



Met Office
Hadley Centre

Current status and future perspectives of operational prediction from subseasonal to longer timescales

Richard Graham, Met Office Hadley Centre

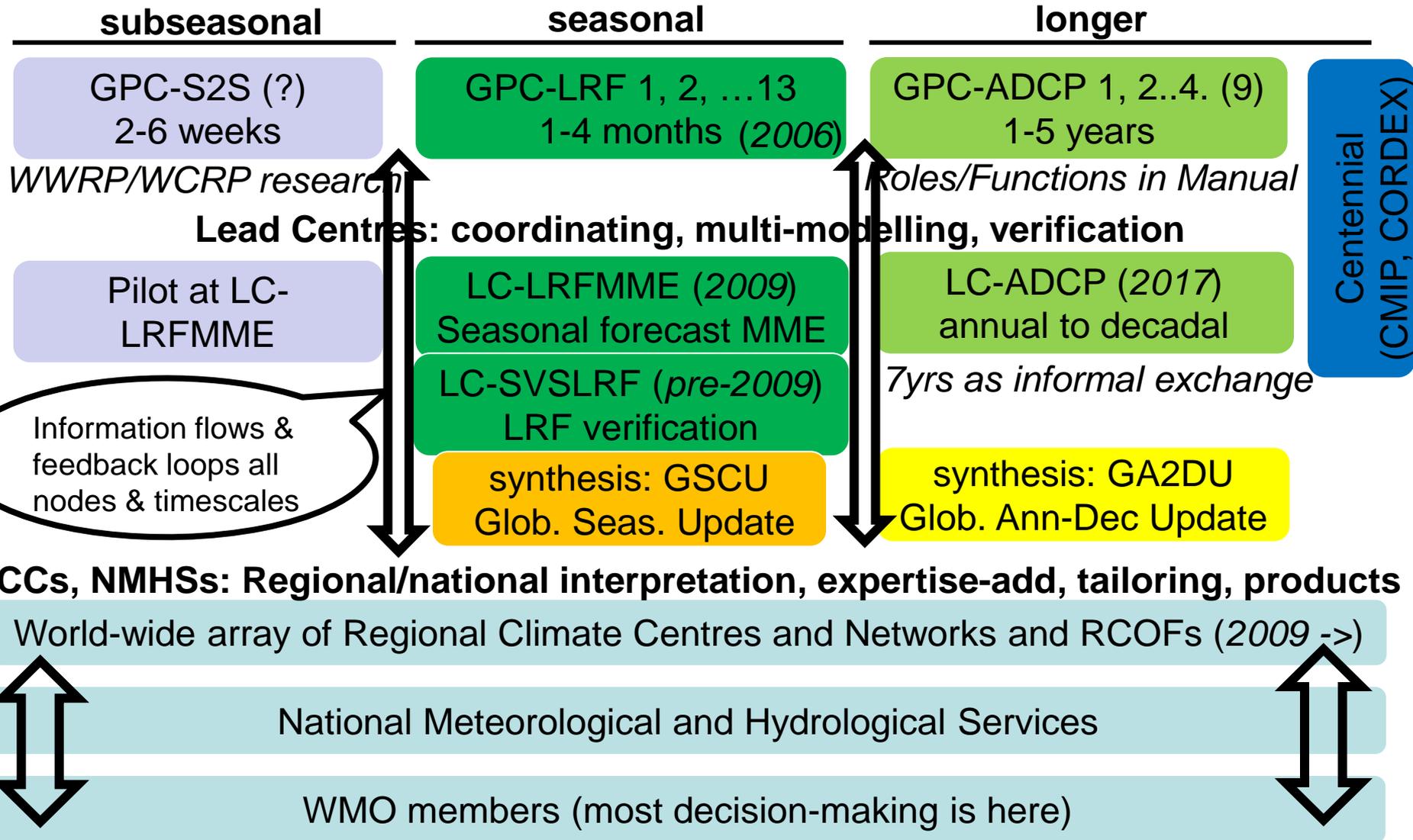
Second WMO Workshop on Operational Climate Prediction, 30 May – 1 June 2018, Barcelona
Supercomputing Centre, Barcelona, Spain

