Dynamical Diagnostics for SAGE III/ISS: Progress Report & OCTAV-UTLS Connections

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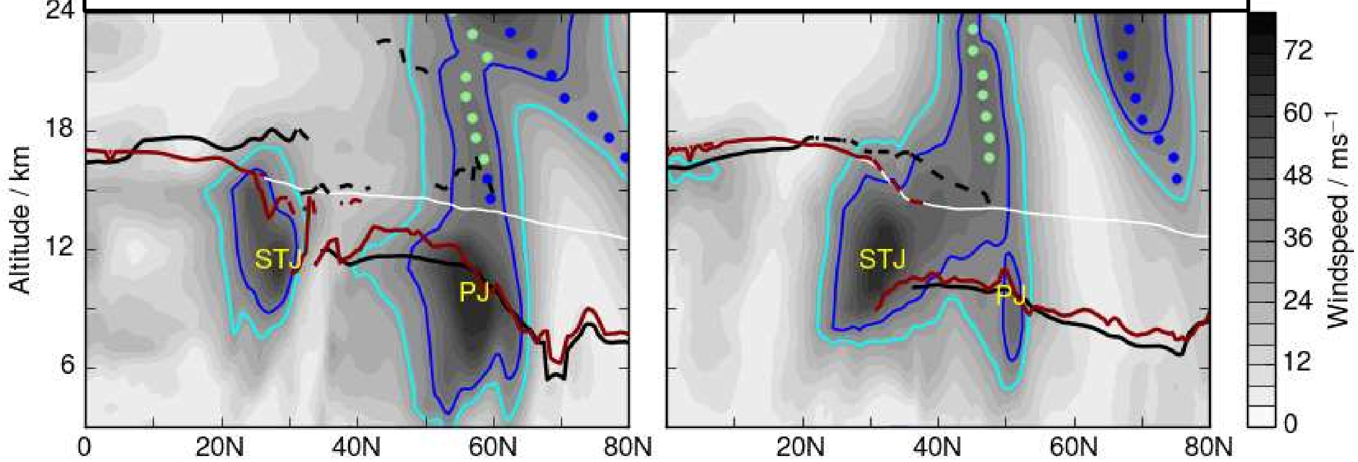
Dynamical Diagnostics from JETPAC

JEt and Tropopause Products for Analysis and Characterization

Reanalysis windspeeds at 117.5W and 105E on 20090129



JETPAC diagnostics have been calculated at multi-instrument measurement locations, including SAGE III/ISS (preliminary calculations have also been done for SAGE II)

Jet Cores: windspeed maxima >40m/s Jet region edges: 30m/s windspeed

Subtropical jet (STJ): Lowest latitude westerly jet with tropopause altitude > 13km at its equatorward edge and a drop >2km between equatorward & poleward edge

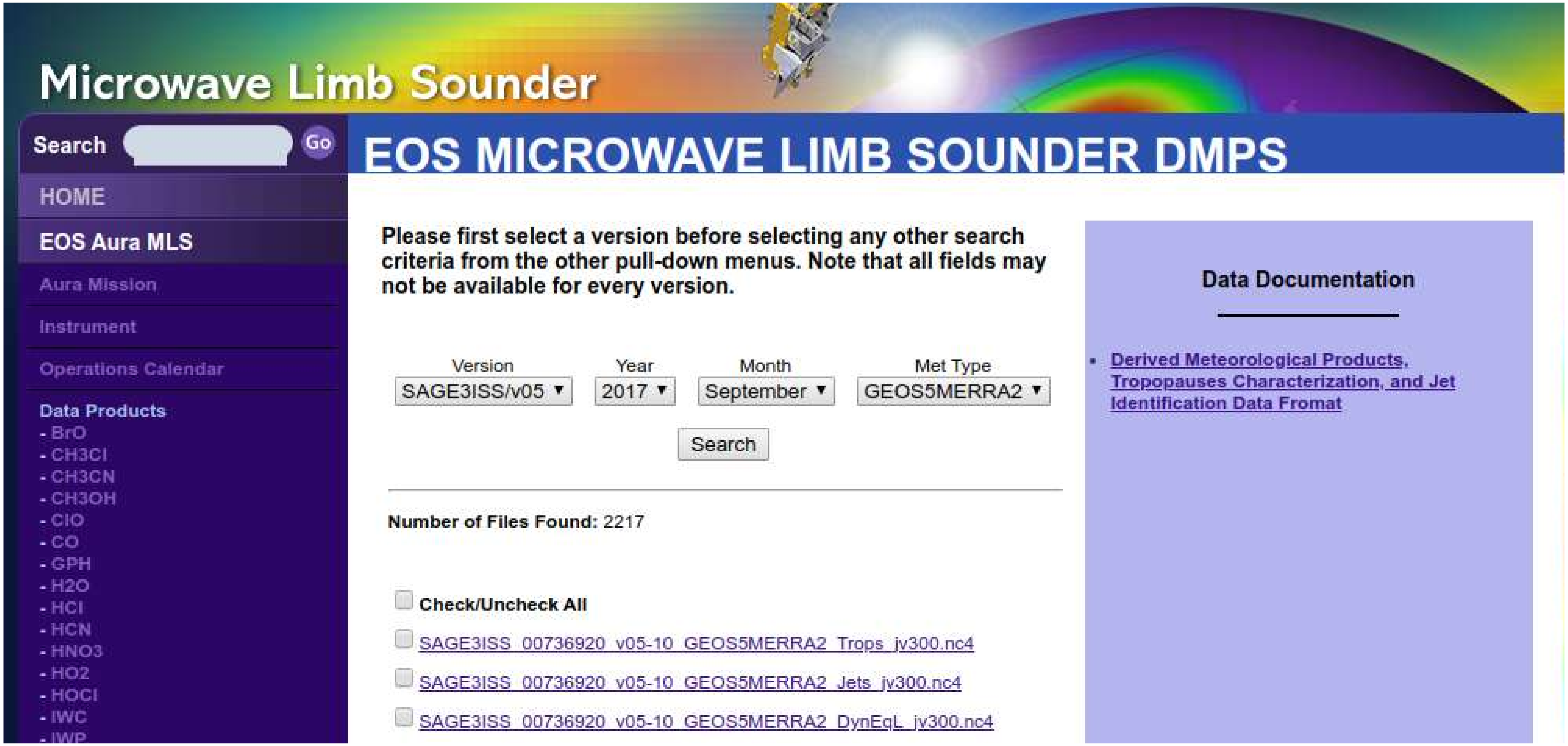
Polar Jet (PJ): Strongest westerly jet poleward of STJ (or of 40° if no STJ)

