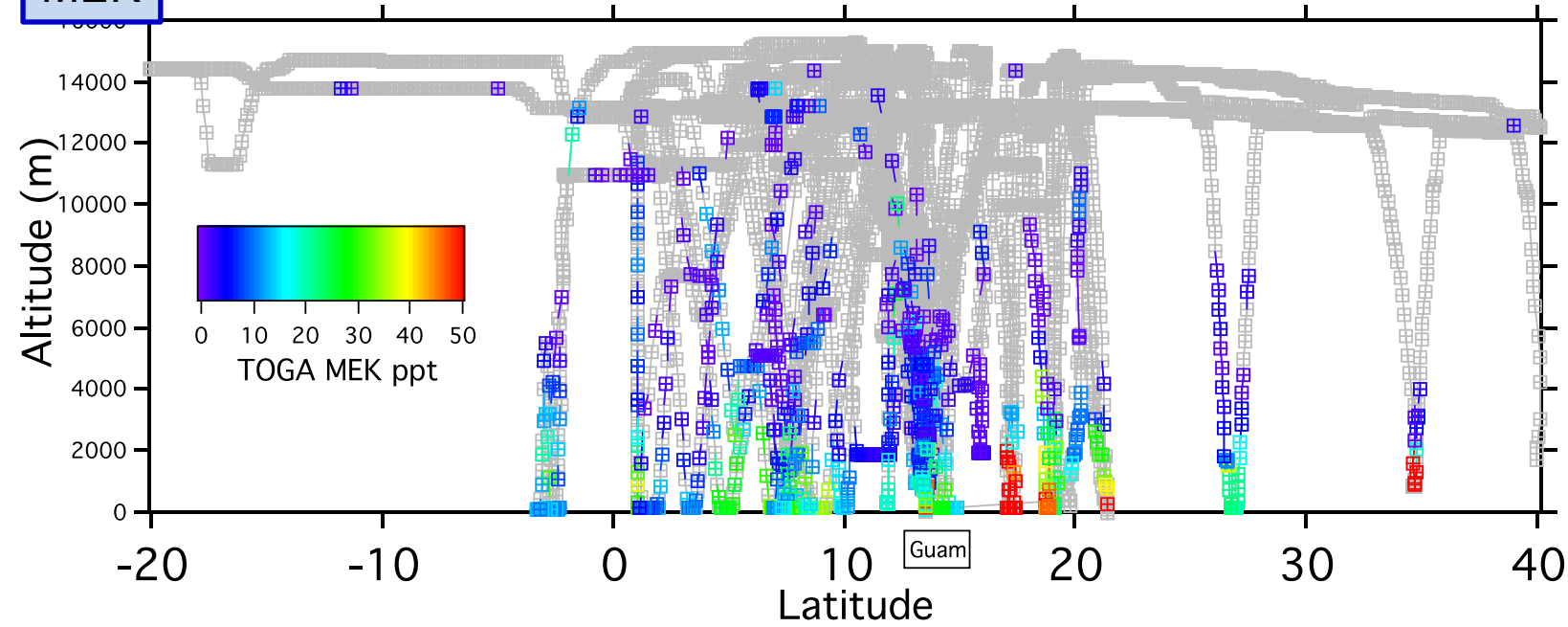
Note: RF11 High alt enhancement for MEK but not n-butane
– more on that later

CONTRAST Spatial Distributions – curtain of related pairs

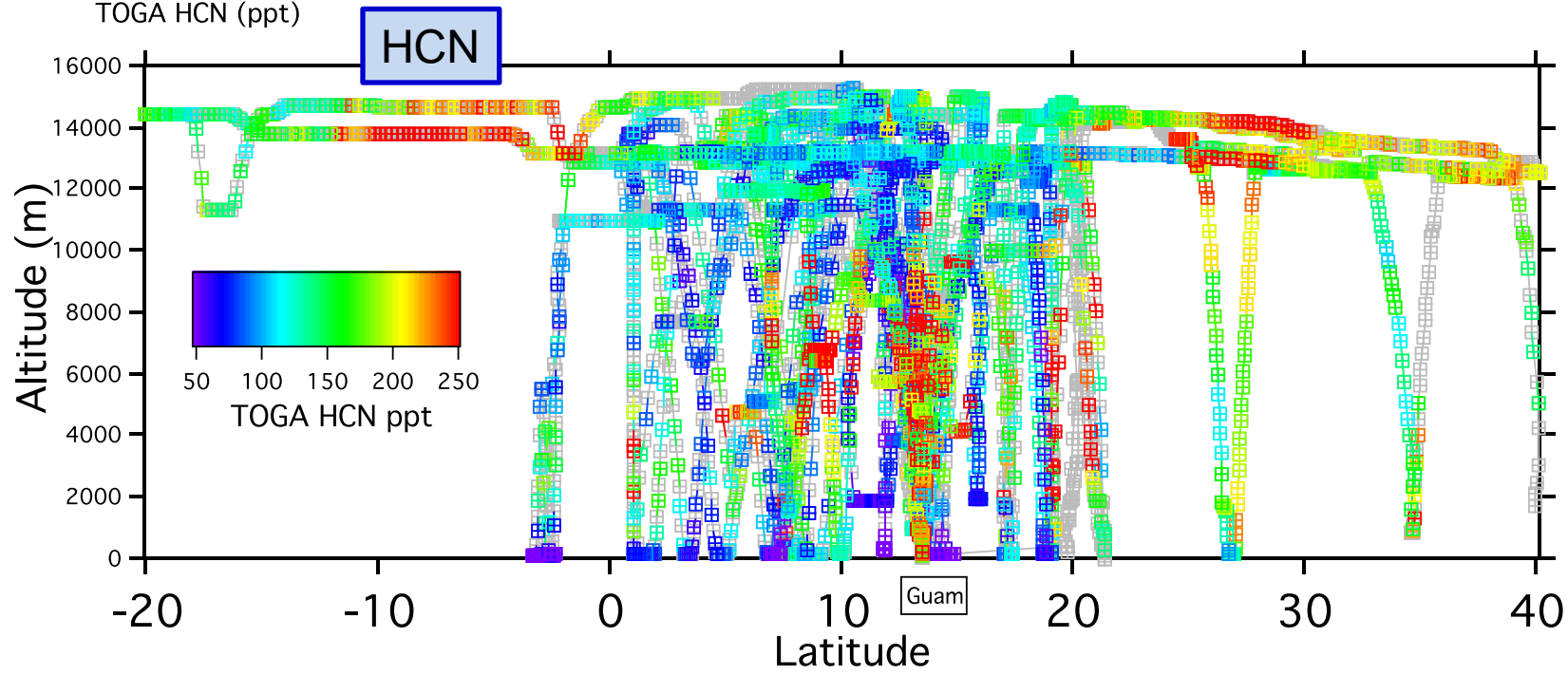
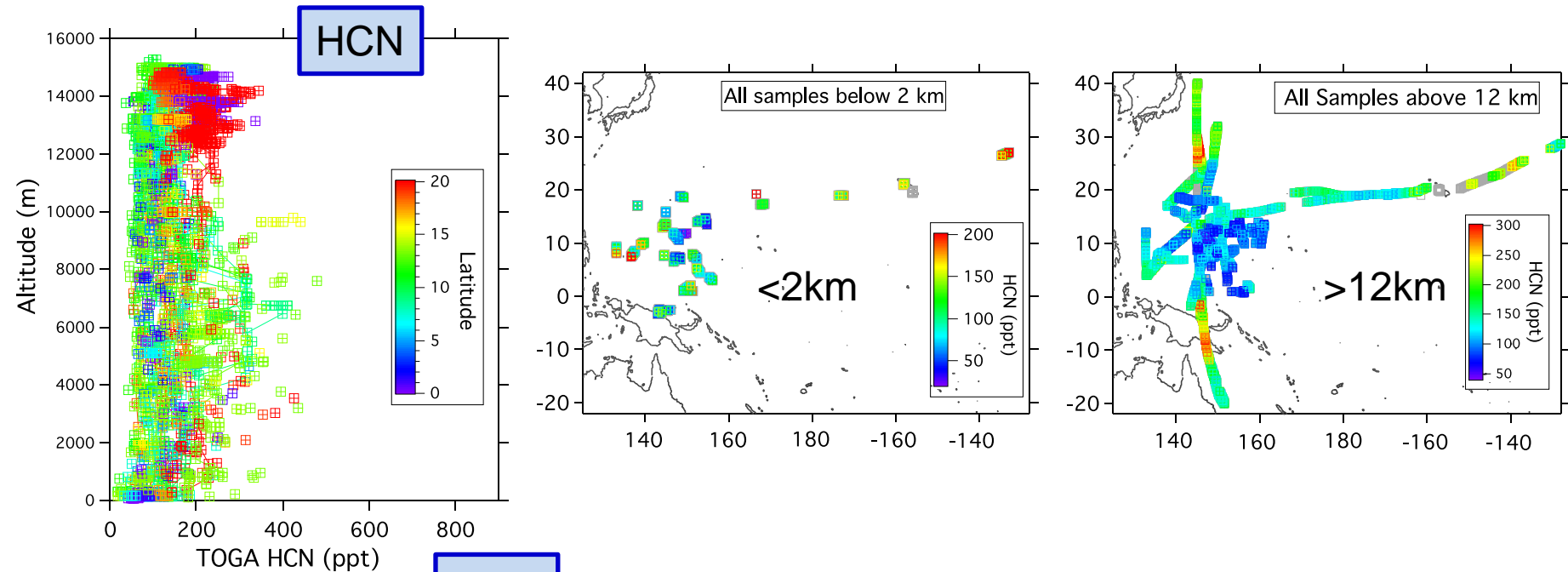
N-Butane



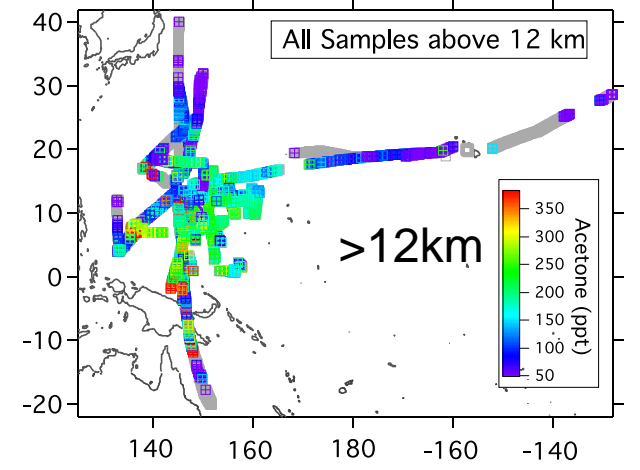
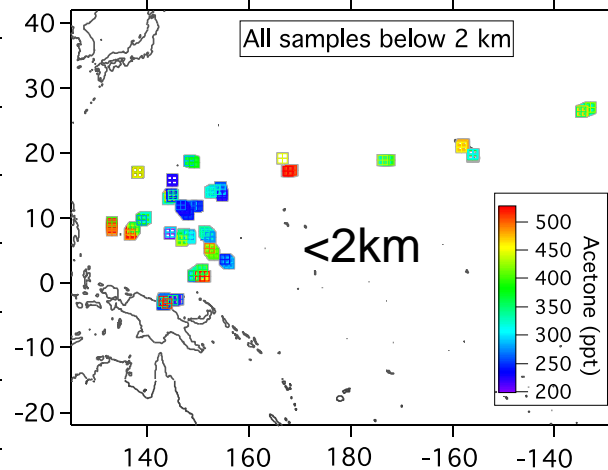
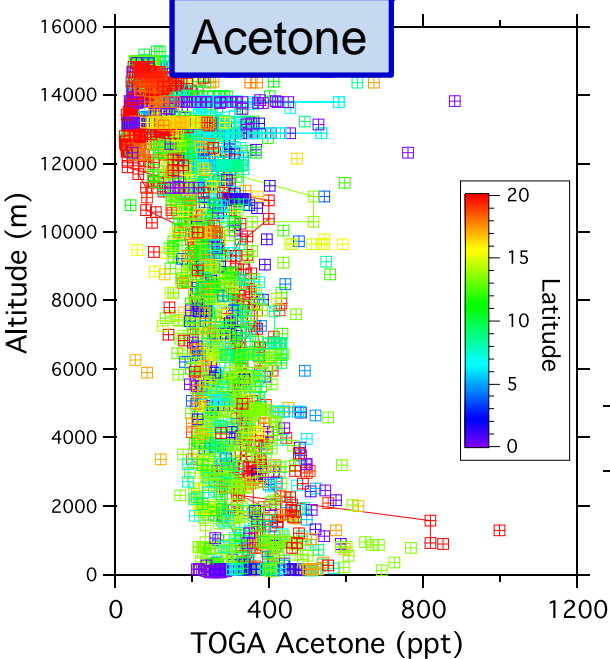
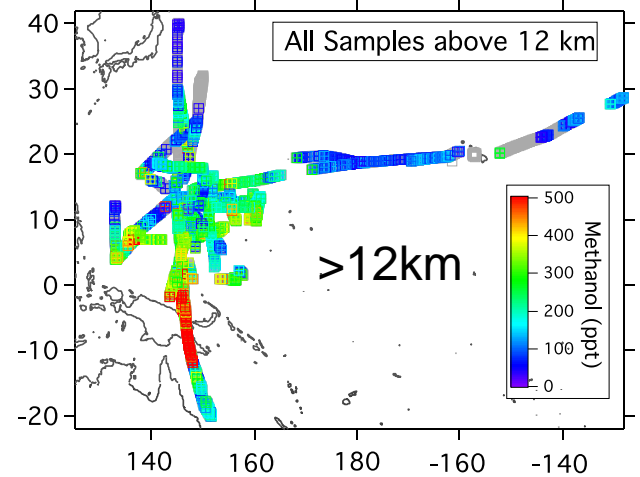
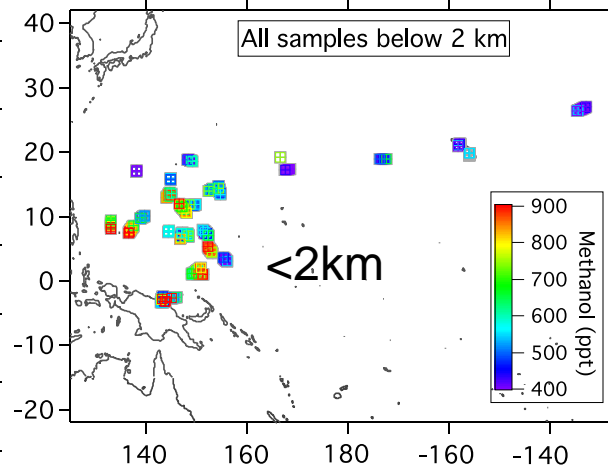
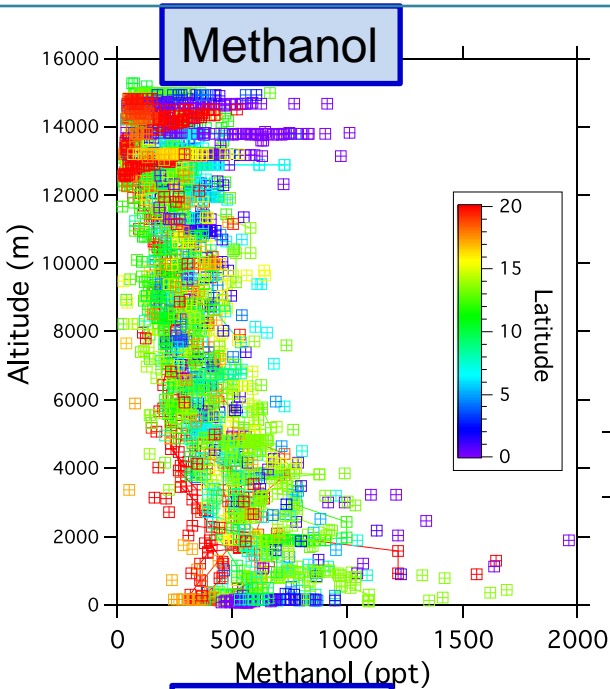
MEK



