YMC Science Issues: Prediction

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Australian Government

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Prediction is our ultimate goal, right?

Content

1. Prediction within the MC region
2. Global prediction related to the MC
3. Improving predictions through YMC observations

Preliminary thoughts/comments

a. Only the scientific challenge of prediction is discussed, not issues with the delivery of predictions or the actions taken.

b. Numerical models are now the dominant source of predictions. Therefore, **prediction issues are primarily modelling issues**, assuming our observations of the initial condition remain the same.

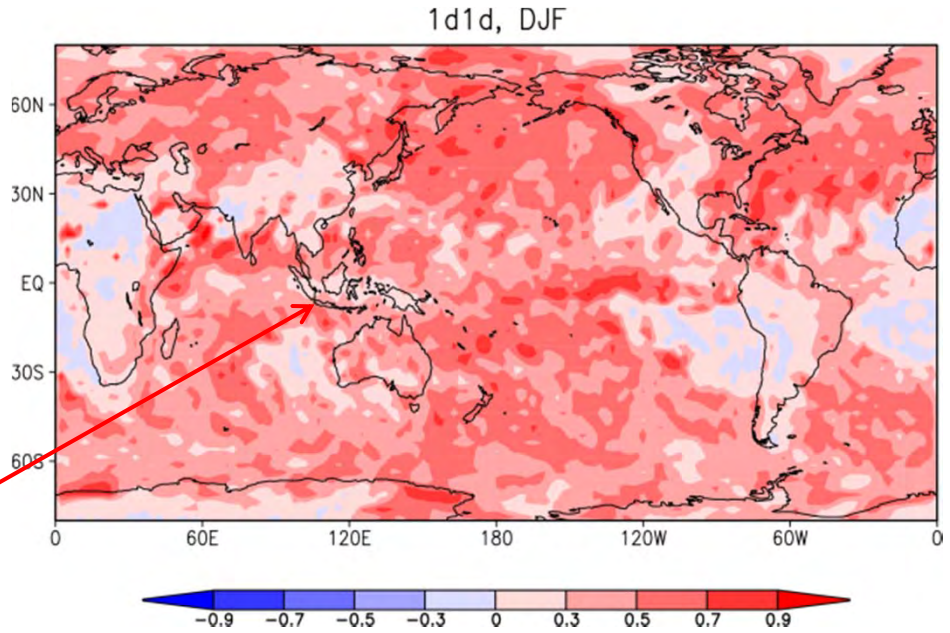
1. Prediction within the MC region

Short-range (12 – 72 hours)

- The presence of a **strong diurnal cycle** makes some aspects of MC prediction easy (if verifying with total fields with sub-daily data).
- Predictions of **daily-averaged anomalies**, however, are generally more difficult in the tropics than mid-latitudes due to the dominance of **tropical convection** (compared to the more predictable dynamics of extratropical systems).

Correlation skill for daily **precipitation anomalies** at a lead time of 1 day from POAMA version 2.4 compared to GPCP (DJF, 1996-2009). *Zhu et al. (MWR; 2014)*

A local minimum occurs over the MC



Medium-range (3 – 10 days)

