Variability of Upper Tropospheric Ozone

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Introduction

What is the spatial and temporal variability of UT ozone?

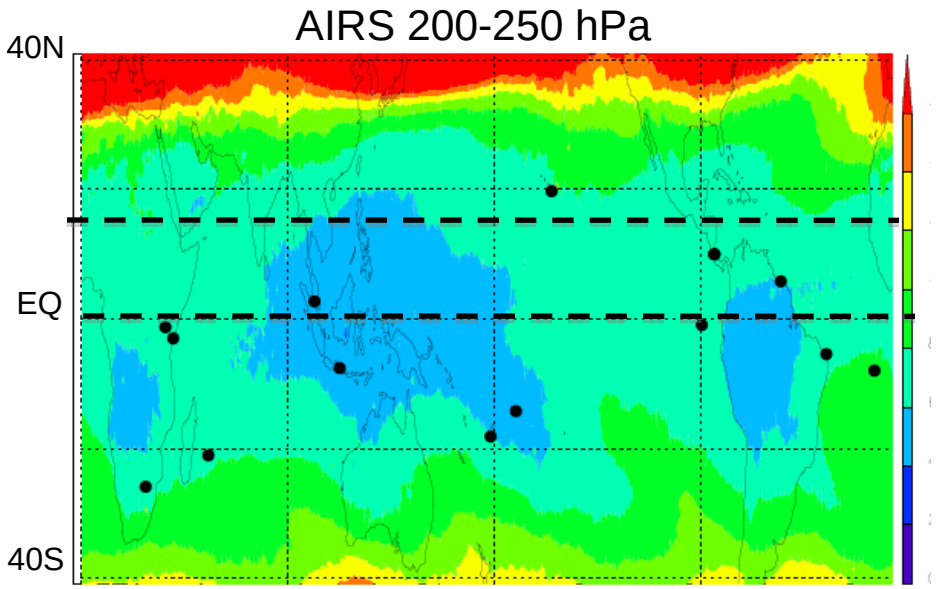
What are key transport / dynamical processes controlling the ozone distributions?

