2.2 Rainfall

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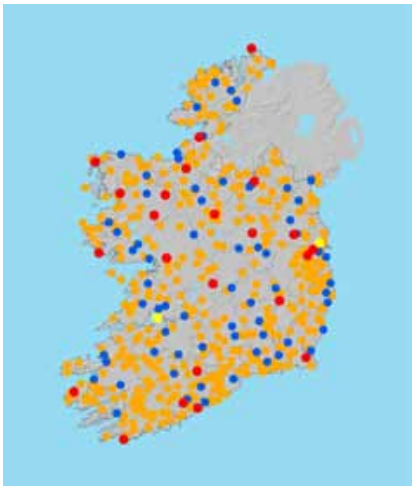
Rainfall (precipitation) plays a vital role in the water cycle and water balance and is essential for the maintenance of life. Because there can be a high variability in rainfall amounts over space and time, a dense network of ground measurement locations is required. Analysis indicates that globally rainfall amounts over land areas have increased by approximately 1% per decade over the twentieth century. In Europe the number of very wet days has increased over the last 50 years. The pattern, timing and intensity of such rainfall will have significant impacts on human society and the environment.

Photo: © Margaret O'Shea



Map 2.2. Location of rainfall observation stations.

Measurements

Rainfall has been measured in Ireland since the early nineteenth century with a peak of over 800 rainfall stations in the late 1950s. Currently rainfall is recorded at synoptic (red and yellow) and climatalogical (blue) weather stations; in addition, there is a wide network of voluntary rainfall observers (orange). At the 25 synoptic stations, readings are made every minute; at climate and rainfall stations a daily rainfall total is recorded. There are also a number of rain gauges in remote locations which are read once a month. Data from rainfall stations are available in digital format from January 1941. Rainfall radars at Dublin and Shannon airports (yellow) are used to infer up-to-the-minute precipitation extent and intensity across the country.

Precipitation can be inferred from measurements made by satellite sensors such as that on board the US Defense Meteorological Satellite Programme (DMSP) series. This is particularly important over oceans and in land areas with few ground-based sensors. An international collaborative programme will see the launch of a constellation of satellites from 2014 as part of the Global Precipitation Measurement (GPM) mission.

'There has been an increase in average annual national rainfall of approximately 60 mm or 5% in the period 1981 to 2010, compared to the 30-year period 1961 to 1990.'

Time-series and Trends

An analysis of annual rainfall totals, based on gridded data averaged over the area of Ireland shows a large year-to-year variability. The dark blue bars in Fig. 2.4 show the annual average rainfall totals (right axis) and the annual anomalies, or differences, from the 1961 to 1990 average (left axis). A moving average for periods of 11 years is also shown (red). Compared to an annual average rainfall of 1186 mm in the 30-year period 1961 to 1990 (bold black line), the period 1981 to 2010 (light blue dashed line) shows a 60 mm or 5% increase. In general, the larger increases in rainfall amount are recorded in the western half of the country.

An analysis of seasonal rainfall amounts over the same period shows small increases in all seasons over recent decades – however, the spatial distribution and intensity vary.

Climate Change Indicators

The World Climate Research Programme has defined a range of climate change indicators to enable uniform comparison of these variables. In the case of rainfall, these indices include number of wet days and heavy-rain days. Information on numbers of wet days can assist in water-supply management and knowledge of heavy-rain days can aid flood management. Trend maps have been calculated for the indicators for stations which have a near complete daily record for the 1961 to 2010 period. Figure 2.5 shows the trends for the number of wet days (days with rainfall greater than 0.2 mm) and the number of heavy rain days (days with rainfall greater than 10 mm).

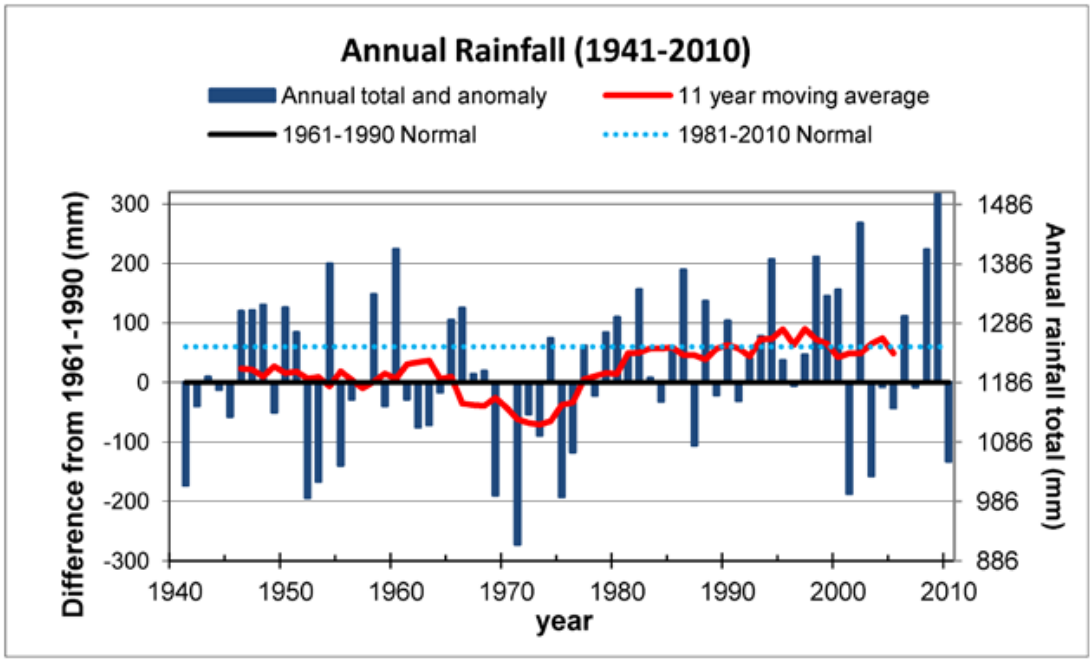


Figure 2.4. Annual rainfall totals and anomalies averaged over Ireland (1941–2010).