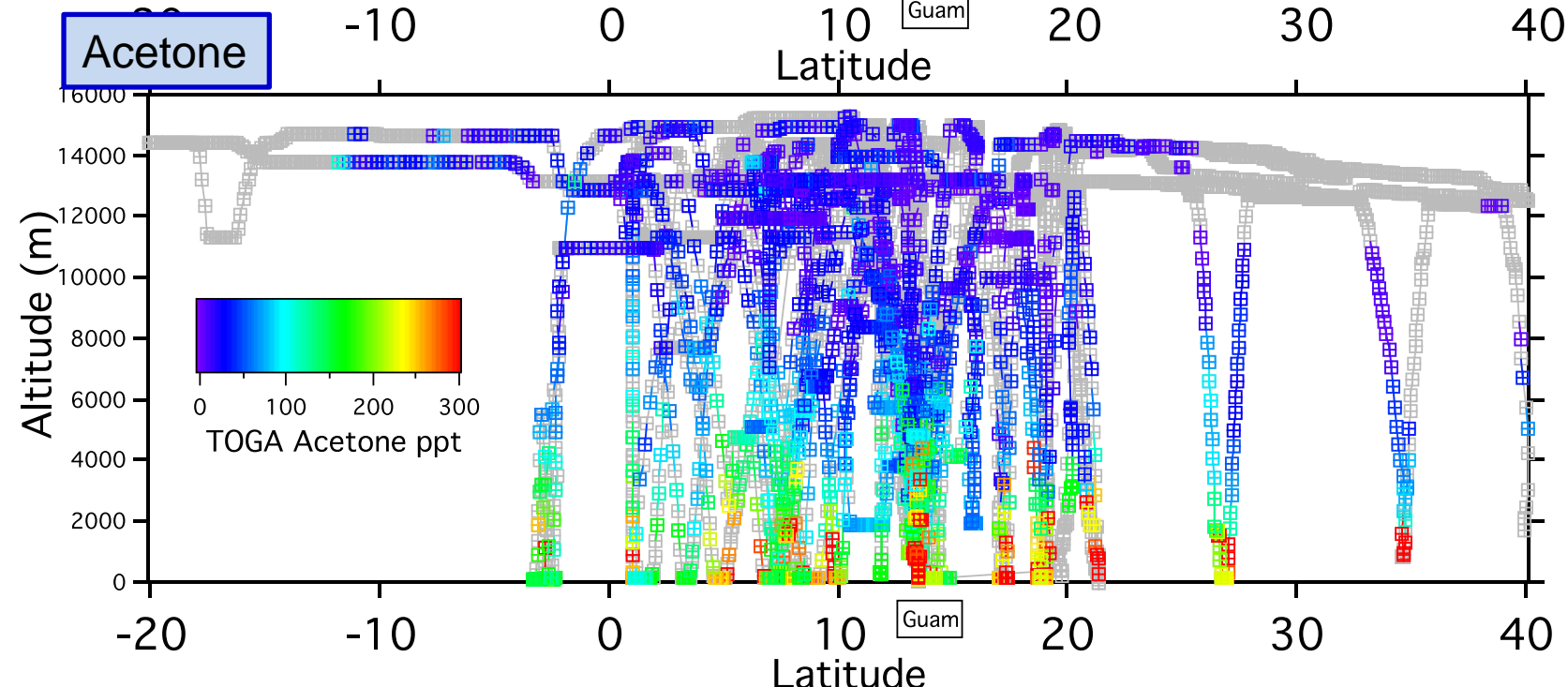
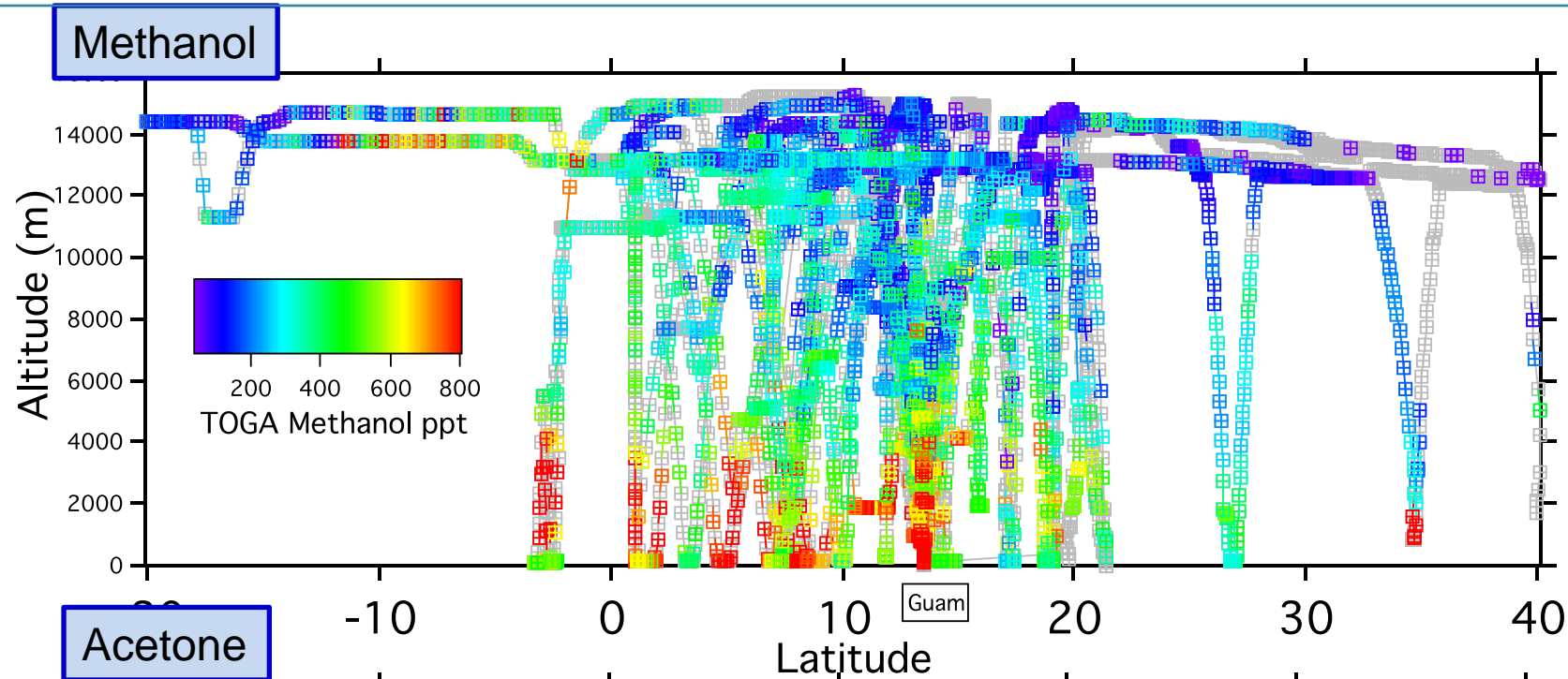
CONTRAST Spatial Distributions



CONTRAST Spatial Distributions

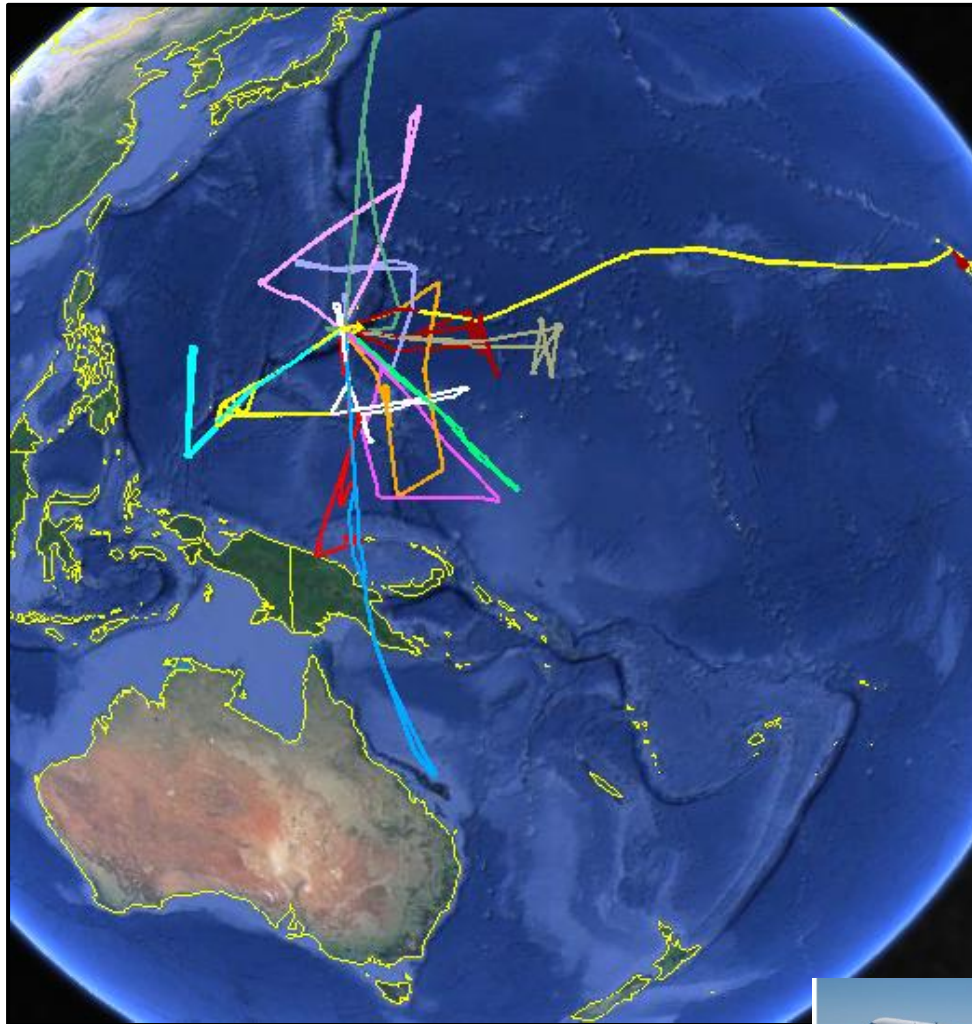


CONTRAST Spatial Distributions - Oxygenates



CONTRAST compared to TORERO

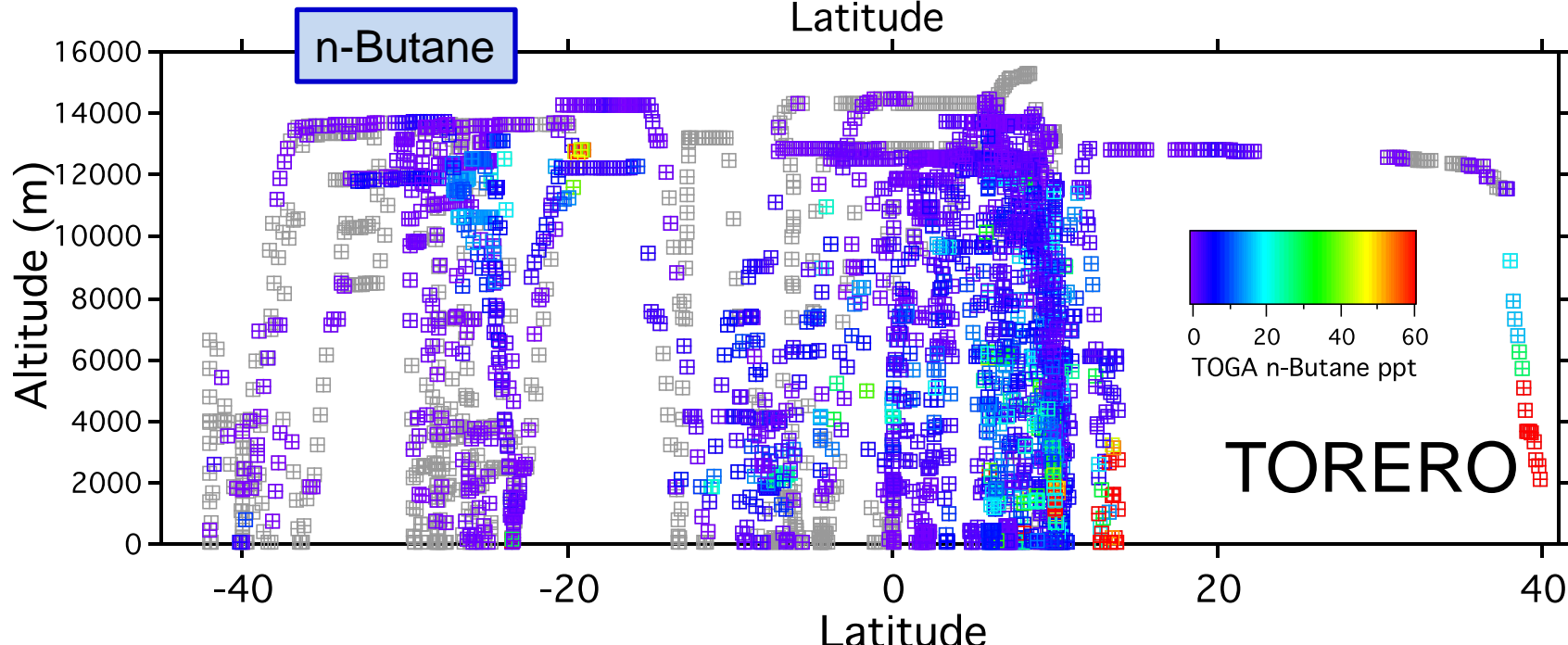
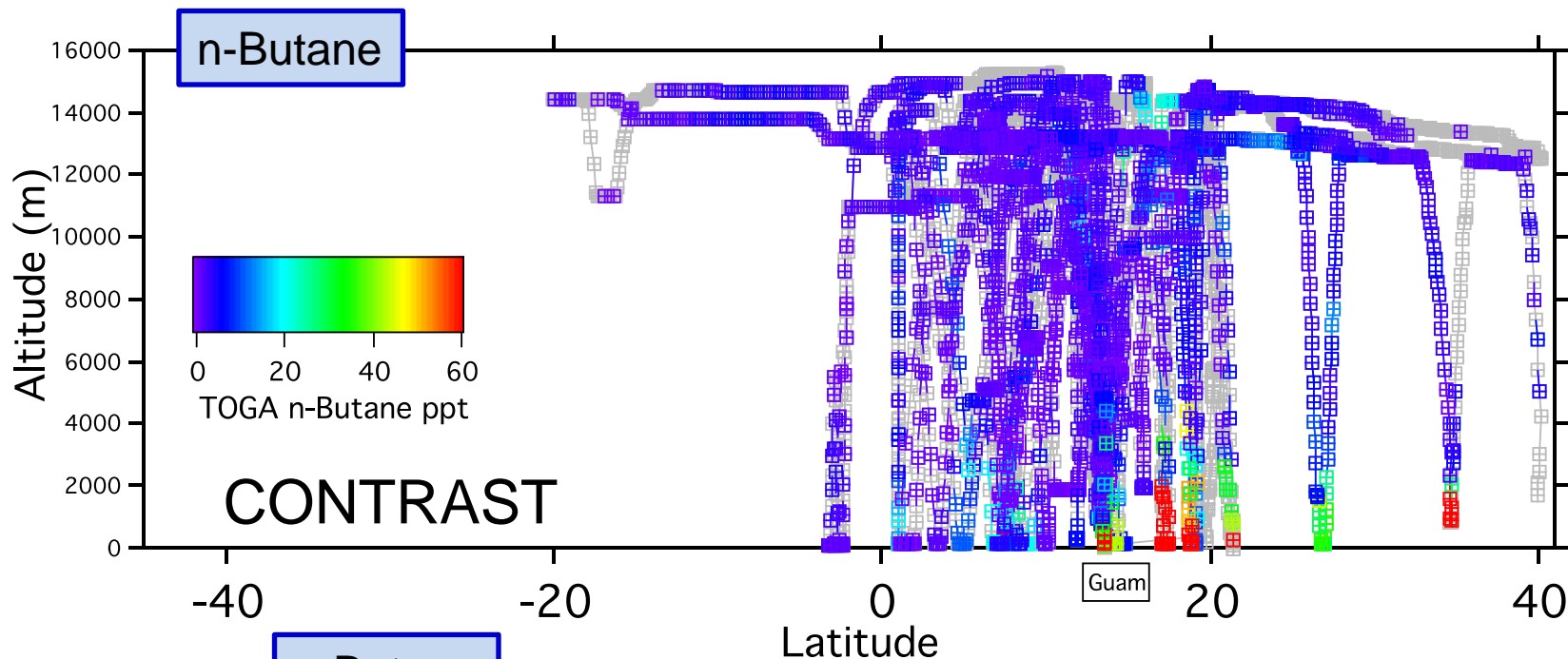
All **CONTRAST** Flights, Jan - Feb 2014