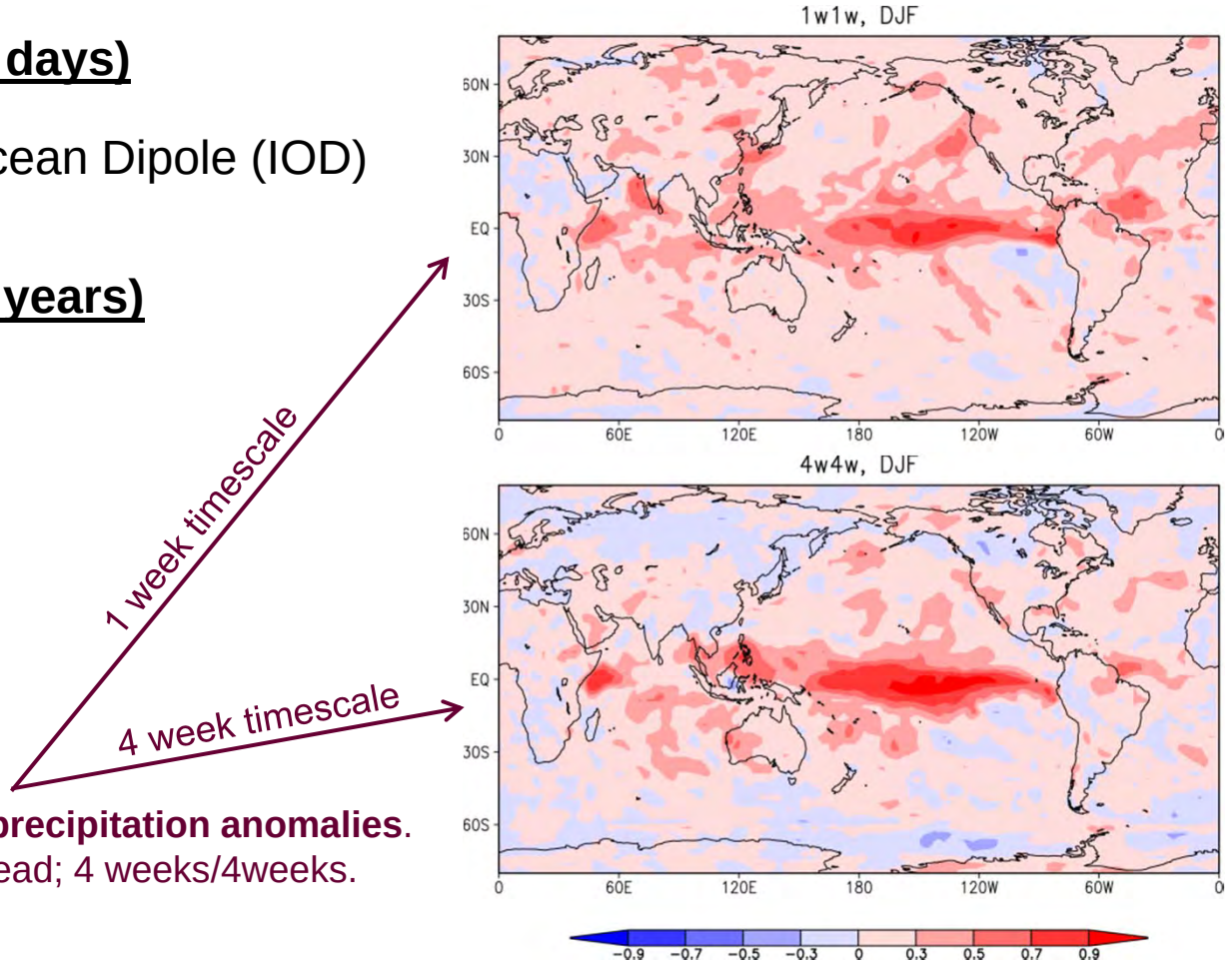
- Tropical cyclones – already well researched and predicted?
- Mesoscale Convective Systems, local circulations (e.g. Borneo vortex), Tropical/monsoon depressions, cold surges, equatorial waves, MJO.
- Convection response to persistent SST anomalies.

Extended-range (10 – 30 days)

- MJO, ENSO, Indian Ocean Dipole (IOD)

Long-range (30 days – 2 years)

- ENSO, IOD



Correlation skill for daily **precipitation anomalies**.
1 week average/1 week lead; 4 weeks/4weeks.
Zhu et al. (MWR; 2014)

Why do we think that we can improve current levels of prediction skill in the MC?

- ENSO has been shown to sometimes have strong impact on MC rainfall (Kirono et al. 1999; Hendon 2003), but the prediction skill of current models is still relatively poor there (see skill plots on last slide).
- Probably the models don't get the complicated local MJO signal either.

Peatman et al. (QJRMS; 2014)

