WACCM Studies in the Upper Stratosphere and Lower Mesosphere

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J. France, E. Peck, L. Holt, M. Brakebusch

France and Harvey [2013], A Climatology of the Stratopause in WACCM and the Zonally Asymmetric Elevated Stratopause, accepted at JGR.

Brakebusch et al. [2013], Evaluation of Whole Atmosphere Community Climate Model simulations of ozone during Arctic winter 2004-2005, accepted at JGR.

Brakebusch et al. [2013], Attribution of Ozone Loss During the Antarctic Winter 2005, in prep.

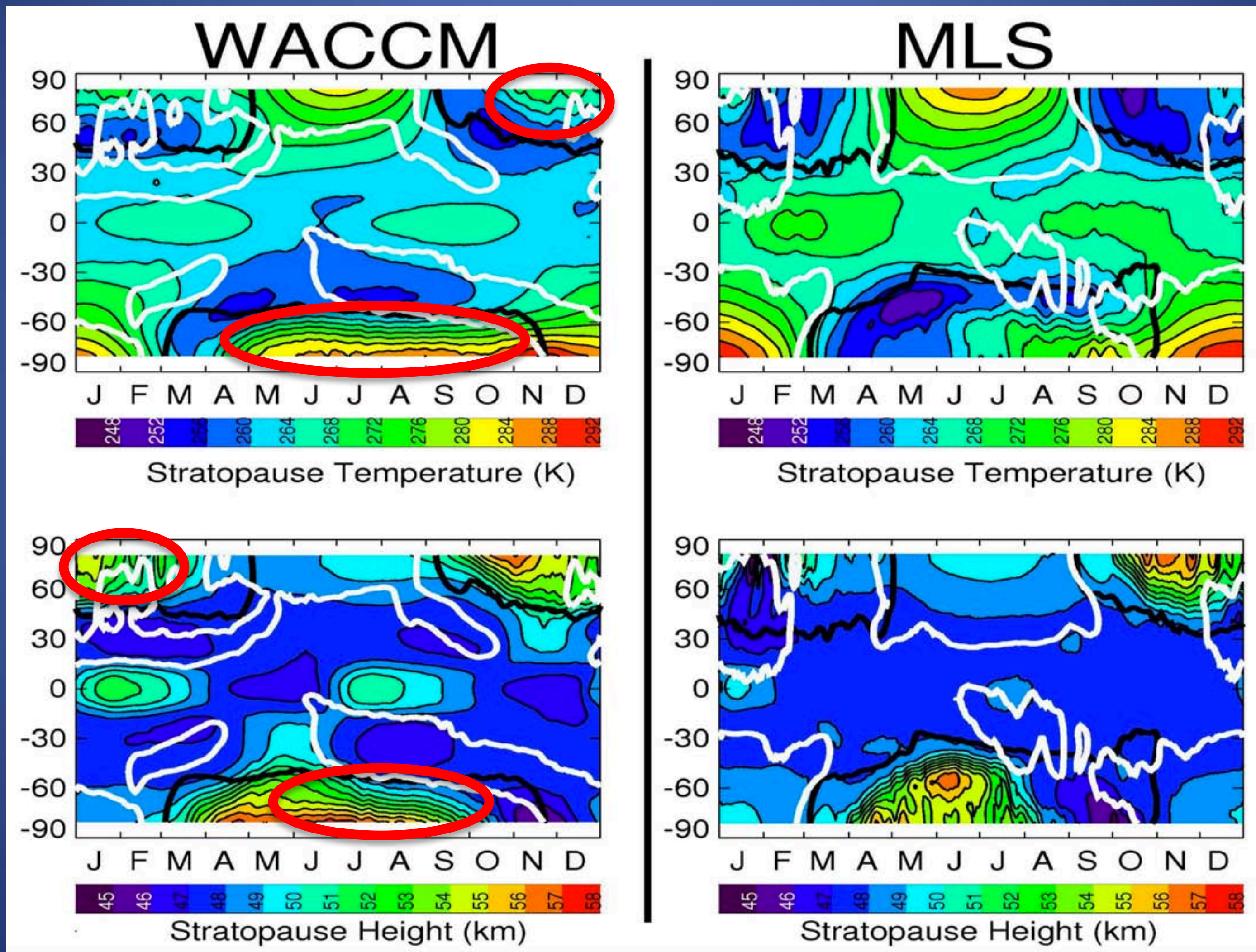
Holt et al. [2013], Descent of EPP-NOx during Arctic Sudden Stratospheric Warmings, in prep.

Randall et al. [2013], Auroral Energy Particle Precipitation: An Atmospheric Coupling Agent?, in prep.

Peck et al. [2013], Solar Cycle Impacts as Simulated by WACCM4, in prep.

Peck et al. [2013], EPP vs. Solar Irradiance Effects on the Atmosphere in WACCM, in prep.

