Minutes for MJO-TF meeting on 16th August, 2014 in Montreal, Canada

In attendance (both locally and remotely): Eric Maloney, Matthew Wheeler, Steve Woolnough, Charlotte DeMott, Jon Gottschalck, Daehyun Kim, Tomoki Miyakawa, Rich Neale, Camille Risi, Prince Xavier, Nick Klingaman, Tieh-Yong Koh, Michel Rixen, Andrew Robertson, Min-Seop Ahn, Xianan Jiang, Tetsuo Nakazawa

8:30: Introduction from co-chairs. Include time for quick introduction from everyone in room.

8:45 – 9:45: Air-sea interaction: Charlotte, Nick, Steve - Review paper, Nick's fellowship plans

Steve, Charlotte, and Nick summarized progress on the MJO air-sea interaction review paper. A complete first draft of the paper was completed and disseminated by Nick a few days earlier. Steve has worked on the theory section, Nick on modelling, and Charlotte on observations. The current version likely contains a lot of overlap, and Steve, Nick, and Charlotte will meet during the next few days to remove any such overlap and refine it. After the WWOSC they will seek comments from the rest of the TF, but given the short amount of time before submission, any comments will need to be made quickly.

Steve noted that our understanding of how the ocean responds to the atmosphere is better than how the atmosphere responds to the ocean.

Charlotte also presented on her ideas for a process-oriented diagnostic for the air-sea interaction problem, and some recommendations for such air-sea diagnostics will be included in the review paper.

Nick also presented on his plans for the next 5 years given his award of a highly competitive NERC fellowship. He will be focussed on subseasonal air-sea interaction.

9:45-10:05: Camille - Ongoing work on the joint evolution of humidity and water isotopic composition during MJO events: model-data comparison, and what it means in terms of phasing of the different moist processes

Camille reviewed work on the use of isotope depletion information to infer moistening processes with the MJO

In the LMDZ model, delta D depletion is coincident with the OLR minimum during an MJO lifecycle, unlike IASI data. We need to better understand why. Hypotheses include: Convection triggers too soon? LS condensation not maintained long

enough? We also need to better understand the processes associated with advection and its impact on delta D.

Daehyun noted that the direction of movement of the phase diagram is different than specific previous studies. Camille cannot reconcile her results with previous research, and some independent work by Daehyun also verifies Camille's result. Tieh-Yong wondered whether errors in humidity could be responsible for the different behavior of the model that IASI rather than the isotopes? It is a possibility.

Daehyun thought that the implication of work suggests that advection by LS motion is most important moistening process. Camille notes however that inferences on moistening impacts of LS advection are completely model derived and should be further verified.

Matt asked what other models have isotopes that could be used to verify the current results. The GISS model does, as Daehyun noted, although the correct tendencies will need to be saved for direct comparison with Camille's model, especially in terms of comparing the importance of physics versus advective tendencies.

<u>10:05-10:25</u> MJO operational forecasting: Jon Gottschalck – 15 mins presentation + 5 discussion

Jon updated the TF on the MJO forecasting activity

He highlighted MJO activity during 2013-14 as an example, including strong Spring 2014 WWBs associated with the MJO.

In terms of models, ECMWF, UKMO, others produce good skill NCEP and the Japan model has poor skill. The MM ensemble forecast is the best. Jon expressed concern about the degraded recent MJO forecast skill in the NCEP model, which is something Jon actively thinks should be addressed. Matt also suggested looking at model spread versus RMS error, and is something Jon will look at.

Jon talked about various improvements made at modeling centers in the context of the MJO forecasting the activity. JMA has made improvements to the realtime datastream, UKMet office has made changes to the datastream that Prince has helped make seamless with the CPC MJO forecasting effort.

Jon noted that an interesting question is how interannual variability affects forecast metrics.

<u>ACTION ITEM:</u> Jon indicated that getting a paper out on the forecasting effort as soon as possible should be a priority. Much is already written and Jon will distribute a draft for comments soon. There is some question of strategy of the papers(s). Jon

proposes a short publication on basic results, and then a deeper paper later that looks at higher order items. The task force generally agreed.

