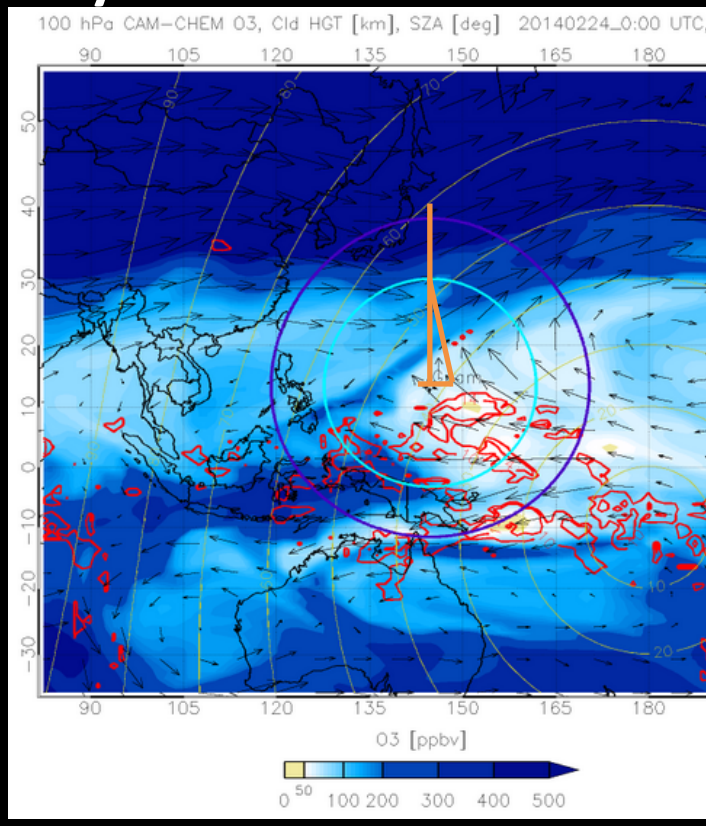
Measurements of BrO and IO in the LS: Constraints on Br_y and I

Theodore Koenig, Sunil Baidar, Barbara Dix, Rainer Volkamer
Department of Chemistry and Biochemistry & CIRES
University of Colorado



- **vious measurements**
- **5 case study bridging TTL and LS**
- **mine**
- **O measurements: revisions and improvements**
- **O to Br_y using a box model**
- **ne**
- **to I_y using box model**
- **clusions & Outlook**
- **cap and outlook**

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ckground – Previous measurements of bromine in the TTL and

t al., 2008

oon DOAS from 33km over tropical Brazil

gley observations at high SZA

measurements match model

BrO is not significantly non-zero through most of the troposphere

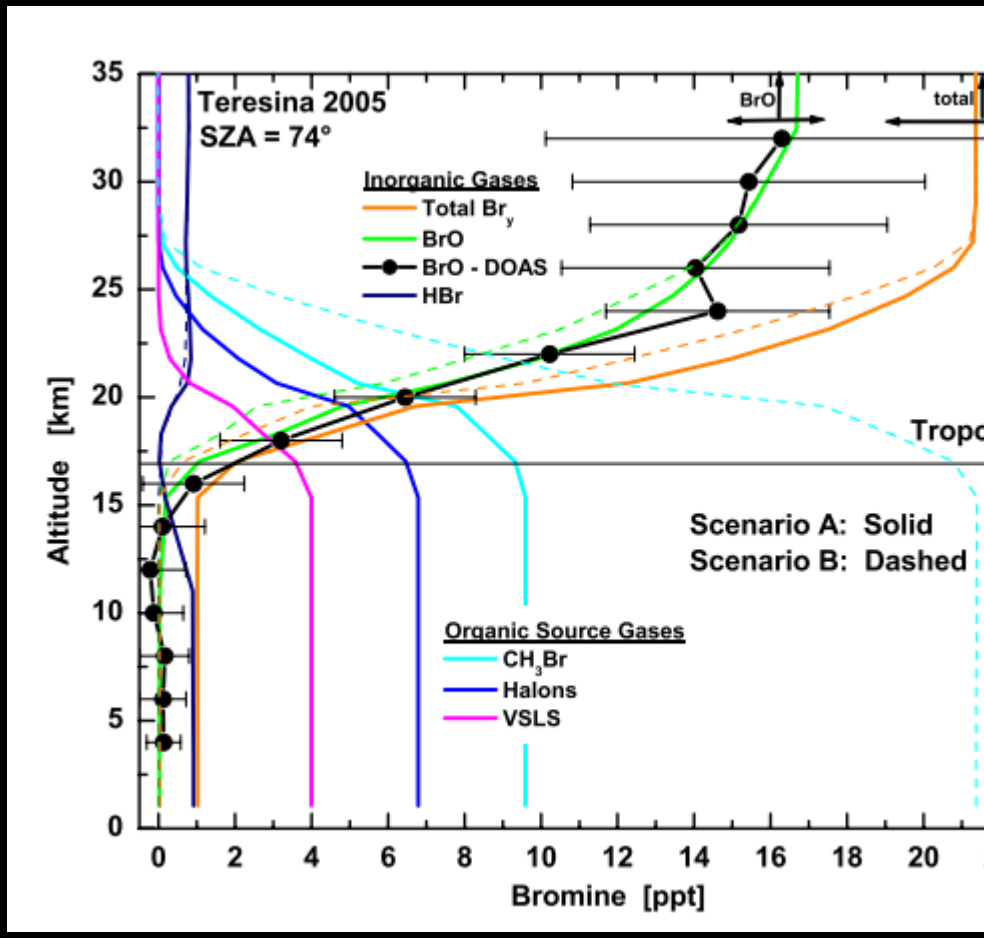
~1ppt BrO just below the tropopause

BrO increases very rapidly across the TTL and LS over 1ppt/km increase in mixing ratio

tospheric Br_y is near latest WMO mate of 20ppt (21.4 ppt)

file shape is driven by conversion of anobromine to Br_y in TTL and LS

ellites infer a larger tropospheric kground



Dorf et al., 2008, ACP: Bromine in the tropical troposphere and stratosphere as derived from ball borne BrO observations.

