

AMWG climate variability diagnostic package

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AMWG Variability Diagnostics

Dave Williamson's [Draft](#) of the WGNE Standard Diagnostics of Variability.

3-Hourly Data [plots](#)

- Diurnal cycle of precipitation plots

6-Hourly Data [plots](#)

- Wavenumber-frequency power spectra plots

Daily Data [plots](#)

- Hovmöller plots of 200 mb velocity potential
- Madden-Julian Oscillation index plots
- Precipitation rate histograms

Monthly/Seasonal Data [plots](#)

- Equatorial Pacific Hovmöller plots of anomalies
- Timeseries of surface temperature anomalies
- Timeseries of Niño 1&2, Niño 3, Niño 4 anomalies
- Timeseries of precipitation anomalies
- Timeseries of total cloud amount anomalies
- Timeseries of sea-level pressure anomalies
- EOFs of N Pacific and Atlantic winter 500 mb geopotential height
- Amplitude and phase of annual cycle of precip and 2-meter temp

Developers: Mark Stevens, Rich Neale, Julie Caron, Dani Coleman, Jadwiga Richter, and Jack Chen
send questions and comments to
Jack Chen (cchen@ucar.edu)

4 components, can be used independently

3 hourly output:
PRECT

6 hourly output:
FLUT, U200, U850,
PRECT, OMEGA500

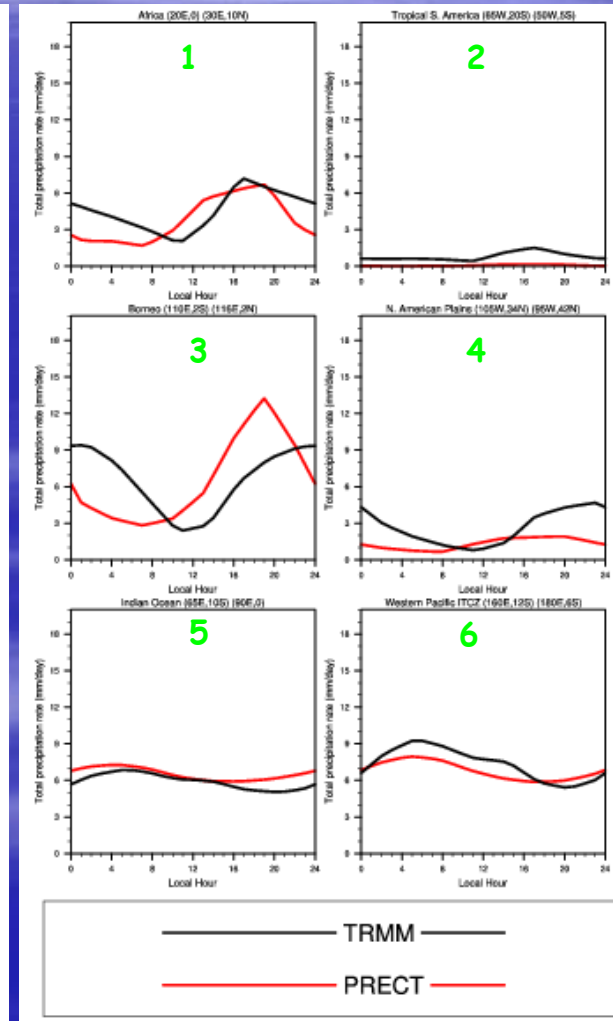
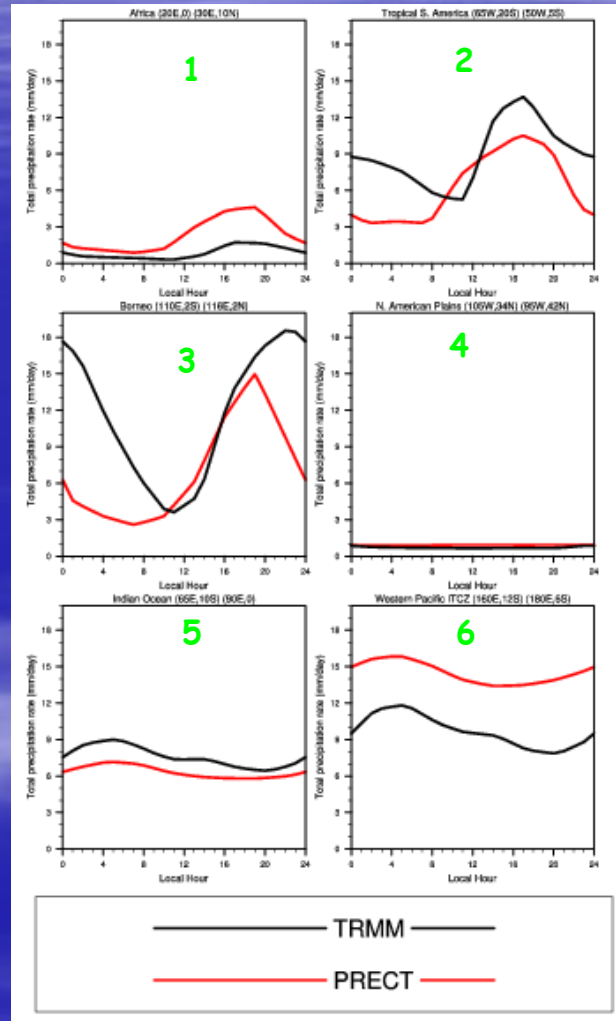
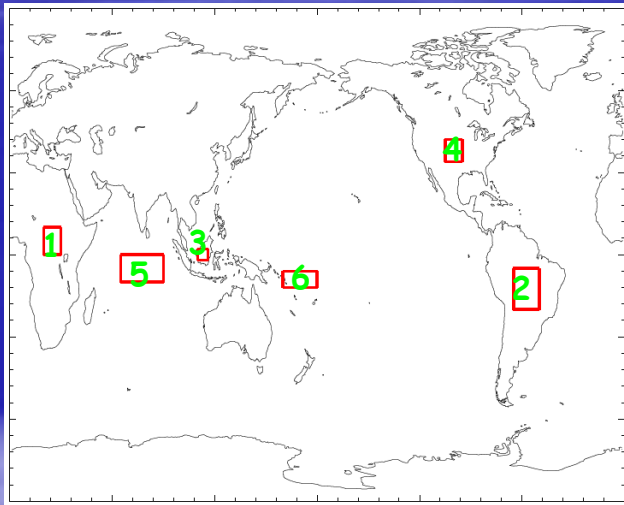
daily output:
PRECT, FLUT,
U850, V850,
U200, V200

