2020 ‘virtual’ MJO TF face-to-face meeting

Date: August 13-14, 2020

Participants

- Thursday, August 13, 2020: Charlotte DeMott, Daehyun Kim, Xianan Jiang, Stephanie Henderson, Matt Janiga, Tomoki Miyakawa, Nick Klingaman, Steve Woolnough, Prince Xavier, Tieh-Yong Koh
- Friday, August 14, 2020: Charlotte DeMott, Daehyun Kim, Rich Neale, Donaldi Permana, Matt Wheeler, Samson Hagos, Hyemi Kim

Agenda (for both days):

- Introductions and Announcements
- Review of TF member research activities
- Action Items
    - MJO Reanalysis Assessment Project (RAP)
    - MJO MSE/moisture budget analysis best practices: paper and/or software package?
    - CMIP6 model analysis
    - other proposed items

August 13

Nick Klingaman: Work w/ Prince on reasons for MJO improvement in MetUM. New version produces the first hint of MJO compared to previous versions. Warmer SSTs in WPac lead to more precipitation there. GC3 SST errors enhance MJO propagation, but it still does OK with OBS SST. GC3 SSTs can improve GC2 MJO, GC2 SSTs degrade a little the GC3 MJO. Model physics in GC3 are improved though, as they get better MJO w/ GC3+GC2_SST than GC2+GC2_SST. Daehyun has submitted paper to GRL on this topic using CESM2 ensembles. Steve argues that analyzing just 20 years of a simulation is not sufficient because of these feedbacks.

Stephanie Henderson: T-ET contributions to PNA growth. The “reverse engineer” PNA growth and find that “optimal growth” condition comes from tropical from concurrent MJO & ENSO state. Most predictability during ENSO years based on MJO, less during ENSO-neutral. Future work: building LIM that removes ENSO, QBO modes for PNA forecasts based only on MJO. Tieh-Yong: How is the fast evolution linked to ENSO? The coupled (ENSO) space just decays slowly, but doesn’t change PNA sign. The internal space (MJO) evolves quickly to reinforce the coupled (ENSO) PNA state.

Daehyun Kim: MJO in CMIP6 models. Also, role of background MMG in OBS: Interannual variability of MJO propagation. Looked at propagation for high and low MMG conditions. Propogation changes as expected. High/low MMG look like Nino/Nina conditions (note that he has eliminated "super" Nino events). Steve: we may need to highlight this finding more. Xianan: zonal moisture gradients must come into play as well.

Xianan Jiang: 1) MJO review paper. 2) interactions of MJO w/ MC. MC damping associated w/ interruption of lower-trop moistening east of local mountains. 3) Further understanding of physics for MJO propagation w/ aqua-planet simulations: lower-tropospheric mean moisture gradient and zonal winds are critical. 4) cautionary note on using RMM MJO index to study MJO trends: increase in frequency of MJO phases 4-6 could be exaggerated due to low-frequency variability signals in the RMM. Removing low-frequency variability from RMM signficicatly reduces MJO trend. Steve: #3, consistent w/ other studies. Would they get the same result w/ different model than ECHAM? I suspect they would, at least wrt to when the w- to e-moving transition happens. Xianan agrees. Steve: are more aqua-planet experiments needed to suss this out? Should look for a link between dITCZ and w- vs e-moving.

Steve Woolnough: 1) MJO modulation of teleconnections to Europe (modulated by ENSO). 2) skill of sub-seasonal prediction systems over Brazil, Africa (including influence of MJO). 3) S2S prediction for Africa (w/ MJO links). 4) book chapter—Steve is MJO TF liaison to S2S TF. 5) TerraMaris (MC process study)—multiple delays due to helium, COVID. 6) impact of CCEWs on MC rainfall and weather regimes for SE Asia. Matt: CCEW detection algorithm question. Append forecast to real-time data to extend window to allow filtering.

Tomoki Miyakawa: New supercomputer "Fugaku" (means Mt. Fuji). 40x faster than previous machine. Combined w/ software improvements, allows ~100x faster simulations. Disaster prevention simulations are first priority: high-impact weather in 2 week - 3 month range. DYAMOND Phase 2: global storm-resolving simulations. Currently running ocean-coupled simulations for the EUREC4A period.