ckground – Previous measurements of iodine in the TTL and LS

spheric:

ntadura et al., 2012, ground based
AS

tropics have a low IO background
ough the FT

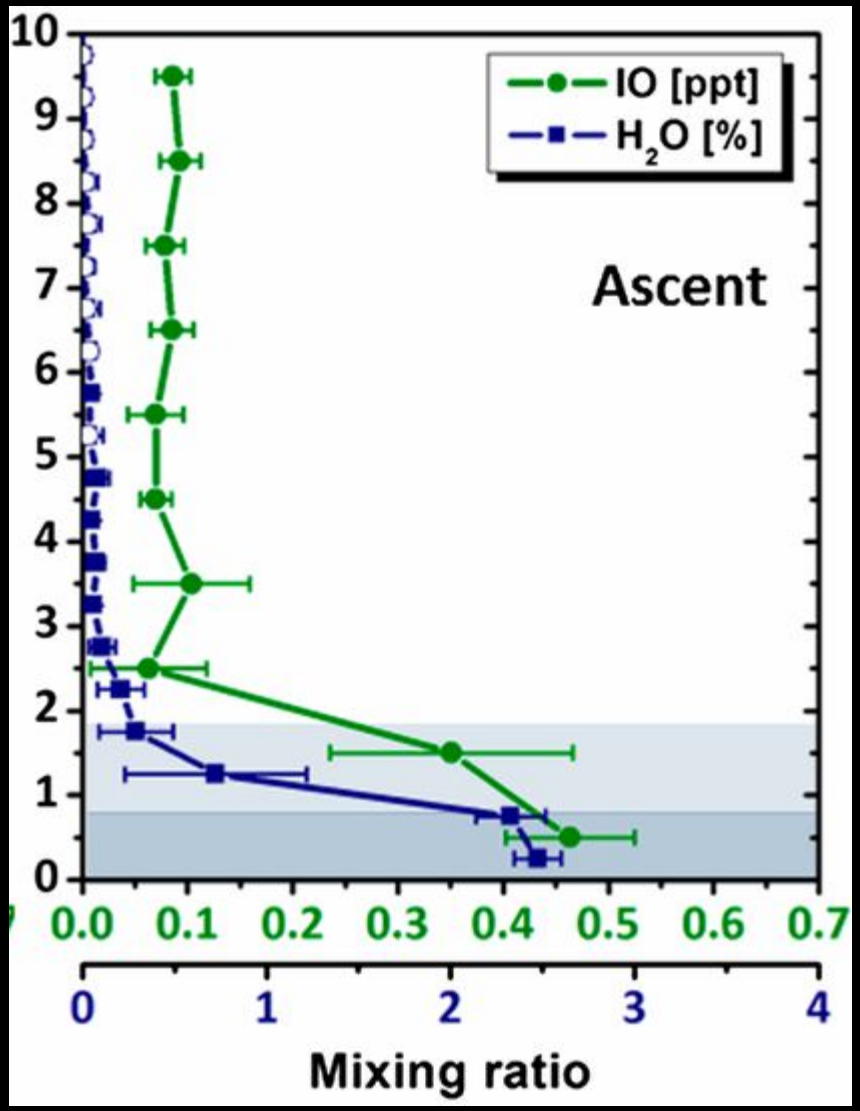
et al., 2013, Volkamer Group AMAX-
AS

pics show a low IO background through
FT

Stratosphere:

ous Balloon-borne DOAS

s below detection in the LS, upper limit
2ppt



Dix et al.,
PNAS: De
of iodine
monoxid
tropical f
troposph

ckground – New information on halogens in the TTL and LS

O CU AMAX-DOAS measurements more
y probe TTL

ng et al., 2015

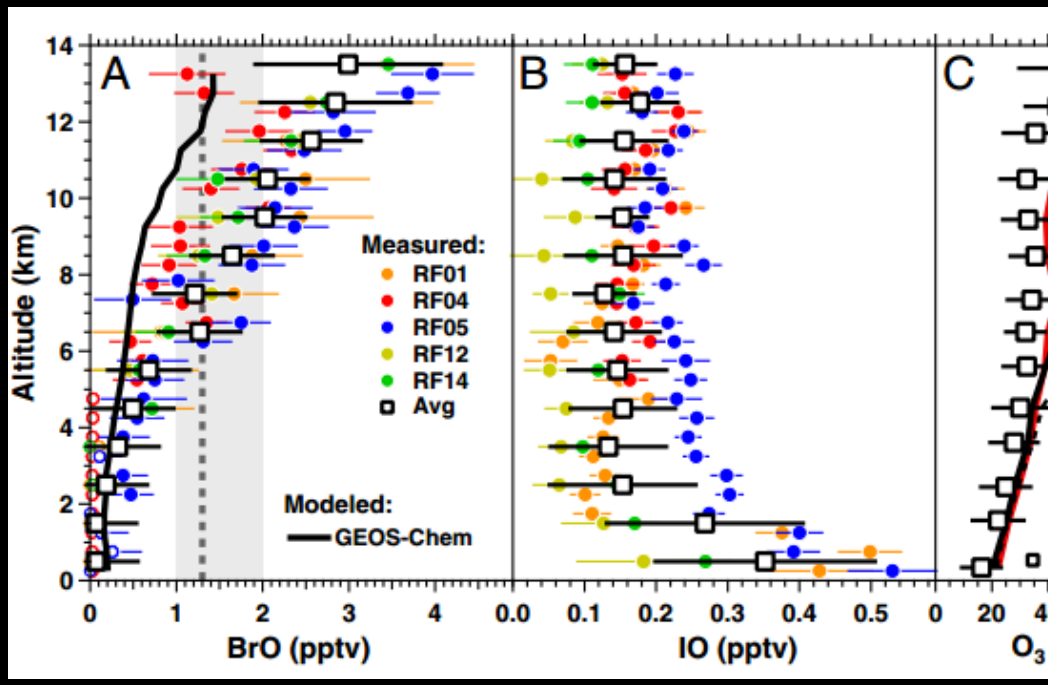
can sometimes be much higher,
ecially in stratospherically influenced air

nd of increasing BrO begins below TTL is
sent through much of FT

background continues to high
pospheric altitudes, may start falling off
ery highest ones

ing suggests previous IO measurements
nay underestimate IO due to
rement conditions