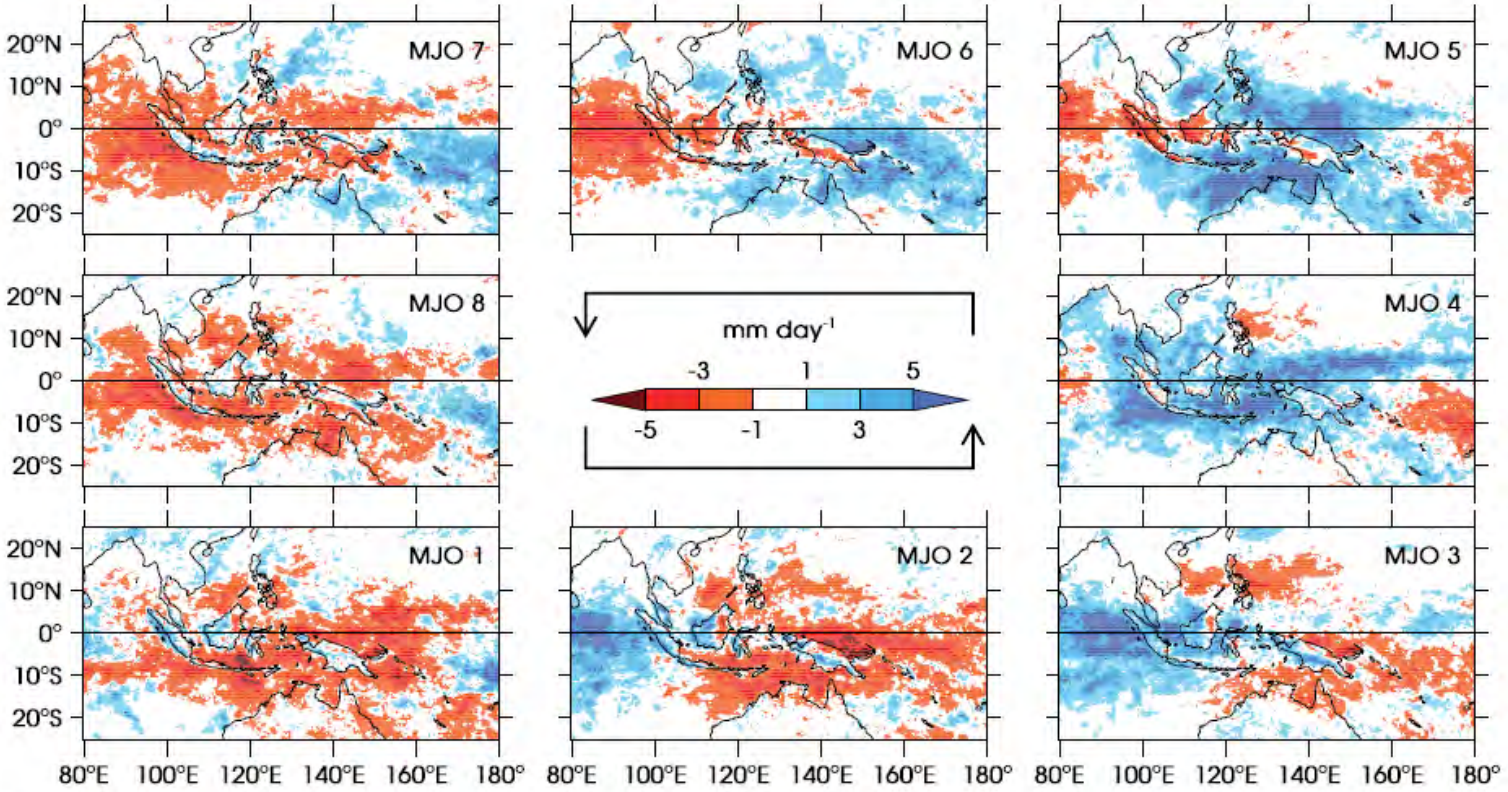
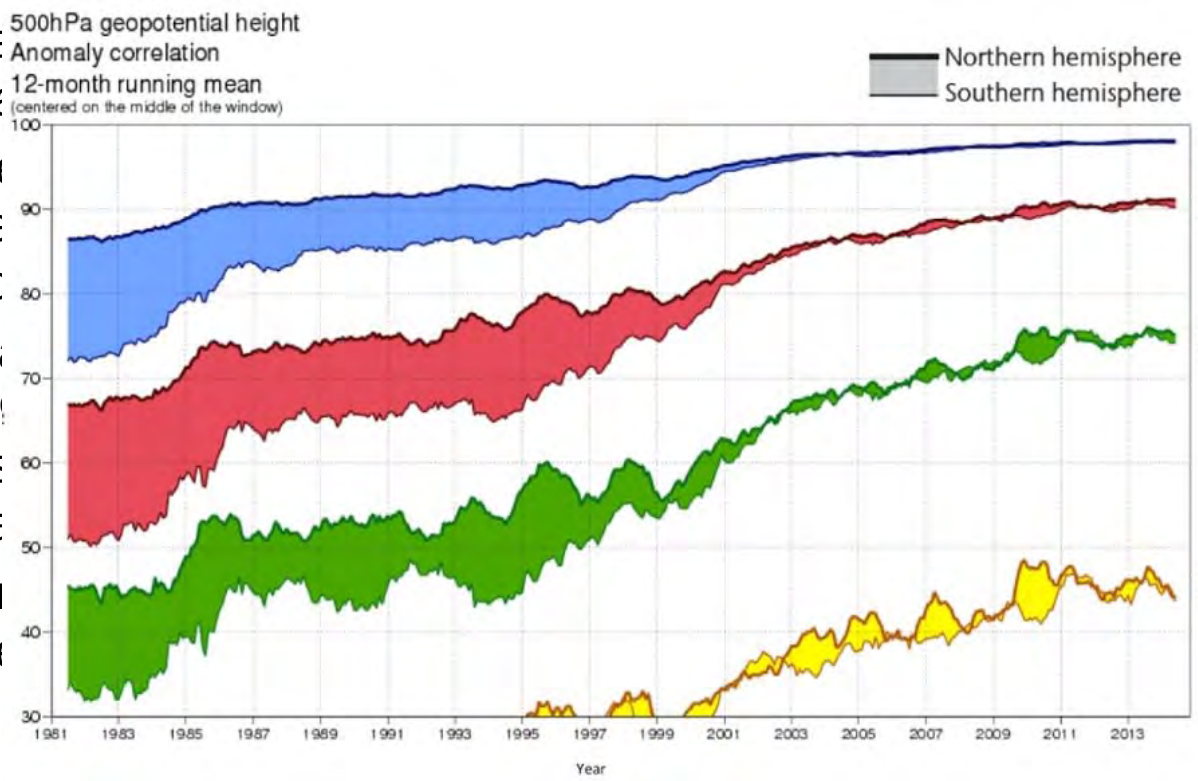