monthly output:
default variables

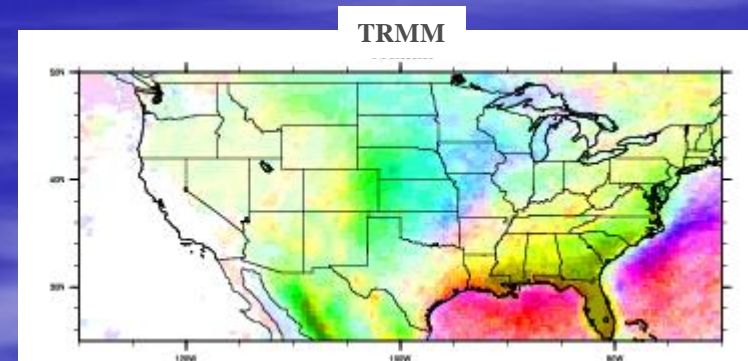
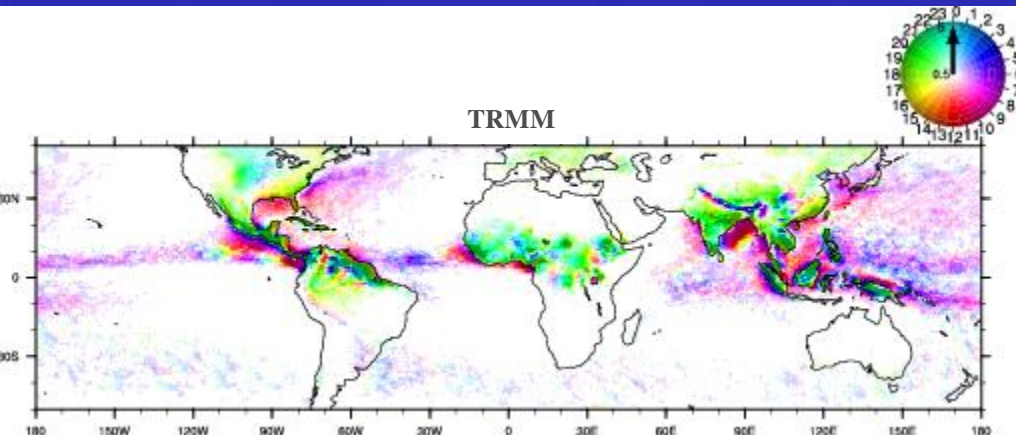
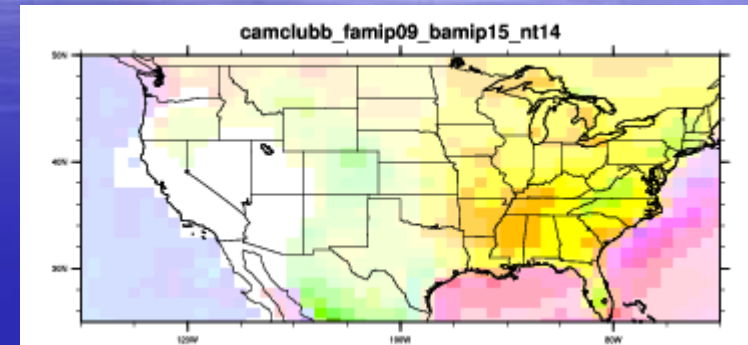
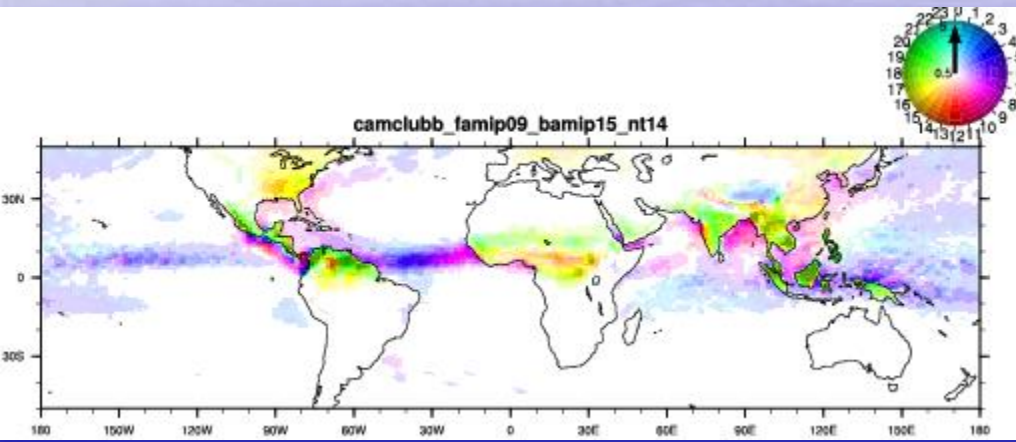
diurnal cycle: regional plots

DJF

JJA



diurnal cycle: global and US plots



6 hourly output: space-time spectra plots



CCSM Atmospheric Model Working Group
Diagnostics Package

National Center for Atmospheric Research Contact Us
Climate and Global Dynamics Division

AMWG Variability Diagnostics for 6-Hourly Data

Wavenumber-Frequency Power Spectra

Zonal wavenumber-frequency logarithm of power spectra calculated from 06Z and 18Z data (summed 15S to 15N) of anti-symmetric and symmetric components of data.

