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A numerical study of tropical cross-tropopause transport by convective overshoots during the TROCCINOX golden day

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Observations obtained during the Tropical Convection, Cirrus and Nitrogen Oxides (TROCCINOX) golden day have revealed the presence of ice particles up to 410 K (18.2 km) 2 km above the local tropopause. The case is investigated using a three-dimensional quadruply nested non-hydrostatic simulation and Meteosat Second Generation (MSG) observations. The simulation fairly well reproduces the measurements along the flight track. A reasonable agreement with MSG observations is also achieved: the 10.8-μm brightness temperature (BT) minimum of 187 K is reproduced (a value 6 K colder than the environmental cold-point temperature) as well as the positive BT difference between the 6.2- and 10.8-μm bands, an overshoot signature. The simulation produces several overshooting plumes up to 410 K yielding an upward transport of water vapour of a few tons per second across the tropical tropopause. The estimated mass flux agree with those derived from over tracer budgets indicating that convection transport mass across the tropopause.