As noted above, NCEP has degrading skill with time. The ECMWF is trending slightly up, but has had transient periods of bad skill, mainly in low MJO variance periods. Most models do not show a strong trend in skill.

Jon solicited ideas on how to best quantify the strength of the bivariate correlation versus variance.

Jon discussed possible indices for assessing MJO onset. Some possible approaches are those of Matthews (2008) and Straub (2013). Jon proposed using some of the rules outlined in Kathy's paper to diagnose onset. Steve asked how will we score forecasts for onset? Jon is thinking about some very simple hit or miss metrics. One issue for assessing onset is that it may be hard to get a statistically significant number of primary events.

Steve thought it would be a nice idea to link to S2S with its long hindcast record (15-30 years) featuring models with consistent forecasting systems as a way of examining skill for periods of different MJO activity. **ACTION ITEM:** We might want to think of ways to link more strongly this forecasting effort with S2S, particularly in the context of onset metrics to provide the most useful information to the user communities.

Matt concurred with the paper plan above, with first a basic paper of how models perform in real time. He also asked whether verification of CPC forecast maps might help to answer questions of useability of the MJO forecasts for S2S?

Tieh Yong also thought we should consider a set of diagnostics that separates RMSE into phase versus amplitude biases. Mich suggested something like a Taylor diagram. Tieh-Yong recommend a modification of Taylor diagram concept. **ACTION ITEM:** Tieh Yong and Jon will discuss some ideas offline.

10:45-11:45 GASS/MJO-TF vertical structure and diabatic heating project: Steve to lead - 1 hour Nick, Prince, Xianan

Steve provided a summary of results from GASS project. No smoking guns as far as key diagnostics that distinguish MJO performance have yet been uncovered. The only possible exception is a reasonable simulation of moistening process being important for a good MJO. But what is cause and effect?

It was pointed out to GASS that we have a massive database to be used for huge numbers of purposes including studies of the midlatitudes that should be advertised strongly to a wider community. Matt noted that this was discussed at WGNE, but word should be spread even further.

As far as the status of papers describing results from the GASS project, the first two are submitted, and only Prince's has not yet been submitted, but this will be done shortly. **ACTION ITEM:** Prince will submit a manuscript on the last set of hindcast simulations.

Xianan presented some recent results beyond those presented in the paper detailing the 20-year simulations. He discussed further diagnostics versus MJO skill metrics. Some diagnostics produce some promise, including moisture sensitivity diagnostics and gross moist stability. Radiative feedback diagnostics produce some puzzling results. It is also notable that slightly different metrics of MJO skill score produce different correlations against process-oriented diagnostics.

Matt noted that this later finding reopens our discussion a couple of years ago of on the best way to assess MJO performance.

Steve updated on the status of a potential DYNAMO hindcast case. A DYNAMO case has not been requested of the modeling centers, and will likely not be done unless a champion and/or compelling need arises, since the YOTC simulations have yet to be fully exploited, and it is still not clear whether a significant additional benefit will be obtained. An interesting angle for a DYNAMO case could be looking at the diurnal cycle of SST, although a process-modeling experiment should really be designed as the best way to do this.

11:45-12:00 Xianan collaboration with Tomoki on CMT – 15mins

Xianan noted that a J. Climate paper has been submitted detailing an analysis of CMT in reanalysis. He also noted that bad MJO GCMs have a strong U-wind bias that might be associated with CMT problems.

Tomoki indicated that he plans to collaborate with Xianan on analysis of high resolution NICAM (14 km, 7 km, 3.5 km) model simulations that extend his previous CMT analysis to a longer record with 19 MJO winter cases for 10 years. His analysis of the CINDY/DYNAMO case shows the same vertical CMT structure with mid trop. deceleration and lower trop acceleration as in his previous analyzed cases. However, results are not as consistent aloft as in the previous case. **ACTION ITEM:** Analysis will be extended to other cases in the simulation dataset.

13:30-13:50 Resolution and phase dependent MJO forecasts: Rich Neale – 15 mins presentation + 5 discussion

Rich's presentation asked the questions of does MJO-phase dependent initialization matter for hindcast skill? Does resolution matter? Is local high resolution a help or hindrance?

