GMAO

Analyses and Forecasts for *YOTC*

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YOTC Implementation Planning Meeting
Hawaii, 13-15 July 2009

GEOS-5 Atmospheric Data Assimilation System

AGCM

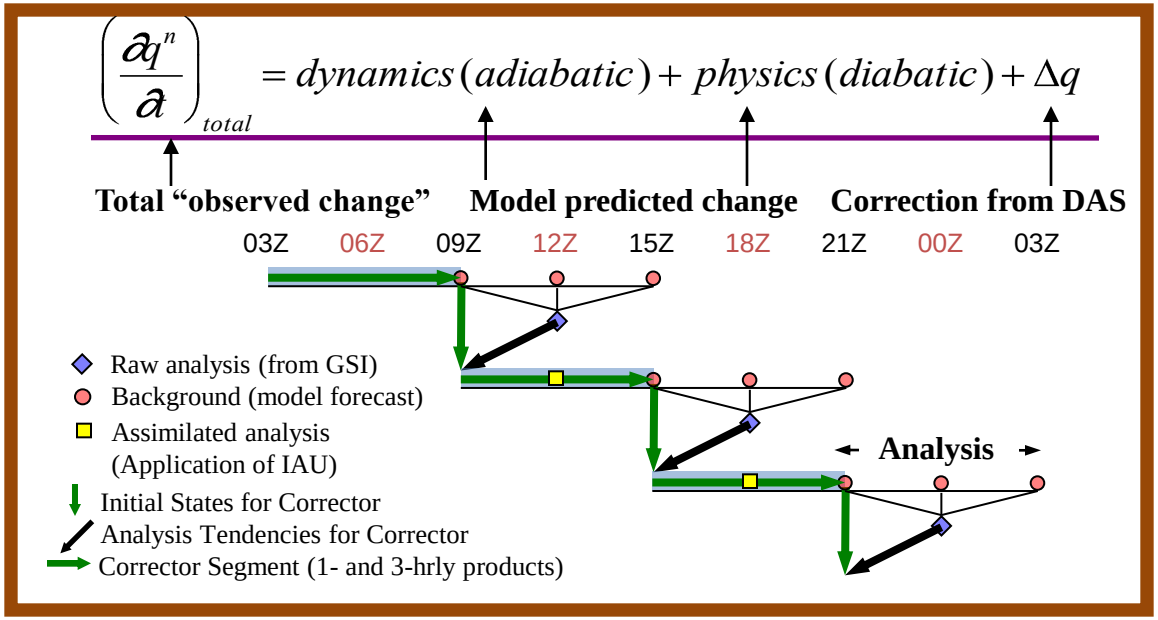
- Finite-volume dynamical core
- Bacmeister moist physics
- Physics integrated under the Earth System Modeling Framework (ESMF)
- Generalized vertical coord to 0.01 hPa
- Catchment land surface model
- *Interactive aerosols from GEOS-5/GOCART*
- Interactive ozone
- Prescribed SST, sea-ice

Analysis

- Grid Point Statistical Interpolation (GSI from NCEP)
- Direct assimilation of satellite radiance data using JCSDA Community Radiative Transfer Model (CRTM)
- Variational bias correction for radiances

Assimilation

- Apply Incremental Analysis Updates (IAU) to reduce shock of data insertion
- IAU gradually forces the model integration throughout the 6 hour analysis period



GEOS-5 Products for YOTC - Analyses and forecasts

- GEOS-5.3.0
- 1/4° × 1/3° × L72
- Analyses and 5-day forecasts from 0Z analysis, January 2009 onwards

  will update to GEOS-5.3.1 in early August – improved hurricanes

  will do 2008 retrospectively with GEOS-5.4.0
- Interactive aerosols with biomass burning emissions from MODIS
- Collections follow MERRA collections
- http://gmao.gsfc.nasa.gov/projects/yotc
- Data distributed from NCCS data portal –

  http://gmao.gsfc.nasa.gov/forecasts

- GEOS-5.4.0:
  - latest merger with NCEP: updated CRTM, include IASI, COSMIC, …
  - Improved physics tunings for the AGCM

YOTC FILE COLLECTIONS

- Distributed through an externally accessible data portal at the NCCS: http://gmao.gsfc.nasa.gov/forecasts/

- MERRA-like products - 19 collections in NetCDF4/ HDF5
- All distributed data products have slightly degraded precision and are compressed with gzip.