-Lopez et al., 2015 in review



Wang et al., 2015, PNAS: Active and widespread halo
chemistry in the tropical and subtropical free tropos

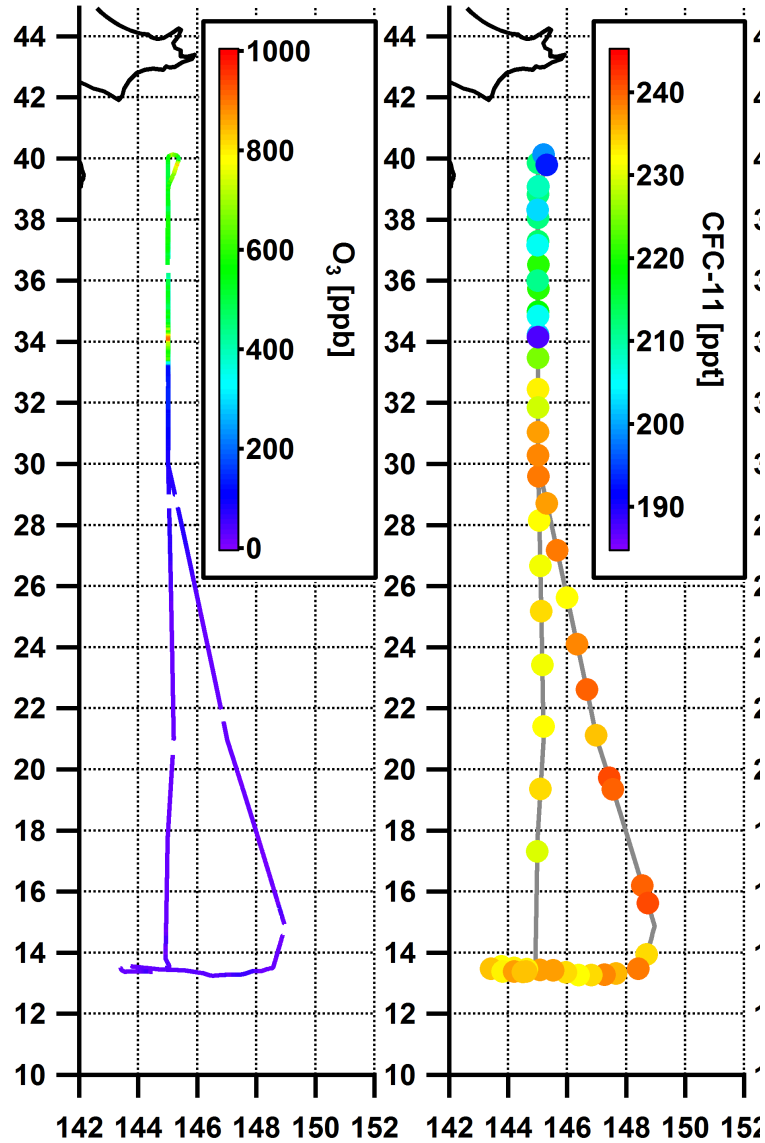
NTRAST RF15 – Overview of flight

starts north from Guam
km in the TTL.

s the jet into the LS and
1km at the
rnmost point.

e the flight track back
m at ~14km.

