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Title:	Seasonal Mean and Extreme rainfall events over India during Indian Summer Monsoon in an Indian Regional Reanalysis Framework
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Abstract:	<p>Indian Summer Monsoon (June-September) Rainfall (ISMR) over the Indian subcontinent accounts for more than 70% of annual rainfall, which is crucial for socioeconomic development and well-being of this densely populated region of the world. Understanding the finer details of rainfall distribution is also important for many sectors such as agriculture and water resource management. Further, the spatio-temporal variability of monsoon rainfall processes, especially the extreme rainfall events (EREs) over India is quite complex due to its variable topography, availability of moisture sources and circulation patterns. Northwest India, the 'breadbasket' of the country along with Central India are home to a significant fraction of Indian population and intensive urbanization which makes them extremely vulnerable to ramifications of EREs such as flash floods, landslides, agricultural and infrastructural damages, including significant loss of human and animal lives. Such events and the associated variability are in general expected to increase owing to climate change. There are limited reports on the characteristics of EREs over Northwest Indian region. Central India (Monsoon Core Region-MCR), on the other hand has got significant scientific attention but it is yet to be viewed from the eyes of the highest resolution first ever regional atmospheric reanalysis over India, Indian Monsoon Data Assimilation and Analysis reanalysis (IMDAA). Therefore, this forms the main motivation to examine the EREs over Northwest and MCR during Indian Summer Monsoon for the period 1979 to 2018 using precipitation data from India Meteorological Department (IMD) and IMDAA reanalysis available at spatial grid of 0.25 o x 0.25 o and 12 km, respectively. Further, the state-of-the-art IMDAA reanalysis precipitation data has been compared with data from IMD, CPC and TRMM using standard statistical skill scores. Our results reveal that IMDAA produces better spatial rainfall distribution compared to IMD data at monthly and seasonal time scales but rainfall patterns indicate varying degrees of overestimation all over the country. IMDAA realistically represent the ISM salient features such as cross-equatorial flow, low-level jet, monsoon trough, tropical easterly jet, and finer rainfall distribution details. Furthermore, EREs and widespread events from IMD and IMDAA exhibit significant quantitative differences in terms of spatio-temporal trends. IMDAA well captures the regional trends in widespread EREs. Our study critically evaluates the proficiency of newly released high resolution IMDAA reanalysis over Indian subcontinent and its competency in terms of representation of monsoonal features with a global reanalysis, ERA5. With trend analysis of EREs and widespread events, our study will further provide inputs in terms of expected future evolution of monsoon precipitation and extreme rainfall events which could help in mitigation policy framework and infrastructure designing.</p>
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