

# Representation of Tracer Gradients across the Extra-tropical Tropopause in WACCM

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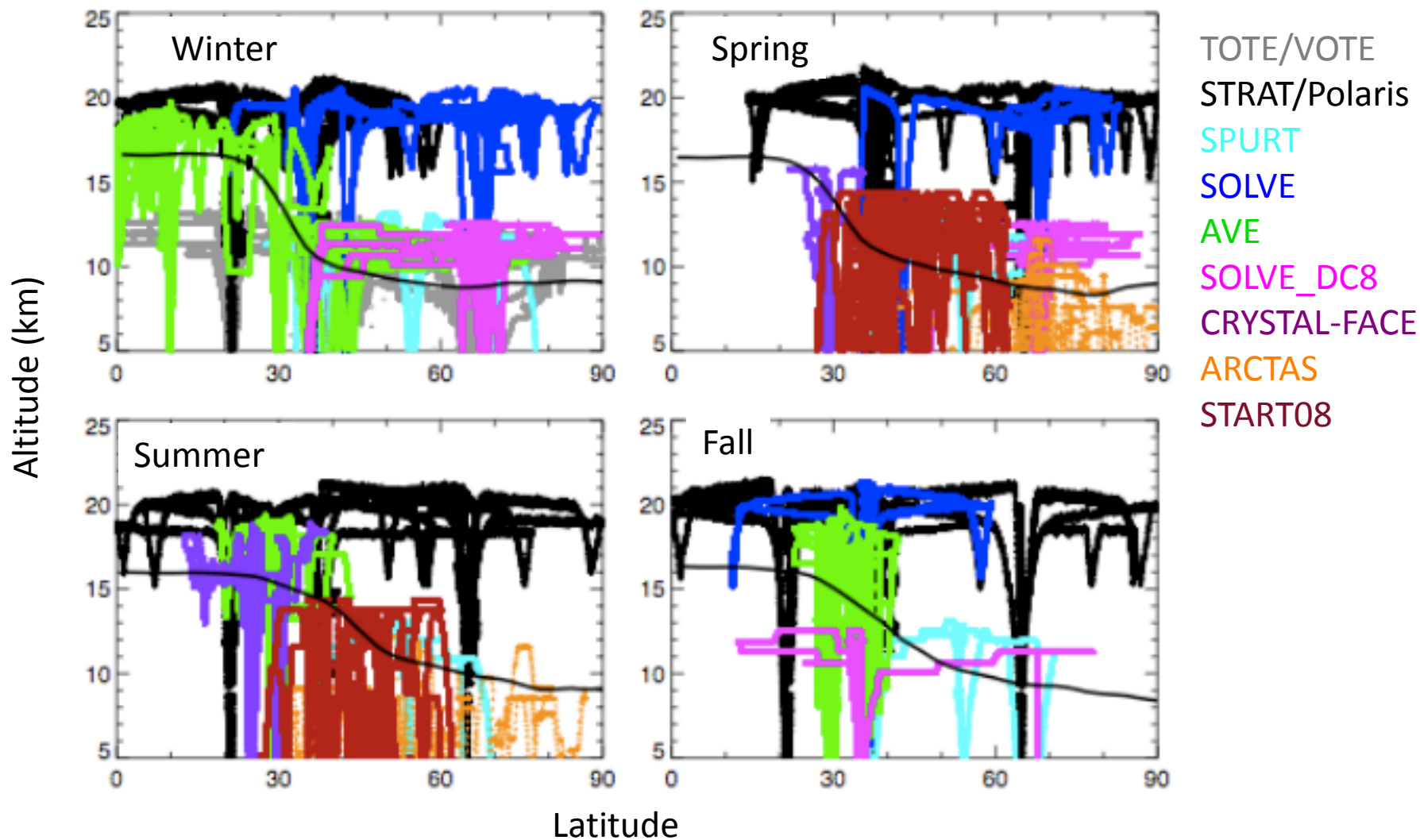
## **Outline:**

