A photograph taken from an airplane window, showing a vibrant rainbow arching over a vast expanse of white clouds and blue ocean. The wing and part of the fuselage of the airplane are visible on the left side of the frame.

Behavior of dry layers in GFS analyses

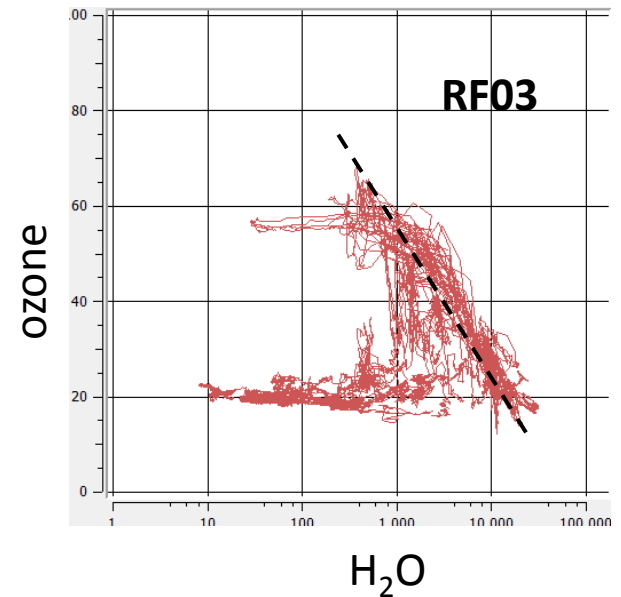
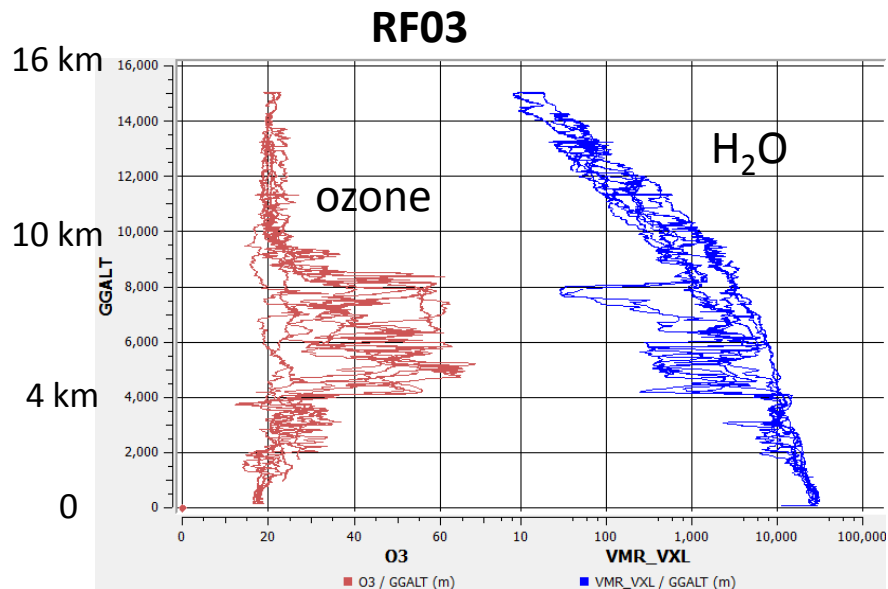
Bill Randel¹ and Louis Rivoire²

¹NCAR

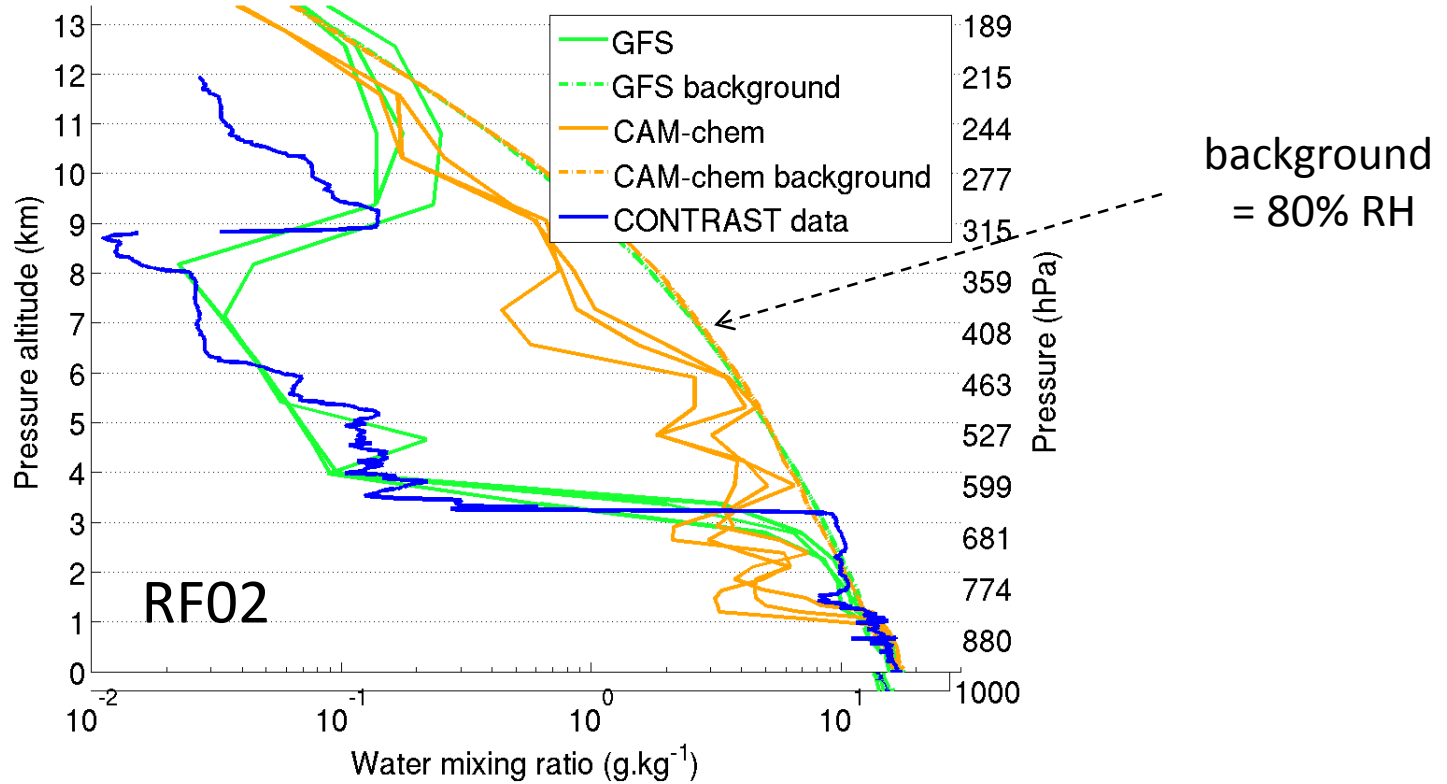
²École Normale Supérieure, Paris

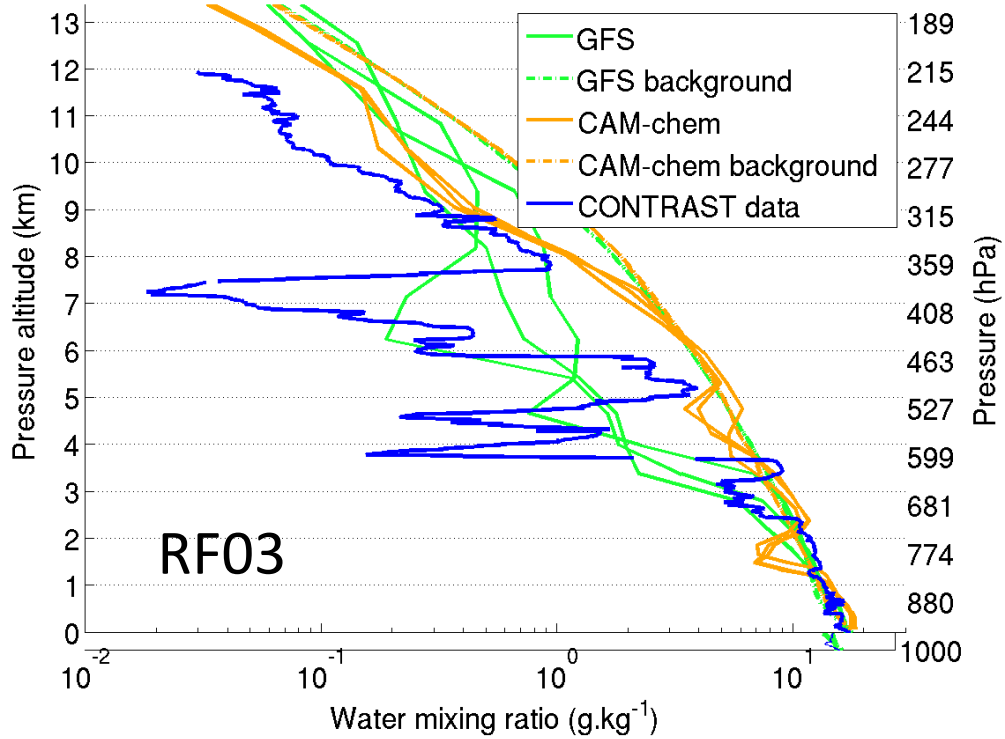
Intro:

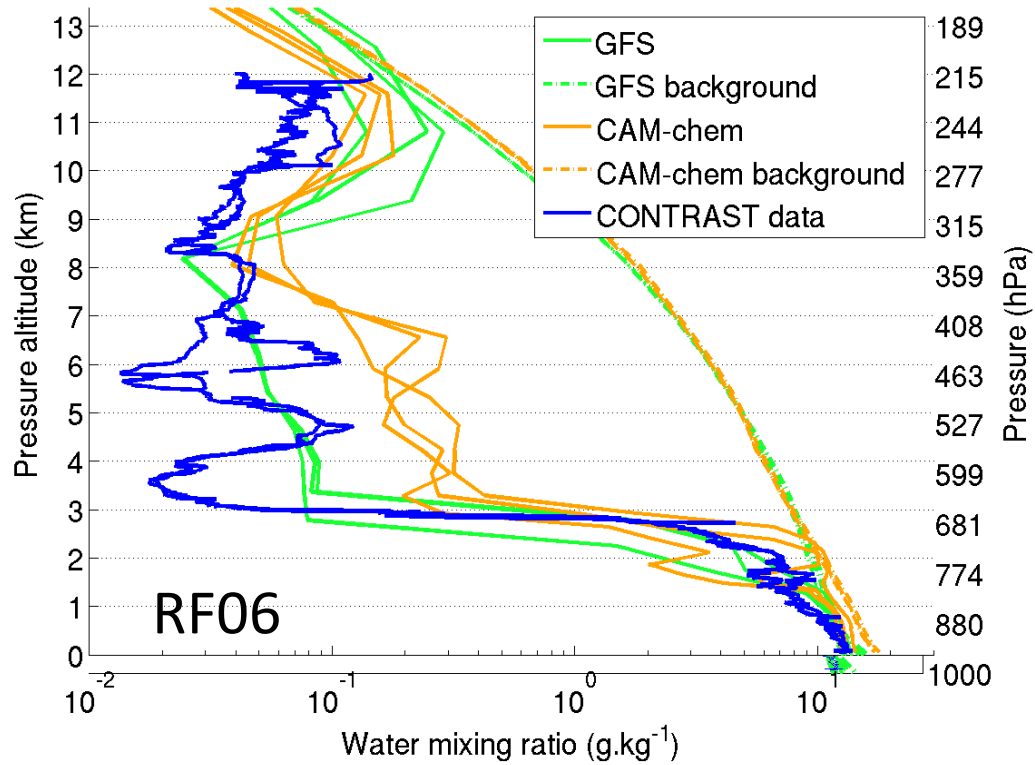
- Ubiquitous dry, high ozone layers observed during CONTRAST
- Comparisons of CONTRAST H₂O profiles with GFS analyses
- Climatology of dry layers in GFS data
- Origin of dry layers: high resolution RDF results

