PEACE, PROSPERITY AND
REGIONAL INTEGRATION

GOOD PRACTICES FOR DEVELOPING OBJECTIVE SEASONAL OUTLOOKS

Based on WMO summary document

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INTRODUCTION

- A Guidance on Operational Practices for Seasonal Forecasting: Provides an overarching technical guidance and recommendations to support operational climate forecasts at regional & national levels for operational centers to gradually adopt objective approaches
- The implementation is an iterative process and not globally uniform as it depends on availability of resources, expertise, requirements
- Recommendations for good practices are divided into two streams:

  (i) Infrastructure: Data access, software, models

  (ii) Routine operation: Development and dissemination of seasonal outlooks

I. INFRASTRUCTURE REQUIREMENTS FOR SEASONAL OUTLOOKS

1. Acquire observational databases. Observational data are utilized for:
    - Characterizing/quantifying regional climate variability
    - Monitoring the current state of climate
    - Validation of seasonal outlook
2. Catalogue and document drivers of climate variability
    - Climatological seasonal cycle (including frequency distribution of relevant variables)
    - Quantify what modes of climate variability influence the region (e.g., ENSO, IOD, MJO)
    - Document trends in regional climate (e.g., surface temperature, precipitation)
    - Identify phenomenon critical in the context of decision making (e.g., rainfall onset and withdrawal dates) and establish their climatology

I. INFRASTRUCTURE REQUIREMENTS FOR SEASONAL OUTLOOKS (CONTD.)

3. Establish adequate framework in support of seasonal outlook capability

- Software tools
  - Seasonal outlook validation
  - Computation of Probability of Exceedance
  - Bias correction and calibration
  - Statistical analysis
  - Statistical downscaling
  - Tailoring of climate outlooks
  - Outlook presentation (e.g., graphics)
- A documentation of methods used for seasonal outlooks
- Capacity to archive seasonal outlook
- Feedback mechanisms of seasonal outlook and engagement with users including coproduction of tailored products
- Public availability of real-time performance of past seasonal outlook
- Public availability seasonal outlook schedule

I. INFRASTRUCTURE REQUIREMENTS FOR SEASONAL OUTLOOKS (CONTD.)

4. Identify what large-scale forecast information will be used at regional and national levels to develop seasonal outlook

- Identify Sources for global forecast information
- If necessary, select models from the available global scale forecast. Selection criteria may depend on:
  - Release date at regional level and timely accessibility of global forecast information
  - Simulation characteristics of modes of regional climate variability and teleconnections in models
  - Skill assessment based on hindcast
- Once sources of global forecast information has been identified, quantify skill of forecasting tools (models) based on available hindcast

II. ROUTINE SEASONAL OUTLOOK DEVELOPMENT AND DISSEMINATION

- Elements of seasonal outlook process
  - Prepare bias corrected real-time forecast information
  - Statistical downscaling for local scale forecast
  - Forecast specific variables relevant for priority end-use applications
- Release of seasonal outlook
  - Set the context for the outlook
  - Well-balanced determination of the lead time
  - Outlook should be cast in terms of probabilistic guidance
  - Include performance of recent outlooks
  - Include a non-technical text summary of the outlook for decision making
  - Include (standard text on) guidance on managing expectation