- Data are produced on two horizontal grids:
  - Native resolution ---------- (1/4° × 1/3°)
  - Reduced resolution -------- (1/2° × 1/2°)

- In the vertical, 3-D data are on:
  - 72 model layers
  - 37 pressure levels to 1 hPa

- Diagnostics temporal resolution:
  - 3D products are 3-hourly
  - 2D products are hourly

- All collections are online

INVARIANTS [1]

ANALYZED FIELDS (u,v,t,q,O_3,p) [2]
NATIVE, INSTANTANEOUS, 6-HOURLY
MODEL AND PRESSURE LEVELS

3D ASSIMILATION and FORECAST FIELDS [3]
INSTANTANEOUS, 3-HOURLY
MODEL and PRESSURE LEVELS

3-D DIAGNOSTIC FIELDS [8]
REDUCED, TIME-AVERAGED, 3-HOURLY
PRESSURE LEVELS

2-D ASSIMILATION and FORECAST FIELDS [5]
NATIVE, TIME-AVERAGED, HOURLY

http://gmao.gsfc.nasa.gov/projects/yotc/GMAO_YOTC_Product_Collections.pdf

http://gmao.gsfc.nasa.gov/research/merra/MERRA_FileSpec_DRAFT_09_02_2008.pdf

GMAO Experimental Forecasts

http://gmao.gsfc.nasa.gov/forecasts/

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GMAO Experimental Forecasts

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Experimental Forecasts

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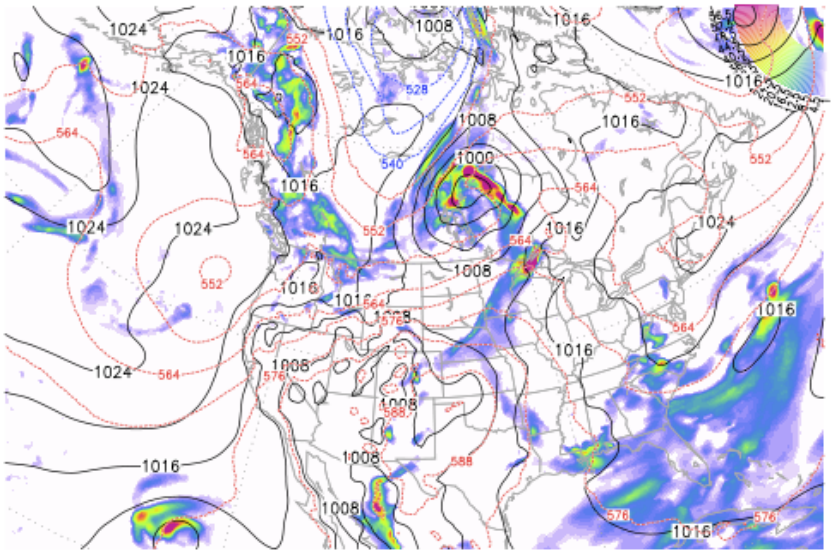
Weather Analyses and Forecasts

WX MAPS | DOWNLOADS | FTP

YOTC Support Forecasts

+ YOTC Interactive Weather Maps
- YOTC Downloads
  GMAO YOTC Product Collections and Variables [PDF]
- YOTC Anon. FTP
  + GEOS-5 Assimilation
  + GEOS-5 Forecast
+ About GMAO Support for YOTC

>> INTERACTIVE WEATHER MAPS



IMPORTANT: Please note that these predictions are experimental and are produced for research purposes only. Use of these forecasts for purposes other than research is not recommended.