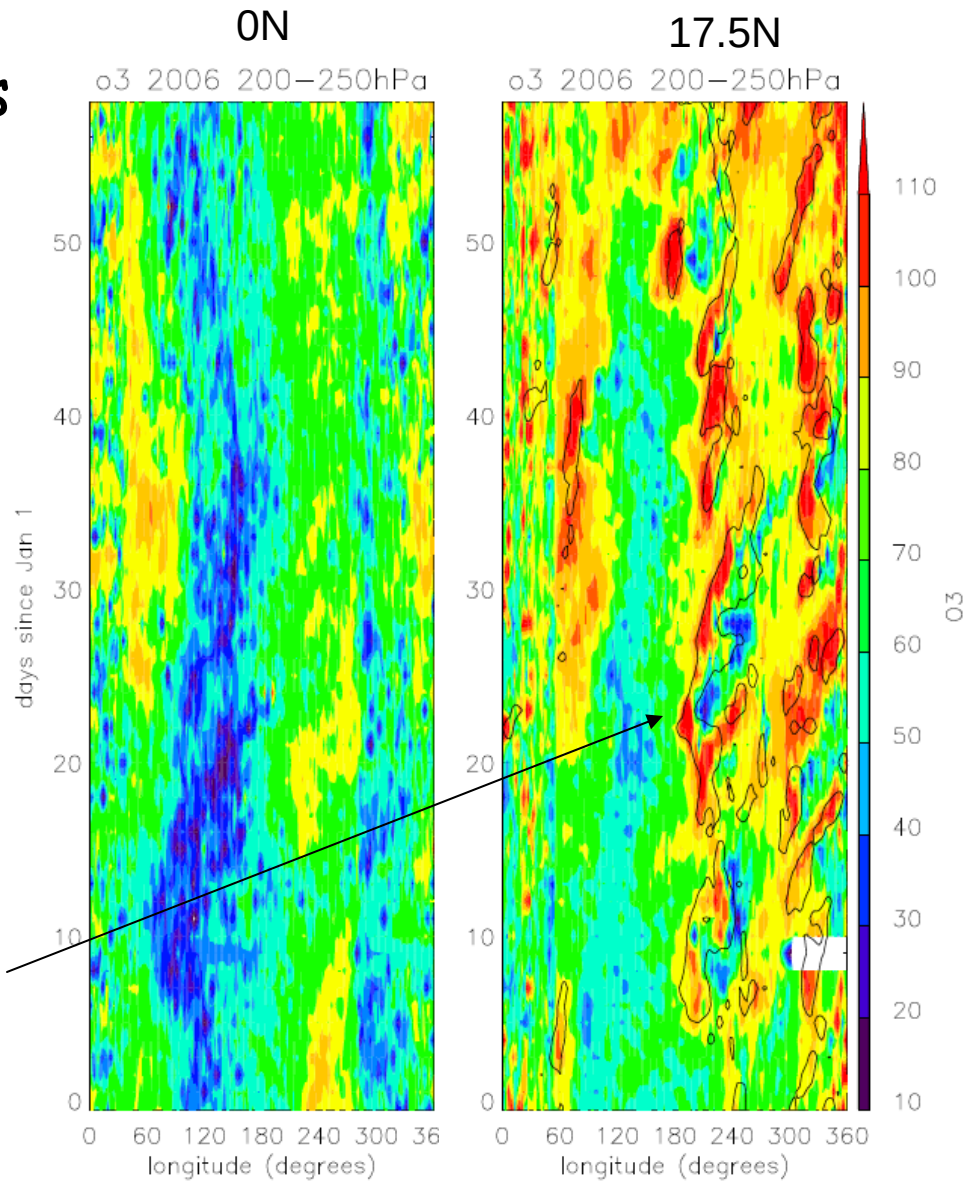
What the projected long-term changes in these processes and the ozone distribution?

Examine using satellite (AIRS, MLS) and in-situ (ozonesonde) data and 3D model simulations (GMI, GEOS-CCM).

AIRS UT Ozone

AIRS measurements show spatial and temporal variations in UT O_3.



