

Vertical structure of western disturbances in the subtropical jetstream and mechanisms associated with extreme rainfall in South Asia

Kieran HUNT¹, Andrew TURNER^{1,2}, Len SHAFFREY¹

¹ *Department of Meteorology, University of Reading, UK*

² *NCAS-Climate, University of Reading, UK*

Western disturbances (WDs) develop initially as cyclonic perturbations in the subtropical westerly jet (STWJ), and are typically incident on northern India about six times per month during the winter (Dec-Mar) season. They are often associated with heavy, sometimes extreme, rainfall events in and around the Karakoram region of northern India and Pakistan; yet the governing dynamics of both WDs and their associated rainfall remain fairly elusive, largely due to the case-study nature of previous attempts at understanding them.

Here, a novel tracking technique is applied to 38 years of reanalysis data to produce a database of over 3000 WDs. Events from this database are then interrogated using both Lagrangian and Eulerian approaches, providing a unique insight into the dynamic and thermodynamic development of these systems, and their interaction with the complex orography in northern India. The first detailed discussion on the three-dimensional structure of WDs is also presented, and it is shown that WD frequency is a strong function of STWJ position. Finally the mechanisms behind associated extreme rainfall events are explored from both Eulerian and Lagrangian perspectives.

Key words: western disturbances, subtropical jet, baroclinicity, India