Characterization of WMO (Temperature gradient) and dynamical (PV-based) tropopauses

Characterization of stratospheric subvortex (blue and green dots; two offspring from split SSW shown here)

JETPAC tropopause and UTLS jet analysis: Manney et al, 2011, 2014, 2017; Manney & Hegglin, 2018

SAGE III/ISS JETPAC Diagnostics



https://mls.jpl.nasa.gov/dmp/data/dmp locator.php

Recent Updates:

- ➢ Corrected horizontal PV gradient naming and description
- ➢ Get dynamical profiles below 10km using SAGE III/ISS 10km values

SAGE III/ISS Trajectory Diagnostics

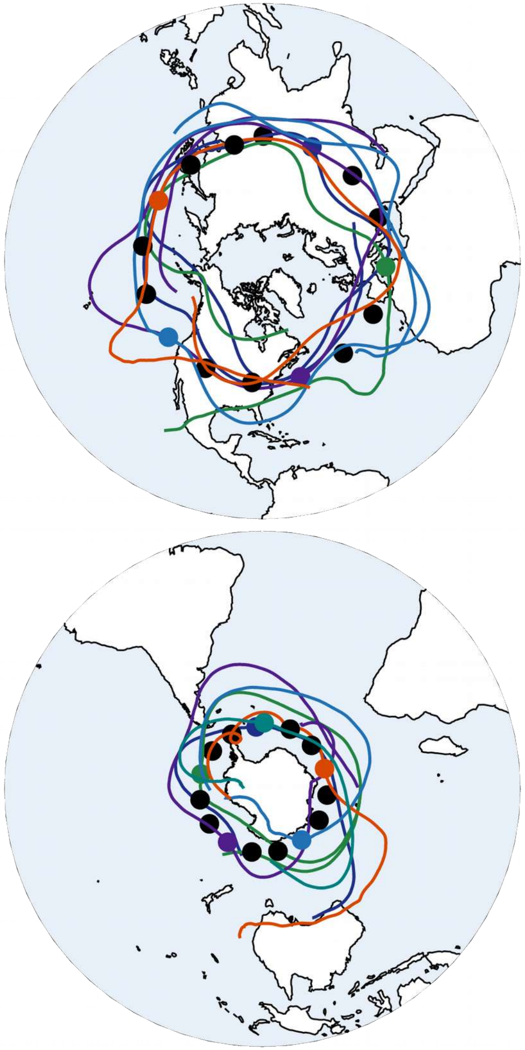
We have launched trajectories from the SAGEIII/ISS measurement locations (10 day forward/backward).

- Currently available until May 2019
- MERRA-2 winds and heating rates are used in a 4th order Runge-Kutta integration with 5 minute timesteps
- Parcel locations are saved every 20 minutes
- Flanking trajectories added to quantify dispersion / mixing
- Trajectories are stored in nc4 format

Future work: Use the trajectory hunting technique to validate SAGEIII/ISS versus other satellite instruments.

Please contact lmillan@jpl.nasa.gov if you want to get a hold of these trajectories