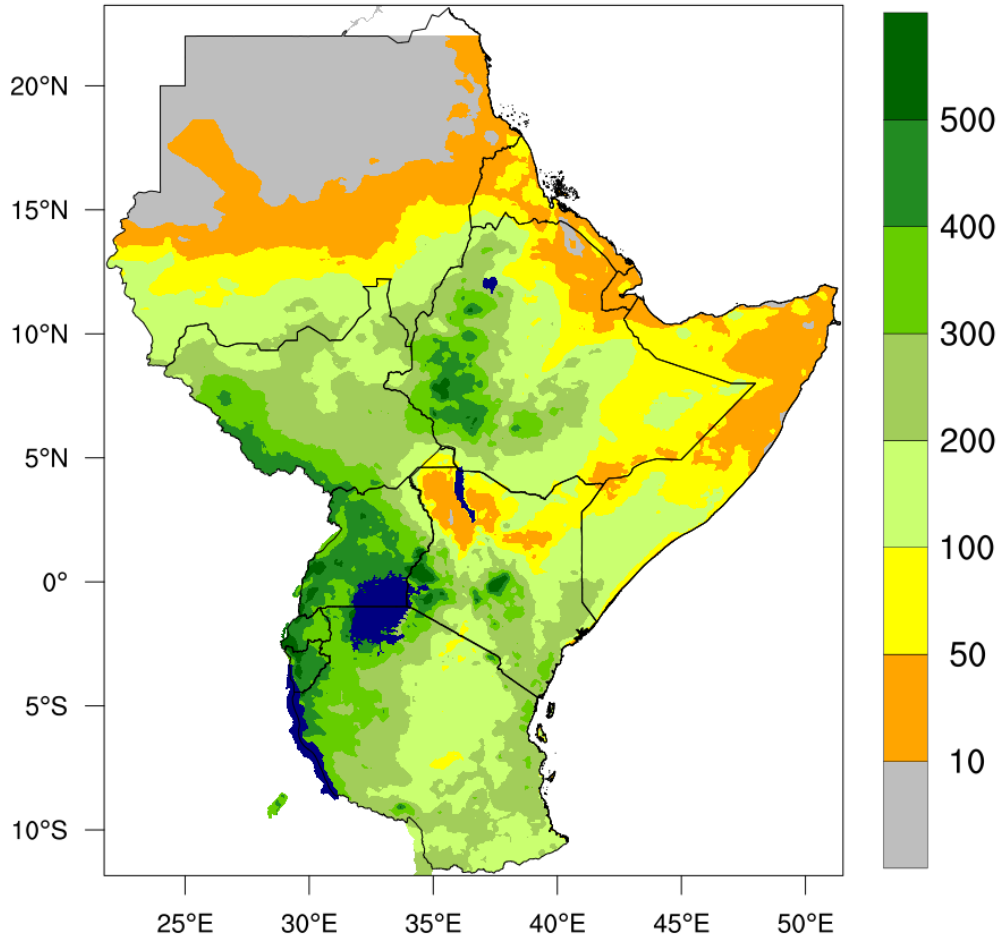
OBJECTIVE SEASONAL FORECASTING AT ICPAC

- Statistical downscaling is based on 10 (usually) GCM model outputs:
  - From IRI (by the 8th): NEMO, CM4i, GFDL-SPEAR, NASA-GEOS, COLA-CCSM4, NCEP-CFSv2
  - From C3S (by 13th): ECMWF, UK-Gloasea5, Meteo-Fr., DWD, CMCC
- ICPAC-CHIRPS are used for observation to develop statistical relationship.
- Two statistical approaches used -- CPT (accounting for large-scale ENSO) and grid-point linear regression (accounting for model dynamics and ENSO at grid scale)
- Equal-weighted averages used to develop consolidated objective forecasts

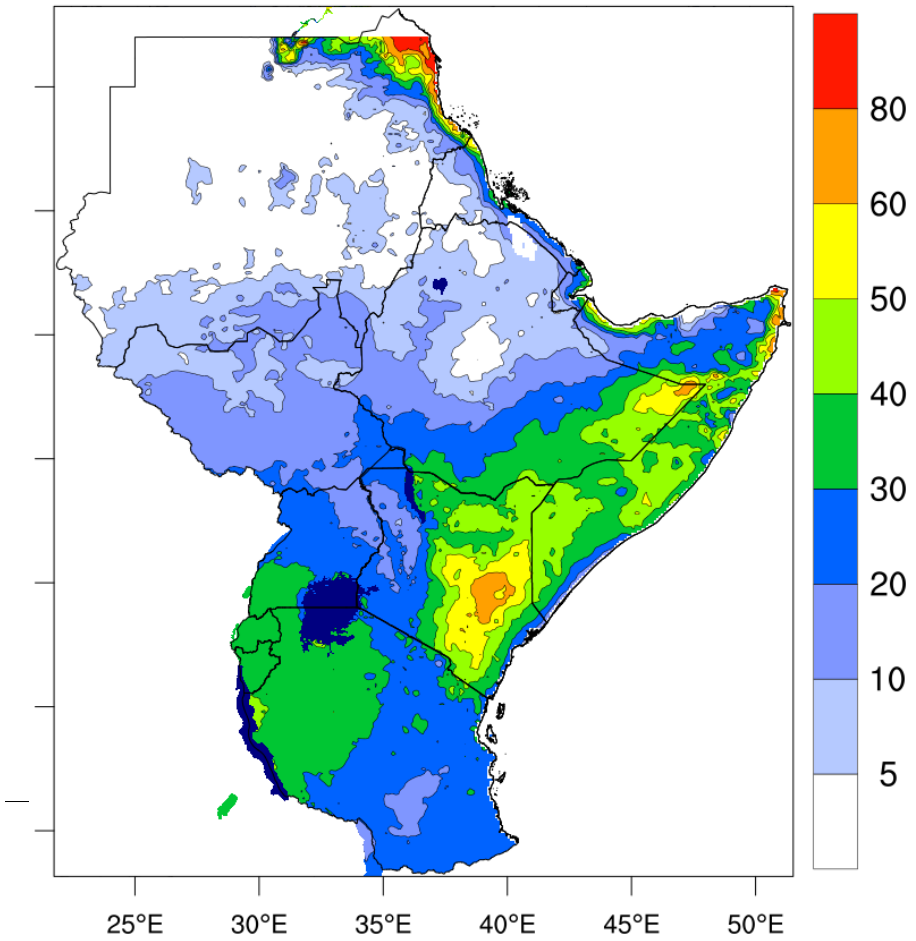
RAINFALL DISTRIBUTION DURING OCTOBER TO DECEMBER (OND) FOR 1981-2020

(CHARACTERIZING/QUANTIFYING REGIONAL CLIMATE VARIABILITY & SEASONAL CYCLE)