Fortran code for computing the space-time spectra and the observed OLR dataset supplied by [Matthew Wheeler](#). See Wheeler and Kiladis, JAS, vol 56, 374-399, 1999.

The observed OLR data is from NOAA polar-orbiting satellites and covers the period 1979-2000. The CAM3 Amip (t42) and NCEP Reanalysis data are for the period 1991-2000.

OLR (outgoing LW radiation)

Anti-symmetric raw power spectra (WK99 Fig. 1a)	plot	plot	plot	plot
Symmetric raw power spectra (WK99 Fig. 1b)	plot	plot	plot	plot
Background power spectra (WK99 Fig. 2)	plot	plot	plot	plot
Anti-symmetric/background power spectra (WK99 Fig. 3a)	plot	plot	plot	plot
Symmetric/background power spectra (WK99 Fig. 3b)	plot	plot	plot	plot

U200 (200 mb zonal wind)

Anti-symmetric raw power spectra (WK99 Fig. 1a)	plot	plot	plot	plot
Symmetric raw power spectra (WK99 Fig. 1b)	plot	plot	plot	plot
Background power spectra (WK99 Fig. 2)	plot	plot	plot	plot
Anti-symmetric/background power spectra (WK99 Fig. 3a)	plot	plot	plot	plot
Symmetric/background power spectra (WK99 Fig. 3b)	plot	plot	plot	plot

U850 (850 mb zonal wind)

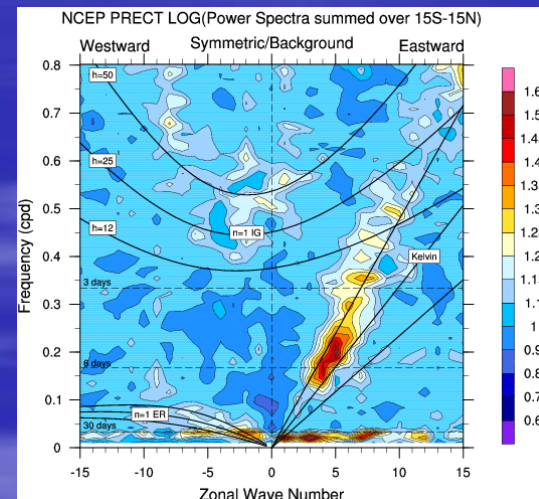
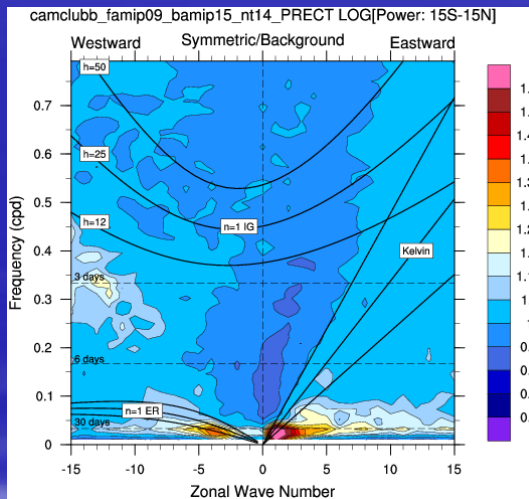
Anti-symmetric raw power spectra (WK99 Fig. 1a)	plot	plot	plot	plot
Symmetric raw power spectra (WK99 Fig. 1b)	plot	plot	plot	plot
Background power spectra (WK99 Fig. 2)	plot	plot	plot	plot
Anti-symmetric/background power spectra (WK99 Fig. 3a)	plot	plot	plot	plot
Symmetric/background power spectra (WK99 Fig. 3b)	plot	plot	plot	plot

PRECT (precipitation rate)

Anti-symmetric raw power spectra (WK99 Fig. 1a)	plot	plot	plot	plot
Symmetric raw power spectra (WK99 Fig. 1b)	plot	plot	plot	plot
Background power spectra (WK99 Fig. 2)	plot	plot	plot	plot
Anti-symmetric/background power spectra (WK99 Fig. 3a)	plot	plot	plot	plot
Symmetric/background power spectra (WK99 Fig. 3b)	plot	plot	plot	plot