Discussion:
MJO RAP: collaboration w/ TIRA group (well-organized, good website). What processes are not well-represented in the reanalysis products? RA products exhibit a lot of variability even in tropical MSE mean state profiles, which affects their vertical gradients. VADV, LW terms exhibit larger inter-RA spread. Should there be some group work on this topic? Such as moisture-convection coupling, teleconnection? Stephanie: currently collaborating w/ Larissa Back - Q1 profiles very different in RA products and CMIP5 models. They went with ERA-I as a favored product. Only regional differences in climatology now, while MJO work is planned. She also wants to look at EPac, where RA and CMIP5 differences were large (tends to be bottom-heavy Q1 region). Ultimately, she wants to study how important these structures are to large-scale circulations. Steve: Q1 is from residual, correct? Yes. Nick: would coupled RA products be useful? Daehyun: RAs are often considered as the truth. Probably OK for low-frequency variability, but less so for higher frequency variability. We want the RA products better constrained by observations. Steve (and Daehyun): all RA products support previous findings of MJO maintenance, propagation—uncertainty remains regarding net effects (VADV+LW), especially for MSE maintenance, and this gets right to the heart of convection. OSEs might help understand the effect of OBS, DA system, model state. Xianan:

MSE profile differences are mainly from q-profile differences. Daehyun: seems that the humidity field is only weakly constrained by observations. Human resources is the main barrier to continuing this work. Daehyun has the data on 2.5 deg resolution that he will share. WGNE is interested in this project. Should we do more than publish papers?

August 14

Matt Wheeler: Continued work on MJO monitoring and forecasting. Recent YMC research cruise. He will serve on the WMO Research Board.

Donaldi Permana: MJO, CCEWs triggering extreme rainfall and floods in Indonesia. Also landslides. MJO/BSISO impact on observation in the MC. MJO-DC interaction from in situ observations. Data is 1983-2012. Also working w/ Simon Peatman on MCS tracking and relation to CCEWs. MattW: does he see evidence of the rainfall vanguard in the in situ obs? Yes, they do see it, but elevation can also regulate this. MattW: which BSISO indices? APCC indices.

Hyemi Kim: MJO teleconnection in CMIP6. Work w/ C. Stan. Examining historical and sps585 to analyze future changes in teleconnection patterns. Chidong's editor's highlight "Emerging Controversy in MJO prediction." MJO is more predictable in EQBO years, but not statistically significant. EQBO MJO activity is much stronger over MC than in WQBO. Nearly all models underestimate the lower stratosphere cooling signature associated with EQBO. She's also used ML methods to improve MJO prediction skill. Rich: how is the MJO in the model interacting with QBO winds? The mechanism remains uncertain. Matt: is the improved skill w/ EQBO simply a result of EQBO being higher amplitude? Yuna Lim showed that skill is there even when controlling for RMM amplitude.

Matt Janiga: Seasonality of MJO skill in CFSv2. Low-Frequency skill is more important than including intraseasonal filtered fields. Trying to get Navy's ESP system added to SubX. Also using this model for TC prediction.

Rich Neale: CESM2-CAM6 sensitivity "revert" experiments. Much less sensitivity to choice of physics than SST distribution! They only get an MJO when they couple. None of the uncoupled model physics changes improved the MJO. In AMIP, MC remains a huge barrier. Even CAM5 gets MJO w/ CESM2 SSTs. MattW: is there a role for flux corrected runs to disentangle these problems?

Samson Hagos: CMIP6 rainfall biases in the tropics, esp wrt dITCZ. rainfall-PW relation. two rainfall regimes: one where P is controlled by evaporation, the other where P is controlled by moisture convergence. Vertical structure convergence determines where model spends the most time. Also has looked at vanguard over MC. Rich: is there a seasonality to the P-PW relationship? In other words, could the P regime depend on how long a model spends in each regime? Samson says this behavior is seen even if you focus on only one season.

Daehyun Kim: high vs low MMG: QBO is not totally independent of El Nino. high MMG looks like CP El Nino.
Discussion:
MJO-RAP: are any of us interested in doing some MJO analysis as part of this project? such as ocean feedbacks? The main issue is how to fund this work. Hyemi would like to apply the teleconnection metrics, but also does not have the manpower. Daehyun has all of the data at 2.5 res data. Rich: we can ID very simple projects (summer intern) and more complex: what are the analysis increments? Charlotte could look at the rotation metric among these. Could TIRA support some students? TIRA wants to know if/why their product is an outlier. Daehyun will look at the RH vs R product. Are the differences rooted in DA or model physics? Rich: Clara Deser might have a student in mind for this work. MattJ: forecast centers have an interest in this work too. Rich: could also examine older reanalyses to demonstrate improvement—good point but no plans to add that since the student has returned to China. MattW: do budget terms look similar for non-MJO periods and regions?

MJO MSE budget analysis: Sould MJO TF make recommendations for how to do MSE budget analysis? Do we as a group want to write a paper on this?

CMIP6 analysis: Who is looking at CMIP6 models? Charlotte, Nick, Samson (MJO relationship to ARs). Hyemi: MJO-teleconnection, including MJO propagation characteristics. Previously, MJO TF has written a group paper on MJO. Hyemi: how do metrics get implemented to PCMDI?

In-situ MC observations: Donaldi has done a large comparison of rainfall products w/ with their gage network. He hasn't yet gotten to MJO phase, but plans to do so.

S2S model analysis: Matt would like to focus more on S2S models. Daehyun: Can we say something about improving S2S skill in certain parts of the world? For example, extreme events. Maybe need a standard forecast metric? Maybe TF should address the TORs during meetings, or discussions about best practices paper.