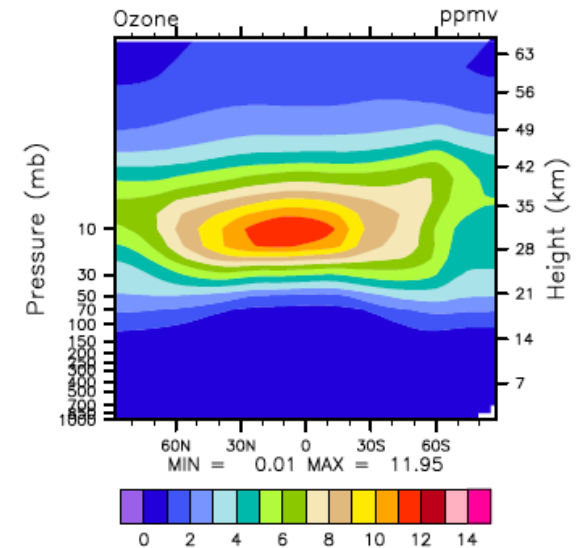
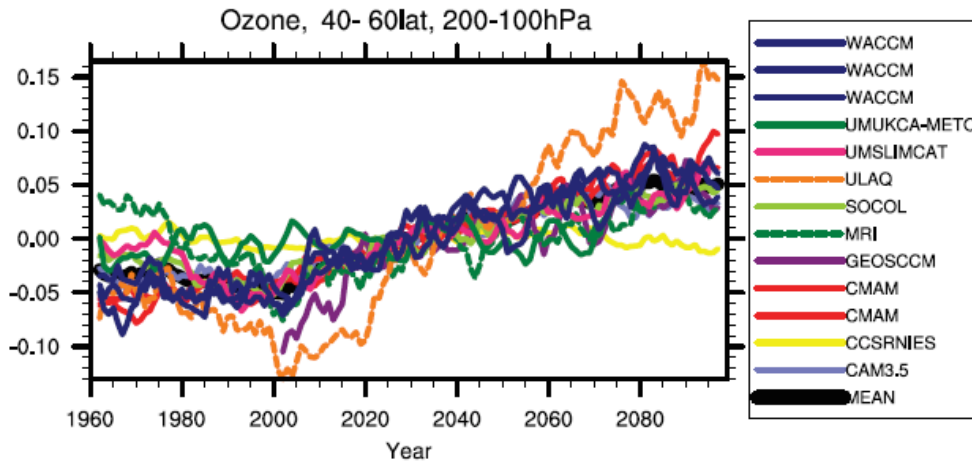


# A Diagnostic Tool for Chemistry-Climate Models

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CCMVal Diagnostics Development Team:

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# Chemistry Diagnostics

- AMWG has a diagnostic package for atmosphere dynamics/physics
- Recently, diagnostics have been developed for Chemistry Climate Models:
  - CCMVal project in support of WMO2010 Ozone assessment.
- Tool runs with WACCM and CAM-CHEM, can be used generally (AR5 models)
- Examples and plans follow

# Motivation and Goals

- **Facilitate the model evaluation, e.g.**
  - Allow quick looks at standard diagnostic plots & output diagnostic variables
  - Produce climatology files from CCMVal-2 CF-compliant model output

CF = Climate and Forecast meta-data
- **Include the diagnostics of the previous round of CCMVal evaluation**
- **Expandable and extensible**
  - Useful by multiple model groups & those analyzing models
  - SPARC CCMVal report can extend tool (i.e. provide diagnostics once report is finalized)

# Principles and Properties

## Principles

- Open Source Code
  - Python Script
  - NCAR Command Language (NCL) Calls (netCDF & Graphics)
- Portable across Platforms & Operating systems
  - UNIX/Linux/Windows/Mac
- Extensible and flexible
  - Run a lot of standard diagnostics. Or run only a few