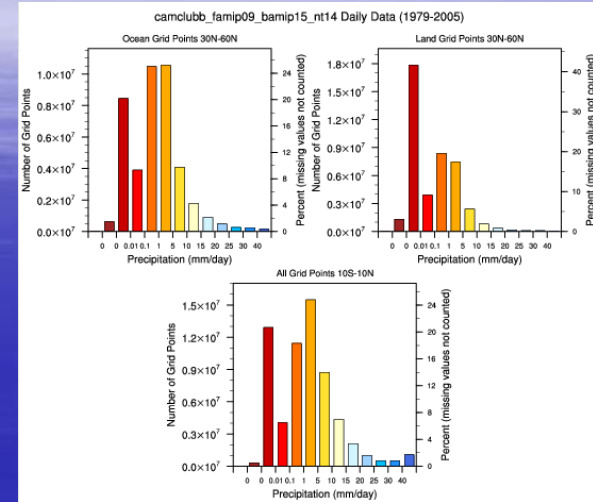
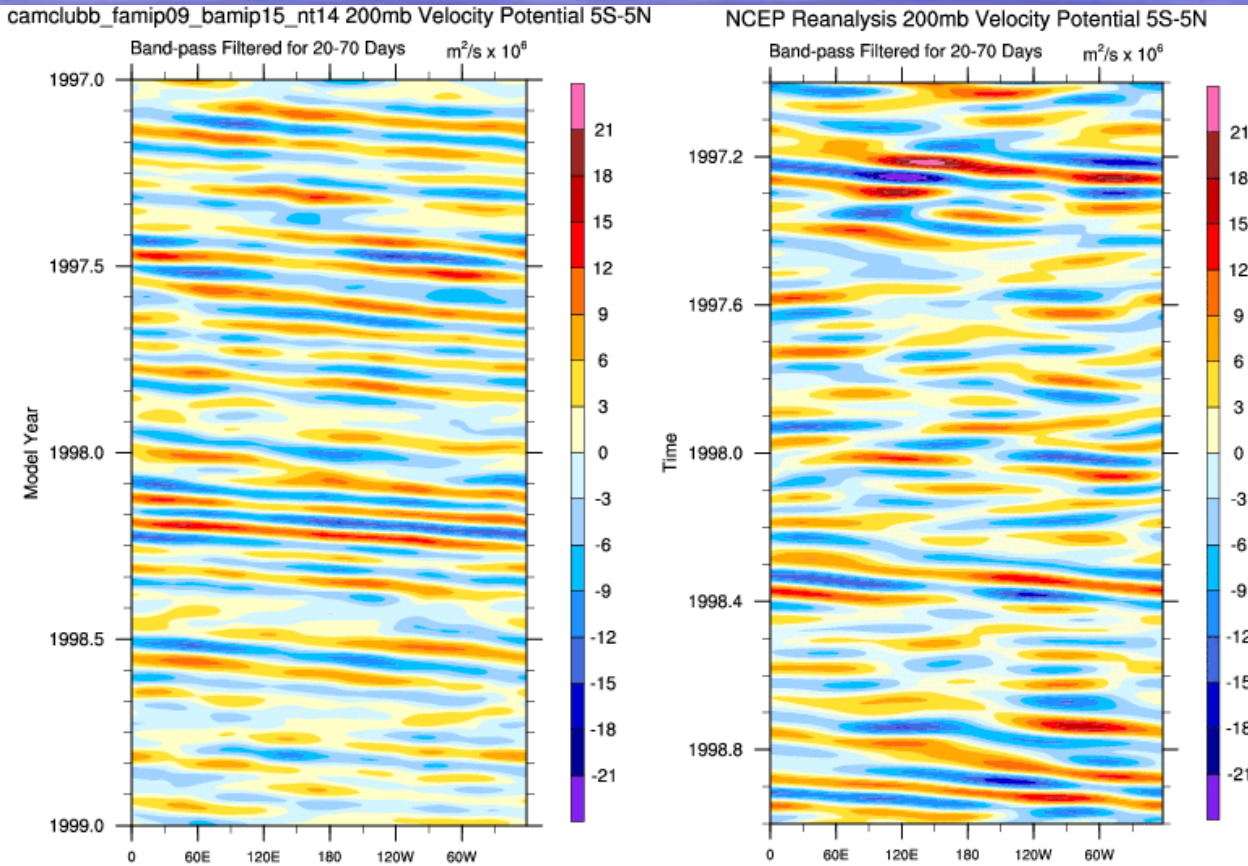
OMEGA500 (500 mb vertical velocity)

Anti-symmetric raw power spectra (WK99 Fig. 1a)	plot	plot	plot	plot
Symmetric raw power spectra (WK99 Fig. 1b)	plot	plot	plot	plot
Background power spectra (WK99 Fig. 2)	plot	plot	plot	plot
Anti-symmetric/background power spectra (WK99 Fig. 3a)	plot	plot	plot	plot
Symmetric/background power spectra (WK99 Fig. 3b)	plot	plot	plot	plot

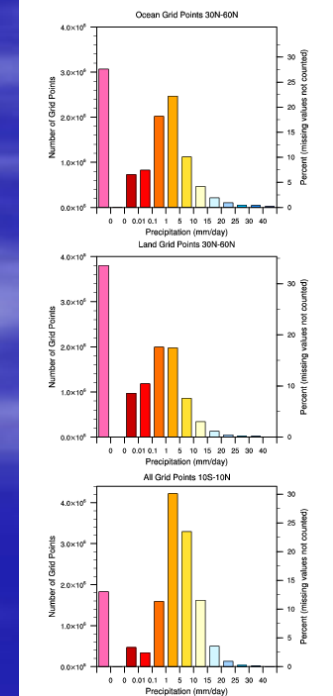


daily output

velocity potential at 200 hPa over 5S-5N
20-70 day band pass filtered, Hovmoller plot



T62 NCEP Reanalysis Daily Data (1981-2000)



histogram
precipitation
rate

daily output: MJO diagnostics

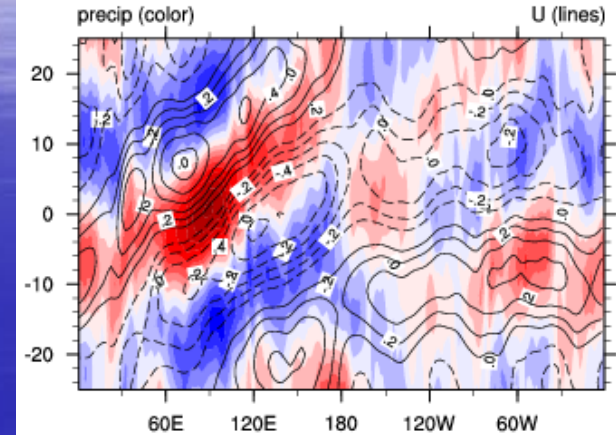
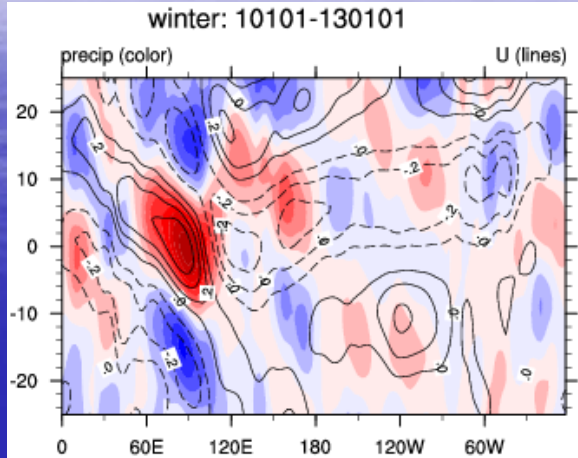
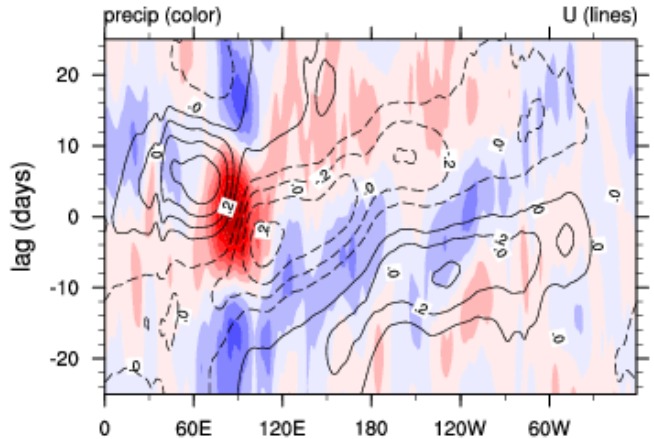
CAM-CLUBB

