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Eurasian snow cover and Indian monsoon : A new episode of a debated relationship

Y. Peings and H. Douville
CNRM/GAME, Météo-France/CNRS, Toulouse, France (yannick.peings@cnrm.meteo.fr)

Since the pioneering works of Blanford at the end of the 19th century, suggesting that Indian monsoon rainfall could be sensitive to snow conditions over Himalaya, many studies have been devoted to a better understanding of the possible teleconnection between winter/spring Eurasian snow cover and the following Indian monsoon. This issue has been recently revisited at CNRM using a maximum covariance analysis. This statistical tool has been applied on both observations (summer precipitation over India on the one hand, satellite data of snow cover or in situ measurements of snow depth on the other hand) and a subset of global coupled ocean-atmosphere simulations from the CMIP3 database. In line with former studies, the observations suggest a link between an east-west snow dipole over Eurasia and the Indian summer monsoon precipitation. However, our results indicate that this relationship is neither statistically significant nor stationary over the last forty years. Moreover, the strongest signal appears over eastern Eurasia and is not consistent with the Blanford hypothesis whereby more snow should lead to a weaker monsoon. The 20th century CMIP3 simulations provide longer timeseries to look for robust snow-monsoon relationships. Some models do show an apparent influence of the Eurasian snow cover on the Indian summer monsoon precipitation, but the snow patterns are model-dependent and not the same as in the observations. Moreover, the apparent snow-monsoon relationship generally denotes a too strong ENSO (El Niño Southern Oscillation) influence on both winter snow cover and summer monsoon rainfall rather than a direct effect of the Eurasian snow cover on the Indian monsoon. New sensitivity studies with the ARPEGE-Climat model are needed to assess the potential impact of snow anomalies on the monsoon, using climatological sea surface temperature to get rid of the oceanic variability.