Seasonal Hydrometeorological Forecasts for Water Management in Northeast Africa: Development, Operationalisation and Performance of a Regional Prediction System

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Upper Atbara Dam Complex, Sudan

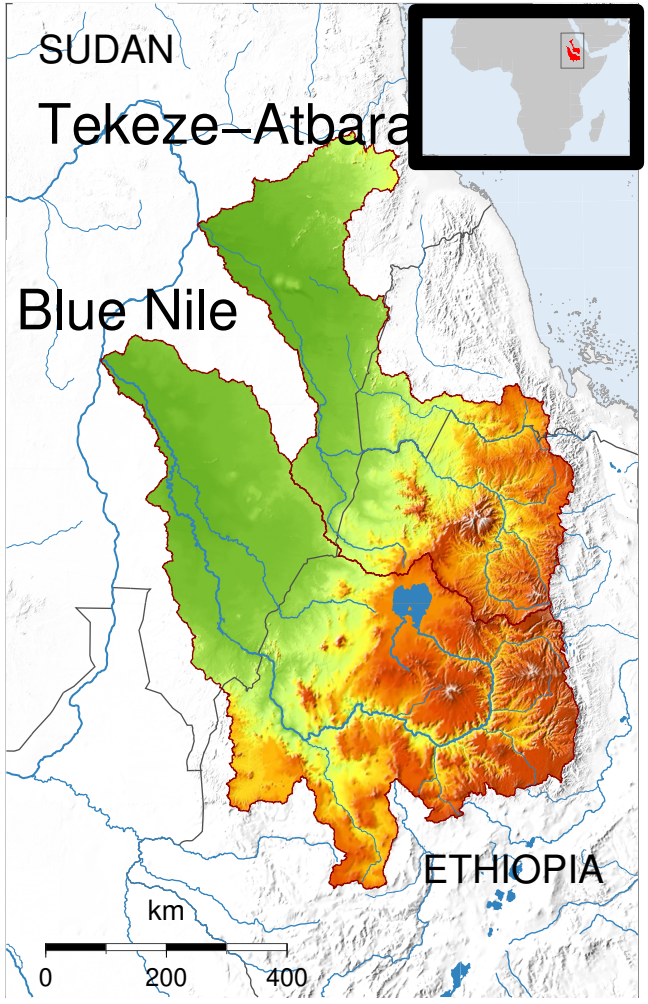
Water Management:
Challenge for Thousands of Years


Khartoum/Sudan


Confluence
White & Blue Nile

Knowledge of River Nile's seasonality crucial since ancient world

Blue Nile and Tekeze-Atbara Basins



- BN & TA provide more than 70% of Nile flow
- 80% arrives during rainy season June-October
- Sufficient storage facilities across the rivers to ensure water availability in dry season
- **Key challenge: how much water can be expected in coming flood season?**
- **Particular recent challenge: filling of *Grand Ethiopian Renaissance Dam (GERD)***

Methods

- SEAS5 global seasonal forecast by ECMWF (≈ 35km resolution)
  - 25 ensemble members for reforecasts 1981-2016
  - 51 ensemble members for forecasts since 2017
  - Leadtimes up to 7 months

- Bi-linear interpolation to ERA5-Land Grid (0.1°, ≈ 10km resolution)
- Bias-correction via modified *Empirical Quantile Mapping*
- Calculation of monthly means & performance indicators (CRPS)

