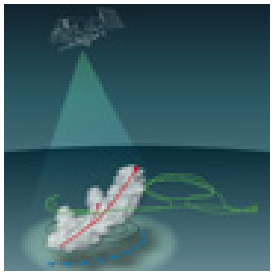

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Three-dimensional radiative transfer around a tropopause fold

Wednesday, 11 March 2020 11:35 (25 minutes)

Tropopause folds are characterized by strong horizontal gradients of temperature, water vapor, and cloud. The two-stream radiation schemes used in almost all weather and climate models ignore this variability. Using the Monte Carlo code MYSTIC, we have computed thermal infrared heating rates for a two-dimensional cross-section of an upper-level front in a NAWDEX event, based on thermal and moisture fields generated by high-resolution simulations using the COSMO model. The impact of the horizontal radiative fluxes is surprisingly small.
Studies using idealized atmospheric cross-sections show that temperature gradients are the largest driver of net radiative cooling, however where the tropopause is vertical and the horizontal gradients in moisture variables are strongest, the horizontal temperature gradient is weak. This structure results from dynamical constraints: the maximum in isentropic PV gradient at the vertical tropopause is associated with a maximum in jet strength, which by thermal wind balance corresponds to a minimum in horizontal temperature gradient.

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