Geophysical Research Abstracts
Vol. 21, EGU2019-6260-1, 2019
EGU General Assembly 2019

Influence of the South Asian high intensity variability on the persistent heavy rainfall and heat waves in Asian monsoon regions

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This study investigates the modulation of intensity variation of the South Asian high (SAH) on the persistent heavy rainfall (PHR) and heat wave (HW) events over the Asian summer monsoon regions during summer 1979-2013. The first mode of an empirical orthogonal function (EOF) analysis performed on the standardized subseasonal anomalies at 200-hPa geopotential height over the SAH's main body (20°–35°N, 35°–110°E), reveals the intensity variation of the SAH with a 10-40-day periodicity. The strengthening (weakening) of the SAH's main body is accompanied by negative (positive) OLR anomalies as well as more (less) anomalous rainfall over the Indian subcontinent, southern foot of TP and subtropical East Asia. Using different thresholds, the proportion is about 30% for modest PHR events with set criterion at 15 mm/day, 20 mm/day and can reach up to 40-50% for extreme PHR events with set criterion at 25 mm/day, 30 mm/day, 90th and 95th percentile during the strong phase of SAH. Only about 10-25% of PHR events occur related to weak SAH, suggesting that strong SAH could facilitate extreme PHR events occurrence. The HW events associated with strong SAH account for about 5% over the south and east Asian regions. In contrast, an increase in HW events occurrence is observed during the weak phase of the SAH with ratio up to 20%. Strong SAH is accompanied with intensified updraft flow, less surface solar radiation anomalies, enhanced cross-equatorial moisture flux and western North Pacific moisture flux, which provide favorable conditions for the PHR events. While the mirror image is seen in the weak SAH phase, contributing to the occurrence of HW events. The above analysis indicates the significant modulation and important impact of SAH to predict extreme rainfall and temperature events over the Asian monsoon regions.