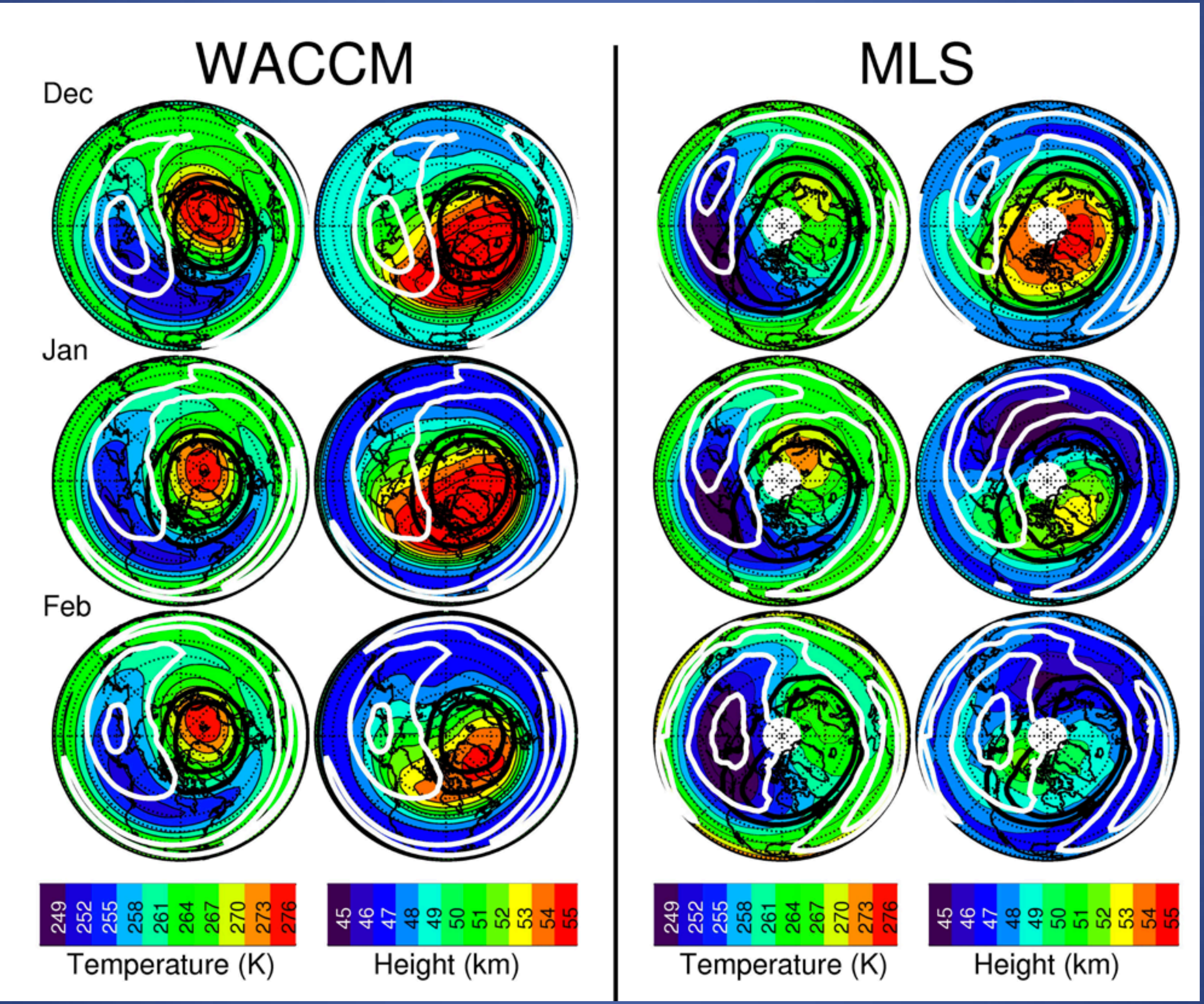
Latitude Time Annual Cycle



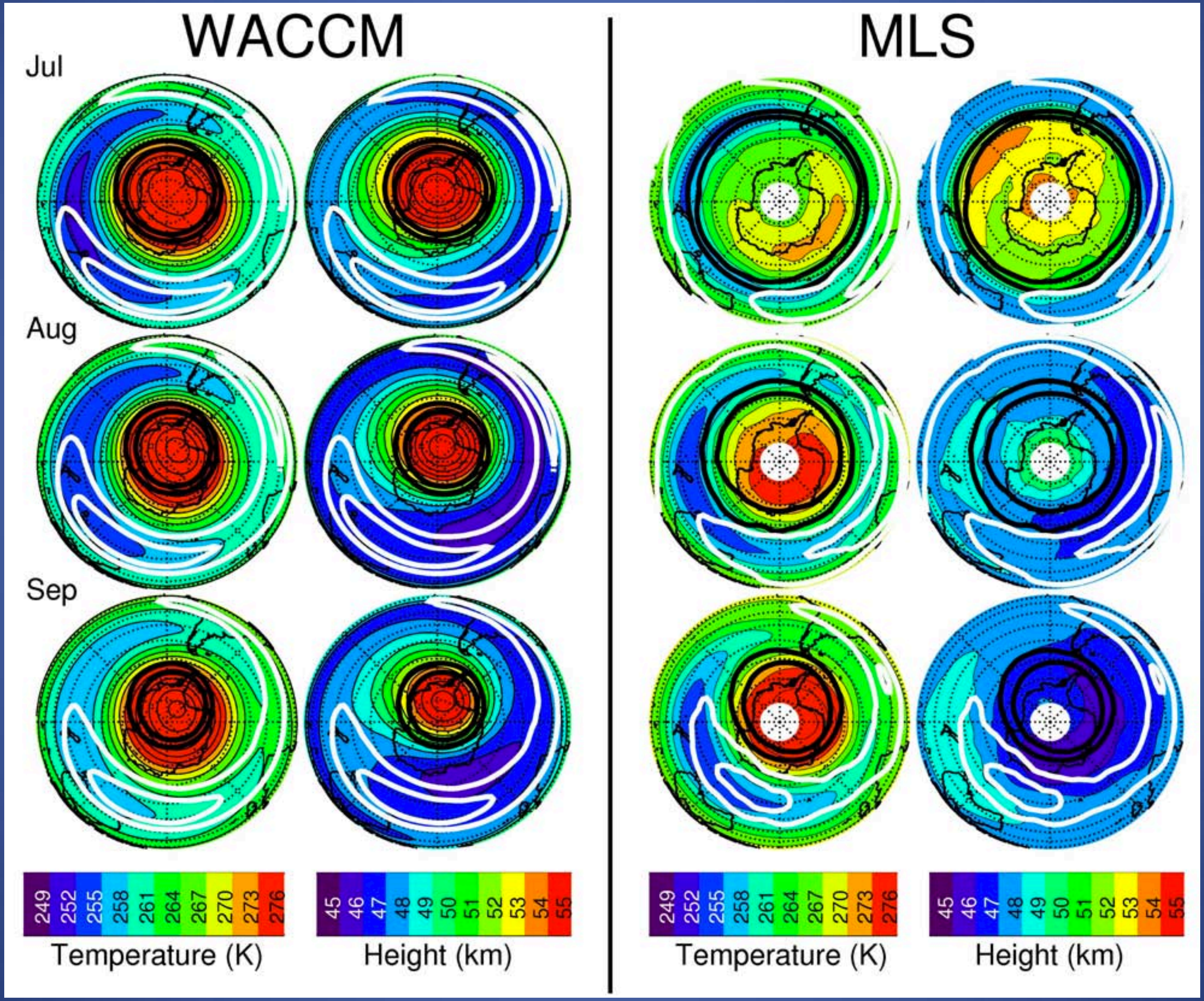
40 Years

8 Years

Arctic Winter



