"WACCM4"

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(Garcia, Richter, Roble, Boville, Walters, Marsh, Sassi, Kinnison, Vitt, et al)

WACCM3

- Whole Atmosphere Community Climate Model, Version 3
  - Released 2008
- Science Goals:
  - Stratospheric Ozone
  - Sun-Earth Connections
- Collaboration among:, CGD, HAO, ACD
- WACCM3.5 run for 2010 WMO Assessment (CCMVal-2)

WACCM3.5 DESCRIPTION

MODEL Framework	Dynamics	Tracer Advection	Resolution	Chemistry	Other Processes
Extension of the NCAR Community Atmosphere Model version 3 (CAM3) Based upon CAM3.5.48	Finite Volume Dynamical Core (Lin, 2004) Fully-interactive, i.e., consistent with model derived: O_3, CO_2, CH_4, N_2O, H_2O, CFC-11, CFC-12, O_2, NO. Specified Dynamics	Flux Form Finite Volume (Lin, 2004)	Horizontal: $1.9°$ x $2.5°$ or $4.0°$ x $5.0°$ (lat x lon) Vertical: 66 levels 0-140km • < 1.0km in UTLS • 1-2 km in strat. • 3 km in M/LT	Middle Atmosphere Mechanism •57 Species including Ox, HOx, NOx, BrOx, and ClOx •No NMHCs •Includes Het. Chemistry on LBS, STS, NAT, ICE •E-region Ion Chemistry •JPL2006	•GW Param. Internal and Orographically-generated Frontogenesis and Convective GW •Molecular Diffusion Banks and Kockarts, 1973 •Auroral processes, inc. ion drag, and Joule heating •Long-, short-wave, chemical potential heating •Aerosol Heatin

# Towards WACCM4

Elements of CCSM Development:

- CCSM4.0: CAM3.5
- CCSM4.X: CAM4.0
- WACCMX
- Other WACCM Physics
  - PMCs
  - Sectional Microphysics (CARMA)

CAM4 Major Changes

- RRTMG Radiation Code
- 2- Moment Microphysics
  - Ice Super-saturation
- Moist Boundary Layer
- Total water PDF Macrophysics
- Modal Aerosol
- Aerosol Activation (indirect effects)