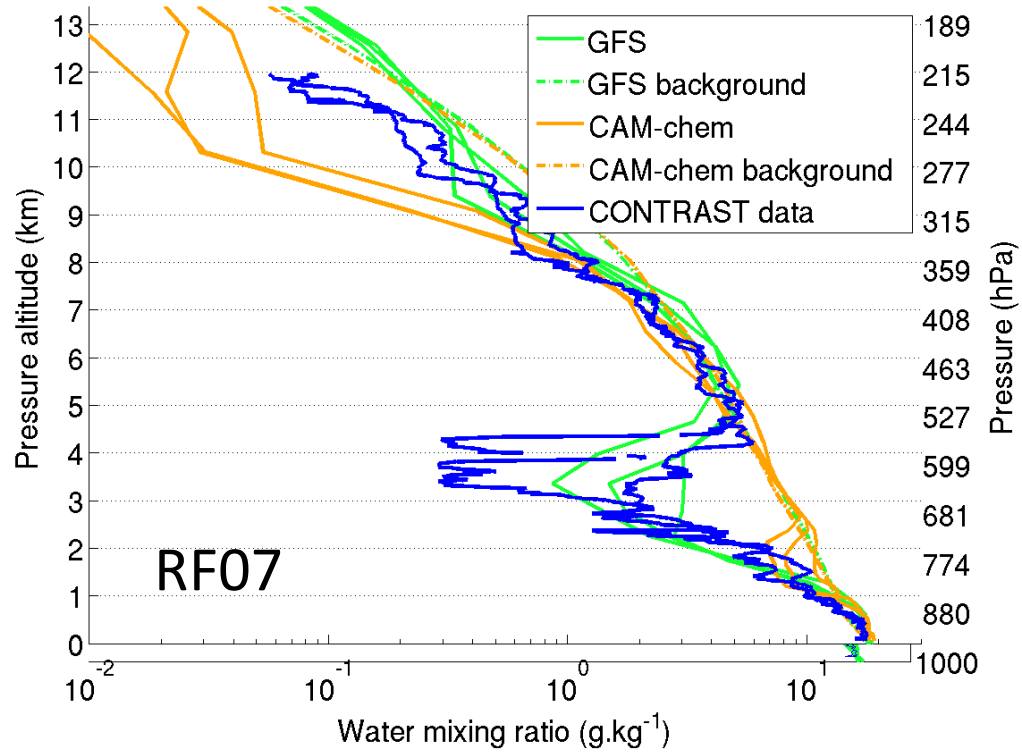


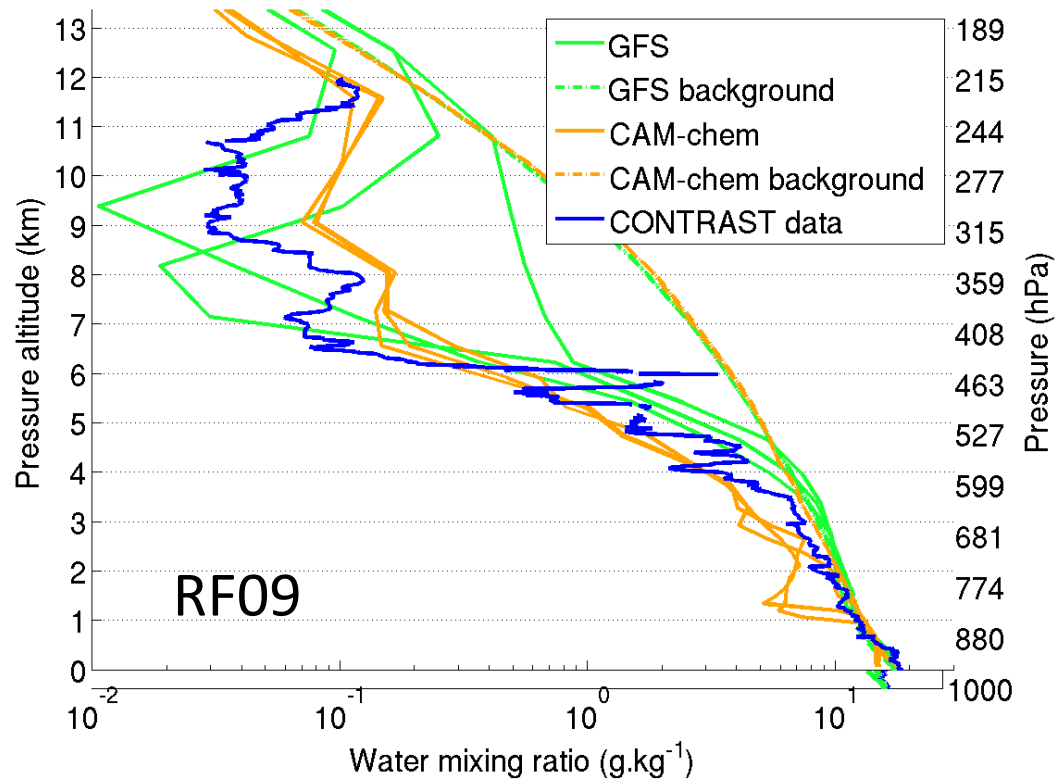
Comparisons of CONTRAST profiles with nearby GFS (and CAM-Chem)