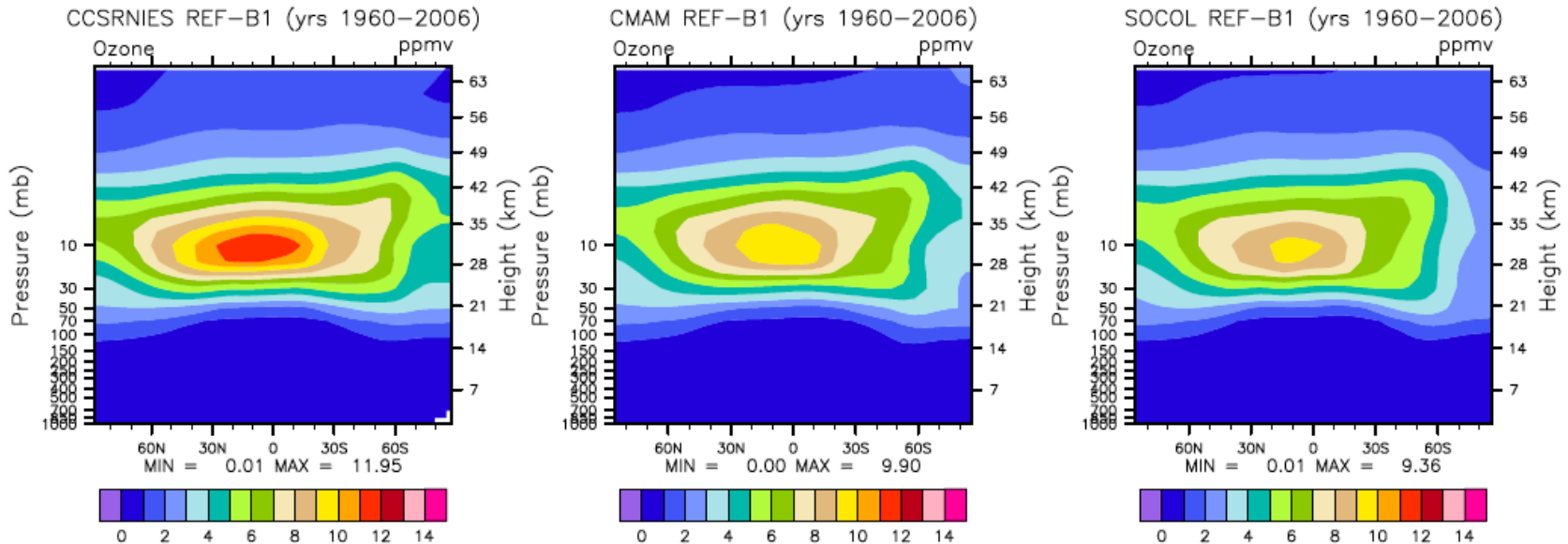
## Properties

- Read CF- compliant netCDF input
  - Or: read non-CF compliant (e.g.: CAM History) and convert
  - Readers for CAM already built
- Generates graphics and netCDF output (for other processing)
- Compare model(s) [one→many] to observations
- Will also generate web pages (eventually)

# Sample output: Zonal Mean Ozone

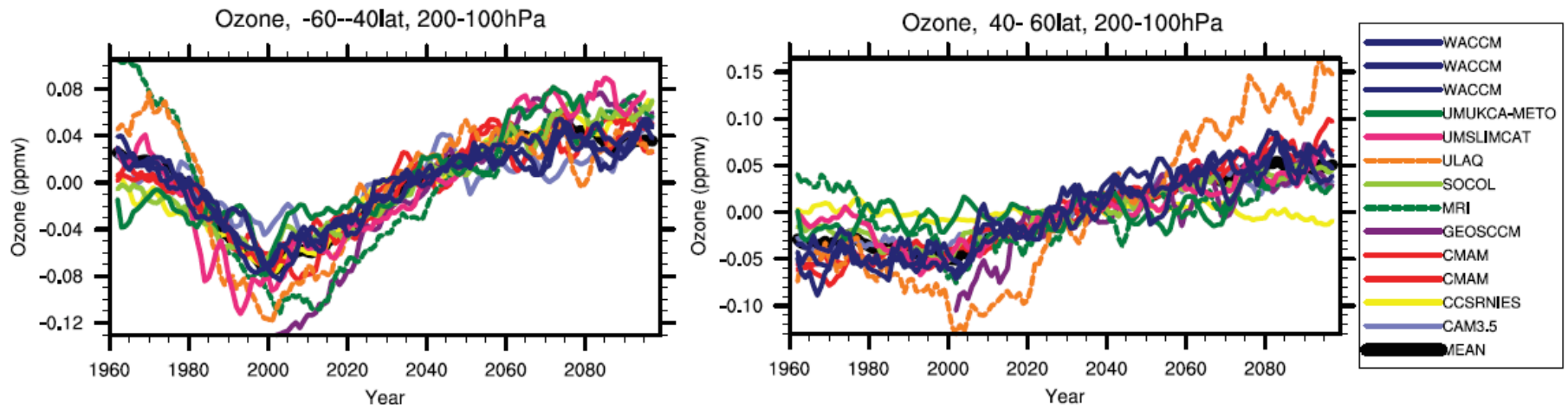
Compare multiple models (or runs from 1 model)

