

Relationship between stratospheric sudden warmings and mesospheric disturbance in the Arctic region

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Observations of mesospheric temperature and wind by a Rayleigh lidar and MF radar at Poker Flat Research Range (65.1N, 147.5W) are conducted by NICT (National Institute of Information and Communications Technology) and the Geophysical Institute, the University of Alaska, Fairbanks. In this presentation, we present the characteristics of the disturbed conditions and the atmospheric waves in the mesosphere associated with stratospheric sudden warmings (SSWs) at Poker Flat in terms of preconditioning in the stratosphere. So far we analyzed the NICT Rayleigh lidar and MF radar data, and stratospheric assimilation data provided by the United Kingdom Meteorological Office on a period that extends from November 1998 to April 2003.

Six major SSWs occurred during analyzed period. Before major SSWs temperature increasing of 10 - 30 K in the lower mesosphere was observed by the NICT lidar, which observations were conducted only at two major events, and intermittent reversals of East-West wind were also observed by the NICT MF radar at all major SSW events. Just before major SSWs disappearance of temperature peak as stratopause and temperature was almost constant from 40 - 80 km altitude range was seen in the results of two-event observations by the NICT lidar. During major SSWs temperature decreasing of 10 - 20 K in the lower mesosphere was observed by the NICT lidar at two events. At all major events East-West wind reversal (eastward to westward) from 30 - 90 km altitude range was seen by the NICT MF radar observations. This wind reversal starts and descends from mesosphere to upper stratosphere and occasionally to troposphere.

In addition, we analyzed wind data observed by the NICT MF radar in order to investigate characteristics of atmospheric waves in the mesosphere. For example, following results were obtained about analysis of activities of short period waves of E-W direction in 1998 - 1999 winter. Decreasing of activity of those waves was observed at two major SSWs. On the other hand increasing of activity was seen before those SSWs, during which enhancement of eastward wind occurred in the upper stratosphere. Decreasing of activity, however, also observed at the period of intermittent reversal of E-W wind (eastward to westward) in the mesosphere. In addition, temperature increasing in the mesosphere was observed just before the period when short wave activities were increased at the two major SSW events.

We will analyze more data and discuss relationship between characteristics of planetary/tidal/gravity waves in the mesosphere, background wind and temperature in the mesosphere and preconditioning in the stratosphere.