All **TORERO** Flights, Jan - Feb 2012

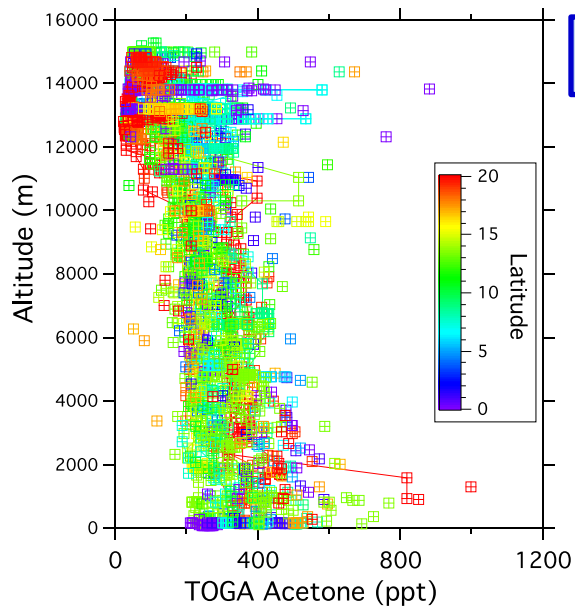


CONTRAST compared to TORERO

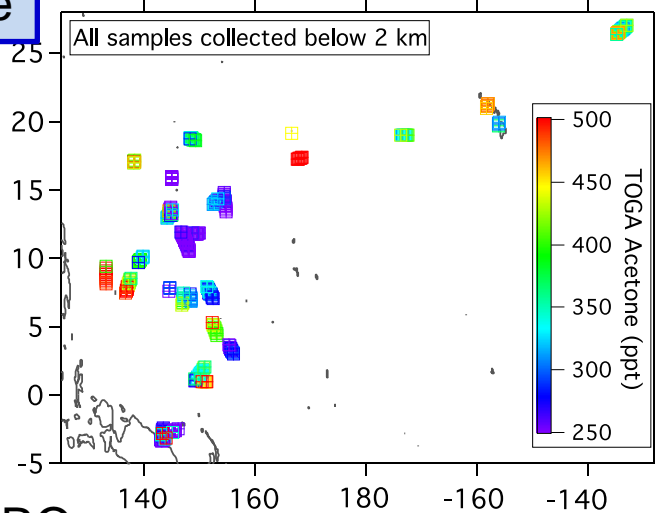


CONTRAST compared to TORERO

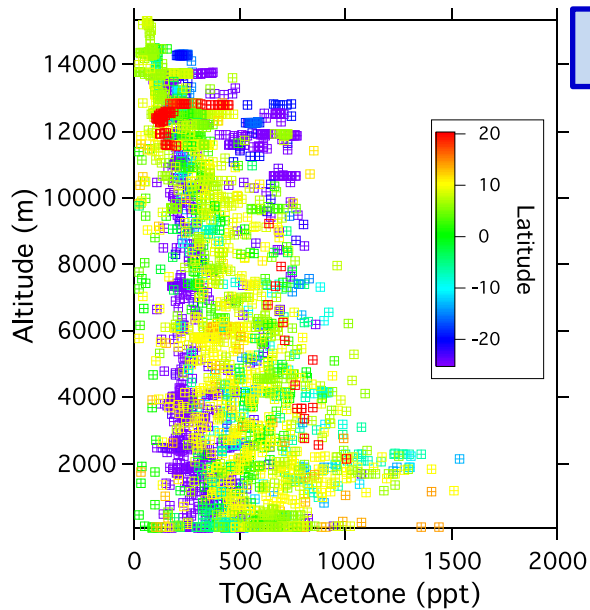
CONTRAST



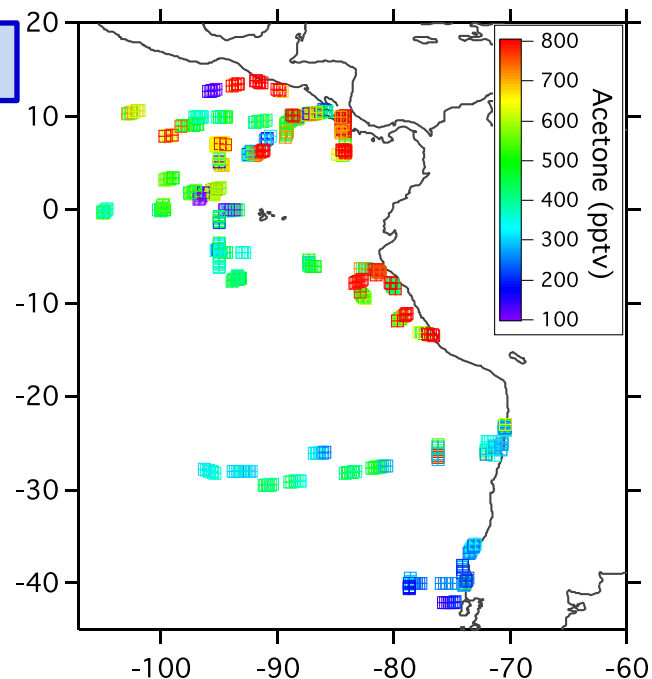
Acetone



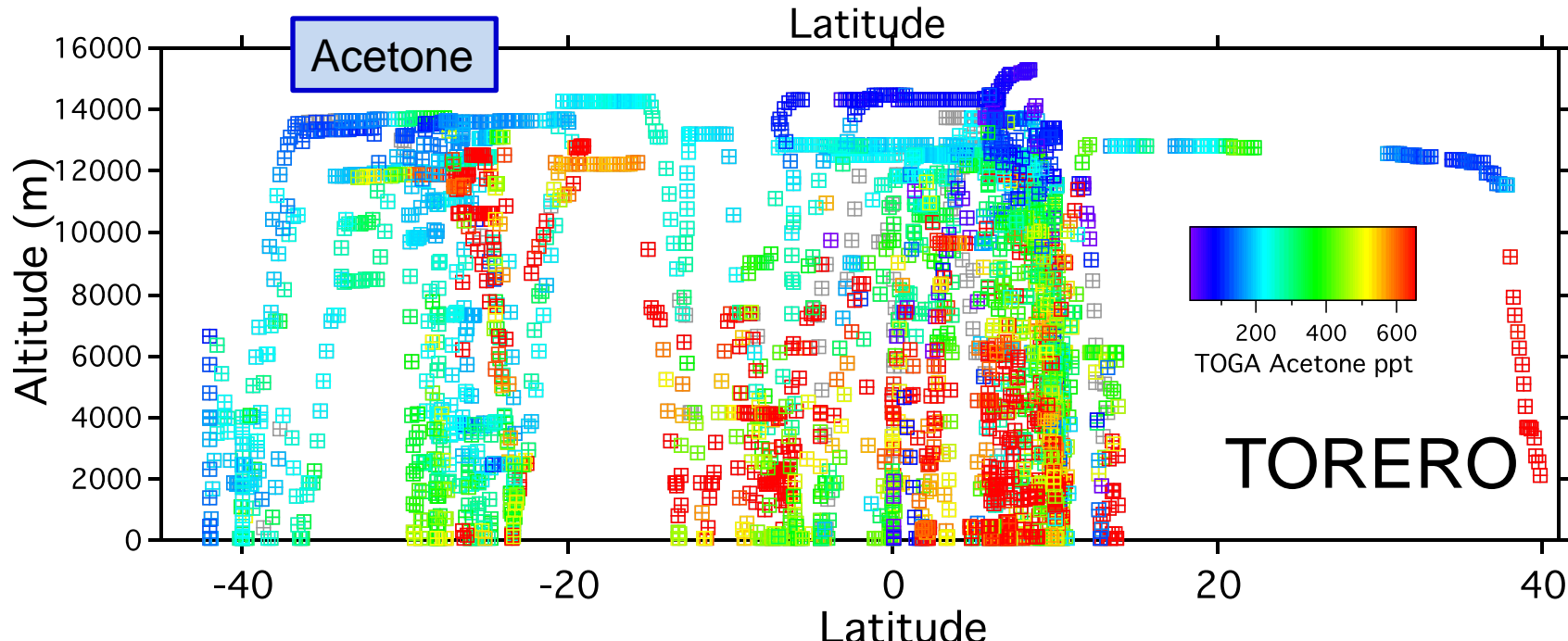
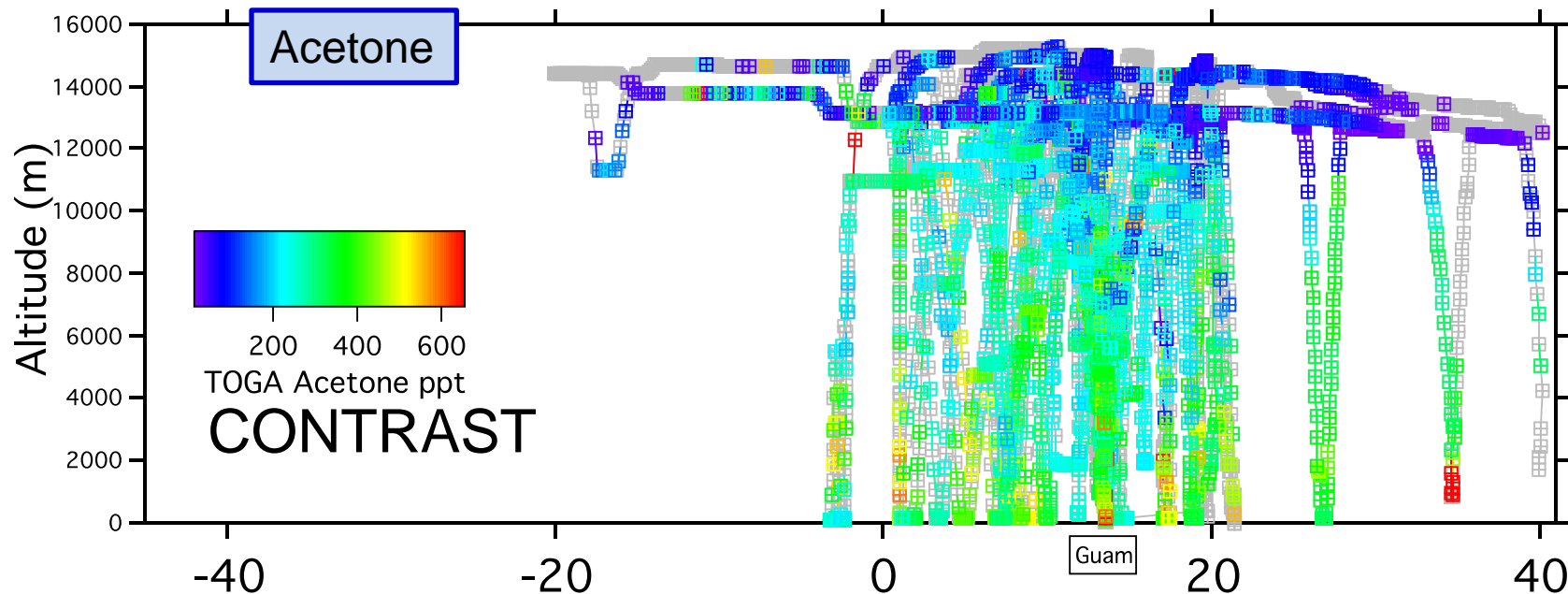
TORERO