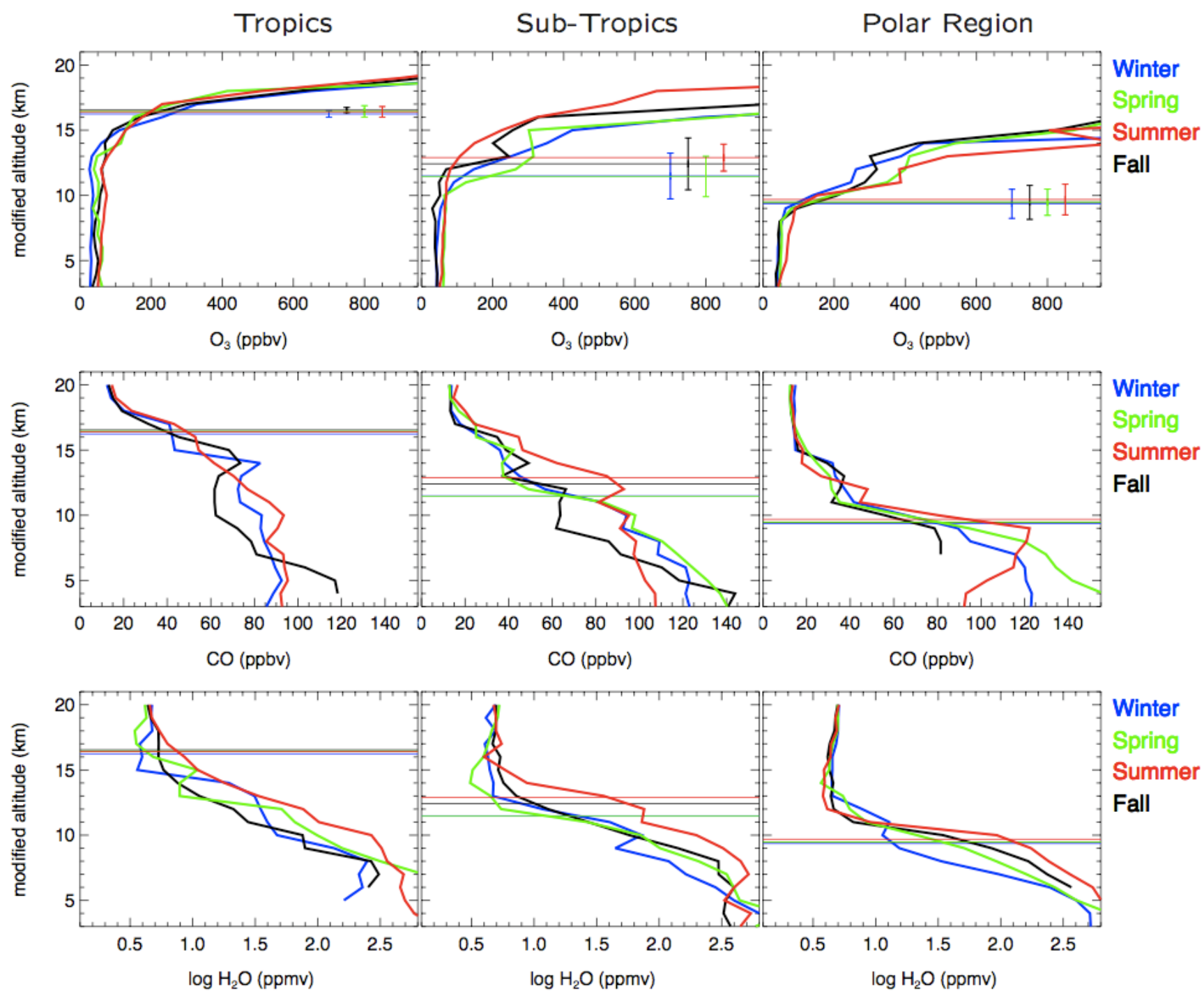
- WACCM Model Simulations
- Aircraft Climatology
- Initial Comparisons