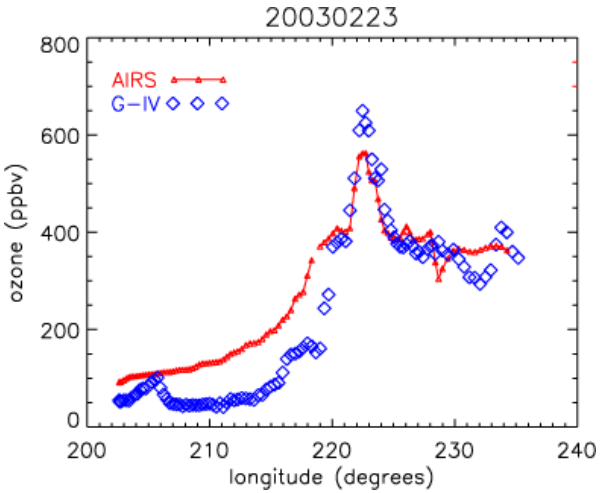


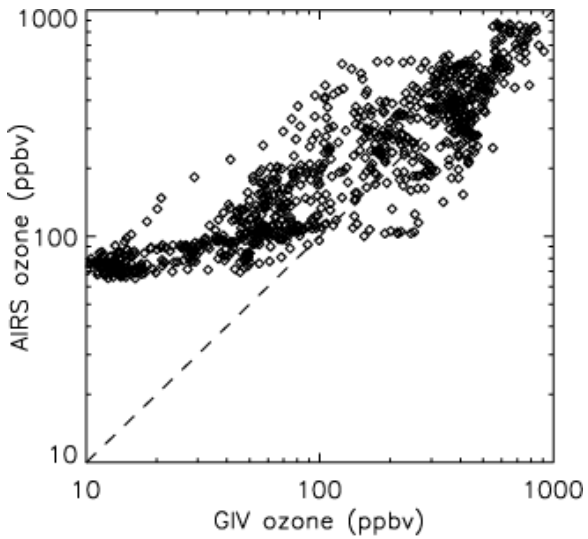
PV intrusions

BUT …

Comparison of AIRS and MLS with in-situ measurements

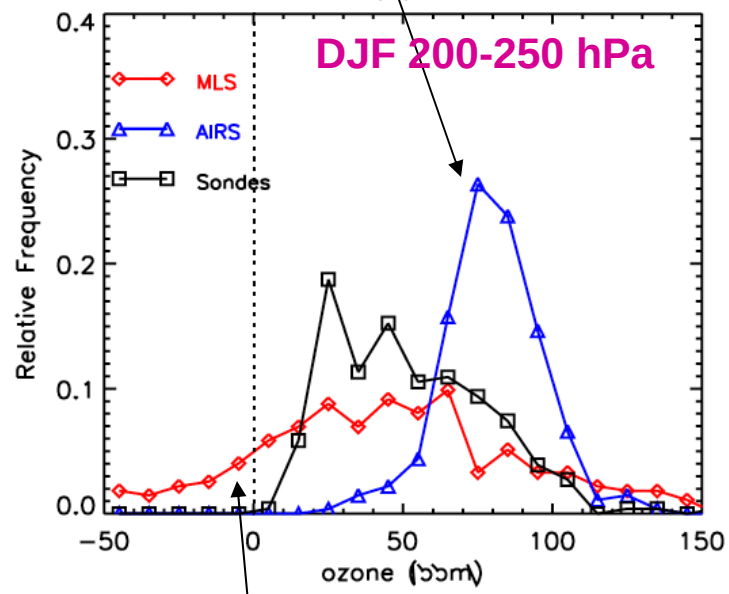
Comparison with measurements from G-IV (NOAA Winter Storms)





AIRS: positive bias

Comparison with Hilo ozone-sondes



MLS: noise ~ ±40ppbv

GMI simulations

Examine UT ozone in GMI simulations driven by meteorological analyses:

- How well does the GMI ozone agree with ozone-sonde measurements?

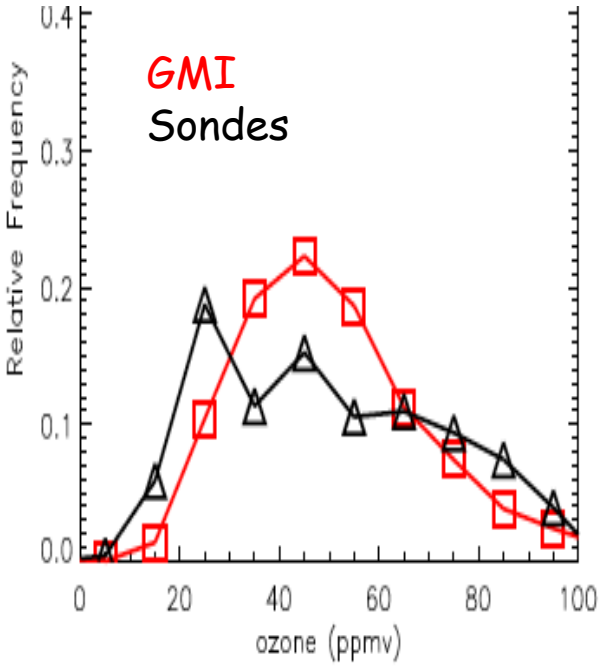
- What is the variability in GMI ozone, and what processes causes this variability?