CAM5

ERA

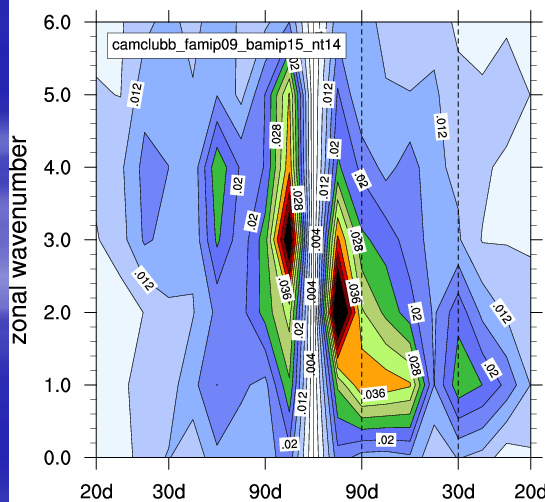
winter: 1.97901e+07-2.00602e+07

winter: 10101-130101



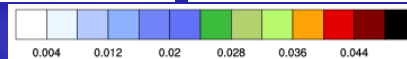
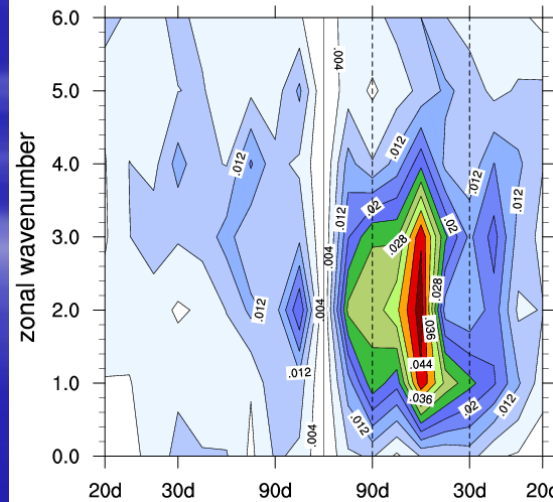
PRECT:19790101 to 20060201

WINTER



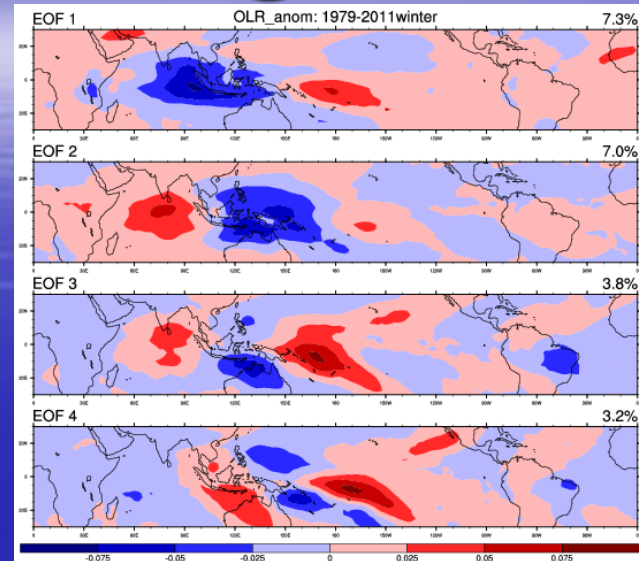
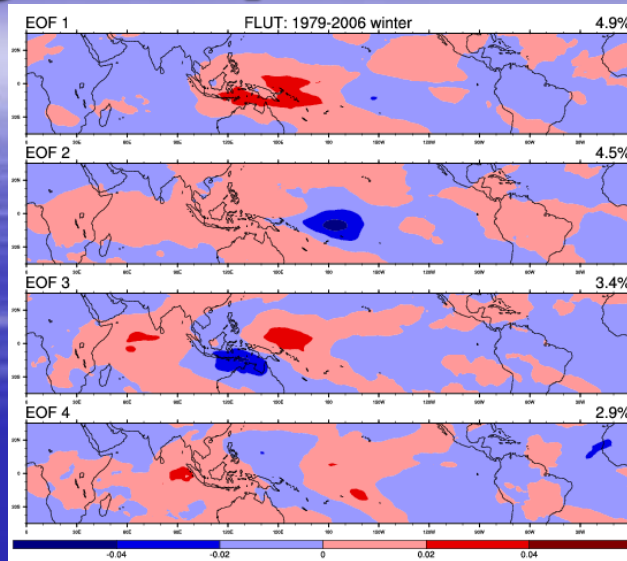
TRMM.PRECT:20000101 to 20110103