C-11 from AWAS, and
BrO and IO all show a
ransition at ~ 33°N

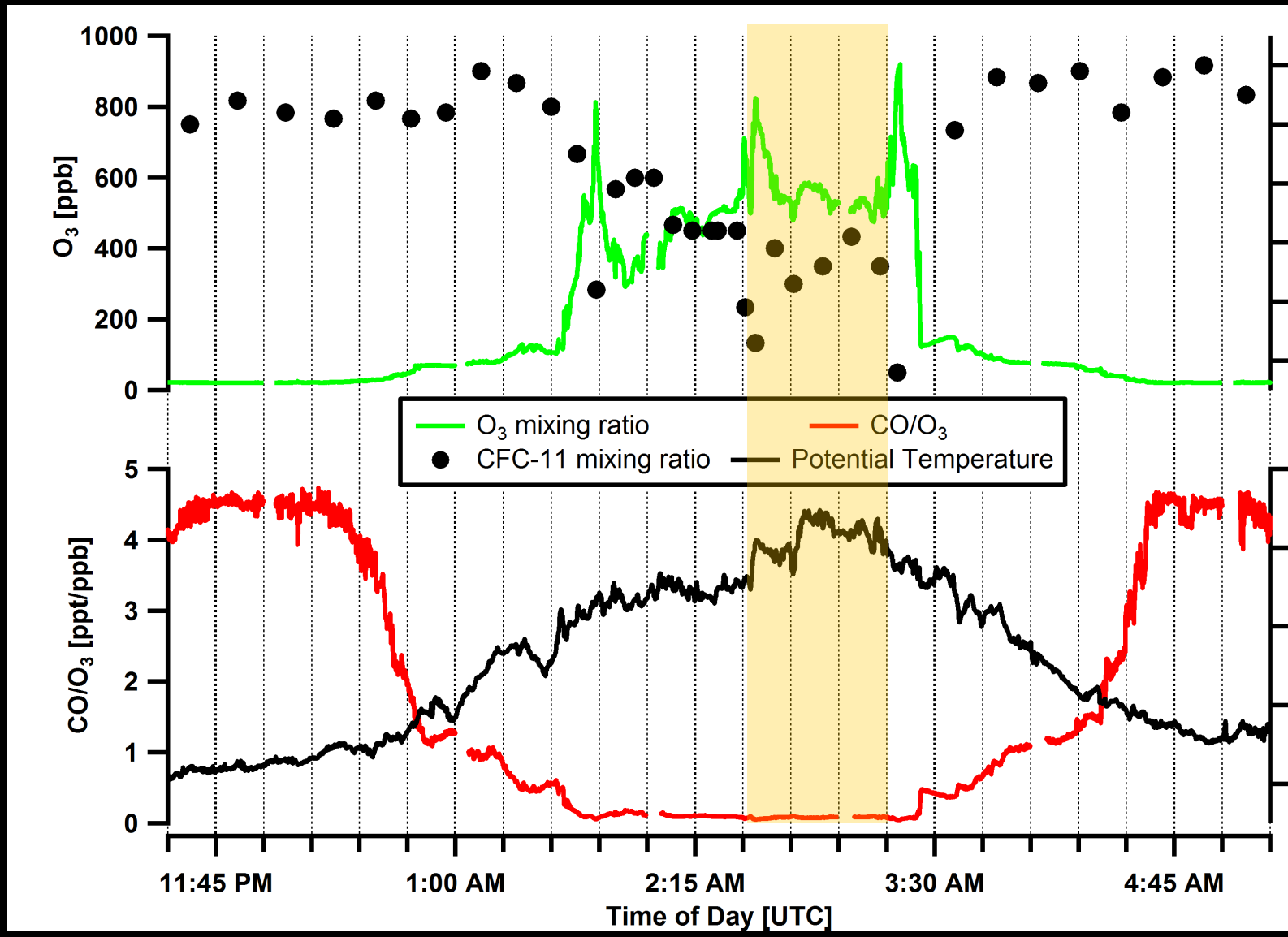


NTRAST RF15 – Two pairs of transitions

CFC-11 show
response when
craft enters the
sphere.

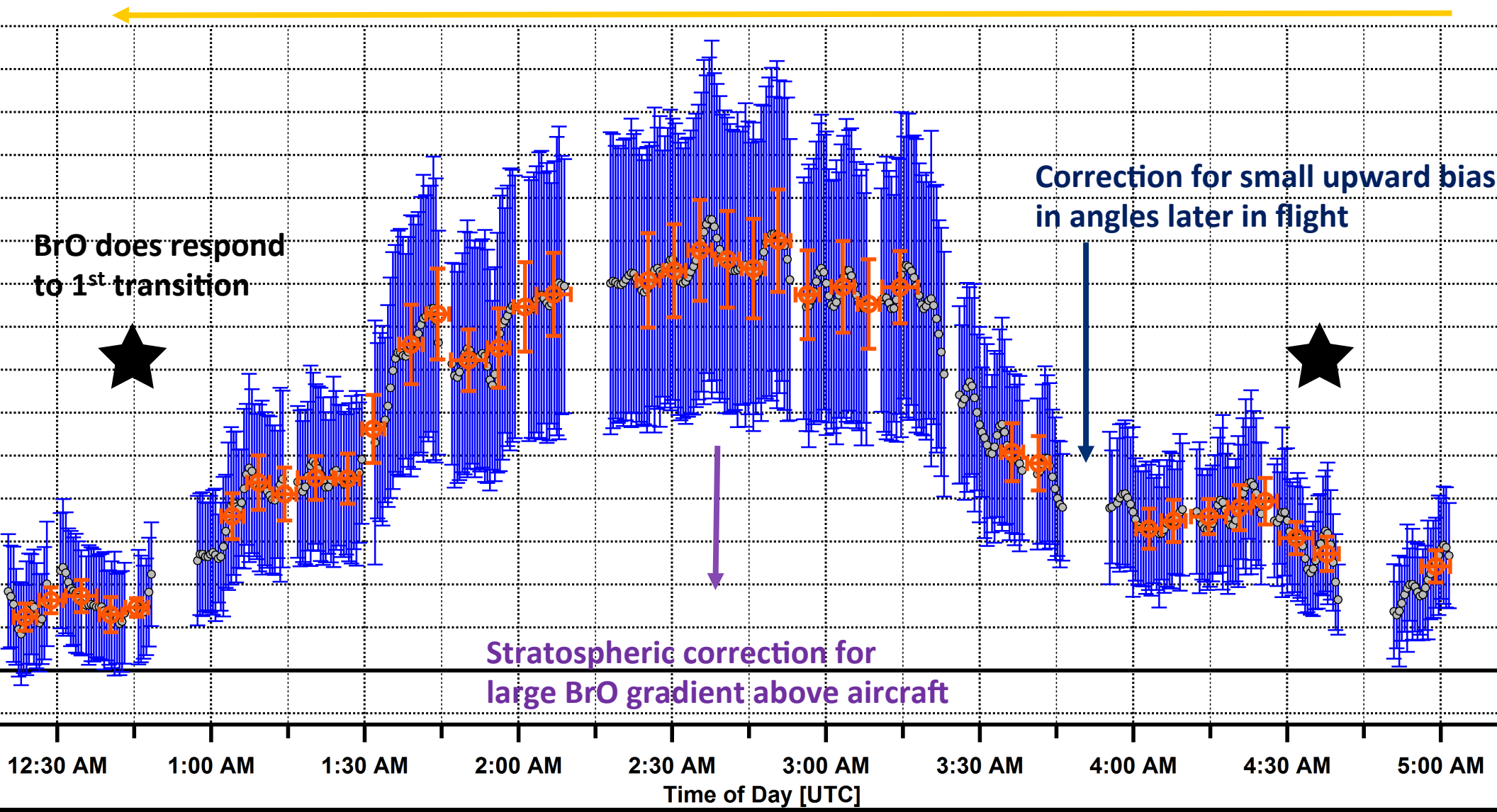
es 3 instances of
stratospheric air
ter and edges.