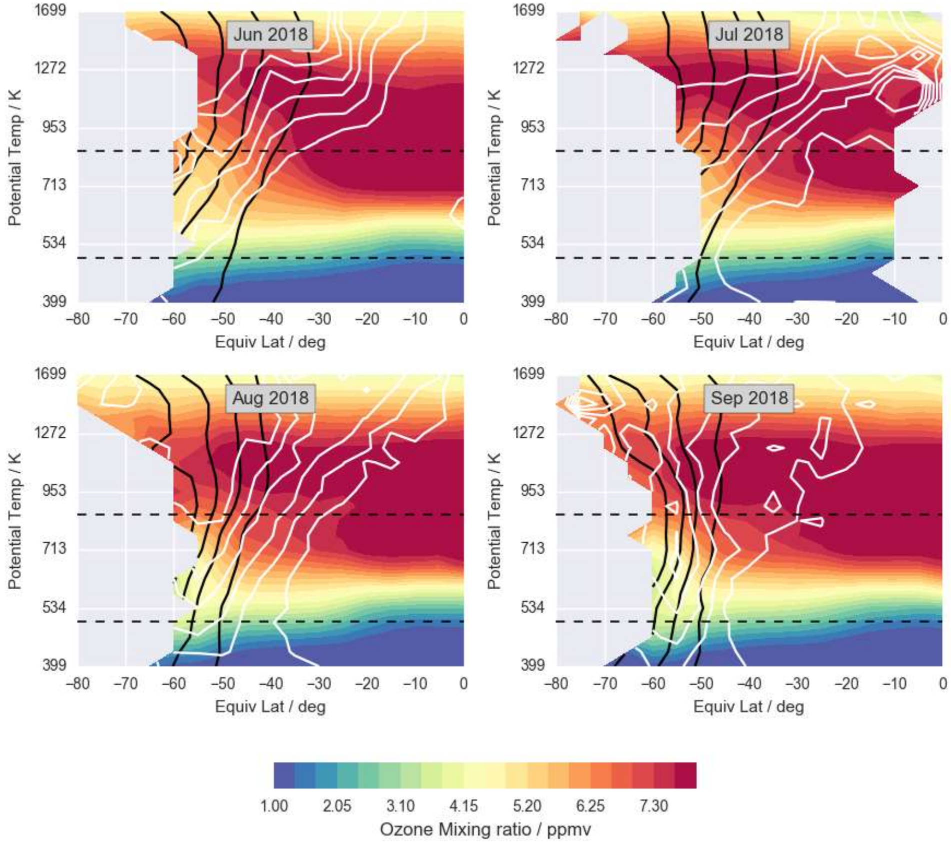
Jan 1st 2018



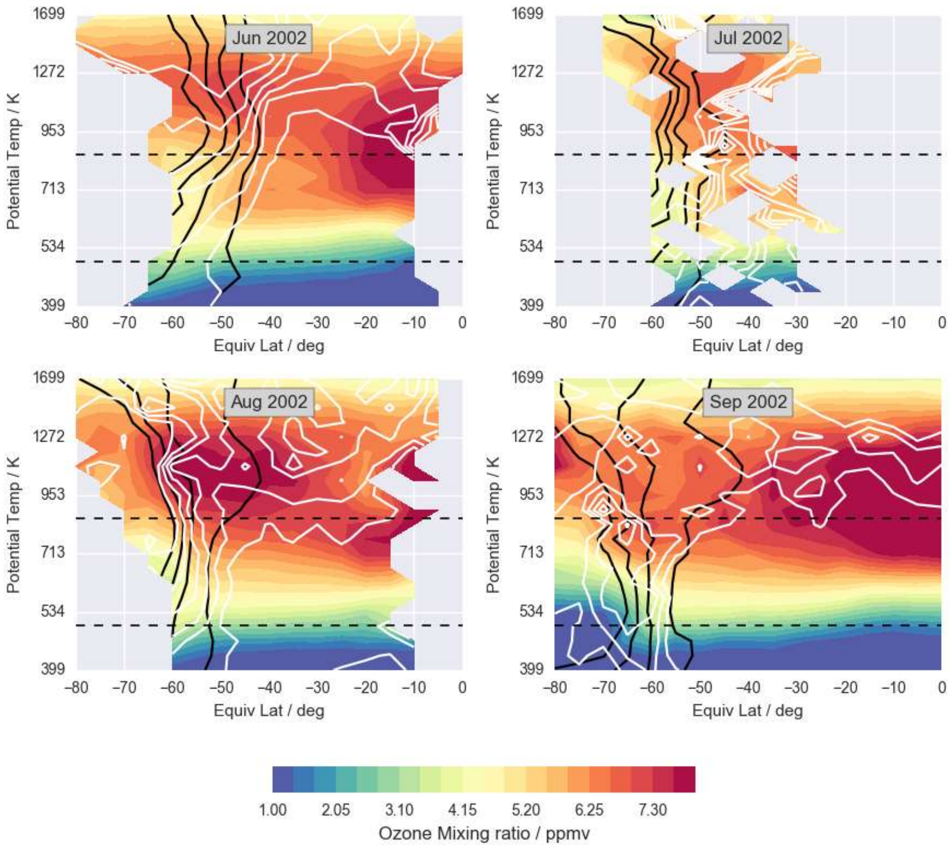
Parcels started at 15km

SAGE Examples: EqL/θ SH Stratospheric Polar Ozone

SAGE III/ISS SH Winter 2018

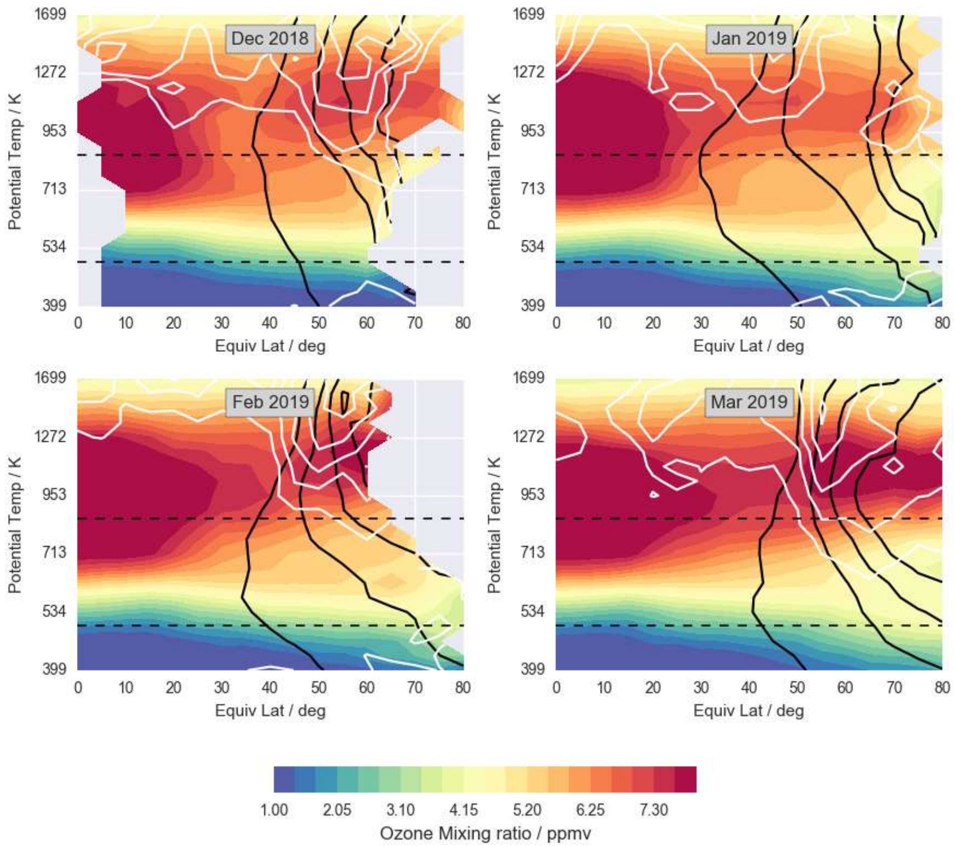


SAGE II SH Winter 2002

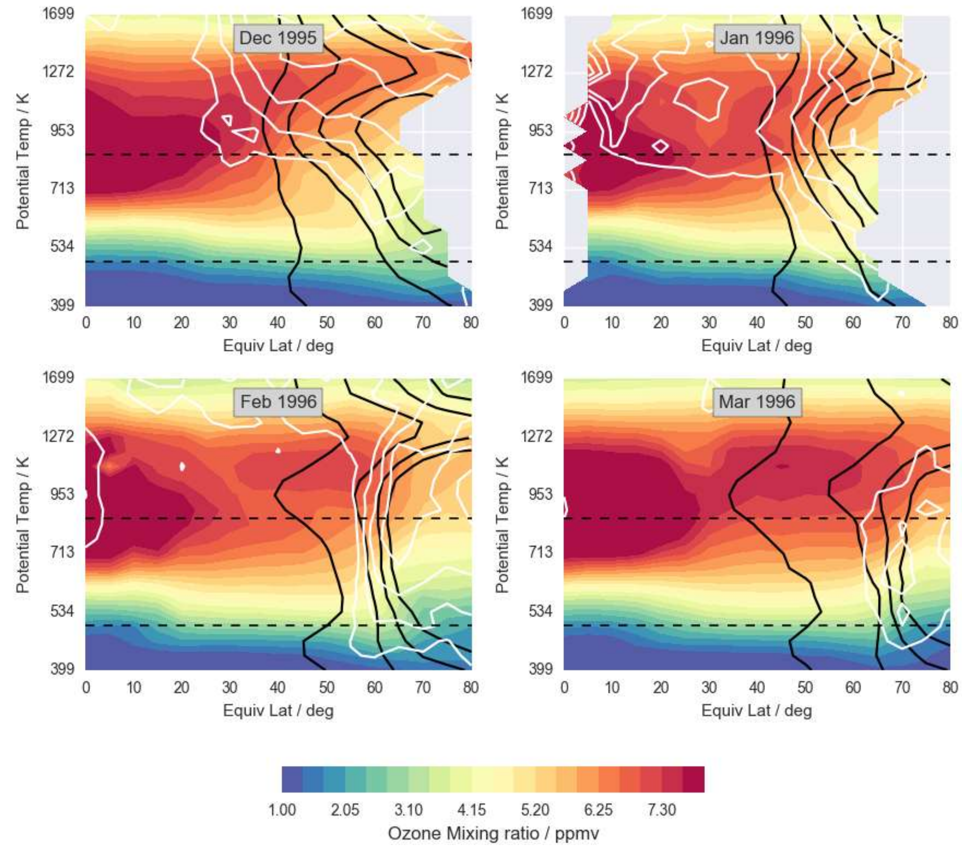


SAGE Examples: EqL/θ NH Stratospheric Polar Ozone

SAGE III/ISS NH Winter 2018/2019



SAGE II NH Winter 1995/1996



OCTAV-UTLS SPARC Activity

Observed Composition Trends and Variability in the UTLS

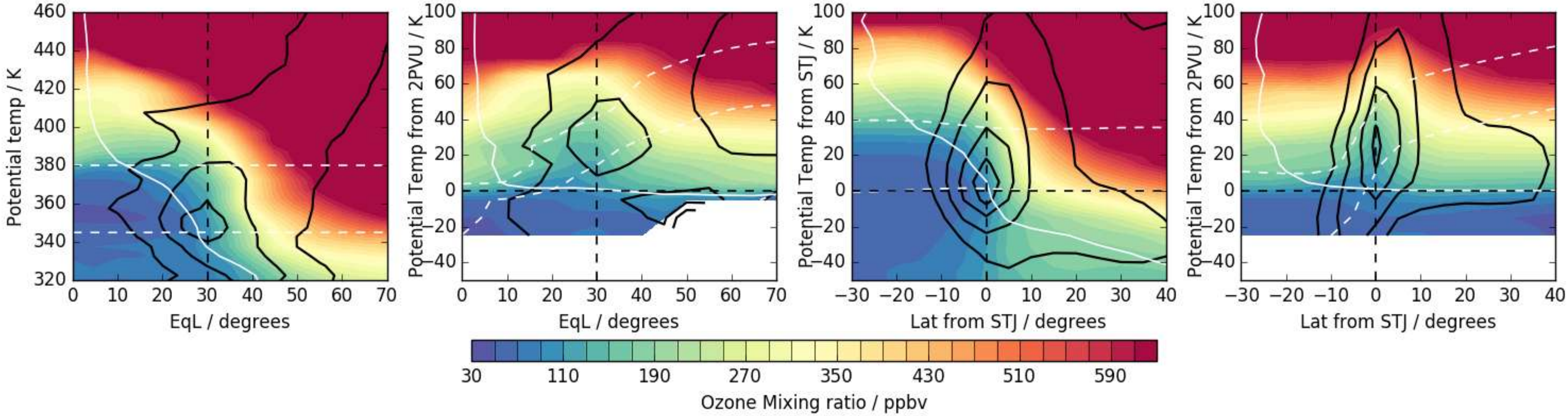
UTLS composition measurements are hard to analyze because:

- Large UTLS atmospheric variability on multiple scales
- Relatively coarse vertical resolution and atmospheric density effects limit global satellite measurements in the UTLS
- Sparse spatial and temporal coverage constrains highly resolved measurements (such as lidar, sondes, aircraft)

Thus instrument-dependent sampling and variability on many scales result in an incomplete and potentially biased view of UTLS composition. How can we maximize our ability to assess composition variability and trends using diverse datasets?