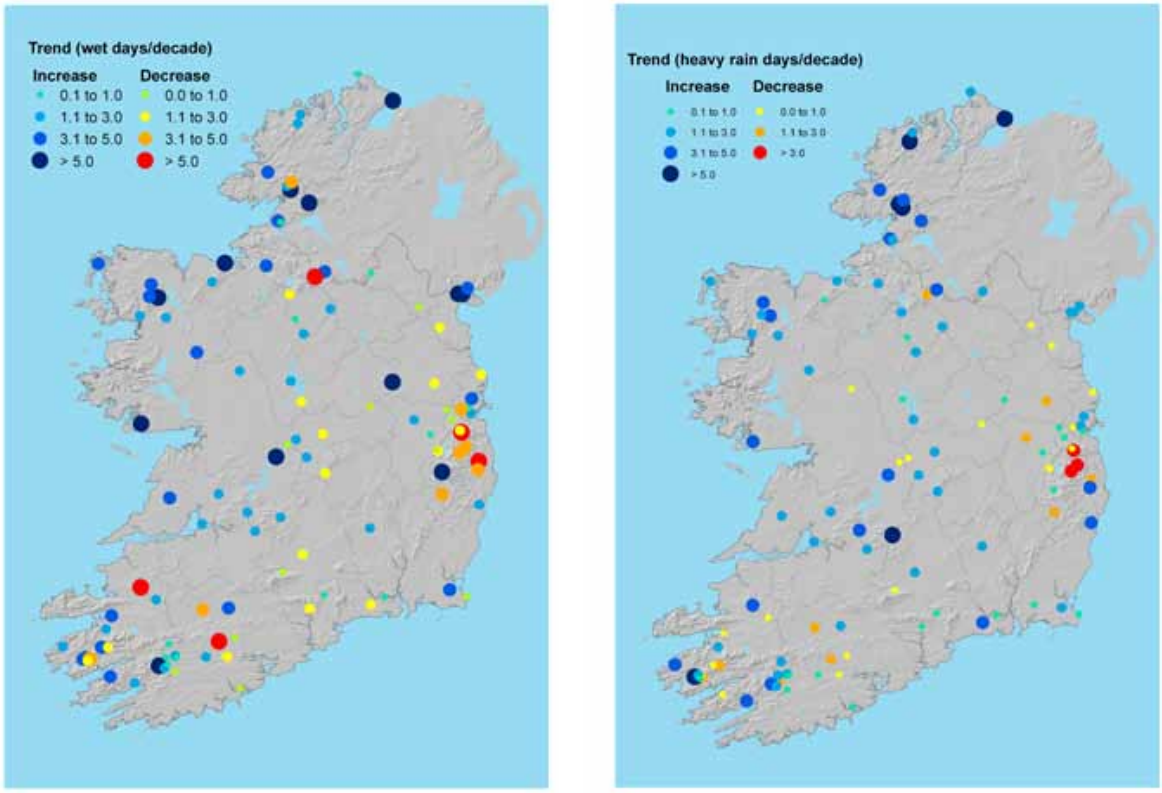


Figure 2.5. Trend in number of wet days per decade[5] (left) and number of heavy rain days per decade[5] (right) (1961–2010).

The trends for rainfall do not show the same level of confidence as those for temperature: they show greater regional variation and occasionally conflicting trends from stations that are geographically relatively close.

'The rainfall network needs to be maintained and expanded in areas of poor coverage.'

Maintaining the Observations

The rainfall network needs to be maintained and expanded in areas of poor coverage. It is becoming increasingly difficult to recruit replacement or additional 'voluntary' observers. Further automation of the network is inevitable and will require financial investment as well as human resources. As with temperature, resources are required to produce homogenised datasets and to collate and digitise paper records, including station metadata.

5 This represents the increase/decrease in number of days per year averaged over a decade.

Further Information and Data Sources

McElwain, L. and Sweeney, J. (2007) *Key Meteorological Indicators of Climate Change in Ireland*. ERC Report 6, Environmental Protection Agency, Johnstown Castle Estate, Co. Wexford, Ireland, pp. 40: http://www.epa.ie/downloads/pubs/research/climate/name,23305,en.html

Information on rainfall in Ireland: http://www.met.ie/climate/rainfall.asp

The World Climate Research Programme's expert team on climate change detection and indices: http://www.clivar.org/organization/etccdi/indices.php

Information on the global precipitation measurement mission: http://gpm.gsfc.nasa.gov/

Near real time rainfall from radar: http://www.met.ie/latest/rainfall_radar.asp

Information on data availability: http://www.met.ie/climate/climate-data-information.asp

Long-term daily series of precipitation for a number of Irish stations are available from the European Climate Assessment & Dataset: http://eca.knmi.nl/

Surface data from some Irish synoptic stations may be accessed at the US National Climate Data Centre: http://www7.ncdc.noaa.gov/CDO/cdo