<b>MODEL Framework</b>	<b>Meteorological Fields</b>	<b>Tracer Advection</b>	<b>Emissions</b>	<b>Chemistry</b>
<p><b>WACCM3</b>            Extension the Community Atmospheric Model, Version 3 (CAM3)</p> <p>Current Version:            V3_5_48_08</p>	<p><b>Fully-interactive</b>, i.e., dynamics consistent with model derived :            O<sub>3</sub>, CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, H<sub>2</sub>O, CFC-11, CFC-12, O<sub>2</sub>, NO</p> <p>-----</p> <p><b>Specified Dynamics:</b>            GEOS-5.1 (starting 2004)</p>	<p><b>Flux Form Finite Volume</b> (Lin, 2004)</p> <hr/> <p><b>Resolution</b></p> <hr/> <p><b>Horizontal:</b>            4° x 5°            1.9° x 2°</p> <p><b>Vertical:</b>            66 levels,            103 levels            80 levels (nudged) (0-150 km)</p>	<p><b>Anthropogenic emissions:</b>            representative of 2006 (David Streets)</p> <p><b>Fire emissions</b>            based on MODIS daily fire counts (Christine Wiedinmyer)</p>	<ul style="list-style-type: none"> <li>• <b>Standard Mechanism</b>              57 species mechanism includes the necessary Ox, HOx, NOx, BrOx, and ClOx species for the Middle Atmosphere (MA)</li> <li>• <b>Trop-MLT Mechanisms</b>              125 species:  <b>Plus NMHCs</b> to represent tropospheric chemistry</li> </ul>

<b>Meteorological Fields</b>	<b>Horizontal Resolution</b>	<b>Vertical Resolution</b>	<b>Chemistry</b>
<b>Fully-interactive</b>	<b>4° x 5°</b>	<b>66 levels dz =(1-1.3 km)</b>	<b>57 species mechanism 125 species mechanism</b>
	<b>1.9° x 2°</b>	<b>66 levels dz =(1-1.3 km)</b>	<b>57 species mechanism 125 species mechanism</b>
	<b>1.9° x 2°</b>	<b>103 levels dz = (0.3-1 km)</b>	<b>125 species mechanism</b>
<b>Specified Dynamics: GEOS-5.1 (starting 2004)</b>	<b>1.9° x 2°</b>	<b>80 levels (nudged)</b>	<b>57 species mechanism 125 species mechanism</b>