JJA



# Ozone Trends (with mean)

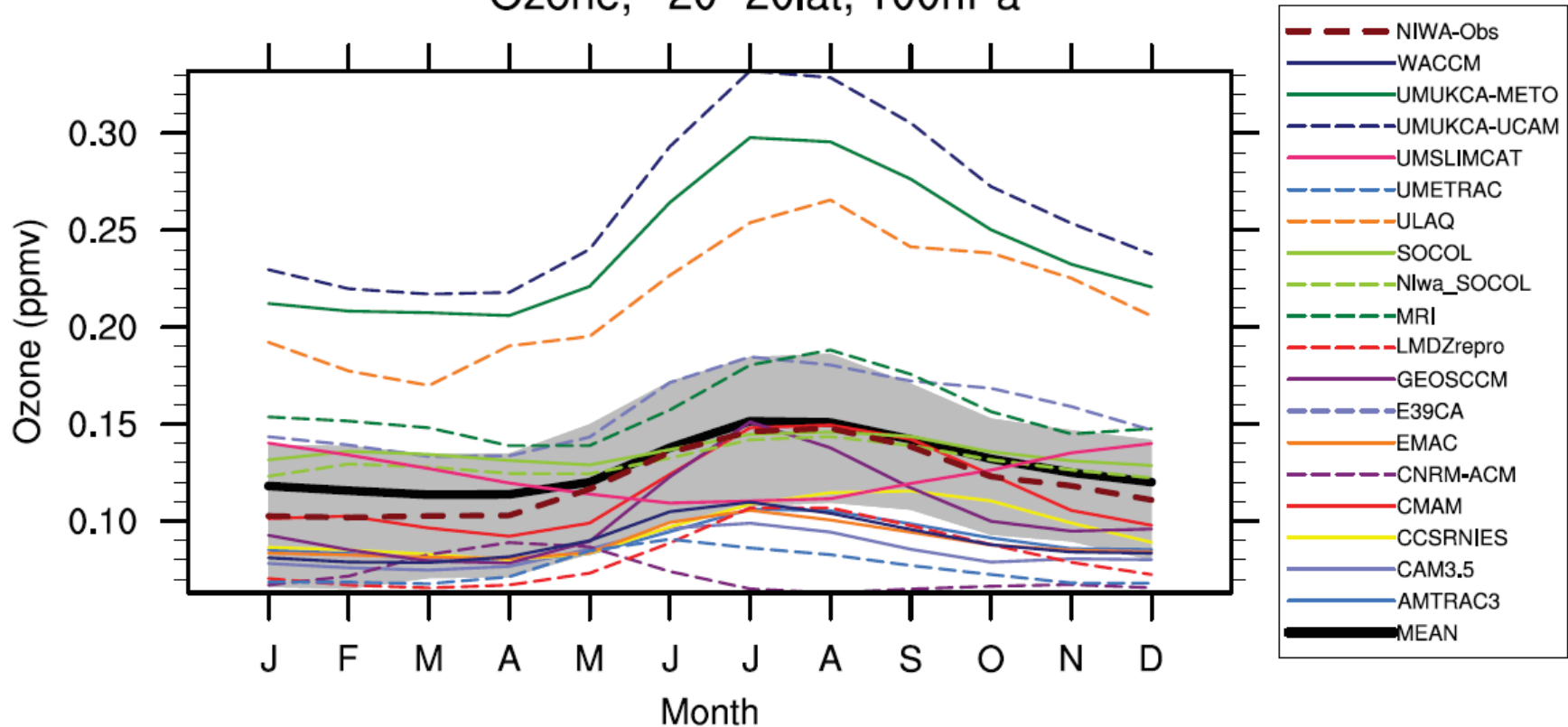
Ozone trends in the Mid-latitude UTLS:  
multiple models and multi model mean