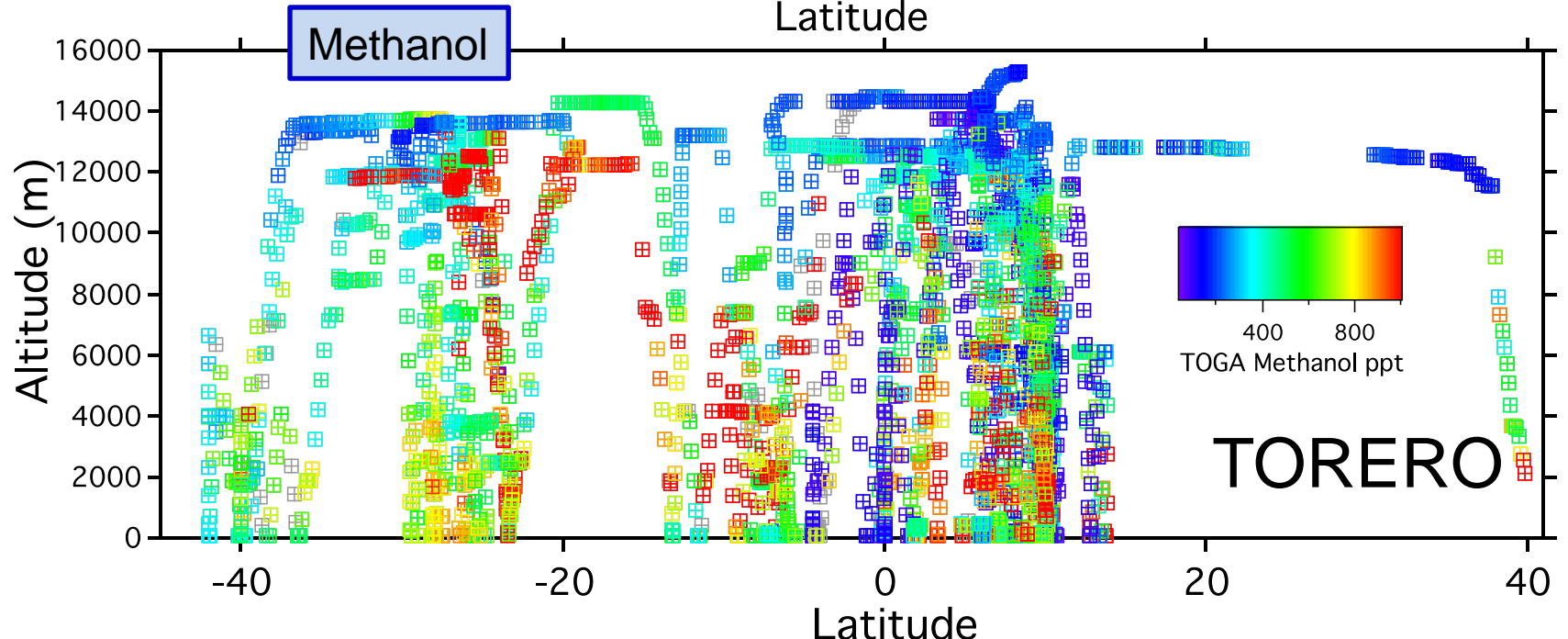
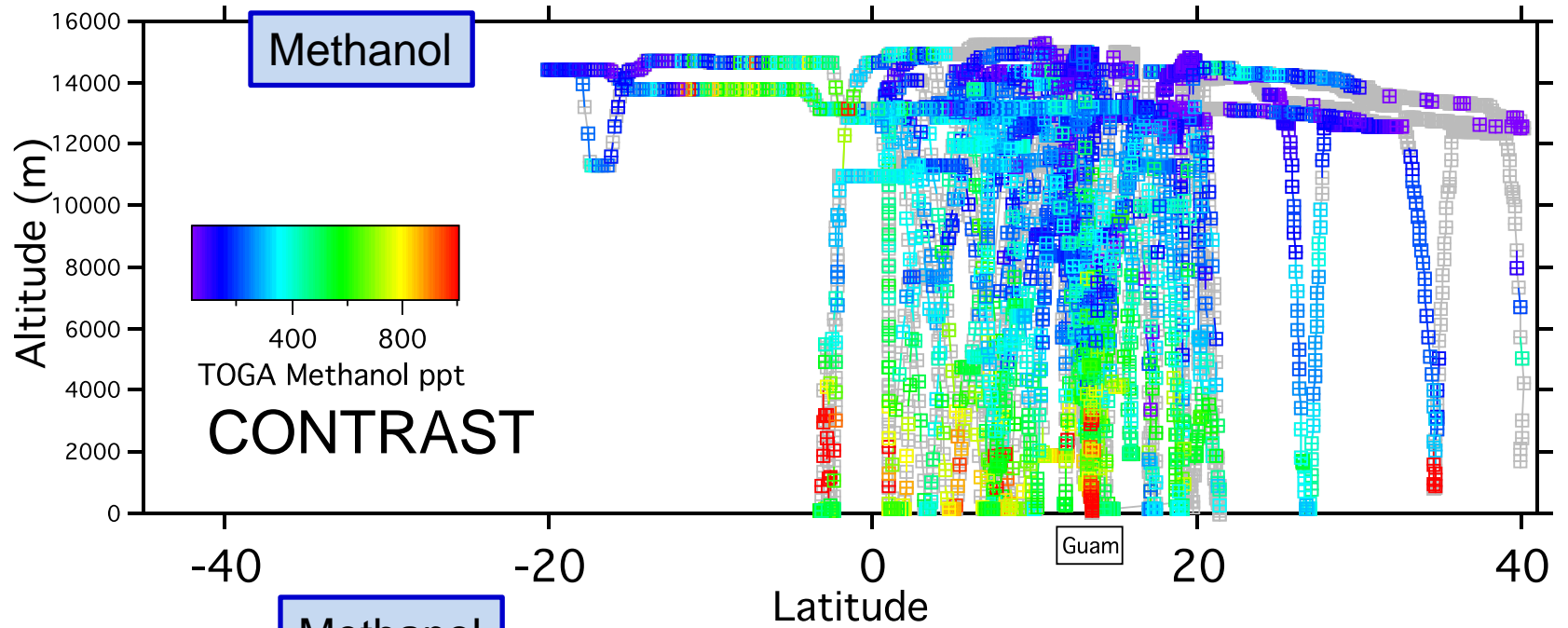
Acetone



CONTRAST compared to TORERO

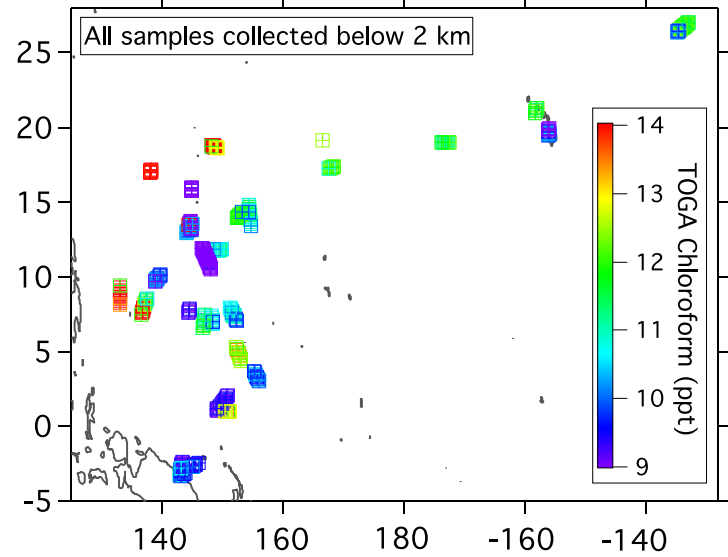
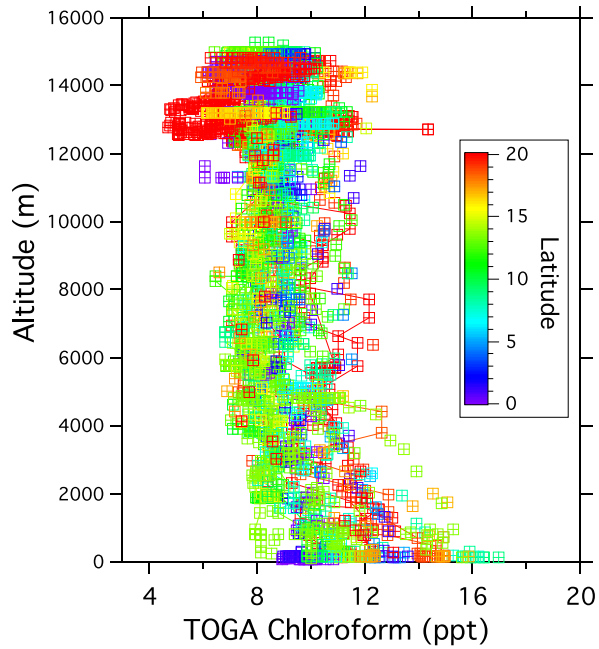


CONTRAST compared to TORERO

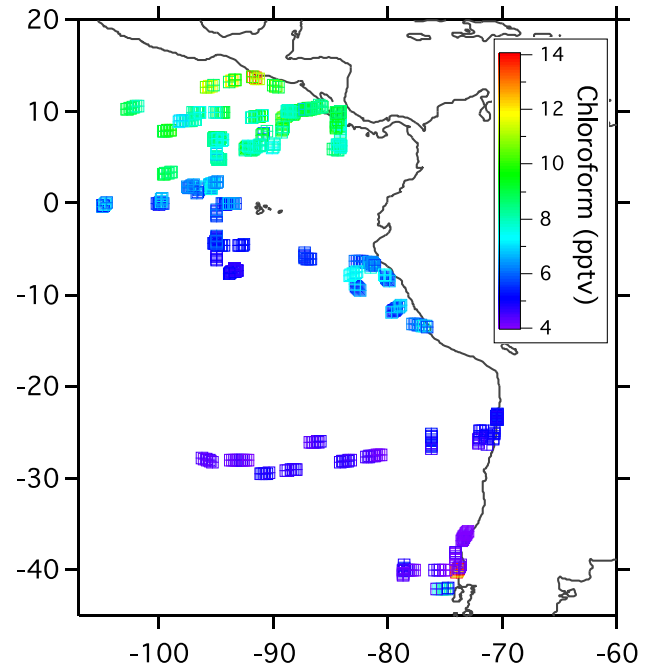
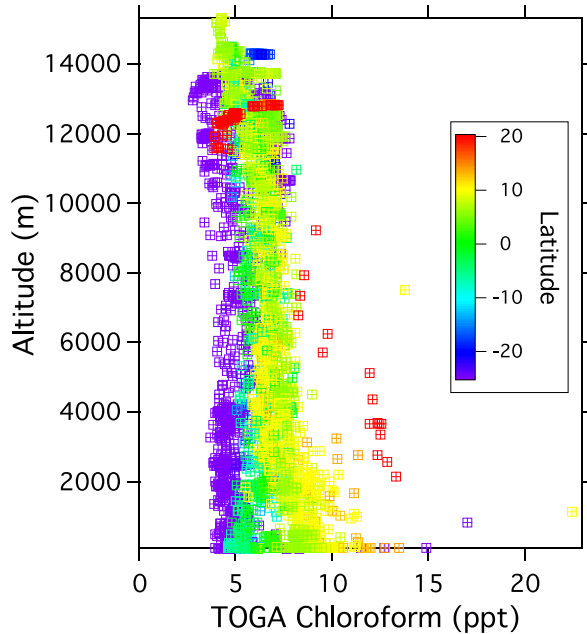


CONTRAST compared to TORERO

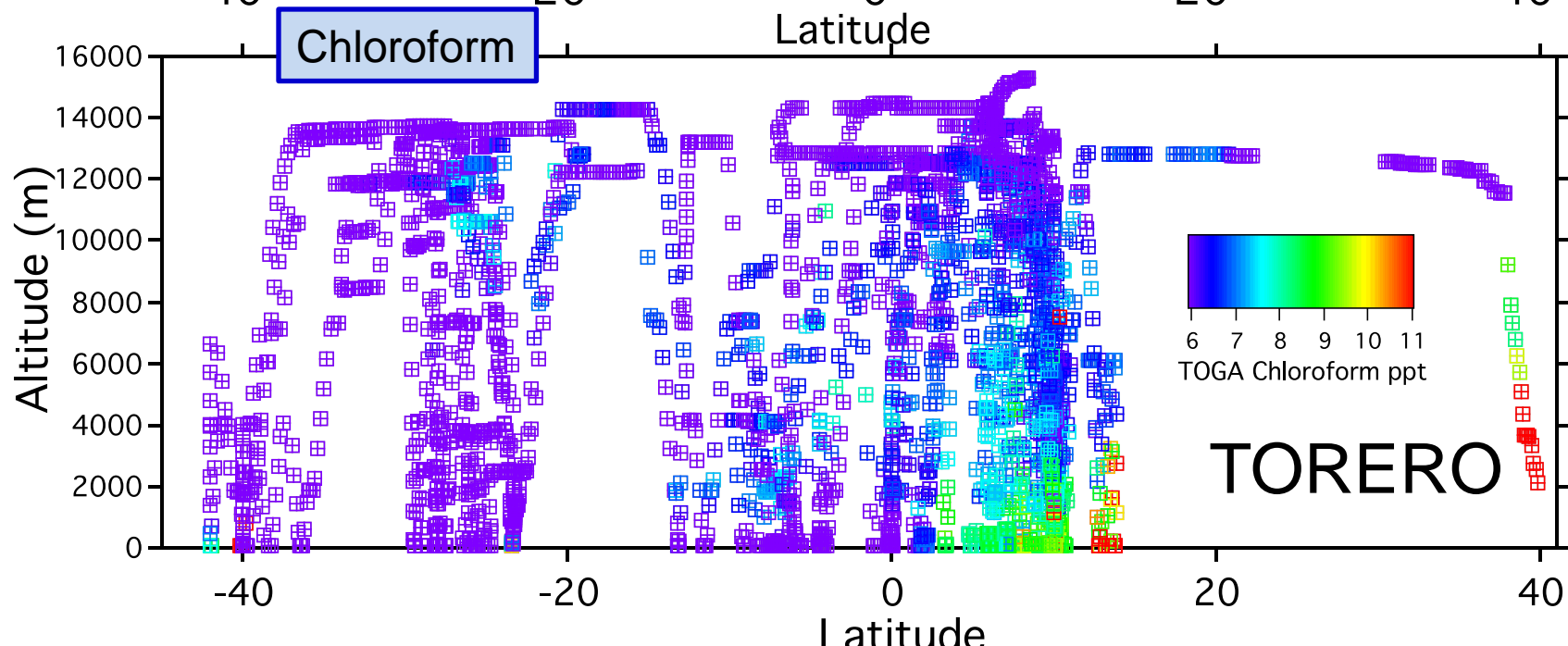
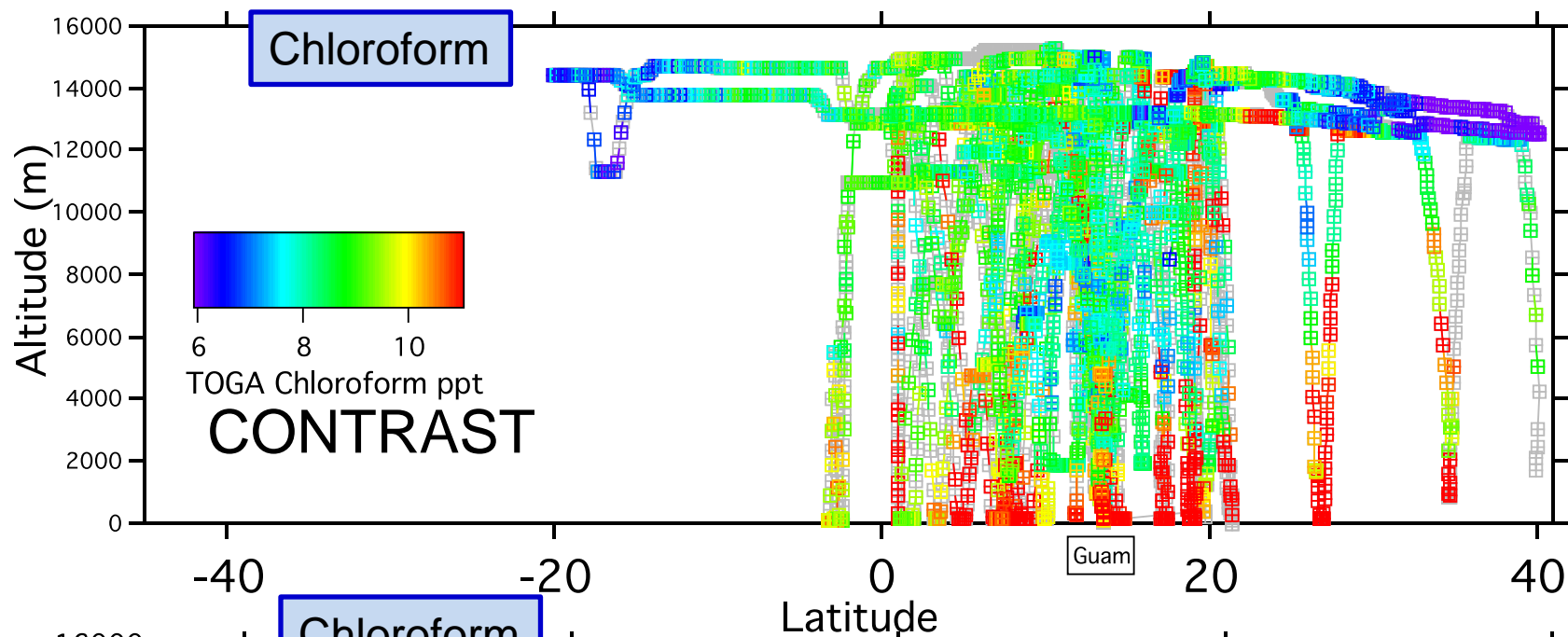
CONTRAST