Content

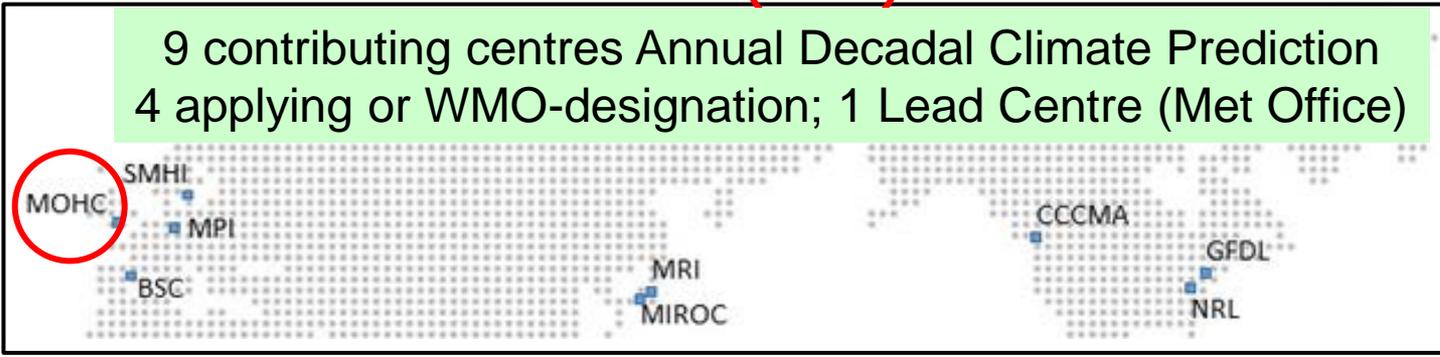
- Overview of status of WMO infrastructure for operational prediction: sub-seasonal to longer timescales
- Hopefully a framework for some talks that follow
- Examples of key products from the wealth of information now available and coming available
- Perspectives – largely drawn from Africa examples
- RCOF review top-level recommendations: “Mainstreaming of objective seasonal climate forecasting underpinning RCOF products”

Developing WMO infrastructure for Operational Climate Prediction: subseasonal to longer timescales

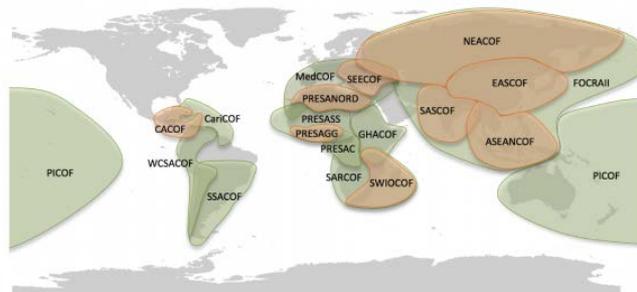
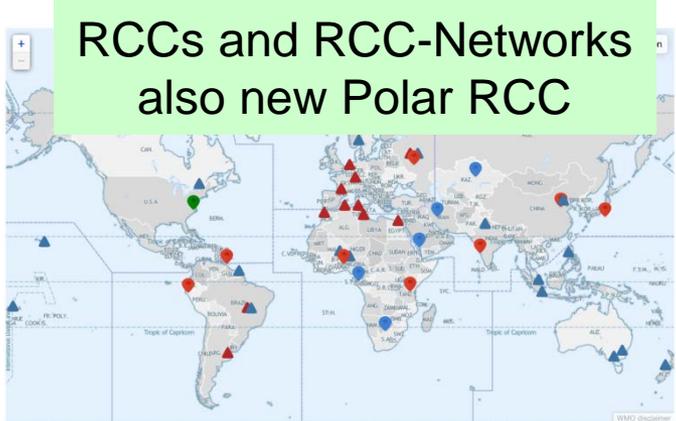
Centres contributing/using real-time forecasts and hindcasts (manual GDPFS)



