Process-oriented modeling summary

Eric D. Maloney

Modeling Projects

Global Models At least 15

Regional Models At least 3

Small Domain Models At least 5

Global Modeling

Superparameterized (Flow-following finite-volume icosahedral model) FIM
- *PI:* Todd Jones/Dave Randall
- *Domain*: Global atmosphere
- *Resolution*: **??**, 64 level
- *Run types*: Hindcast
- *Initialization method*: CAPT or Data Assimilation

IPSL Forced and Coupled model
- *PI:* JP Duvel, JY Grandpeix
- LMD-Z atmospheric and NEMO Ocean Models
- *Domain:* Global with zoom over the Indian Ocean, Single column version
- *Run type:* Hindcast and CMIP/AMIP type runs with different physical packages
- (Convection scheme and closure, Ocean diurnal warm layers)

NICAM (Nonhydrostatic ICosahedral Atmospheric Model) [funding pending]
- *PI:* Nasuno, Satoh
- *Domain*: Global atmosphere
- *Resolution*: 7-14 km, 40 level
- *Run types*: Hindcast and forecast (see ops plan)
- *Simulation length*: 1-2 month run with 14 km (possible ensembles), and 1-2 month run with 7 km.
- *Simulation period:* October-November 2011, or prominent events
- *Initialization method*: CAPT/reanalysis

Global Modeling

HYbrid Coordinate Ocean Model (HYCOM) [funding pending]
- PI: Shinoda, Wang, Han
- Domain: Global ocean and Indo-Pacific basin
- Resolution: 1/3°, 1/12°,1/25°
- Run types: Forced, long-integration and DYNAMO period
- Simulation period: 1/12° and 1/25°: 2003-2007, 1/3°, 1960-2008, 1/12° October-January 2011-12.
- Initialization method: Data assimilation.

Community Climate System Model 4 (CCSM4)
- *PI:* Art Miller
- *Domain:* Global coupled model
- *Resolution:* 1 degree
- *Run types*: Long-integration
- *Simulation period:* Multiple decades
- *Initialization method:* Arbitrary

Seoul National University GCM [funding pending]
- PI: Daehyun Kim, Adam Sobel
- Domain: Global atmosphere and single column atmosphere
- Resolution: T42L20 (could be changed)
- Run types: Long-integration, hindcasts, short forced SCM integrations
- Length of runs: Decades, 2-3 month hindcasts, weeks (for SCM)
- Simulation period: DYNAMO period and multidecadal runs
- Initialization method: DYNAMO data (SCM), CAPT/reanalysis (e.g. NCEP/NCAR),
- and balanced GCM restart file

Global Modeling

GFDL CM2.1 [funding pending]
- *PI:* Daehyun Kim, Adam Sobel
- *Domain:* Global atmosphere and couple ocean/atmosphere and single column atmosphere
- *Resolution:* 144x90L24
- *Run types*: Long-integration, hindcasts, short forced SCM integrations
- *Length of runs*: Decades, 2-3 month hindcasts, weeks (for SCM)
- *Simulation period*: DYNAMO period and multidecadal runs
- *Initialization method*: DYNAMO data (SCM), CAPT/reanalysis (e.g. NCEP/NCAR) and balanced GCM restart file

Superparameterized Community Atmosphere Model (SP-CAM)
- *PI:* Kuang, Sobel, Maloney
- *Domain*: Global atmosphere
- *Resolution*: about 2.5^o x 2.5^o horizontal with 26 levels
- *Run types*: Hindcast
- *Simulation length*: 1-2 month
- *Simulation period:* Prominent DYNAMO events
- *Initialization method*: YOTC period and prominent DYNAMO events

Global WRF
- *PI:* Kuang, Sobel, Maloney
- *Domain*: Global atmosphere
- *Resolution*: 40 km horizontal with RAVE factor of 10.
- *Run types*: Hindcast
- *Simulation length*: 1-2 month
- *Simulation period:* YOTC period and prominent DYNAMO events
- *Initialization method*: CAPT/reanalysis and 3Dvar assimilation

Global Modeling

NCAR CAM with Relaxed Arakawa-Schubert Convection
- *PI:* Maloney, Sobel, Kuang
- *Domain:* Global atmosphere and single column atmosphere
- *Resolution:* T42 to T63 (could be changed)
- *Run types*: Long-integration, hindcasts, short forced SCM integrations
- *Length of runs*: Decades, 2-3 month hindcasts, weeks (for SCM)
- *Simulation period*: DYNAMO period and multidecadal runs
- *Initialization method*: DYNAMO data (SCM), CAPT/reanalysis (e.g. NCEP/NCAR)

NCAR Community Atmosphere Model (CAM) with Revised Zhang Convective Closure [funding pending]
- *PI:* Guang Zhang and Xiaoliang Song
- *Domain:* Global atmosphere
- *Resolution:* T42L26
- *Run types*: Long-integration and hindcasts
- *Length of runs*: Decades and 2-3 month hindcasts
- *Simulation period*: DYNAMO period, YOTC period (01May2008-20FEB2009), and multidecadal runs
- *Initialization method*: CAPT/reanalysis (e.g. NCEP/NCAR) and arbitrary GCM initial condition

Iowa State University General Circulation Model
- *PI:* Xioaqing Wu, Mitch Moncrieff
- *Domain:* Global atmosphere
- *Resolution:* T42L26
- *Run types*: Long-integration
- *Length of runs*: Decades
- *Simulation period*: Multidecadal runs
- *Initialization method*: Arbitrary GCM initial condition

