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Indian monsoon prediction clues in equatorial Atlantic

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Improved understanding of conditions in the equatorial Atlantic could help predict the Indian summer monsoon better, according to a new study¹.

Conditions in the tropical Pacific and the Indian Ocean are known to have a major influence on the development of the Indian monsoon. However, a variety of other factors affect the monsoon making monsoon rainfall prediction in the Indian subcontinent tricky business. The Indian economy leans heavily on the monsoon rains and an incorrect prediction could have serious implications.

While searching for clues, researchers from the Indian National Centre for Ocean Information Services, and University of Maryland found that wind conditions and heat content in the tropical Atlantic may provide better pointers towards predicting monsoon. According to them, this may be useful especially when the signals from the Pacific Ocean are weak.

Previous studies have shown that the heat content in the tropical Pacific is a better indicator of the Indian monsoon rainfall than the sea surface temperature. Similarly, heat content in the Indian Ocean in the equatorial belt is a good indicator of the Indian Ocean Dipole Zonal Mode, which also has a bearing on the Indian monsoon. Until now, the relationship between heat content in the tropical Atlantic and the Indian monsoon rainfall was not investigated.

During monsoon period in India, something similar to El-Nino southern oscillation (ENSO) happens in the tropical



Wind conditions and heat content in the tropical Atlantic may provide clues to predict Indian monsoon better.

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Atlantic. Called the Atlantic Zonal Mode (AZM), this can drive pressure changes above the Indian landmass, and alter rainfall. Research suggests that a warm Atlantic zonal mode drives high pressure over northern Bay of Bengal, and decreases rainfall in the Central India, whereas a cold Atlantic zonal mode increases rainfall by creating low pressure systems over the Bay of Bengal.

The researchers did a monthly composite analysis of the zonal surface winds, heat content, and sea surface temperature in the tropical Atlantic. Their studies revealed that heat content in the eastern equatorial Atlantic and the zonal surface winds in the western equatorial Atlantic are signatures of an imminent AZM. Since the effect of AZM on the Indian monsoon rainfall is fairly well understood, these findings can help better understand how the conditions in the tropical Atlantic affect Indian monsoon.

“Any single parameter – El Nino, AZM or Indian Ocean Dipole – cannot provide information about monsoon. It is a combination of many atmospheric and ocean processes that change or modulate the monsoon. We have recently identified that AZM has some modulation on the Indian Monsoon,” says Muthalagu Ravichandran, one of the researchers from the Indian National Centre for Ocean Information Services.

“AZM is important for predicting Indian monsoon”, says Bhupendra Nath Goswami, a professor at the Indian Institute of Science Education and Research, Pune. About 60% of inter-annual variability of the Indian monsoon rainfall is potentially predictable, of which about 35% is explained by the ENSO. “The remaining predictable variance is explained by other parameters including the extra-tropical sea surface temperature and the equatorial AZM,” he says.

References

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