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Horizontal structure of the radiative heating rate in the tropical tropopause layer

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Most of the troposphere to stratosphere transport (TST) takes place in the tropical tropopause layer (TTL). Deep convection lifts air to the lower boundary of the TTL. Above this level vertical motion is primarily determined by radiation, where heating causes up-welling and cooling down-welling motion. The cloudless sky radiation budget is controlled by the vertical distribution of trace gases (water vapour, ozone, and CO2) and temperature. Additionally water and ice clouds strongly modify the radiative heating budget. Their influence depends on cloud height, cloud optical thickness, and multilayer overlap, which is subject of ongoing research, e.g. Corti et al. (2005), Fueglistaler and Fu (2006). But in most recent papers the spatial variation of the radiative heating rate is not considered at all or only in rough approximation.
In this study the radiative heating budget in the TTL is examined under particular consideration on its horizontal and temporal variation. In order to achieve the required high spatial and temporal resolution of the simulation a cloud data set from Mayer et al. (2006) derived from Meteosat Second Generation observations is used as input data set for clouds. For temperature and trace gas profiles ERA40 reanalysis data is used. The radiative transfer simulations are carried out for cloudless and for cloudy sky in order to separate the contributions of trace gases and clouds. Furthermore the implications on the radiatively driven vertical mass flux in the TTL region are discussed.
References:
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