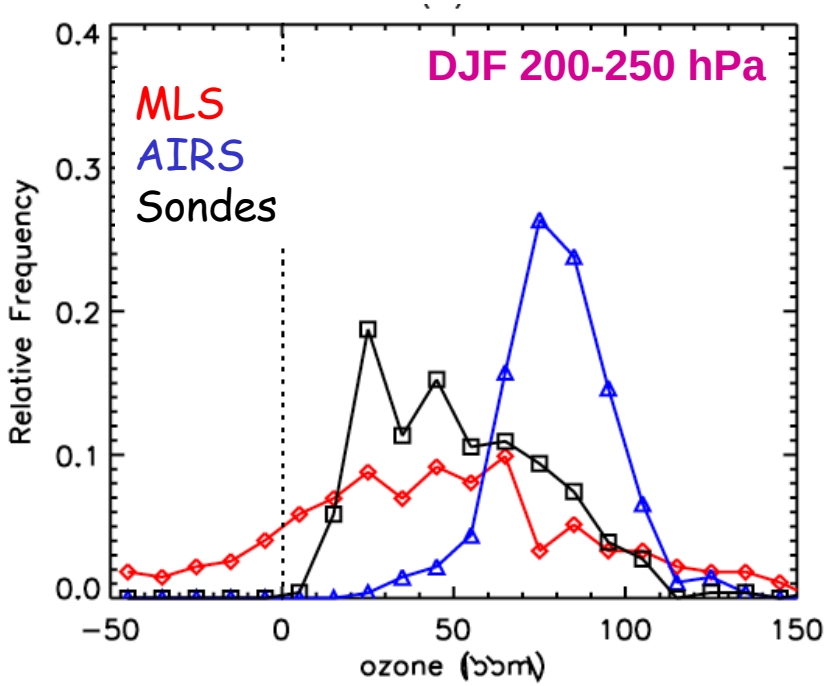
- Can the GMI ozone be used to better quantify (even account for) the uncertainties in AIRS and MLS measurements?

GMI G4DAS simulations 2004 - 2007

Comparison of Hilo ozone-sondes

PDF of GMI ozone is much closer to Hilo ozondesonde than either AIRS or MLS.

