

MJO Task Force Meeting

Czech Hydrometeorological Institute, Prague

10:00-17:00 (GMT+2) 29 June 2015

Agenda

Attendees (In Person): Steve Woolnough (co-chair), Charlotte DeMott, Nick Klingaman, Tomoki Miyakawa, Rich Neale, Ken Sperber, Prince Xavier, Xianan Jiang (invited)

Attendees (remotely): Eric Maloney (co-chair, from item 6), Adrian Matthews (for items 1-2), Matt Wheeler (for items 1-5), Min-Seop Ahn (invited, from item 2)

Unable to attend: Jon Gottschalck, Daehyun Kim, Camille Risi, Tieh-Yong Koh, June-Yi Lee

Items for discussion:

1) Brief Report on WGNE-30 Meeting

- a. SW relayed the positive feedback from Jean-Noël Thépaut (WGNE co-chair) on the MJO-TF activities and the presentation that JG gave on our behalf.

2) Maritime Continent Project

- a. SW reported on behalf of EM on the YMC planning meeting which was attended by EM, T-YK, TM and MW from the task force, a full meeting summary can be found at

[http://www.bmkg.go.id/ymc/dokumen/First International Science and Planning Workshop on Years of the Maritime Continent \(YMC\).pdf](http://www.bmkg.go.id/ymc/dokumen/First_International_Science_and_Planning_Workshop_on_Years_of_the_Maritime_Continent_(YMC).pdf)

The YMC science plan has been reorganized around 5 themes (atmospheric convection; ocean and air-sea interaction; stratosphere-troposphere interaction; aerosol; and prediction improvement) EM and MW were on the writing teams for convection and prediction. The latest version can be found here

[http://www.bmkg.go.id/ymc/dokumen/YMC SciencePlan v2.pdf](http://www.bmkg.go.id/ymc/dokumen/YMC_SciencePlan_v2.pdf)

Next YMC meeting

- International YMC Implementation Plan Workshop, 24-27 Nov 2015, Jakarta Indonesia

- b. Status of plans for Joint MJO-TF/S2S Workshop in Singapore
SW reconfirmed the planned joint MJOTF/S2S/YMC workshop in Singapore in April 2016 to be hosted at Nanyang Technological University. We're still seeking sponsorship for this meeting.

ACTION: All MJOTF members interested in attending to identify possible clashes in April 2016

ACTION: SW/T-YK/EM to confirm dates and identify organizing committee including membership of S2S

ACTION: Organizing committee to advertise meeting and invite abstracts/speakers as soon as possible

- c. Existing Plans for work

AM presented plans for a UK consortium (UEA, UoR, UoL and Met Office) contribution to the YMC program focused on the diurnal cycle and its interactions with larger-scales including a proposed field campaign including in-situ, aircraft and sea/wave-glider observations along with a modelling

component comprising simulations with CRMs, CSRMs and GCMs . Likely location will be off Java with flight transects to Christmas Island for ~2 months during Nov 2018-Feb 2019. Hoping to coordinate with Australian ship campaign. Proposals passed outline stage full proposal due Nov 2015. AM/SW/NK will also have PhD project advertised at UEA for Oct 2016 Entry SW reported on a new project led by Duane Waliser, Dariusz Baranowski and XJ to develop metrics on the diurnal cycle, multiscale interactions and air-sea interaction in the Maritime Continent using the MJODH database CDM reported on a proposal to look at the Maritime Continent and the MJO with a coupled version of SPCAM in which the air-sea interaction is computed within the CRM, rather than the global model.

XJ reported on a proposal to look at the diurnal cycle with GPM

3) Update on CMIP5 paper and process oriented metrics paper

M-SA presented work with DK on the role of long-wave radiative feedbacks on the MJO, reported in a recently accepted J.Clim paper.

- The greenhouse enhancement factor (GEF) is measured at different precipitation anomaly regimes as the negative ratio of anomalous outgoing longwave radiation to anomalous precipitation.
- The greenhouse enhancement is greater in weak precipitation anomaly regimes and its effectiveness decreases monotonically with increasing precipitation anomaly. The GEF also amplifies locally when convection is strengthened in association with the MJO, especially in the weak precipitation anomaly regime ($< 5 \text{ mm day}^{-1}$).
- A robust statistical relationship is found among CMIP5 climate model simulations between the GEF and the MJO simulation fidelity. Models that simulate a stronger MJO also simulate a greater GEF, especially in the weak precipitation anomaly regime ($< 5 \text{ mm day}^{-1}$).
- Models with a greater GEF in the strong precipitation anomaly regime ($> 30 \text{ mm day}^{-1}$) represent a slightly slower MJO propagation speed.
- Many models that lack the MJO underestimate the GEF in general and in particular in the weak precipitation anomaly regime.

There was some discussion (RN,PX,SW,XJ) on how these might relate to some of the representation of the physical processes in the models, including different treatments of cloud within the large-scale precip and convection schemes, looking at some of these processes in the MJODH database might be able to reveal more information on this.

