

YOTC MJO Task Force –12th Telecon

Meeting time: 21:00 GMT, 22nd March 2012.

Participants

Task Force: Eric Maloney, Matt Wheeler, Masaki Satoh, Augustin Vintzileos, Ken Sperber, Chidong Zhang, Hai Lin, Rich Neale, June-Yi Lee, Steve Woolnough, Prince Xavier

Others:

Jim Benedict (CSU)

Proposed Agenda

- 1) Jim Benedict and Eric Maloney: Update on moist static energy diagnostics applied to climate models
- 2) Chidong Zhang: Coordinated modeling center effort to assess forecast skill during DYNAMO
- 3) June-Yi Li: Predictability and prediction skill of MJO using the ISVHE dataset.
- 4) Steve Woolnough: update on the Pan-GASS meeting

Meeting Minutes (by Matt and Eric)

1. Jim Benedict: *Update on moist static energy diagnostics applied to climate models*

Jim Benedict presented some results on a new process-oriented climate model diagnostic based on the vertically-integrated moist static energy budget. In particular, he tried to assess whether a quantity called gross moist stability (GMS) is a good predictor of the ability of a model to produce a good MJO. For the tropics that are regulated by weak temperature gradients, GMS is essentially a measure of how efficient convection is at removing moisture from the column. GMS is regulated by factors such as the vertical profile of diabatic heating, and the basic state profile of moist static energy. Jim diagnosed model pairs from three different models: The GFDL AM2 and AM3, and the NCAR CAM (the second member of the model pair was SP-CAM). Each model pair included a model with low variability, and also one in which convection modifications were made to improve the MJO simulation. As hypothesized by Raymond et al. (2009) and other places, it was shown that models with enhanced intraseasonal variability are associated with reduced GMS. The next steps are to refine these diagnostics, and expand them to include an analysis of the moist static energy budget as a function of phase of the MJO. This will be reported at future telecons.

Chidong asked why the slope of the transition (in the MJO amplitude versus GMS plot) from low variability to high variability models are different for one model pair to the next.

While there was not good explanation provided for this, this might indicate that factors other than GMS affect model MJO performance, or these differences may be due to different model physics among models.

Matt asked whether there is any significance to negative GMS, which seems to occur in some of the models with good MJO. It was answered that negative GMS implies that vertical circulations due to convection import more water vapour into the column through convergence than water vapour is rained out, thus implying that this model is particularly effective at supporting water vapour anomalies that could sustain the MJO.

Ken noted that GFDL models have an increase in NH winter variability in the Northern Hemisphere when intraseasonal amplitude is increased, which is unrealistic. This deficiency in model performance was noted.

Matt asked how these GMS diagnostics compare to Daehyun's and Prince's diagnostics based on the vertical profile of water vapour versus precipitation rate, in terms of their ability to predict MJO activity. It was noted that the GMS metrics shown by Jim appear to provide comparable performance and are a complementary diagnostic to those involving water vapour. In fact, there may be some interdependence between the two as the ability of a model to realistically simulate the interaction between convective and humidity is tied to GMS of the model.

ACTION ITEMS: Jim will refine this analysis, keeping the discussion on the telecon in mind, and extend the analysis to examine variations in the MSE budget as a function of MJO phase in different models. More comparison to the process-oriented metrics of Prince and Daehyun will also be conducted.

2. Chidong Zhang: *Coordinated modeling center effort to assess forecast skill during DYNAMO*

Chidong discussed a nascent effort to assess forecast skill for two DYNAMO events in the Fall of 2011. The outline of the proposal is listed here:

Evaluation Metrics of MJO Forecast Skill during the CINDY/DYNAMO Field Campaign

Purpose: Quantitatively assess MJO forecast skill for individual events beyond the measure using the RMM index

Participating centers: NCEP, ECMWF, BOM, EC, TCWB, JMA, CPTEC, UKMO

Focus: two MJO events in October 10 – December 10, 2011

Optional: MJO event in February 20 – March 10, 2012 (without the DYNAMO sounding arrays)

Quantitative skill measure: Pattern correlation and RMS error
0000 UTC forecast daily
Weekly running averages

1. Horizontal domains: 15°S-15°N
Domain 1: 50 – 150°E (Indian Ocean)
Domain 2: 0 – 180°E (eastern hemisphere) or 50°E – 170°W (warm pool)
Domain 3: 0 – 360° (tropics)
Variables and references: OLR (NOAA)
Surface rainfall (TRMM)
Column water vapor (SSM/I)
10m, 850 and 200 hPa u (ERA-I)
200 hPa velocity potential (ERA-I)

2. Zonal-vertical cross-sections: 0°E – 180°E, 1000 – 100 hPa
Cross-section 1: 15 – 5°S average
Cross-section 2: 5°S– 5°N average
Cross-section 3: 5 – 15°N average
Variables and references: T, u, v (ERA-I)
q or RH (ERA-I and ECMWF OA)

3. Point time series of vertical profiles 1000 – 100 hPa
Point 1: average over the DYNAMO northern sounding array
7°N-80°E, 4°N-73°E, 1°S-73°E, 0-80°E
Point 2: average over the DYNAMO southern sounding array
1°S-73°E, 7.5°S-73°E, 8°S-80°E, 0-80°E,
Variables and references: RH, T, u, v (DYNAMO soundings)

Much discussion of this proposal ensued after the discussion of the outline by Chidong.