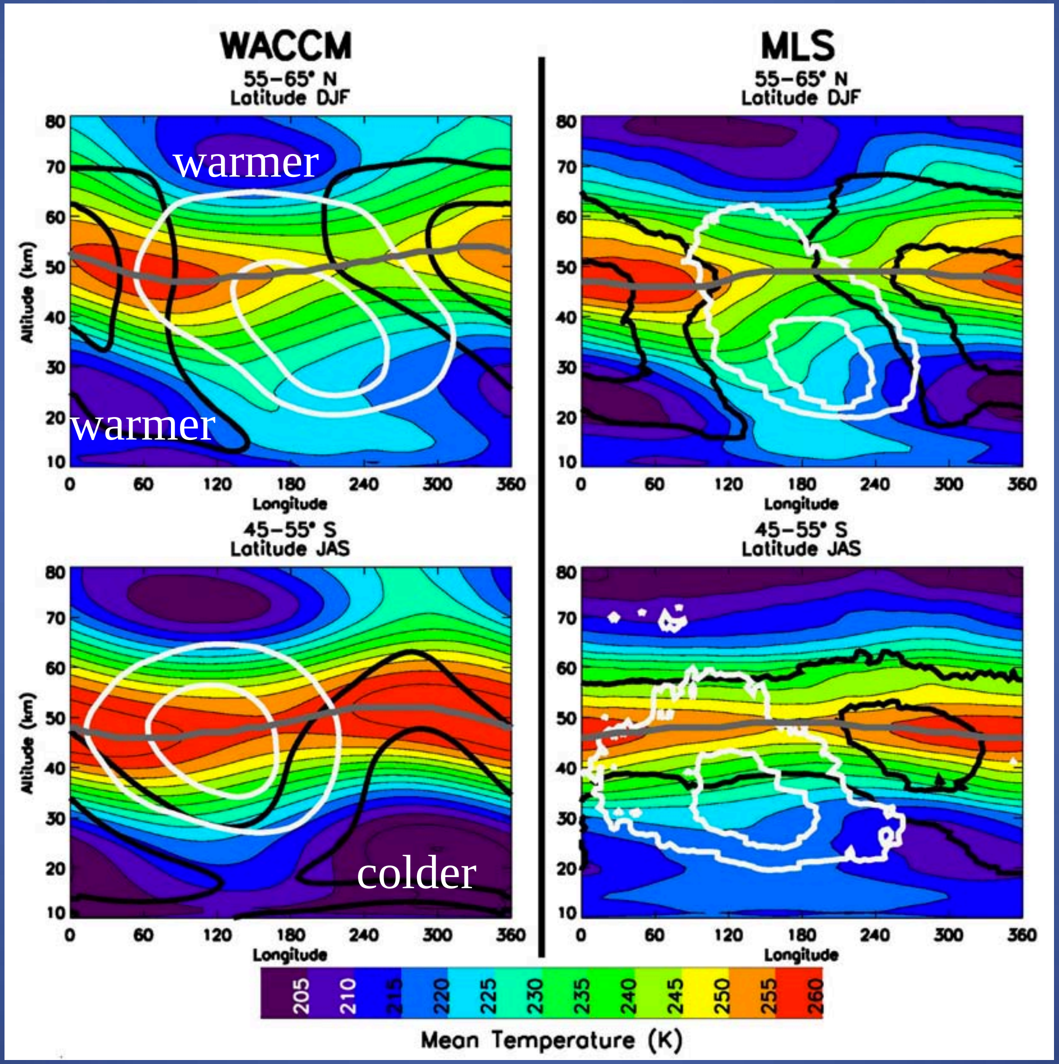
Antarctic Winter/Spring



Longitude Altitude Plots

NH

SH

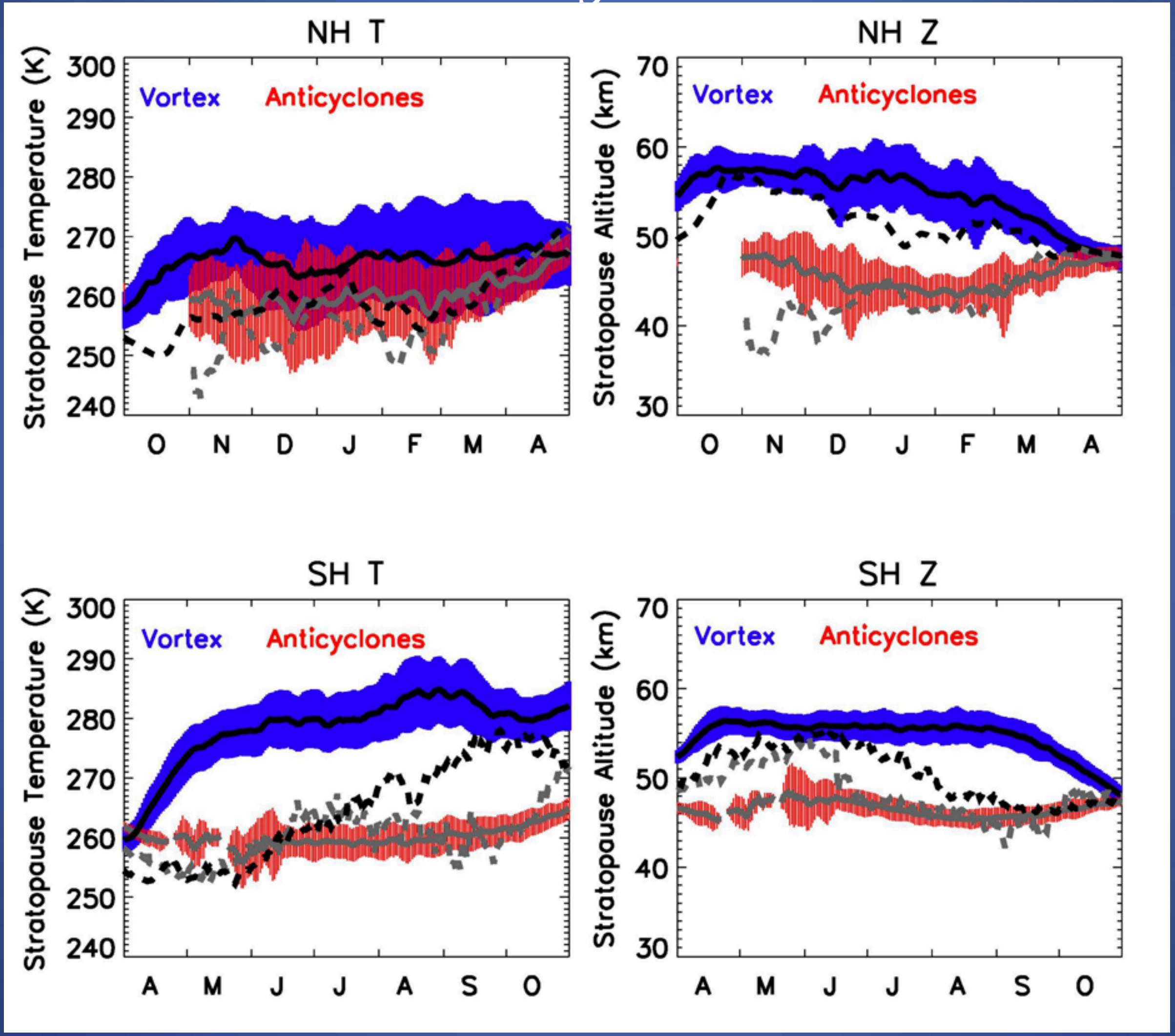


Smaller Upper Stratospheric Antarctic Vortex