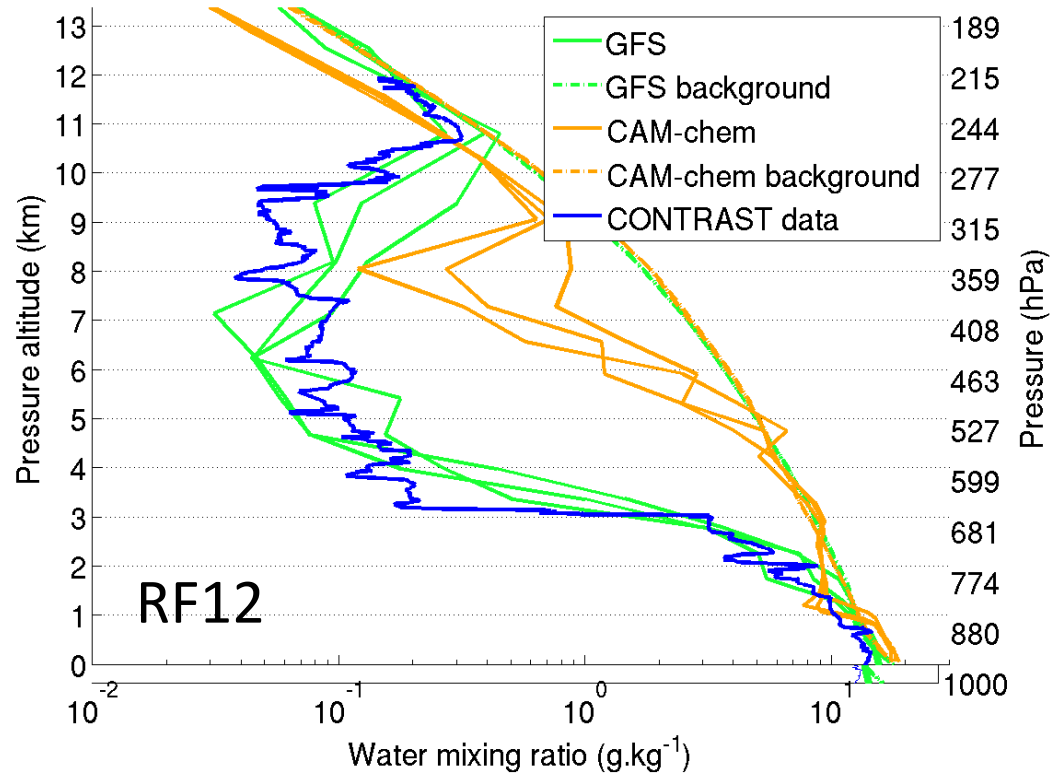






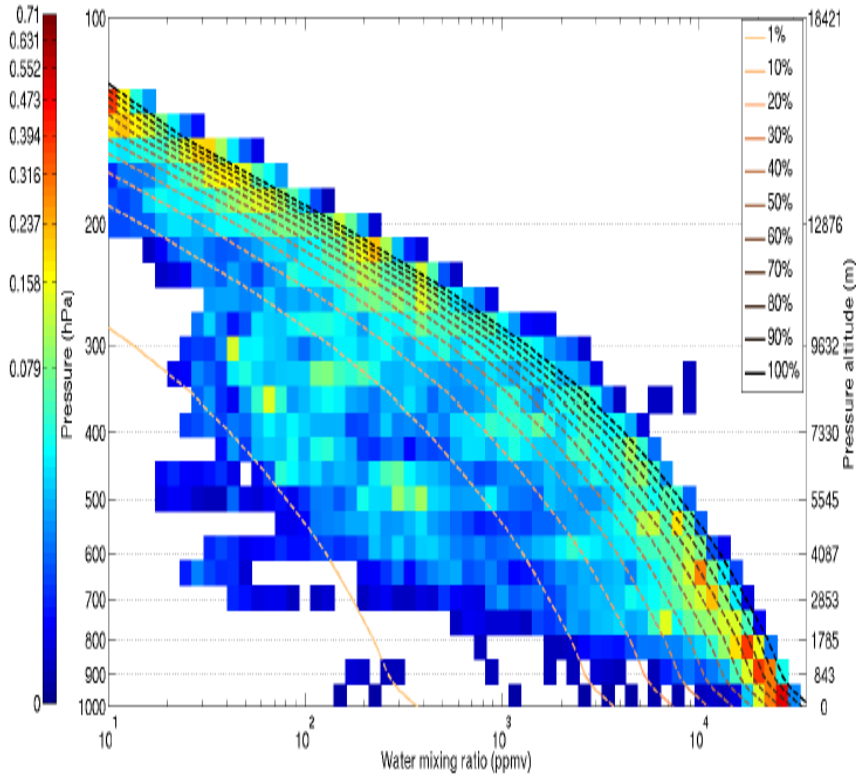






PDF's of H₂O vs. altitude

CONTRAST



(a) CONTRAST

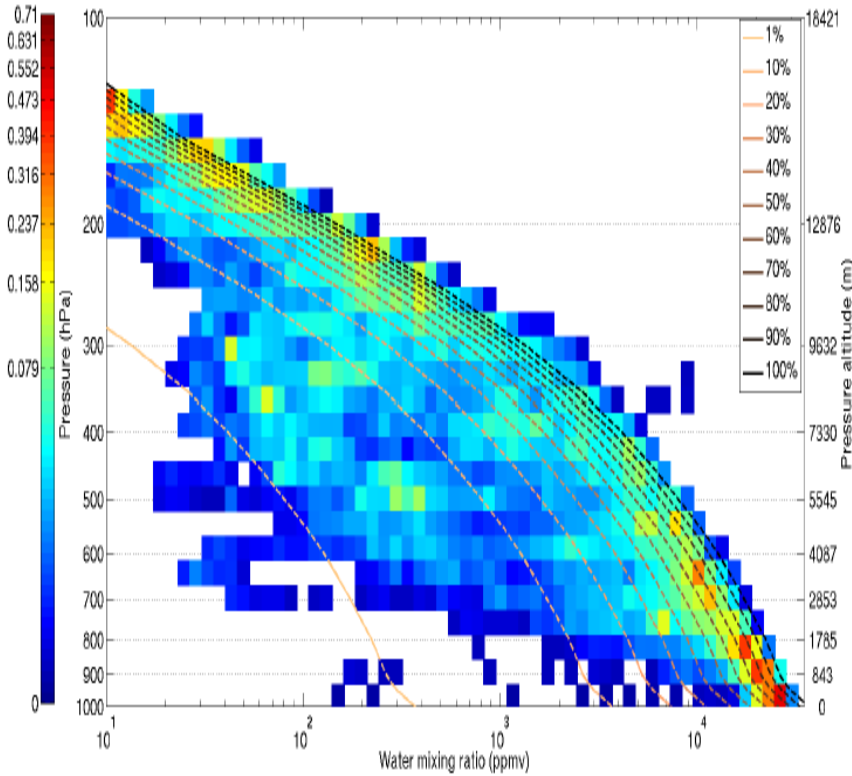
PDF's of H₂O vs. altitude

in a region near Guam

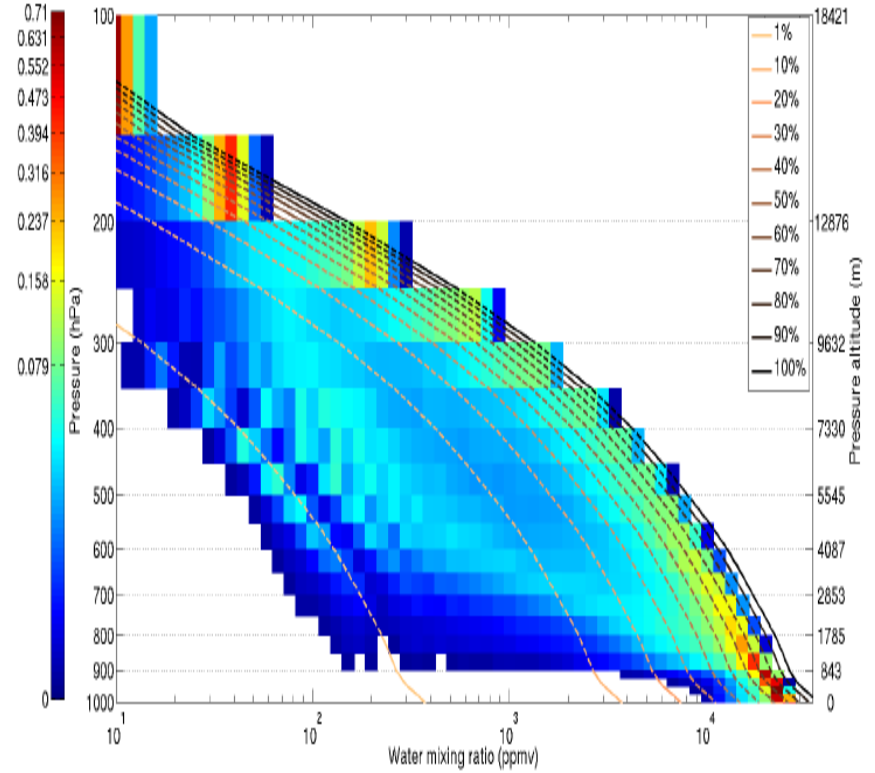


CONTRAST

GFS



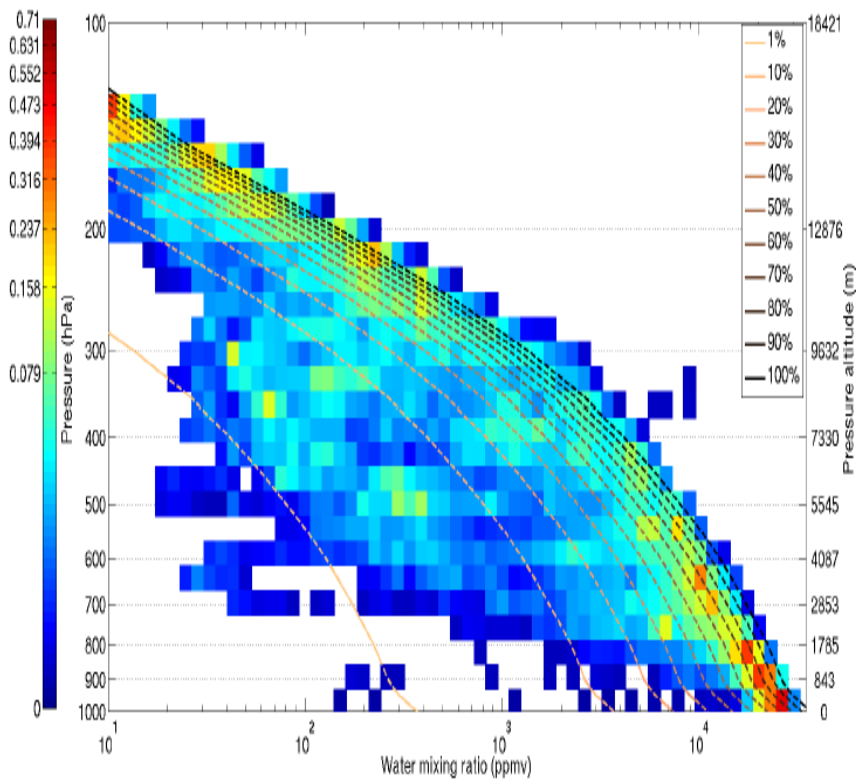
(a) CONTRAST



(b) GFS

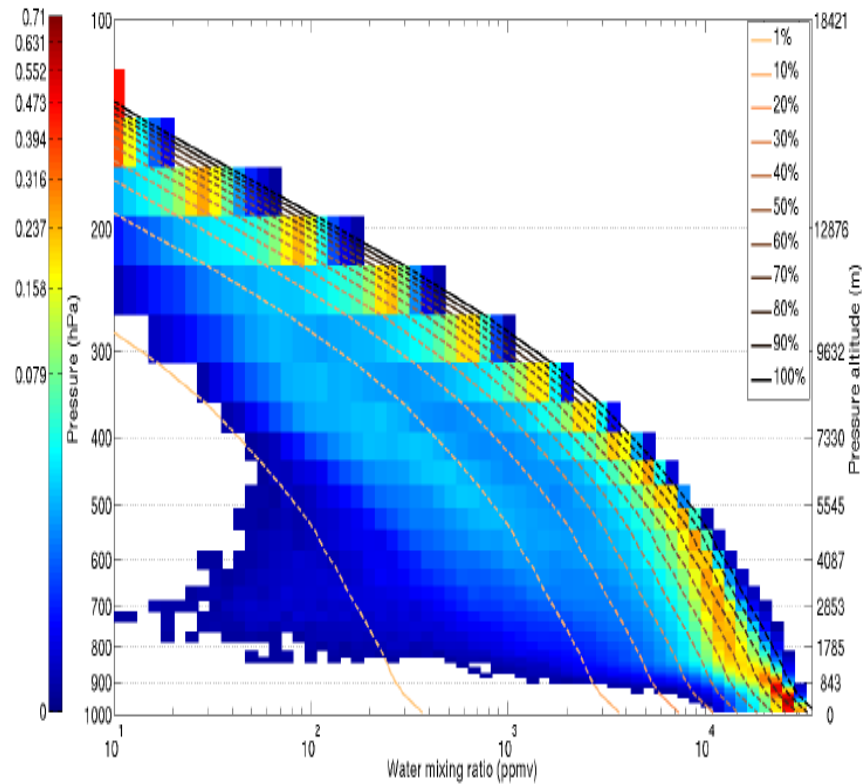
PDF's of H₂O vs. altitude

CONTRAST



(a) CONTRAST

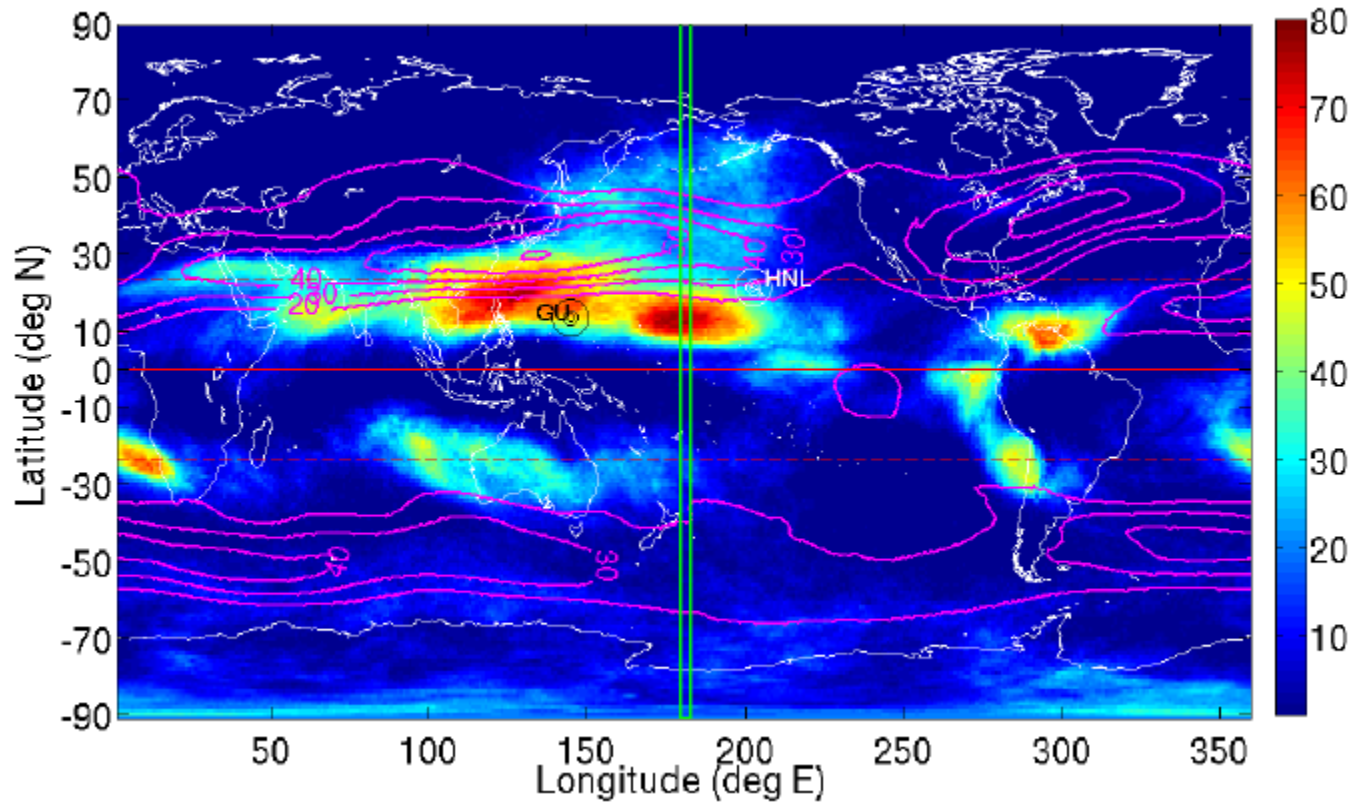
CAM-Chem



(c) CAM-chem

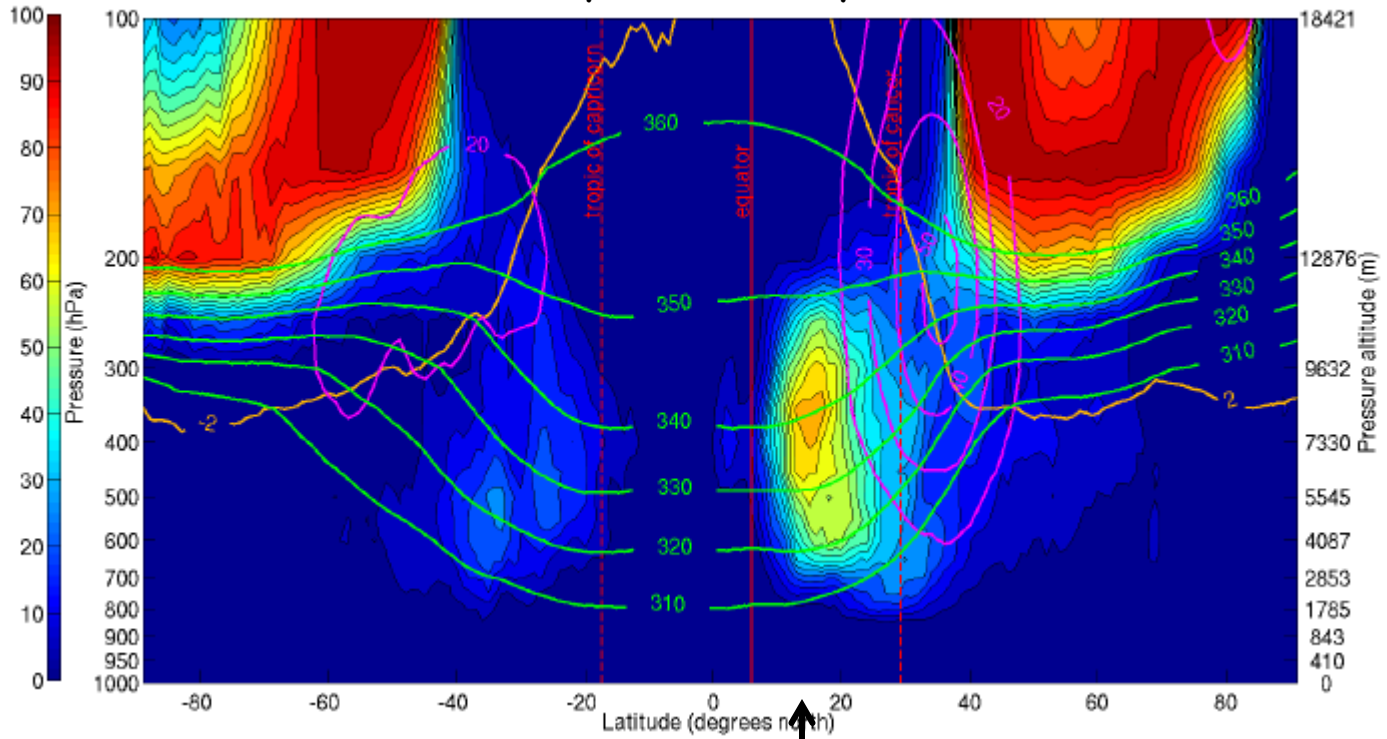
GFS frequency of very dry layers (<8% RH)

