RCOF Review: Towards Objective Seasonal Forecasting

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Global RCOF Review 2017

- To commemorate the important milestone in RCOF evolution completing two decades of successful implementation WMO has taken up a comprehensive review of the RCOF process – **Global RCOF Review 2017.**
- For this purpose, WMO organized an **International Workshop on Global Review of RCOFs** from 5 to 7 September, 2017 in Guayaquil, Ecuador, hosted by the International Research Center on El Niño (CIIFEN).
- The 2017 RCOF Review was the third in the series of periodic review events, the earlier two having been conducted in 2000 in Pretoria (South Africa), and in 2008 in Arusha (Tanzania)

RCOF Review 2017: SWOT Analysis (1/2)

Strengths

- Capacity development and relationship building among NMHSs.
- Interaction/collaboration.
- Coordinated RCC/NMHS linkages.
- Access to GPC-LRF data, products and tools.
- Sustained building of a community of learning.
- Communication and awareness building.
- Harmonizing products across region.
- Consolidating information from multiple sources through expert consensus approaches.

Weaknesses

- High staff turn over and sub-optimal retention of capacities.
- Low level of awareness of probabilistic outlooks.
- Lack of good quality data, sharing constraints.
- High subjectivity in consensus practices.
- Low user engagement and national follow-up.
- Lack of standardized approaches to downscaling, calibration and Verification.
- Lack of ability to demonstrate value of forecasts.

Adapted from: Andrew Tait

RCOF Review 2017: SWOT Analysis (2/2)

Opportunities

- Sector-specific tailored products/co-production approaches.
- Foster linkages with research and adaptation communities.
- Regional approaches to GFCS implementation/funding access.
- Improvements in forecast skills/usefulness.
- Sub-seasonal/annual forecasts on the horizon.
- Regional product standardization
- More frequent RCOFs through electronic communication.
- User engagement through NCOFs

Threats

- Sustainable funding
- Low/varied technical capacities of NMHSs (infrastructural/human resources).
- Visibility (public as well as policy makers).
- Inadequate observational networks/databases.
- Perceived low importance of seasonal forecasts.

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Workshop Conclusions

- Participants unanimously recognized the progress achieved, particularly on the contributions of RCOFs in promoting wider use and better interpretation of seasonal forecasts at the national levels
- Agreed on the way forward towards the new generation of RCOFs, including:
  - Mainstreaming of objective seasonal climate forecasting underpinning RCOF products ,
  - New approaches including expanded product portfolio, based on standardized operational practices,
  - Follow-up integration of seasonal outlooks in decision-making process at country level
  - Improved Partnership and User Engagement in RCOF process
  - Organization of "centralized" training workshops to better target capacity development efforts required for RCOF operations

Workshop Recommendations (1/2)

- Promote greater access and utilization of WMO LC -LRFMME data to enable RCCs to produce objective forecast for RCOF operations/RCCs to optimize skills for the region of interest
- RCCs to continue guiding/coordinating the RCOF process, including the responsibilities of RCCs to play a role in resource mobilization for RCOFs
- Build feedback mechanisms at RCOF sessions to propose improving RCC activities to better address RCOFs needs
- Expand RCOF product portfolio to include:
  - Climate Monitoring
  - Verification
  - Remote climate anomalies
  - Sub seasonal products
  - Introduce Climate Change component, in terms of observed trends, attribution of extreme events in climate change context, etc.
  - Replace the pre-COF training sessions with "centralized" training workshops that address specific competencies across regions
- Promote stronger linkages of RCCs, RCOFs with research community

Workshop Recommendations (2/2)