transition is more
potential
rature begins to
e, changes in
race gases



omine – Latest BrO measurements from AMAX-DOAS

Time stamp correction since AMAX looks ahead of aircraft

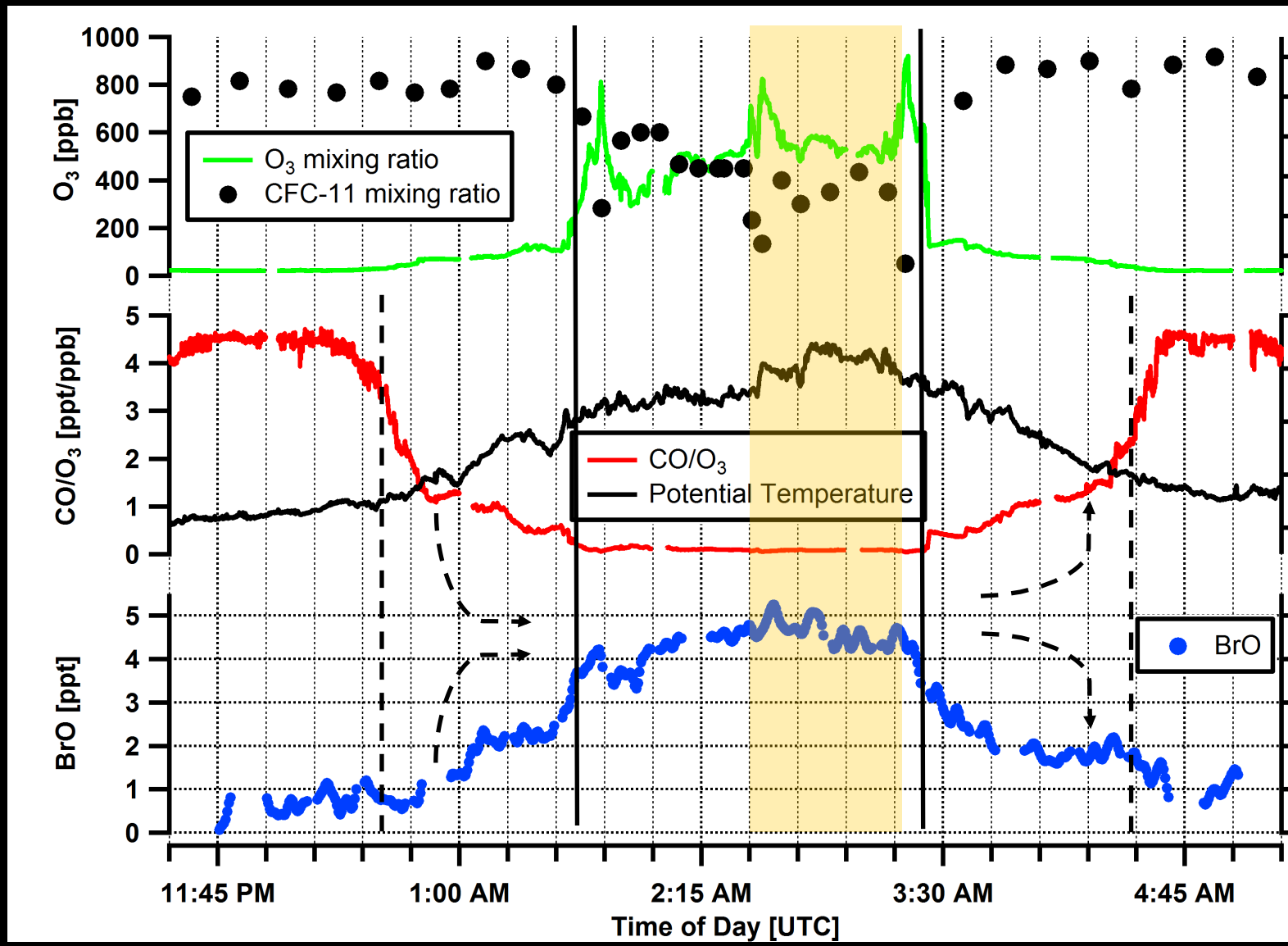


x & Volkamer poster for details