Global/Regional centres & entities



Lead Centres Forecast:
LC-LRFMME (336 RCC/NMHS users)
Verification:
LC-SVSLRF



RCOFs:
consensus forecast and dissemination,
user engagement

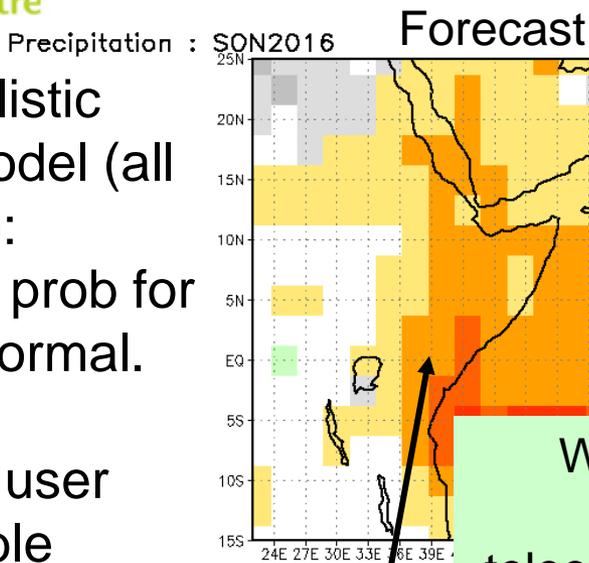


Greater Horn of Africa: Sept-Nov 2016

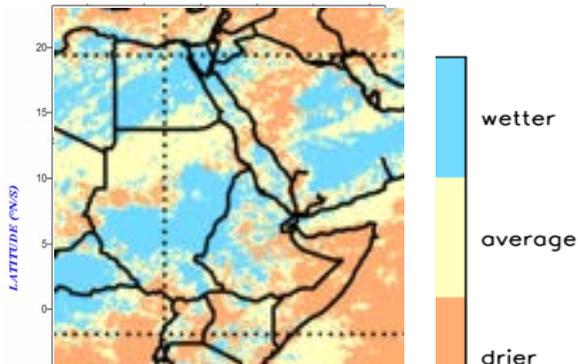
LC-LRFMME products – used (with other inputs) by ICPAC at GHACOF44

Probabilistic
Multi-model (all models):
60-70% prob for below normal.

MME is user selectable



Observed tercile



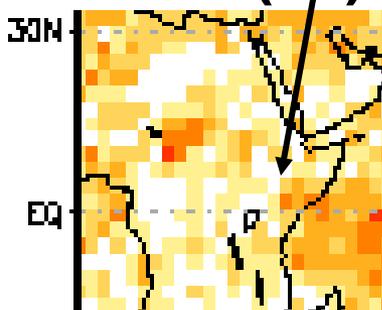
Widespread drought
Short Rains
2016

Which GPC models correctly reproduce ENSO/IOD teleconnection? ICPAC-led WISER-W2SIP will investigate

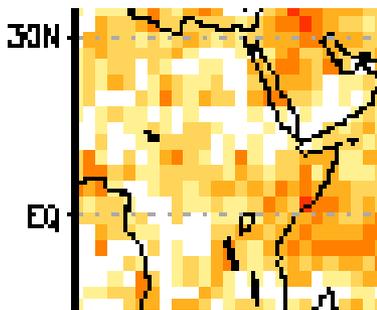
ROC skill lower-tercile 1993-2009



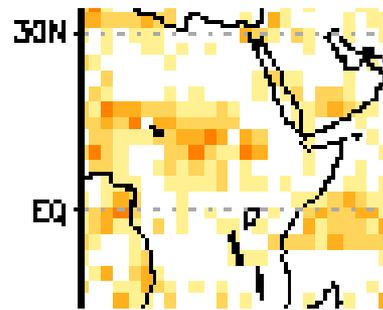
MME(all)



GPC X



GPC Y

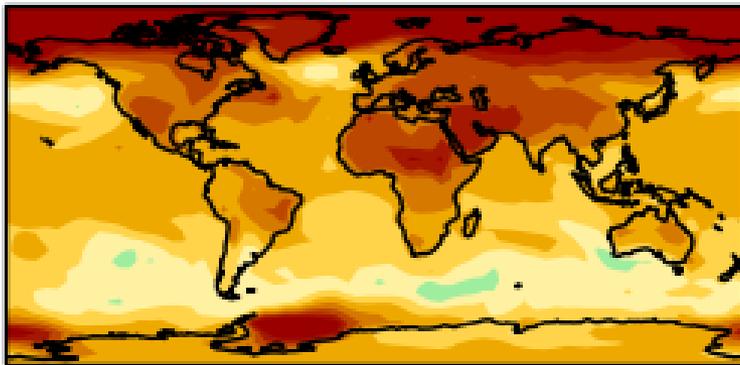


Verification:
Skill varies with model (and region/season)

