Snow depth changes in Spring over the Tibetan Plateau

Jun Matsumoto[1]; Satoshi Hori[1]

[1] Earth and Planetary Sci., Univ. Tokyo

The decadal changes in the spring (March-April) snow depth over the Tibetan Plateau and the associated atmospheric conditions are investigated using station snow depth observation and the ERA-40 reanalysis data for the period of 1961-2002. The time series of SDI (Snow Depth Index), representing interannual variations of accumulated snow depth during March and April over the Eastern Tibetan Plateau, exhibit a remarkable increase in the late 1970s and a decrease at around 1998/99.

To reveal why the interdecadal variation has occurred, at first, synoptic conditions causing snowfalls over the eastern plateau are investigated. It is found that snowfall over the eastern plateau is mainly caused by migrating westerly depressions.

From the comparisons of atmospheric conditions between three eras (1962-1980, 1981-1998, and 1999-2002), during high (low)-SDI period, negative (positive) pressure anomaly center and positive (negative) center are recognized at mid-latitudes including the Tibetan Plateau and at low-latitudes, respectively. These indicate that the meridional pressure gradient between mid-latitudes and low-latitudes is increased (decreased) during high (low)-SDI period. Considering the synoptic conditions causing snowfall, it is suggested that the increase (decrease) of meridional pressure gradient leads to a favorable (unfavorable) circulation field for the occurrence and development of westerly depressions, which brings an increase (decrease) of SDI.

Negative (positive) pressure anomalies at mid-latitudes between periods are caused by low (high) temperature anomalies in full of vertical tropospheric atmosphere and positive (negative) anomalies at low-latitudes are caused by high (low) temperature anomalies in low troposphere. It is suggested that full troposheric low (high) temperature anomalies at mid-latitudes are involved with strong (weak) NAO (North Atlantic Oscillation) and low tropospheric positive (negative) temperature anomalies at low-latitudes are involved with positive (negative) SST anomalies in the tropical Indian Ocean.

The SDI defined in this study has significant positive correlation with winter-NAO index and March-AO index, while it is not significantly correlated with subsequent AIMR (All India monsoon rainfall). There is a tendency that the onset date of the subsequent SCSSM (South China Sea summer monsoon) is earlier (later) in the year with higher (lower) SDI.