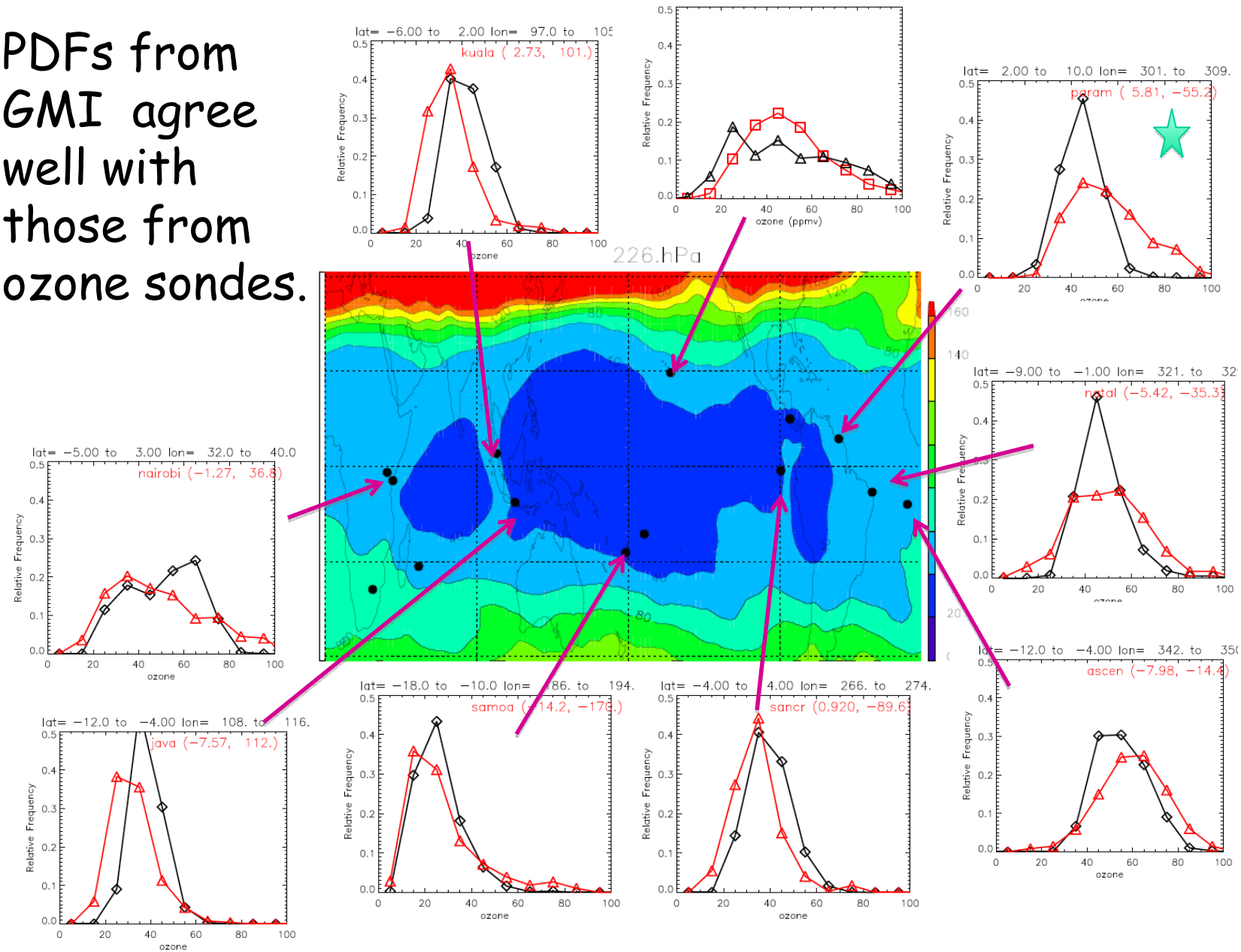




GMI - OzoneSonde PDFs

DJF

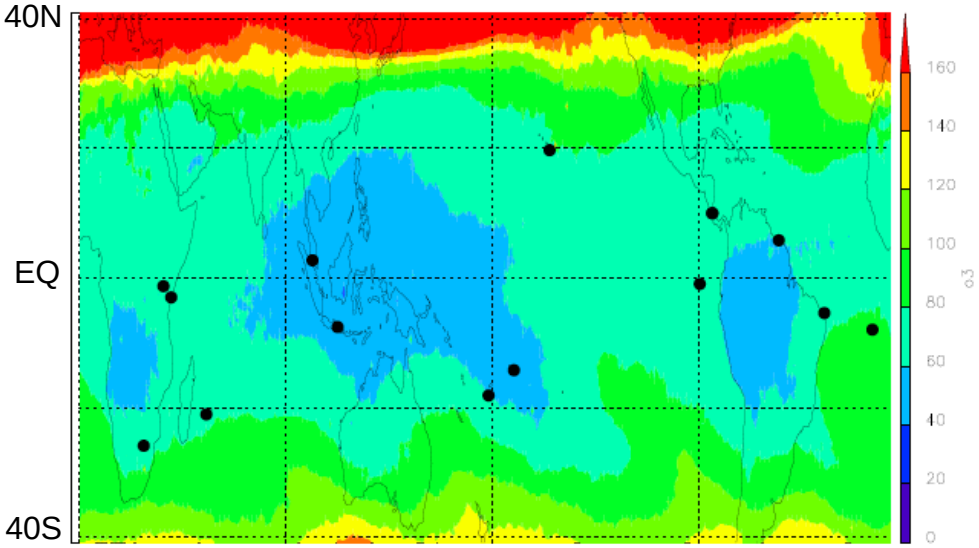
PDFs from GMI agree well with those from ozone sondes.



