Introduction

Motivation: Climate change studies based only on raw long-term data are potentially flawed due to the many breaks introduced from non-climatic sources, consequently quality controlled and homogenised climate data is desirable for biasing climate related decision making. This reflects a growing demand for climate information or climate services more generally for use across a range of decision-making environments. Seasonal cycles of precipitation in Ireland are projected to become more marked as the climate changes, and regional extremes in summer dry spells and winter precipitation have been recorded in recent years. Therefore to analyse and monitor the evolution of precipitation patterns across Ireland, quality controlled and homogenised climate series are needed.

Aims and objectives: To compare the results of two modern relative homogenisation methods (HOMER and ACMANT) for a medium sized network of 333 series (IENet) from the Met Éireann monthly precipitation series network for the 1941–2010 period (Figure 1).

Study area: The study area is the whole island of Ireland, that covers ~84 421 km² on the Atlantic margin of northwest Europe, between ~51° and 56° N. Elevations reach up to 1038 m above sea level (a.s.l) (Corrian Tuathail, Co. Kerry) although much of the island is lowland, partly surrounded by mountains, with a characteristic temperate oceanic climate. On average, annual precipitation ranges from 750 to 1000 mm in the drier eastern half of the country and >3000 mm yr⁻¹ in parts of the western mountains (Rohan 1986).

Results

HOMER break detections: Two hundred and thirty five stations were found to be homogeneous, but 120 breaks were detected by HOMER across the other 98 stations and multiple breaks were found in 22 records. To date 69 breaks have metadata support and metadata is awaited for some further station records. HOMER correction amplitudes for inhomogeneities in the series ranged from -0.61 to +0.77 (Figure 2).

ACMANT break detections: ACMANT consistently detected more breaks than HOMER in all decades, with the biggest disparities in break detection rates in the 1950s and 1960s (Figure 2). One hundred and seven stations were found to be homogeneous, but 224 breaks were detected by ACMANT across the other 226 stations and multiple breaks were found in 132 records.

The spatial locations of multiple break detections for the IENet series were different between HOMER (Figure 3a) and ACMANT (Figure 3b). In addition, there are regional differences, HOMER e.g. detected more multiple breaks associated with stations in the mountains of the SW. Whereas ACMANT detected more multiple breaks in stations across the country compared to HOMER.

Discussion

The mean value for candidate and reference series for IENet across the networks defined by HOMER was 0.90 and the overall mean network range of r was 0.85-0.95. HOMER was first run on all series with known outliers included, and the results scrutinised; series were then re-processed in HOMER following the removal of outliers. However, the distribution of years with breaks detected by HOMER remained the same, indicating that for IENet break detection by the programme is not sensitive to outliers.

Amplitude provides an indication of the magnitude of breaks detected as well as the amount of adjustment needed to correct the inhomogeneity. For the results with HOMER, across all stations and detected breaks the mean correction amplitude was 100.22. A combination of the density of the network and high correlation coefficients between the station series (reflecting a maritime climate) are allowing both HOMER and ACMANT to detect relatively small breaks.

Conclusions and ongoing work

• HOMER consistently detects less breaks than ACMANT for the current IENet precipitation series. ACMANT detects more overall and more multiple breaks than HOMER, and with a different spatial pattern of detections.
• For the 120 breaks identified by HOMER, 89 (~74%) were confirmed by the metadata. However, metadata were not available for all the station series in the current network.
• The spatial characteristics of the IENet precipitation records (a dense network) allied to the climatic characteristics of a maritime region (relatively low amplitudes of variation) result in highly correlated series. These properties of the data and the network are useful for the test application of relative homogenisation methods to the preserved series.
• The analysis using ACMANT has been extended to a wider network of 700+ series and the results are being processed. However, it is unlikely that full metadata support will be available to check all the ACMANT detections across this larger network. Despite considerable effort it has not been possible to apply HOMER to this larger network due to complications with missing data in many of the series.
• We consider that by using Ireland as a case study, the prospects for evaluating variations in network density on the break detection frequency of methods such as HOMER and ACMANT for real world precipitation time series are excellent.

References