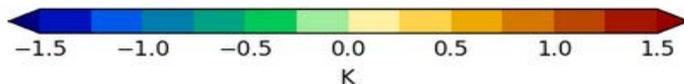
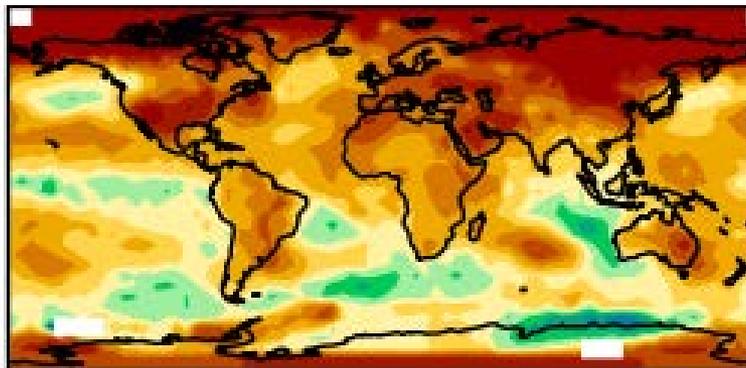
Annual to decadal: informal exchange (since 2010), LC-ADCP now designated

annual prediction (year 1) surface air temperature anomaly, 2017

Multi-Model Ens mean



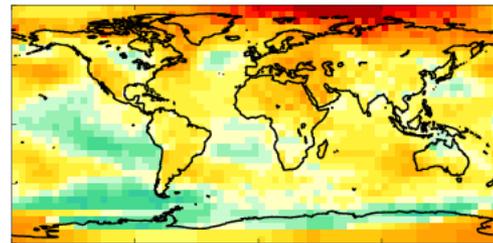
Observations 2017



1-5 year average: prediction and verification

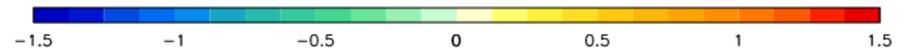
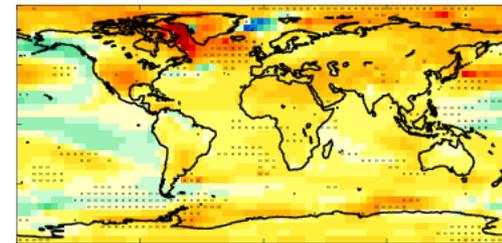
Observed

(A) Observations
September 2010 – August 2015



MOHC predicted

(B) Five year mean forecast
from September 2010



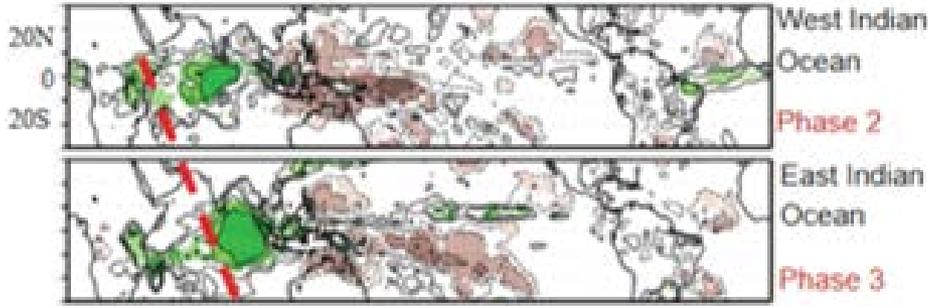
Sep 2010- Aug 2015

- Precipitation and pmsl also
- Other good potential from predictability of Atlantic Multi-decadal variability (AMV)
- Europe: winter temperature and summer rainfall
- Atlantic hurricane frequency
- Sahel rainfall
- drought risk in southwest USA

Sub-seasonal: early warning for onset, dry spells, heavy rain

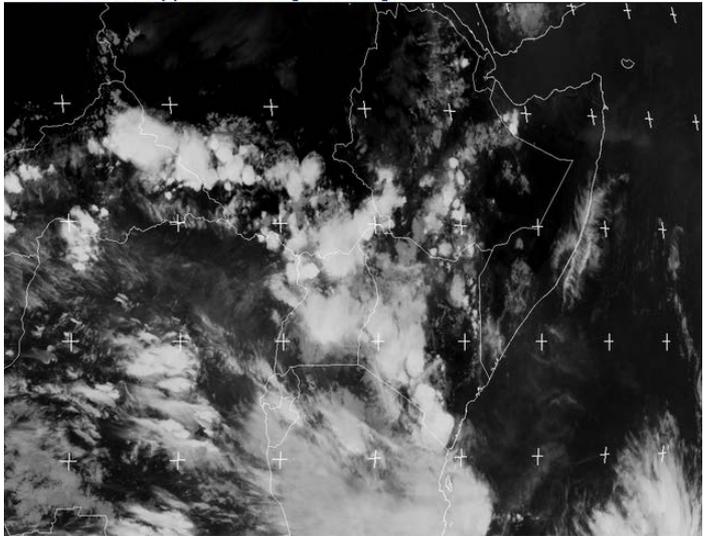
Example East Africa

MJO in East-West Indian Ocean favours wet East Africa (green)

