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A numerical study of tropical cross-tropopause transport by convective overshoots

J.-P. Chaboureau¹, J.-P. Cammas¹, J. Duron¹, P. J. Mascart¹, N. M. Sitnikov², and H.-J. Voessing³

¹Laboratoire d'Aérodynamique, Université Paul Sabatier and CNRS, Toulouse, France

²Central Aerological Observatory, Dolgoprudny, Russia

³Institute for Atmospheric Physics, University of Mainz, Germany

Abstract. 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 was investigated using a three-dimensional quadruply nested non-hydrostatic simulation and Meteosat Second Generation (MSG) observations. The simulation reproduced the measurements along the flight track fairly well. A reasonable agreement with MSG observations was also achieved: the 10.8- μm brightness temperature (BT) minimum of 187 K was reproduced (a value 6 K colder than the environmental cold-point temperature) as was the positive BT difference between the 6.2- and 10.8- μm bands, an overshoot signature. The simulation produced 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 agrees with those derived from over tracer budgets, indicating that convection transports mass across the tropopause.

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