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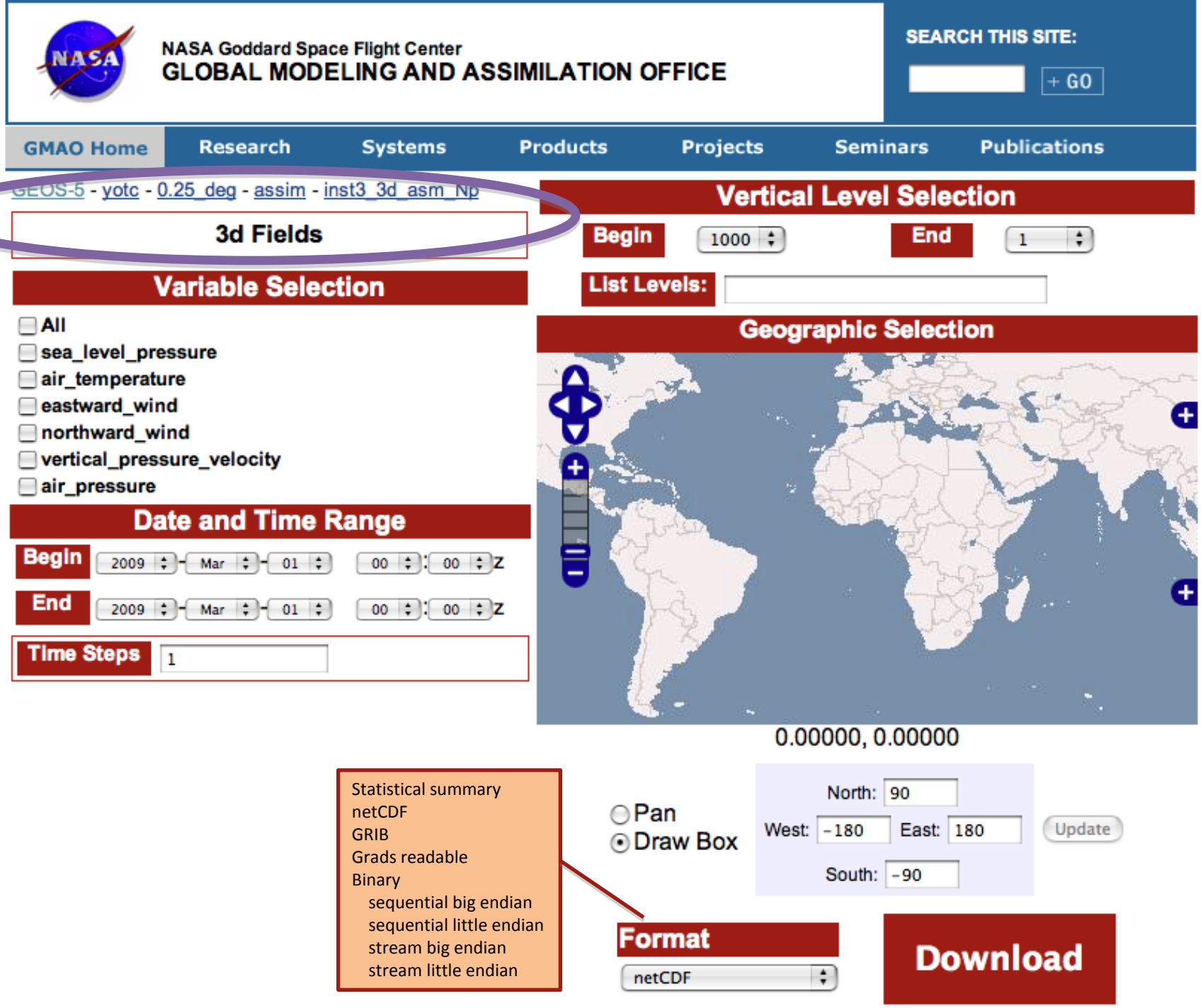
Individual files by collection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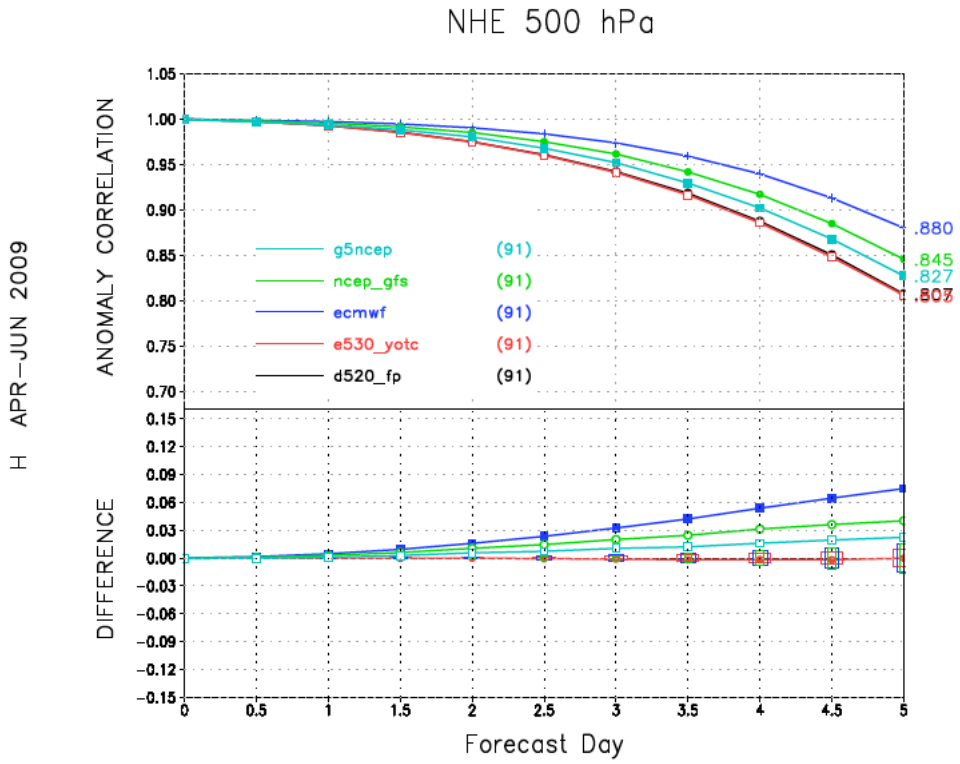
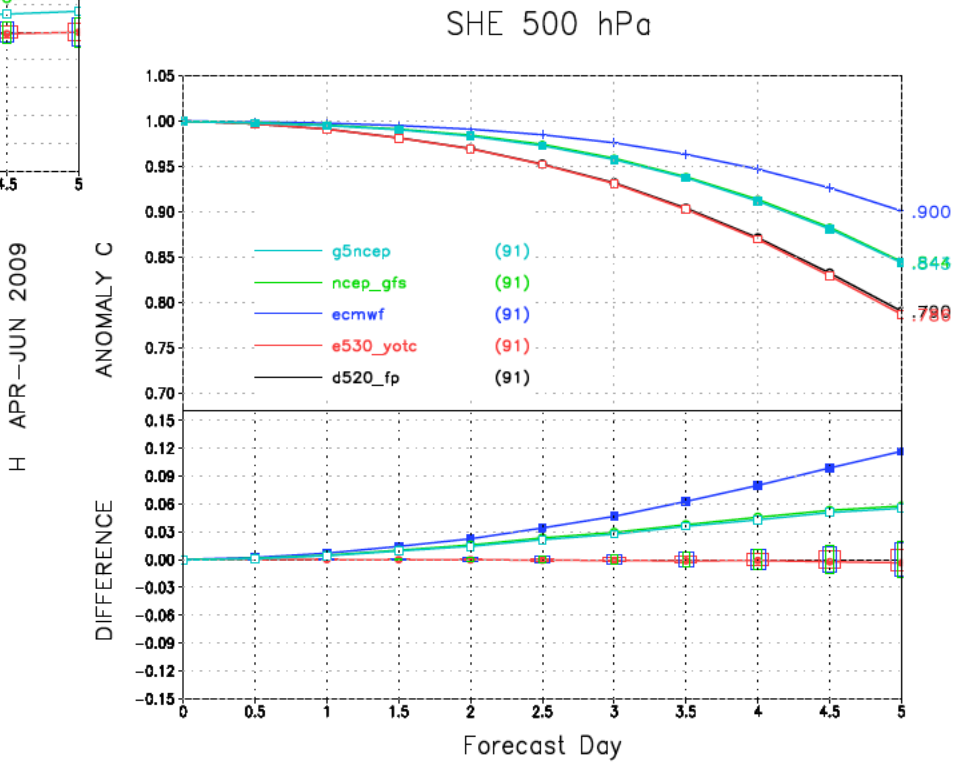
GEOS-5 - yotc - 0.25_deg - assim - inst3_3d_asm_Np
3d Fields
Vertical Level Selection
Begin
1000
End
1
List Levels:
Variable Selection
All
sea_level_pressure
air_temperature
eastward_wind
northward_wind
vertical_pressure_velocity
air_pressure
Geographic Selection
Date and Time Range
Begin
2009
Mar
01
00
00
Z
End
2009
Mar
01
00
00
Z
Time Steps
1
0.00000, 0.00000
Statistical summary
netCDF
GRIB
Grads readable
Binary
sequential big endian
sequential little endian
stream big endian
stream little endian
Pan
Draw Box
North: 90
West: -180
East: 180
South: -90
Update
Format
netCDF
Download