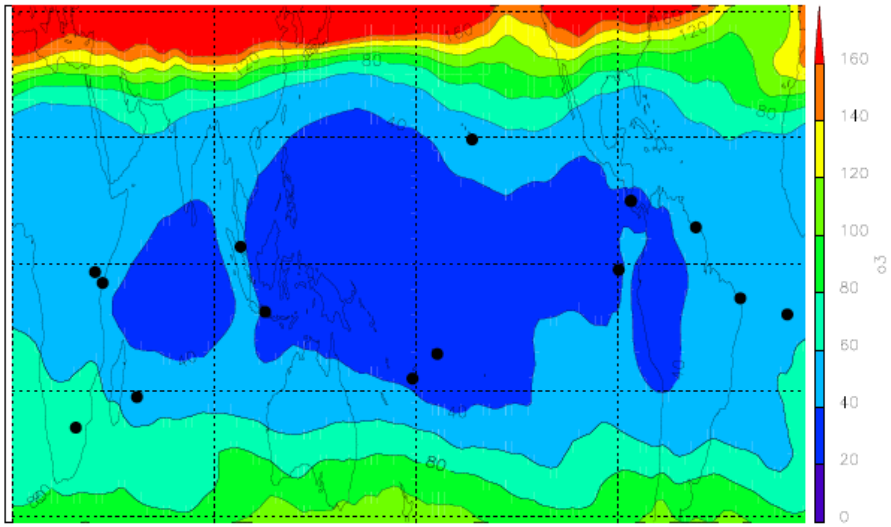
O_3 Climatology: AIRS, MLS & GMI

DJF MEAN

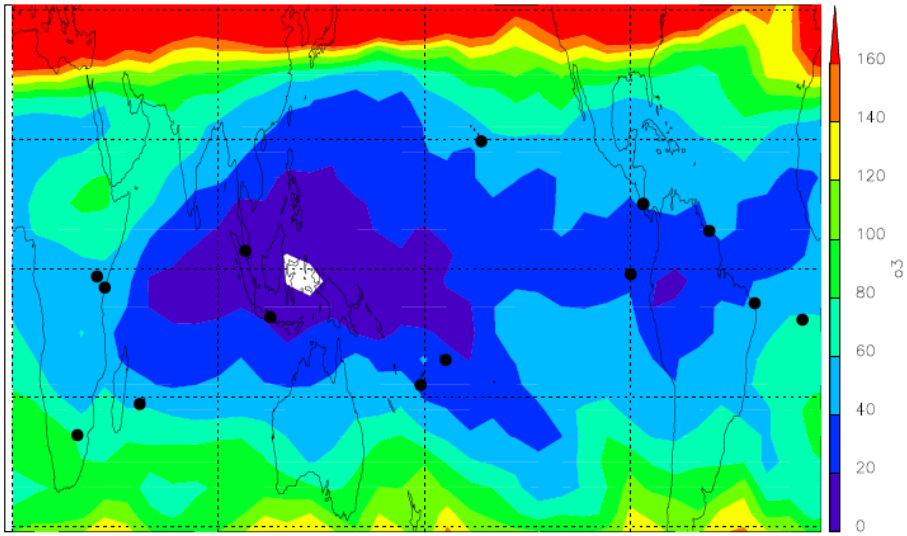
AIRS 200-250 hPa



GMI 226 hPa



MLS 215 hPa

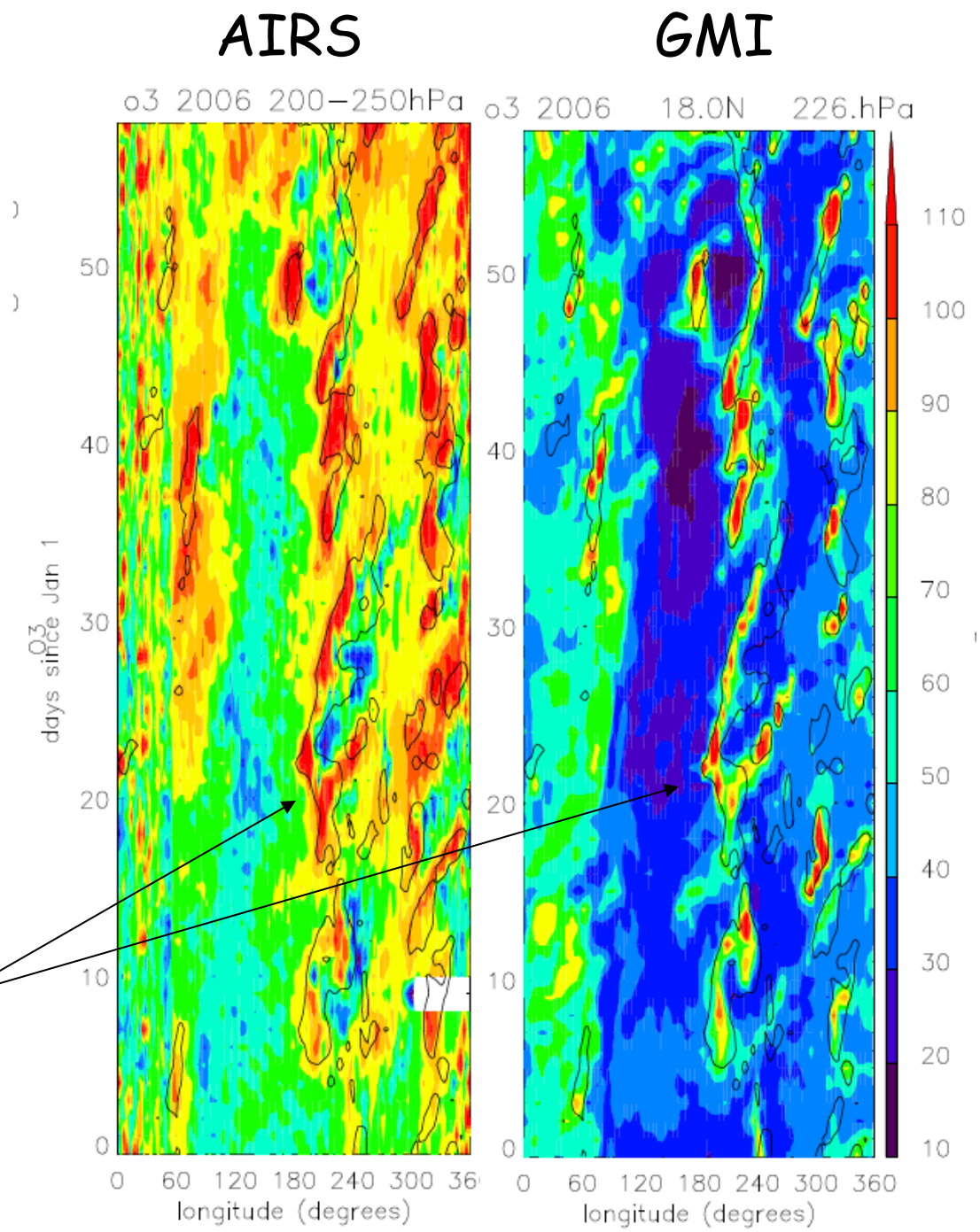


Spatial variations in mean GMI ozone qualitatively similar to AIRS and MLS but very different magnitudes.

Daily Variability: AIRS & GMI

Also similar daily variability (coherent with PV), but again magnitude is very different.

Intermittent high values in Eastern Pacific and Atlantic connected with high PV



FUTURE WORK

- Complete comparison of GMI with ozonesondes.

- Examine spatial and temporal variations in GMI ozone, and relate to dynamical /transport processes (using meteorological fields, trajectory simulations, …).

- Compare with AIRS and MLS (distributions, spatial and temporal variability).

- Examine ozone in GEOSCCM-COMB simulations.