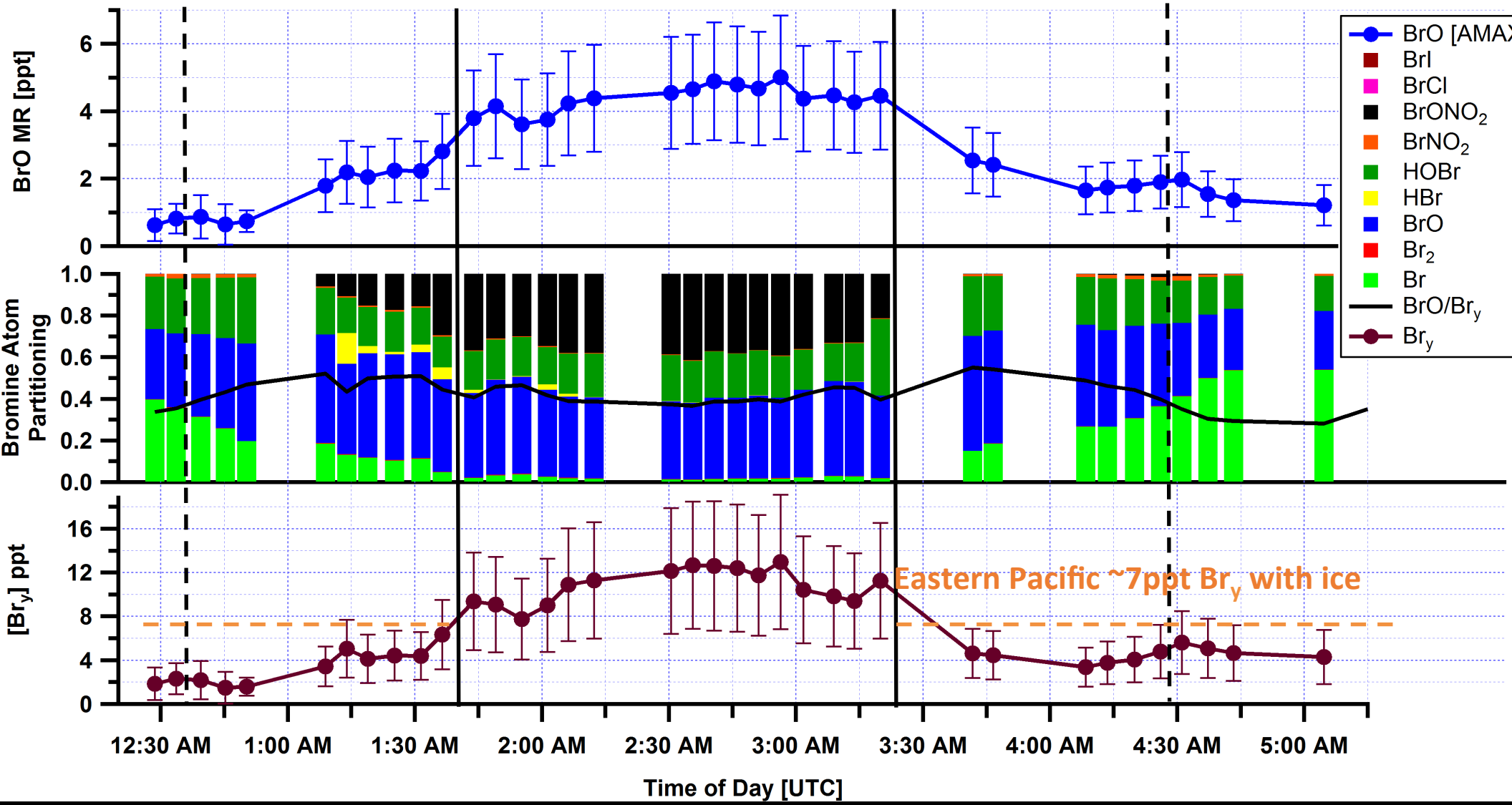
omine – BrO in Context

ange to the
sphere is abrupt
O as for other
s.

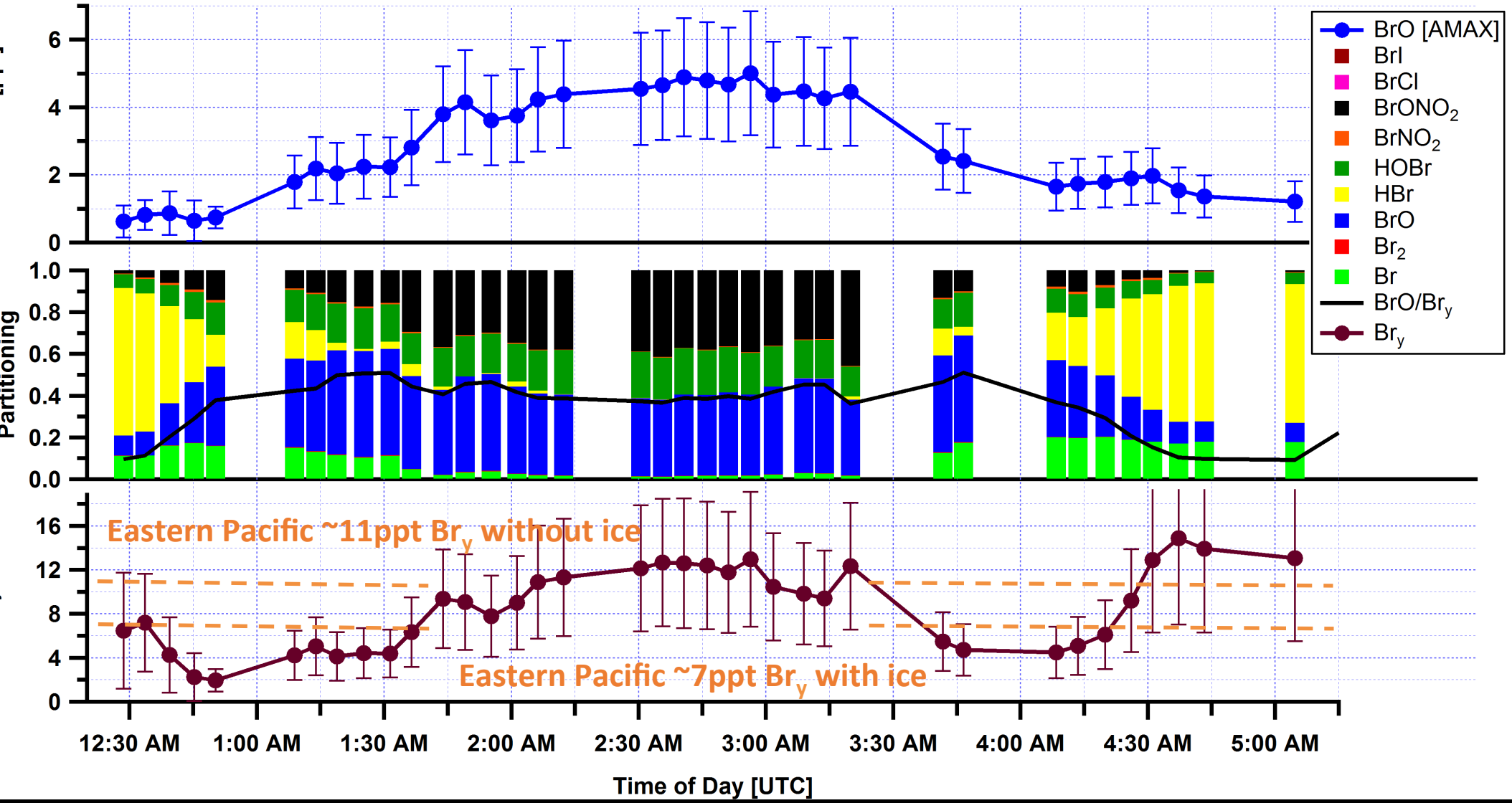
her transition is
subtle, including a
ion period and a
n with consistent



omine – Box Modeling to infer Br_y from BrO (with ice)