- Establish/Implement regular NCOFs (and other similar mechanisms) at national levels, and where required at sub-national levels with the primary aim of sharing seasonal products and their updates on a regular basis to support sector-driven climate risk management
- National Frameworks for Climate Services (NFCS) linked to high-level cross-cutting objectives, will provide mechanisms for sustainability to the national climate forums
- Ensure joint provider-user ownership of RCOF process, demonstrating the value of forecast and advocating with the governments the usability/value of the RCOF/NCOF products

http://www.wmo.int/pages/prog/wcp/wcasp/meetings/workshop_rcofs.php

Objective climate forecasting: draft discussion paper

- Seasonal forecast (outlook) is the flagship activity of RCOFs; a key mandatory function of RCCs
- Increasing focus on development of objective regional seasonal forecasts
- http://www.wmo.int/pages/prog/wcp/wcasp/linkedfiles/Draft-Discussion-Paper-Objective-Regional-Seasonal-Forecasts.docx
- Living document, to be generalized to cover all regions (Reviewed by CCl, CBS, WWRP and WCRP experts) – suggestions for improvement welcome
- Considered by WMO Executive Council at its 69th session in May 2017
- RCOF Review 2017 agreed to take it forward: RCOF v2.0

EC-69 Decision 4.5/2 (May 2017)
SUB-SEASONAL AND SEASONAL FORECASTING SYSTEMS

Recognizing:

1. That current use of dynamical forecasts in the process of developing seasonal climate outlooks at RCOFs is **mainly subjective** and depends on confirming or challenging the statistical results, and the blending of individual national forecasts into a spatially coherent regional outlook on the basis of expert assessment,
2. The limitations of subjective consensus-based approaches for the **usability of forecasts**, particularly at the national level, as well as the challenges they pose for evaluation of forecast skill,
3. That, at the same time, the **expert assessment** taking into account many aspects, such as current climate conditions, past statistical relationships as well as the characteristics and limitations of the models used, are also still required to formulate sub-seasonal to seasonal forecasts with better forecast skill,
4. That the longstanding RCOF process involves seasonal outlook preparation through consensus building of expert assessment, and that it is **not merely a mechanical blending** of the various forecast inputs,
5. The **rapid advances in dynamical modelling** for sub-seasonal and seasonal forecasting, operational availability of such forecasts with greater space-time resolutions, and the need to **optimize their use** in the operationalization of regional forecasting systems,
6. That further progress on operational seasonal forecasting, and the routine development of associated **tailored products for decision support**, will entail more widespread adoption of objective seasonal forecasting schemes that readily facilitate the tailoring of forecast products to support specific end uses,

Decides to consider the adoption of **objective sub-seasonal and seasonal forecasts** as an overarching technical strategy, particularly at regional and national levels, promoted through RCOFs, by adopting suitable operational practices and capacity development efforts, **to be facilitated by a global RCOF review;**

Inputs

- Dynamical forecasts from GCM systems
  - Tier 1, Coupled Atmosphere-Ocean GCM
  - Tier 2, Atmosphere GCM driven by SST (predicted/persisted)
  - Ensemble, MME, probabilistic
- Statistical forecasts
  - Usually driven by SST
  - Probabilistic
- Conditional climatology
  - State of ENSO, knowledge of impacts
- Observed state
- Climatology

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After Jim Renwick

Methods

- Wholly objective
  - (Skill-weighted) average or ensemble of model output
  - Possibly bias-corrected, calibrated
  - No “interpretation”
- Mostly objective
  - Use the above as a first guess, adjust by expert judgement
  - Hedging, allowing for “modest skill”
- Mostly subjective
  - Model output weighted or averaged through consensus discussion
- Wholly subjective
  - Knowledge of ENSO and other drivers, expert assessment of local effects

After Jim Renwick

Pre-COF consensus

Consolidate forecast information from:

- Multiple sources available
- Multiple methods used
- Different level of expertise

Major inconsistencies are resolved by:

- Democratic forecast combination rather than simple averaging.
- Consideration of model viability as opposed to skill (sometimes some of the predictors have weak theoretical basis).
- The large-scale structure of the forecast.
- Redefinition of regions, perhaps with examination of predictions for individual stations.
- Further analyses.