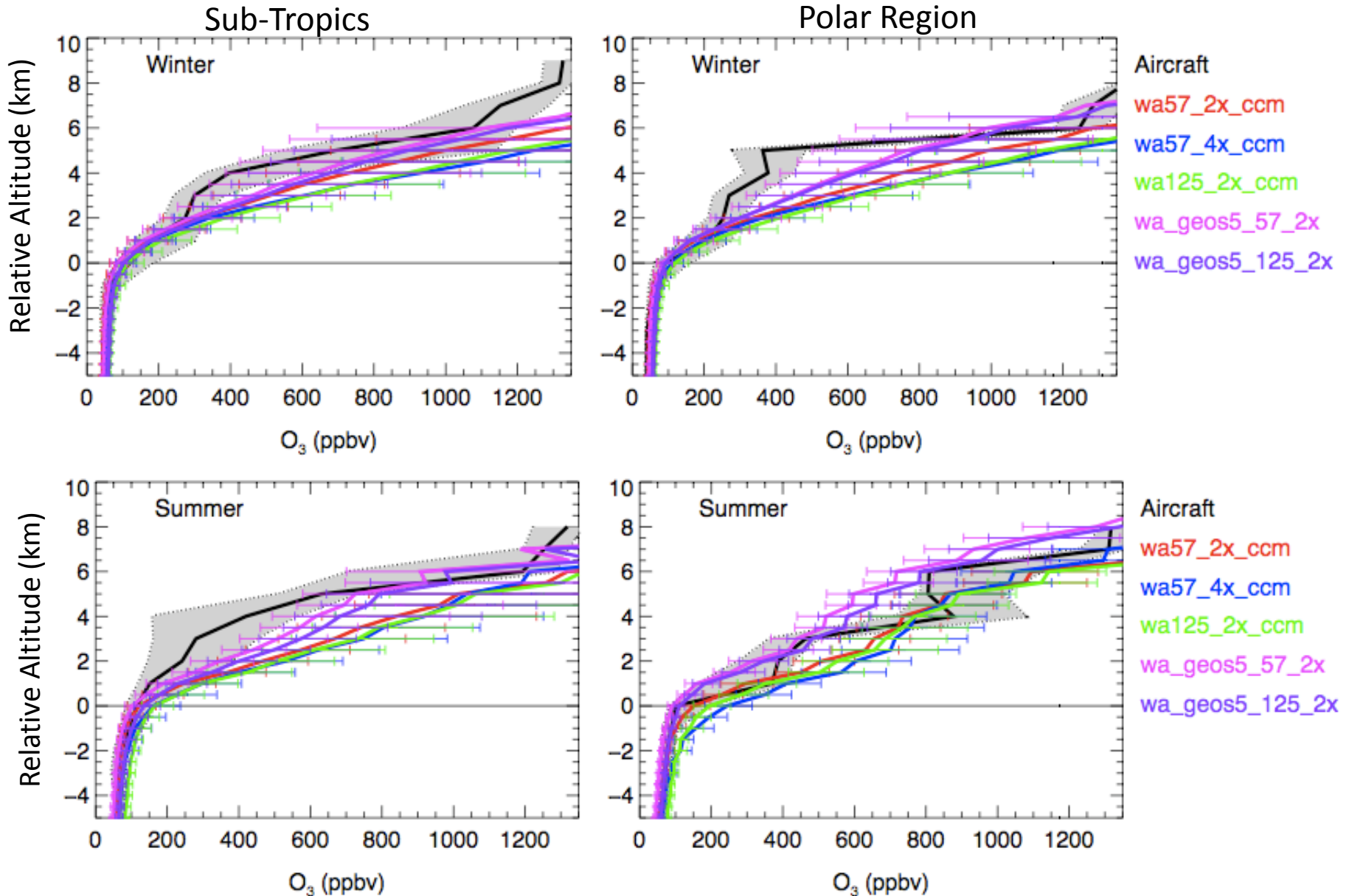
# Basis for comparison: UTLS aircraft Climatology 1995-2008





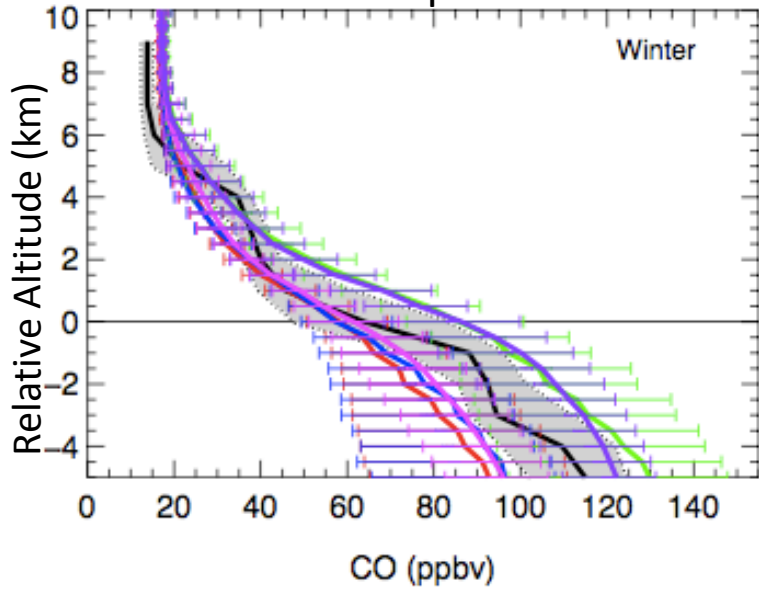
# Ozone (ppbv) vs. Relative Altitude (km)

