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Influence of topography onto the temperature variation around the tropical tropopause layer

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The tropical tropopause layer (TTL) is a region where the tropospheric air passes through before entering the stratosphere. Since this region is very cold, the air from the troposphere is dehydrated around here. It is known the Kelvin wave around the TTL affects the big temperature variation and strong dehydration. We investigated the temperature variations around the TTL using the Nonhydrostatic Icosahedral Atmospheric Model (NICAM) on December 2006 (Miura et al. 2007). We found that the temperature variations associated with Kelvin waves are very large over the mountain regions. The amplitude is about 2-times larger than that over the ocean even on the same latitude. We think this result would be a new scientific discovery from simulations or finding of unknown biases of simulations. In this study, we investigate the influence of the topography on the temperature variations around the TTL using the NICAM, re-analysis, satellite, and radiosonde data. We used the Constellation Observing System for Meteorology, Ionosphere, and Climate (COSMIC) data as a satellite data in December, January and February from 2006 to 2010 in order to investigate the temperature variations. The large temperature variations (standard deviation) were found over the mountain regions. This result satisfies the 90% statistical significance level, but the number of data samples is a few. We investigated some reanalysis data having different horizontal resolutions. The standard deviations of the TTL temperature near mountains became large as the horizontal resolution of the model became high. We checked a reanalysis data of the Year of Tropical Convection (YOTC) data from ECMWF with a horizontal resolution of 0.125 degree. When Kelvin waves passed through over the Western Pacific, the amplitude of temperature was large about 2 K over the mountain regions. The power spectrum in the mountains between 7 days and 12 days was actually larger comparing with the ocean. We compared the two local radiosonde data in Jambi and Kototabang (near mountains region). We found that there was no clear difference of temperature variation. Although the temperature variations at Kototabang were slightly large, it is associated with local diurnal variations but not the wave activities. In this study, we found large temperature variation over the mountain in the observational data and numerical models. We would discuss present results and the possibility of this work.