



## **A 305 year monthly rainfall series for the Island of Ireland (1711-2016)**

Conor Murphy (1), Ciaran Broderick (1), Tim Burt (2), Catriona Duffy (1), Neil Macdonald (3), Tom Matthews (4), Mark McCarthy (5), Donal Mullan (6), Simon Noone (1), Ciara Ryan (1), Peter Thorne (1), Seamus Walsh (7), and Robert Wilby (8)

(1) Maynooth University, Irish Climate Analysis and Research UnitS (ICARUS), Geography, Maynooth, Ireland (conor.murphy@nuim.ie), (2) Department of Geography, Durham University, South Road, Durham DH1 3LE, UK., (3) School of Environmental Sciences, University of Liverpool, Liverpool, UK., (4) School of Natural Sciences and Psychology, Liverpool John Moores University, Liverpool, Merseyside, UK, L3 3AF., (5) Met Office, Hadley Centre, Fitzroy Road, Exeter, EX1 3PB, UK, (6) School of Natural and Built Environment, Queen's University Belfast, UK, (7) Climatology and Observations Division, Met Éireann, Dublin, Ireland., (8) Department of Geography, Loughborough University, UK.

This paper derives a continuous 305 year monthly rainfall series for the Island of Ireland (IoI) for the period 1711-2016. Two key data sources are employed: i) a previously unpublished UK Met Office Note which compiled annual rainfall anomalies and corresponding monthly per mille amounts from weather diaries and early observational records for the period 1711-1977; and ii) a long term, homogenised monthly IoI rainfall series for the period 1850-2016. Using estimates of long term average precipitation sampled from the quality assured series the full record is reconstituted and insights drawn regarding notable periods and the range of climate variability and change experienced. Consistency with other long records for the region is examined, including: the England and Wales Precipitation series (EWP; 1766-2016); the early EWP Glasspoole series (1716-1765) and the Central England Temperature series (CET; 1711-2016). Strong correspondence between all records is noted from 1780 onwards. While disparities are evident between the early EWP and Ireland series, the latter shows strong decadal consistency with CET throughout the record. In addition, independent early observations from Cork and Dublin, along with available documentary sources, corroborate the derived series and add confidence to our reconstruction. The new IoI rainfall record reveals that the wettest decades occurred in the early 18th Century, despite the fact that IoI has experienced a long-term winter wetting trend consistent with climate model projections. These exceptionally wet winters of the 1720s and 1730s were concurrent with almost unprecedented warmth in the CET, glacial advance throughout Scandinavia, and glacial retreat in West Greenland, consistent with a wintertime NAO-type forcing, but with an amplitude unparalleled in the contemporary era. Our study therefore demonstrates the value of long-term observational records for providing insight into the natural climate variability of the North Atlantic region.