

Atmospheric moisture budget during winter seasons in the western Himalayan region

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Abstract: Winter precipitation in the western Himalayas occurs under the influence of western disturbances (WDs) that move in synoptic timescale from west to east across the Himalayan region. The main objective of the study is to examine the water vapor budget during life cycles of WDs using the high-resolution global climate forecast system reanalysis data. It is found that over western Kashmir, even in climatological mean, a westerly trough is seen in moisture flux. Precipitation exceeds evaporation over most of Jammu and Kashmir, Hindukush region and the region to the west in winter seasons. Large interannual variability is noticed in all components of the moisture budget in the region. In order to understand the mechanism of moisture transport and atmospheric moisture budget over study area during the life cycle of WDs, an EOF analysis has been carried out using geopotential height at 500 hPa. The first two leading modes represent eastward moving WDs. Composite analysis of moisture budget (both atmospheric and surface) has been made using the dates from the EOF analysis. It is found that large variations in moisture transport occur during different phases of the WDs. When a cyclonic circulation is around 72°E, strong meridional moisture transport (from Arabian Sea) occurs and moisture convergence over western Himalayas enhances precipitation over the region. After the circulation moves further east, moisture convergence decreases and precipitation reduces. However, evaporation amount increases marginally due to clear sky conditions. During the life cycle of WDs, large variation in meridional transport of moisture flux is noticed as compared to zonal transport.