Results from one year using 10 day instantaneous output

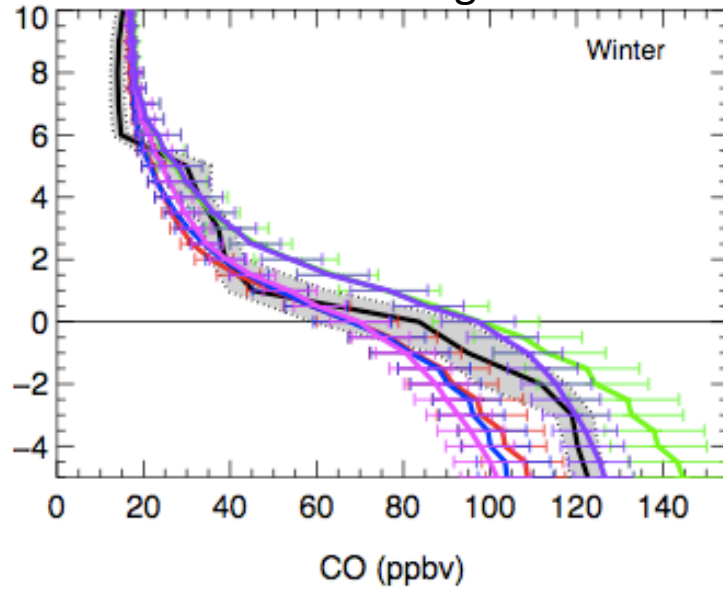


# CO (ppbv) vs. Relative Altitude (km)

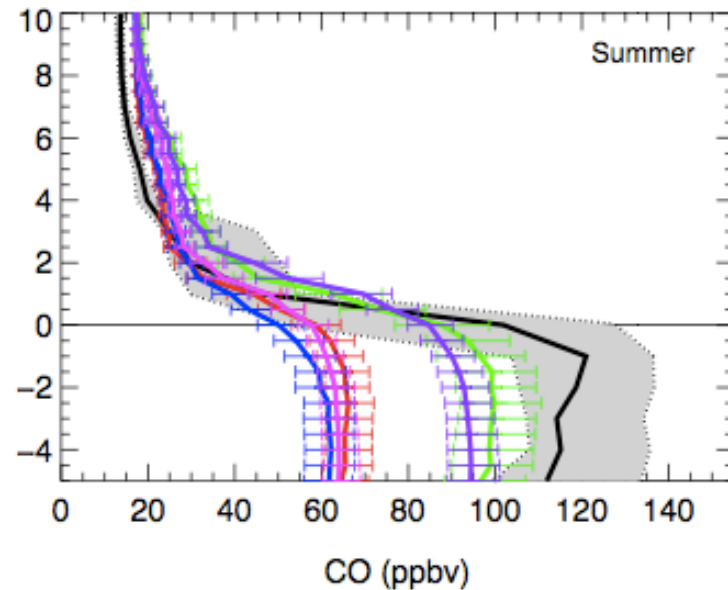
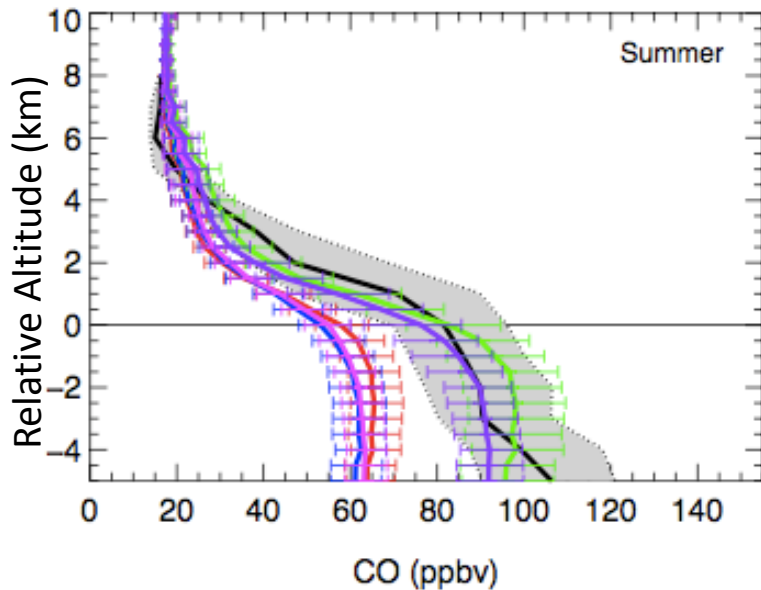
## Sub-Tropics