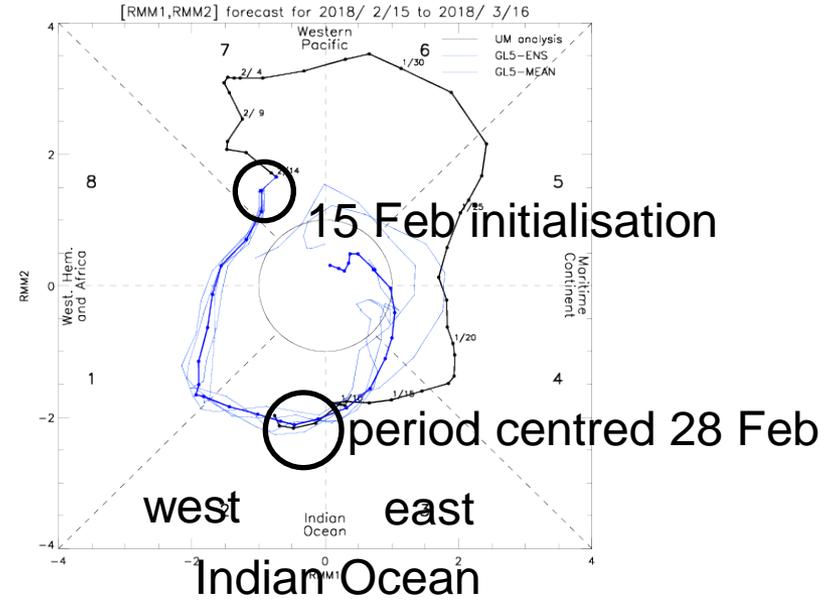


1 March 2018

Zoom: SHIFT key pressed and Drag on the image



GloSea5 Initialised 15 February 2018



2 March, Nairobi floods





Met Office
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LC-LRFMME real-time sub-seasonal pilot multi-model with 8 GPCs:

tercile rainfall predictions for: 26 Feb – 4 March

12 Feb (week3)

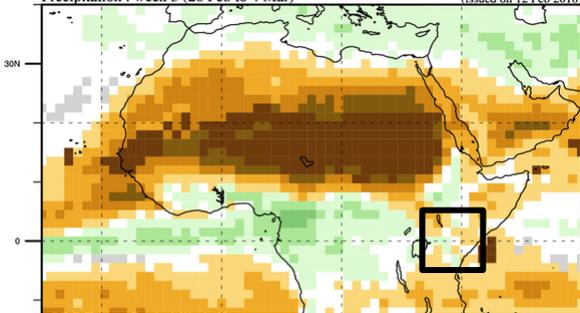
19 Feb

26 Feb

Probabilistic Multi-Model Ensemble Forecast
/ ECMWF / Washington / Tokyo / Exeter / Seoul / Melbourne / Beijing / Montreal

Precipitation : week 3 (26 Feb to 4 Mar)

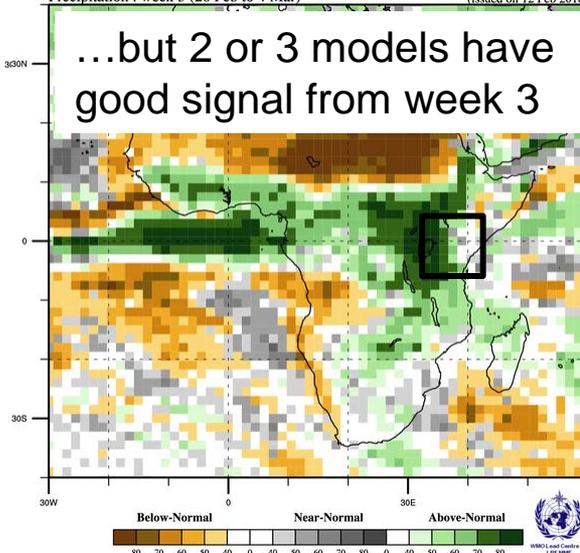
(issued on 12 Feb 2018)



GPC Exeter Probabilistic Forecast

Precipitation : week 3 (26 Feb to 4 Mar)

(issued on 12 Feb 2018)