TORERO

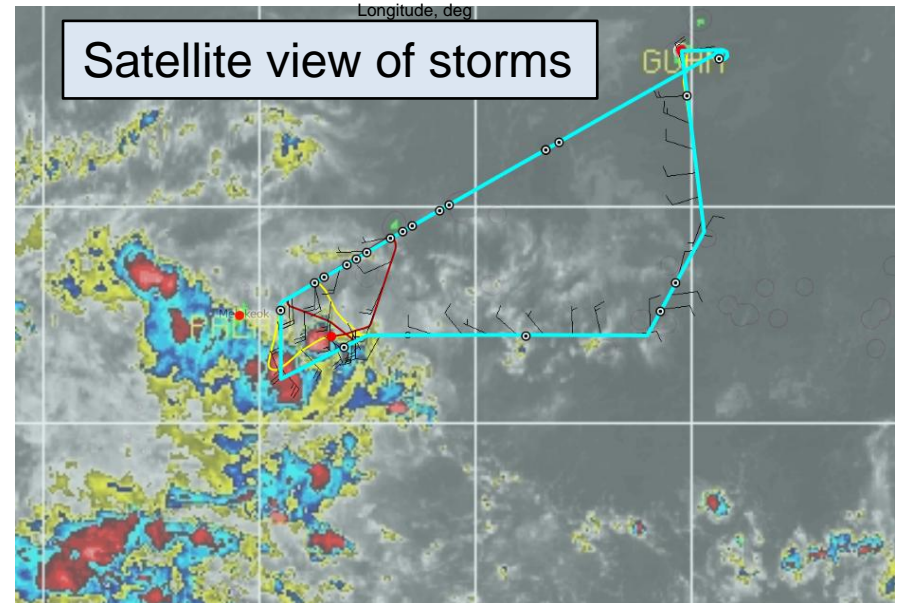
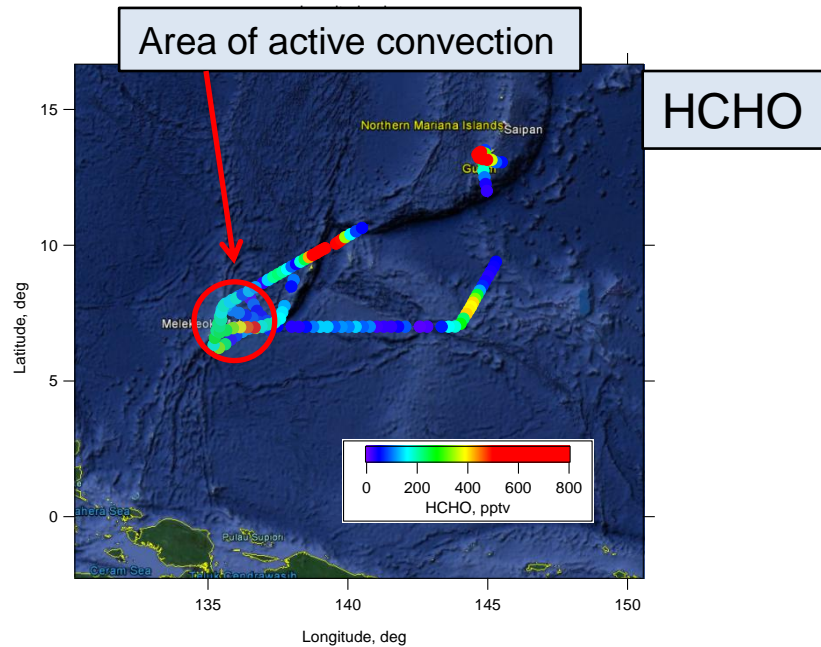
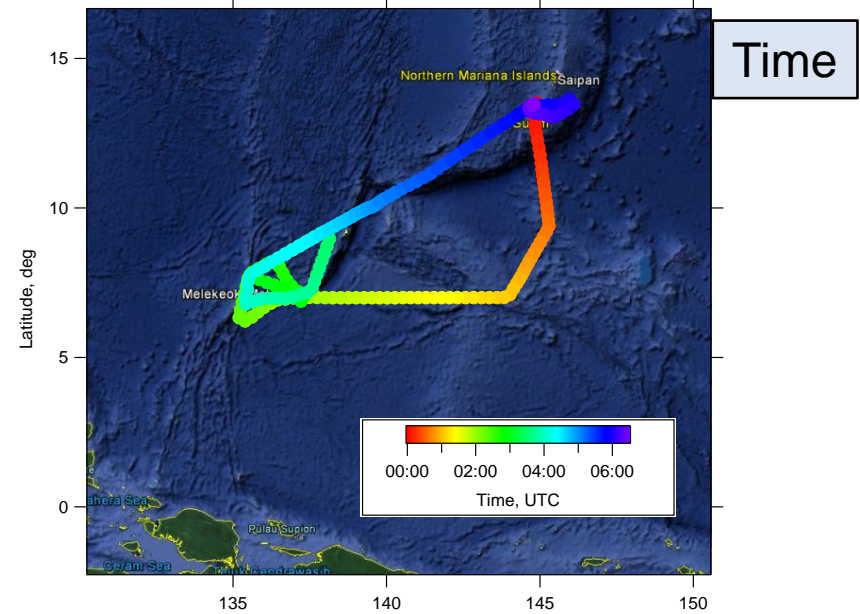
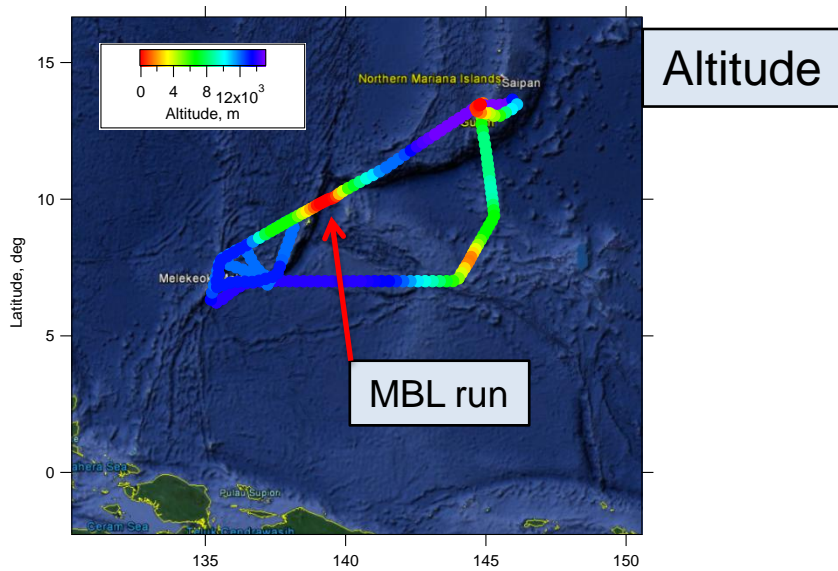


CONTRAST compared to TORERO



CONTRAST RF11 (Feb 12)

- Convection flight – redistribution of trace species



Tropical Storms – a mechanism for impacting the oxidizing capacity of the upper troposphere

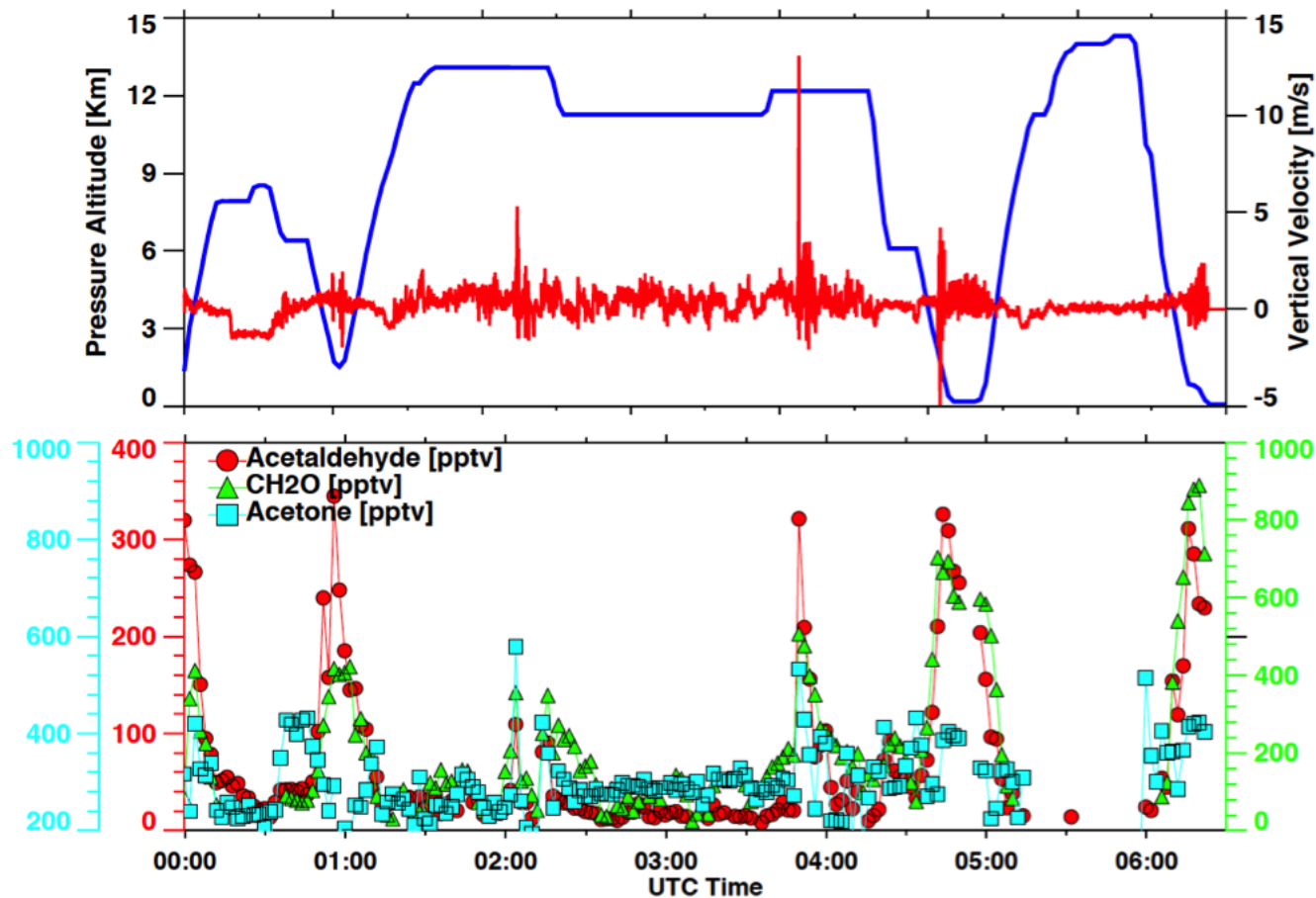
Short-lived boundary layer species observed at the tropical upper troposphere on the GV near active convection

Lifetime:

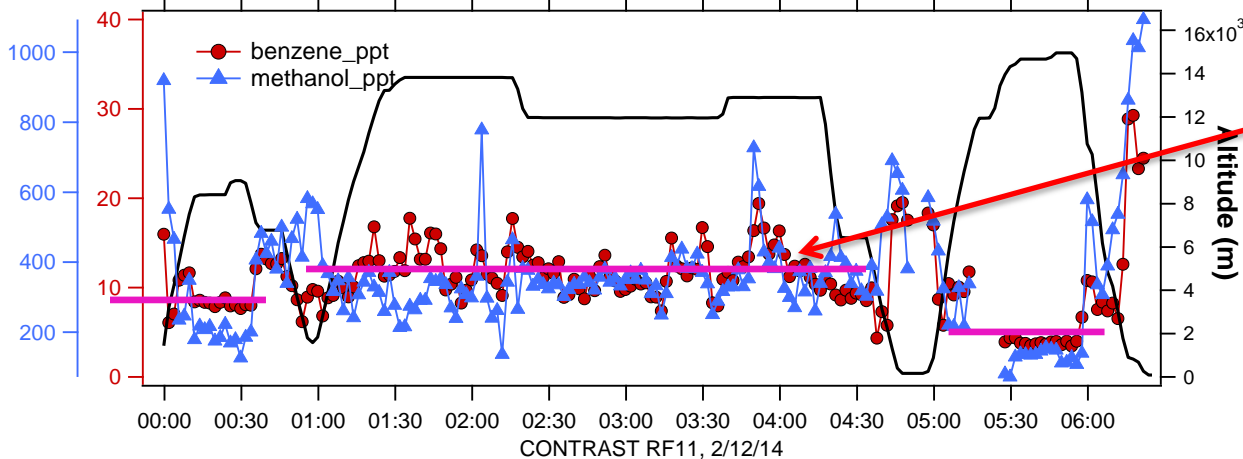
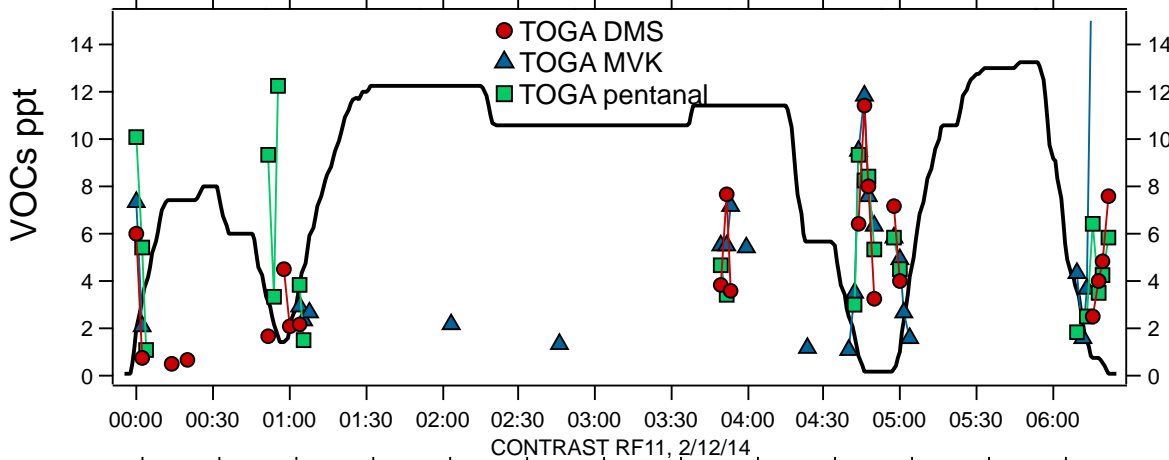
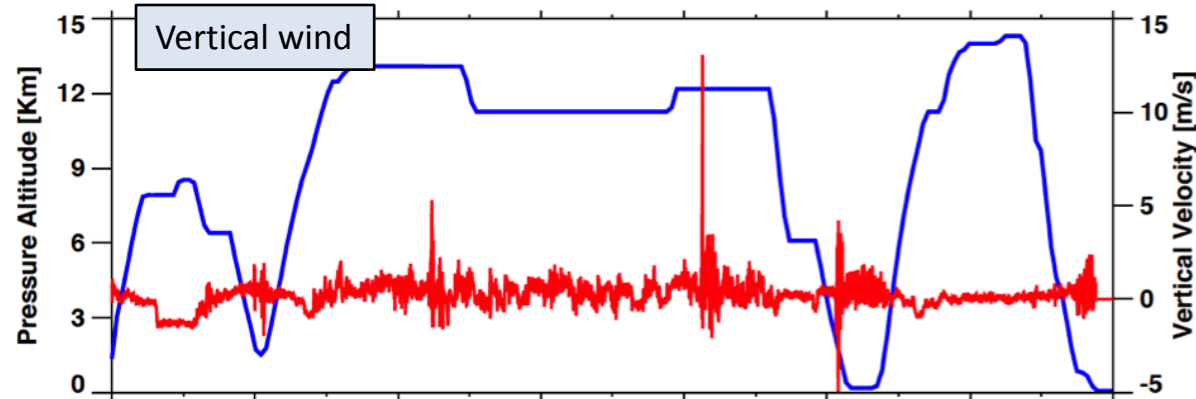
Acetone \approx weeks

