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ユーラシア大陸南部の気候変動が受けるダイポールモード現象のインパクト
Impacts of the Indian Ocean Dipole on climate variations in the southern part of the Eurasian Continent

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Since the discovery of the Indian Ocean Dipole (IOD) in 1999, various regional climate variations have been identified as outcomes of IOD rather than El Nino/Southern Oscillation (ENSO). Here, based on recent studies, we show two typical examples in the southern part of the Eurasian Continent.

Using reanalysis data and snow cover data derived from satellite observations, respective influences of Indian Ocean Dipole (IOD) and El Nino/Southern Oscillation (ENSO) on the Tibetan snow cover in early winter are investigated. It is found that the snow cover shows a significant positive partial correlation with IOD. In the pure positive IOD years with no co-occurrences of El Nino, negative geopotential height anomalies north of India are associated with warm and humid southwesterlies to enter the plateau from the Bay of Bengal after rounding cyclonically and supply more moisture. This leads to more precipitation, more snow cover, and resultant lower surface temperature over the plateau. These negative geopotential height anomalies north of India are related to the equivalent barotropic stationary Rossby waves in the South Asian wave guide. The waves can be generated by the IOD-related convection anomalies over the western/central Indian Ocean.

Using monthly data during 1974-2005 from 183 meteorological stations in the southern part of Iran, the interannual variation of precipitation are examined. The precipitation in this region occurs during the rainy season from October to May. The interannual variation in fall and early winter during the first part of the rainy season shows a significant positive correlation with both IOD and ENSO. However, a partial correlation analysis used to extract the respective influence of IOD and ENSO shows a significant positive correlation only with the IOD and not with ENSO. The southeasterly moisture flux anomaly over the Arabian Sea turns anticyclonically and transport more moisture to the southern part of Iran from the Arabian Sea, the Red Sea, and the Persian Gulf during the positive IOD. During the latter part of the rainy season in late winter and spring, however, the interannual variation of precipitation is more strongly influenced by modes of variability over the Mediterranean Sea. The induced large-scale atmospheric circulation anomaly controls moisture supply from the Red Sea and the Persian Gulf.

Identification of the true cause of regional climate variations is very important for societal applications of climate forecast information.

Keywords: IOD, ENSO, partial correlation, Tibetan snow cover, Iran