Research BRIEFS

NCAP-COALESCE

CarbOnaceous AerosoL Emissions, Source apportionment & ClimatE impacts

Understanding scientific complexities related to carbonaceous aerosols focussing on issues underlying their origin and fate, and their role as drivers of regional climate change over India.

Monsoon season local control on precipitation over warm tropical oceans

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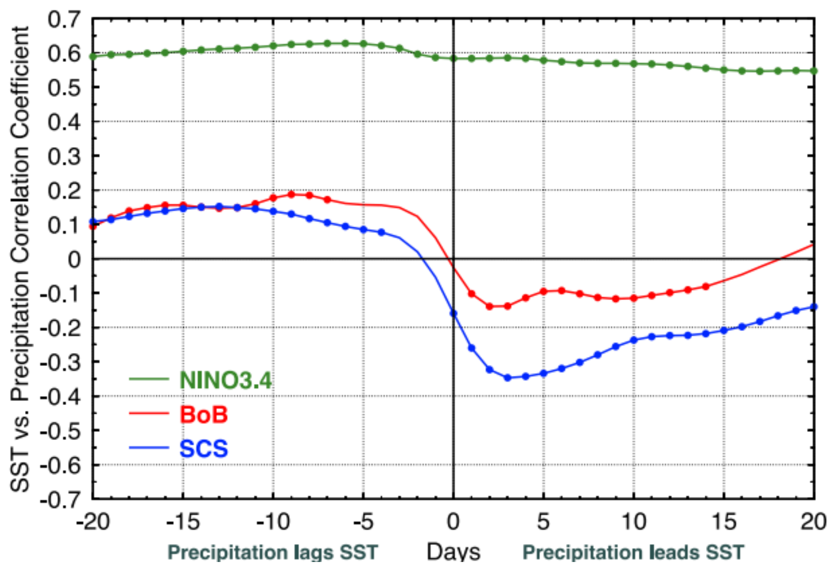

Figure 1: Lead/lag correlation coefficients between TRMM precipitation and SST for June– September averaged over the NINO3.4 (170◦–120◦W; 5◦S –5◦N), BoB and SCS regions. Solid circles represent correlation coefficients significant at 99% level based on *r*-test.

Key highlights:

- The relationship of the average precipitation to the average SST over a grid or a region such as BoB or SCS and shown it to be rather weak for the time-scales considered with or without lag.
- The variation of precipitation over these warm oceans is strongly related to the low level convergence on the time scales of 1, 5 and 10 days, and one month.

Summary of your Research:

Understanding local SST control on precipitation during monsoon is important for deducing climate change due to global warming, particularly for warm oceans.

Studies of the relationship of the precipitation over tropical oceans with local sea surface temperature (SST), on the monthly scale, have shown that the propensity for precipitation is high for SST above a threshold of 27.5 ◦C/28 ◦C.

However, for warm oceans with SST above the threshold such as the Bay of Bengal and South China Sea, for each SST, there is a large variation of precipitation and the SST–precipitation relationship is weak. On daily scale mean precipitation increases slightly with SST when precipitation lags SST by a few days, but the relationship between them is rather weak.

But, when SST is above the threshold, for daily, pentad, 10-day and monthly time scales, and with or without time lag, the curve depicting the variation of mean precipitation with SST explains only a small fraction of precipitation variance and hence cannot be considered to be representative of the SST–precipitation relationship, or used to deduce the impact of SST on precipitation. On the other hand, the local control on precipitation is predominantly atmospheric dynamics with the relationship of variation of precipitation to low-level convergence on all timescales, being strong. This suggests that for warm oceans, the limiting resource for precipitation/convection is not SST but dynamics.

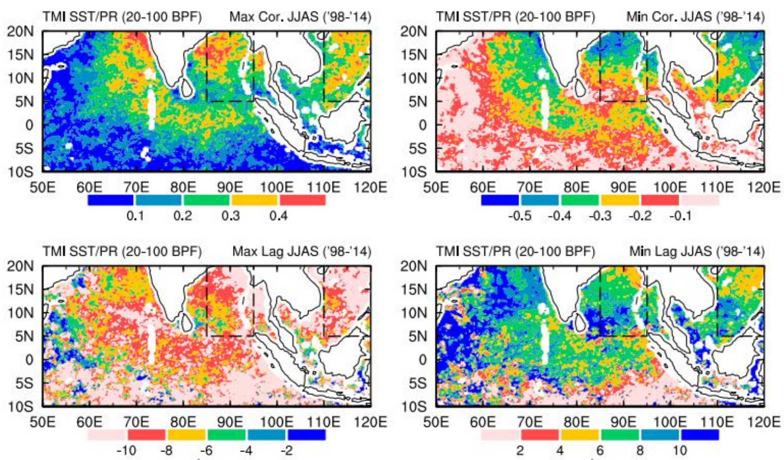

Figure 2: Local grid-point correlation between 20–100 day band pass filtered anomalies of daily SST and precipitation. **a** Maximum (when SST leads precipitation, top-left) and **b** minimum (when precipitation leads SST, top-right) for June to September during 1998–2014 and the lead or lag time corresponding to the **c** maximum (bottom-left) and **d** minimum (bottom-right) correlations between SST and precipitation. Boxes denote BoB and SCS regions

Take away/conclusion :

- The observed SST–precipitation relationship (the variation of the mean precipitation with SST), it cannot be concluded that precipitation increases with SST when appropriate lag between SST and precipitation is incorporated.
- Warm oceans for which SST is maintained above the threshold, the SST is no longer a limiting resource for precipitation, but the dynamics is.
- the interaction with convective systems over the equatorial Indian Ocean/West Pacific and the nature of the atmosphere–ocean coupling over the Bay of Bengal have to be properly incorporated in the models for a realistic simulation of the variation of the precipitation over this warm ocean.

Research Article citation

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