

Atmospheric conditions prior and during the Onset of Eastern Africa Short Rains

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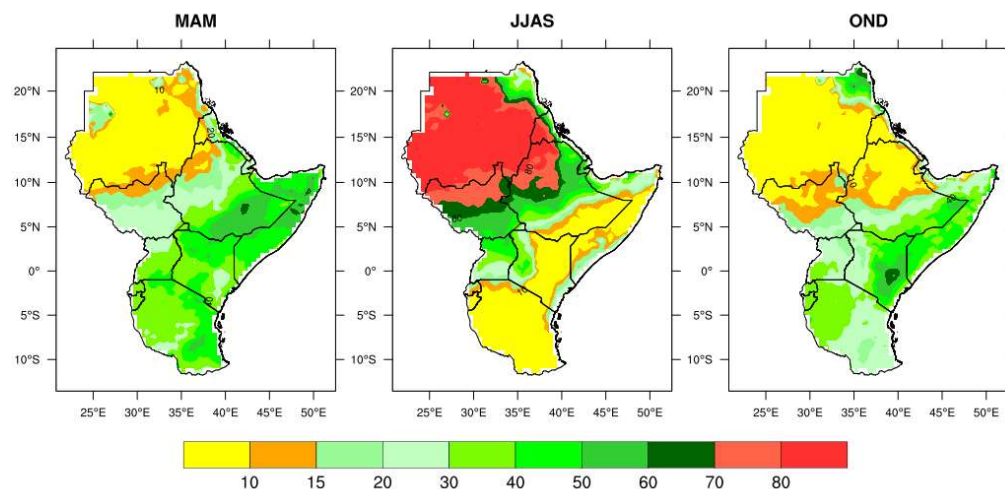
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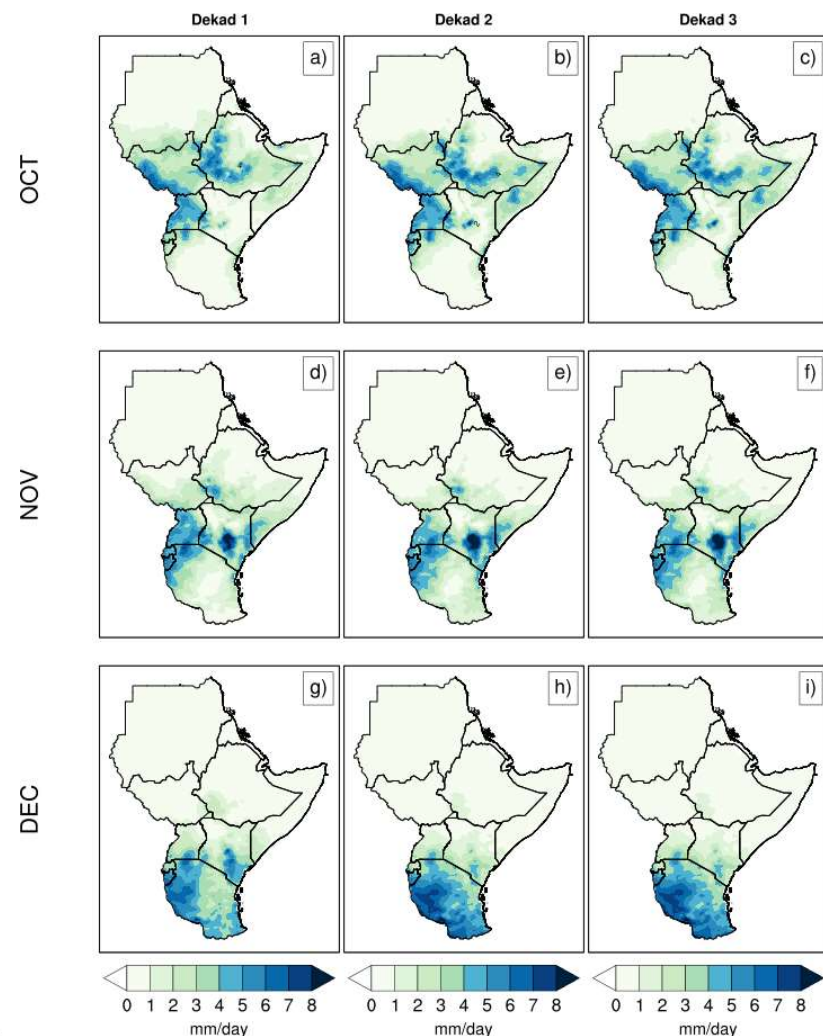
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- Eastern Africa has three major seasons, the March-May (Long Rains), June-September (JJAS) and October-December (Short Rains) seasons.
- The short rains season is very important over the equatorial region and contributes up to 60% of total annual rainfall over eastern Kenya.



INTRODUCTION



Aim: To identify differences in the atmospheric conditions prior to and during the onset of the short rains over eastern Africa.