NHE 500 hPa
H APR-JUN 2009
ANOMALY CORRELATION
DIFFERENCE
g5ncep (91)
ncep_gfs (91)
ecmwf (91)
e530_yotc (91)
d520_fp (91)
.880
.845
.827
.807
Forecast Day

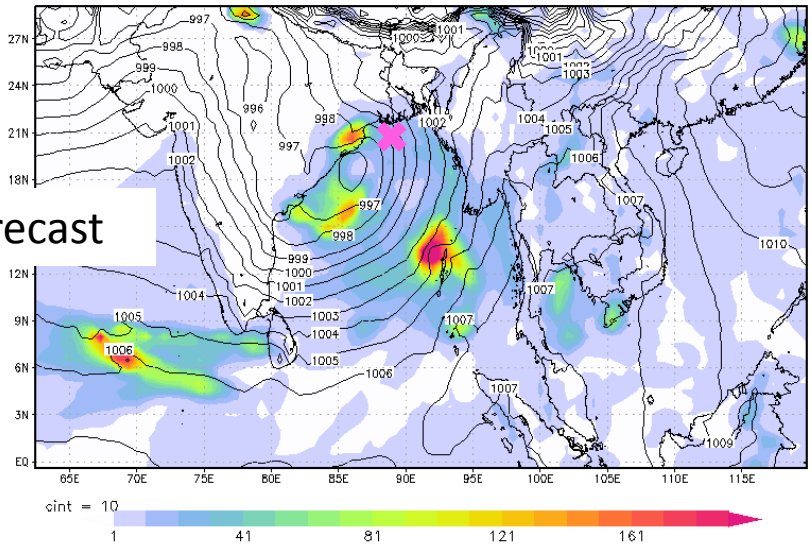

SHE 500 hPa
H APR-JUN 2009
ANOMALY C
DIFFERENCE
g5ncep (91)
ncep_gfs (91)
ecmwf (91)
e530_yotc (91)
d520_fp (91)
.900
.845
.790
Forecast Day