Global Modeling

NCAR Community Atmosphere Model Versions 3 to 5

- *PI:* Rich Neale
- *Domain:* Global atmosphere
- *Resolution:* 2 degrees, to 0.25 degrees horizontal , 26 to 80 levels
- *Run types*: Hindcast
- *Length of runs*: several days to weeks
- *Simulation period*: DYNAMO period, YOTC period (01May2008-20FEB2009)
- *Initialization method*: CAPT

CFS and MOM4

- *PI:* Augustin Vintzileos, Ragu, Dave Behringer,
- *Domain:* Global atmosphere and ocean
- **[more information needed]**

ECCO-JPL ocean analysis model

- *PI:* Waliser
- *Domain:* Global ocean
- *Run types*: Ocean data assimilation
- *Length of runs*: Decades
- *Simulation period*: DYNAMO 1993 through DYNAMO period

Regional Modeling

Coupled Ocean Atmosphere Mesoscale Prediction System(COAMPS)/NCOM/SWAN

- *PI:* Chen, Flatau, Shinoda, Jensen
- *Domain:* Regional coupled ocean/atmosphere/wave model
- *Resolution:* Two-nested atmospheric grids: 27 and 9 km, 40 vertical levels, One NCOM grid, 1/8 degree, 60 vertical levels, 23 sigma layers, One wave (SWAN) grid (406x207), 33 freq (1-24s), 36 directions.
- *Run types:* Hindcast/forecast
- *Simulation period:* October-Dec 2011-12 (will coordinate with other DYNAMO PIs on hindcast periods)
- *Length of forecasts*: At least 5-day
- *Initialization method:* Global ocean and atmosphere analysis

RSM (Regional Spectral Models) /ROMS (Regional Ocean Modeling System) and WRF (Weather Research and Forecasting Model) /ROMS

- *PI*: Art Miller
- *Domain:* Regional coupled ocean and atmosphere models
- *Resolution:* **??**
- *Run types*: Hindcasts
- *Simulation period:* YOTC period 01May2008-20FEB2009 and during the DYNAMO time period
- *Initialization method:* Atmosphere initialized from and forced with ERA-YOTC (25km) or NCEP GFS (1deg). ROMS initialized from ocean analysis (e.g., NCEP CFS)
- *Coupling strategy:* 1. Fully coupled with hourly coupling (Control) and BC specified from NCEP. 2. Fully coupled with daily coupling and BC specified from NCEP. 3. Uncoupled atmosphere-only runs: a) SST specified from obs, b) SST specified but with with 20-100day SST signal removed 4. Fully coupled with climatological lateral BCs.

Regional Modeling

WRF

- *PI*: Takemi
- *Domain:* Mesoscale domain nested within JMA's GSM analysis
- *Resolution:* 100 m (innermost domain)
- *Run types:* hindcast simulation and idealized experiment.
- *Length of runs*: ?
- *Period:* Case study basis
- *Release plan:* Yes. A year after the end of the field campaign (upon request). Via internet.

Small Domain Modeling

General Ocean Turbulence Model (GOTM) [funding pending]

- *PI:* Shinoda, Wang, Han
- *Domain:* One-dimensional ocean model
- *Resolution*: N/A
- *Run types*: Forced with DYNAMO flux products
- *Simulation period*: October-January 2011-12.
- *Initialization method*: Ocean analysis product.

LES (Skyllingstad) with WRF radiation and microphysics

- *PI:* Eric Skyllingstad and Simon de Szoeke
- *Domain:* 150-200 km atmospheric LES in DYNAMO region **[plans exist to couple to ocean LES, pending funding]**
- *Resolution:* Tens of meters
- *Run-types*: Forced process studies
- *Simulation period*: 4-5 day long periods during DYNAMO
- *Initialization method:* DYNAMO field observations
- *Data policy:* Will be publically available after initial analysis period by PIs.

Small Domain Modeling

Limited Domain WRF

- *PI:* Kuang, Sobel, Maloney
- *Domain*: DYNAMO region (e.g. 190x190 km^2)
- *Resolution*: about 2 km horizontal, but will be varied
- *Run types*: DYNAMO-forced process studies, using conventional and WTG methods
- *Simulation length*: order of weeks
- *Simulation period:* DYNAMO period
- *Initialization method*: DYNAMO data

Limited Domain System for Atmospheric Modeling (SAM)

- *PI:* Sobel, Kuang, Maloney
- *Domain*: DYNAMO region (e.g. 190x190 km^2)
- *Resolution*: about 2 km horizontal, but will be varied
- *Run types*: DYNAMO-forced process studies, using conventional and WTG methods
- *Simulation length*: order of weeks
- *Simulation period:* DYNAMO period
- *Initialization method*: DYNAMO data

Small Domain Modeling

Iowa State University Cloud Resolving Model

- *PI:* Xioaqing Wu, Mitch Moncrieff
- *Domain:* DYNAMO region
- *Resolution:* 1 km
- *Run types*: Forced process studies
- *Length of runs*: 2-3 months
- *Simulation period*: DYNAMO and TOGA-COARE
- *Initialization method*: Field observations

DYNAMO Model Intercomparison Project

Discussion to be held later this morning:

Goal: Develop a framework to conduct process-oriented comparison of different models as they simulate MJO initiation. Guide parameterization improvements

- Common variables/diagnostic quantities (likely different among hierarchy of models)

- Common initialization if hindcast experiments

- Will need to later choose interesting cases.

- Interface with WCRP/YOTC MJO Task Force