OND average rainfall (mm)



OND annual fraction (%)



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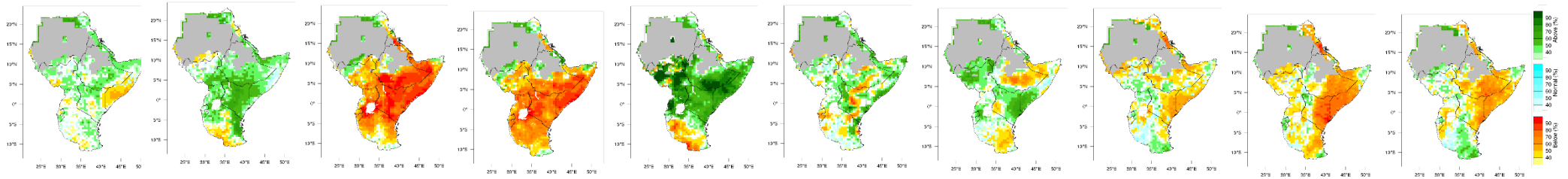
TERCILE CATEGORY RAINFALL PROBABILITIES

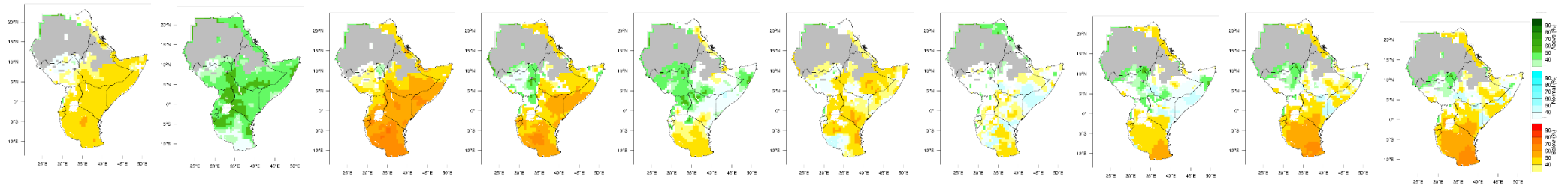
EnsRegr

CanCM4i CCSM4 GFDL-A GFDL-B GEOSS CFSV2 NEMO ECMWF UKMO MetFrance



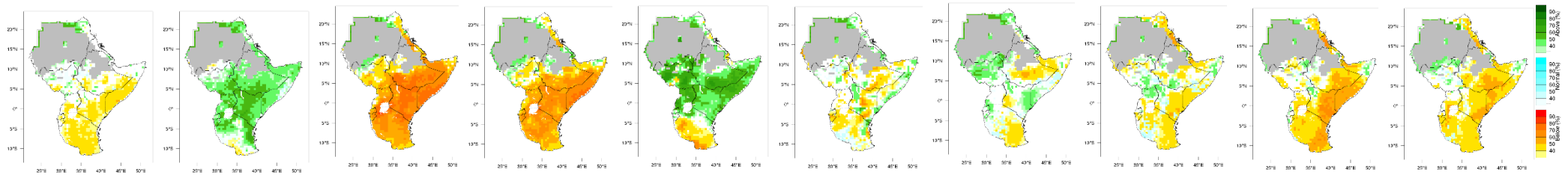
CPT

CanCM4i CCSM4 GFDL-A GFDL-B GEOSS CFSV2 NEMO ECMWF UKMO MetFrance



EnsRegr+CPT

CanCM4i CCSM4 GFDL-A GFDL-B GEOSS CFSV2 NEMO ECMWF UKMO MetFrance



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INPUTS FOR OCTOBER-DECEMBER (OND) 2021 OUTLOOK