He conducted some CAM5 simulations with regional refined grid capabilities. He first looked at some DYNAMO and YOTC hindcast simulations that we initialized from a nudged state with 12 hour timescale. High resolution versions of the model better simulate precipitation features at 10-15 days, and also in MJO skill scores. The model responds to nudged state better in the quarter degree res. simulation that coarser ones both being initialized before and after the MJO maximum. at least for first MJO event. Moral: Need fine resolution for nudging to be successful. Initializing during the peak of the MJO event doesn't seem to produce better hindcast skill in the high resolution model, though.

Tieh-Yong asked whether Rich nudged the condensed phase variables? No, just winds and temperature. Tieh Yong noted it might be an issue in terms of incomplete nudging using no condensed species.

Rich then described some simulations with local and regional refinements in aquaplanet experiments with tropical versus midlatitude refined grids. He gets a local increase in precipitation in the refined grid. However, there is a large dependence of results on physical parameterizations. The regional refinement results are consistent with the global 0.25 degree simulations in terms of reduction of deep convective precipitation with large scale precipitation taking over. The sensitivity is much less for a higher convective adjustment timescale, however. Rich noted that the refined region looks like a barrier to propagating organized disturbances.

Rich noted his sensitivities demonstrate a good example of why convective parameterizations need to be better designed when going to variable resolution grids.

<u>13:50-14:20</u> CMIP5 MJO analysis: Min-Seop Ahn and Daehyun – 15 mins presentation + 15 discussion

Min-Seop gave an update on assessment of the MJO in 22 CMIP5 models. The initial discussion involved possible MJO indices used in assessment. On the basis of some exploration, it was decided to use the Crueger et al. skill score to assess amplitude and propagation, and the weighted mean of variance in the intraseasonal band of the wavenumber frequency diagram to get dominant period.

It was demonstrated that RH sensitivity diagnostics, GMS, and radiative feedbacks are significantly correlated with MJO performance. GMS affects the period of MJO propagation most, and RH metric affect the combined propagation and amplitude most.

Matt asked if we can tell the community based on the analysis techniques which CMIP5 model is best. Daehyun said that this diagnostic analysis can do this.

Steve thought it puzzling the difference between CNRM coupled and uncoupled versions, and so it would be good to dig a bit more into the differences in process-oriented diagnostics between them.

Matt asked whether the CMIP5 analysis is under control, or is more input needed from the task force? Daehyun said that he and Min-Seop are ready to write up a paper. Steve asked whether moistening rate as function of precipitation rate could be good additional diagnostic to consider, and it was agreed. **ACTION ITEM:** Min-Seop and Daehyun will write a paper on the analysis of CMIP5 models.

14:40 – 14:55 Update on S2S, S2S database, training activities, etc.: Andy Robertson

Andy first gave a broad overview of S2S. He discussed the forecast database, consisting of forecasts archived 3 weeks after real time. He also discussed the global framework for climate services being a big emphasis of S2S. The S2S subprojects were discussed, with the interaction with the MJOTF on the MC being one of S2S subprojects. A KMA website is up and running discussing the subprojects, including the MJOTF subproject. It was noted that the MJOTF/S2S subproject whitepaper covers a lot of ground and contains many questions. Matt noted that if we answer half of these questions, we will be successful.

Andy noted that precipitation will be archived at 4x a day, thanks to the urging of Steve and others.

Centers have started providing test data to ECMWF for the model archive and six centers are ready for data exchange. The data portal is to be open with at least 3 models by January 2015. All partners should be ready to send data by the end of 2014.

S2S activities also include training courses focused on developing countries. One will be at APCC in Busan in October, and November 2015 at ICTP.

14:55 – 15:10 S2S/MJO-TF project on the Maritime Continent: Steve Woolnough

Steve discussed the joint MJOTF/S2S subproject in more detail. He noted there are action tasks in the MJO MC plan that add some direction to the plan. We might use S2S database to address some questions in document, but it cannot be used for all. For example, we might extend the forecasting analysis that Jon has done and the work in ISVHE to the S2S database. A focus would be specific examination of the Maritime continent and diagnosing propagation occurs across the MC from model to model.