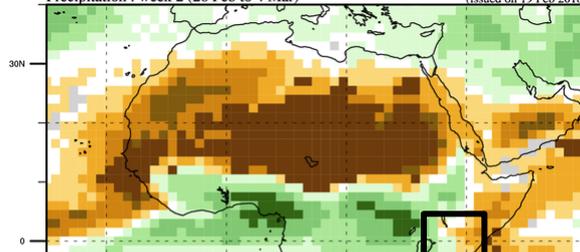


...but 2 or 3 models have good signal from week 3

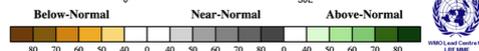
Probabilistic Multi-Model Ensemble Forecast
/ ECMWF / Washington / Tokyo / Exeter / Seoul / Melbourne / Beijing / Montreal

Precipitation : week 2 (26 Feb to 4 Mar)

(issued on 19 Feb 2018)



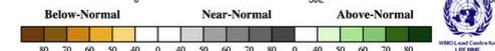
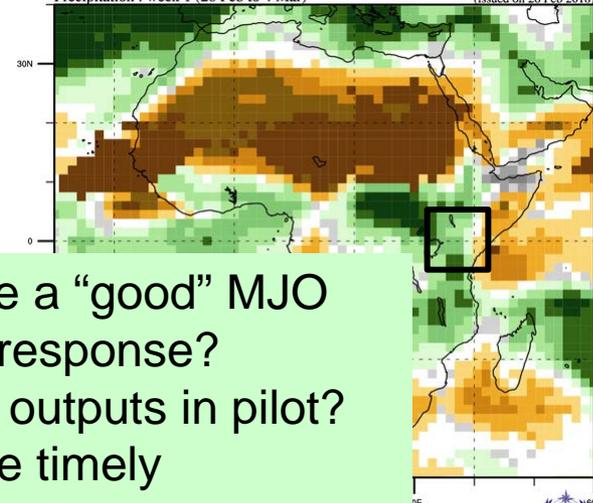
- Which GPC models have a “good” MJO and realistic East Africa response?
- Include individual model outputs in pilot?
- S2S real-time pilot will be timely



Probabilistic Multi-Model Ensemble Forecast
/ ECMWF / Washington / Tokyo / Exeter / Seoul / Melbourne / Beijing / Montreal

Precipitation : week 1 (26 Feb to 4 Mar)

(issued on 26 Feb 2018)

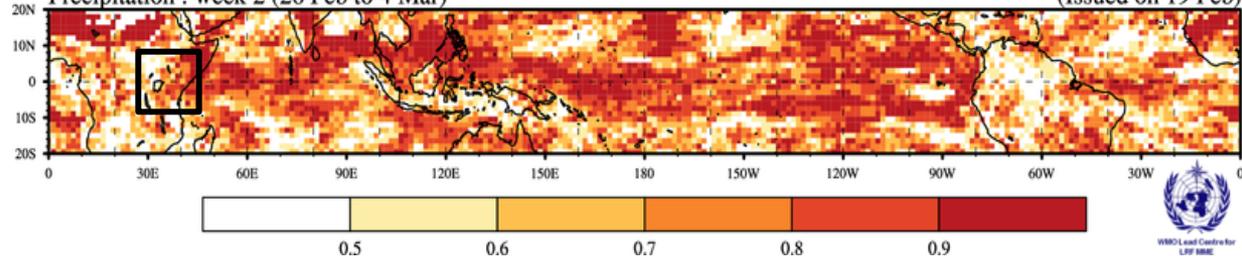


MME verification at week 2 – promising skill

PMME Relative Operating Characteristics Map(Above Normal)
ECMWF, Washington, Exeter, Melbourne, Beijing

Precipitation : week 2 (26 Feb to 4 Mar)

