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Research Article

Comparisons of the Generalized Potential Temperature in Moist Atmosphere with the Equivalent Potential Temperature in Saturated Moist Atmosphere

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Abstract

The real tropospheric atmosphere is neither absolutely dry nor completely saturated. It is in general moist but not saturated. Here the generalized potential temperature (GPT) was introduced to describe this humid feature of real moist atmosphere. GPT's conservation property in moist adiabatic process was discussed and proved. Comparisons of GPT in moist atmosphere with the equivalent potential temperature (EPT) in saturated moist atmosphere were made by analyzing three torrential rain cases occurring over Jianghuai Valleys in 2003, the north China in 2004, and with the typhoon Fung-Wong in 2008, respectively. Results showed that the relative humidity is not up to 100% even in torrential rain systems, the saturated condition for EPT is not always held, and thus GPT can describe the moisture concentration and moisture gradient better than EPT. The GPT's definition includes the process that the air changes from dry to moist, then up to saturated. Therefore, potential temperature (PT) and EPT can be considered as its two special status. Similar as PT and EPT, GPT can be used to study atmospheric dynamic and thermodynamic processes more generally because of its conservation property in moist adiabatic process.

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