# Tropical Ozone Annual Cycle

## Comparisons with observations (Ozone)

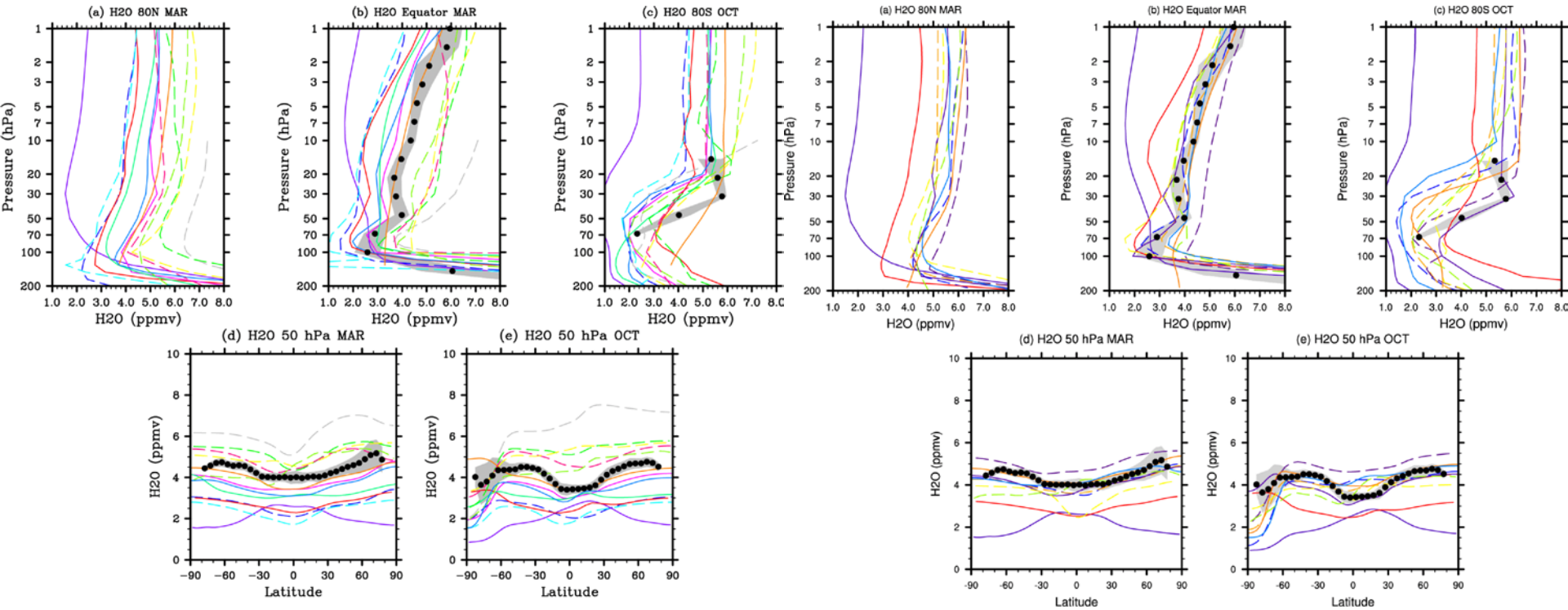
Ozone, -20- 20lat, 100hPa



# CCMVal-1 v. CCMVal-2

## CCMVal-1 H<sub>2</sub>O

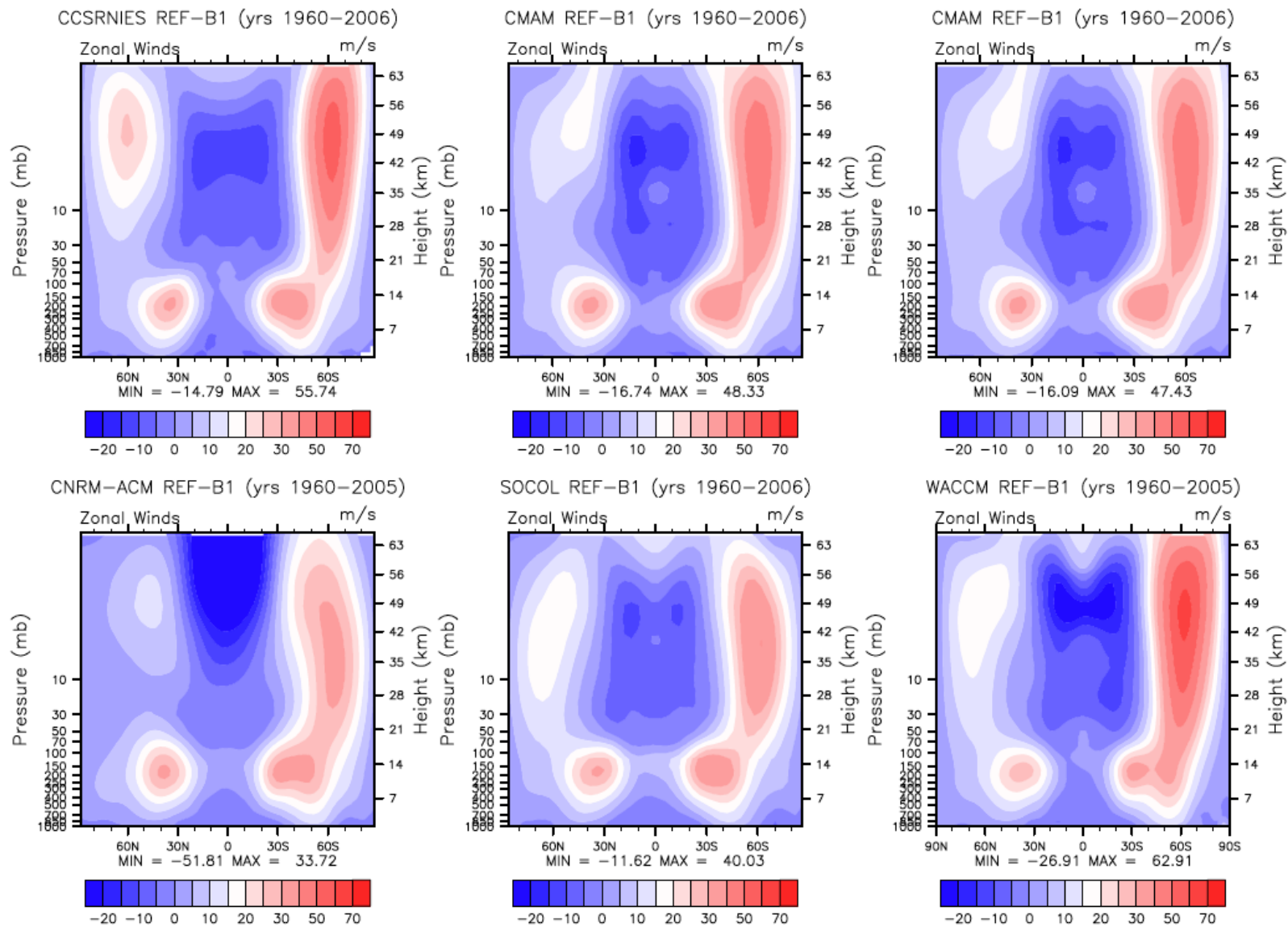
## CCMVal-2 H<sub>2</sub>O





# Zonal Wind

ANN