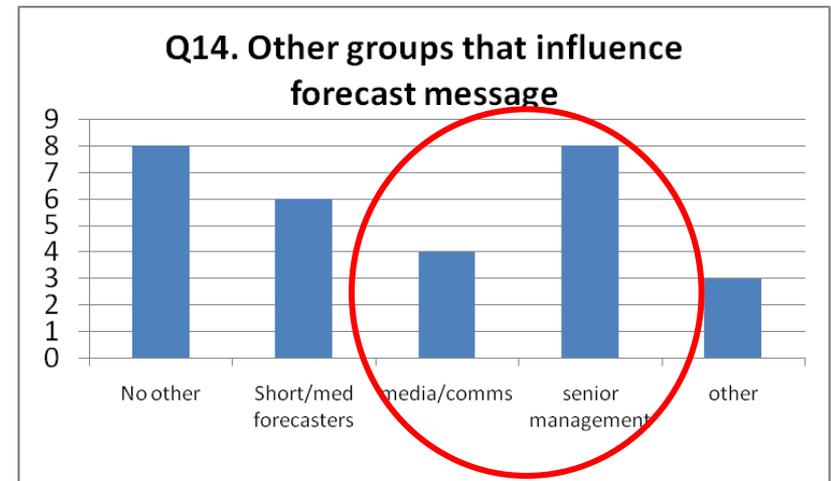
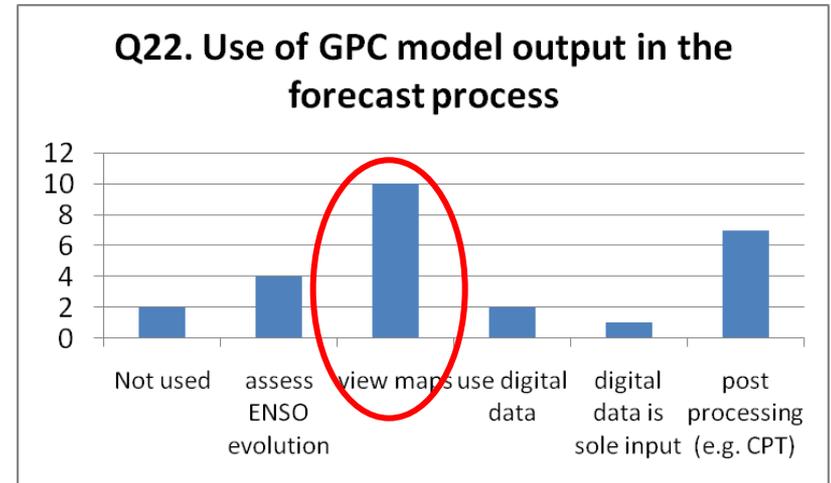
(Issued on 19 Feb)



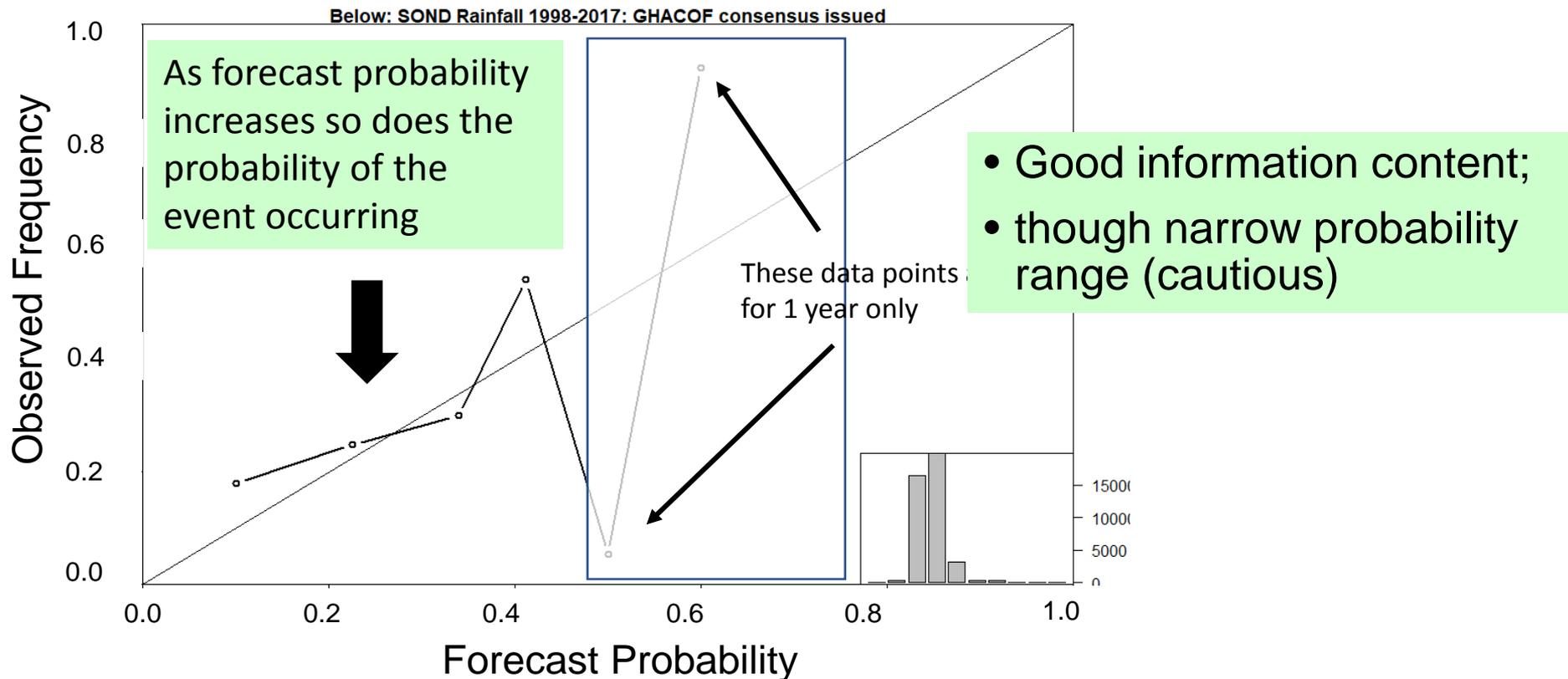
Moving to more objective use of GPC outputs

