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The influence of the El Niño Southern Oscillation on cool-season rainfall variability in southeastern Australia from a weather system perspective

Seraphine Hauser (1), Christian Grams (1), Shayne McGregor (2), Michael Reeder (2), and Julian Quinting (1)

(1) Institute of Meteorology and Climate Research, Department Tropospheric Research, Karlsruhe Institute of Technology, Eggenstein-Leopoldshafen, Germany (seraphine.hauser@partner.kit.edu), (2) School of Earth, Atmosphere and Environment, Monash University, Clayton, Australia

The El Niño Southern Oscillation (ENSO) is typically associated with below average cool-season rainfall in southeastern Australia. However, there is also a large case-to-case variability. Despite recent progress in understanding the linkage of remote climate drivers and this variability, the dynamical processes by which the drivers transmit their influence on rainfall are not fully understood. With this study, we aim to advance the dynamical understanding by combining a set of four clusters of monthly rainfall anomalies over southeastern Australia and a novel dataset of objectively identified weather systems derived from ERA-Interim reanalyses.

First examinations of the large-scale atmospheric flow highlight the influence of the location of anomalous midlatitude ridging on the spatial rainfall variability. Above average cool-season rainfall over southeastern Australia during El Niño (Cluster 1) is associated with enhanced activity of cut-off lows systems forming over the Great Australian Bight west of a blocking anticyclone. Conversely, anomalous high pressure over almost the entire continent suppresses the eastward movement of rain-bearing weather systems leading to below-average rainfall in the area (Cluster 2). Although the enhanced activity of warm conveyor belts connected with East Coast Lows over the Tasman Sea seems to be the main contributor to rainfall along the east coast in non-El Niño years, anomalous high rainfall east of the Great Dividing Range during El Niño events (Cluster 3) can be explained by the presence of cut-off lows. In contrast, enhanced westerlies due to a deep trough south of Australia support the movement of rain-bringing weather systems over southeastern Australia and enhance rainfall west of the Great Dividing Range (Cluster 4).