

# **Projected changes in cut-off lows and their implications for North American extreme precipitation events**

Abstract:

Cut-off low (COL) pressure systems, synoptic-scale phenomena with substantial influence on regional weather patterns, raise critical concerns regarding their dynamics in a changing climate. However, uncertainties persist regarding future COL changes and their attributes. This study investigates future changes in COLs and their impacts in North America, using a multimodel ensemble of state-of-the-art climate models from the Coupled Model Intercomparison Project Phase 6 (CMIP6), with spatial resolutions from 250 to 50 km. Employing a feature tracking algorithm to a common set of models, encompassing historical simulations (1980-2009) and future projections (2070-2099) under a high-level greenhouse gas emission scenario (SSP585), comprehensive insights emerge concerning projected COL changes, including frequency, intensity and precipitation patterns across North America's seasons. Our findings show a notable, consistent increased COL track density in summer in the northeast Pacific and western United States (US), contrasting with a robust decrease during winter and spring. While climate models exhibit limited confidence in predicting COL intensities, projections indicate a robust increased precipitation in a future climate, with more intense and concentrated rainfall in winter and spring and more widespread rainfall in autumn. The projected increase in extreme precipitation events draws attention to the importance of understanding COL-related precipitation dynamics for climate change adaptation strategies.

Keywords: Cut-off lows, CMIP6, multimodel ensemble, climate projections, extreme precipitation events, North America.