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Observations of a deep tropopause fold over Darwin during ACTIVE and SCOUT-O3 - Implications for the TTL and local meteorology

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The meteorology of the Darwin (Northern Australia) region and the nearby Tiwi Islands is of particular interest due to the potential influence of frequent deep-convective storms on stratosphere-troposphere exchange. Such meteorology and convective transport has been the subject of intense study during the simultaneous and synergistic ACTIVE (Nov 2005 - Feb 2006) and SCOUT-O3 (Nov-Dec 2005) campaigns, which combine low and high altitude aircraft measurements over the Darwin and Tiwi Island region and includes a series of ozonesondes launched throughout ACTIVE. In this paper we discuss ozone soundings recorded from Darwin Airport in November and December 2005 which show evidence for stratosphere-to-troposphere transport of dry, ozone-rich air over Northern Australia in an unusually deep and unusually placed tropopause fold, both in terms of its geographical location and low latitude, and its extent into the lower free troposphere. The potential role of such thick layers of dry, ozone-rich air in the free troposphere are investigated here in the context of local and regional convective inhibition and intensity using a large eddy model of so-called Hector island thunderstorms, with a comparison to 3D polarimetric radar observations, as well as available meteorological fields and satellite imagery provided by the Australian Bureau of Meteorology. In addition to the potential for convective perturbation, the presence of such chemically perturbed layers of air in the free troposphere may also affect local chemistry, and subsequently the composition and chemistry of the TTL by later uplift in deep tropical convection.