Snow-monsoon teleconnections: testing competing mechanisms using idealized snow forcing in a GCM

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Anomalous snow cover in the previous winter/spring has long been regarded as a possible predictor for the Asian summer monsoon. However previous work in this area is inconclusive, both in the mechanism that communicates snow anomalies to the monsoon summer, and even the region from which snow has the most impact. Complex interactions between ENSO and both the monsoon and snow cover further complicate our understanding.

A 1050-year control integration of the HadCM3 coupled model is analysed and shows evidence for weakened monsoons being preceded by strong snow forcing over either the Himalaya/Tibetan Plateau, or West Eurasia. However, EOF analysis of springtime interannual variability in snow cover shows the leading mode to have opposite signs in these regions. Hence competing mechanisms are likely. The simulation of the ENSO-monsoon relationship in HadCM3 is poor however: it suffers from a poorly timed peak during the monsoon summer and incorrect sign the preceding winter.

Ensemble integrations are carried out using the atmospheric component of HadCM3 and a variety of anomalous snow forcing initial conditions obtained from the control integration. Forcing is provided during the previous spring over the Himalaya/Tibetan Plateau and Western Eurasia both alone and in combination. The application of climatological SSTs ensures the absence of any ENSO effects. This study thus aims to elucidate a more detailed understanding of the mechanisms connecting anomalous snow forcing and the Asian summer monsoon through surface hydrology, albedo and circulation changes.