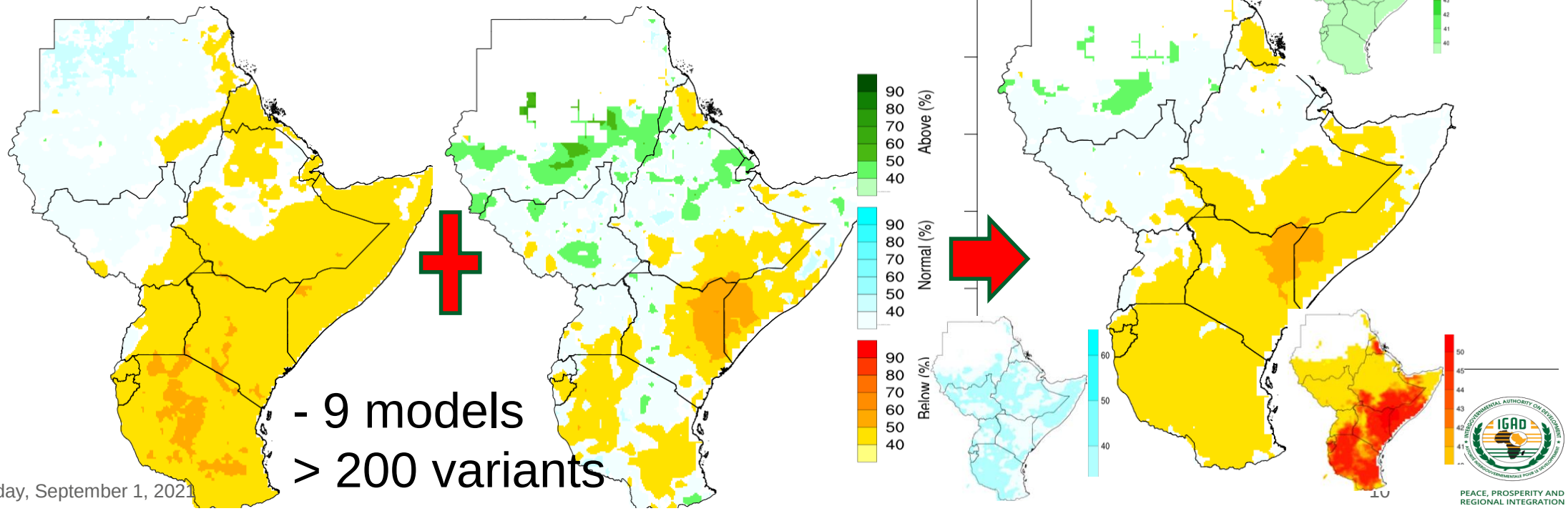
Forecast outputs from 9 Global Climate Centers were processed using two approaches to fit the climate of the GHA

Predictions indicate drier than average season over the southern and equatorial GHA

CPT
(global effects)

Regression
(Local climate)

Final: Multi-model Average



- 9 models
> 200 variants

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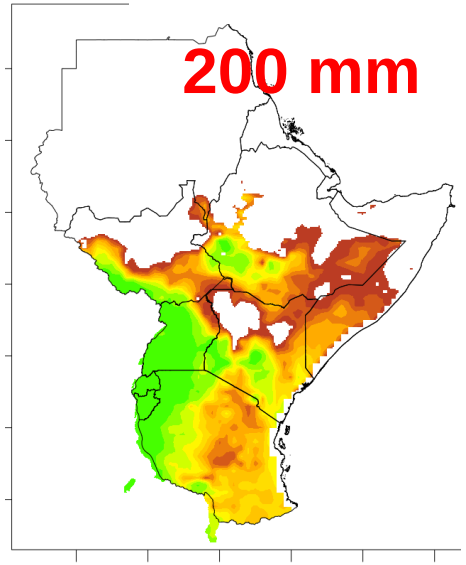
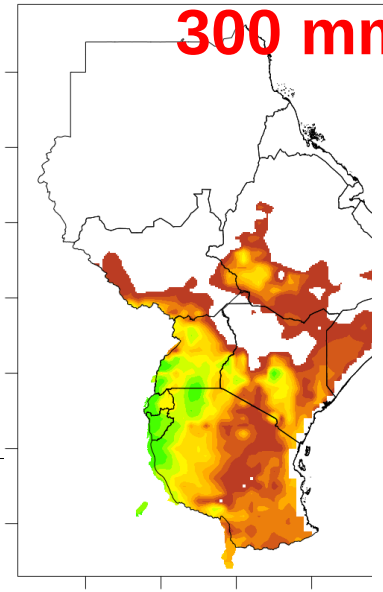
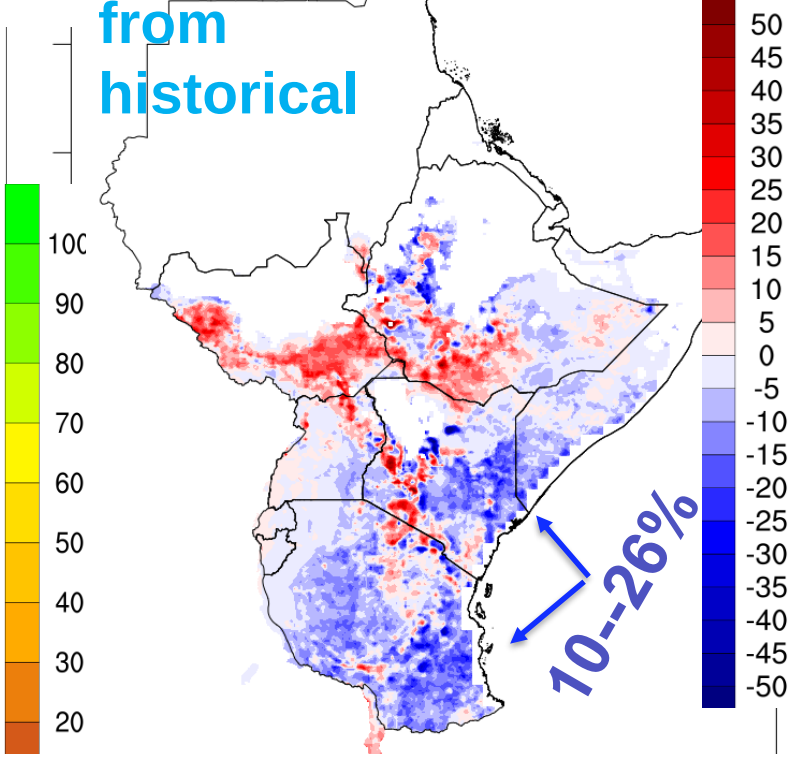
PROBABILITY OF EXCEEDANCE FOR OND RAINFALL