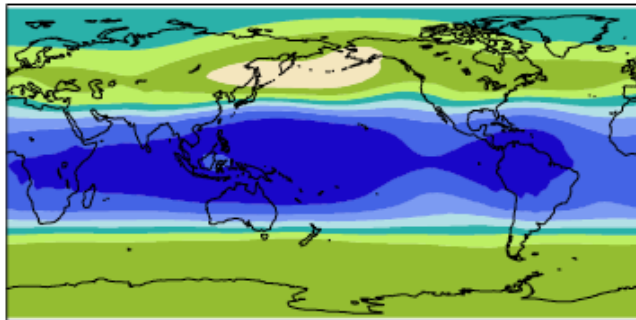


# Cold Point Tropopause Temperature

## Derived Fields: Tropopause Temperature

DJF

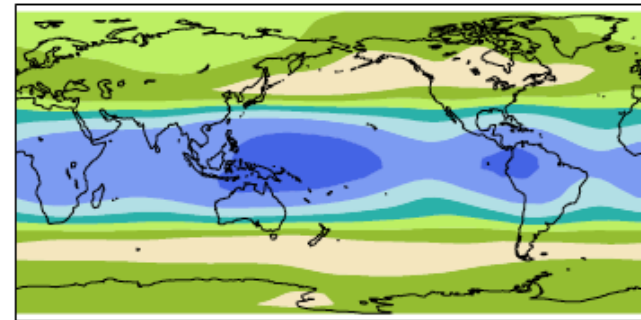
CCSRNIES REF-B1 (yrs 1960-2006)  
Cold Point Tropopause Air Temperature



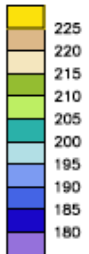