January - February 2014 340 K

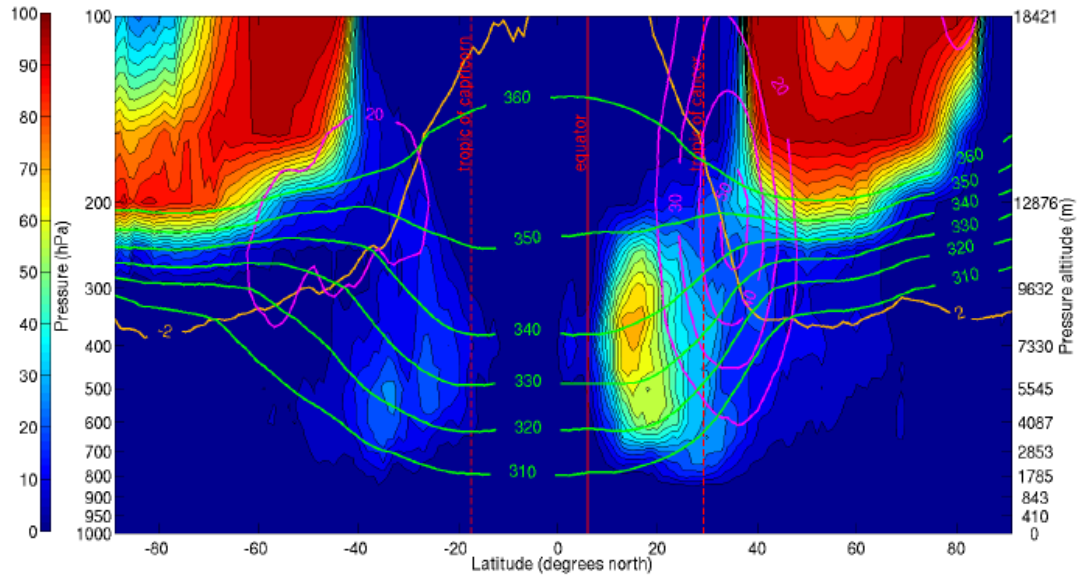


GFS frequency of very dry layers (<8% RH)

January - February 2014

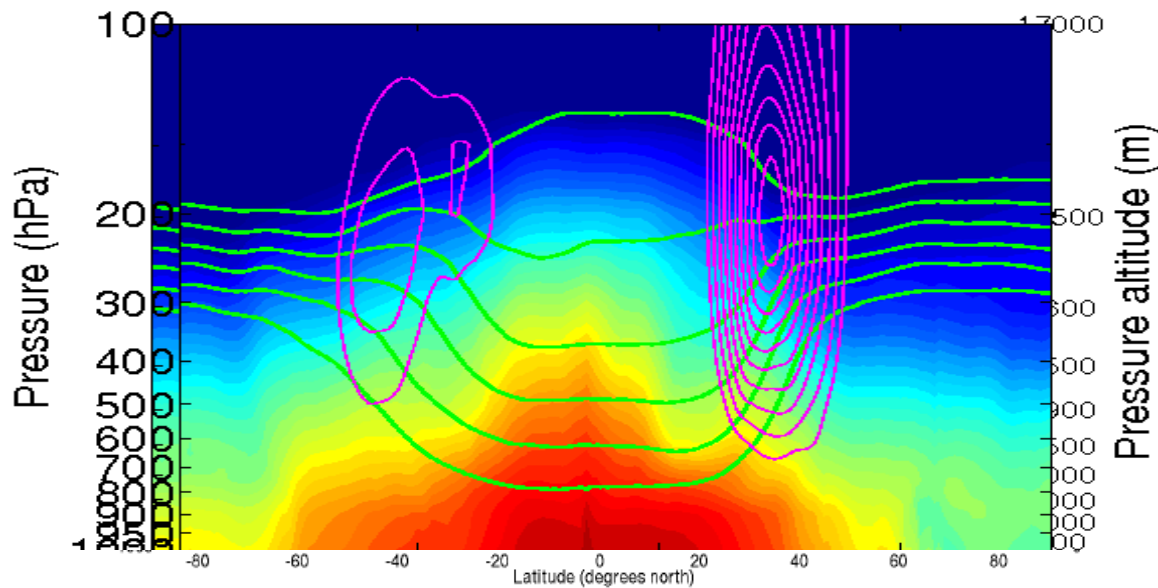


Guam

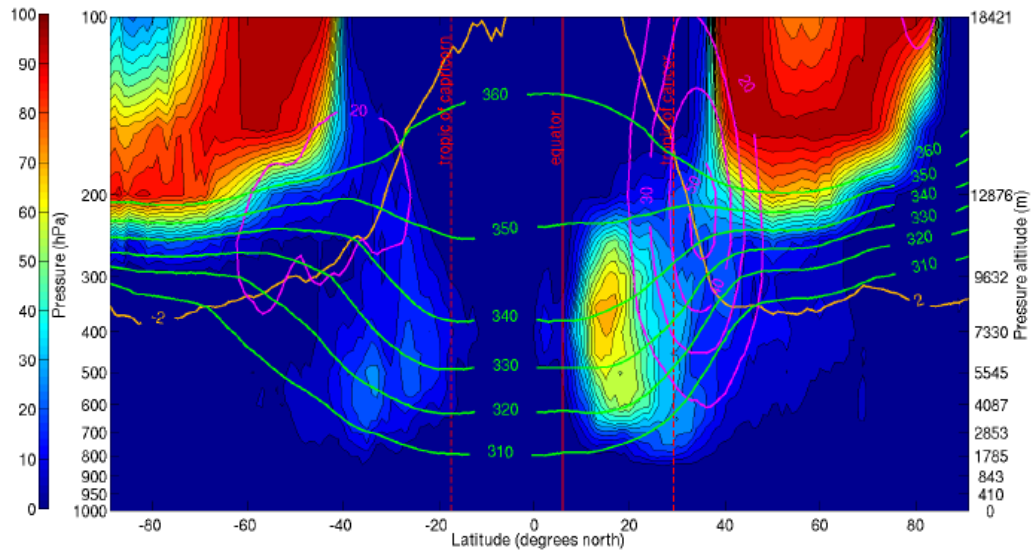


(a) CES

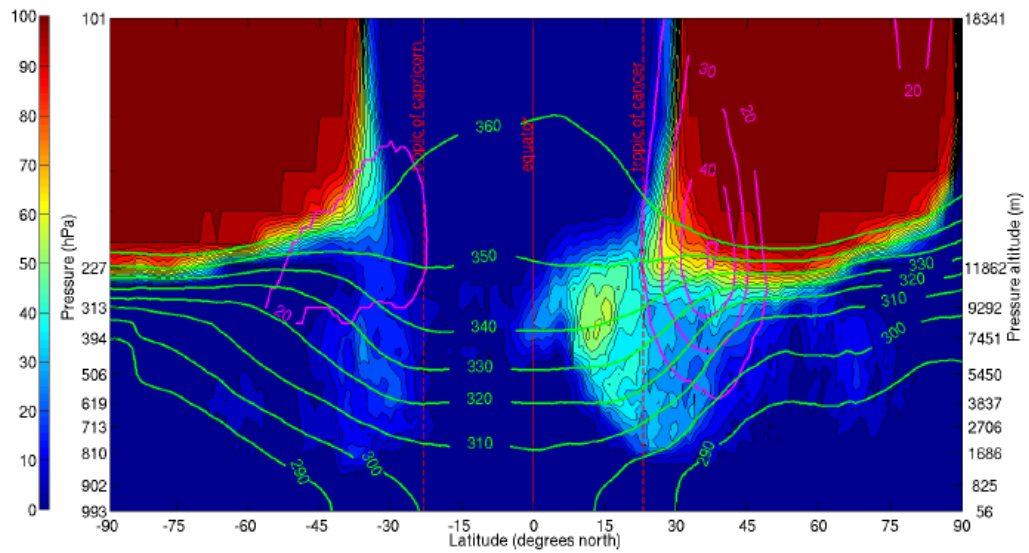
frequency of
very dry layers



background
H₂O structure



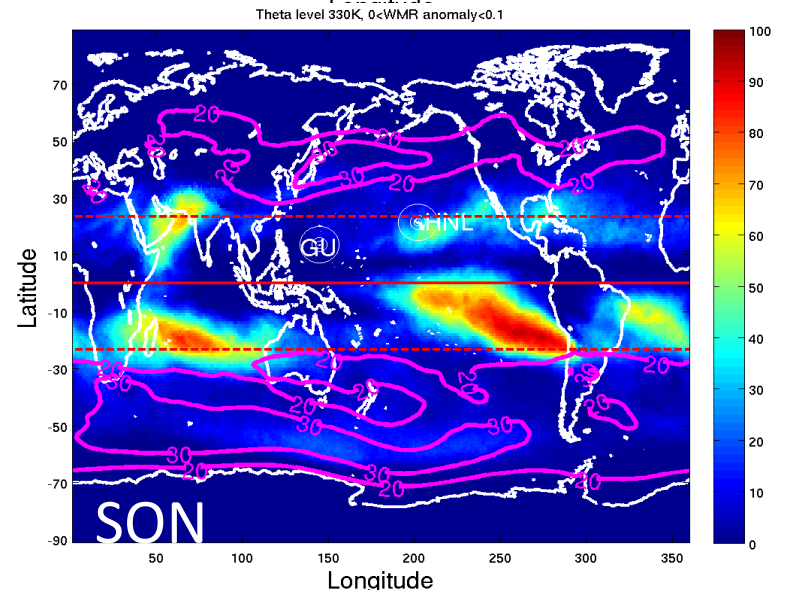
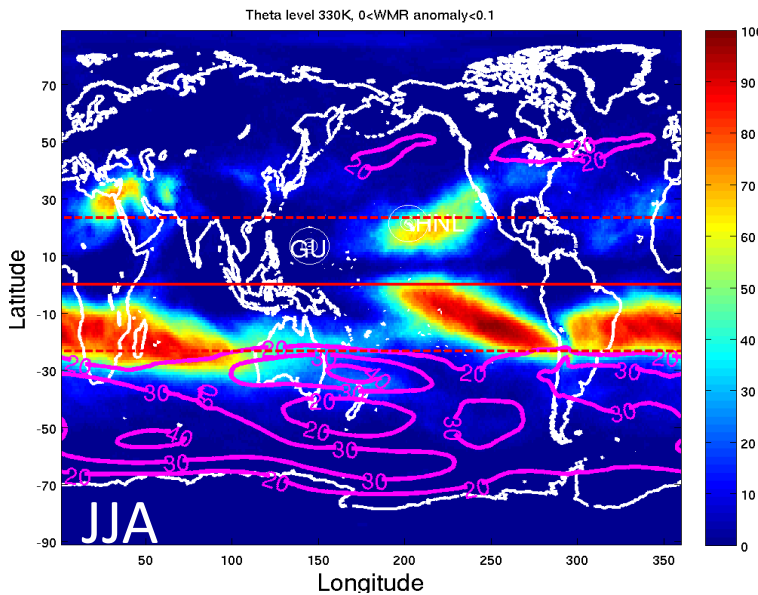
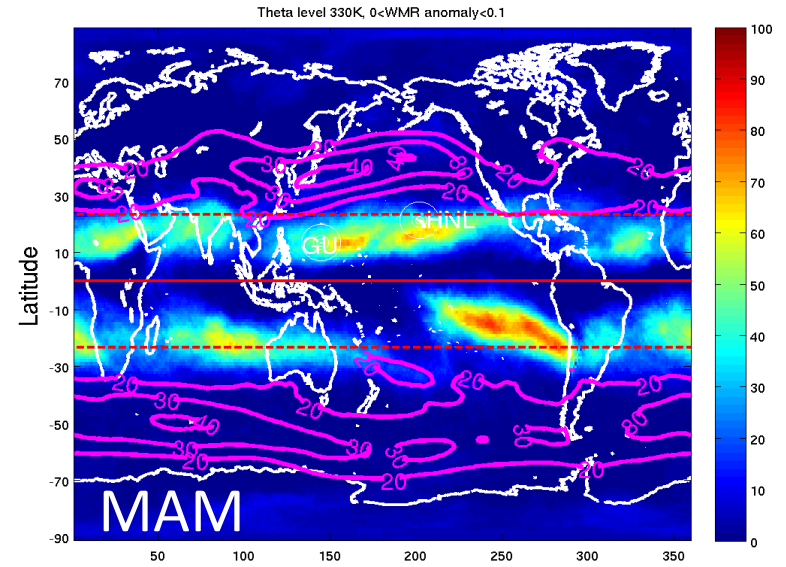
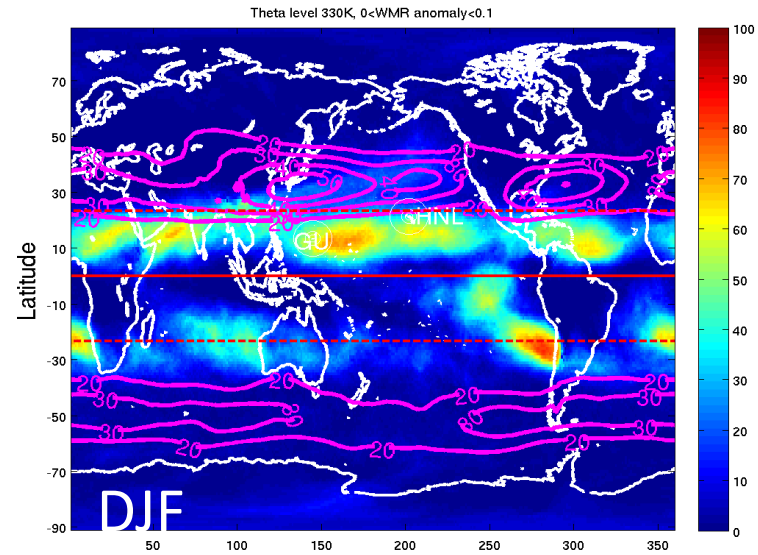
GFS