Formaldehyde \approx hours

Acetaldehyde \approx hours



CONTRAST RF11 (Feb 12)

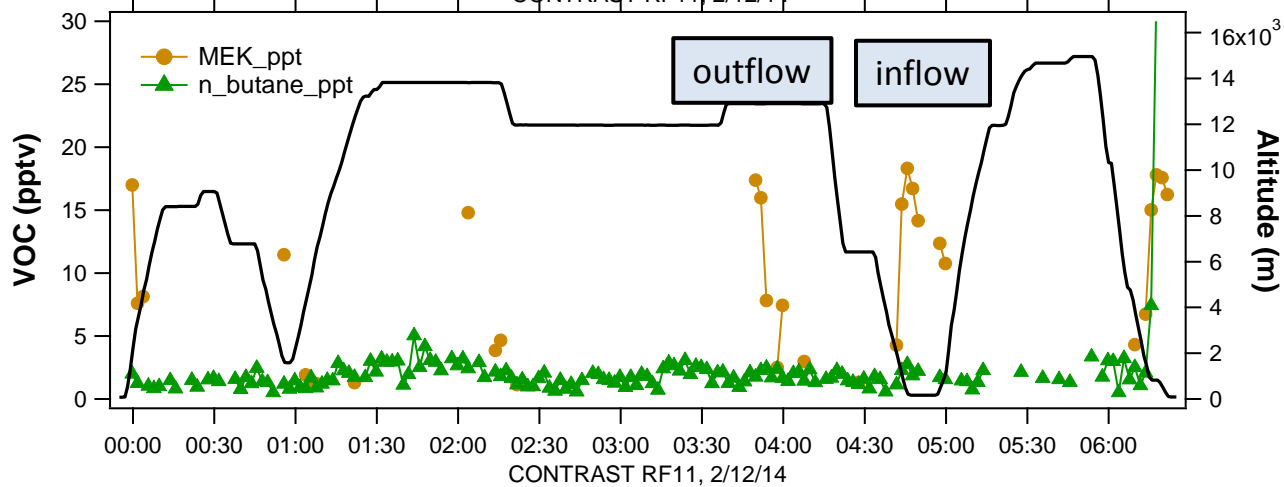
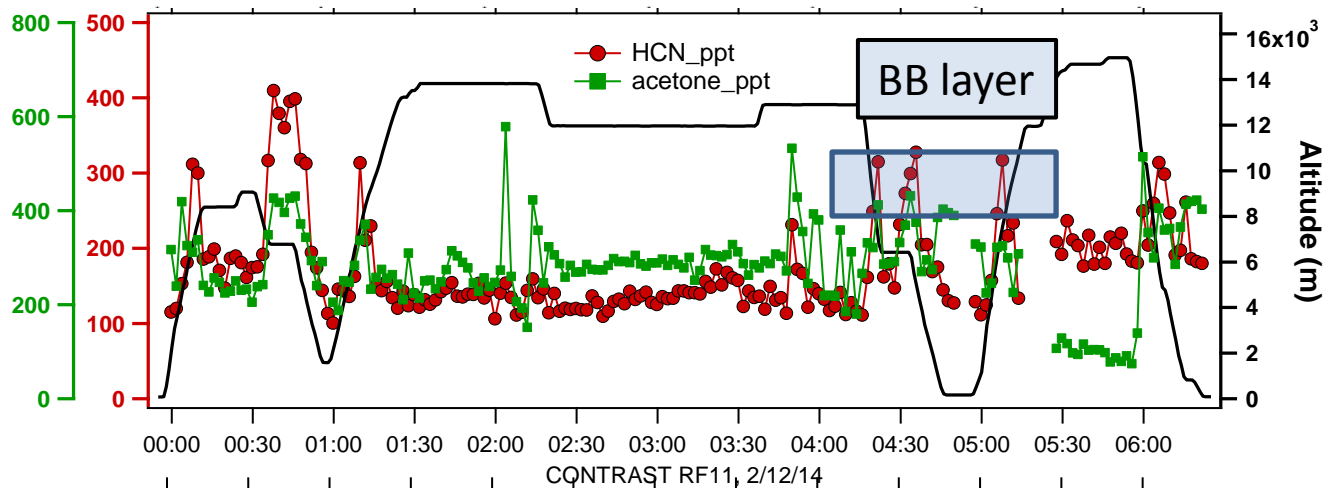
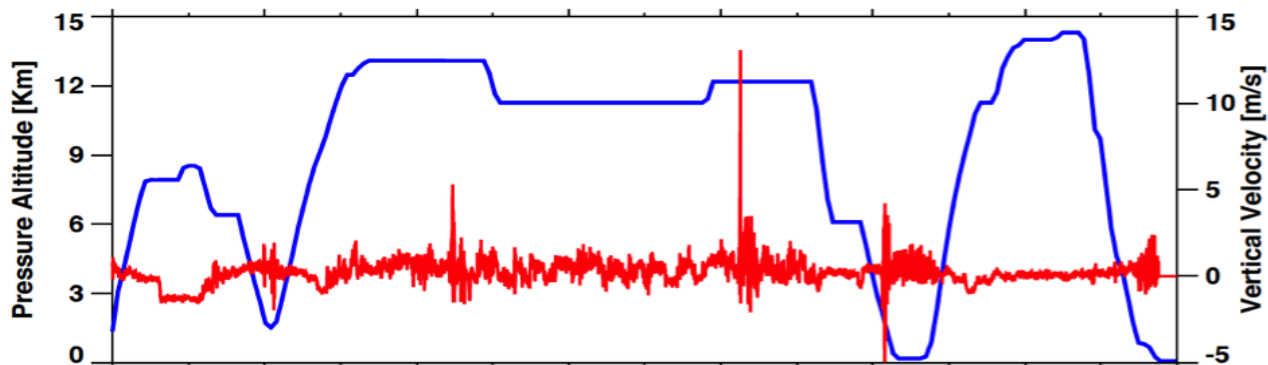


MVK, DMS, pentanal
very short-lived
boundary layer
species observed at
the tropical upper
troposphere on the
GV near active
convection

benzene, methanol
Longer - lived
species

convection raises
the average MRs in
12-13 km level
compared to mid-
level and 14+ km

CONTRAST RF11 (Feb 12)



Acetone and HCN
HCN – BB only
Acetone – BB +
other sources - MBL

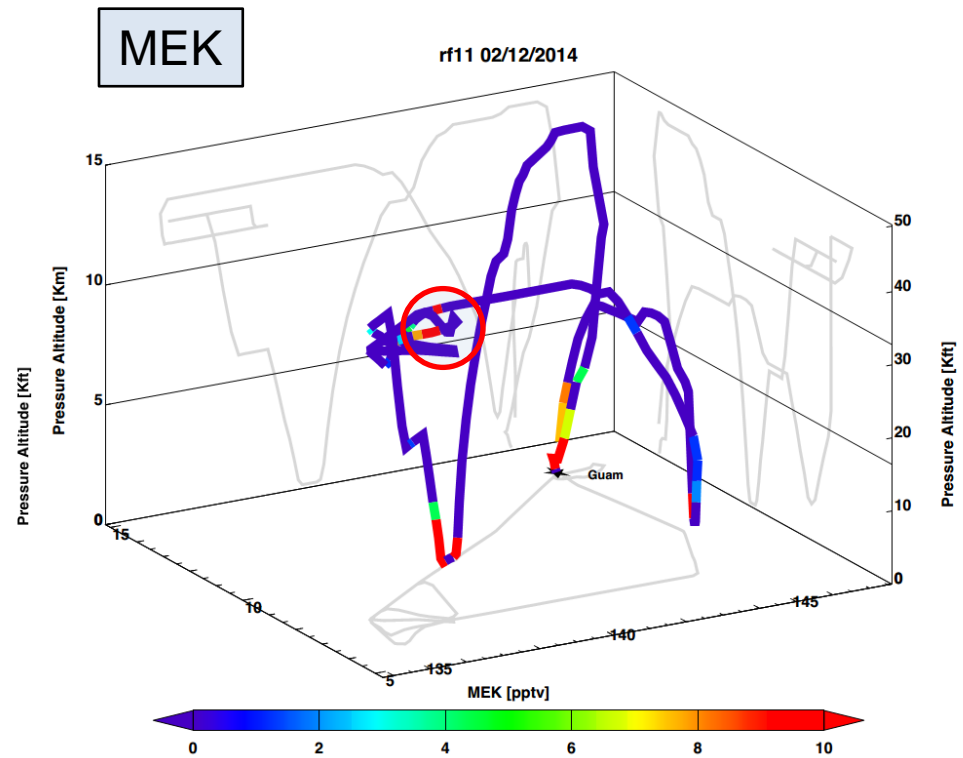
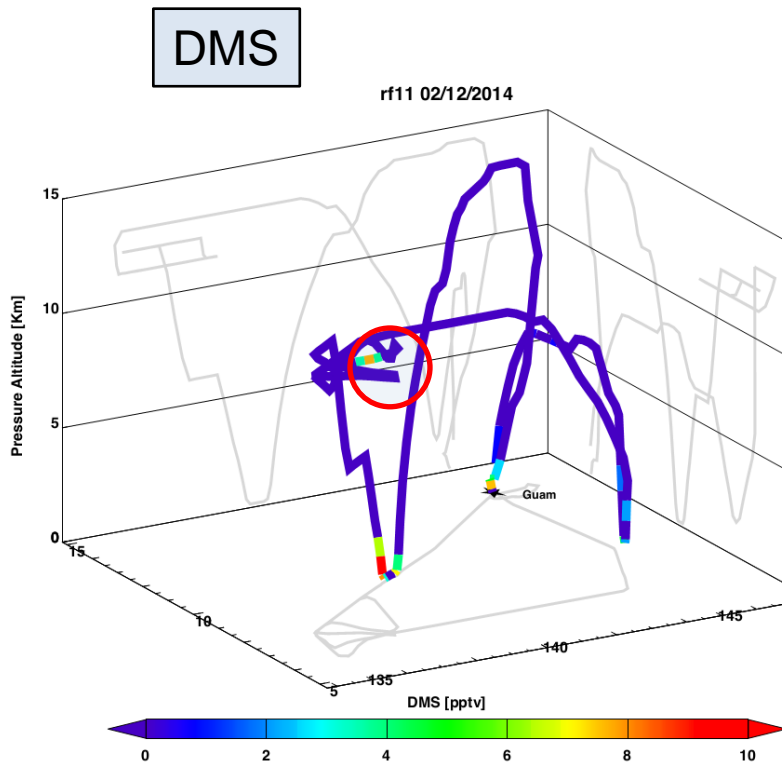
n-butane and MEK
n-butane not
elevated in MBL
thus not elevated in
convection
MEK – MBL source
other than n-butane

Inflow/outflow ratios

Compound	Ratio outflow/inflow	Description
i_Butane	1.00	unreactive insoluble
n_Butane	1.00	unreactive insoluble
MEK	0.95	unreactive insoluble
Acetaldehyde	0.95	reactive insoluble
MVK	0.68	reactive insoluble
Pentanal	0.50	reactive insoluble
DMS	0.71	reactive insoluble
Formaldehyde	0.74	reactive soluble

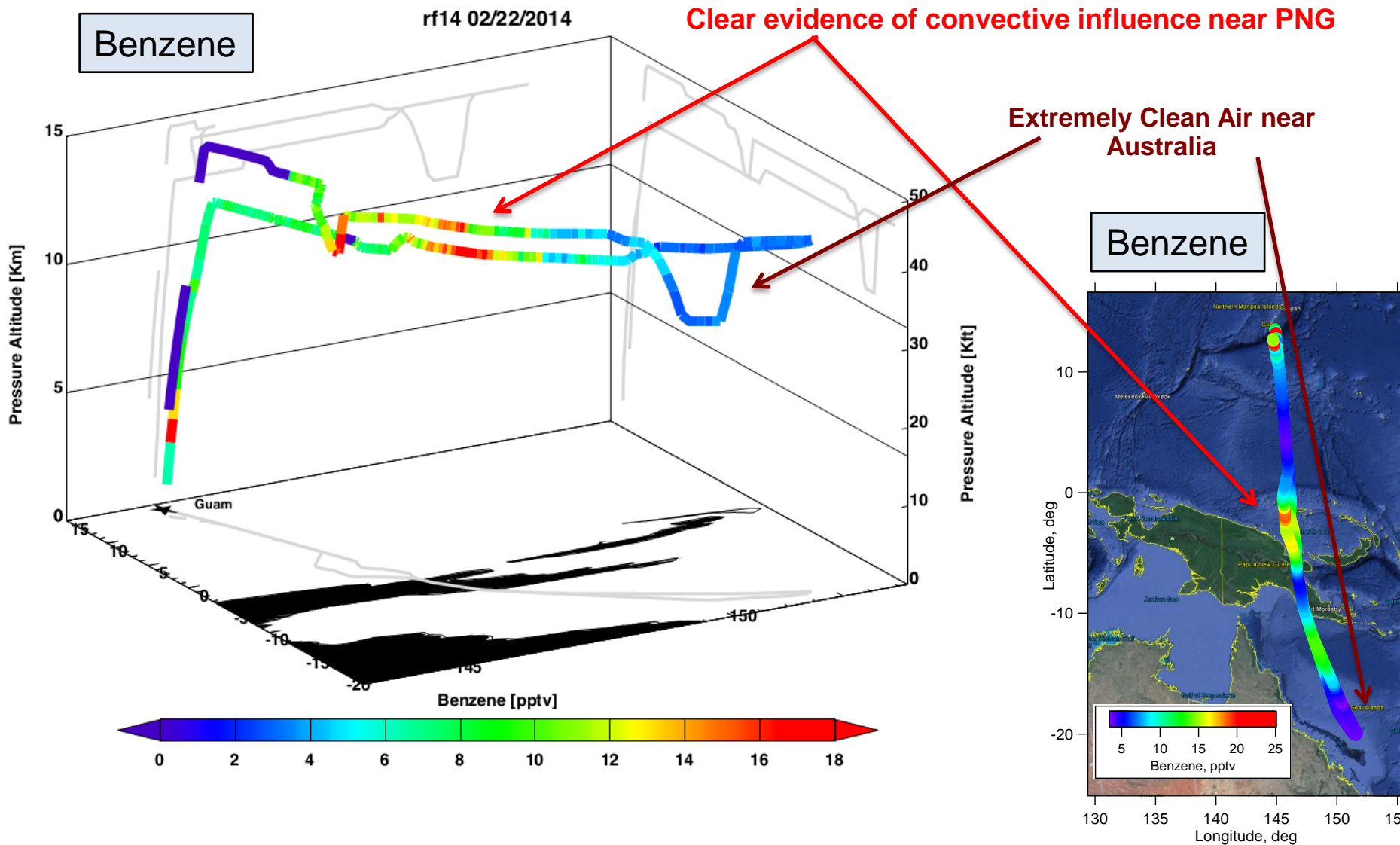
DMS, MEK

short-lived boundary layer species observed at the tropical upper troposphere on the GV near active convection