Predicted







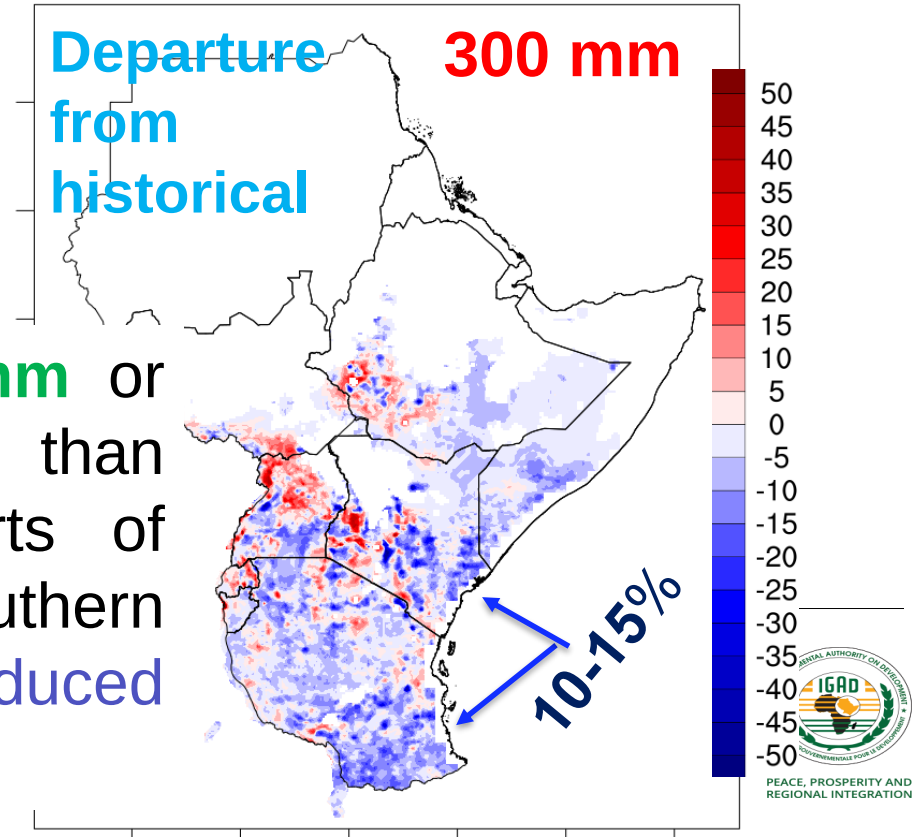
Departure from historical

200 mm

Predicted probability of exceeding 200 mm is lower than historical values over Kenya (by up to 23%) and Tanzania (by up to 26%); thus reduced chance of exceeding 200 mm OND rain