CAM-Chem

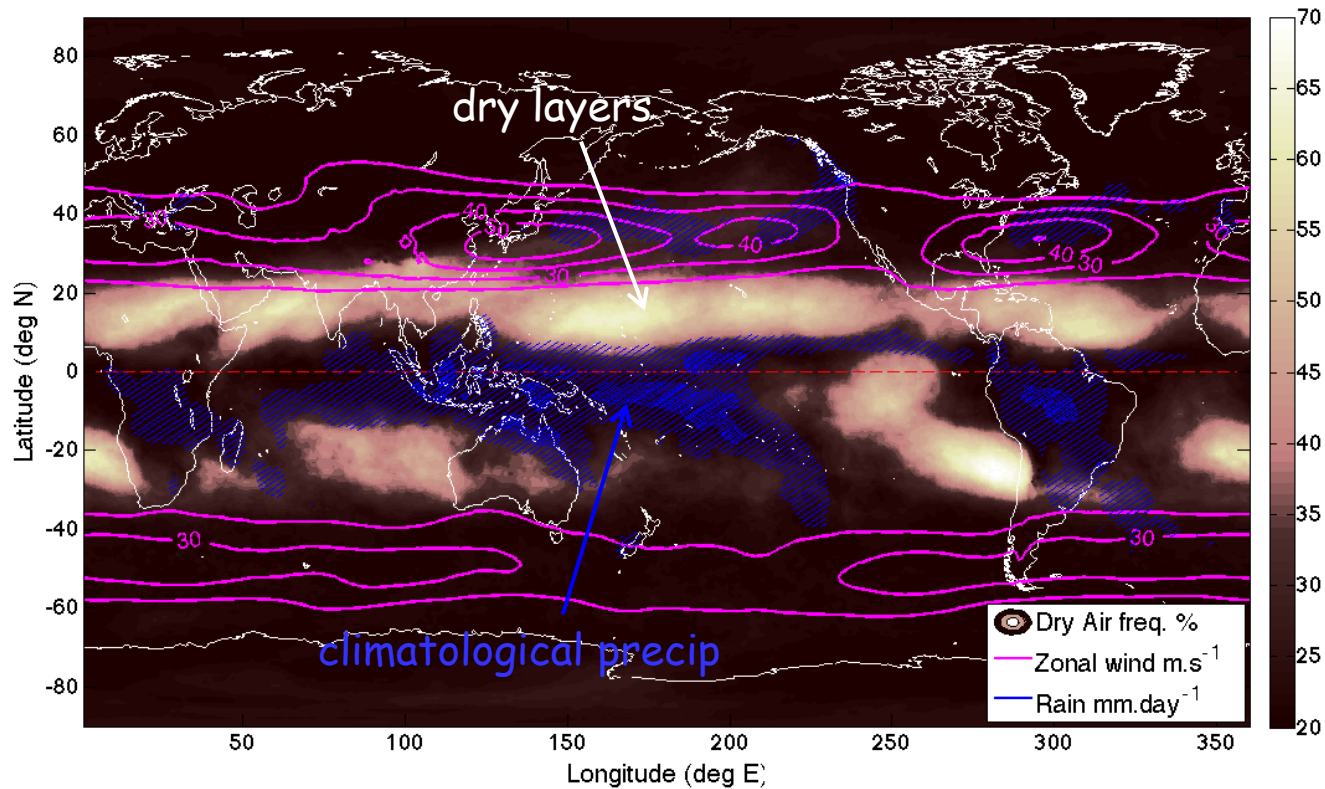
(b) CAM-chem

Global climatology from GFS at 330 K



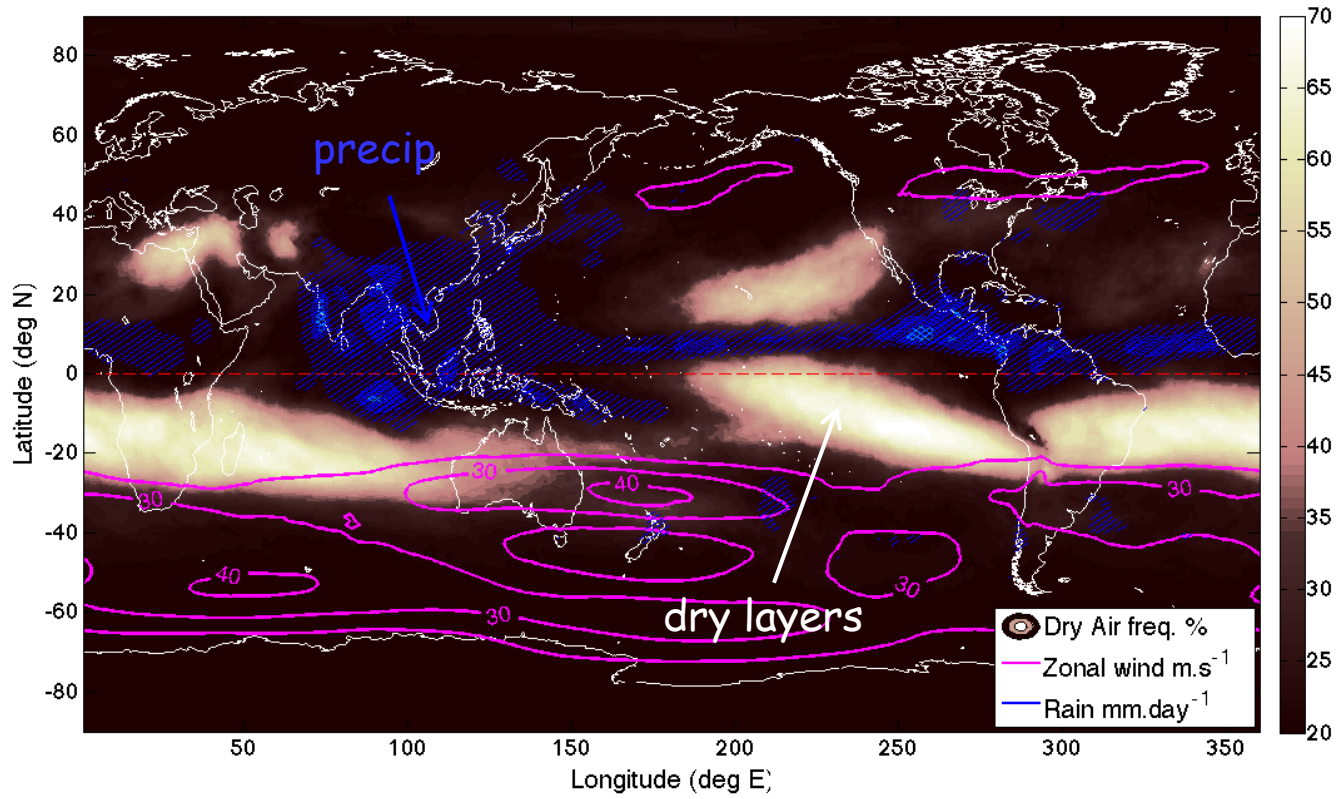
Frequent dry layers fill tropical regions outside of precipitation

