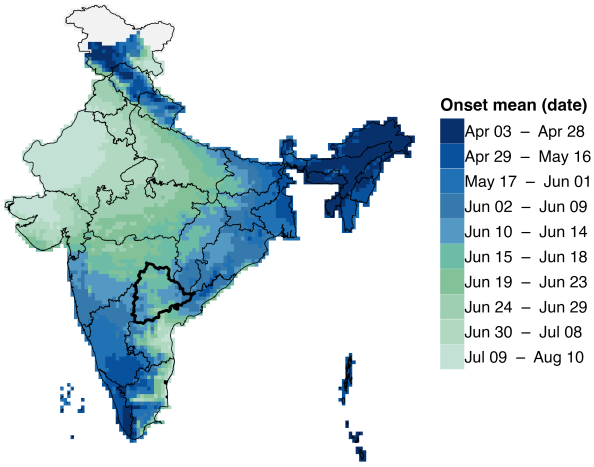
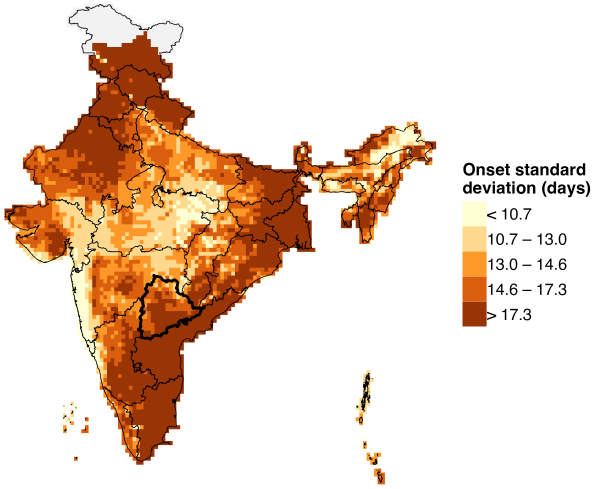
Sample Work

Monsoon Onset

Based on the European Centre for Medium-Range Weather Forecasts Reanalysis dataset (ERA5), which provides post-processed daily statistics on single levels from 1940 to the present, and drawing on the monsoon onset definition by Moron and Robertson (2014), adjusted to better reflect the Indian context, I defined the onset date as the first wet day (≥ 4 mm) of the first 5-day wet sequence from April 1st that accumulates at least the 5-day wet spell interannual mean for April–October at that pixel. To avoid false positives in cases where an early wet spell is followed by drought, an onset date is only valid if it is not followed by a 10-day dry spell (receiving less than 5 mm) within the subsequent 30 days. The time span of the analysis is from 1940 to 2024.



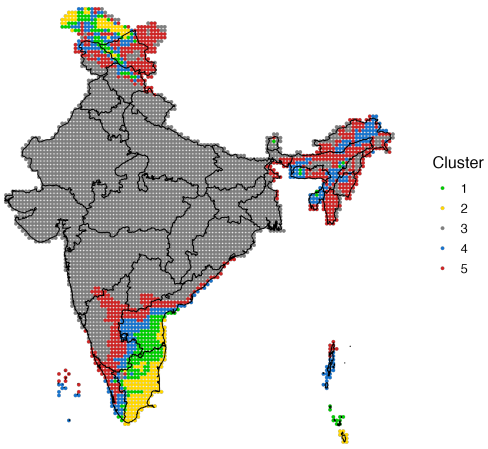
(a) Onset Date - Mean (Grid)



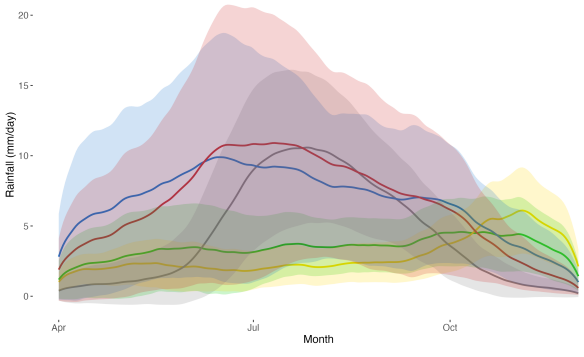
(b) Onset Date - Std. Dev. (Grid)

Monsoon Region

Based on ERA5, and following Moron et al. (2017), to construct five clusters, I first applied a low-pass recursive first-order filter with a cutoff of 1/30 to the ERA5 gridded daily precipitation data, using a Butterworth filter. Second, I standardized the filtered data to have a mean of zero and a variance of one. Third, I extracted the leading empirical orthogonal function from the standardized, filtered data for each pixel. Finally, I applied a standard k-means clustering algorithm to these data. The time span of the analysis is from 1940 to 2024.



(c) K-means Clustering



(d) Cluster Rainfall Trends by Month