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Relative homogenisation of a dense monthly precipitation station network in Ireland

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During the long period of climatic observations, station location, instrumentation and other aspects of observations may change, resulting in non-climatic temporal variation in the observed data. Such non-climatic changes affect the accuracy of observed data for application to the detection of climate change and climate variability. However, accurate climate data is essential for basing climate related decision making on, and homogenised climate data are becoming integral to efforts to deliver climate services. The aim of homogenisation techniques (i.e. procedures combining detection and correction) is the removal or reduction of any spurious non-climatic signal introducing inhomogeneities to the time series being investigated.

Although statistical homogenisation has a century long history, the theory and development of multiple break homogenisation appeared only in the 1990s coincident with the more widespread use of personal computers. One early representative of such multiple break methods was PRODIGE (Caussinus and Mestre 2004). During the European project COST ES0601 (known as 'HOME', 2007–2011) two new multiple break methods were created based on PRODIGE: one is Homogenisation software in R (HOMER, Mestre et al., 2013), the interactive homogenisation method officially recommended by HOME and the other is the fully automatic ACMANT (Adapted Caussinus–Mestre Algorithm for homogenising Networks of Temperature series, Domonkos, 2011) extended later to precipitation homogenisation (Domonkos, 2015). Both HOMER and ACMANT provide additional functionality compared to the parent method PRODIGE, and they are assumed to be the most efficient relative homogenisation methods currently available.

Relative homogenisation is more robust than absolute methods provided station records are sufficiently correlated, and ideally where reliable metadata and station histories to account for breaks and potential outliers are available. A homogenisation analysis is provided for 299 of the available precipitation records for the island of Ireland using state of the art relative homogenisation methods. The HOMER and ACMANT programmes were applied to this network of station series (1941-2010) where the relative proportion of missing monthly values varied. Some key findings include;

• HOMER has a lower tolerance of missing values by comparison with ACMANT;
• ACMANT is better suited to the automation and rapid processing of larger networks, but offers no scope for metadata integration or for graphical interpretation by the user;
• By comparison HOMER offers metadata integration and excellent graphical support for the user, but is better suited to small-medium networks and interactive use in the current state of development.

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