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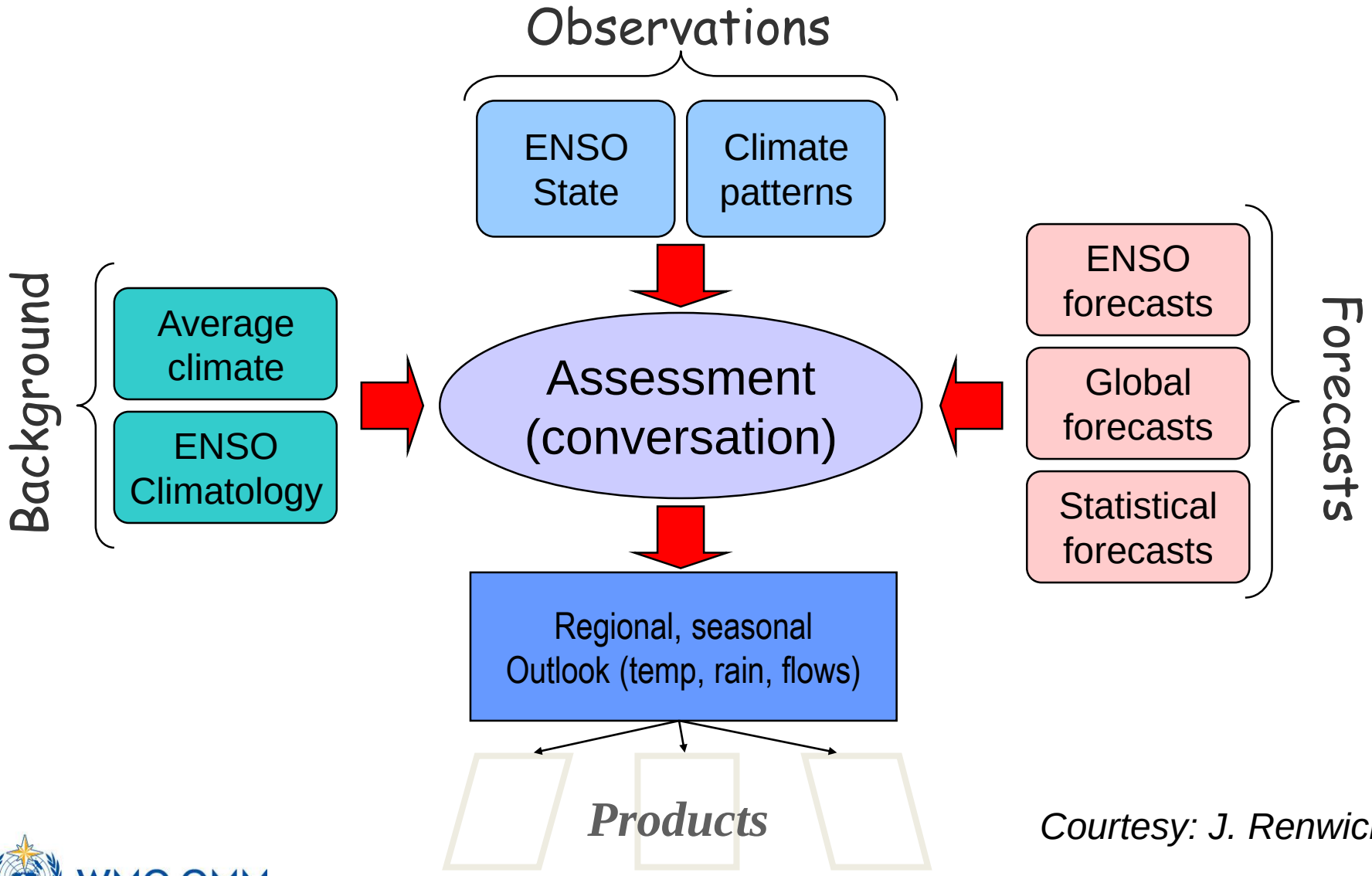
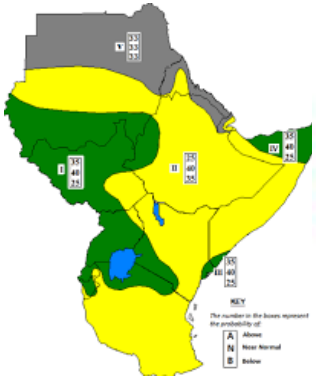
After Simon Mason

