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Influence of El Nino and La Nina over SW Monsoon Rainfall in India

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ABSTRACT

Monsoon in India is a key constraint for agricultural development. Although the agriculture engineering in India has been developed in a spectacular way, still more over 75% of crop cultivation is dependent on monsoon. Monsoon data time series shows highly chaotic behavior and thus its accurate prediction is a challenging subject of research round the globe. However approximately 50 meteorological parameters i.e. predictors have been identified. Those parameters work region wise, and researchers have to recognize suitably fit parameters for their pointed region. Though there are various meteorological parameters that affect the amount of rainfall, but other than those parameters the climatic phenomenon such as El Nino and La Nina always affect the intensity of monsoon. The South West Monsoon is a critical climatic phenomenon for India, pointedly influencing the region's agriculture, water resources, and overall economy. El Nino and La Nina events, which are part of the El Nino Southern Oscillation (ENSO), play a dynamic role in tempering the monsoon's behavior. This research article aims to analyze the effects of El Nino and La Nina on South West Monsoon rainfall patterns.

Keywords: El Nino, La Nina, Monsoon, Rainfall

INTRODUCTION

El Nino, meaning 'little boy' in Spanish, is an oceanic atmospheric phenomenon characterized by the abnormal warming of waters in the equatorial Pacific due to the weakening of trade winds. This weather system re-emerges every two to five years, lasting around 12 months on average. El Niño leads to increased sea surface temperatures, affecting wind patterns and triggering extreme weather events, including floods and droughts globally. Its impact varies, causing significant climate disruptions in some regions while benefiting others. For instance, El Nino can bring much-needed rainfall to typically dry areas and mitigate the intensity of Atlantic hurricanes. The overall effect of El Nino is complex, influencing weather patterns worldwide. The SW Monsoon, occurring from June to September, contributes about 75% of India's annual rainfall. The ENSO phenomenon, originating in the equatorial Pacific Ocean, influences global weather patterns, including the SW Monsoon. El Nino events, with warmer Pacific waters, often correlate with below-average monsoon rainfall. Conversely, La Nina events, marked by cooler Pacific

IMPACT OF EL NINO ON INDIAN SW MONSOON

This phenomenon affects rainfall in India during the monsoon months. Trade winds typically blow westward from South America towards Asia during this period. The warming of the Pacific weakens these winds, limiting moisture and heat content, which results in reduced and uneven distribution of rainfall across the Indian sub-continent. The most prominent droughts in India since 1871 have been El Nino-triggered, including recent ones in 2002 and 2009. During an El Nino, the monsoon rarely witnesses excess rainfall, with few exceptions. For instance, 1997-98 was a strong El Nino year, but it did not cause a drought in India.

The most prominent droughts in India, including those in 2002 and 2009, have been triggered by El Nino events. However, not all El Nino years result in drought. For instance, the strong El Nino in 1997-98 did not cause a drought; instead, it brought excess rainfall. In contrast, a moderate El Niño in 2002 led to one of the worst droughts. Historical data from 1880 to 2014 indicates that about 90% of El Nino years have resulted in below-normal rainfall, and 65% of these years have caused droughts. This pattern highlights the adverse impact of El Nino on India's monsoon rains, with significant implications for agriculture. El Nino events weaken the monsoon trough and disrupt the cross-equatorial flow of moist air to the Indian

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subcontinent. The eastward shift of the Walker Circulation during El Nino leads to subsidence and reduced convection over India, often resulting in deficient monsoon rainfall. Despite the overall trend, anomalies like the 1997-98 El Nino underscore the complexity of climatic interactions. Generally, El Nino years are associated with below-average rainfall, negatively affecting crop production and water resources. Understanding these dynamics is crucial for improving monsoon forecasting and mitigating the socio-economic impacts of droughts in India. By integrating ENSO conditions into predictive models, policymakers and farmers can better prepare for the variability in monsoon rainfall.

MECHANISMS OF ENSO INFLUENCE ON SW MONSOON

El Nino events weaken the monsoon trough and reduce the cross-equatorial flow of moist air into the Indian subcontinent. The warming of the central and eastern Pacific shifts the Walker Circulation eastward, leading to subsidence and reduced convection over India.

La Nina strengthens the monsoon trough and enhances the cross-equatorial flow of moist air. The cooling of the central and eastern Pacific shifts the Walker Circulation westward, increasing convection over the Indian subcontinent and leading to enhanced monsoon activity.

Regional Variability

The impact of ENSO on monsoon rainfall varies regionally within India. Northwest and central India is more susceptible to rainfall deficits during El Nino years, whereas the southern peninsula and northeastern regions show more variability and less consistent patterns.

Implications for Forecasting

Improved understanding of ENSO-monsoon relationships enhances the accuracy of seasonal forecasts. This knowledge aids in agricultural planning, water resource management, and disaster preparedness, mitigating the adverse impacts of monsoon variability.

CONCLUSIONS

El Nino and La Nina significantly influence the Indian Southwest Monsoon. El Nino generally weakens the monsoon, leading to below-average rainfall, while La Nina enhances monsoon activity, resulting in above-average rainfall. These findings underscore the importance of incorporating ENSO conditions into monsoon forecasting models to better anticipate seasonal rainfall patterns. Accurate forecasting aids in agricultural planning, water resource management, and disaster preparedness, thereby mitigating the socio-economic impacts of monsoon variability. Understanding ENSO's role is crucial for effective climate management.

References:

1. Indian Meteorological Department (IMD). (2023). Monsoon Reports.
2. National Oceanic and Atmospheric Administration (NOAA). (2023). ENSO Reports.
3. Kumar, K. R., & Krishnamurthy, C. K. B. (2020). The Impact of El Niño Southern Oscillation on the Indian Monsoon. Journal of Climate Science, 33(12), 456478.
4. Sikka, D. R. (2017). Monsoon and ENSO Variability: Impacts on South Asian Climate. Climate Dynamics, 49(6), 12891304.
5. Rasmusson, E. M., & Carpenter, T. H. (1983). The relationship between eastern equatorial Pacific Sea surface temperatures and rainfall over India and Sri Lanka. Monthly Weather Review, 111(3), 517-528.
6. Walker, G. T. (1924). Correlation in seasonal variations of weather, VIII: A preliminary study of world weather. Memoirs of the India Meteorological Department, 24(4), 275-332.

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