DJF



Note dry regions are also regions of downwelling Hadley circulation

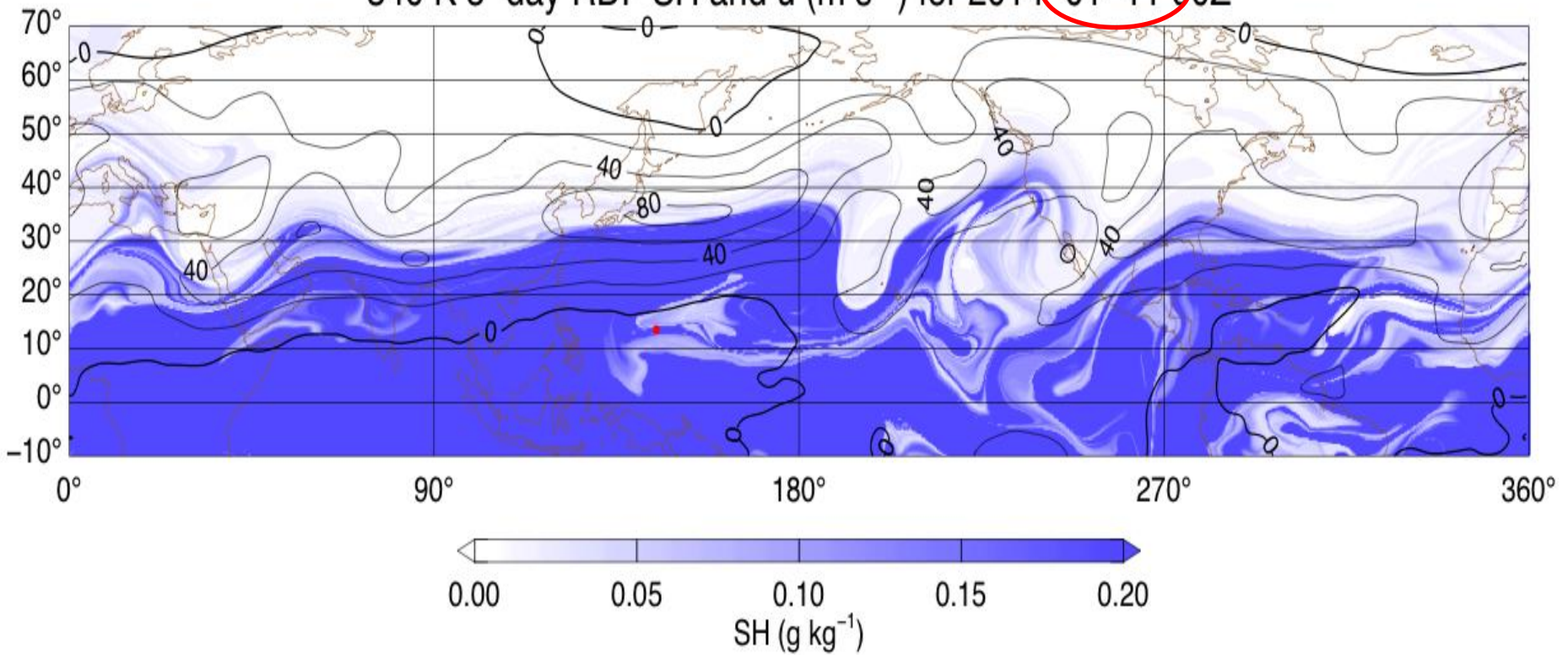
JJA



High resolution Reverse Domain Filling (RDF) calculations

from Ken Bowman, Texas A&M

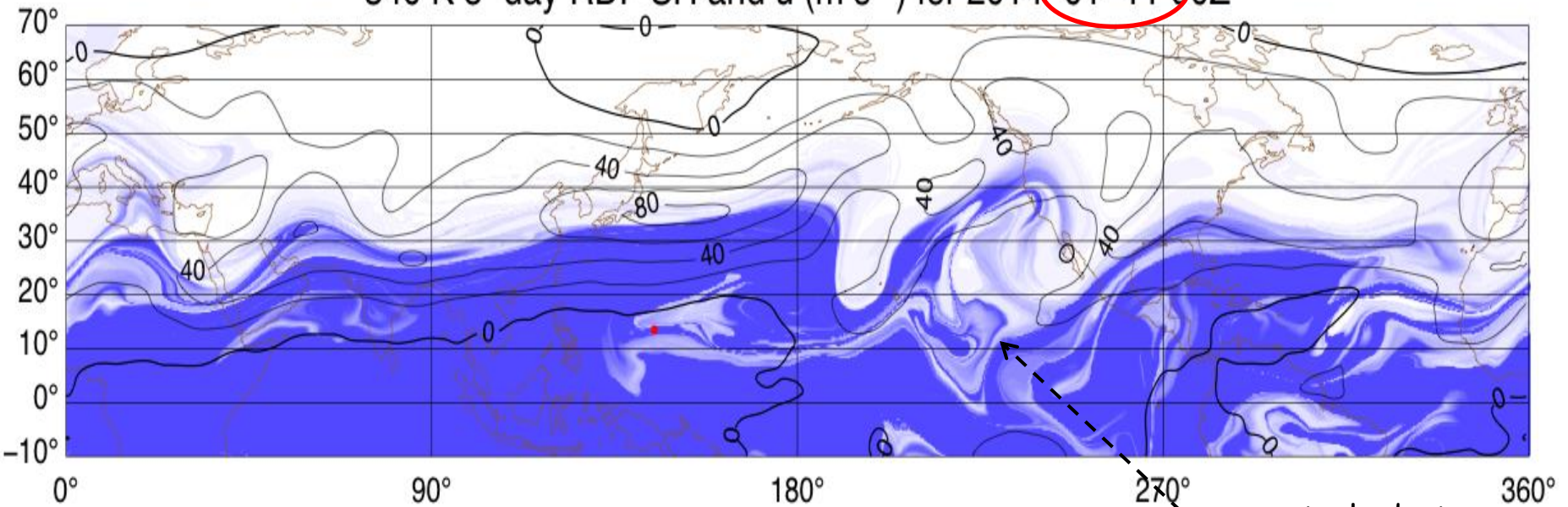
340 K 5-day RDF SH and u (m s^{-1}) for 2014-01-11 00Z



High resolution Reverse Domain Filling (RDF) calculations

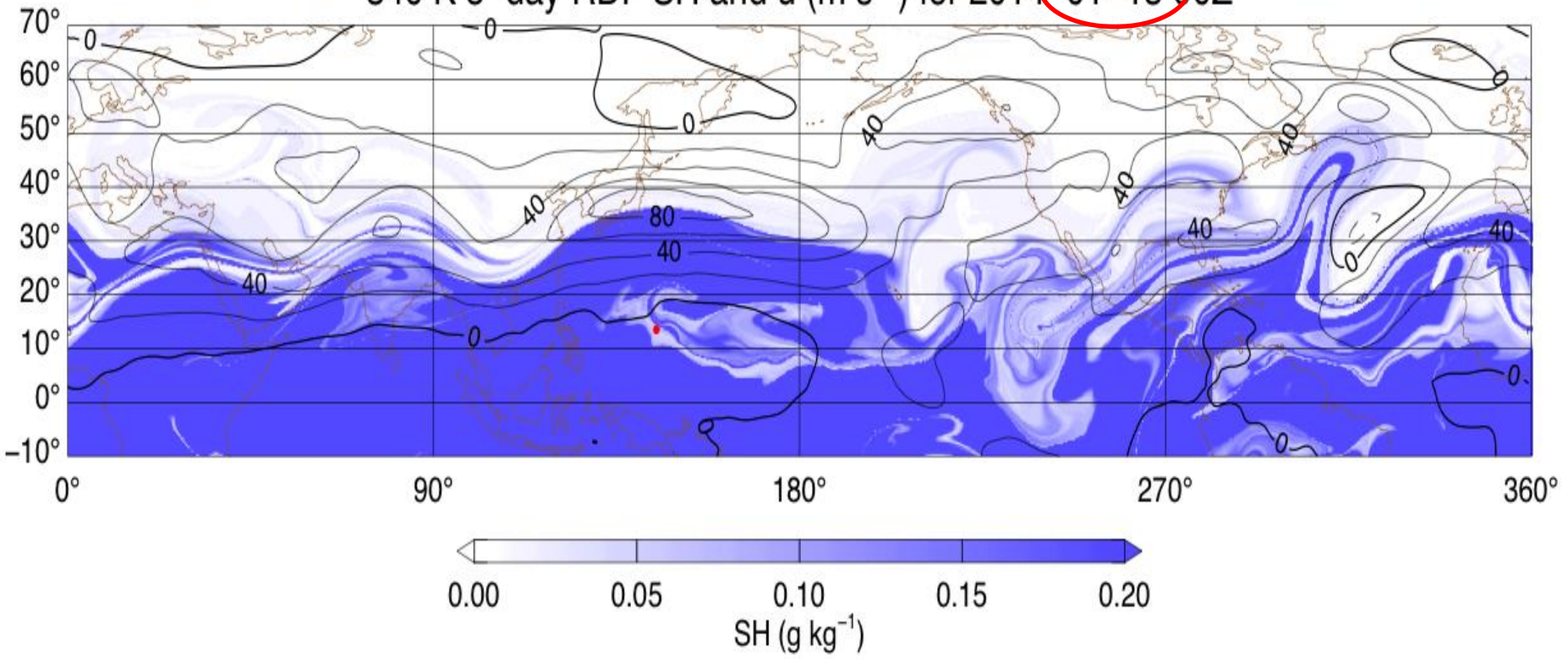
from Ken Bowman, Texas A&M

340 K 5-day RDF SH and u (m s^{-1}) for 2014-01-11 00Z

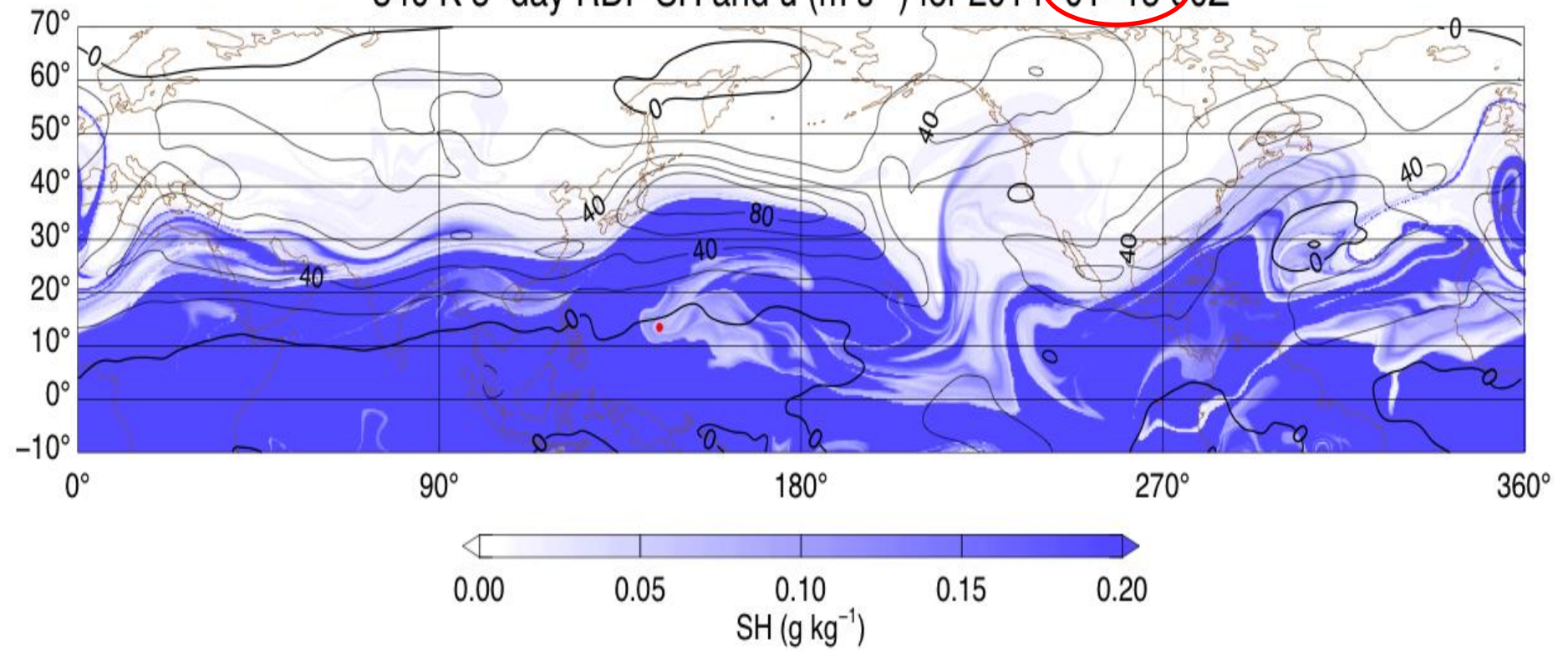


westerly duct

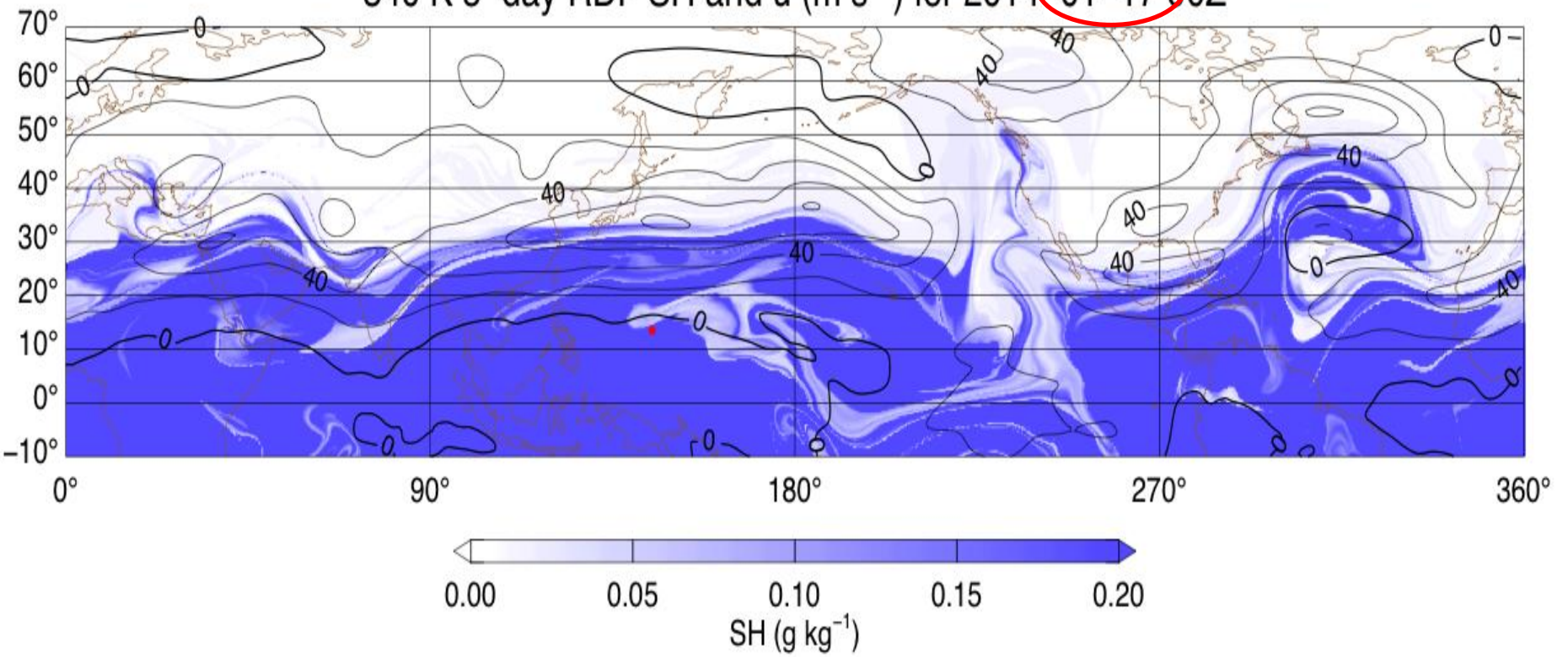
340 K 5-day RDF SH and u (m s^{-1}) for 2014-01-13 00Z