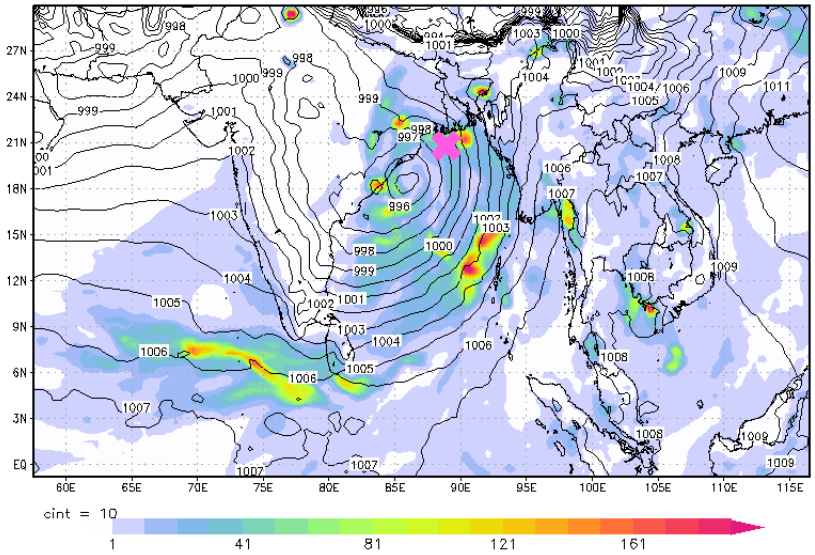
Forecasts of TC Aila on May 25, 0Z
SLP and precipitation

½° GEOS-5.2.0 system

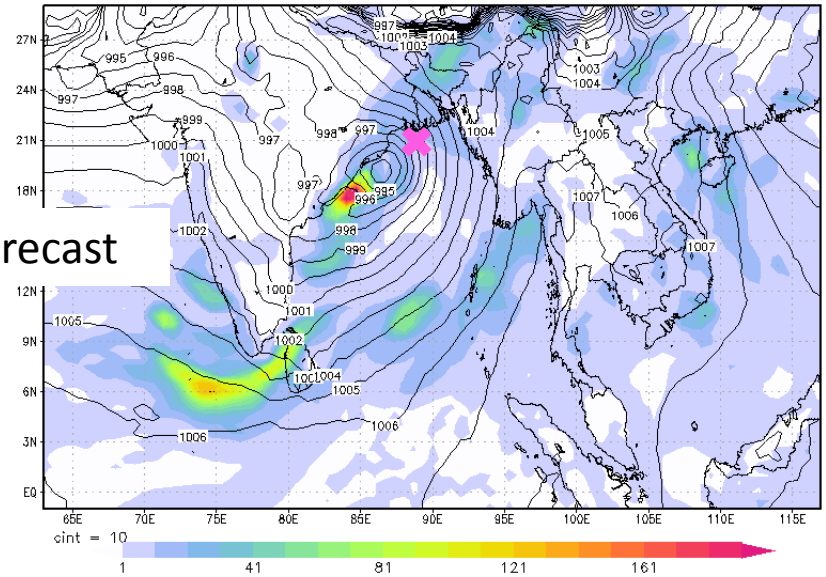
¼° GEOS-5.3.0 system (YOTC)