Departure from historical

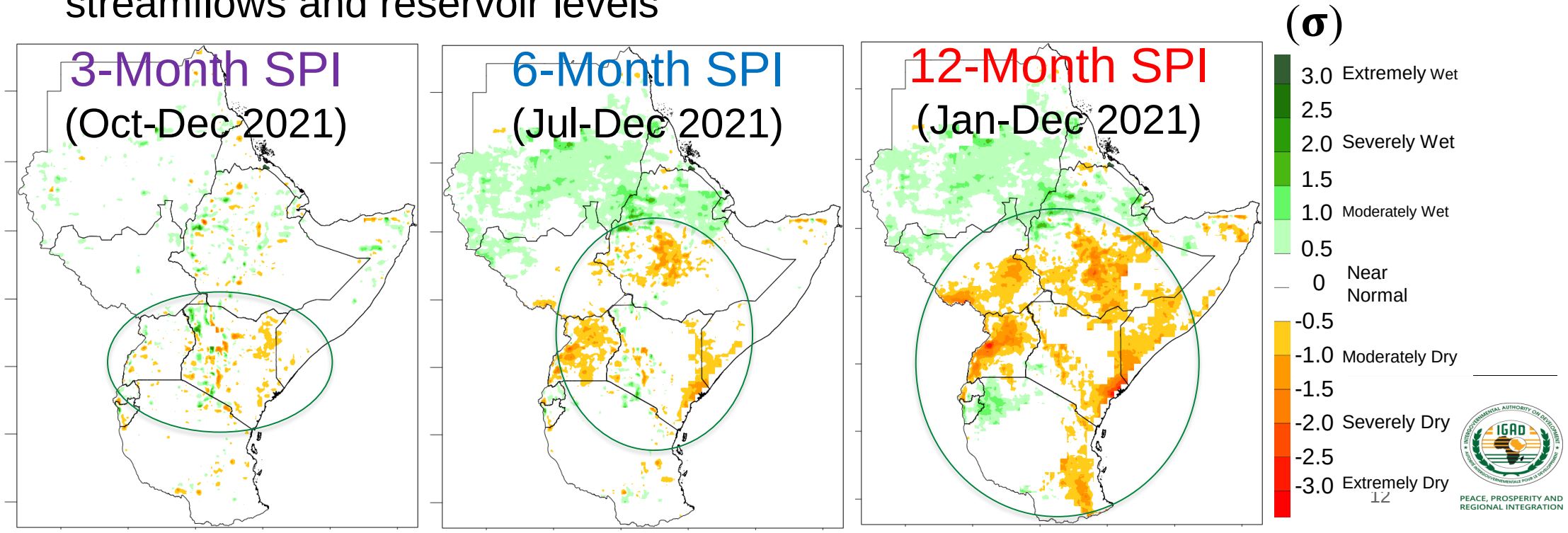
300 mm



The chance of getting **300 mm** or more during OND is lower than historical by 20-30% in parts of Kenya and 10-25% over southern Tanzania; Hence there is a reduced chance of exceeding 300 mm

STANDARDIZED PRECIPITATION INDEX (SPI) FORECAST ENDING ON 31 DECEMBER 2021

- SPI is precipitation-based drought index (WMO 2012). It measures departures from zero in standard deviation units
- 3-month SPI reflects short to medium-term moisture status or reservoir levels
- 6-month SPI indicates medium-term trends in rainfall (can be associated with anomalous streamflows)
- 12-month SPI is a cumulative trend of droughts/wetness & can be tied to streamflows and reservoir levels