340 K 5-day RDF SH and u (m s^{-1}) for 2014-01-15 00Z

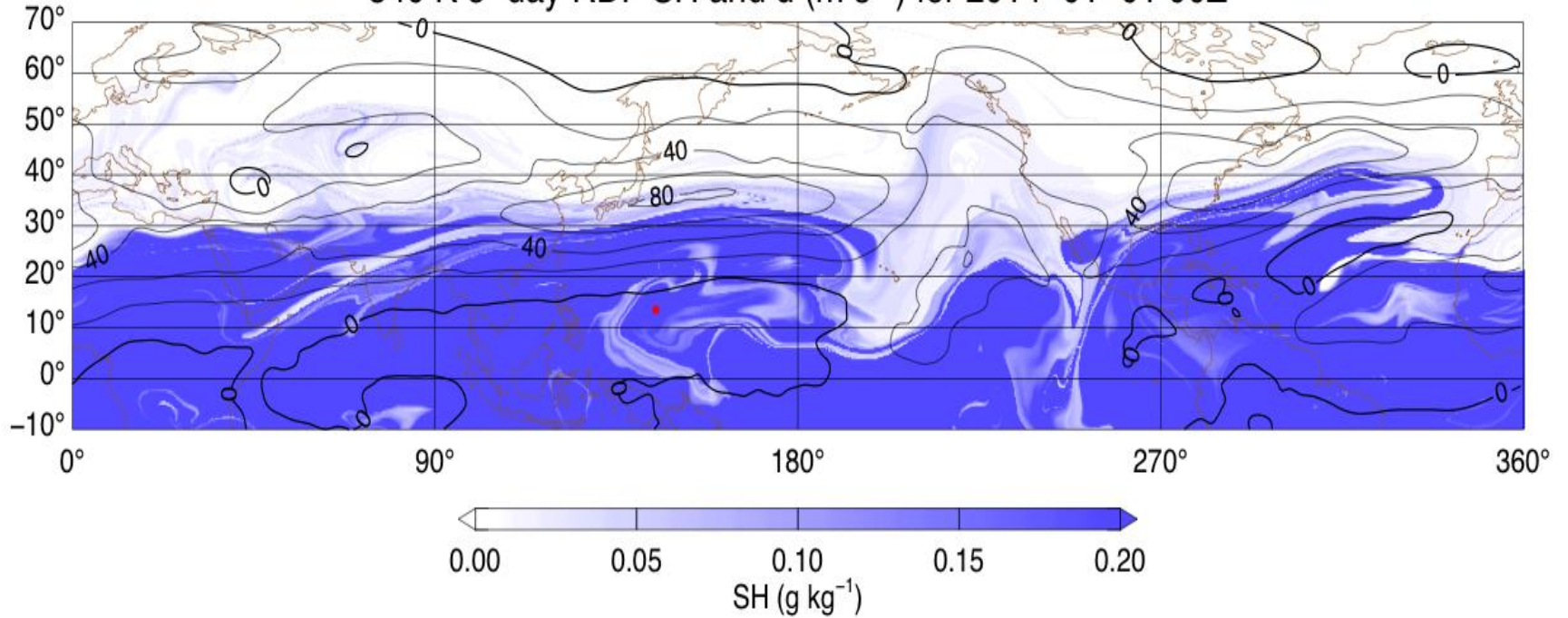


340 K 5-day RDF SH and u (m s^{-1}) for 2014-01-17 00Z



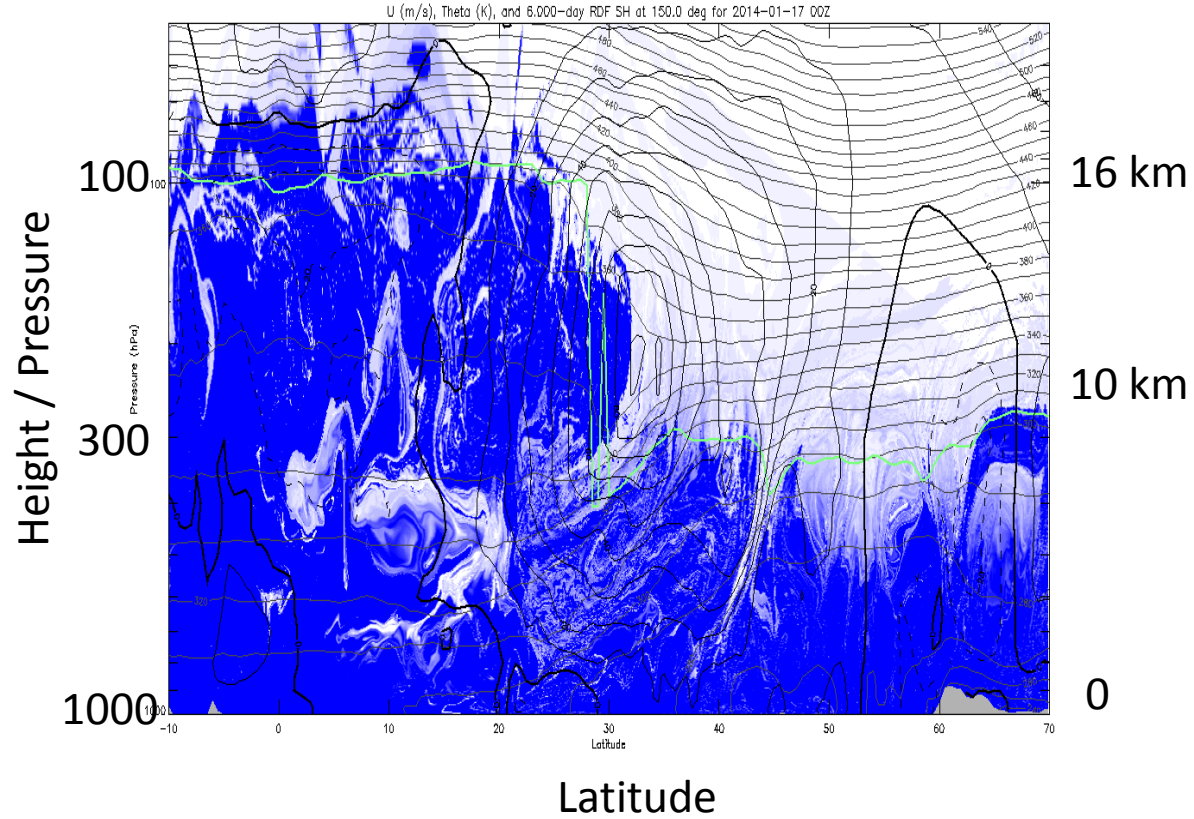
January - February 2014

340 K 5-day RDF SH and u (m s^{-1}) for 2014-01-01 00Z



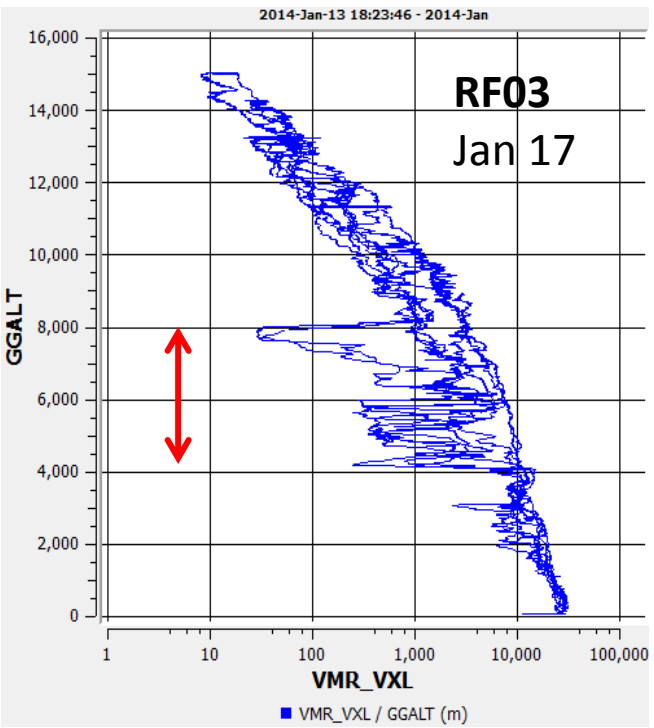
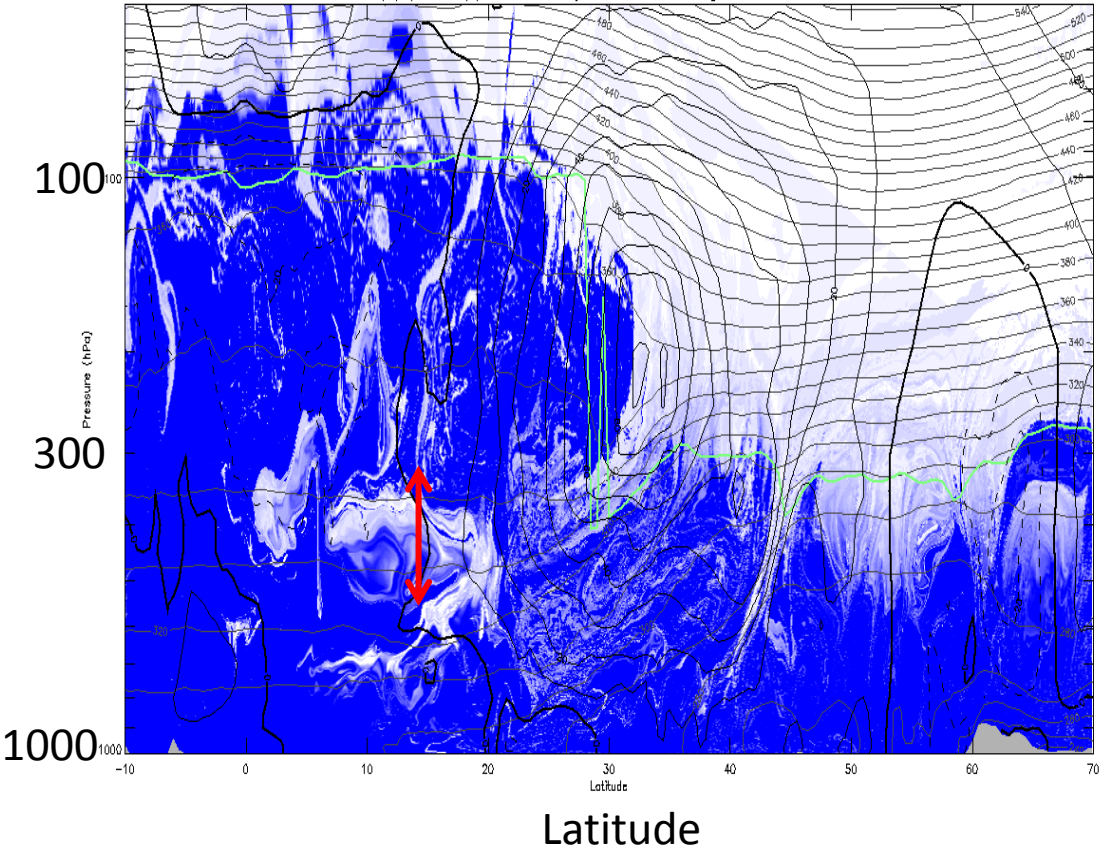
Vertical slice at longitude near Guam