MS-A also reported on the status of the CMIP5 paper, a draft of the paper is with DK and will then be circulated to the whole task force

Result part 1. MJO indices

- Most CMIP5 models underestimate the MJO amplitude and eastward propagation, especially in OLR signal.
- Most CMIP5 models simulate fast MJO propagation speed compared to observations

Result part 2: Process oriented diagnostics

- RH-metric is relatively well correlated with MJO amplitude and eastward propagation of precipitation and wind signal

- GEF-metric is relatively well correlated with MJO amplitude and eastward propagation of precipitation signal
- NGMS-metric is relatively well negative correlated with not only eastward propagating speed of precipitation and wind signal but also MJO amplitude and eastward propagation of precipitation signal

4) Tropical Wave Activity in CESM CMIP6 Candidates

RN presented some work on the development work in CAM for the version of CESM which will contribute to CMIP6. There is a fall-back position which is CAM5.3 + small changes, and two main development paths with major changes to the moist physics

- UNICON (Park 2014a,b J.Clim): Unifying, dry, shallow and deep and now accounts for sub-grid-scale mesoscale flows
- CLUBB: Replaces all moist physics, and BL turbulence except deep convection based on high level closures (10 prognostics), assumed pdfs close dissipation terms.

The presentation focused mainly on the representation of equatorial waves (Wheeler-Kiladis) and the MJO. UNICON does much better WK diagram cf 5.3, CLUBB not so good, but maybe slightly better cf 5.3 in MJO

Both improve the diurnal cycle slightly, however initially both had very bad ENSO when coupled. Developments of model to improve ENSO, very successful in both versions, UNICON able to maintain its MJO in this updated version but has too much power in WK diagram. CLUBB had poor performance in this respect, working hard to improve this, changing convective closure and modifying Zhang-McFarlane in line with ECMWF modifications, explored the sensitivity of equatorial waves and MJO to 'tuning'

Problems propagating over the MC, regressions based in WP look better

However will be using CLUBB because better handled to Cloud-radiative effects, and better climate sensitivity and better aerosol effects.

5) Convective Momentum Transport

- a. TM presented some results on his analysis of the CMT in NICAM simulations following on from earlier presentations to MJOTF. Tripolar structure with eastward acceleration at low levels, westward acceleration in the lower-troposphere and westward acceleration at upper-levels: possible impacts of this CMT include, delaying westerly advection of mid-level moisture, enhancing WISHE, and produce tilting structure.

Analysis of NICAM MJO ensembles, consistent with previous study, may need a better way of compositing, next step will be to quantify the net effect. 54 simulations are consistent, but not clear in all events, sometimes MJO not coherent, and sometimes MJO centre may not be well defined. Some evidence of resolution sensitivity, in particular 7km simulations seem a bit messy, seems to be associated with excessive LH flux, westward TC's develop near equator, and "linger", CMT carrying momentum of eddies to near the surface.

- b. XJ presented some analysis by Ji-Hyun Oh et al. (J. Climate 2015), on 3D CMT structure associated with MJO in NCEP CFS, relative contributions from

different scales. Parametrized CMT consistent with NICAM. Separate CMT into <5deg, >5deg and parametrized. Meso-scale CMT small, mainly captured by parametrization, large-scale transports dominated background u advected by MJO w. The sub-grid scale CMT balances large-scale circulation.

XJ also presented analysis of WWE in Dynamo MJOs (JAS accepted). du/dt westerly through most of depth, decomposed of PGF; low level westerly, upper level easterly acceleration; vertical advection accelerates upper levels, easterly acceleration by horizontal advection at low-levels. Temporal separation of flows shows most of the vertical advection comes from long-time scale (>5days) flow. Differences dominant terms and signs of terms in momentum budget for the two westerly events associated with Dynamo MJO2 were analyzed. While PGF dominates the 1st WWE, horizontal advection, co-played by Kelvin, Rossby, and WIG waves, is important for the 2nd WWE.

6) Update on air-sea interaction project

a. Status and summary of review paper

Two of the initial reviews of the paper were quite critical of the ocean component of the paper, and the paper required substantial revision. We've just received the second reviews and these were much more positive, with some minor revisions required.

b. Plans for future work

NK presented his plans for analysis of air-sea interaction in SPCAM, IFS – KPP. Initial work with SPCAM-KPP, SPCAM has stronger MJO amplitude than observations, SPCAM-KPP too fast relative to observations, and atmosphere only with SPCAM-KPP SSTs, SPCCSM and SPCAM too slow, very little difference for all these models in rate of amplitude loss, SPCCSM has best propagation, but air-sea coupling in KPP framework doesn't really make a difference?

Annual mean SST precipitation bias not really changed, but seasonal (solstice) conditions, very different, shift in location of ITCZ, likely leads to change in the projection of heating to Kelvin-wave and Rossby-wave modes.

c. Discussion of air-sea interaction diagnostics:

CDM introduced a discussion on air-sea diagnostics, we initially planned to include a discussion of the diagnostics in the review paper, but we felt that (a) we weren't ready to do that and (b) the review paper was already long. CDM identified two types of diagnostics, descriptive, and process diagnostics. For example SST variance, lagged regressions of fluxes on rainfall, relationship between SST change and fluxes, ocean response, SST contributions to flux variability. As an example model's show much stronger correlation between $dSST/dt$ and Q_{net} than observations. It's clear that it is not easy to identify diagnostics that can separate how the air-sea interaction influences the MJO from the fact that the MJO is different in your coupled and un-coupled simulations.