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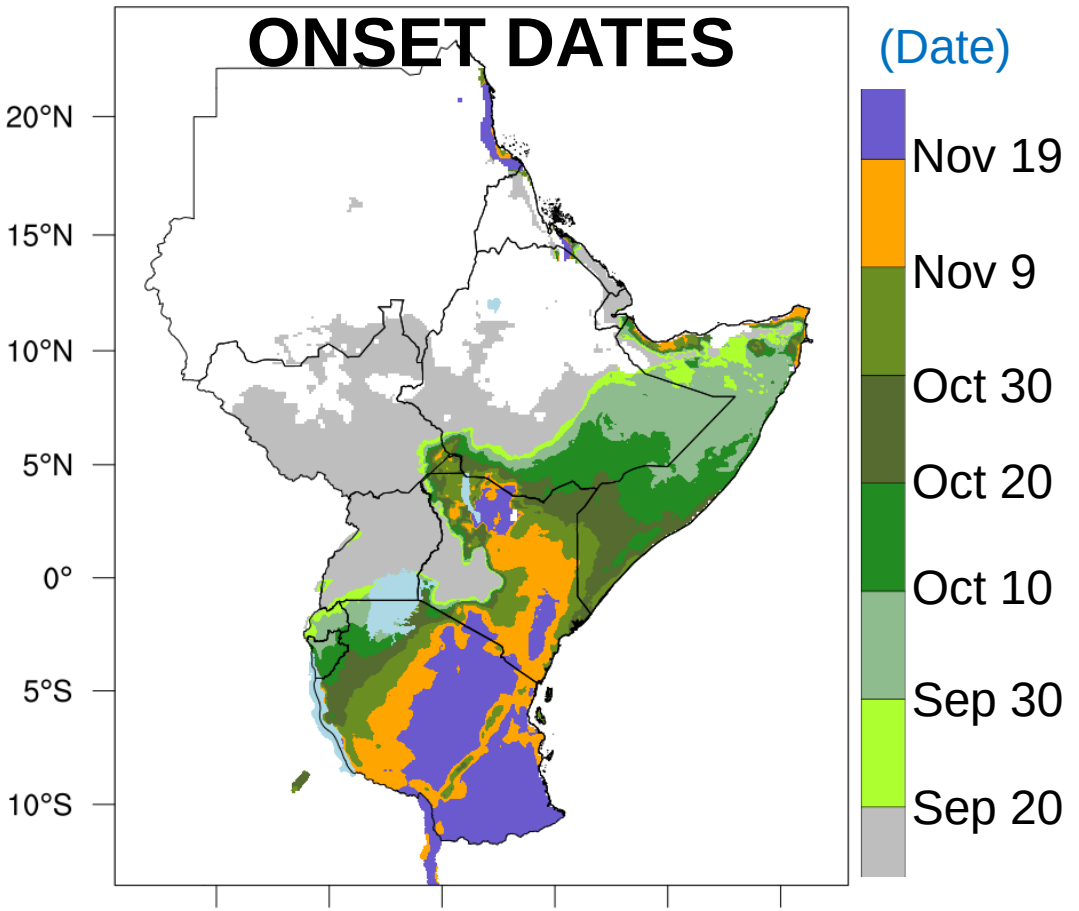
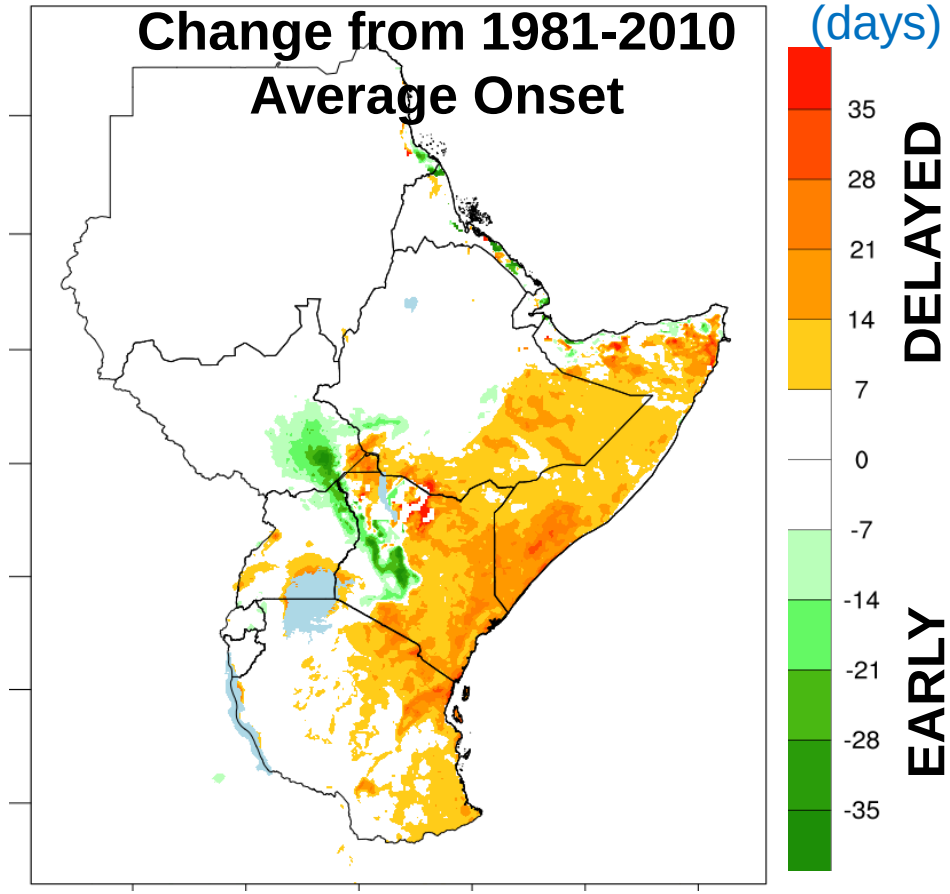
ONSET OF OCTOBER-DECEMBER (OND) 2021 SEASON



Average of 43 WRF ensemble members driven by the CFSv2 model



Delayed onset favored over eastern Kenya and southern Somalia

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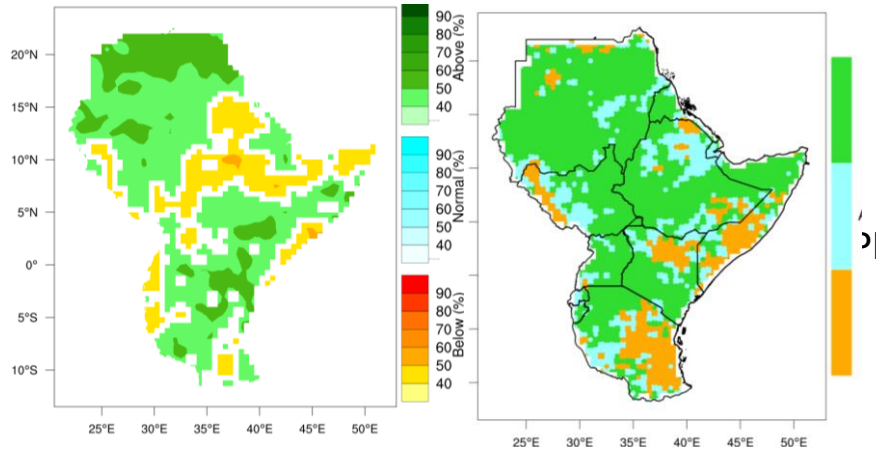
REAL-TIME VERIFICATION (JJAS 2019, 1 MONTH LEAD)