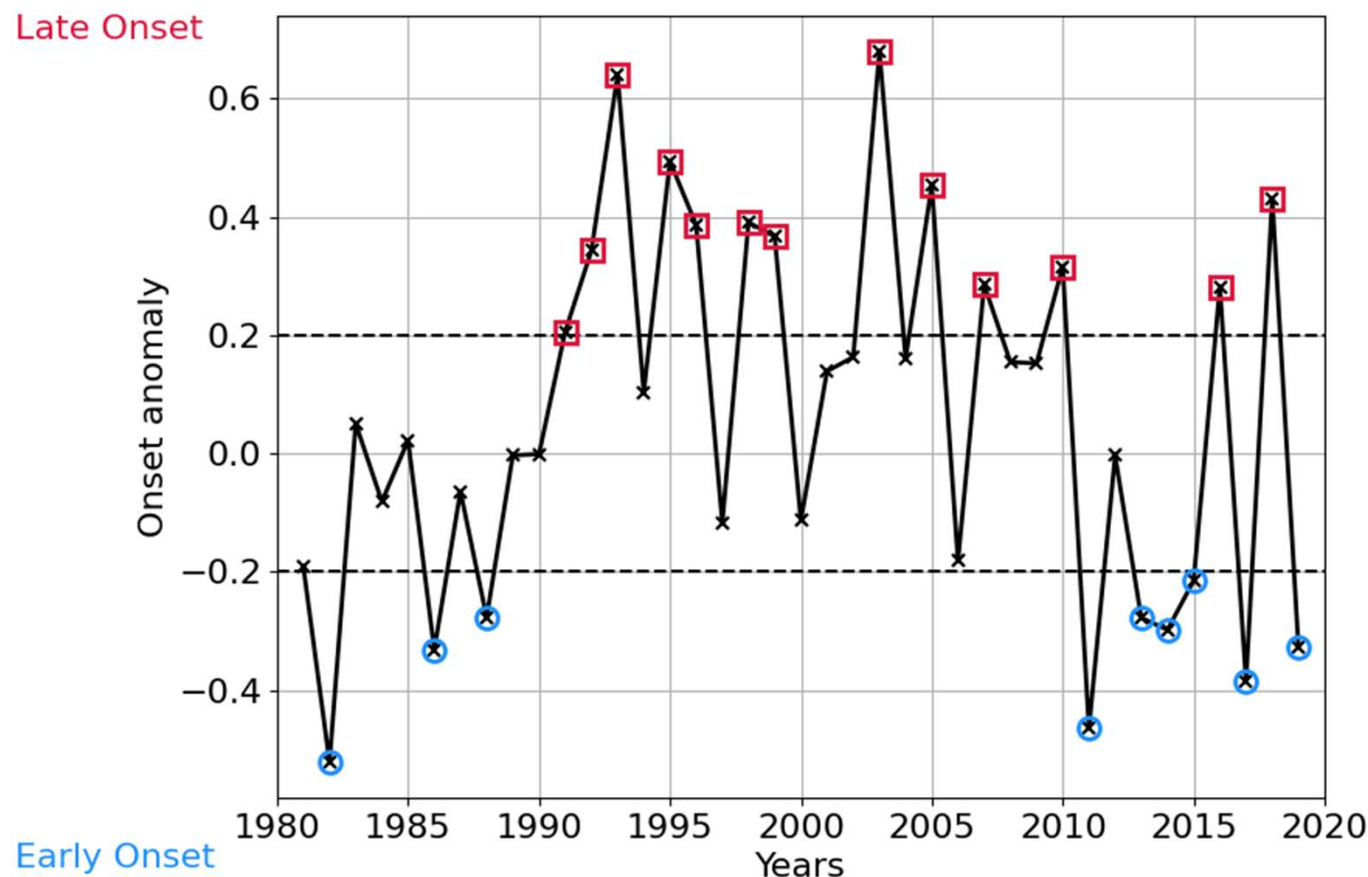
- Daily Climate Hazards Group InfraRed Precipitation with Station Data (CHIRPS) from 1981-2019 was utilized for onset analysis (Funk et al., 2015).
- The vertically integrated moisture fluxes, meridional and zonal winds were obtained from ERA 5 reanalysis.
- The daily sea surface temperatures (SST) are obtained from the NOAA Optimum Interpolation Sea Surface Temperature (OISST).

DATA AND METHODS

- Onset: First day of the season when a wet spell of accumulated rainfall in 3 days is at least 20mm and there are no consecutive dry days of 7 days or more in the next 20 days. At least two of the 3 days have rainfall exceeding 1mm.
- Composite analysis is performed on different atmospheric fields.