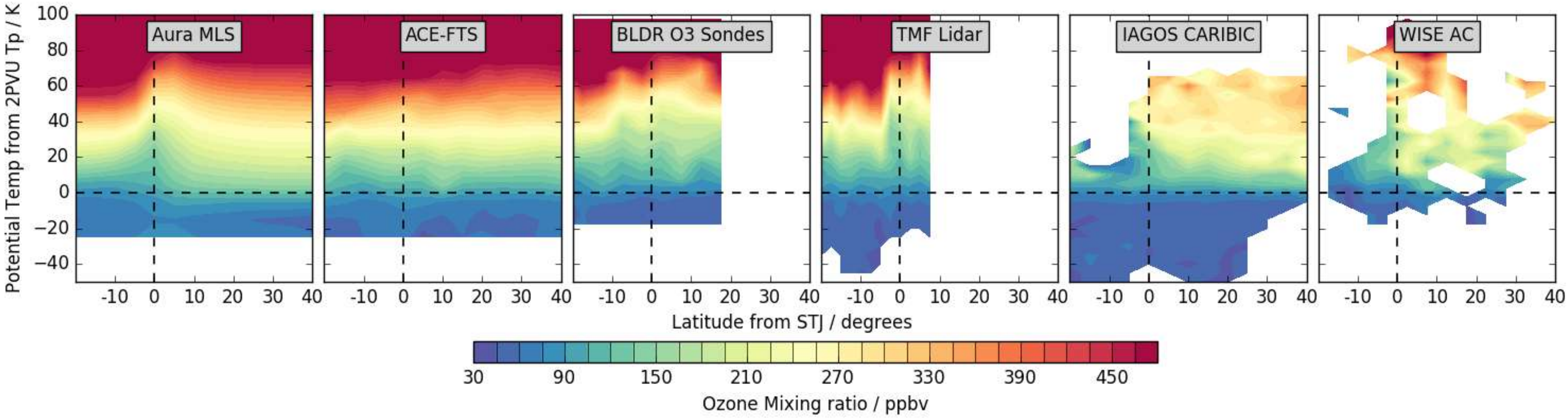
OCTAV-UTLS aims to develop unified consistent geophysically-based metrics that can be applied to data from different observation techniques / platforms and use these metrics to assess our current ability to diagnose and understand UTLS composition trends and variability, and to recommend future measurement strategies.

OCTAV-UTLS SPARC Activity



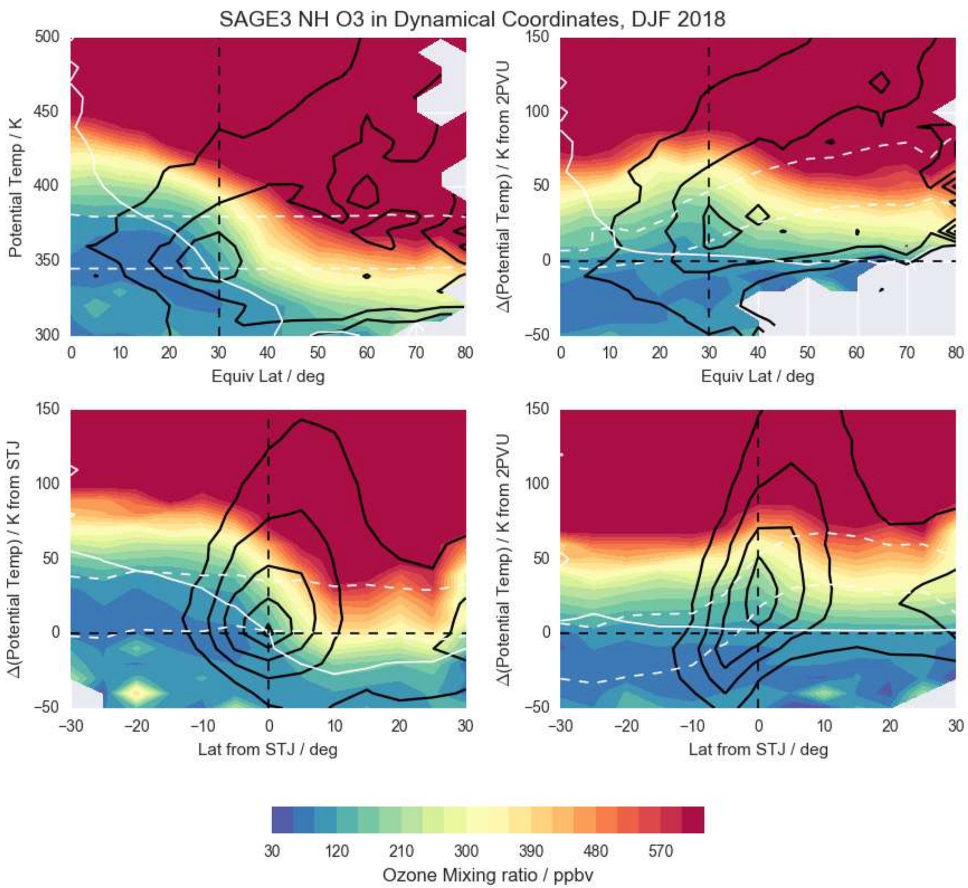
Aura MLS UTLS Ozone measurements in various dynamical coordinate systems
(black = windspeeds, solid white 2PVU, dashed white 345 and 380 K potential temperature)

