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Two different mechanisms of the Asian summer monsoon-ENSO connection

RYUICHI KAWAMURA[1]
[1]*Department of Earth Sciences, Toyama University, Toyama 930-8555, Japan*

Two different mechanisms accounting for the Asian summer monsoon (ASM)-ENSO link are presented using reanalysis data aided by coupled ocean-atmosphere models. One is the direct impact of ENSO on ASM during its growth phase. An upper-level velocity potential anomaly systematically moves eastward from the tropical Indian Ocean to the warm pool region of the western Pacific during the growth phase of ENSO. In the meantime, the ASM variability is directly affected by the evolution of the anomalous Walker circulation. The other is the lagged and indirect impact of ENSO on ASM through land-surface hydrologic processes during its decay phase. An upper-level velocity potential anomaly in the vicinity of the Philippine Sea and maritime continent expands westward into the northern Indian Ocean and South Asia during the decay phase of ENSO. The equatorially asymmetric structures of rainfall and SST anomalies are observed over the tropical Indian Ocean during the pre-monsoon season. These features are one of the major precursory signals of an anomalous ASM. As a remote forcing, anomalous convection over the northern Indian Ocean strongly influences the land surface hydrologic conditions over central and southwest Asia, resulting in anomalous temperatures over the land, which in turn produces a change in the land-ocean thermal contrast.

The coupled models capture features of these two different mechanisms. Since the late 1970s, severe and extended El Ninos with a 4-5 year periodicity have tended to dominate the ENSO cycle. A change in the ENSO cycle after the late 1970s has resulted in a change in the relative importance of the two ENSO impacts on the ASM and ENSO link.

Keywords: Asian summer monsoon; ENSO; Walker circulation; coupled ocean-atmosphere model

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