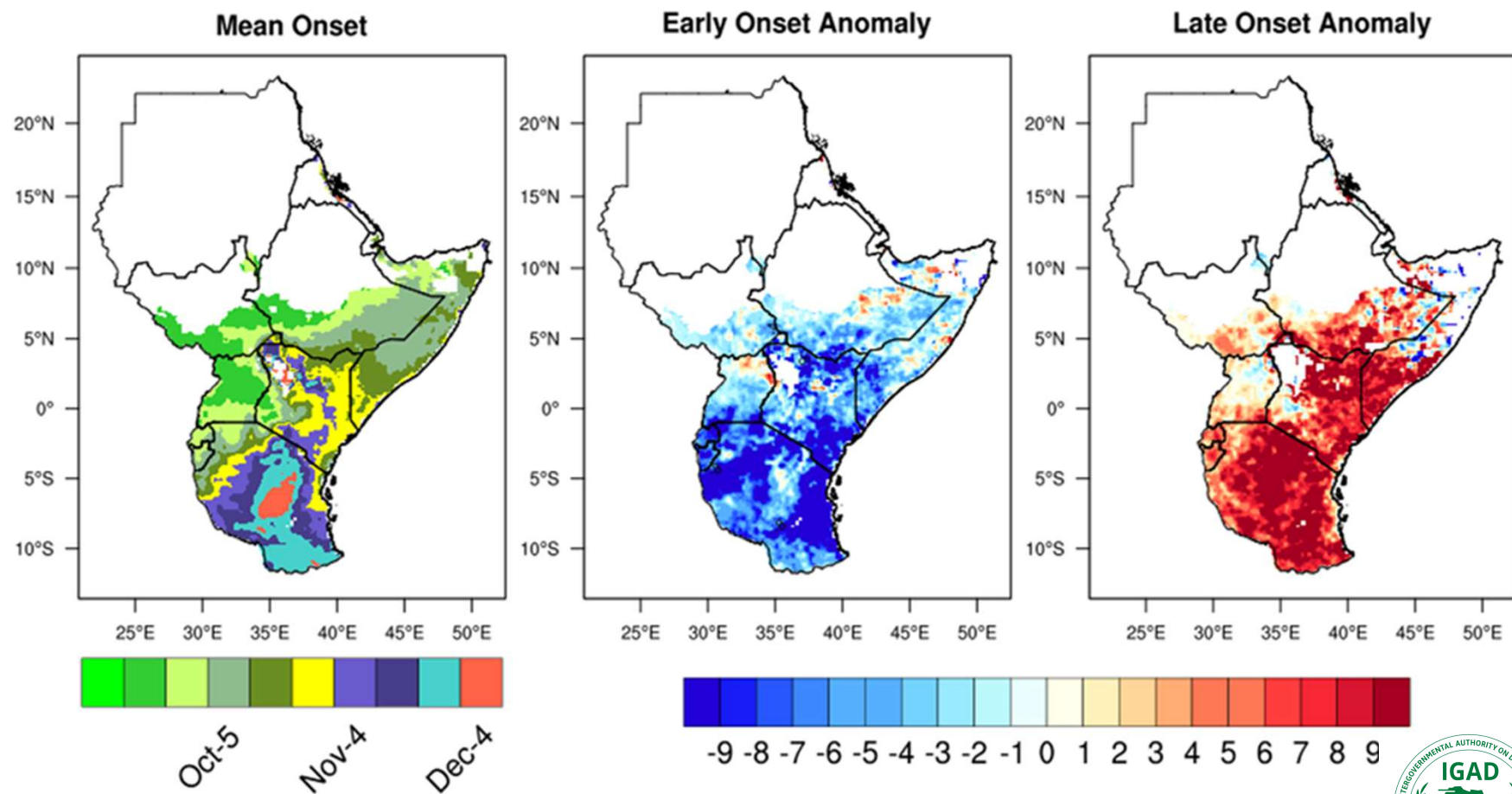


- The years marked with the red square are used for the late onset, those marked with the blue circles for Early onset.
- Years without the blue circle and red square are used as the normal onset years.