OCTAV-UTLS SPARC Activity



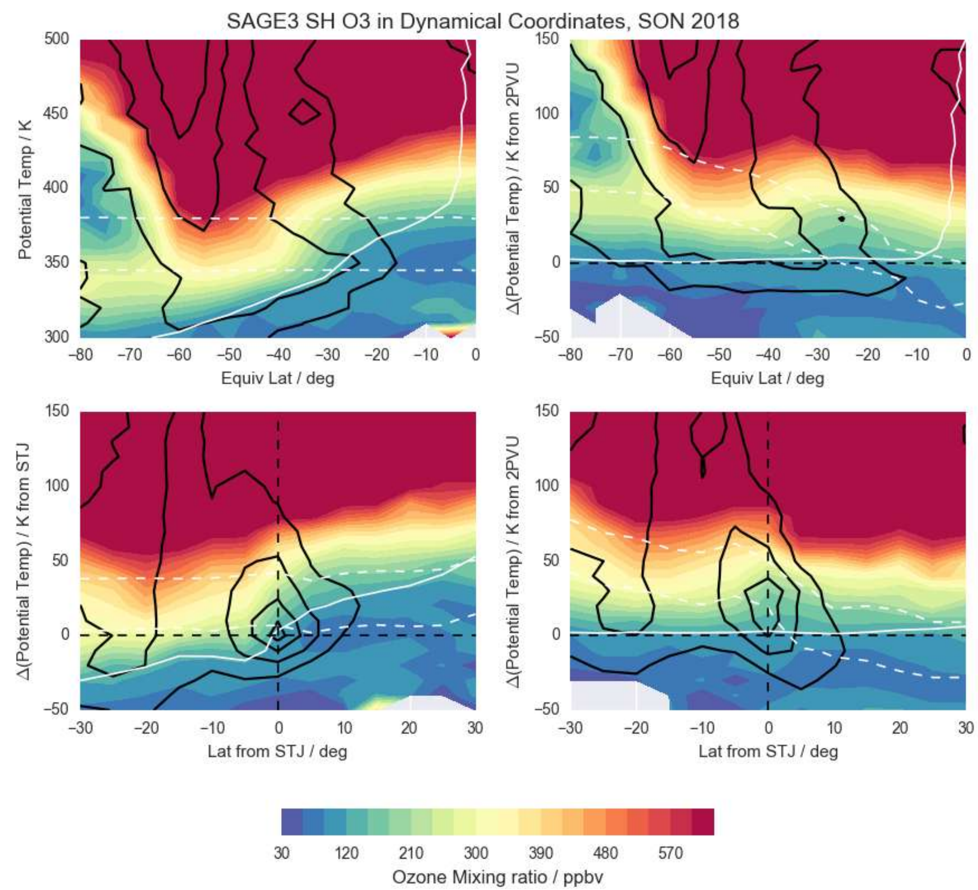
Multi-platform UTLS Ozone measurements mapped in
latitude from STJ & potential temperature from 2PVU tropopause
(SON 2005–2016, except WISE Sep/Oct 2017)

OCTAV-UTLS & SAGE

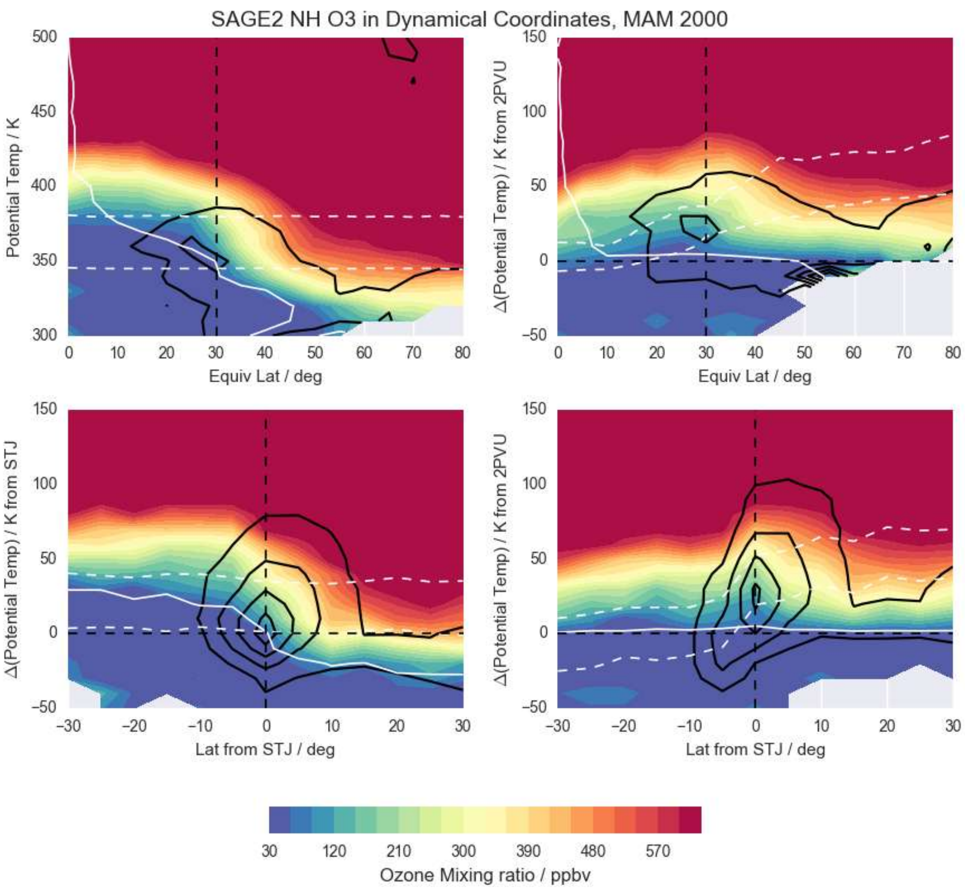


SAGE III/ISS NH DJF 2018 (left) & SH SON 2018 (below) in various dynamical coordinates