CAM4: Ice Supersaturation

RELHUM PDF -30 to 60lat 500-100hPa

ACARS RH
AIRS RH
MOZAIC RH

Latest ANN
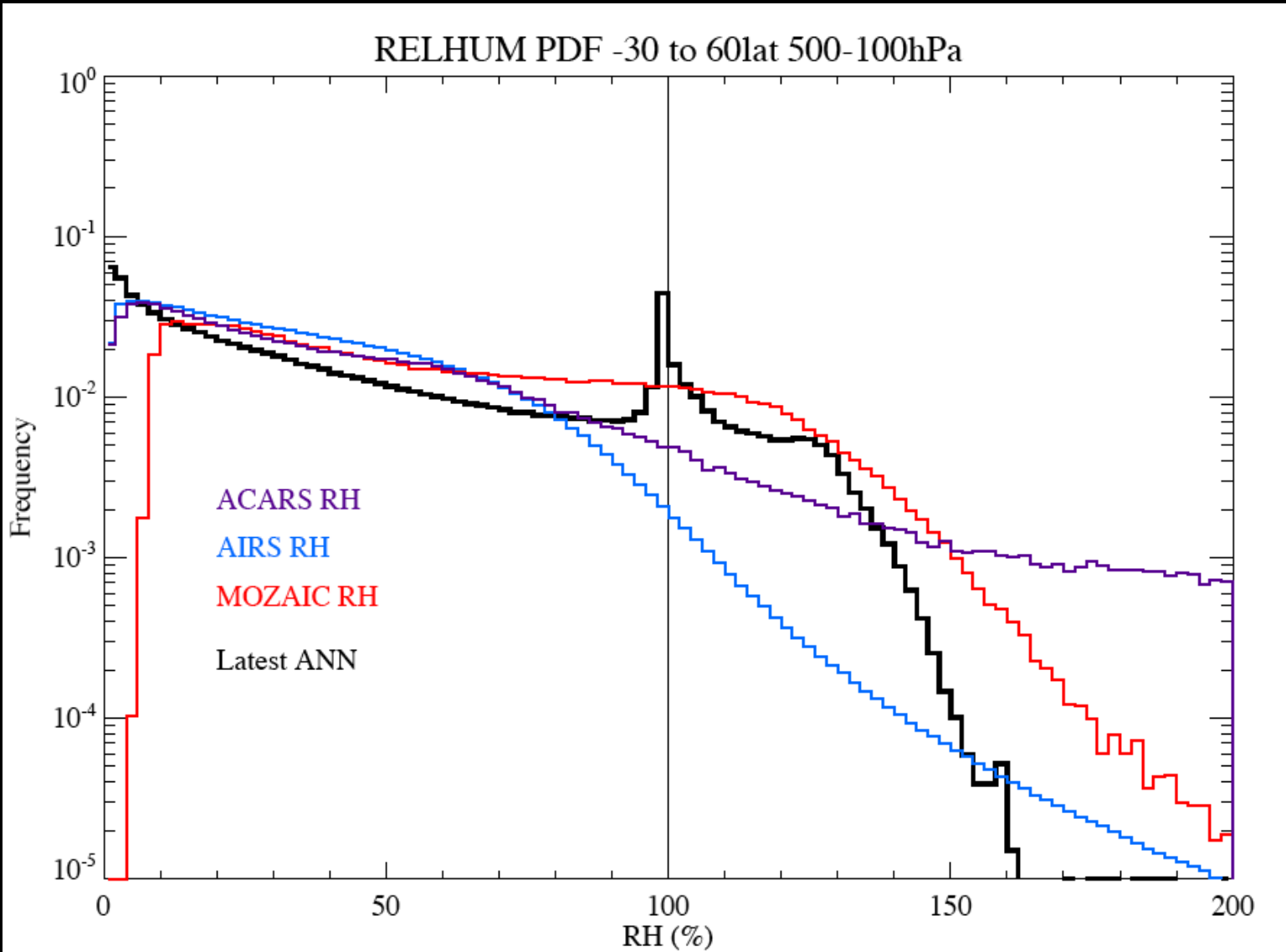
CAM4 Implications For WACCM

- ## Significant Changes to Atmosphere
  - Alteration of wave structures
  - Change in tropical tropopause
  - New Aerosol model

- ## Tuning for WACCM
  - GW/SSW probably requires retuning
    - Parameterizations the same
  - UTLS
    - Tropical tropopause adjusted with convection
    - Stratospheric H_2O can be adjusted with ice nucleation (not depending on SST)

Path Forward

- WACCM will be run as an IPCC AR5 model
  - WACCM4.0 pacing CCSM4.0
    (code is very similar to CAM3.5 / WACCM3.5)
  - Based on CAM3.5 atmosphere code
  - CCSM4.0 code base and component models
- WACCM4.X (CAM4)
  - Adds ice super-saturation
  - Aerosol interface (SAD) may need modification
  - Probably will require retuning gravity waves
  - If it looks better, could be used for AR5?
  - Will want WACCM4.X for UTLS Studies

Questions

- What Model to 'release'?
  - WACCM3.5.48 (CCMVal-2/WMO model)
  - What is WACCM4 (=AR5 model?)
    - CAM3.5.1 or CAM4?
    - If CAM4 run for AR5 (Sep 1), then what?
    - What resolution: 2º or 1º?
  - Preferences? Depends on timelines, solutions

Notes:
  - WACCM4.0/4.1 will be easier to support (stable code)
  - Don't want too many releases

Questions: Continued

- When to put WACCMX into model?
  - post-AR5 freeze, maybe post release?
  - WACCM4X release when ready?