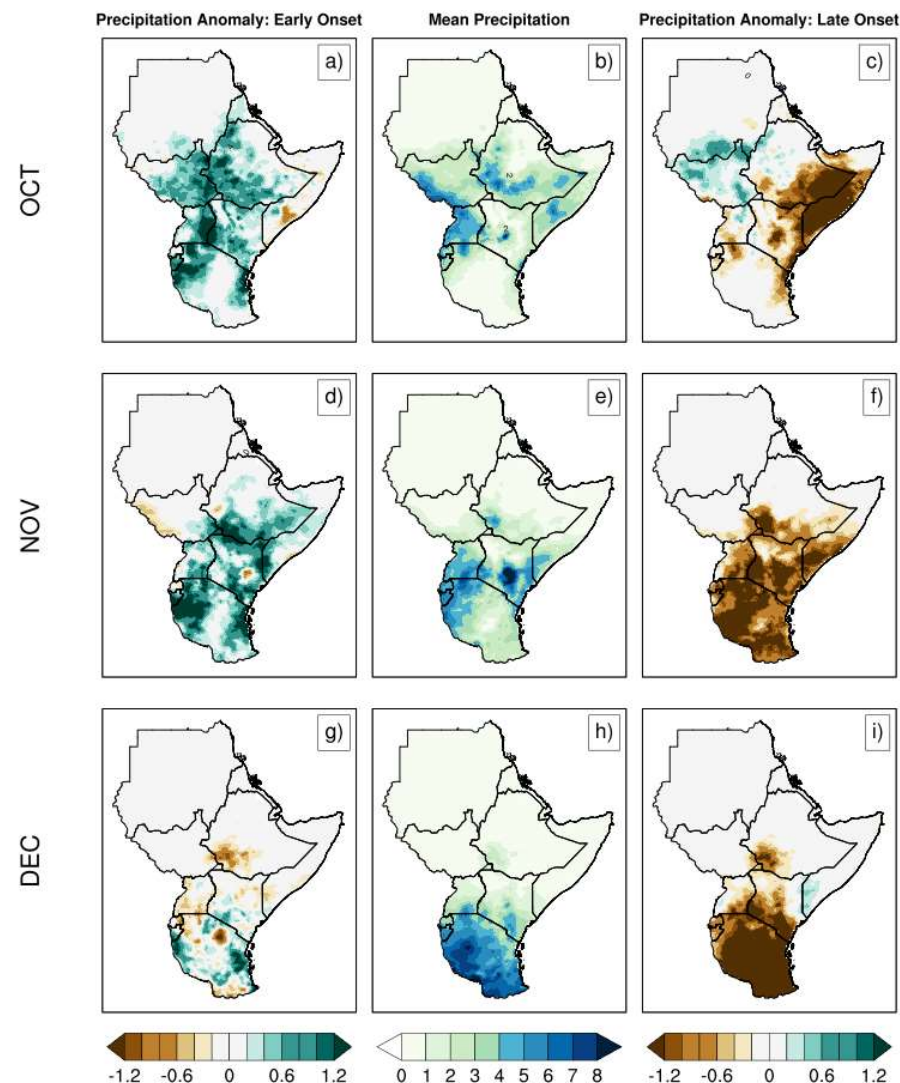
MEAN ONSET



- Mean onset occurs in October over most of the region with an active season.

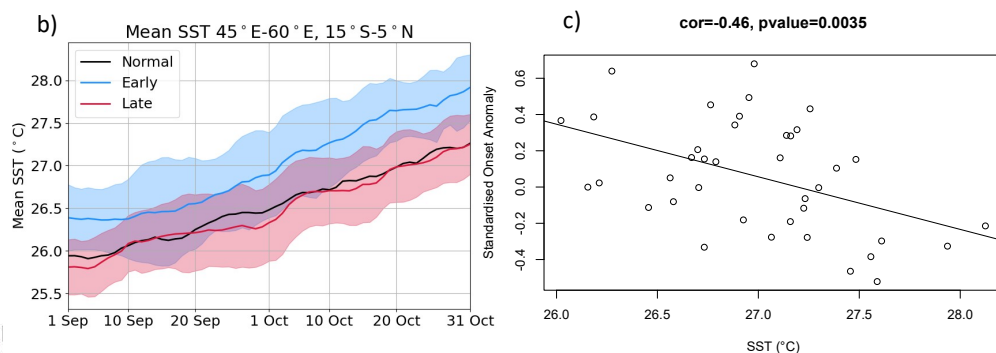
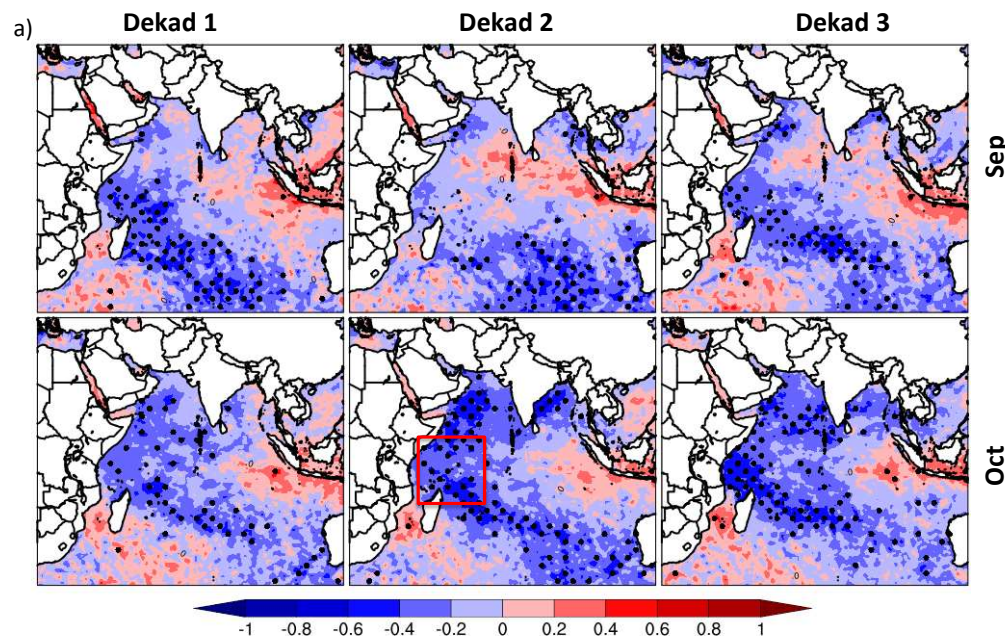
Rainfall Onset and Total Rainfall Composites

