Changes in Stratospheric Thermal Structure and Chemical Composition during a Major Stratwarm Event of 2013

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Ozone mass mixing ratio obtained from both European Centre for Medium Range Weather Forecasting (ECMWF) Reanalysis (ERA)-Interim and Sounding of Atmosphere by Broadband Emission Radiometry (SABER) instrument onboard Thermosphere, Ionosphere, Mesosphere Energetics and Dynamics (TIMED) satellite shows large values in the equatorial upper stratosphere during the occurrence of a major sudden stratospheric warming (SSW) in January 2013 preceded by a large reduction of planetary wave activity. However surprisingly equatorial temperature is found to decrease at pressure levels where the ozone mixing ratio is larger. The computed radiative heating rate using SBDART model also shows positive heating rate indicating that the temperature should increase in response to the ozone accumulation over equator. In addition to radiative heating due to ozone, heating rate due to the other dominant factors, namely, ascending motion and convergence of meridional heat flux which could influence the thermal structure of the equatorial stratosphere, are estimated. It is found that the observed low temperature during the SSW is mainly due to large upward motions. The estimated heating rates agree reasonably well with the observed heating rates at 10-8 hPa indicating the dominance of transport at lower stratosphere. The large discrepancy between the estimated and observed heating rates in the upper stratosphere may be due to the dominance of photochemistry. To study the variations of chemical constituents during the SSW, we investigated the volume mixing ratios (VMR) of different chemical components obtained from Microwave Limb Sounder onboard Aura satellite which show distinct variations at high and low latitudes in the upper stratosphere (30-50 km) during the occurrence of SSW in January 2013. In this study, it is being observed that zonally averaged H_2O VMR (WVMR) is decreasing over equatorial region with the onset of the warming event. Oxidation of methane (CH_4) is the primary source of upper stratospheric water vapour, so probably this change in WVMR is due to change in methane concentration during the SSW. The cause of this HVMR decrease is still under investigation; Further results will be presented during the meeting.