Annual Cycles in Polar Vortices and Anticyclones

NH

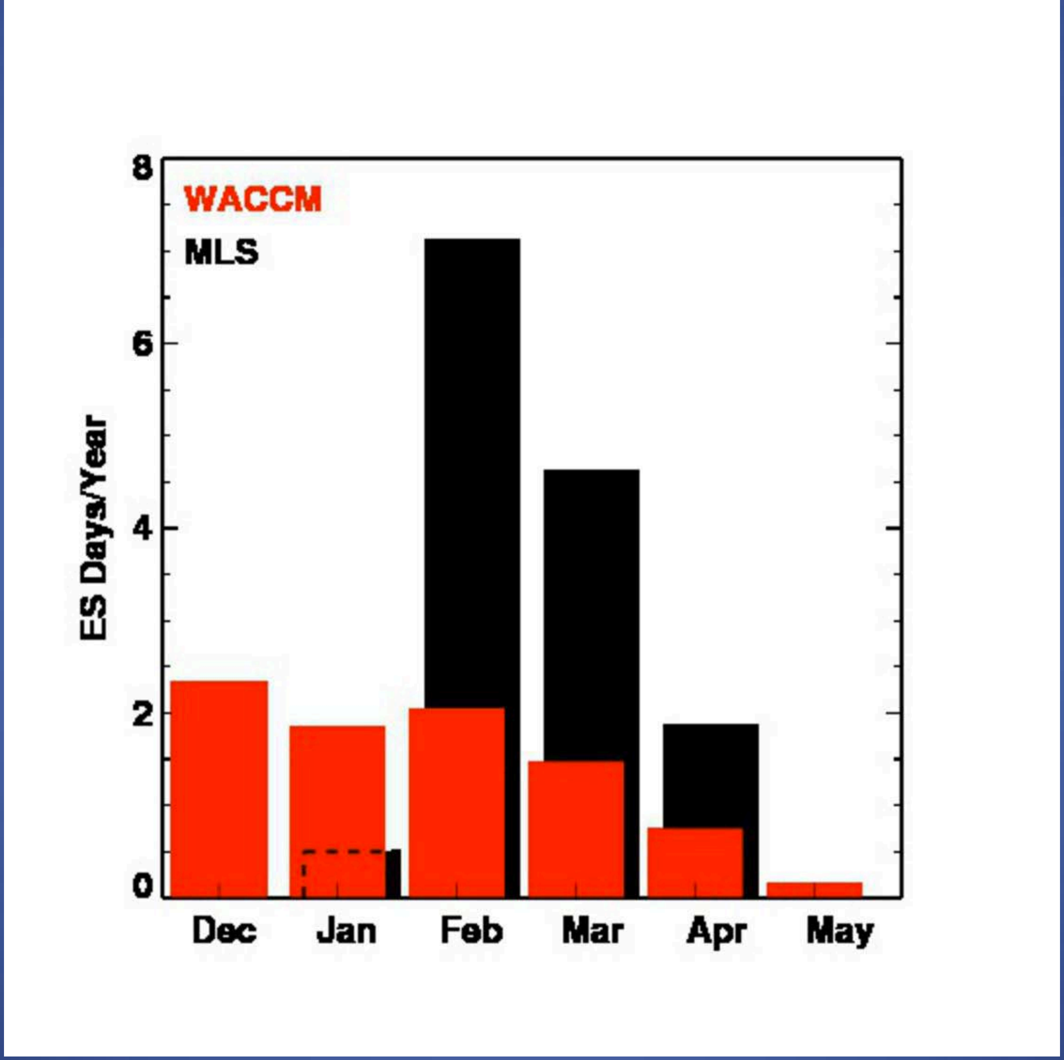
SH



NH stratopause in the Arctic Vortex:
1) 5-10 K warmer Oct-Mar.

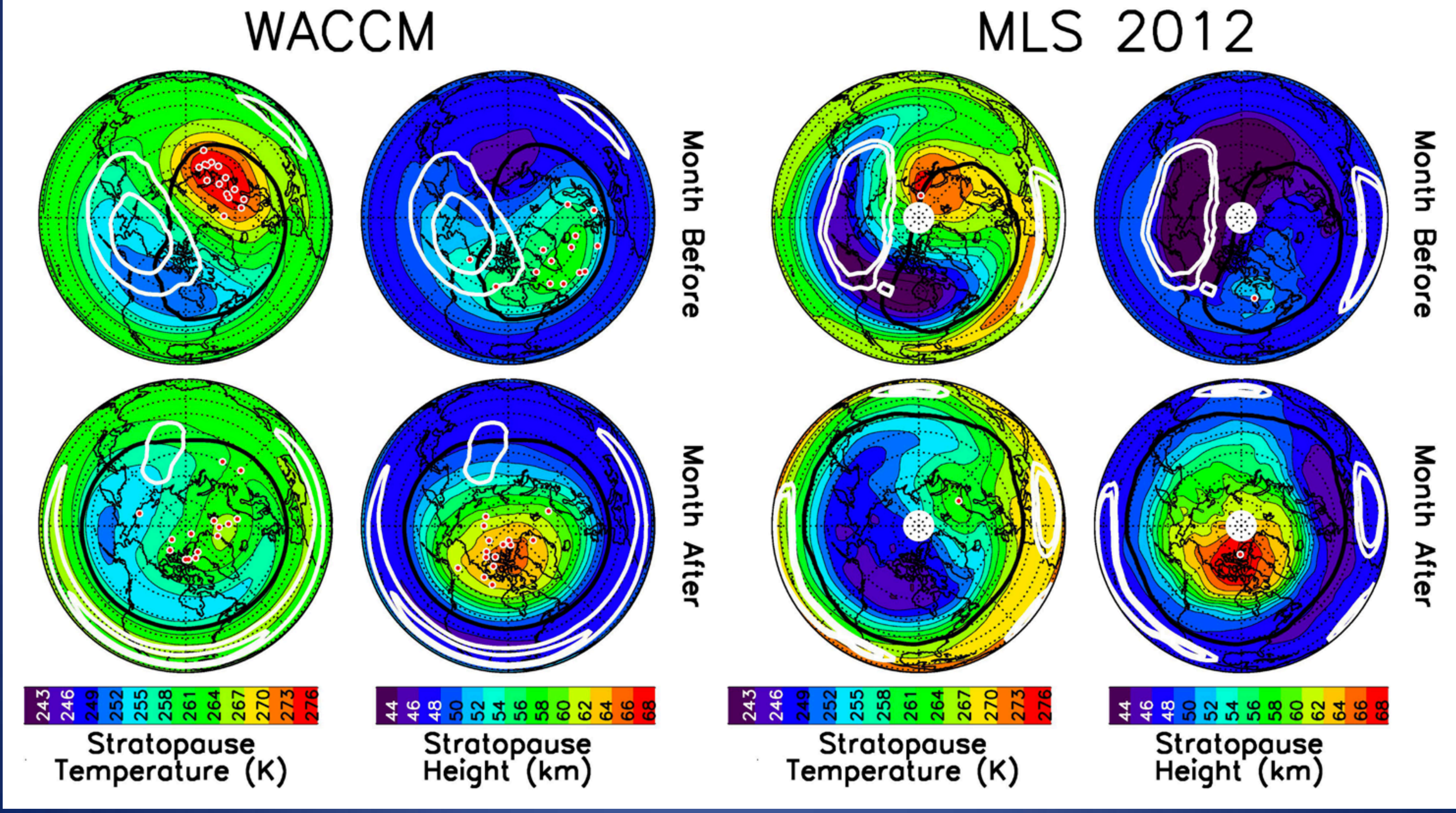
SH stratopause in the Antarctic Vortex:
1) >10 K warmer May-Aug.
2) 10 km higher Aug-Sep.