ACTION: All to think of ideas some diagnostics to elucidate the mechanisms by which air-sea interaction influences the MJO

d. CDM presented some analysis air-sea interaction and propagation of the MJO through the maritime continent compared to Eastward Decaying events

that don't propagate through the Maritime Continent. Some seasonality and dependence on background state (e.g. ENSO, IOD) remove events from anomalous ENSO, IOD years. MJO events tend to have larger spatial scale and colder cloud decks with warmer SSTs preceding convection. MJO events further separated into small and big MJOs. Small MJOs and EDs look very similar in OLR in Indian Ocean, Small MJOs have larger intraseasonal SST signature, but even with IOD and ENSO removed there are some substantial differences in background SST. Is this a control on the propagation or an artefact of the relatively small sample size?

7) 14:30 Update on MJO-DH project (Steve, Nick, Prince, Xianan)

- a. 4 papers are now published in JGR on the Diabatic Heating Project. NK presented a short summary of the synthesis paper which looked at the models which contributed to all 3 experiments,
 - Little relationship between models skill in climate mode and hindcasts
 - GMS and RH metrics which were related to skill in climate models don't carry particularly well into hindcasts
 - Some skill of moistening metric from hindcasts in climate models

b. Report on database

There have been a number of enquiries about using the database, mostly for MJO related studies, but we have no formal record of use of the database.

c. Ongoing and planned analysis and experiments.

XJ presented an MSE budget analysis using the MJODH database (Jiang et al 2105)

Characteristics of good vs bad MJO, smaller scale precipitation features, good MJO models have dmse/dt structure with observed E-W dipole, bad models have poor relationship. Analysis of growth and propagation terms. Obs: advection damps MSE, Rad+LH amplify, So low NGMS leads to "good" MJO. Strong MJO small flux feedback, counter-intuitive maybe related to the fact that strong MJO models are very sensitive to PW anomalies, convective timescale PW'/P' about 1 day on average, shorter timescale has stronger amplitude

MJO propagation: related to horizontal advection term, two processes – high frequency transports, but not much difference between good and bad models. The leading term in observations is horizontal advection of background MSE by MJO winds, there is a difference between good and bad models. Good models underestimate zonal advection but overestimate meridional. In bad models both are small. Good models underestimate zonal gradients in MSE, but have a stronger circulation net effect is weak zonal advection but too strong meridional advection.

NK presented some analysis of timestep behaviour in 2day hindcasts, wide variety in behaviour at timestep and gridpoint level between models, much reduced when looking at common temporal and spatial resolution. Hoping to analyse how much this intermittency matters for the large-scale dynamics.

8) Process-oriented metrics

EM presented two successful projects to a NOAA MAPP Call for metrics for climate and ESM model development (Activities of the MJOTF were cited in the call) EM is involved in one proposal to develop a framework and

infrastructure for applying metrics to arrangement of models and one to develop MJO related metrics

9) 15:30 Wider discussion on interactions with S2S Project

a. Prediction Skill Aspects

SW highlighted that it would be good to engage with S2S more broadly in characterising the predictive capability of current operational systems for the MJO, including more detailed analysis of e.g. phase, seasonal, interannual dependence of MJO prediction.

ACTION: SW and EM to discuss with JG,MW,J-YL and any other interested parties how we might take this forward

b. S2S Teleconnections Project:

SW reported that Cristiana Stan and Hai Lin are leading a new S2S sub-project on teleconnections which will focus on Tropical –Extratropical interactions, especially the MJO. We should think about how we can engage with this project.

This is something that we have had on our to-do list since the USCLIVAR days and it would be good to think how we can engage with this. SW and EM are currently on the sub-group for this as TF representatives.

PX noted that he is now funded by a difference project to look at teleconnections of MJO to extra-tropics. As this is difficult in climate simulations of the UM (no MJO) he will focus on analysis of S2S system GloSEA5. May be able to link behaviour of model to diabatic process to MJO teleconnections in the 20day and 20years MJODH project.

ACTION: All to consider whether they would like to take a lead on behalf of the MJOTF in this area

10) 16:15 Update on BSISO activities

SW gave a brief updated on the BSISO activities on behalf of J-YL

5 models soon to be 6 contribute to the real time BSISO prediction monitoring project hosted at APCC; Models have skill at about 10-20days (BSISO1) and 10-16 days (BSISO2) for 2013-2014

Plans to extend to all models in S2S

Plans to focus on predictions of regional rainfall patterns and extreme events; including monsoon onset, monsoon rainfall indices and extreme events

11) 16:30 AOB

Aim for a telecon in September

ACTION: SW and EM to trawl for dates