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Observations of a tropopause fold over NW Australia during the ACTIVE campaign- Implications for tropical convection

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Factors affecting the intensity and frequency of deep tropical convection are important in determining the tropical radiation budget and troposphere-to-stratosphere exchange rates. This work discusses two periods of dramatically reduced rainfall and cloud cover over a large area of NW Australia in November 2005, which coincided with the presence of a dry pool over the region. This dry pool was deposited by two tropopause folds associated with breaking Rossby waves on the Southern Sub-tropical Jet, which penetrated the tropics as far north as 10 degS. Ozone and radiosondes launched from Darwin, Australia, between 23 November 2005 and 27 November 2005 as part of the Aerosol and Chemical Transport in tropIcal conVEction (ACTIVE) aircraft campaign, show deep layers of characteristically stratospheric ozone-rich, low-humidity (less than 10%) air extending to 700 hPa over this period with ozone concentrations of up to 100 ppbV within such layers; exceeding climatological averages by a factor of three. Back trajectories and ECMWF fields are used to demonstrate the passage of these tropopause folds, with MTSAT-1R water-vapour and TOMS satellite ozone fields showing a resultant dry, ozone-rich pool residing over a large area of North West Australia during this period. Analysis of MTSAT-1R-derived cloud statistics and land-based rain gauges over the same area show markedly reduced precipitation and cloud cover during this time, with remaining convection confined to coastal zones. This reduction in convective activity is expected to be due to the entrainment of very dry air into developing convective cells, evaporating cloud droplets in developing convection.

The frequency of such tropopause fold events and their potentially important impact on tropical convection is currently poorly characterised. These observations illustrate this importance and highlight the need for such processes to be considered in studies of tropical deep convection and tropical tropospheric chemistry.