Min = 180.67 Max = 218.98



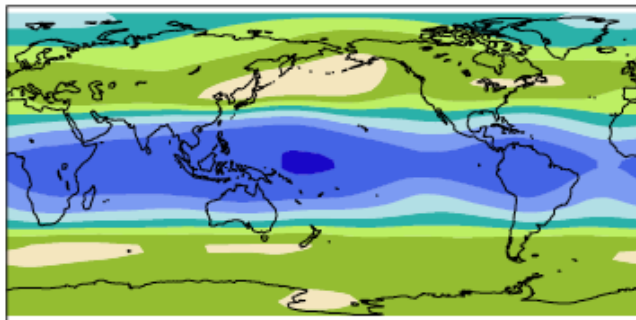
CMAM REF-B1 (yrs 1960-2006)  
Cold Point Tropopause Air Temperature



Min = 186.89 Max = 218.93



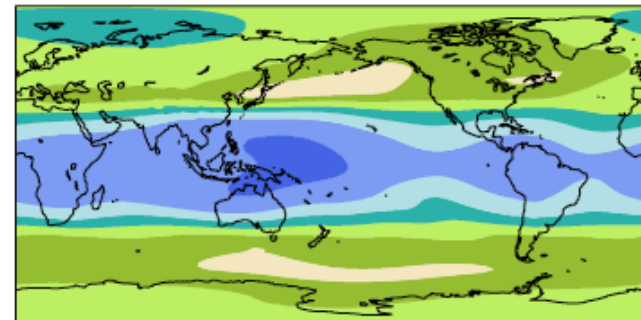
SOCOL REF-B1 (yrs 1960-2006)  
Cold Point Tropopause Air Temperature