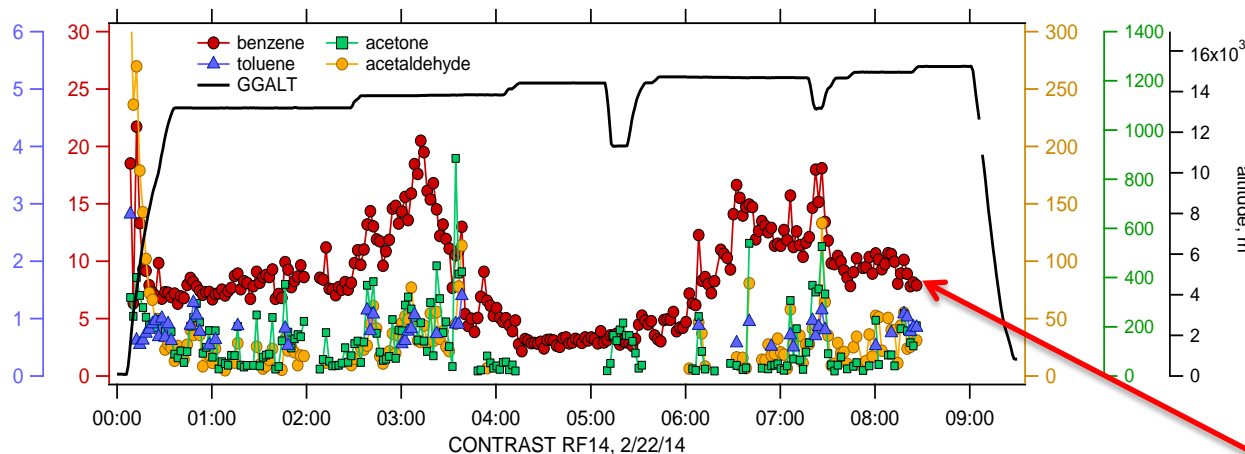


CONTRAST RF 14 (Feb 22)

- Flight to Australia

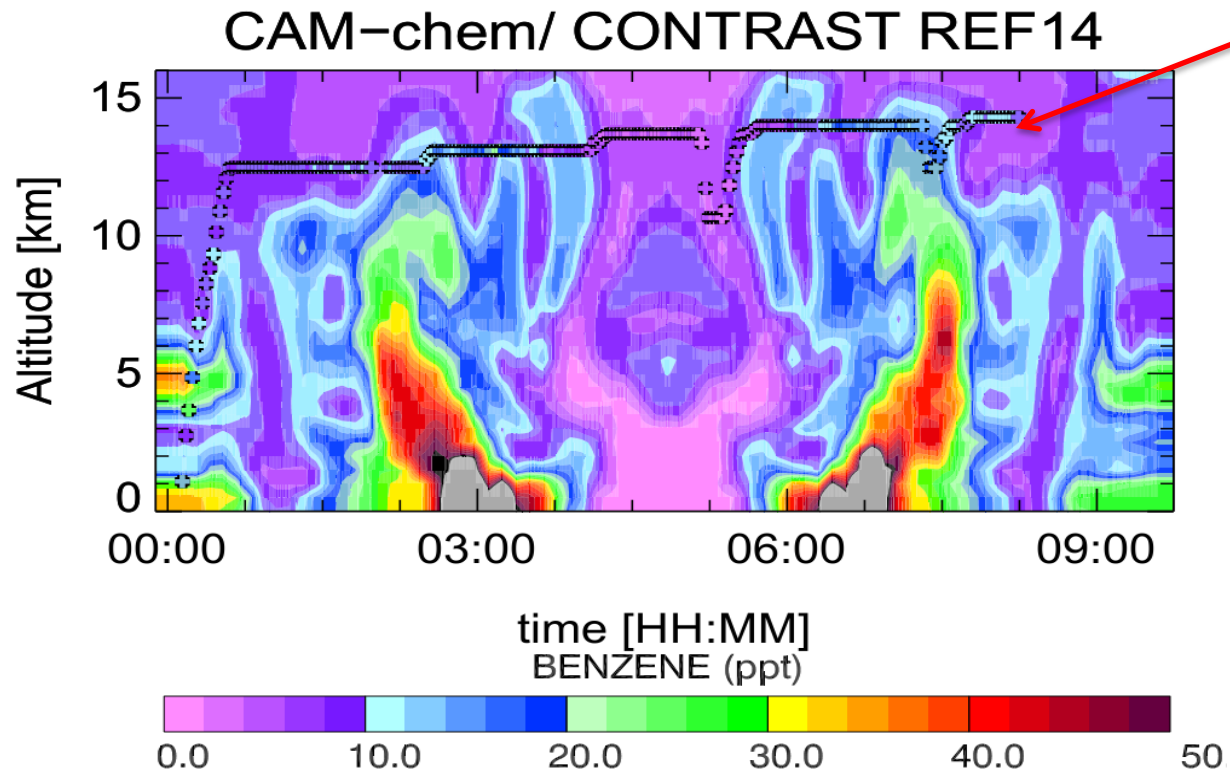


CONTRAST RF14 (Feb 22)

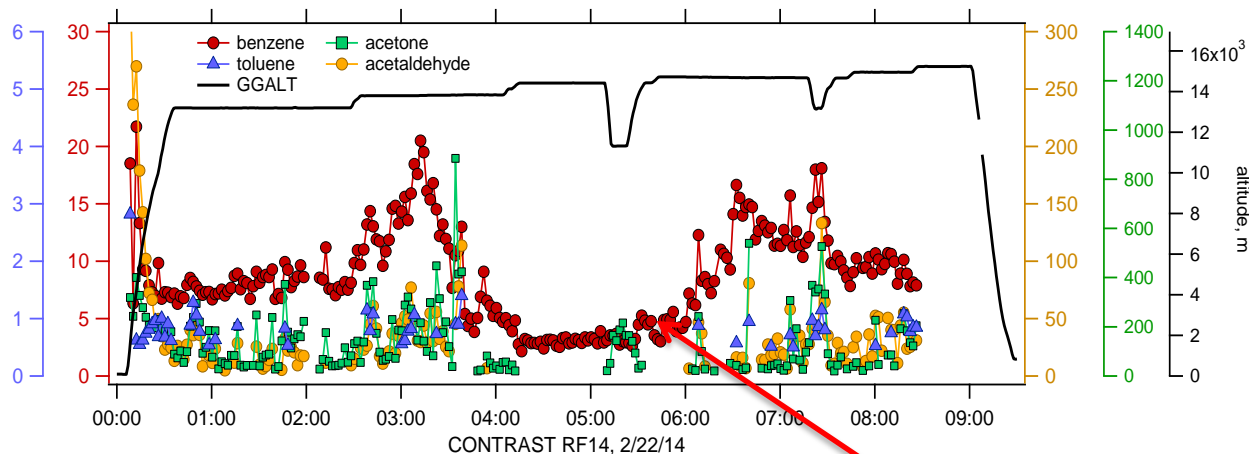


TOGA benzene
toluene
acetaldehyde

CAM-chem captures the benzene spatial distribution well – note the low values in SH

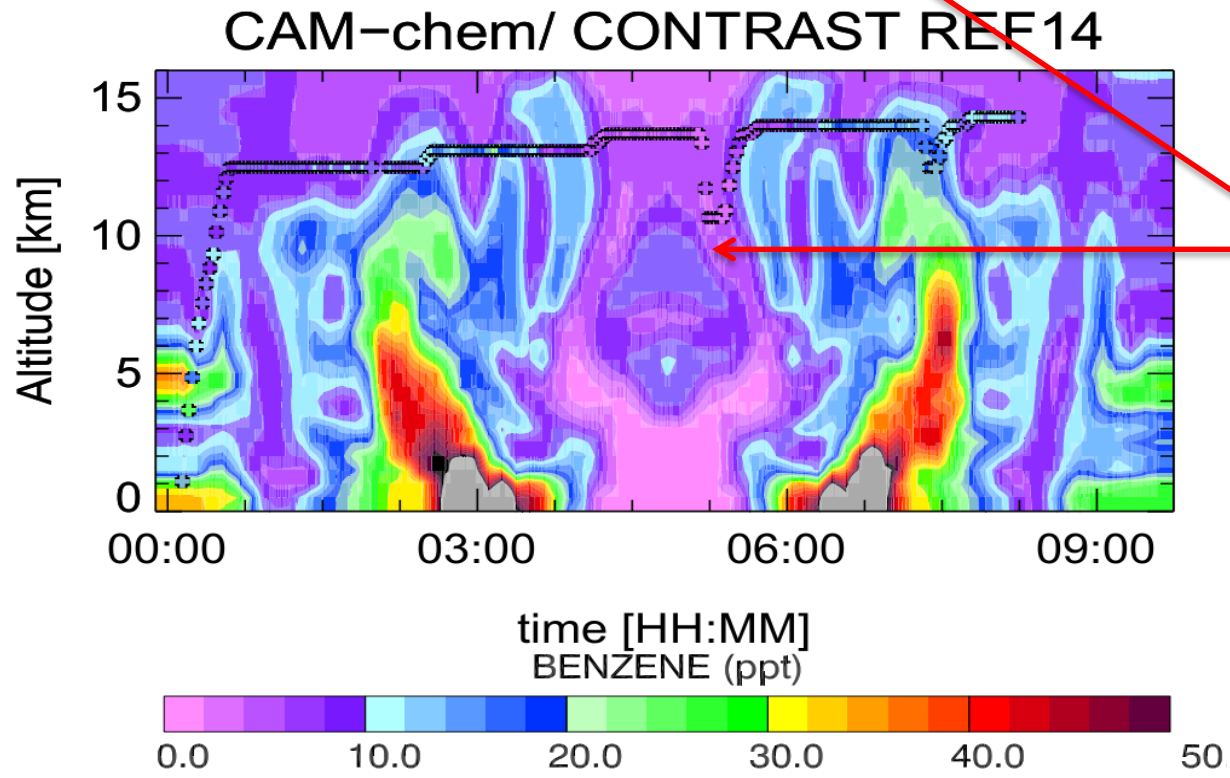


CONTRAST RF14 (Feb 22)



TOGA benzene
toluene
acetaldehyde

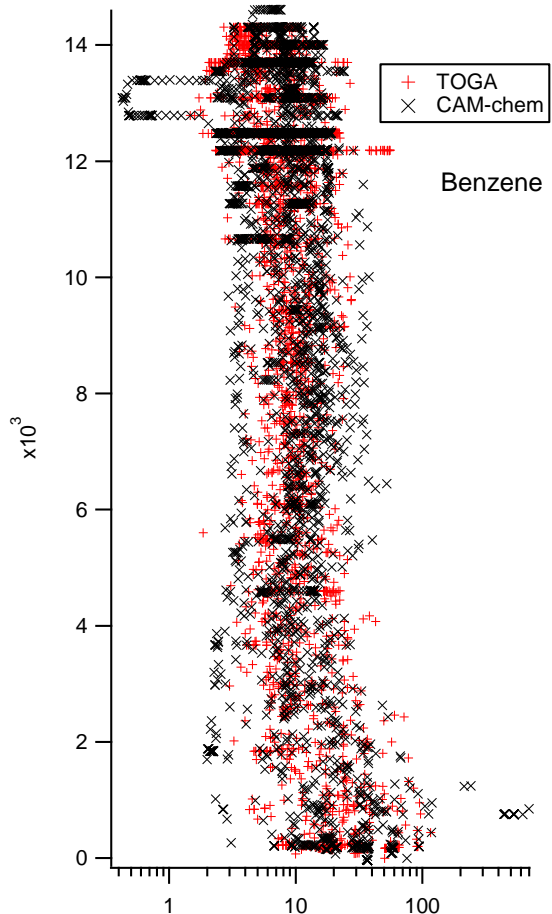
CAM-chem captures the benzene spatial distribution well –



