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Climate change is not the primary cause of extreme monsoons in Pakistan

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Monsoons have been frequently severe in Pakistan in the last few decades, leading to extreme droughts and floods of unprecedented proportions. The wide belief is that these changing precipitation patterns are mainly due to climate change. However, considering this region's long history of floods and droughts, it is unwise to rule out the role of natural climate variability without a careful diagnosis. This study examines the contribution of oceanic and atmospheric variability to unusual precipitation distributions in Pakistan. We find that variations in sea surface temperatures in the tropical Pacific and northern Arabian Sea and internal atmospheric variability related to the circumglobal teleconnection pattern and the subtropical westerly jet stream account for 74% of monthly summer precipitation variability in the 21st century. Several of these forcings have co-occurred with record strength during episodes of extreme monsoons, compounding the overall effect. Climate change may have contributed to increased variability and the in-phase co-occurrences of the identified mechanisms, but further research is required to confirm any such connection.