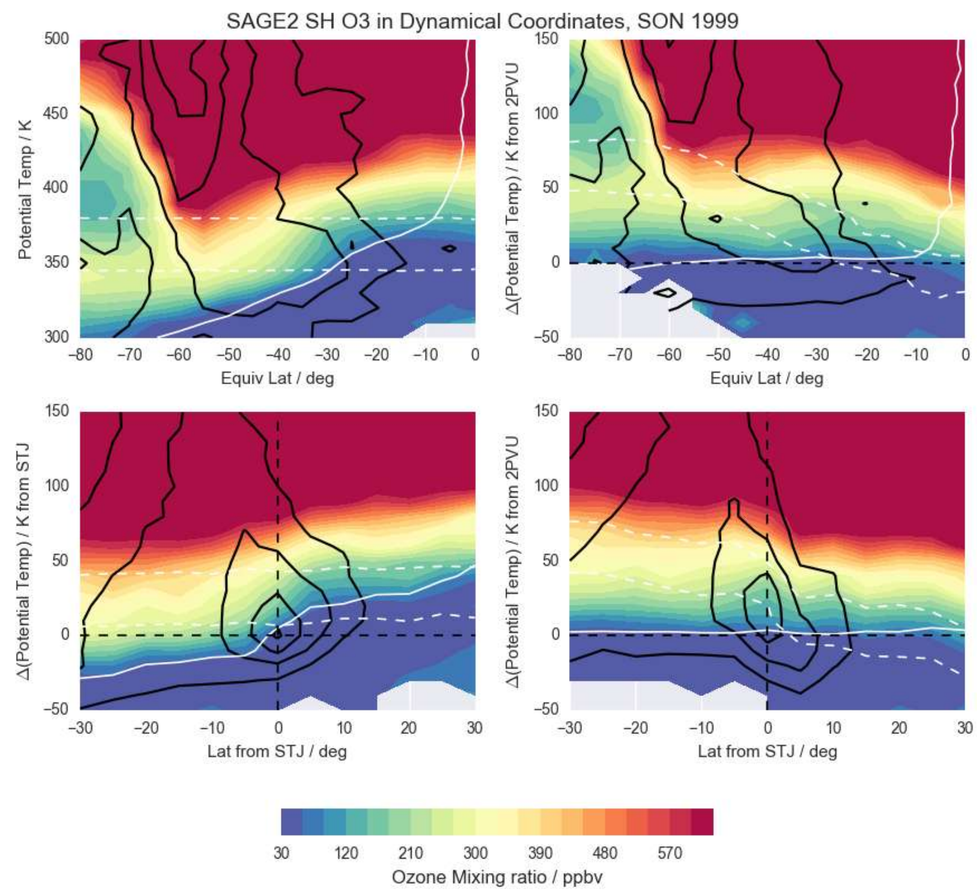
(black = windspeeds, solid white 2PVU, dashed white 345 and 380 K potential temperature)



OCTAV-UTLS & SAGE



SAGE II NH MAM 2000 (left) & SH SON 1999 (below) in various dynamical coordinates



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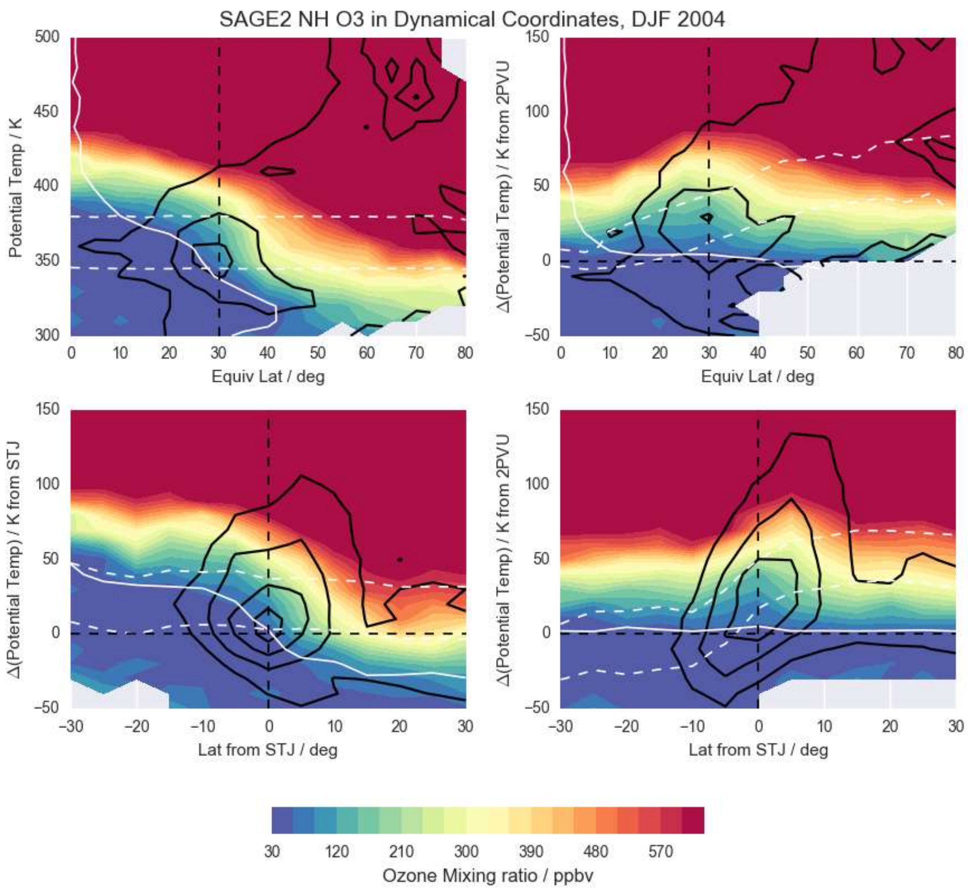
Future work: SAGE & MLS Comparison / Bias Assessment