January 17

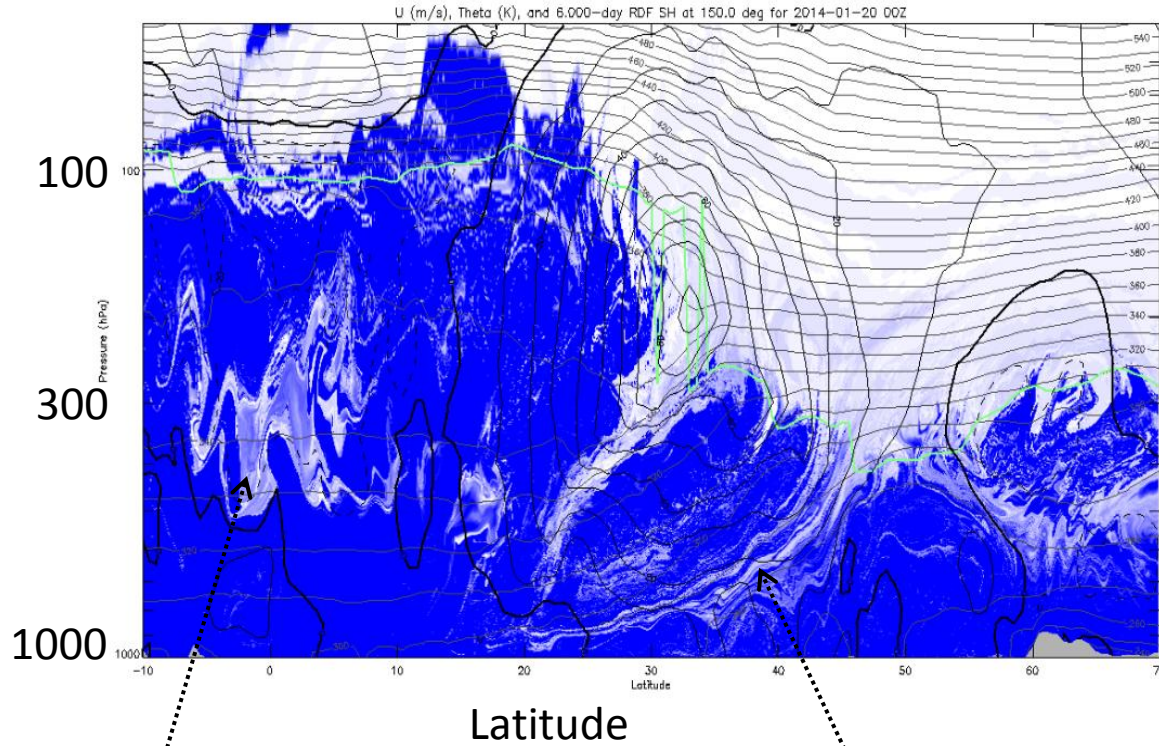


January 17

U (m/s), Theta (K), and 6,000-day RDF SH at 150.0 deg for 2014-01-17 00Z



January 20

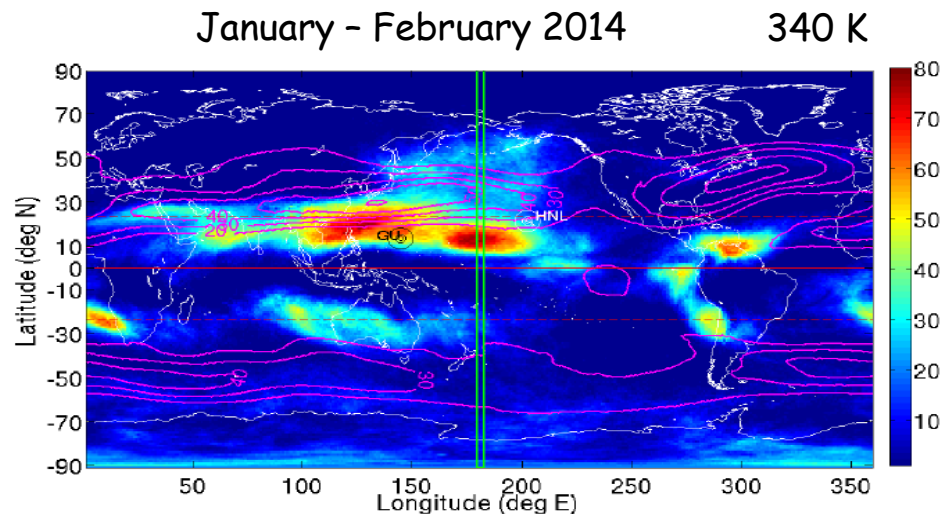


transport past equator

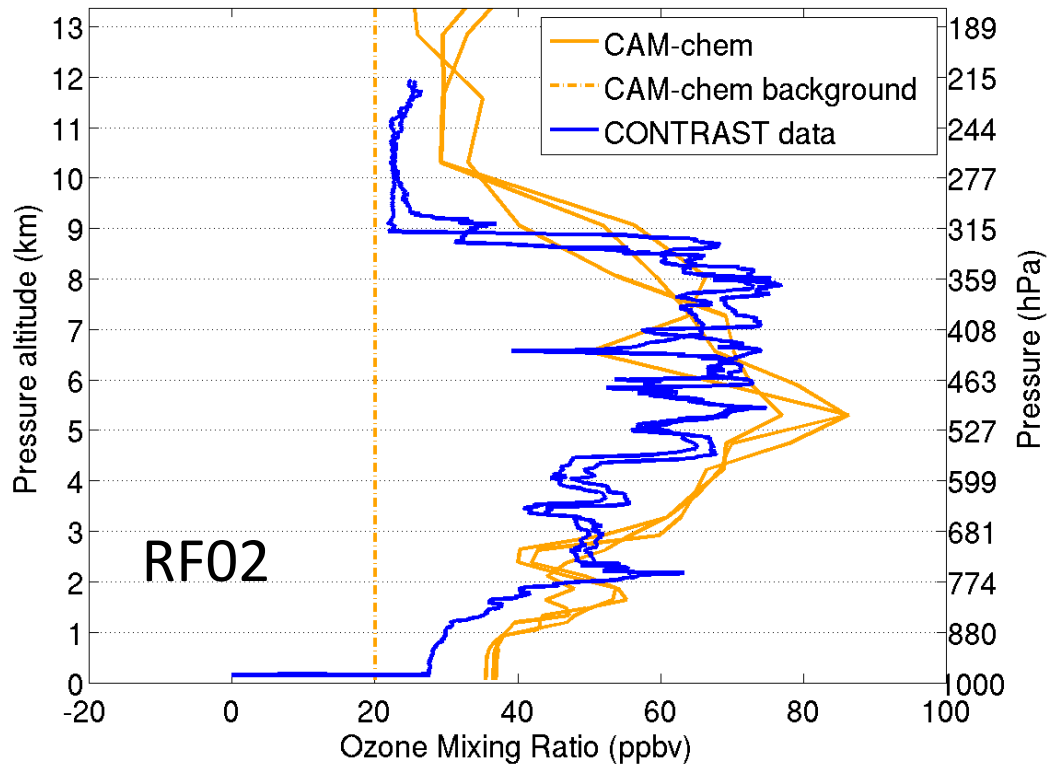
fine-scale structures
induced by large-scale transport

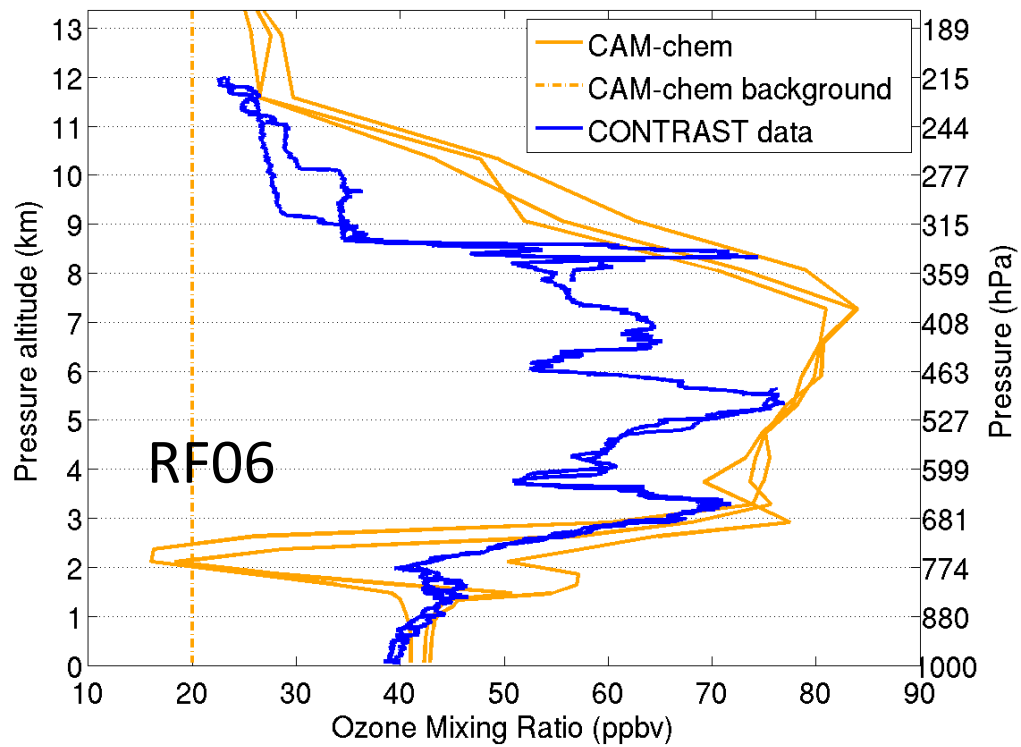
Key points:

- GFS analyses agree well with dry profiles in CONTRAST
- Dry layers are ubiquitous in subtropics in all seasons, max near 330-340 K
- Trajectory calculations suggest quasi-horizontal transport from extratropical UTLS (through westerly duct for CONTRAST)
- Not a new result: extensive literature on dry layers and mechanisms

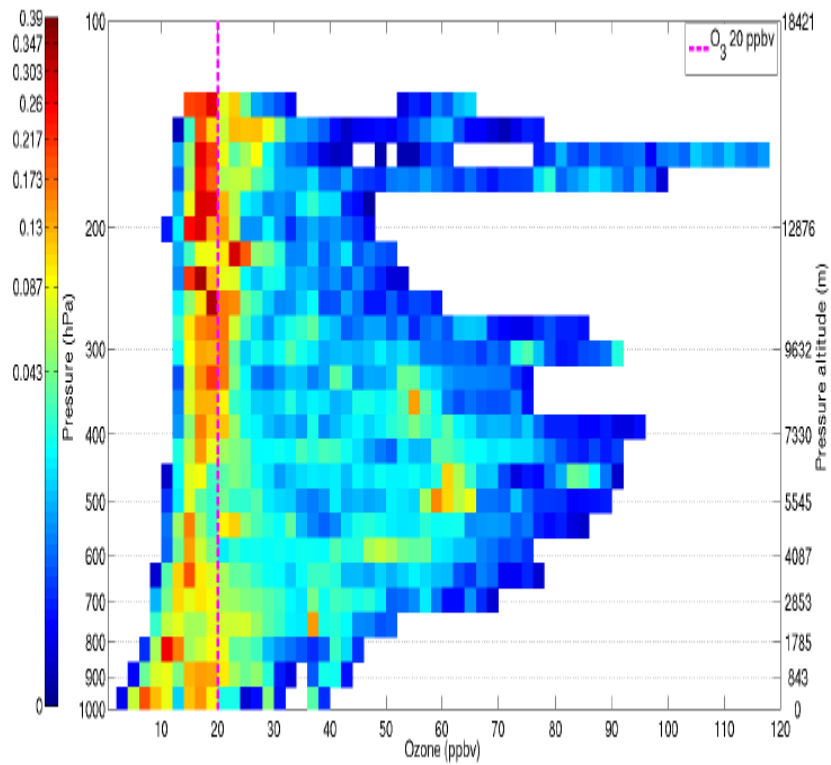


Extra slides



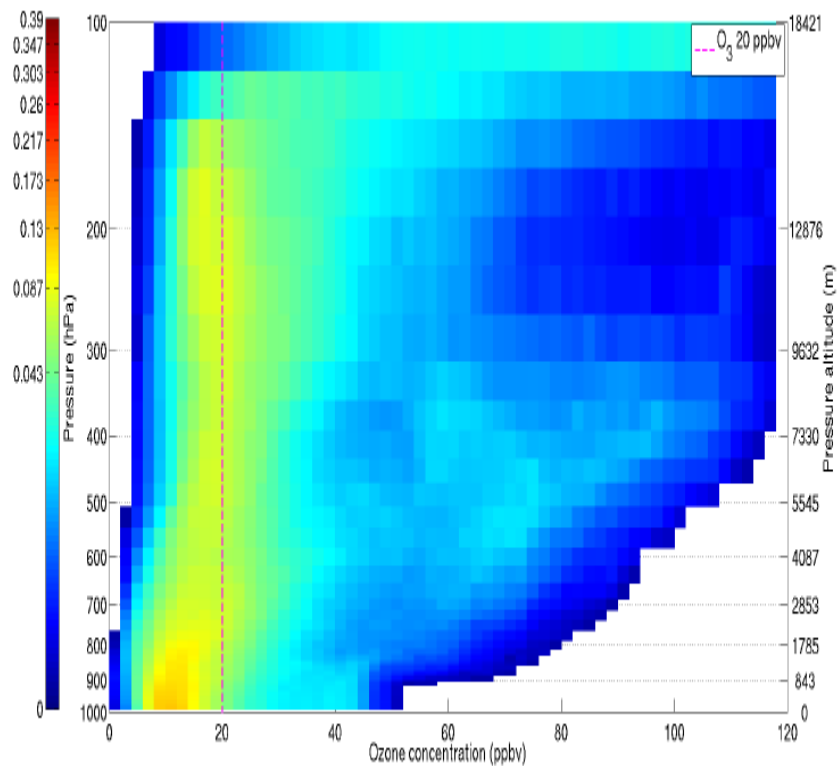


CONTRAST



(a) CONTRAST

CAM-Chem



(b) CAM-chem