ES Event Monthly Frequency

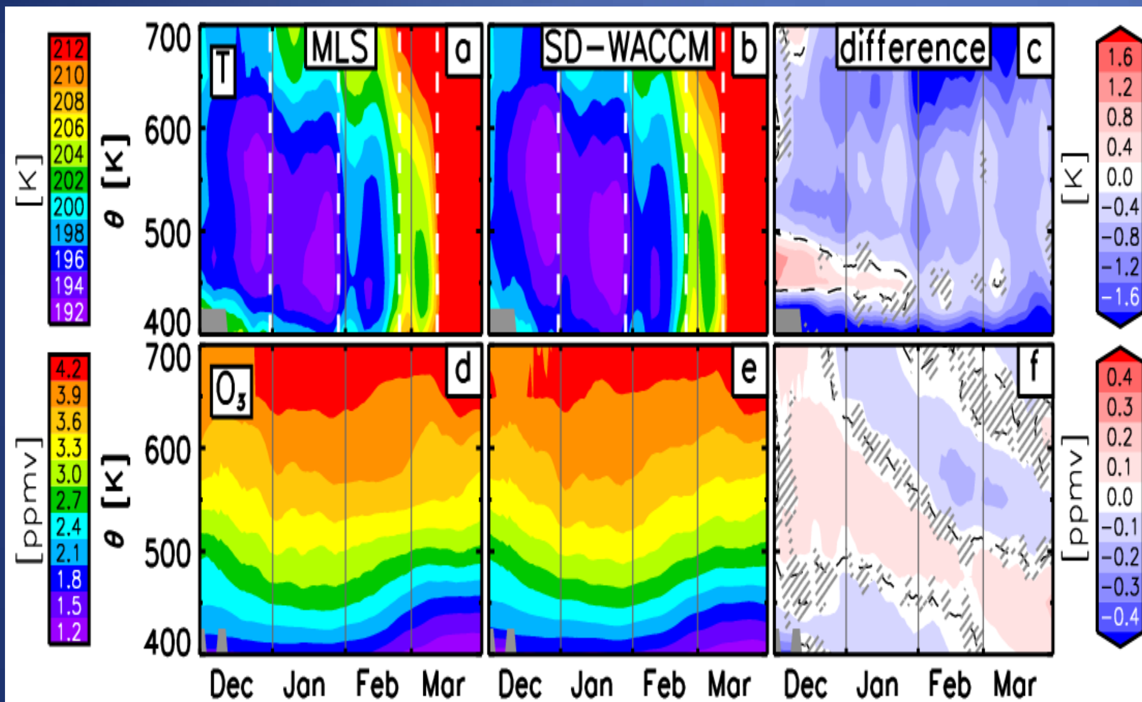


December ES events in WACCM are not observed by MLS

Stratopause Composites
1 Month Before and 1 Month After ES Events



Matthias Brakebusch: Polar stratospheric ozone studies and WACCM evaluation



Brakebusch et al. [2013], **Evaluation of Whole Atmosphere Community Climate Model simulations of ozone during Arctic winter 2004-2005**, *accepted at JGR*.

1. SD-WACCM is a useful tool for investigating polar O_3 loss.
2. SD-WACCM O_3 and MLS O_3 differences are smaller than 10%.
3. Temperature bias improves heterogeneous chemistry and thus O_3 loss.