JJAS 2019



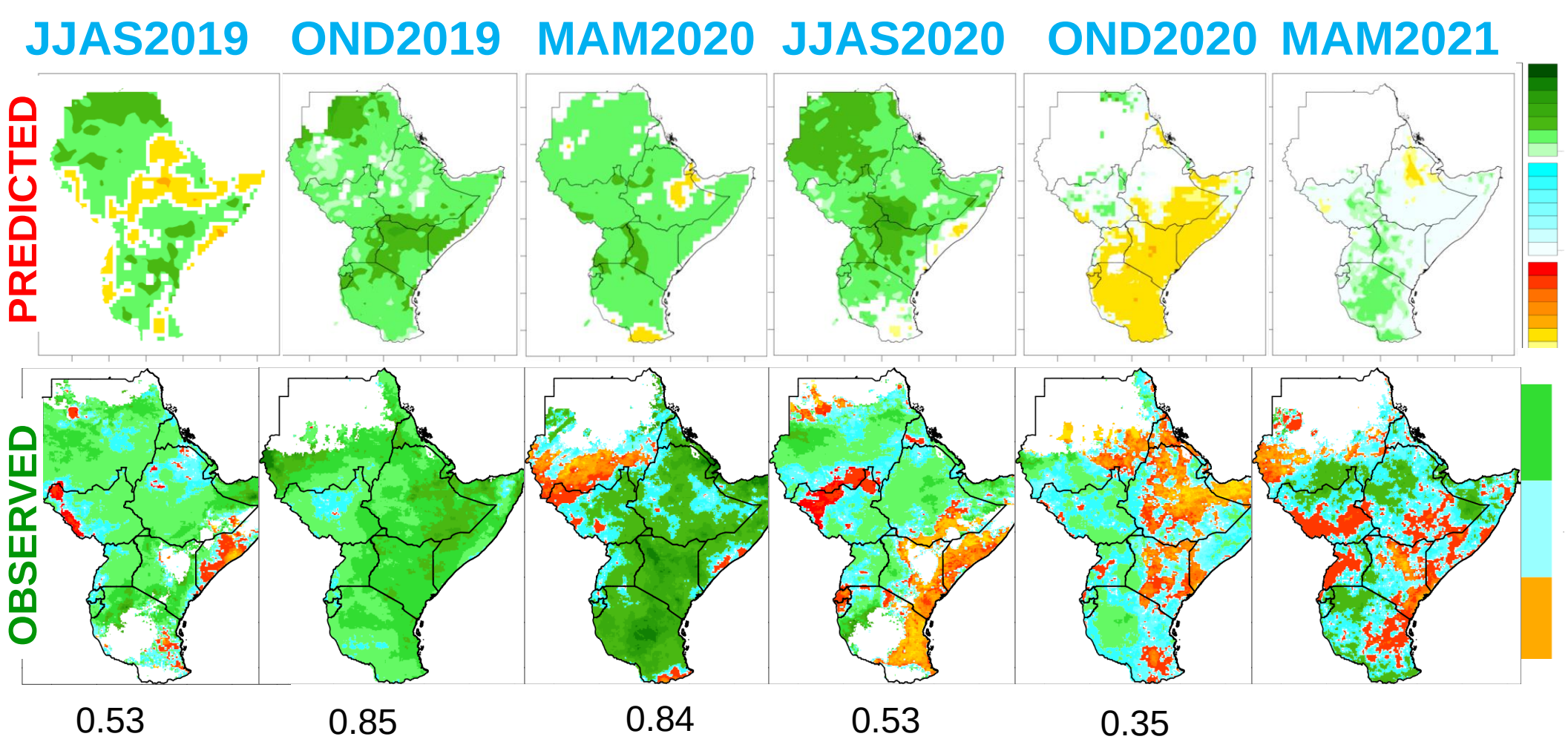
PRD	OBS B	OBS N	OBS A
B	105	108	335
N	0	6	4
A	180	332	969

Percent Correct = 0.53
Heidke Skill Score = 0.295
Pierce Skill Score = 0.295
Gerrity Score = 0.353

Threat Score 0.1442 0.01333 0.5324
Bias by cat. 1.923 0.02242 1.132
Percent correct by cat. 0.6945 0.7822 0.5826
Hit Rate (POD) by cat. 0.3684 0.01345 0.7408
False Alarm Rate by cat. 0.2526 0.002511 0.7004
False Alarm Ratio by cat. 0.8084 0.4 0.3457

Baseline is arbitrary: = 0.3333
Brier Score (BS) = 0.2624
Brier Score - Baseline = 0.3249
Skill Score = 0.1923
Reliability = 0.03417
Resolution = 0.09667
Uncertainty = 0.2222

PAST OBJECTIVE SEASONAL FORECASTS & OBSERVED SEASONAL RAINFALL



THANK YOU VERY MUCH!