Impact of tropical tropopause layer cooling trend on extreme deep convection in Asian-African sector

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Previous studies have suggested that the recent increase in tropical extreme deep convection, in particular over Asia and Africa during the boreal summer, has occurred in association with a cooling in the tropical lower stratosphere. The present study is focused on the Sahel region of West Africa, where an increased occurrence of extreme precipitation events has been reported over recent decades. The results show that the changes since the 1980s involve a cooling trend in the tropical lower stratosphere and tropopause layer, combined with a warming in the troposphere. This feature is similar to that which might result from increased greenhouse gas levels. It is suggested that the decrease in the vertical temperature gradient in the tropical tropopause region enhances extreme deep convection where penetrating convection is frequent, whereas tropospheric warming suppresses the shallower convection. The essential feature of the recent changes over the tropics is therefore the depth of convection, rather than the total amount of surface precipitation. This could enhance cooling in the lower stratosphere through decrease in ozone concentration.