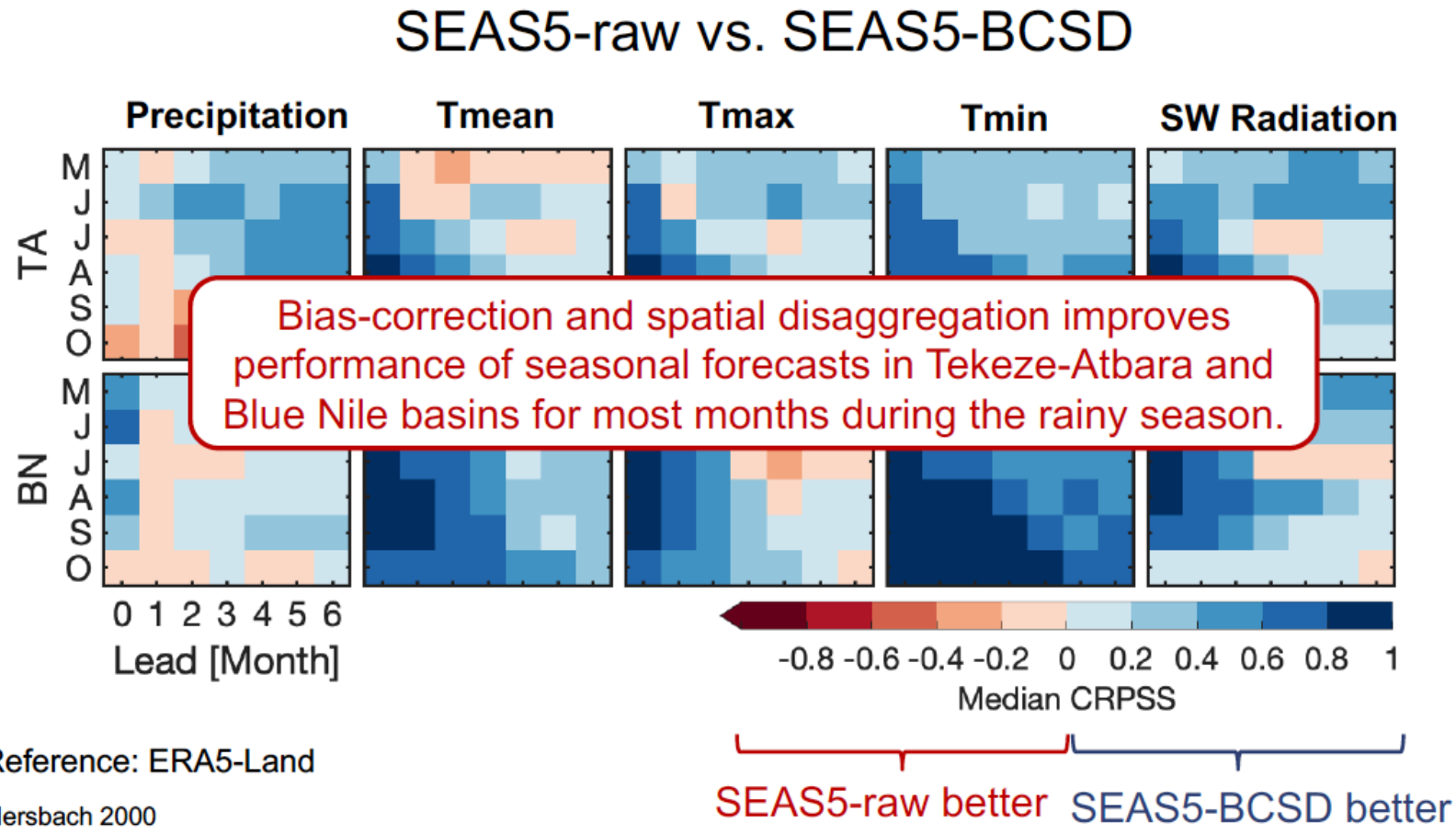
Recent Forecast April 2020

- Calculation of Quantiles (Q0.2, Q0.4, etc.) for delineation of categories
- Simple summation of number of ensemble members that fall within one category-> majority is plotted for each pixel

Continuous Ranked Probability Skill Score

CRPS measures the difference between the predicted and occured cumulative distributions[1].