Augustin asked how the climatology would be removed from the forecast, as well as how to remove the effects of La Nina? It was also noted that nothing in the proposal explicitly mentions the ocean. Chidong responded that not all centers are running a coupled forecast system, and hence is inclined to keep things simple at first and just concentrate on atmospheric fields. The climatology and ENSO removal issue was cited as extremely important. ECMWF recommended removing ERA-I as climatology from ECMWF forecasts, and so presumably this could be done for other modelling centers. Augustin noted that this might only be appropriate if the center has a model that is fixed in time, such as ECMWF and NCEP do with their reanalysis models, and the forecasts are being conducted with a model version similar to the reanalysis model. Prince cautioned that it is important to remove the climatology from the same model as is being used to do the forecast.

Chidong asked if removing the running mean from forecasts rather than a climatology could be acceptable. Matt noted that this would need to be done with a 30-day running mean or longer to do this right.

It was asked by Matt whether model ensembles are being used for this forecast exercise. Chidong said that ensembles not available at most modelling centers, and hence only

deterministic forecasts are available for most, but we should think about developing statistics for available ensembles.

Matt suggested some methods to analyse ensemble forecasts, for example determining the probabilities of precipitation exceeding some amount in a given region, and then comparing to improvement over climatology using a Brier skill score.

Matt also suggested that we should compare the hand-drawn forecasts that Jon Gottschalk made during DYNAMO to verify forecast skill for rainfall and OLR. This is feasible because these maps have been digitized.

Augustin asked whether data denial experiments at ECMWF are still planned, and the answer from Chidong was that yes, this indeed is the case.

Chidong inquired as to whether data fields should be saved from the extratropics by the modelling centers to determine whether DYNAMO tropical-extratropical teleconnections are forecasted skilfully by the models. As this would require additional person-hours and data storage capabilities, it was determined that such analysis would be a lower priority, unless someone stepped forward in the task force to provide resources to do so.

ACTION ITEMS: Chidong will take recommendations from the task force to refine the proposed forecast exercise, including developing a standard method to remove the climatology and ENSO from the forecasted fields. Hand-drawn expert forecasts produced at CPC will be entrained into the forecast exercise. Analysis methods for ensemble forecasts will be developed.

3. June-Yi Li: *Predictability and prediction skill of MJO using the ISVHE dataset.*

June-Yi discussed some initial results from the Intraseasonal Variability Hindcast Experiment (ISVHE). Hindcasts from 11 models will be available next month, at which time the entire dataset will likely be made publicly available on a server at IPRC.

While boreal summer is also a focus, Jun-Yi's initial results detail the MJO forecast skill of the models for boreal winter.

First, an analysis of intrinsic modes of variability was conducted for the models, and indicated a variety of differing abilities to produce variability resembling the MJO. When using a Taylor-diagram approach to compare the model modes to the observed MJO, a disconnect in model performance was noted for convection versus the large-scale circulation fields.

Assuming a perfect model, potential predictability of the model MJO simulations were assessed, showing skill of up to 40 days.

Actual forecast skill was then assessed. Interestingly, the multimodel mean did not beat the skill of best 3 models. The best 3 models get skill out to 28 days in bivariate correlation, and about 25 days for the multimodel mean. However, RMSE error evolution is comparable for the multimodel mean and best 3 models.

The best 3 models still exhibit reduced MJO forecast skill when initialized during MJO phases 4 and 5, associated with the transition of convection from the Indian Ocean to West Pacific. There tends to be (slightly) higher model skill during La Nina years than El Nino years in the multimodel ensemble. However, this is not necessarily true for the 3 best models.

Discussion followed Jun-Yi's presentation. Chidong asked how the modeling centers can put this forecasting information provided here into practice. Is the time ready to make recommendation to observational forecast centers based on this analysis, or do we need more work? Jun-Yi noted that simply using the coupled models in the experiment may be a good start, although Eric noted that there may be a way of doing a weighted combination of models based on skill.

Matt noted that Jon's MJO forecasts during DYNAMO are sort of like a weighted multimodel ensemble, although Chidong noted that there must be some way of doing this in a more objective manner based on the ISVHE results.