WINTER

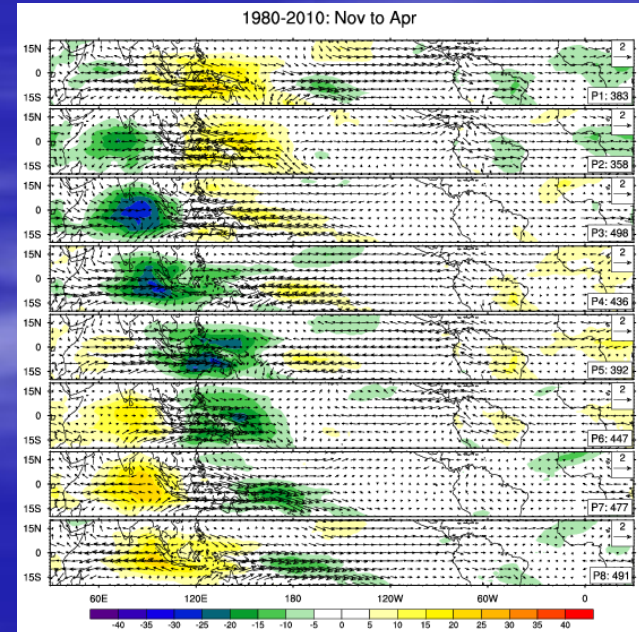
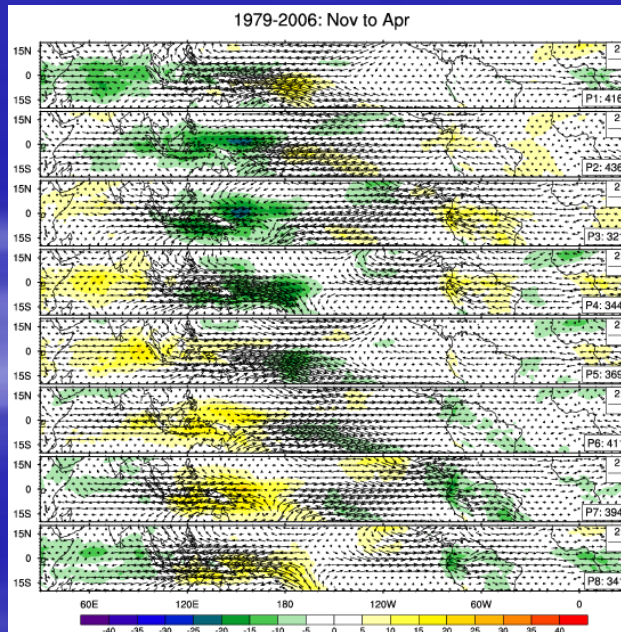


daily output: MJO diagnostics

Four leading EOFs



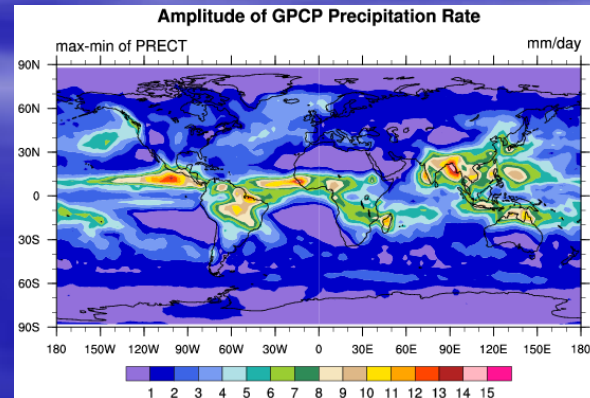
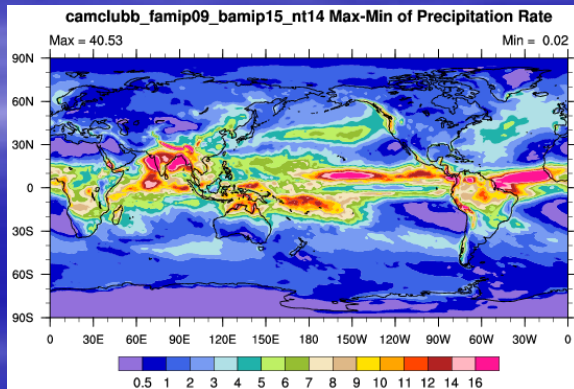
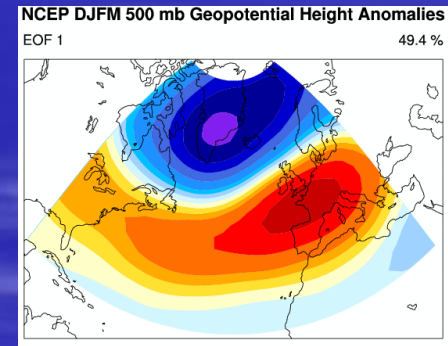
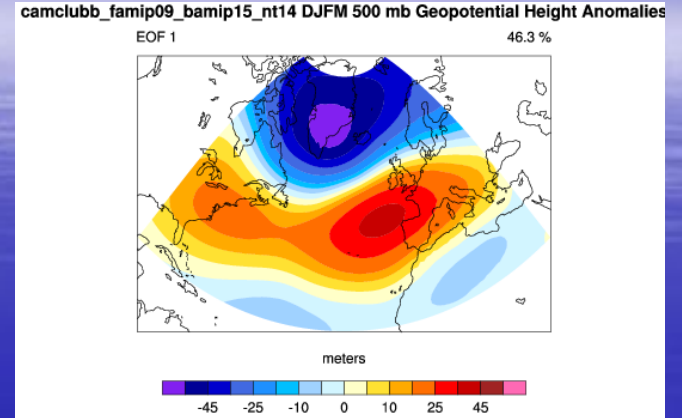
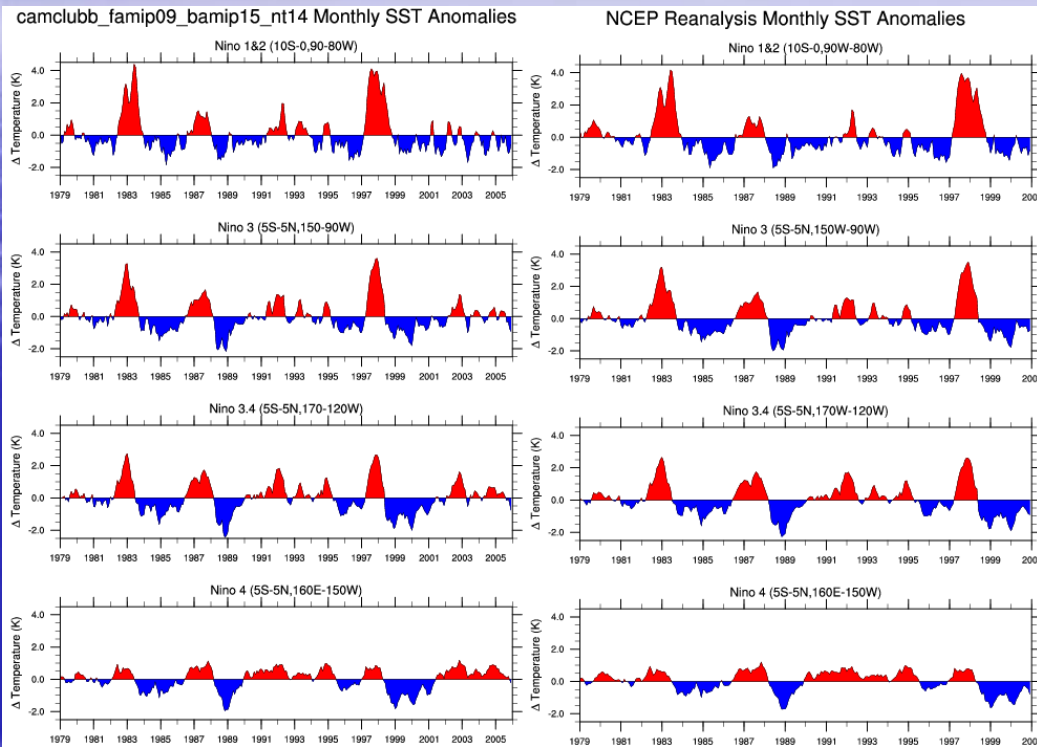
composite life cycle