## Polar Region



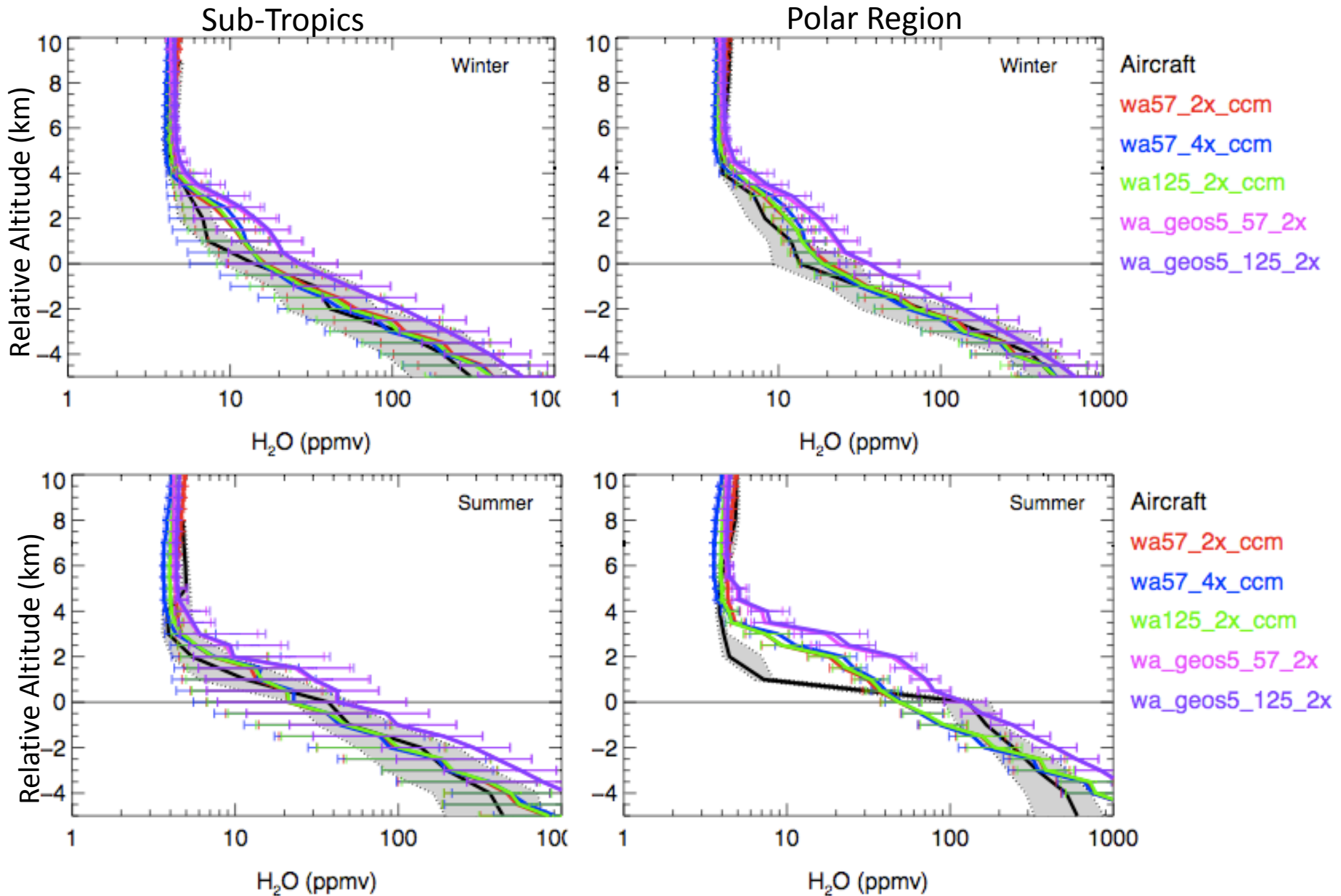
- Aircraft
- wa57\_2x\_ccm
  - wa57\_4x\_ccm
  - wa125\_2x\_ccm
  - wa\_geos5\_57\_2x
  - wa\_geos5\_125\_2x



