

# ARRCC Impact Story

Measuring the skill of South Asian precipitation forecasts for a more accurate seasonal monsoon outlook



## Motivation

South Asia is the most densely populated geographical region in the world and highly vulnerable to variability in precipitation. Livelihoods and economies in this region rely heavily on the monsoon system. Alongside partners, we have refined the precipitation skill assessment of 12 seasonal forecast models in order to inform the model selection process for the seasonal forecast produced at the South Asian Seasonal Climate Outlook Forum (SASCOF). This work will ultimately help to aid decision-making in climate sensitive sectors within the region on a seasonal basis. This work will ultimately inform the model selection process for the seasonal forecast produced at the South Asian Seasonal Climate Outlook Forum (SASCOF) before each of the major monsoon seasons.



Rainy day – Dhaka, Bangladesh.

## Our approach

The World Meteorological Organisation (WMO) defined an initiative to move towards a more objective-based forecasting process by selecting a set of candidate models based on their skill and performance<sup>1</sup>. Following this advice, we worked closely with partners in Hydrology and Meteorology departments across South Asia to:

1) Write an extensive literature review to establish the current status of seasonal forecasting in South Asia. We identified the need for forecast verification and skill assessments on a national level.



3) Assess how larger-scale climate drivers (e.g. El Niño Southern Oscillation (ENSO) and the Indian Ocean Dipole (IOD)) affected model skill in predicting precipitation variability.



2) Assess the skill of seasonal models during two major monsoon seasons (summer monsoon July-September, winter monsoon October-December) by comparing the output from the hindcasts of 12 dynamical seasonal prediction systems with precipitation observations for the period 1993-2016. Model skill was measured using a variety of verification metrics<sup>2</sup>. (Figure 1)



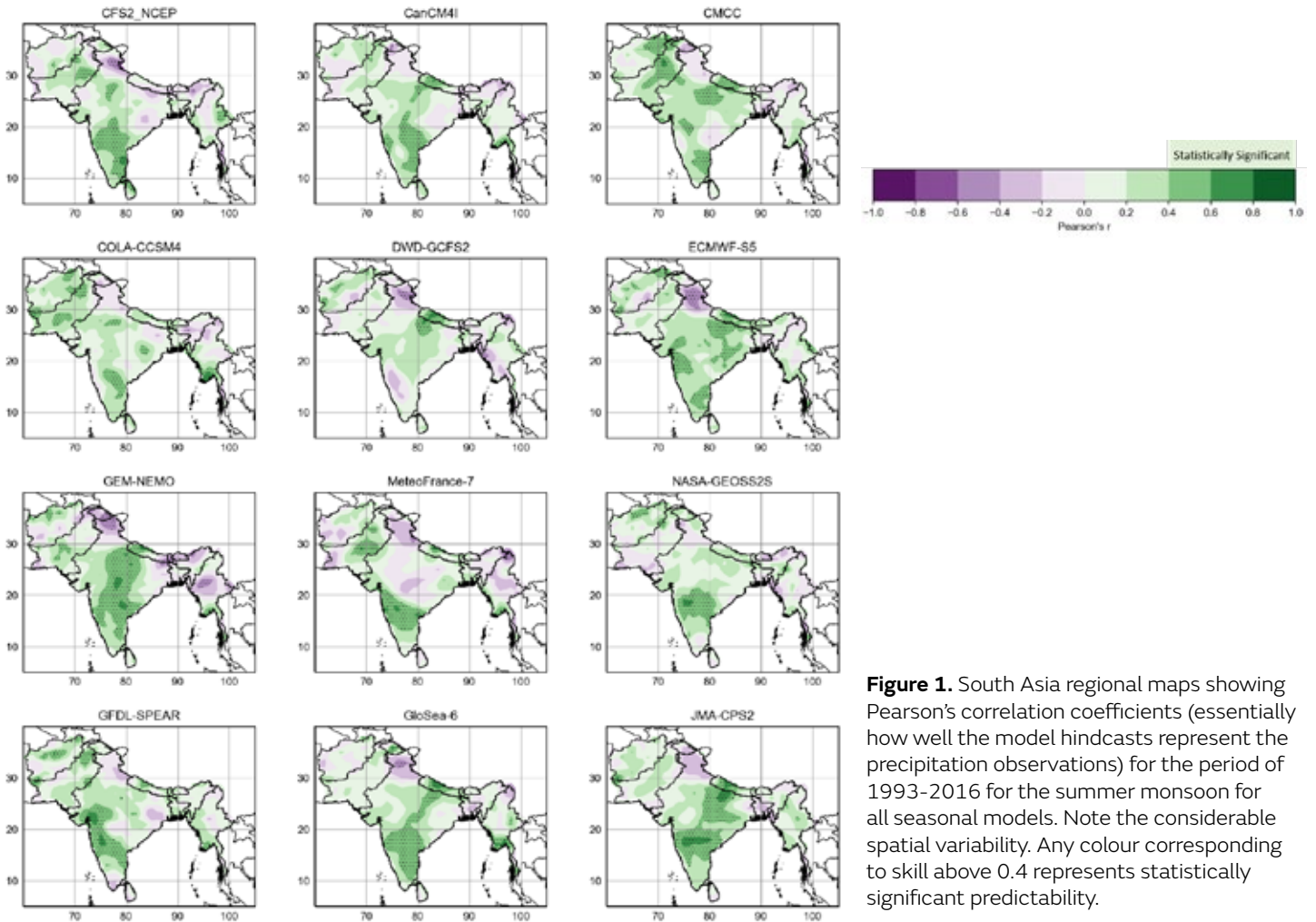
## Findings and Impacts

- We find that models generally do **well** at predicting South Asian **precipitation variability** in both winter and summer monsoon seasons, but their **skill varies** significantly between different countries within the region. For instance, during the summer monsoon models have good predictability over Nepal and India, but low predictability over Bangladesh.

This work was conducted under the Strengthening Climate Information Partnerships South Asia (SCIPSA) project of the ARRCC Programme.



- Models do better at predicting precipitation variability when it is **strongly driven** by ENSO and IOD teleconnection events. The strength of these teleconnection drivers varies seasonally and spatially across the region.
- The range in predictability of South Asian precipitation between the models highlights the importance of using a **multi-model ensemble** as a basis for a SASCOF regional forecast to effectively represent seasonal and spatial precipitation variability.



**Figure 1.** South Asia regional maps showing Pearson's correlation coefficients (essentially how well the model hindcasts represent the precipitation observations) for the period of 1993-2016 for the summer monsoon for all seasonal models. Note the considerable spatial variability. Any colour corresponding to skill above 0.4 represents statistically significant predictability.

## What's next?

**Country Specific Guidance:** Tailoring the report findings to guide national-level forecast production. This would be done through national-level assessment of model skill scores and could be tailored to specific seasons.

**Enhancing Model Applications:** Testing the existing models for additional variables such as temperature to benefit a wider range of sector users.

**Adding additional models and datasets:** Testing additional models to infill areas with lower model skill such as Bangladesh. Also, including additional observational datasets will ensure areas such as the Maldives are also included in the model skill assessment.

<sup>1</sup> WMO, W. M. O. (2020). Guidance on Operational Practices for Objective Seasonal Forecasting 2020. Retrieved from [https://library.wmo.int/doc\\_num.php?explnum\\_id=10314](https://library.wmo.int/doc_num.php?explnum_id=10314)

<sup>2</sup> For the full report including methodological details, please see 'Skill of South Asian Precipitation Forecasts in Multiple Seasonal Prediction Systems' here: <https://tinyurl.com/3czps48k>.

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