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Diurnal variation of upper tropospheric humidity and its relations to convective activities over tropical Africa

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Abstract. Diurnal variations of upper tropospheric humidity (UTH) as well as middle tropospheric humidity (MTH) were examined in conjunction with the diurnal cycle of convection over tropical Africa and the adjacent tropical Atlantic Ocean using Meteosat-8 measurements. Cloud and humidity features were also tracked to document the diurnal variations of humidity and clouds in the Lagrangian framework.

A distinct diurnal variation of UTH (and MTH) is noted over regions where tropical deep convective cloud systems are commonly observed. The amplitude of the UTH diurnal variation is larger over land, while its variations over convectively inactive subtropical regions are much smaller. The diurnal variation of UTH tends to reach a maximum during nighttime over land, lagging deep convection and high cloud whose maxima occurred in the late afternoon and evening, respectively. It was revealed that these diurnal variations over the African continent are likely associated with continental-scale daytime solar heating and topography, in which topographically-induced signals develop earlier around the mid-afternoon and merge into stronger and broader continental-scale convection clusters later, forming a precipitation maximum in the late afternoon. It was also revealed that advection effect on the diurnal variation appears to be insignificant.

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