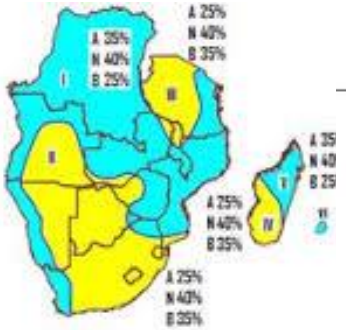
Consensus Process in RCOFs: Mostly Subjective

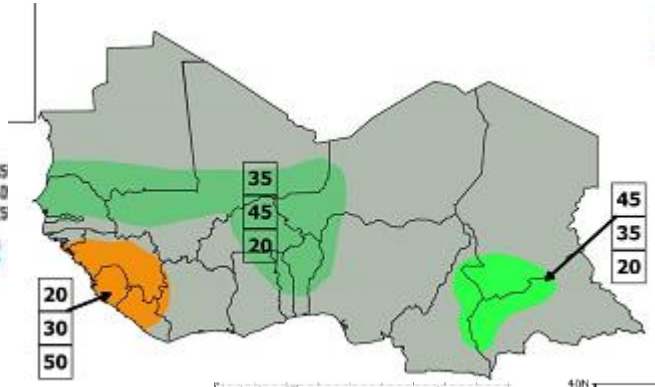


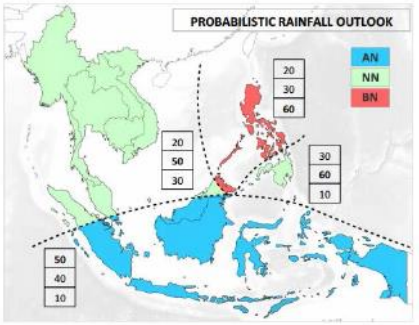
Courtesy: J. Renwick

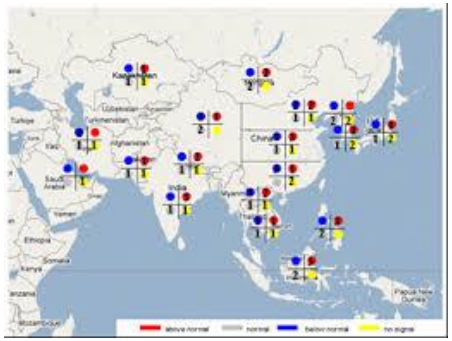
Some RCOF products worldwide

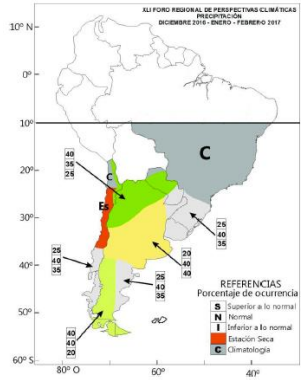


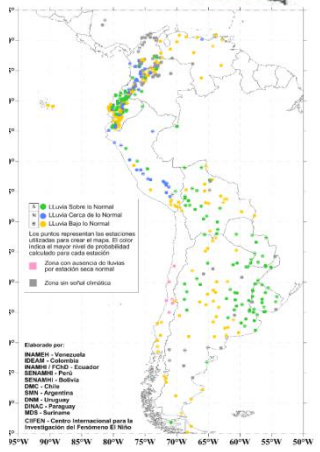


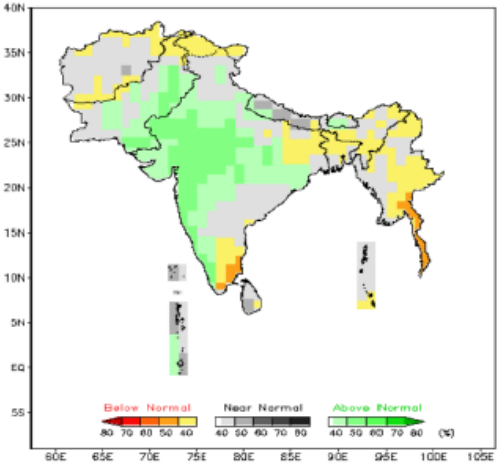


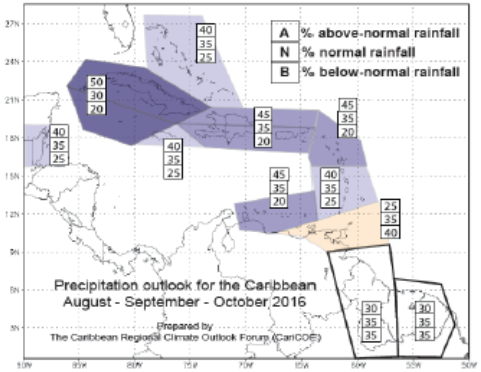


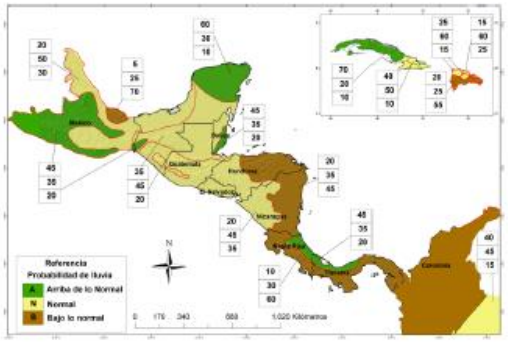












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Key Limitations of RCOF outlooks

- Format unsuitable for applications in specific decision making
- Forecast skills not routinely evaluated/communicated
- Lack of opportunities to implement new measures reflecting progress in science
- No systematic approach to provide regular updates as the target season evolves
- Very limited use of RCOF products or value addition at the national level
- Lack of user-tailored or targeted product packages/practical constraints to engage users at the regional level
  - Space-time resolution inadequate for most user level decision support

Promoting Objective Approaches for Operational Regional Seasonal Forecasting

- CBS/CCl Technical Guidance on Operational Predictions from Sub-seasonal to Longer-time Scales (OPSLS), in collaboration with WWRP and WCRP – A high-priority need
- OCP Workshop series to be key drivers of good practices
- Global RCOF Review 2017 showed the intent to change
- GPC-LRF/RCC engagement – Digital data access
- Move from consensus regional outlook preparation to consensus objective approach for regional prediction (e.g., reference periods, variables, model identification/MME, calibration tools, presentation formats, verification, etc.); rule-based consensus – replicable, traceable, verifiable
- Piloting of development and institutionalization of objective seasonal forecasting schemes in selected regions

Three Dimensions for Pilots (1/3)

Identification of skillful seasonal forecast methodologies for specific regions. For example,

- Identify the global model which demonstrates the highest skill for a given regional domain
- Identification of a Multi-Model Ensemble (MME) of global models that gives the best skill for a given regional domain
- Maximize the exploitation of the available predictability in the system
- Design innovative products to extract/characterize decision-relevant features

Three Dimensions for Pilots (2/3)

Identifying and accessing the necessary resources for developing and operationalizing such methodologies

- WMO is making concerted efforts to attract extra-budgetary resources
- Opportunities already opening up with an explicit focus on sub-seasonal and seasonal forecasting (e.g., CREWS regional/national projects, ACP, ACREI, Adaptation Fund, etc.)

Three Dimensions for Pilots (3/3)

Assembling and coordinating the cooperation among the institutions that would be involved in further developing and operationalizing skillful seasonal forecast systems

- GPC-LRF and RCC inputs; engagement of other institutions (e.g., IRI, APCC, C3S,…)
- Targeting NMHS implementation (two-way interaction)
- Addressing research needs, particularly at regional/national levels
- Co-production with climate-sensitive user sectors

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Thank you

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