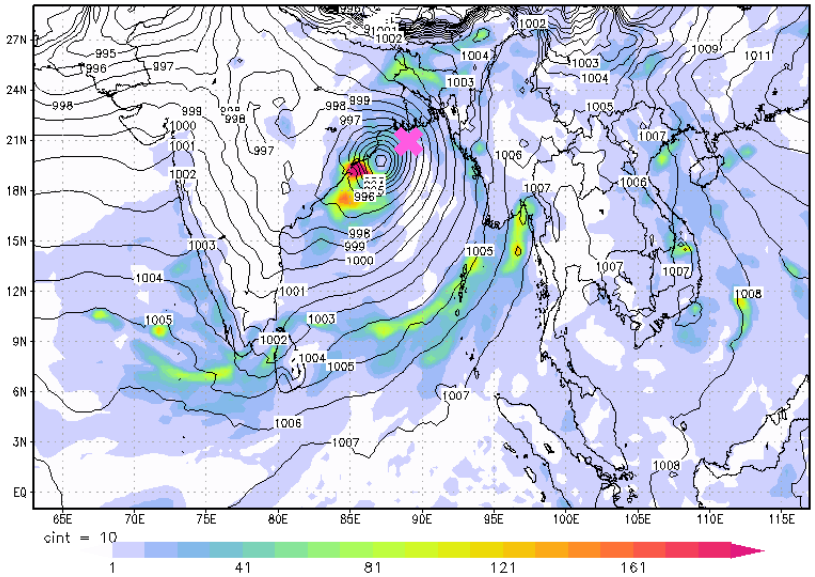
4-day forecast

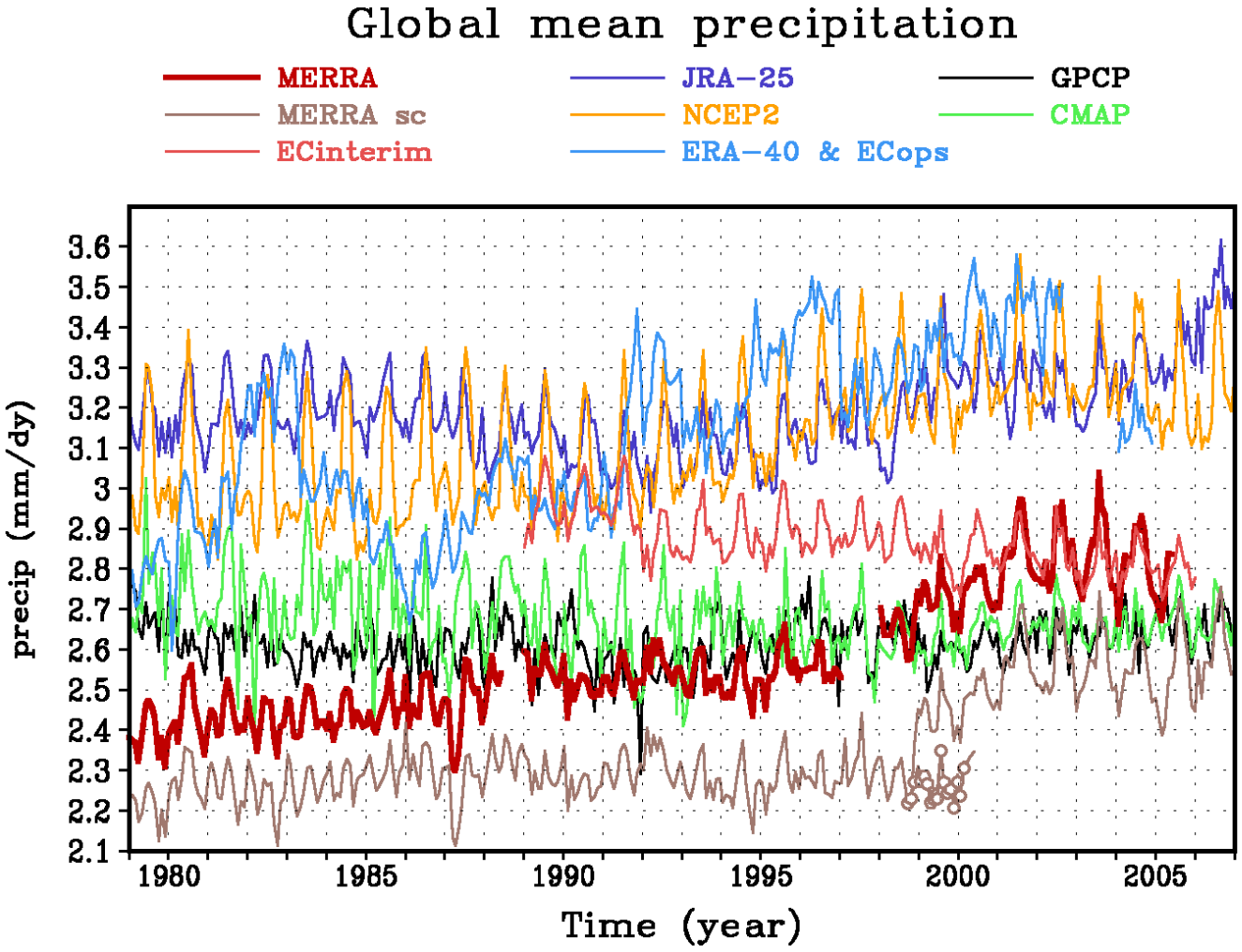




2-day forecast






Global mean precipitation
MERRA
MERRA sc
ECinterim
JRA-25
NCEP2
ERA-40 & ECops
GPCP
CMAP
precip (mm/dy)
3.6
3.5
3.4
3.3
3.2
3.1
3
2.9
2.8
2.7
2.6
2.5
2.4
2.3
2.2
2.1
1980
1985
1990
1995
2000
2005
Time (year)