- Early onset is generally associated with enhanced rainfall during the month of October, while late onset is associated with rainfall deficit.
- Just as in October early (late) onset is associated with enhanced (deficit) rainfall.

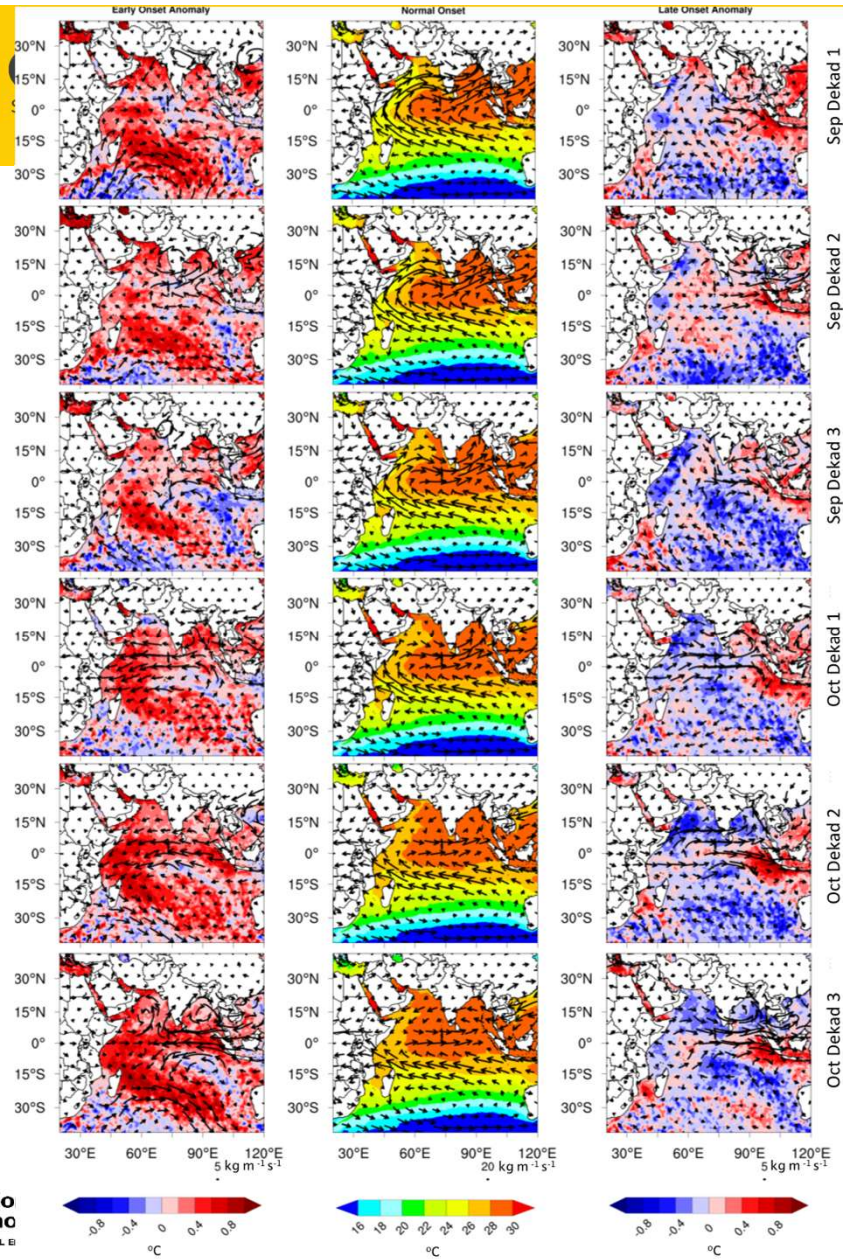




Correlation for rainfall onset and SST



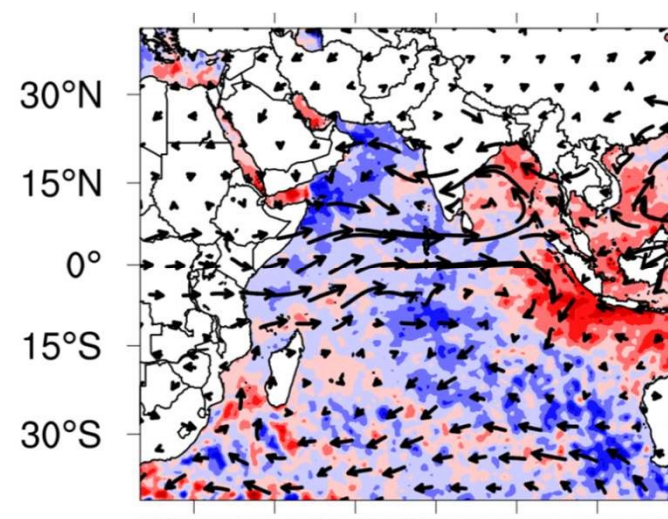
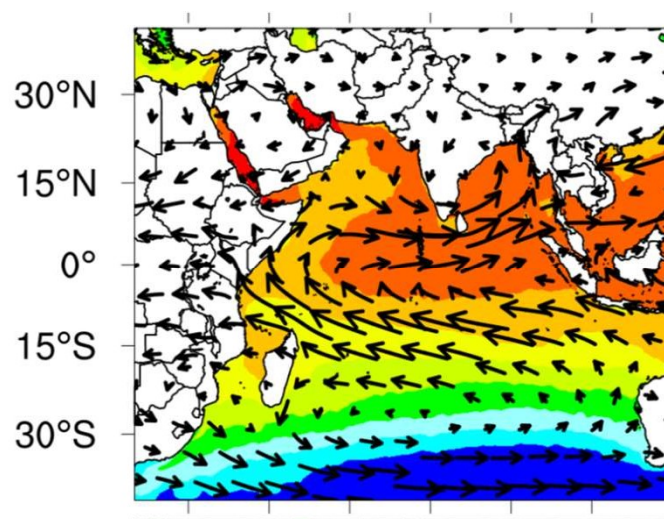
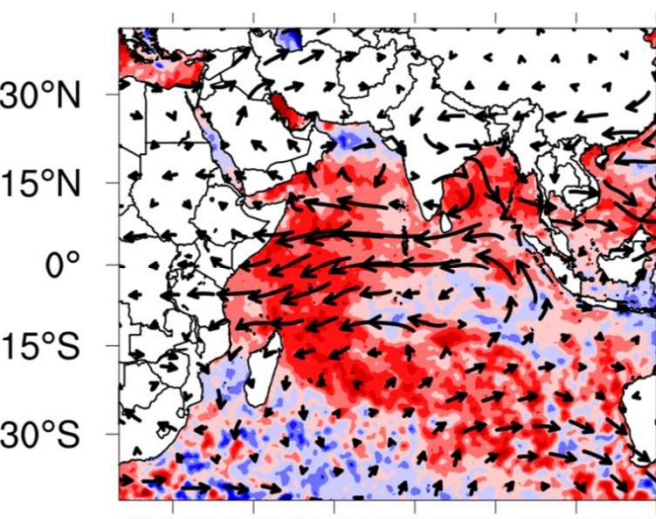