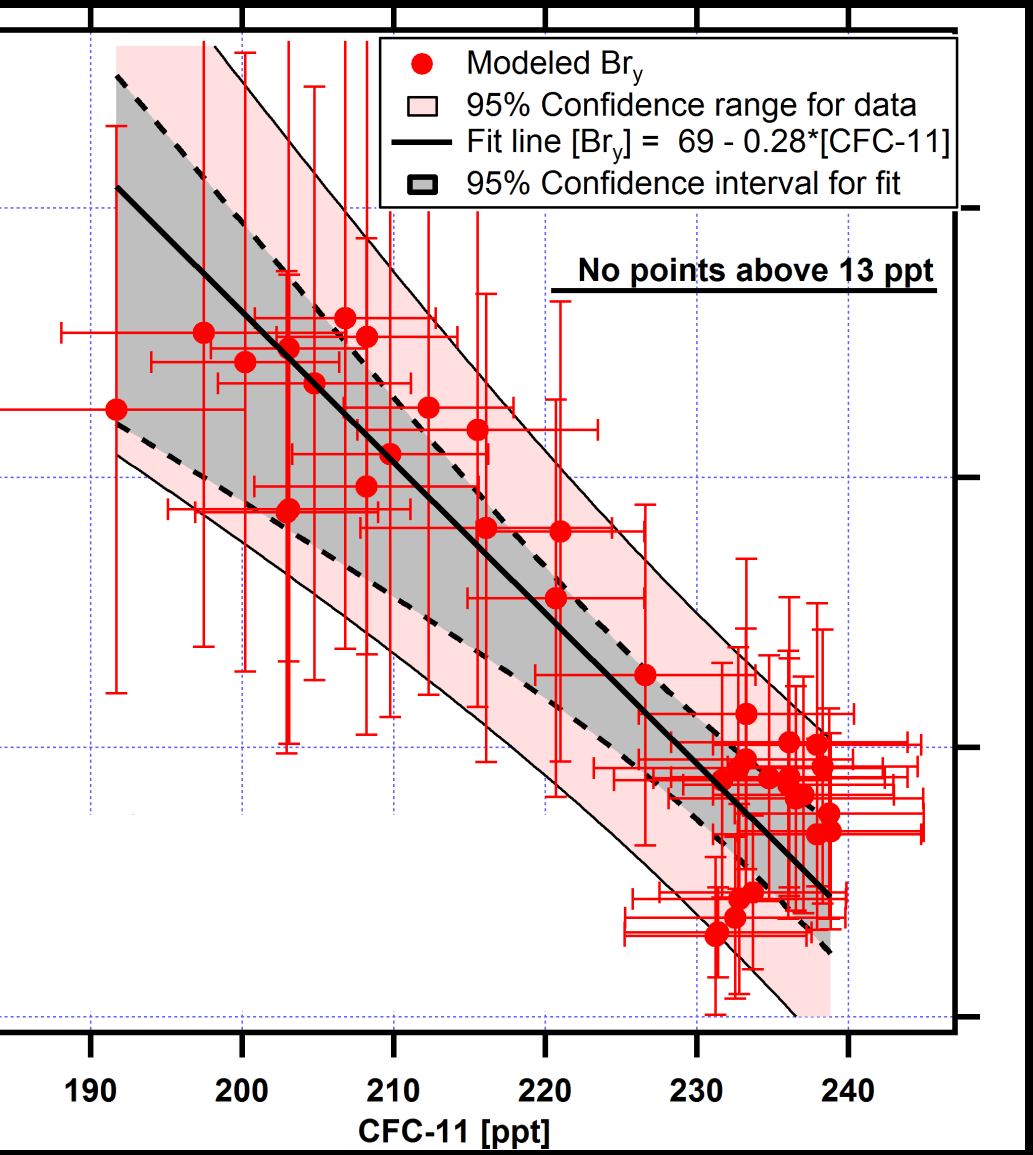


omine – Br_y not including ice recycling

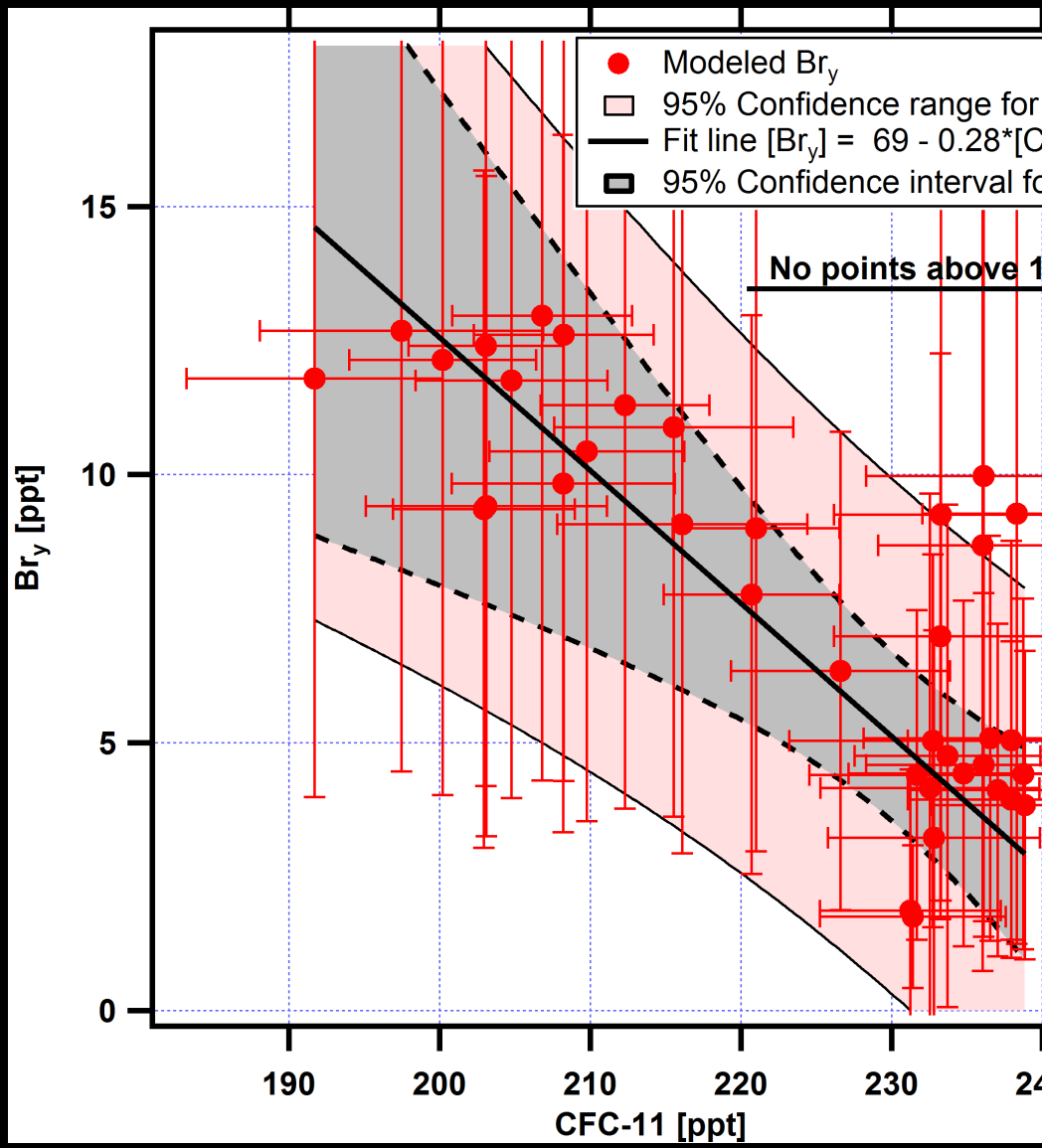


omine – Br_y against CFC-11

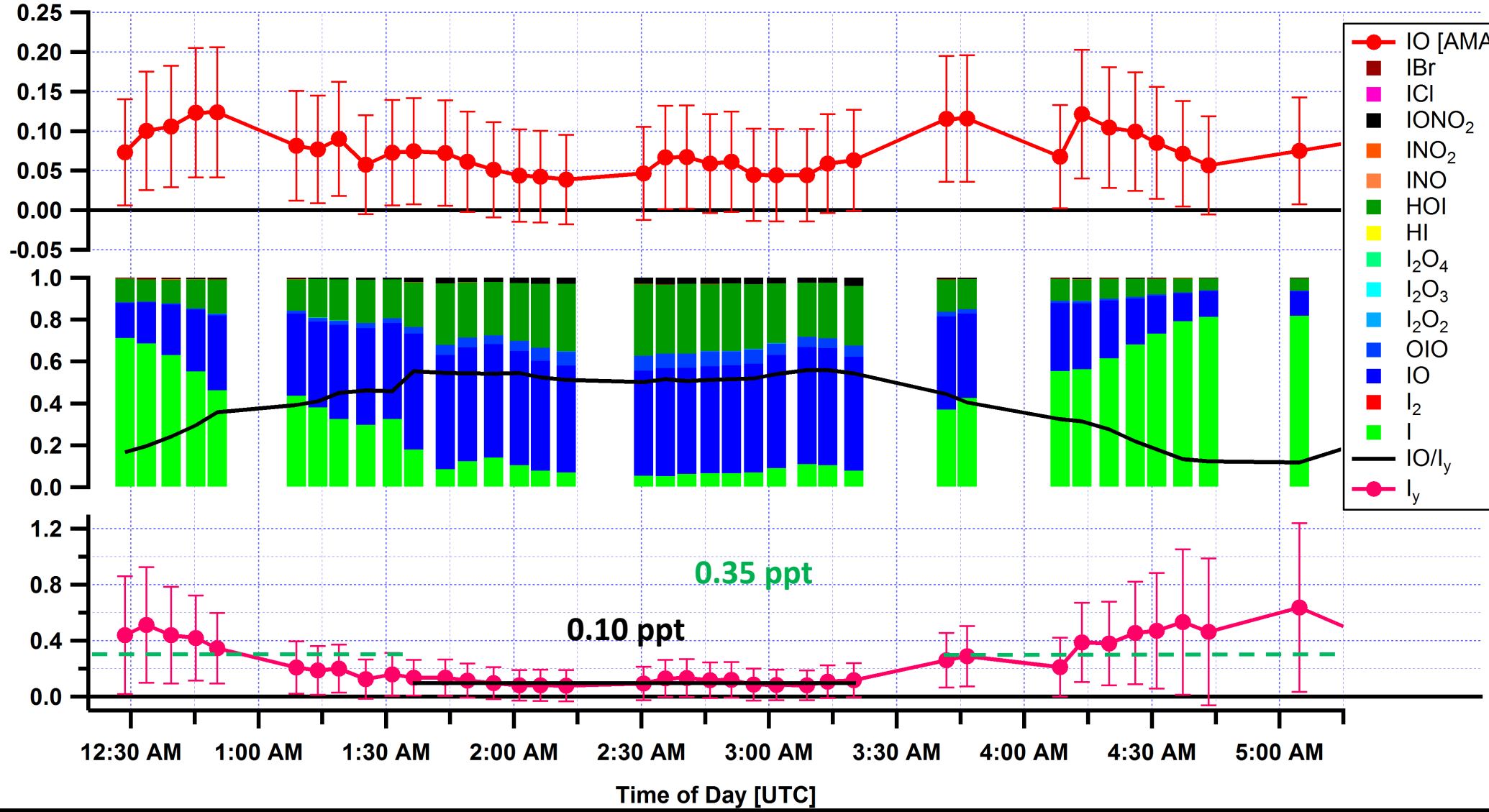
Ice case



Mean of two cases



ine – Box Modeling of I_y from IO (preliminary)



nclusion and Outlook

the inorganic bromine concentration in the TTL and LS?

- Average Ice case: 2.4-5.3 ppt Br_y (lower limit)
- Average from sensitivity studies: 2.6-7.9 ppt Br_y
- significant variability: 2 ppt < Br_y < 10ppt

8 - 13ppt Br_y (no sensitivity to het chem scheme)

7 – 11ppt Br_y

TTL Eastern Pacific
Volkamer et al., 2015, AMT
Wang et al. 2015, PNAS

inorganic iodine?

as detected and quantified in the LS

able IO and I_y during RF15: 0.1 – 0.6 ppt I_y

k in progress…

0.25 – 0.7 ppt I_y

TTL Eastern Pacific
Wang et al. 2015, PNAS
Saiz-Lopez et al., 2015, GRL

:

esults – apply CU box model to other case studi

sults – finalize IO data, I_y J-values, assess cross-hal

O measurements from AMAX-DOAS? Preliminary re

osphere (work in progress)

BrO data has been submitted to the CONTRAST data archive. Interested? Please contact: rainer.volkamer@colorado.edu

owledgements

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e Volkamer Group for help with the DOAS lysis

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