



Abnormal Vertical Structure of Water Vapor over Taklamakan Desert from COSMIC Observations

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Water vapor is an important greenhouse gas. The vertical structure of the water vapor has a great impact on the weather and the climate. The Taklamakan desert is the largest desert in China, surrounded by a series of high mountains. The vertical structures of the water vapor over the Taklamakan desert have rarely been described by former research, due to the lack of conventional observations.

This work is the first result of the water vapor vertical structure over the Taklamakan desert and its surroundings (35N-47N, 75E-94E) from the COSMIC occultation observations. Analysis found that a humid layer frequently occurs at the average height of 4800m. An "abnormal profile" was defined if a peak was observed in mid-troposphere in the humidity profile. This "abnormal profile" appeared in 24% of the total profile and appeared much more often inside the desert than outside during the year 2008 to 2010.

Based on model analysis, two possible mechanisms were proposed to explain the reason of the formation of the abnormal profile. Through the statistics, 53% of total "abnormal profiles" were due to the transported water vapor topographic uplift effect, the topography of the desert forces the east-blowing wind to climb the surrounding mountains, bringing the low-altitude water vapor to mid-troposphere above the desert. The rest were due to the lack of water content in the air close to the ground.

This new discovery and its possible explanations will help us to understand more about the climate of the Taklamakan desert and possibly also other similar regions.