monthly output

anomaly time series

EOF



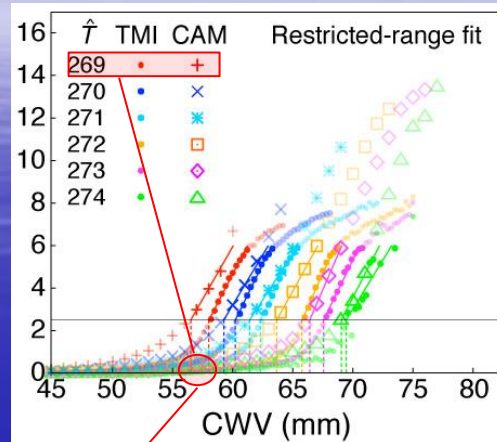
some reminders

- 4 components can be used independently
- model output needs to be put into: 1) h0LL (monthly), 2) h1LL (daily), 3) h2LL (6-hourly), 4) h3LL (3-hourly)
- gridded dataset needed (pre-processing needed for SE runs)
- Stay tuned! We are refining figures and adding new diagnostics into the package.

Transition to strong convection:

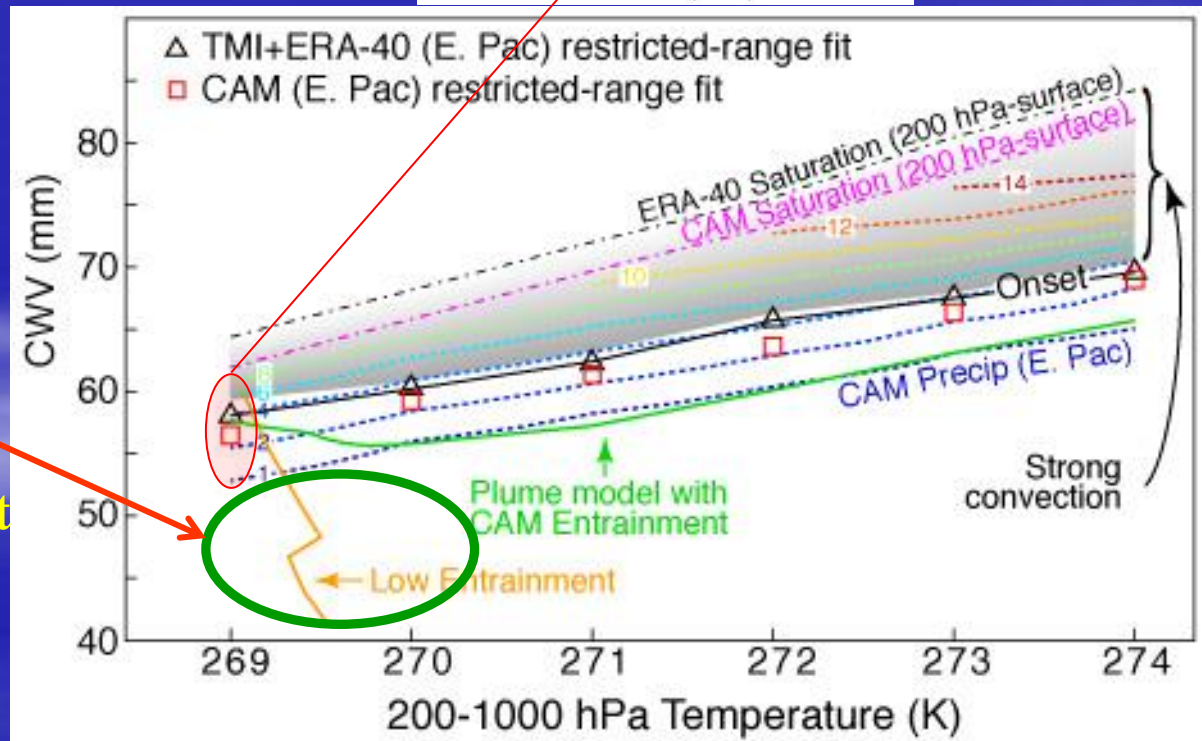
CAM* 0.5° compared to TMI** retrievals

Model onset of deep convection compared to microwave retrievals
Onset by convective instability; note difference from column saturation (Sahany et al. 2014)