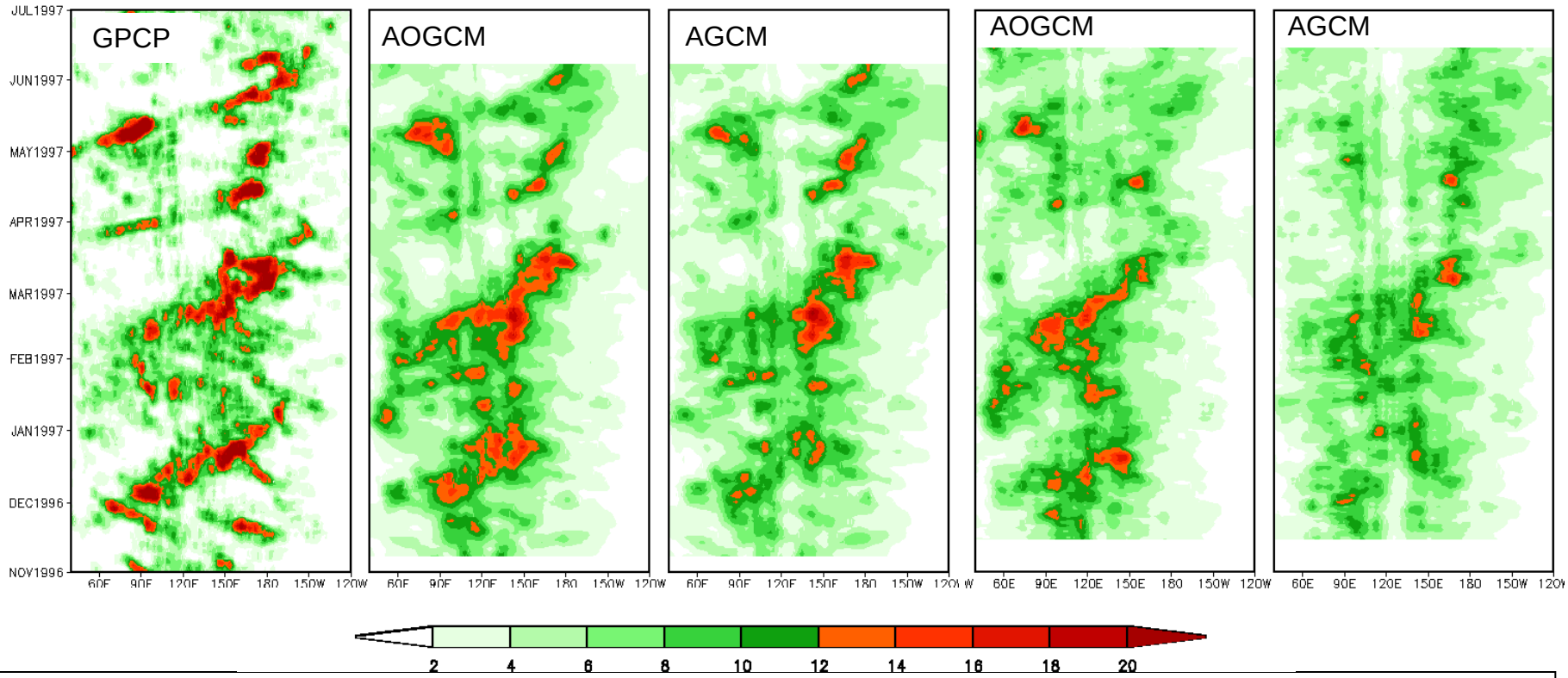
Subseasonal Predictions: Impact of MJO and Coupling

Precipitation Hindcasts (15S-5N)

2° × 2.5° AGCM

One Week Hindcasts

Two Week Hindcasts

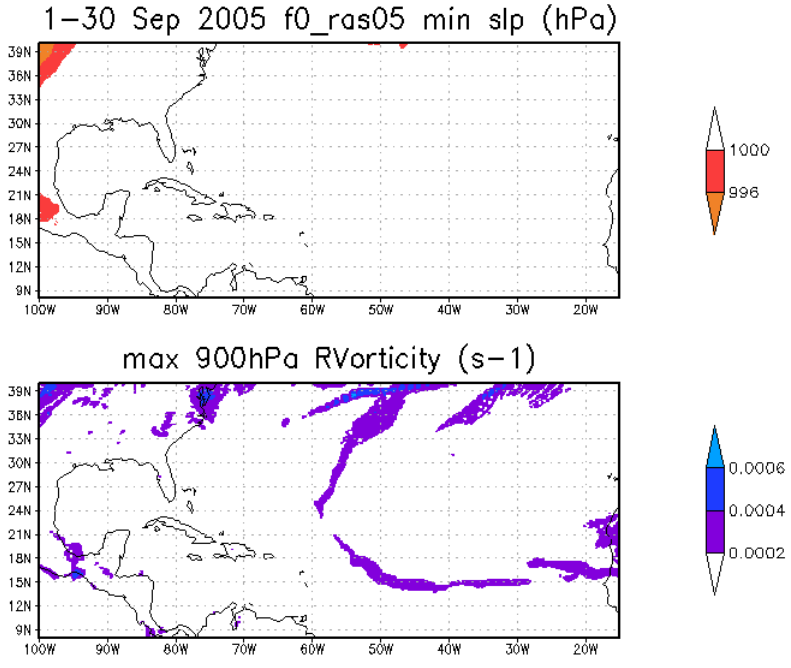


Hindcasts (Nov 1996 - June 1997) using AOGCM (atmosphere initialized from MERRA scout run; ocean from coupled MERRA replay) and AGCM (atmosphere is initialized from MERRA scout run; SSTs are specified from observations).