- Aircraft
- wa57\_2x\_ccm
  - wa57\_4x\_ccm
  - wa125\_2x\_ccm
  - wa\_geos5\_57\_2x
  - wa\_geos5\_125\_2x

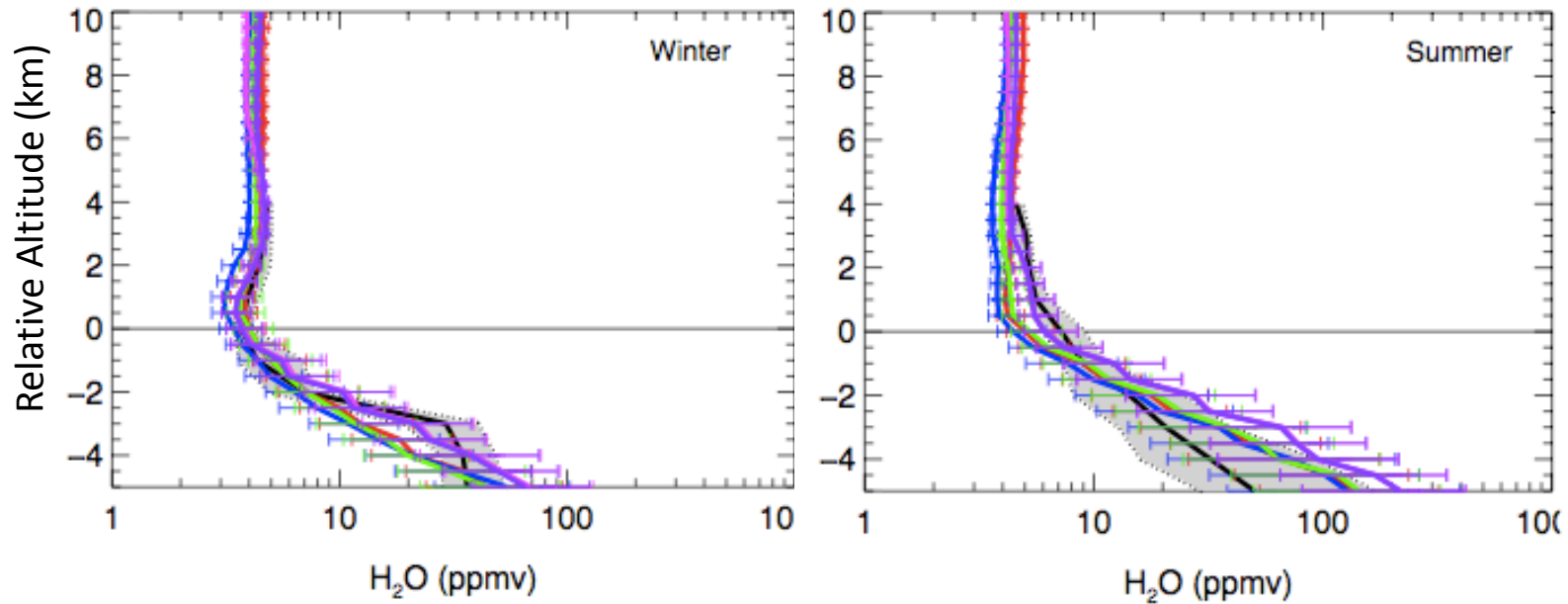


# H<sub>2</sub>O (ppbm) vs. Relative Altitude (km)





# Tropics: H<sub>2</sub>O (ppbm) vs. Relative Altitude (km)



# Summary

## **Model runs with varying resolution and chemical description:**

- Allows to localize shortcomings in the model
- Test the importance of vertical and horizontal resolution
- Test the importance of the tropospheric chemical mechanism for different species