(caution re high precip. rate retrieval; more on μ wave onset stats cf. Neelin et al. 2009; in situ obs. version see Holloway & Neelin 2009)

Plume model with CAM convective physics shows low values of entrainment are inconsistent with observed onset (Sahany et al. 2012)



*Community Atmos. Model 3.5; **TRMM Microwave Imager column water vapor (CWV), ERA40 Temp

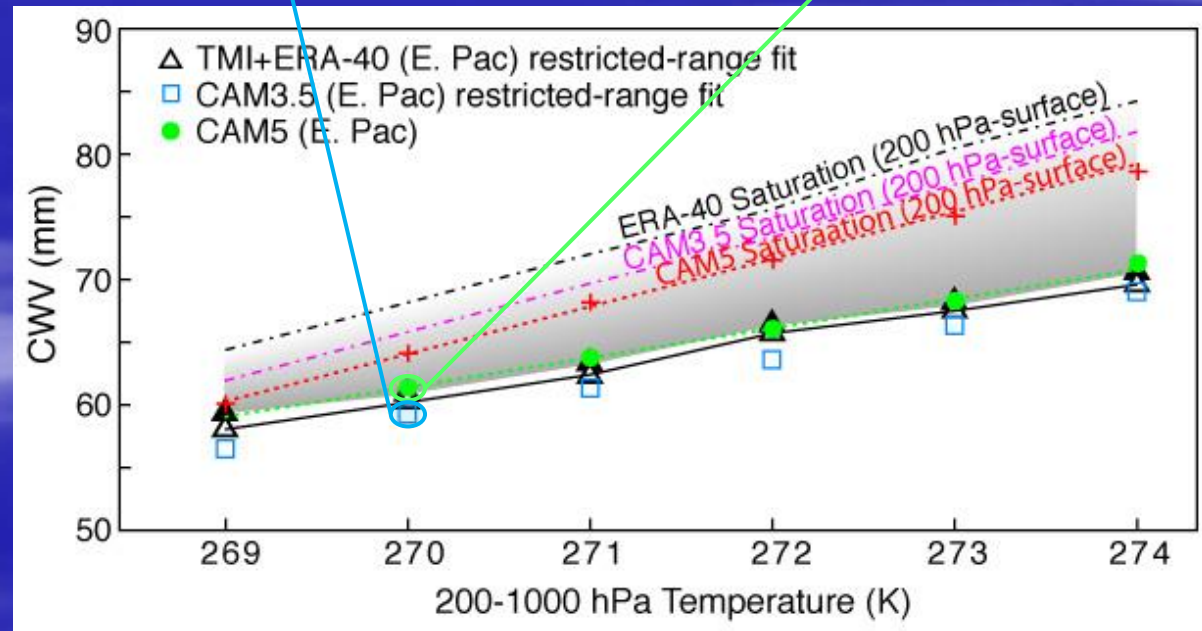
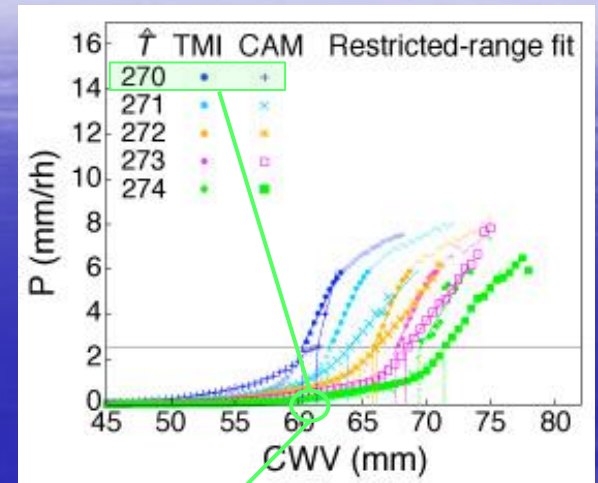
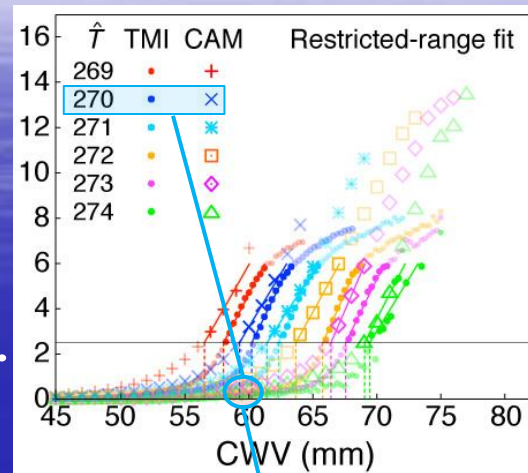
Transition to strong convection:

CAM3.5 0.5° & CAM5 1° compared to observations**

Model onset of deep convection compared to microwave retrievals due to convective instability; note difference from column saturation (Sahany et al. 2014 + Chen & Gettelman CAM5 analysis)

(caution re high precip. rate retrieval)

Related statistics for fast-process evolution near convective onset: pdfs of CWV for precipitating points, distribution of precipitation accumulations,...



**TRMM Microwave Imager column water vapor (CWV), ERA40 Temperatures