



Eof analysis of the formosat-3/cosmic satellite observations on the longitudinally averaged vertical thermal structure of the troposphere and stratosphere in the year 2008

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This paper aims to describe the longitudinally averaged vertical thermal structure of the troposphere and stratosphere as observed by the FORMOSAT-3/COSMIC GPS Occultation Data. Each file gives atmospheric profile without moisture information. Previous literature states that describing stratosphere-troposphere exchange by a single mass transport rate between the two has limited utility [1]. Deriving a level 3 satellite data set from the aforementioned level 2 satellite data set, this paper describes the characteristics of the longitudinally averaged vertical thermal structure of the troposphere and stratosphere in the year 2008 by applying an Empirical Orthogonal Function Analysis on the structure. Results show that the lowest temperatures are located at around 15 km above both poles and the equator and the highest temperatures are located at around 45 to 50 km with latitudinal location showing a temporal relationship with the location of the sun. Also, there exists an area of constant temperature of around 240 K from 10 km to 35 km over the tropics and subtropics. This area forms a bridge between the troposphere and stratosphere. Furthermore, during summer and autumn, the bridge experiences an increase in temperature that forms a gap within it. The temperature in this gap is at around 250 K. Applying the EOF Analysis on the 2008 average structure, the highest mode, Mode 1 (75.65%) shows a spatial structure wherein there is an area from 30N to 60N and also from 30S to 60S both with a height from 5 km altitude to 40 km altitude. Mode 2 (18.71%) shows a spatial structure wherein there is an area of high temperature from 30N to 30S and 5 km to 10 km altitude which is below as spatial structure similar in dimensions but on top of the later that shows low temperature. Mode 3 (4.95%) shows a spatial structure wherein there is an area from 60S to 90S and 30 km to 50 km of high temperature and an area from 60N to 90N and 30 km to 50 km of low temperature. This study concludes that despite the extreme differences of the Troposphere and Stratosphere, from Mode 1 of the EOF Analysis, we can see that the overall structure from the Troposphere and Stratosphere is heavily due to a 'bridge – like' phenomenon between the two layers.

References:

1. Holton, James R., Peter H. Haynes, Michael E. McIntyre, Anne R. Douglass, Richard B. Rood, and Leonhard Pfister. "Stratosphere-troposphere Exchange." *Review of Geophysics* 33.4 (1995): 403-39. [Http://www.agu.org/](http://www.agu.org/). Web. <<http://www.agu.org/journals/rg/v033/i004/95RG02097/95RG02097.pdf>>.