- The rainfall onset is negatively correlated with the SST's over the West Indian Ocean and positively correlated over the maritime continent.
- The black dots on the plots represents correlations that are statistically significant at the 5% significance level.



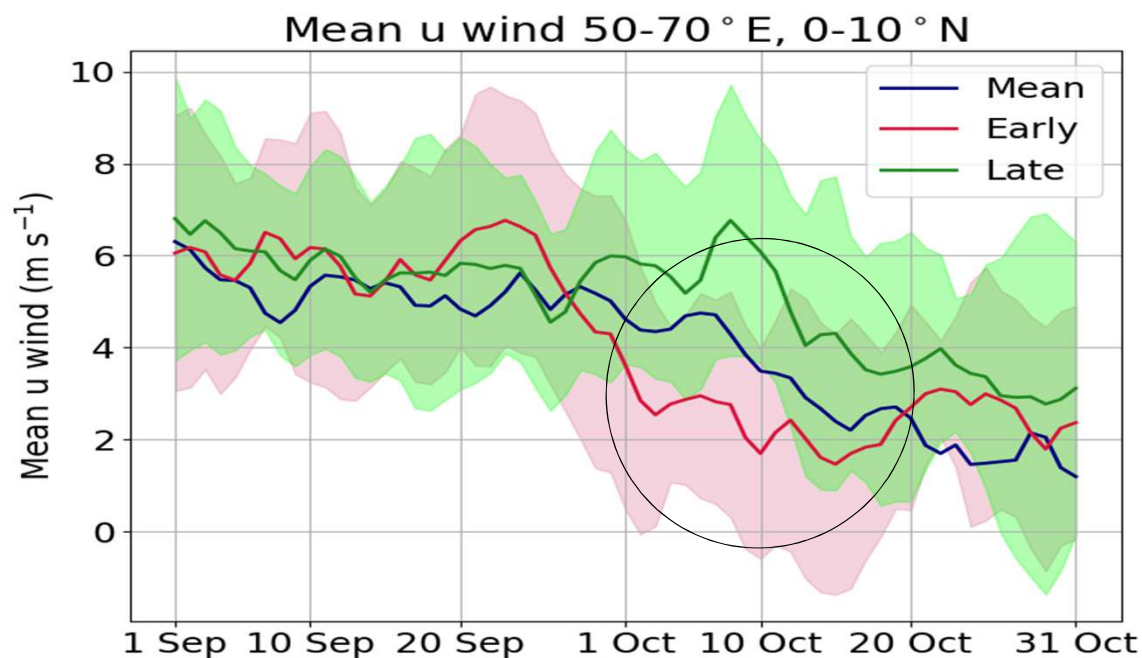
Composites for SST and vertically Integrated moisture

- Warmer SST during the early onset years and generally cooler SSTs in the late onset years.

