

## The longterm trend of temperature in mesopause region between 1990 and 2020

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The mesopause in the upper atmosphere is a boundary between mesosphere and thermosphere with the coldest atmospheric temperature. It is formed mainly by the combining effects of radiative cooling of CO<sub>2</sub> and the vertical adiabatic circulation in the upper atmosphere. A continuous multidecade nocturnal temperature data base of an advanced Na lidar between 1990 and 2020, obtained in USA at middle latitudes, provides an unprecedented opportunity to study the longterm variations of this important atmospheric boundary. In this paper, in addition to the temperature longterm trend in mesosphere and lower thermosphere, we focus on the longterm trend of radiative mesopause mostly during winter and dynamic mesopause during summer, including mesopause height and temperature longterm variations. A longterm study by Whole Atmosphere Community Climate Model with thermosphere and ionosphere extension also indicated the similar mesopause changes, mostly caused by stratosphere and lower mesosphere cooling and contraction.

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