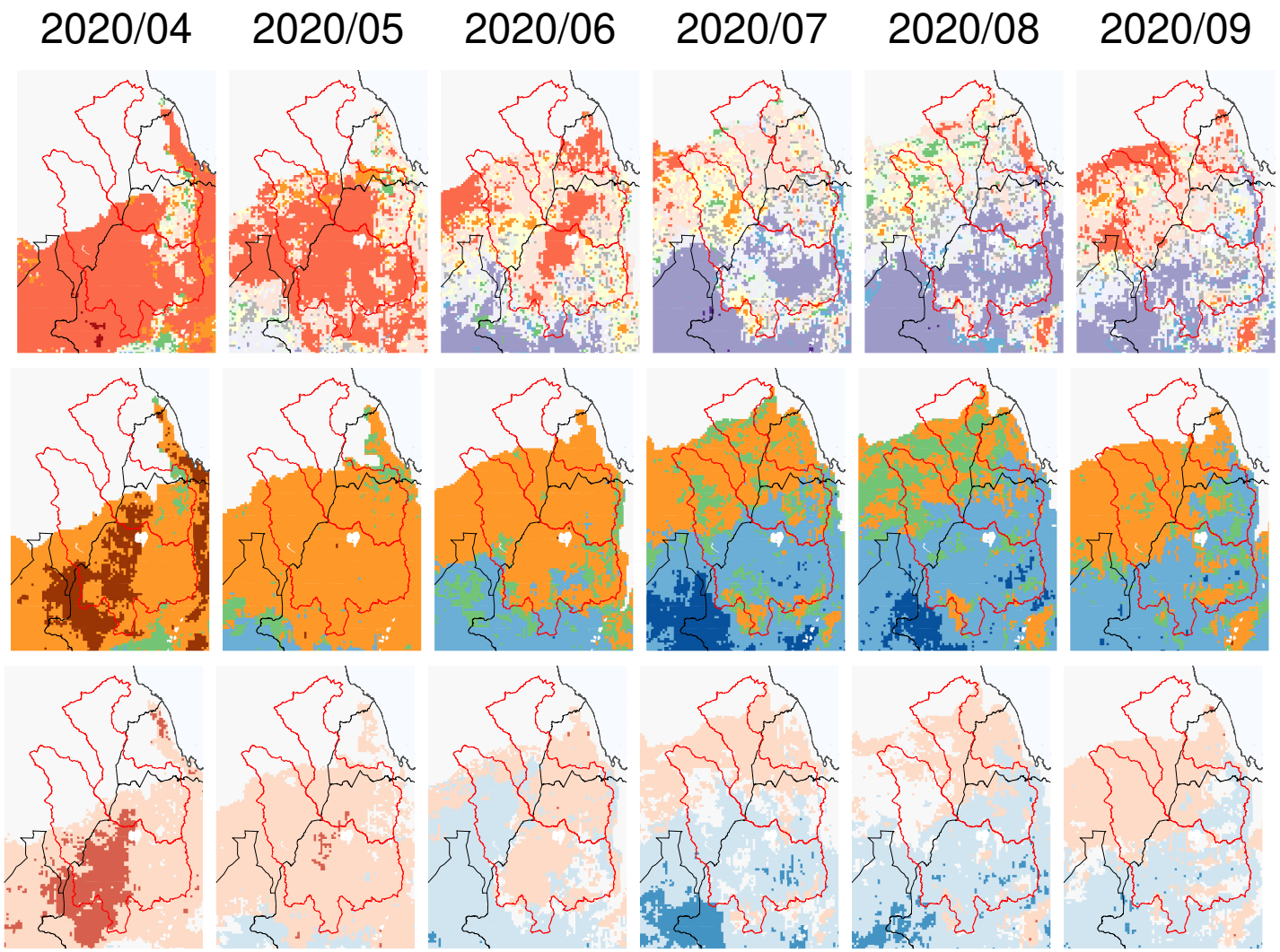
$$CRPSS = 1 - \frac{CRPS_{SEAS5-BCSD}}{CRPS_{SEAS5-raw}}$$



