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Wind, pressure and temperature fields near tornadic and non-tornadic narrow cold-frontal rain bands

Matthew Clark (1) and Douglas Parker (2)

(1) Observations Research and Development, Met Office, Exeter, United Kingdom (matthew.clark@metoffice.gov.uk), (2) School of Earth and Environment, University of Leeds, Leeds, United Kingdom

Narrow cold frontal rain bands (NCFRs) occur frequently in the UK, especially in the autumn and early winter months. Tornadoes and other instances of localised wind damage have been documented in association with meso-gamma-scale vortices ('misocyclones') that sometimes form along the zone of strong horizontal wind shear at the leading edge of the NCFR. A climatology of NCFRs has been constructed for the period 2004 – 2014, using an archive of composite radar rainfall data. Over this 11-year period, 227 NCFRs meeting basic intensity, size and longevity criteria are identified. Tornado data from the Tornado and Storm Research Organisation (TORRO) reveal that 44 of these NCFRs (19.4%) produced at least one tornado.

Wind, pressure and temperature fields are analysed for a subset of cases, using ECMWF reanalysis, automatic weather station and wind profiler data. We describe some differences between tornadic and non-tornadic NCFRs, with particular emphasis on the near-surface wind fields post-front. We discuss the potential utility of these results for the forecasting of NCFR tornado risk.