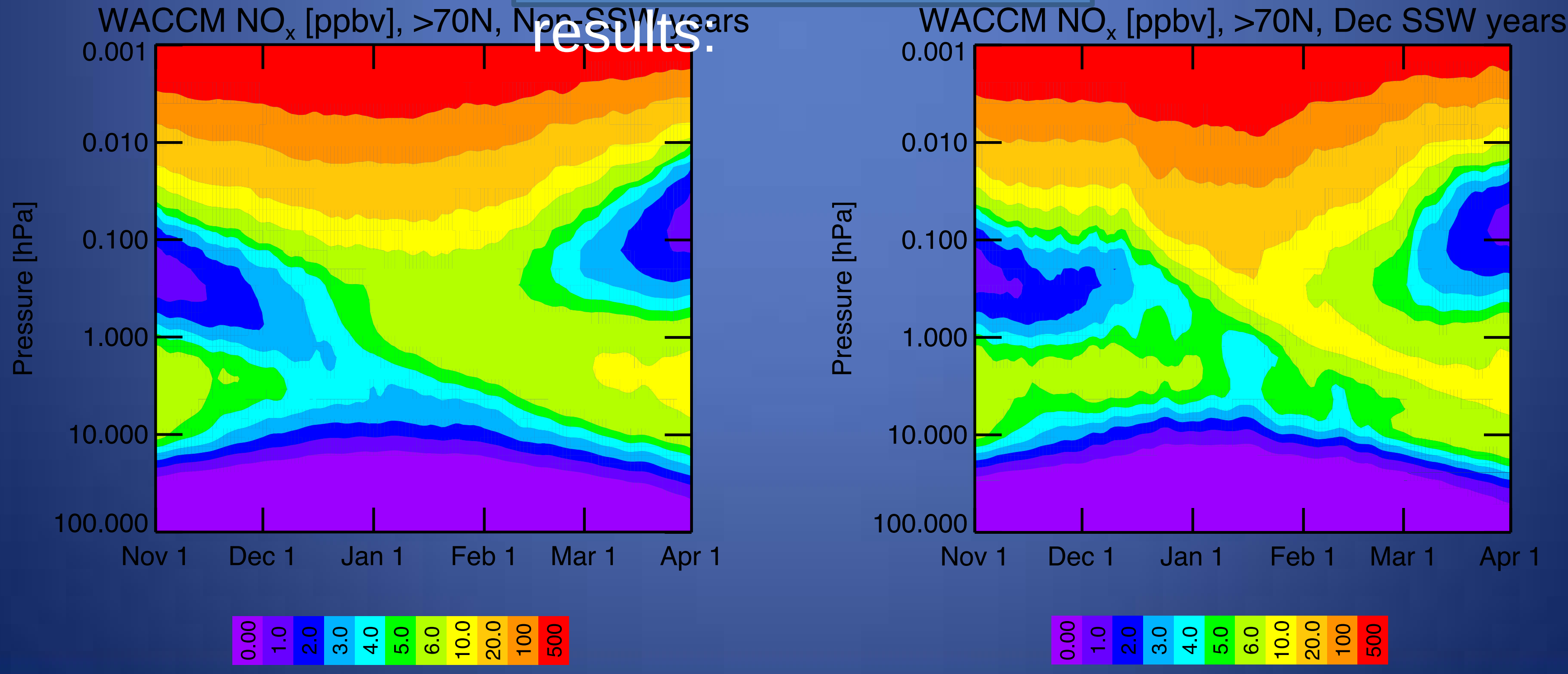
Brakebusch et al. [2013], Attribution of Ozone Loss During the Antarctic Winter 2005, in prep.

Laura Holt: Descent of EPP-NOx during Arctic SSWs

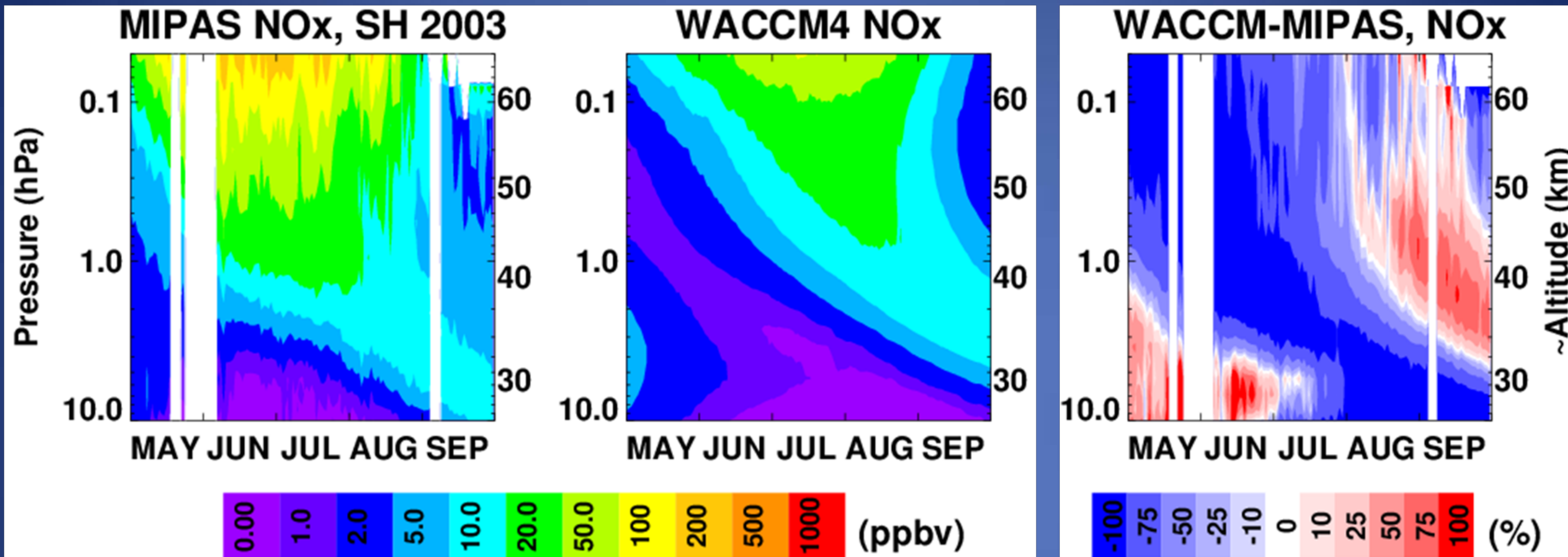
Science questions:

- How do sudden stratospheric warmings affect the transport of NO_x created by energetic particle precipitation?
- Does the timing of the warming affect the amount of NO_x transported to th

Initial WACCM results:



Randall and Peck: EPP and Solar Effects in WACCM

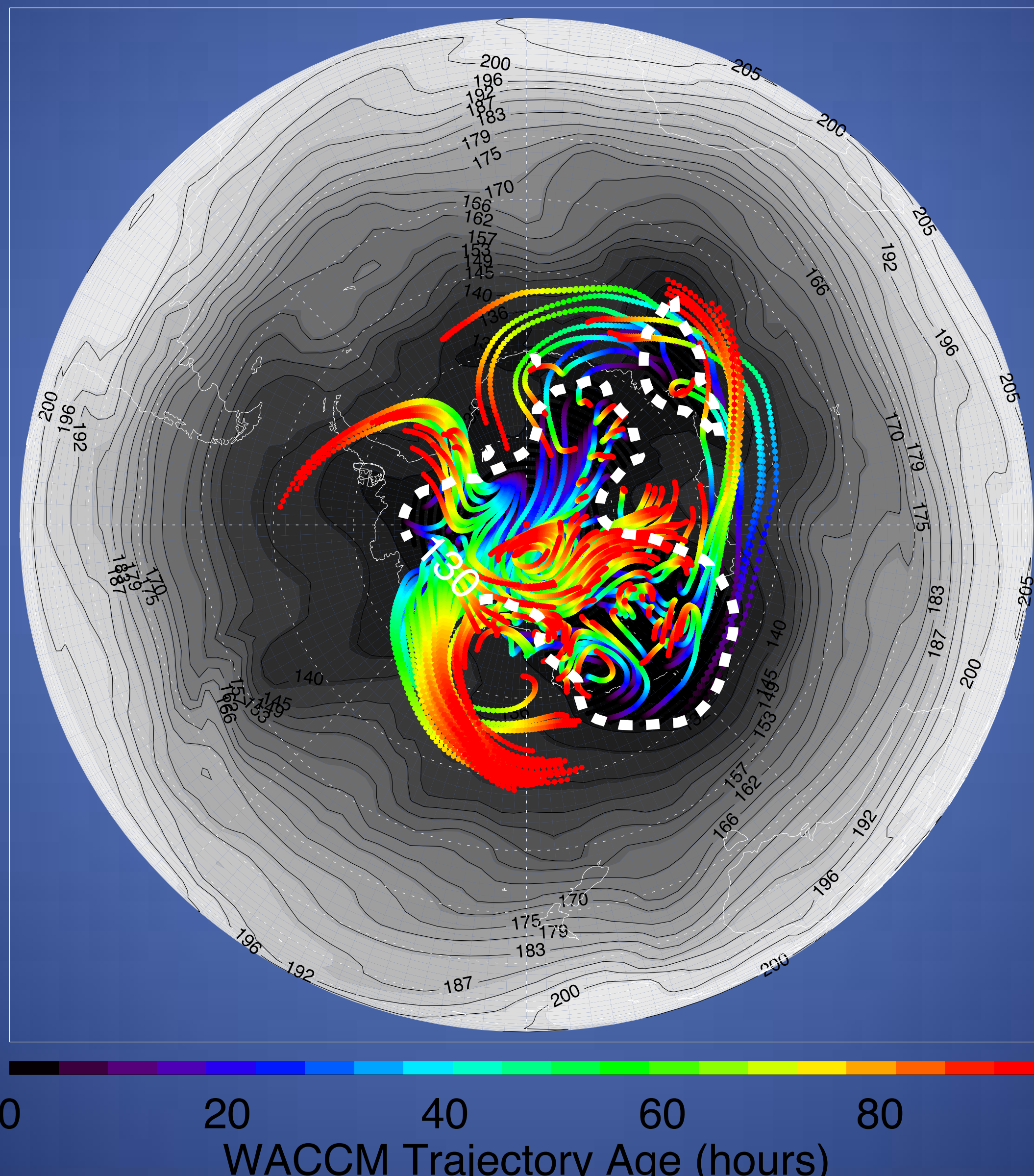


MIPAS NOx (left), WACCM NOx from the HA run (middle), and the % difference (right) for the SH in 2003 >70^{o}S.

Annual cycle of WACCM4 NO_x, O_3, T, U at 80°S for strong aurora vs. weak aurora runs.

Randall et al. [2013], Auroral Energy Particle Precipitation: An Atmospheric Coupling Agent?
Peck et al. [2013], Solar Cycle Impacts as Simulated by WACCM4
Peck et al. [2013], EPP vs. Solar Irradiance Effects on the Atmosphere in WACCM

Future Work: Lagrangian Trajectories



Thanks!