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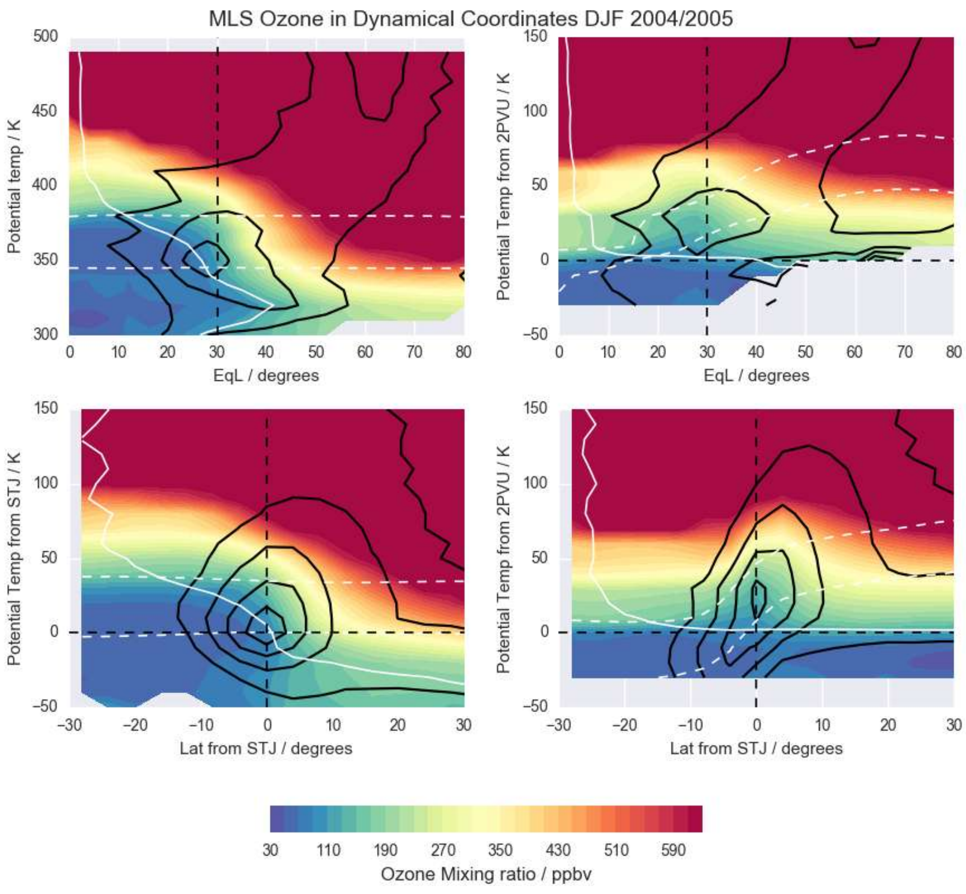
SAGE II (left) and MLS (below) Ozone in dynamical coordinates for DJF 2004/2005



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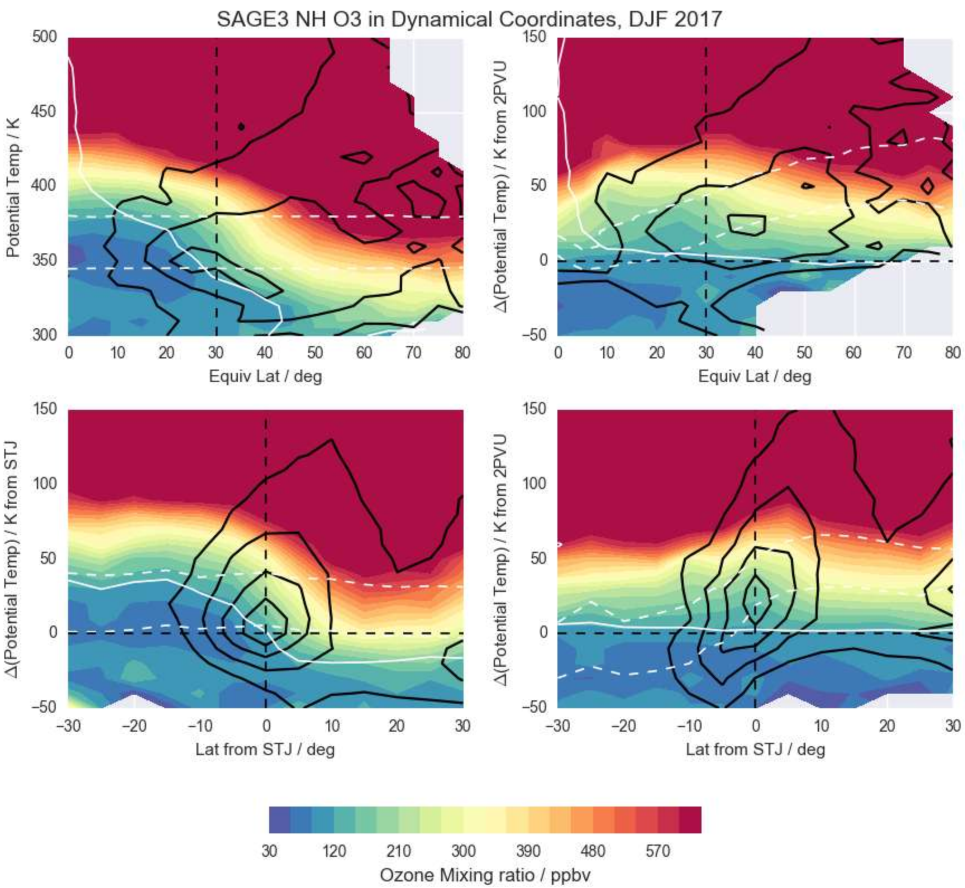

SAGE III/ISS (left) and MLS (below) Ozone in dynamical coordinates for DJF 2017/2018

(black = windspeeds, solid white 2PVU, dashed white 345 and 380 K potential temperature)