Min = 184.72 Max = 219.52



WACCM REF-B1 (yrs 2001-2005)  
Cold Point Tropopause Air Temperature



Min = 189.13 Max = 218.47

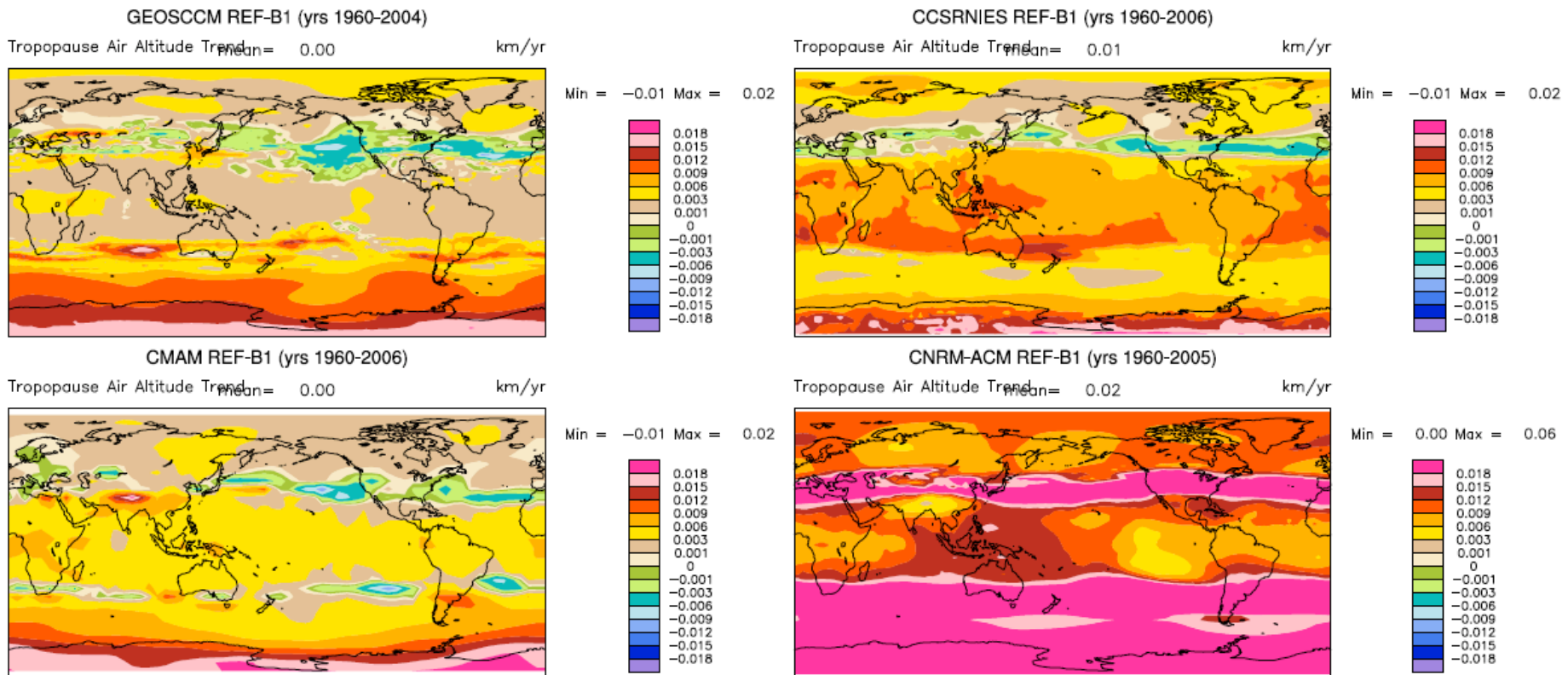




# Tropopause Altitude Trends (REF-B1)

Trends from a derived variable

ANN



# Notes

- Requires only NCL & Python installed.
  - Open Source
  - Python installed on many platforms
  - NCL 'easy' to install
  - No separate netCDF libraries
- Will run on Linux/Unix/Mac & Windows
  - Pre-compiled binaries available for most systems
  - Runs with X windows emulator under windows
- Flexible and built with text namelists
  - Average user will not need to modify python, not much NCL
  - Many users can just copy and paste, or use standard sets
  - Easy to hack to do what you want!

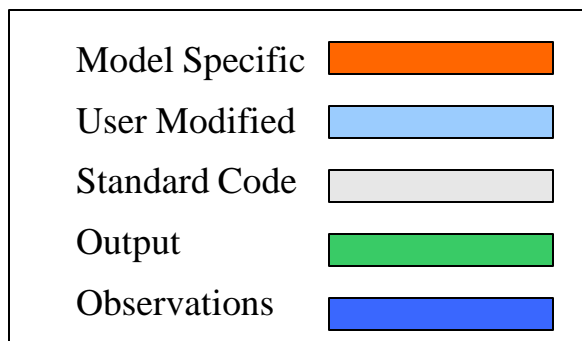
# Next Steps

- Finish Technical Note for Geosci. Model Dev.
- Modifications to work with large data sets  
(multiple 1-2 GB files)
- Extend output sets to provide web pages
- Add in more observations

## NOTES:

- CAM & ChemWG could be a prime user
- Already runs with CAM & WACCM
- Have some resources at NCAR & NIWA (NZ) to help over next 18 months.

# CCM-Diag Schematic



Model specific code: model variable mapping

reformat/[model]\_convert.txt

Model specific code: read files

[model\_name].py

[model\_name].ncl

Model Output  
(netCDF)

Basic Control: input models,  
basic functions

namelist

main.py

(loop over variables)

Climatology &  
Timeseries netCDF Files  
(CCMVal-CF compliant)

Specify Variables (climatologies) & plots

diag\_att/[set].att

Observations (Climo)

var\_att/[var]\_att.ncl

Variable descriptions (computation)  
(named in [set].att)

plot\_type/

Plotting codes  
(named in [set].att)

Plot variables  
(netCDF)

Figures  
(PNG/GIF)