Steve also described a UK Department for International Development (DfID)project on natural disaster risk in developing countries that the task force might interface

with. **ACTION ITEM:** Steve requested the task force provide feedback on any questions/key issues that might be missing in the MJOTF MC project/whitepaper as it now stands.

It was noted that a key issue not on the list is the different nature of MC precipitation over MC continent land regions versus oceanic regions when the large-scale MJO envelope goes over.

Steve noted that Adrian Matthews and Tieh-Yong were asked to join the task force to help lead MC effort.

15:10 – 15:25 Maritime Continent work in Australia and elsewhere: Matt Wheeler

Matt talked about the Australia MC initiative in the context of the larger YMC effort. The MJO is only a small component. The overall project is motivated by model bias (e.g. precipitation and diurnal cycle). Right now, Matt and others are working with Indonesia to get ship clearance, by first securing a buy-in from scientists and then linking with governments to get clearance. Mich asked whether getting WCRP and WWRP can help in any way, specifically providing letters to support the project for getting clearance and also urging funding. The TF said it definitely wouldn't hurt. Mich said to let them know what they can do. Mich also asked about central database archive for YMC and whether and how it would be archived. A similar arrangement would likely take place as done for DYNAMO. Tetsuo also recommended we might interface with PPP on use of their datasets since their effort may produce a similar global dataset as for YOTC experiment, right now slated to cover 2017-2019 for two boreal winters.

Tieh-Yong asked whether Matt is discussing the MC experiment with anyone in Malaysia? Not Matt directly, but yes, this is being done. Tieh-Yong recommended the met office in Malaysia be contacted. As far as motivation for the placement of Australian and other vessels, ideally ships would be located off Sumatra and Java to examine interesting diurnal cycle, but also because the oceanography is very interesting there.

15:25 – 15:40 Tieh-Yong Koh ideas on MC

Tieh-Yong gave an overview of his work on the Maritime Continent and MJO.

Questions include how does the MJO manifest locally. He did an analysis of radiosonde stations in Malay Peninsula. EEOF analysis was used to derive two leading modes (13-365 day filter). From these modes, RMM-like phase diagrams are derived that are rotated relative to RMM, but correlated at 0.6. Global composites look like the MJO. Tieh-Yong showed composite structure in geopotential height,

winds T, and q. A cool boomerang structure exists in height versus phase composites of temperature that is unlike ocean regions.

A double peak in precipitation composites occurs that does not show in OLR. Eric asked whether different maxima in convective and stratiform heating might explain these peaks. It was also asked whether some of the features might be associated with convection over the ocean that might be influencing OLR over land? Andy suggested that we should look more into diurnal cycle. The suppressed phase of MJO could be associated with stronger land precipitation because of stronger diurnal cycle. Matt suggested that we should compare to the Peatman and Matthews study that looks at this issue.

15:40 – 16:20 MC project discussion: Steve/Andy/Matt/Tieh-Yong/Eric/etc.
Key points that were discussed as priorities for future exploration include:
- the MC as a barrier to eastward propagation.
- Local systems (e.g. diurnal cycle)
- Intraseasonal variation of rainfall on land. It seems that the correlation of indices and land rainfall is not high, maybe because other things affect land rainfall in addition to MJO.

Steve said that specifically linking MJO to rainfall is important for S2S, particularly whether MJO prediction is the most important thing for intraseasonal rainfall prediction. Andy noted that topics such as this nicely connect with the monsoon project of S2S.

It was also noted that links with the YMC project might give the task force the chance access to datasets we might not otherwise have.

16:20: Discuss future of the MJO-TF

It was noted that the task force should continue in some form after its expiration in one and half years due to its vigorous new thrusts in air-sea interaction, the Maritime Continent, and process-oriented diagnostics that are just getting going.

Future meetings were also discussed. Options included AOGS, AOFD, and IUGG.
ACTION ITEM: More discussions are needed on a 2015 meeting venue for the MJO task force. Separate to this action item, a consensus developed in subsequent discussions to hold a joint MJOTF/S2S/YMC science meeting in Singapore around April of 2016 to discuss issues related to subseasonal variability in the MC region.
ACTION ITEM: Tieh-Yong will explore possible venues for the meeting.