Figure 5. As Figure 4, but for daily mean precipitation anomaly from TRMM 3B42HQ. This figure is available in colour online at wileyonlinelibrary.com/journal/qj

2. Global prediction related to the MC

- MC re … globe (Lau a … ability.
- Relate … to conve … o seasc …
- MC ha … ian elsewh…
- Errors … atropics (Ferra …
- Extrer … urch 2012; Dole … er the MC.

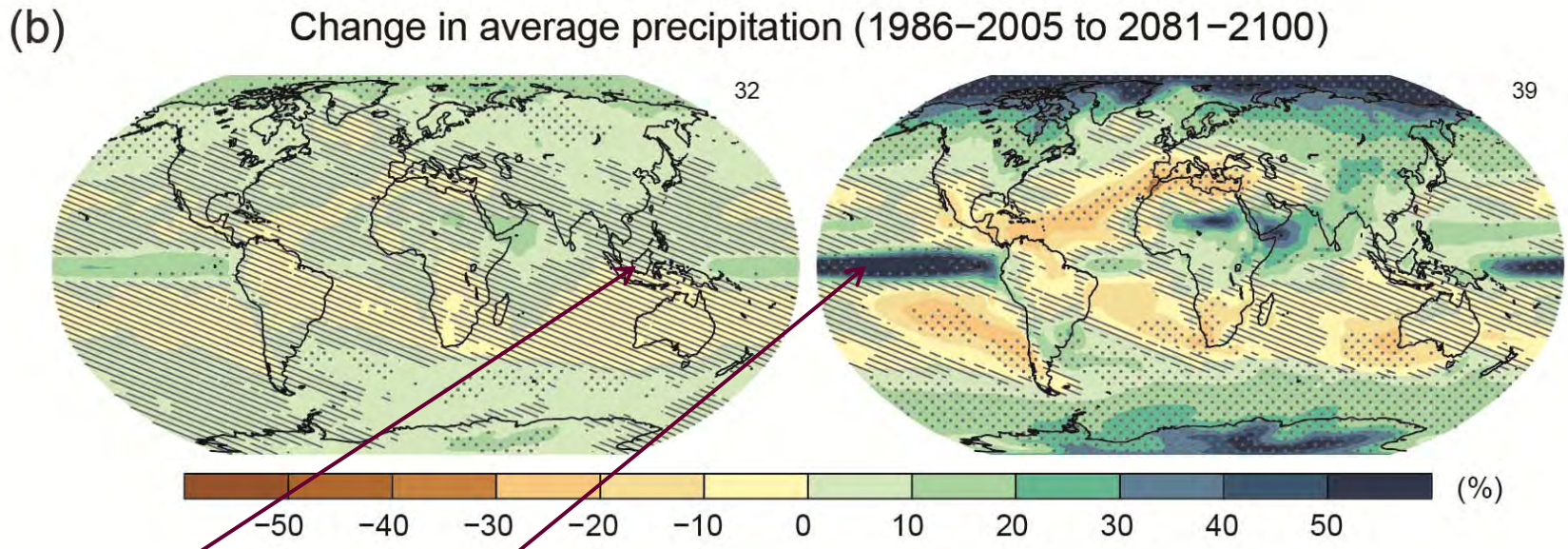


So, if we can improve biases and prediction in the MC region, global prediction should also be improved.

But by how much? Bechtold et al. (2008) provides a good example to follow.

It follows that **global climate change projections** are likely compromised by MC biases and prediction errors as well.

Note that there is no strong agreement between models on the predicted change of Indonesian precipitation in the coming century.



IPCC (2014; WG1 Summary for Policymakers)

Hatching indicates regions where the multi-model mean is small compared to natural internal variability. **Stippling** indicates regions where the multi-model mean is large compared to natural internal variability and where at least 90% of models agree on the sign of change.

How can YMC help prediction?

- Prediction improvements will primarily be achieved by improvements to our **numerical models**, provided those improvements are targeted to the phenomena and processes most relevant for prediction.

- Where should the effort be targeted to best benefit prediction (on al time scales)?

  Note that increased resolution can only do so much, and is often not practical (Jakob 2010).

  - Convection/cloud paramterization and microphysics
  - Boundary-layer parameterization
  - Air-sea and land-air fluxes
  - Representation of topography
  -

How can we improve the Prediction section of the Science document?

- Does this section properly fit where it is?
- A science **issue** or **theme**?