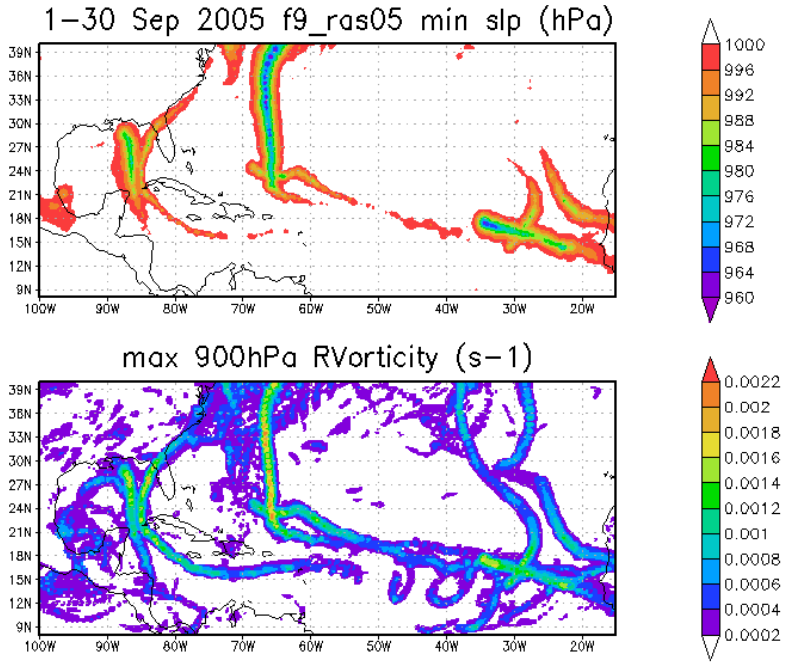
Schubert & Chang

Impact of Cumulus Entrainment on Tropical Cyclones in ¼° GEOS-5 AMIP runs

"GEOS-5.3.0" Control



"GEOS-5.3.1" with stochastic Tokioka



No cyclone reaches 1000hPa in the Control during September. At least 7 cyclones below 1000 hPa in GEOS-5.3.1. One hurricane goes below 960hPa. Very realistic track variability, scale. Even non-developing waves are well captured

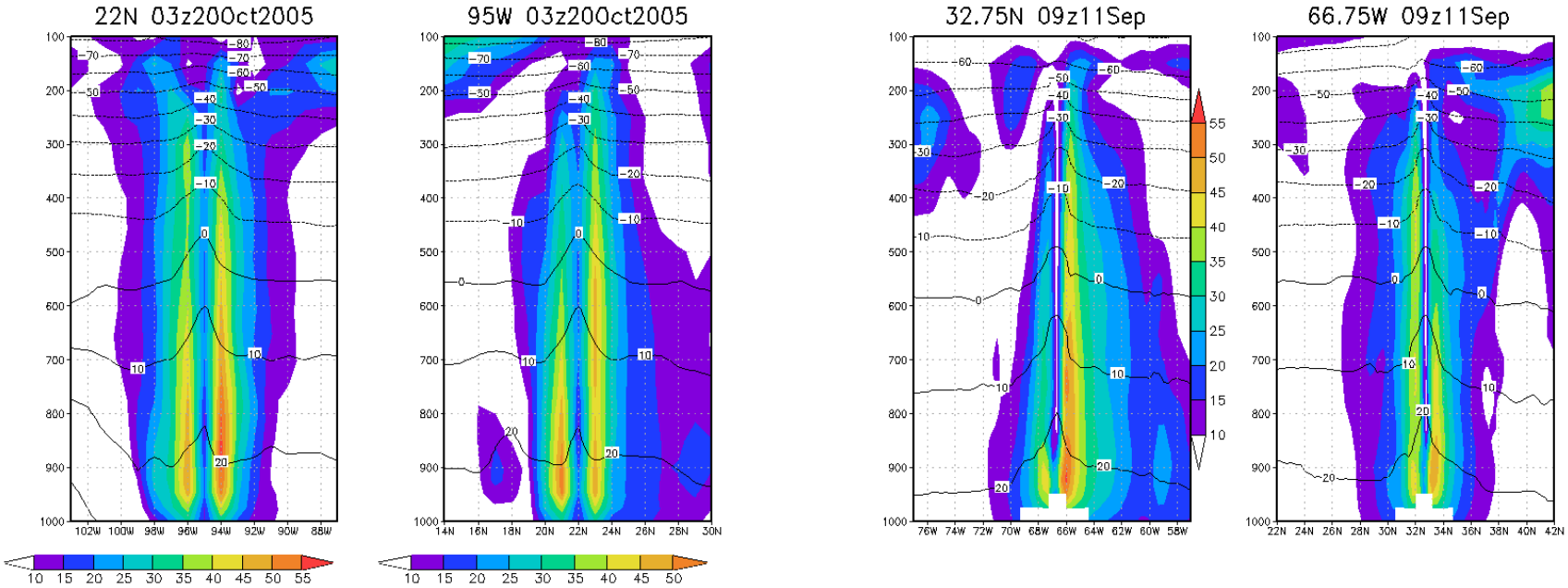
Reale, Lee, Schubert

AMIP: Strongest hurricane - vertical structure

ECMWF T511 NR

¼° GEOS-5 with Tokioka

Wind speed (m/s)
Temp (°C)



Zonal

Meridional

a distinct eye-like feature
a very prominent warm core
Low-level wind speed exceeds 55 m/s

Well-defined warm core
Very realistic scale
Wind up to 60 m/s
Wind max at less than 900hPa

Reale, Lee, Schubert

GMAO POCs:

- Science: Max Suarez
- Technical: Gi-Kong Kim
- OpenDAP interfaces: Arlindo da Silva

We appreciate feedback on GEOS-5 products

Thank you!!