A case study of formation and maintenance of a lower stratospheric cirrus cloud over the tropics

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Abstract:
A rare occurrence of stratospheric cirrus at 18.6 km height persisting for about 5 days during 3-7 March 2014 is inferred from the ground-based Mie lidar observations over Gadanki (13.5\textdegree\ N, 79.2\textdegree\ E) and spaceborne observations. Due to the vertical transport by large updrafts on 3 March in the troposphere, triggered by a potential vorticity intrusion, the water vapour mixing ratio shows an increase around the height of 18.6 km. Relative humidity with respect to ice is 150\%, indicating that the cirrus cloud may be formed though homogeneous nucleation of sulphuric acid. Once formed, the tropical cirrus clouds can normally persist for several hours to several days. In the present study, the cirrus cloud persisted at least 5 days. Large upward motions and cold temperature anomalies induced by equatorial waves would be required for the persistence of cirrus clouds (Boehm et al., 1999). The Gadanki radiosonde and COSMIC RO temperature anomaly shows alternate warm and cold anomalies propagating downward during 28 February-8 March in the height region of 17–19 km, indicating the presence of a wave having a 4-day periodicity. The presence of cold anomalies on 4-7 March at a height where cirrus is observed is suggested as a reason for the maintenance of the cirrus cloud for about 5 days.