Characteristics of Global Multiple Tropopause as Observed with Radio Occultation Measurements from COSMIC

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Abstract: In this study, the spatiotemporal structure of the climatology of multiple tropopauses (MTs) is presented by using the temperature profiles from the Global Positioning System (GPS) radio occultation (RO) measurements from the Formosa Satellite-3/Constellation Observing System for Meteorology, Ionosphere and Climate (FORMOSAT-3/COSMIC) mission between Jan. 2007 and Dec. 2012. The global distributions of the percentage occurrence of double tropopauses (DTs) in different seasons are given and the relationship between the occurrence of DTs and jet streams is discussed. The inter-annual variations and the trends of the occurrence of DTs are studied. The statistical distributions of the height of MTs at different latitudes are shown and the seasonal differences in the meridional distributions of MTs are analyzed. Our results agree well with those of earlier studies based on other data sets. In addition, we find some new MT features. A global increase of the occurrence of DTs is found between 2007 and 2012. There is an increasing trend of the occurrence of DTs in the extra-tropics, especially in the subtropics in both hemispheres, and a decreasing trend in the tropics. We also find that the maximum seasonal variation of the occurrence of DTs is located between 30° N to 40° N, which is much stronger than that in the SH. The occurrence of DTs is much lower from the winter of 2009 to the spring of 2010 than during the same time period of other years.