- In early October: Early onset has moisture fluxes into the region while late onset moisture is directed outwards.

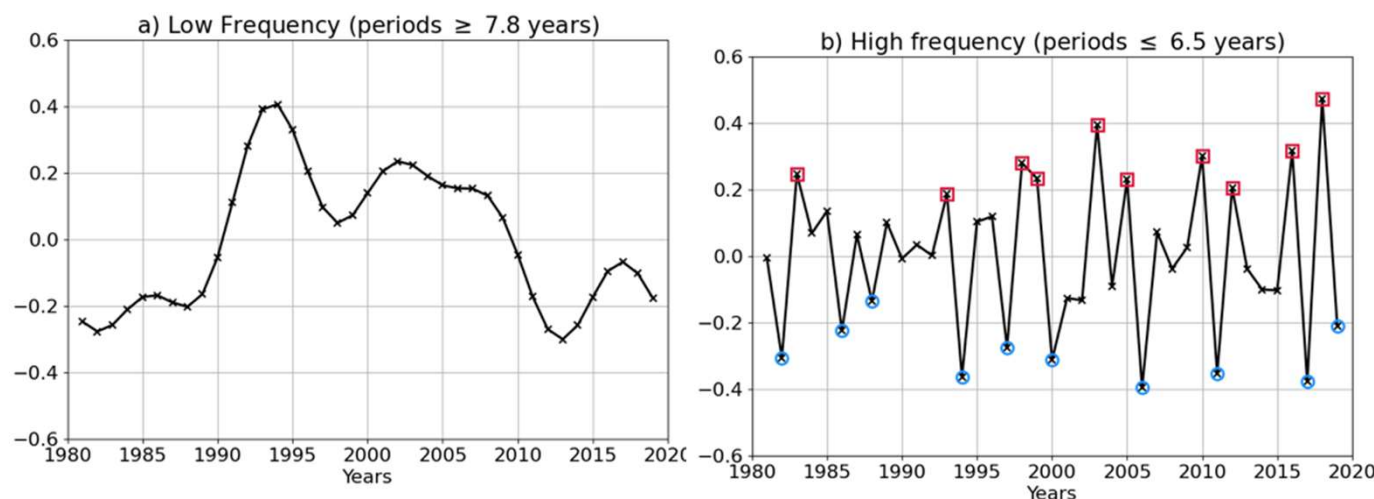


Oct Dekad 1



- No discernible differences in mean uwind in September
- High mean uwind during late onset and low uwind in early onset (i.e. stronger westerlies)