Augustin noted that Jon is making MME forecasts for DYNAMO, and will assess whether issues like multimodel mean versus an individual or subset of models does better.

June-Yi notes that she is still working on providing a similar analysis for the boreal summer ISO, entraining the new real-time modeling method for the boreal summer ISO she has been developing recently.

Hai-Lin asked whether models that simulate the MJO better have better forecast skill? Jun-Yi noted that she can not point to a definitive relationship yet.

ACTION ITEMS: Jun-Yi will extend her analysis to boreal summer. Possible recommendations to modelling centers on methods and models to use for subseasonal prediction may result from this activity.

4. Steve Woolnough: update on the Pan-GASS meeting

Steve sent on email update on planning for the September Pan-GASS meeting in Denver:

The meeting is 10-14 September 2012 in Boulder, the hoped for attendance is ~250

The Agenda is being developed, the morning consists of two plenary sessions approx 1.5hrs each with 1 or 2 invited speaker/speakers +2 or 3 contributed talks (see below),

The afternoons have parallel breakout groups for ongoing projects 2 or 3 each day, the MJO Diabatic Heating Project Breakout is on the Thursday afternoon.

There will be two poster sessions on Monday and Wednesday evenings (until ~6.30), with posters up for two days (hopefully) and a panel discussion on Tuesday evening on "How Can Models Be Better Constrained With Observations"

There will be a dinner on the Thursday evening

ACTION for us is to think about the format for the diabatic heating breakout (we have about 3 hours including a break for coffee)

We should probably devote about half the time to presentations from the leads of each of the 3 sub-projects and then we need to think about the remaining time, contributed talks on related research or discussion, business ...; Things to note,

- a) The breakout will likely be attended by people not directly involved in the project or MJO research (we're in competition with Polar Clouds)
- b) the original plan was for a Task-Force meeting the following Monday so no need to included time for TF business, but we could use the time for a couple of talks to advertise other TF activities, but my feeling from limited experience is that, providing we get data from participants fairly soon, will need the time to talk about this project, and the posters might be a good time to advertise other projects
- c) These breakout meetings are often used to conduct project "business" as well as science
- d) We probably don't need to plan the breakout in detail very far in advance, but we might need to advertise a general plan in advance, definitely so if we want to solicit contributed talks

Plenarys are

Mon: "Progress in Representing Atmospheric Processes in Weather and Climate Models"

"Stable Boundary Layers and Land-Atmosphere Interactions"

Tues: "High-Resolution Modeling, the GrayZone, and Stochastic Physics"

"Cloud Microphysics, Precipitation, and the Interactions of Clouds and Aerosols"

Weds: "New Observations and Recent Field Campaigns"

"Boundary Layer Cloud Processes and Feedbacks"

Thurs: "Polar Cloud Processes and Radiation"

"The Large-Scale Organization of Tropical Moist Convection"

Fri: Summaries from Breakout Discussions/Repots from Project Groups"

(about two-thirds of the invited speakers are confirmed"

Discussion related to this email followed. It was noted that although plenary talk slots are tight, contributed talks related to MJO could work if they are particularly relevant to the meeting goals.

An abstract call will occur in the next couple of weeks.

Of particular interest to the task force is the planning of the diabatic heating breakout on Thursday. Time available during this session to discuss task force science relevant to GASS is still up in the air, and may depend on the number of attendees from modelling centers and the depth and number of initial results that will be available from the diabatic heating project. There may be more or less time for discussing the MJO depending on how this plays out. An action item would be to consider possible contributions from the task force to this breakout, contingent on time.

Chidong asked whether there could be more than one Thursday breakout formed on the large-scale organization of tropical convection that includes a breakout with more MJO emphasis? Steve said no, and that the breakouts are already set for this day, and adding more would likely cause too much competition between sessions.

Even though Rob Wood is an invited presenter on Wednesday in the plenary session related to recent field campaigns, there might be room for a contributed talk on DYNAMO.

Matt asked if there is any possibility of DYNAMO breakout on Wednesday. Steve thought this might be a possibility, and will ask.

ACTION ITEMS: Task force needs to consider possible contributions to the Thursday breakout on diabatic heating. Chidong will submit an abstract related to DYNAMO for possible inclusion as a talk in the Wednesday plenary session on field programs. Steve will inquire as to whether a separate Wednesday breakout on DYNAMO is possible.

5. Ken Sperber: *Update on WGNE/WGCM Climate Model Metrics Panel.*

Ken gave a brief report on activities related to development of MJO metrics for the Climate Model Metrics panel. In the next month or so, Ken will formally start coding up in open source the MJO diagnostics defined in Sperber and Kim (2012) for the climate model metrics panel, which will then be posted on the panel website.

Ken will forward the website to the group, although it is in development and will be modified.