Reference: ERA5-Land

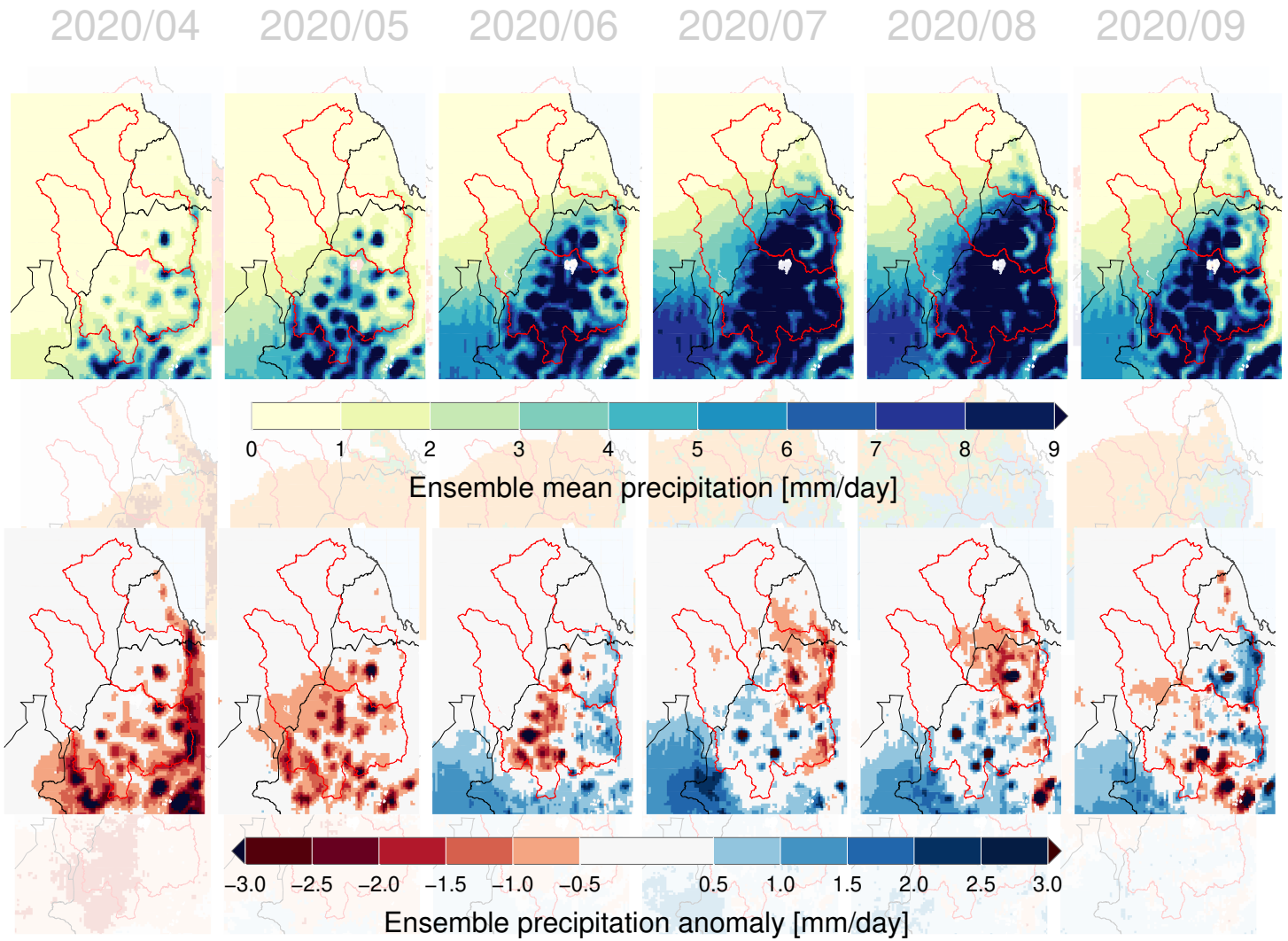
[1]Hersbach 2000

Recent Seasonal Forecast, April 2020



Extremes:
0 – 10% quantile
90 – 100% quantile

Recent Seasonal Forecast, April 2020



very dry
moderate dry
normal conditions
moderate wet
very wet
no category
no precipitation

below normal
normal conditions
above normal
no category
no precipitation

extreme dry
extreme wet
no extremes

Extremes:
0 – 10% quantile
90 – 100% quantile

Summary & Outlook

- Methods are also applied for further basins in close cooperation with national scientists and stakeholders:

- Volta-Niger/West Africa
- Karun/Iran
- Sao Francisco/Brazil
- Catamayo-Chira/Ecuador-Peru

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- Currently:

- Implementation of methods into online tool & visualization in close interaction with decision makers
- Forecasts are regularly communicated to *Ministry of Irrigation and Water Affairs* and *Sudanese Meteorological Association*
- More information SaWaM project: http://grow-sawam.org/
- More presentations: **Thu, 07 May, 10:45–12:30 | D262 (C. Lorenz)**
  Thu, 07 May, 08:30–10:15 | D2342 (T. Portele)