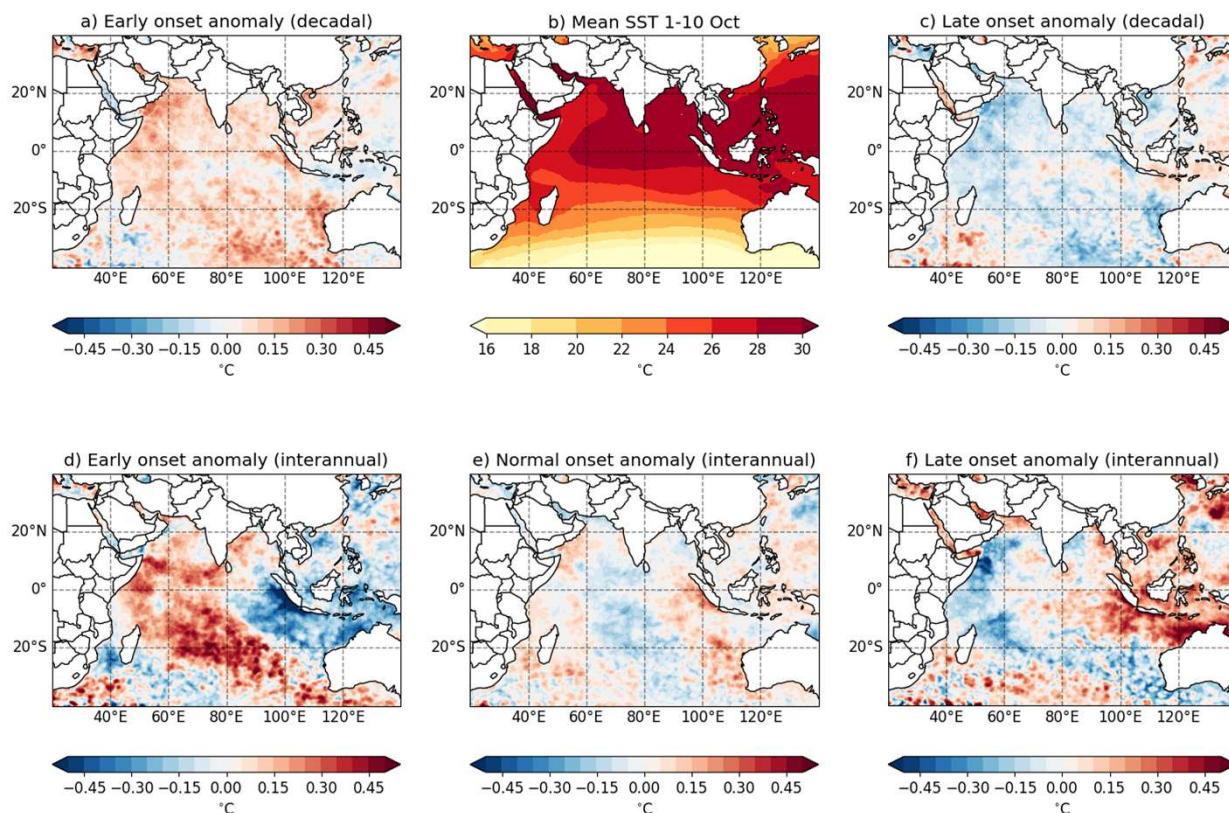
Interannual and Decadal Variability



- The low frequency timeseries indicates that in the first and last 10 years the region mostly experienced early onset while in the middle 19 years the region experienced late onset.
- The high frequency timeseries shows a relatively uniform distribution of early, normal and late onset years with no obvious time period being dominated by a single category.

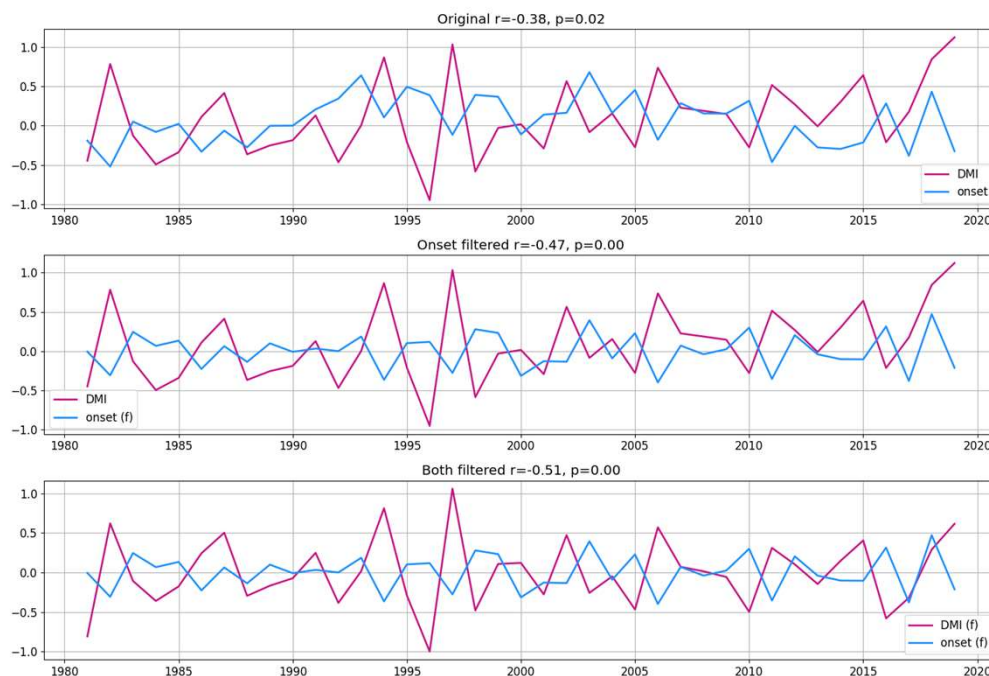


Interannual and Decadal: SST



- On decadal timescales, in the early onset years the Indian Ocean is warmer, while for the late onset years the basin is cooler .
- The interannual variability analysis shows that for the normal onset anomaly years the western and eastern parts of the Indian Ocean basin are warmer than during the mean onset years while the central part is cooler.

Onset Date and Dipole mode Index



- Analysis shows statistically significant correlations between the interannual variability of the onset and the dipole mode index.

Conclusion

- Early onset is generally associated with enhanced rainfall during the months of October and November, while late onset is associated with rainfall deficit
- Warm SSTs are associated with early onset while no major differences are evident for mean and late onset years.
- Moisture fluxes into the region for the early onset years in Early October.

Thank you

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