Quantitative study of atmospheric rivers in the Indian subcontinent

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The principal sources of freshwater in India include precipitation, glaciers, and snowmelt. The former dominates the country's annual river water contribution, which is important for agriculture and livelihood of the residents, and the latter two sources contribute at a much lower fraction in comparison to precipitation to even meet the minimum requirements. However, there is a large degree of variations in their spatio-temporal distribution throughout the country. India receives a major portion of its annual precipitation during the boreal summer (June – September). The well-known but relatively unexplored contributors to precipitation in India are atmospheric rivers (ARs). This study aims to understand the main climatological and dynamical differences between the Indian summer monsoon (ISM) and ARs in boreal summer. Zonal ('u') and meridional ('v') wind speeds, integrated water vapor transport (IVT), and integrated water vapor (IWV) are used to identify distinct features in ARs in the Indian sub-continent that can be used to distinguish them from ISM. The major differences between the two synoptic features were found in the increased zonal wind speed and moisture inputs during AR events, which often result in extreme precipitation and floods. Besides understanding them, the identification of ARs in this region and accounting for their existential contribution to moisture during peak rainfall seasons is critical for further hydrological impacts studies.