

Subseasonal prediction of the Indian monsoon: An application over Bihar

Andrew W Robertson¹, Nachiketa Acharya¹, Ángel Muñoz², Nicolas Vigaud¹, Simon Mason¹, and D. S. Pai²

¹IRI, Columbia University, Palisades, NY; ²India Meteorological Dept., Pune, India

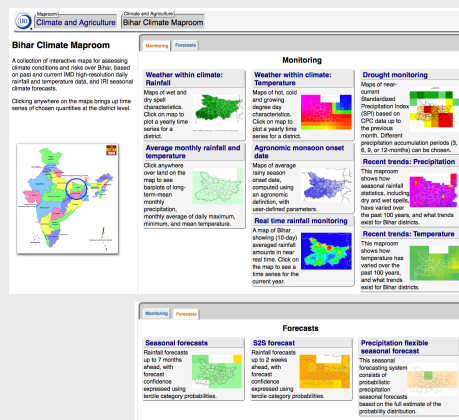
Introduction

An ultimate goal of the WWRP/WCRP Subseasonal to seasonal prediction project (S2S) is to advance the science and practice of subseasonal forecasting to the point where such forecasts can become useful tools for societal use. This requires the forecasts to be calibrated against observed data and presented in an appropriate format.

In this work, calibrated forecasts of weekly rainfall from the NCEP CFSv2 model have been generated in tercile probability format every Thursday during the 2018 Indian summer monsoon season, and provided via India Meteorological Dept (IMD) to Bihar State Agricultural University to help inform farmers in 4 districts of Bihar, via text messages.

Bihar Climate Maproom

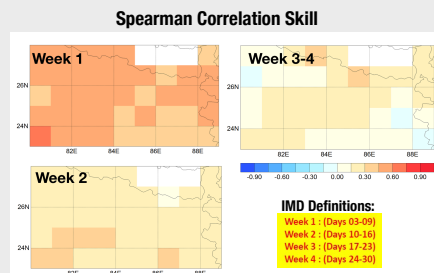
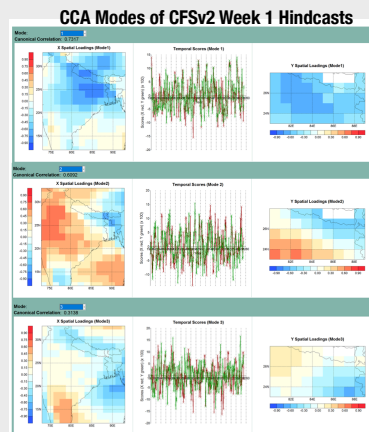
The experimental subseasonal forecasts (weeks 1–4) form part of an online maproom, which presents agriculturally-relevant climate information based on IMD gridded data, as well as seasonal forecasts.



<http://iridl.ldeo.columbia.edu/maproom/Agriculture/bihar.html>

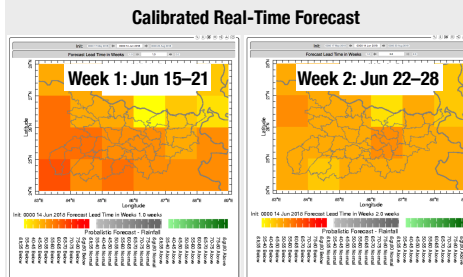
Forecast Calibration with CCA

- Canonical correlation analysis (CCA) is used to calibrate CFSv2 weekly-averaged precip fields over India (12N–32N, 74E–92E) from the S2S database, against IMD 1-degree gridded observed rainfall over the region of Bihar (23N–28N, 80E–89E).
- CCA training:
 - Jun–Aug, 1999–2010
 - 371 hindcast ensemble means, every 3 days
 - leave-5-out cross-validation
 - uses weekly anomalies for each target week for both obs and (lead dependent) forecasts



- Fairly high skill in week 1, but skill in week 3–4 range is poor.

Example Forecast, June 14

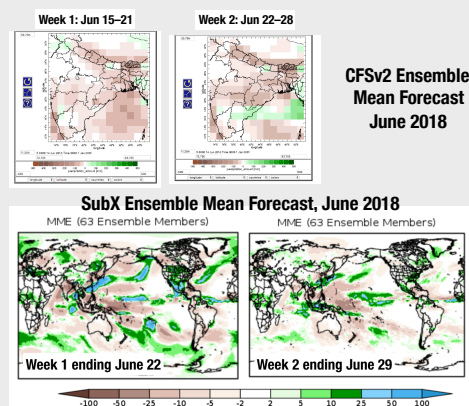


- Real-time probability forecast is expressed as tercile categories, using transformed Gaussian distribution.
- Below-normal tilt of probabilities for both weeks.

Forecast Text sent to IMD/Bihar State Ag University:

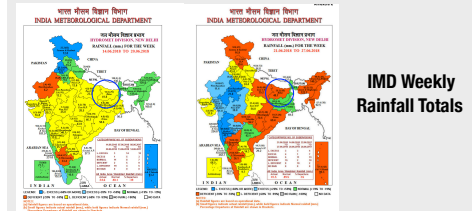
Sub-Seasonal Forecast:
Rainfall is likely to remain below normal in week 1 (June 15–21) and week 2 (June 22–28), with moderately greater likelihood of below normal rainfall in week 1 (55–60% compared to 33%) and slightly greater likelihood of below normal rainfall in week 2 (40–45% compared to 33%).

Forecast Diagnostics

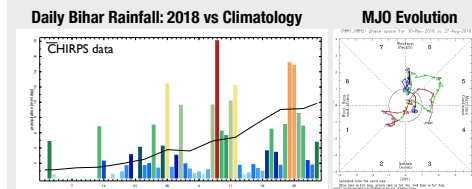


- Strong broad-scale negative precip. anomalies were forecast over most of India, together with a pronounced Meiyu front over E Asia (flooding over Japan).
- Delayed monsoon onset over India and Bihar.

Observed Rainfall Evolution



- Bihar recorded rainfall deficits of -70% and -36% in the 2 weeks respectively.



- Monsoon break/delayed onset conditions occurred in the second half of June.
- MJO was in Phase 1, consistent with subsidence over India.

Conclusions

- CCA provides a candidate “MOS Correction” methodology for calibrating S2S probabilistic precipitation forecasts, as used in seasonal forecasting.
- The leading CCA modes depict large-scale weekly precip. patterns with hallmarks of the monsoonal intraseasonal oscillation.
- Useful forecast skill remains limited to the first 2 weeks over India.
- Monsoon break episode over Bihar in June 2018 well captured 1–2 weeks ahead.
- Future scope to include multiple S2S/SubX models.
- A Python interface to IRI’s CPT MOS tool “PyCPT” is being developed (see Muñoz talk, A3-03).

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