A Relationship between Ural-Siberian Blocking and Himalayan Weather Anomalies

U Tiwari[a], and ABG Bush[a]

[a]Department of Earth and Atmospheric Sciences, University of Alberta, Edmonton, AB, Canada

Because of their distinctly high elevation, the Himalaya are directly influenced by upper-tropospheric Jet stream winds and circulation anomalies that on many occasions have brought unusual weather patterns to the region. In this study, we establish the dynamical relationship between upper-tropospheric blocks formed over the Ural-Siberian region and anomalous weather patterns over the Himalaya using a combination of reanalysis data and regional climate model simulations. We identify two distinct blocks (an omega (Ω) block and a dipole (Rex) block) using an appropriate blocking index and computed the anomalous atmospheric fields associated with these types of blocks.

In both cases, the low-pressure component of the block lies westward of the western Himalaya and the upper-level convergence/divergence of ageostrophic winds along the upstream/downstream portion of the trough creates anomalous positive/negative sea level pressure at the surface. The local sea level pressure is enhanced over the Arabian Peninsula and the Arabian Sea, while downwind over the Himalaya there is a negative pressure anomaly. There is entrainment of high potential vorticity (PV) air that descends and flows equatorward. During the Ω blocking event, the trough is terrain-locked over the western Himalayan notch and its circulation induces moisture transport from the Arabian Sea and the Bay of Bengal leading to strong precipitation events over the western and eastern Himalayan notches. During a dipole blocking event, the trough leads to a widespread precipitation over the entire Himalayan arc. Our results suggest that atmospheric blocking events are important factors controlling precipitation over the Himalayan region and as such they also play a role in the mass balance of Himalayan glaciers. Furthermore, identifying their anomaly patterns can contribute to improved weather forecasts over the Himalayan region.

Corresponding author: utiwari@ualberta.ca