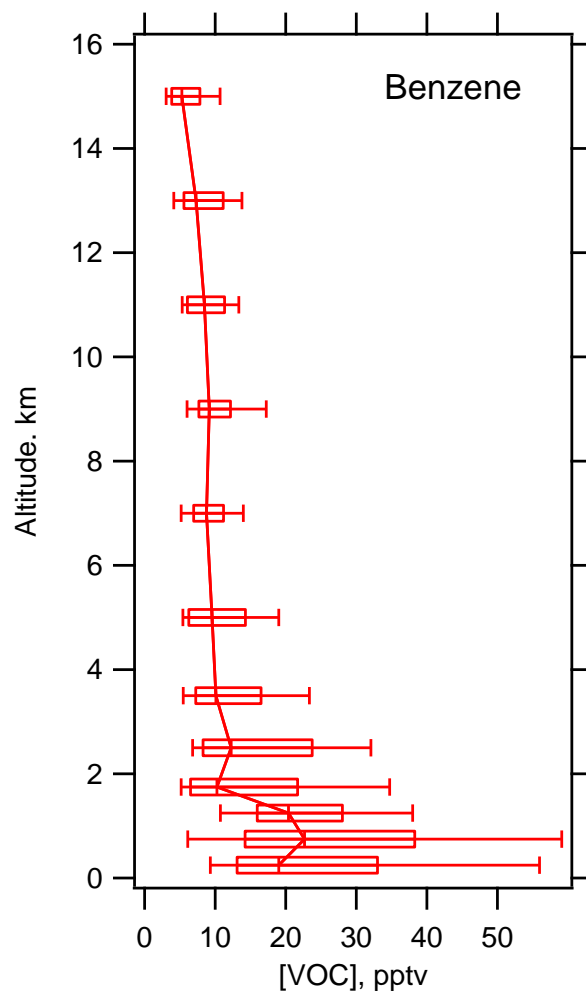
note the low values in SH

Benzene

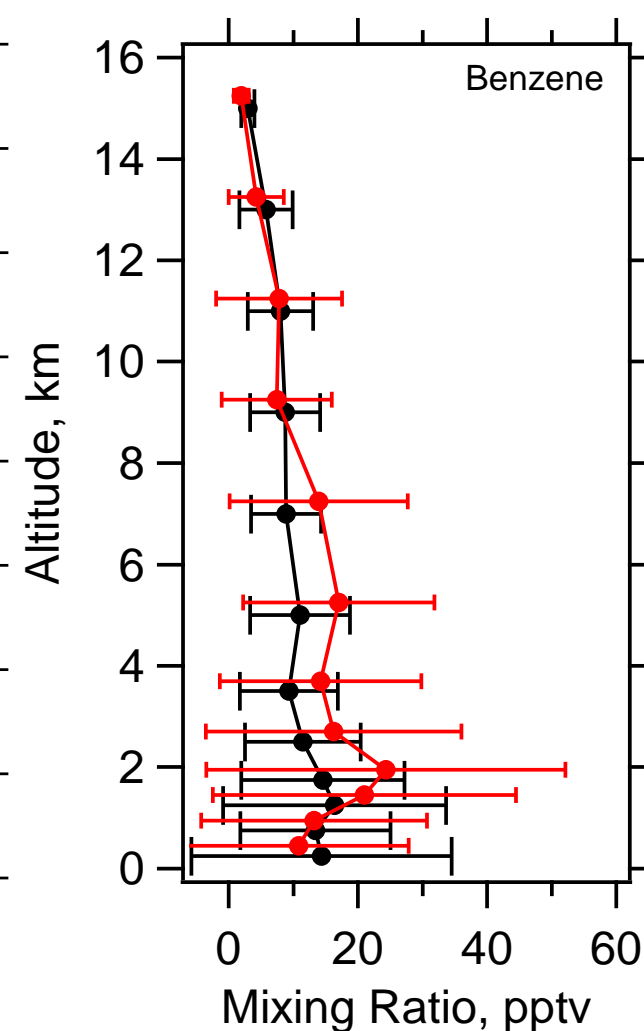
CONTRAST



CONTRAST



TORERO

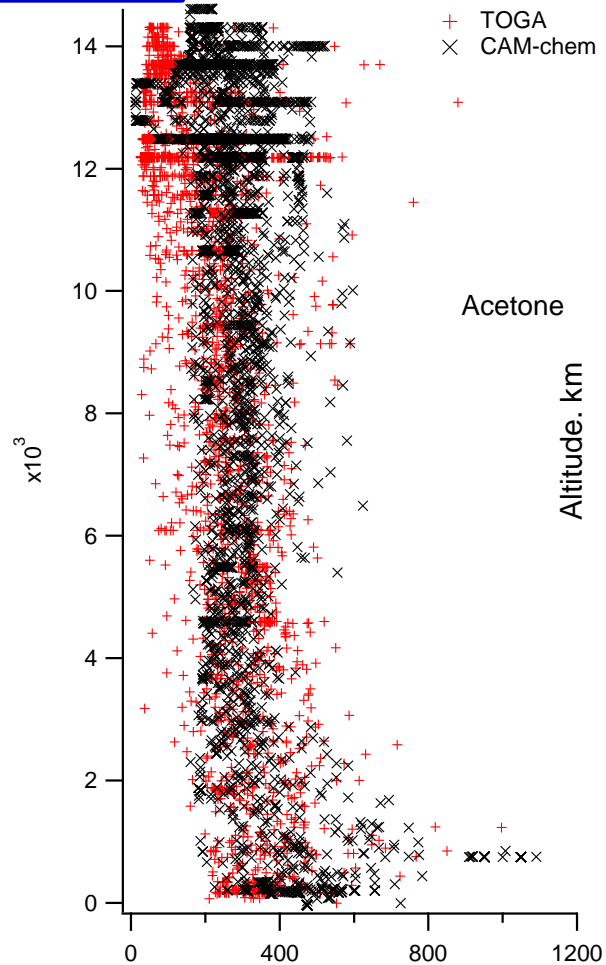


All over-ocean data,
 red = CAM-chem (1 deg, June 2014)
 Black = TOGA data

CAM-Chem Model Comparison

Acetone

CONTRAST

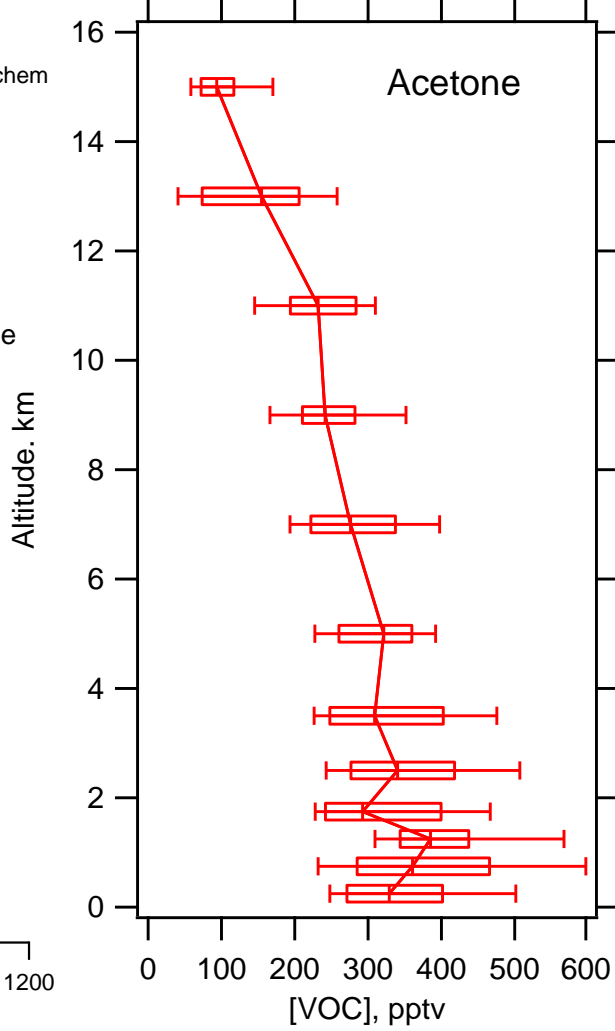


+ TOGA
x CAM-chem

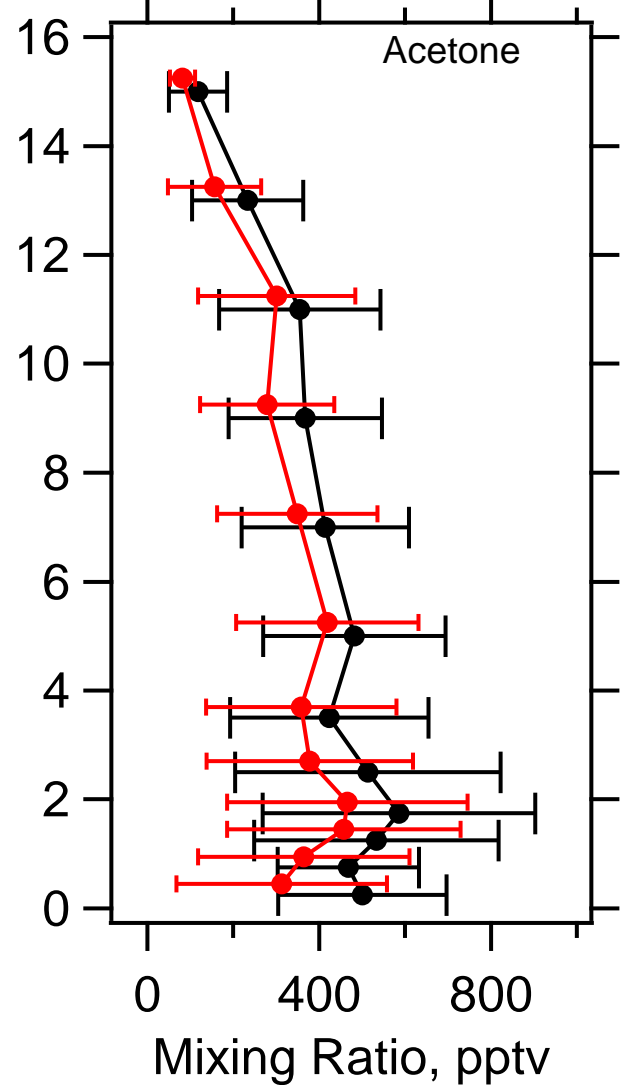
Acetone

All over-ocean data,
red = CAM-chem (1 deg, June 2014)
Black = TOGA data

CONTRAST



TORERO

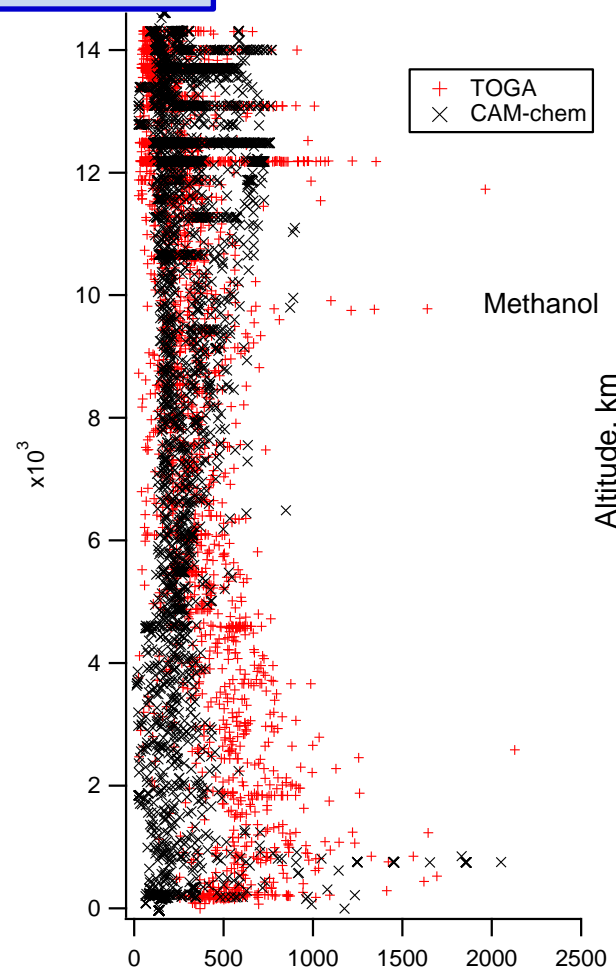


Acetone

Mixing Ratio, pptv

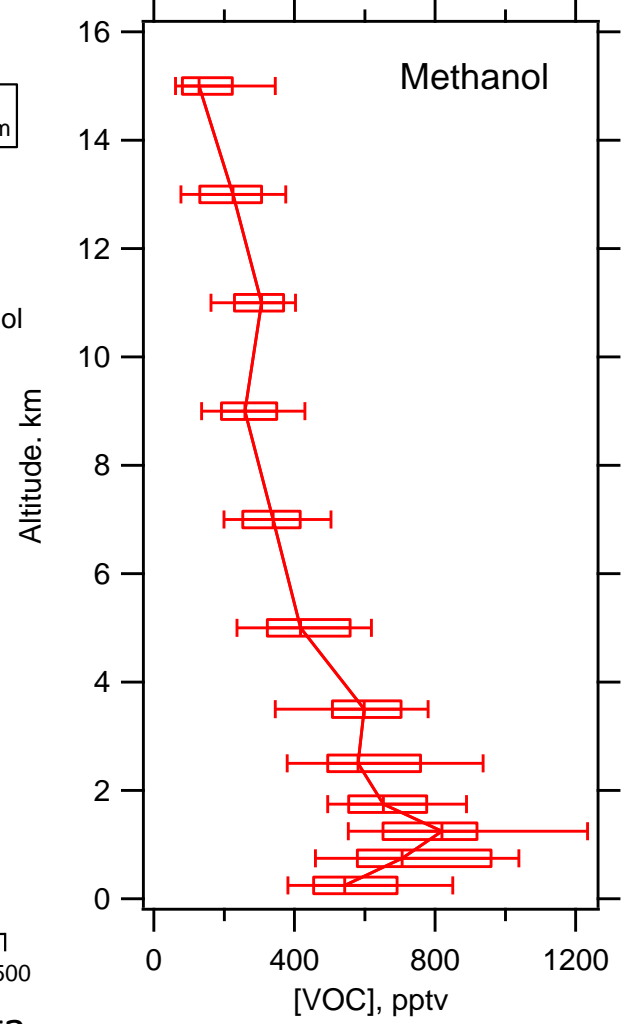
Methanol

CONTRAST

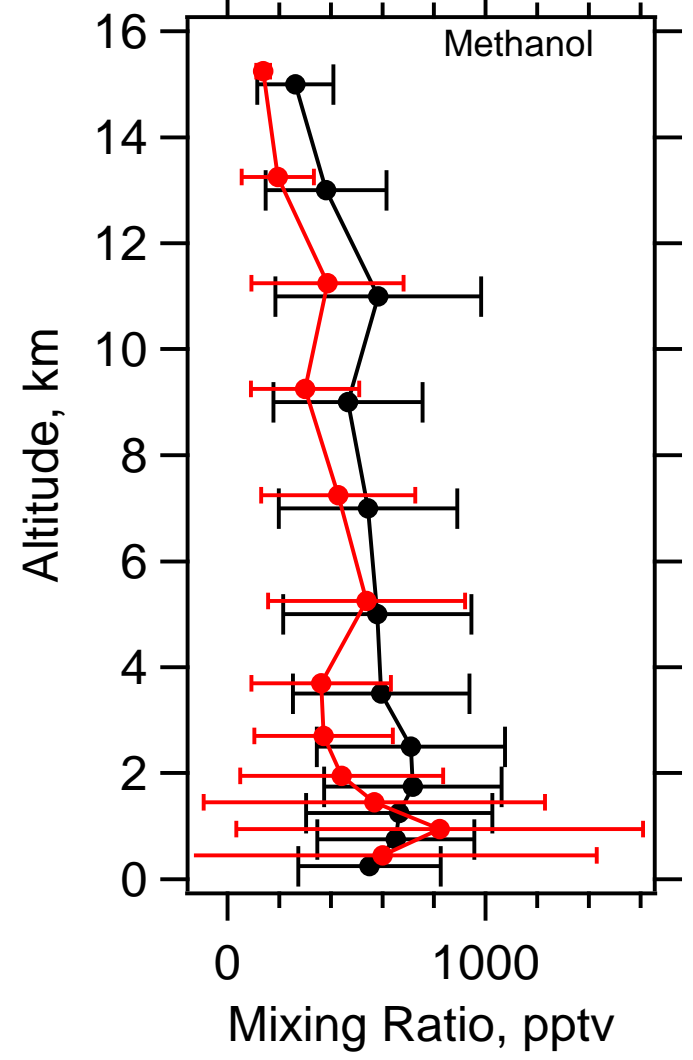


All over-ocean data,
 red = CAM-chem (1 deg, June 2014)
 Black = TOGA data

CONTRAST



TORERO

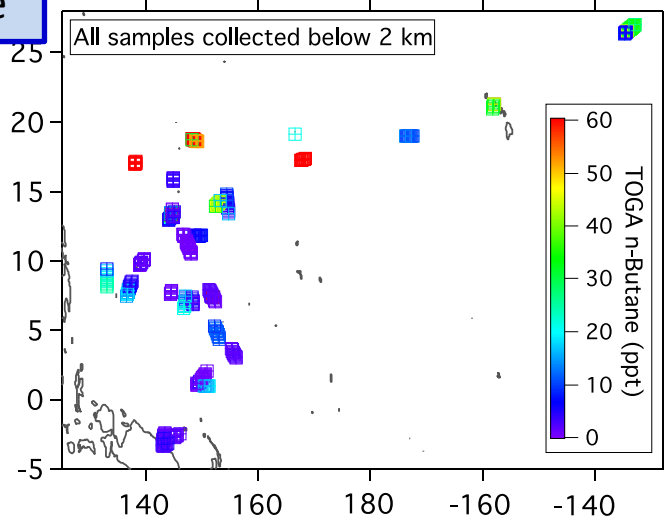
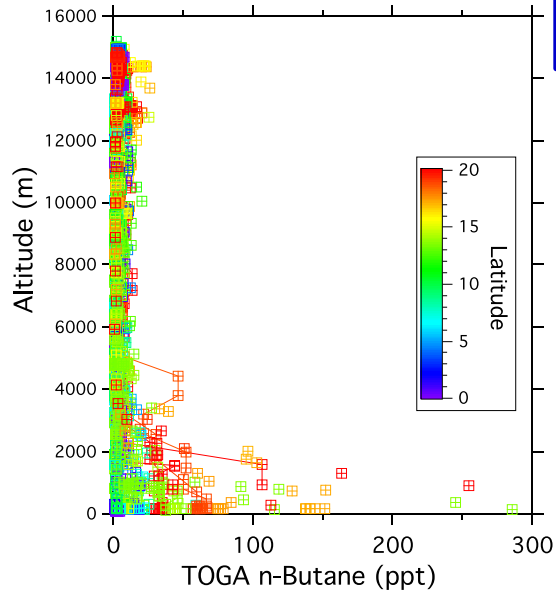


End – thanks!

CONTRAST compared to TORERO

CONTRAST

n-Butane



TORERO

n-Butane