- (subjective) viewing of maps remains main method of GPC use
- Non-meteorological influences on probabilities
- Both the above can hinder forecast objectivity

Survey for OCP-1



Reliability: GHACOF consensus forecasts OND 1998-2017: below normal tercile category



- With appreciation to ICPAC for sharing
- Similar results to Mason and Chidzambwa (2009)

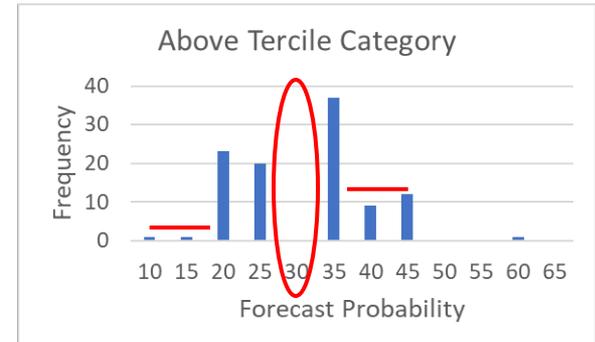
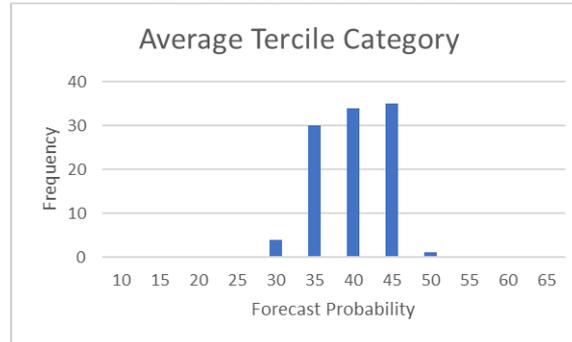
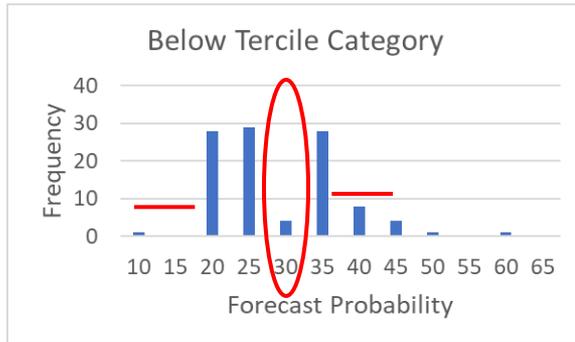


Analysis of GHACOF consensus probabilities, Oct-Dec season

with appreciation to ICPAC for sharing results – output monitoring, step towards enhanced objectivity



Frequency of use of probabilities all GHA forecast zones, all years
= 129 forecasts



- Forecast show good reliability over 20-40% range (not shown here), however...
- ...also signs of subjectivity
 - 30% seldom used – artificial “dip” (because of 30/40/30 – user confusion)
 - Above/Below: Few issued probabilities less than 20% or greater than 35%
 - Average category: much greater use of probabilities of: 40%, 45%
 - Objective use of GPCs can assist with “bolder” reliable forecasts



Summary and further comments

- A wealth of information for sub-seasonal to longer timescales is well established (seasonal), coming available (annual to decadal), or in pipeline (subseasonal)
- Many examples of benefit to operational climate prediction and early warning to WMO members
- Interpretation and use of outputs is not always straightforward (e.g. model biases) - sustained interaction between GPCs/RCCs/NMHSs is needed to assist use
- Need for greater objectivity when using in RCC/NMHSs operational outputs (RCOF review)
- Objective probabilities are important for Forecast-based Action/Financing – (Red Cross Climate Centre framework for using probability forecasts in decision-making)



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Thank you! Any questions?