

information



NATURAL HERITAGE TRENDS

CLIMATE CHANGE: PRECIPITATION

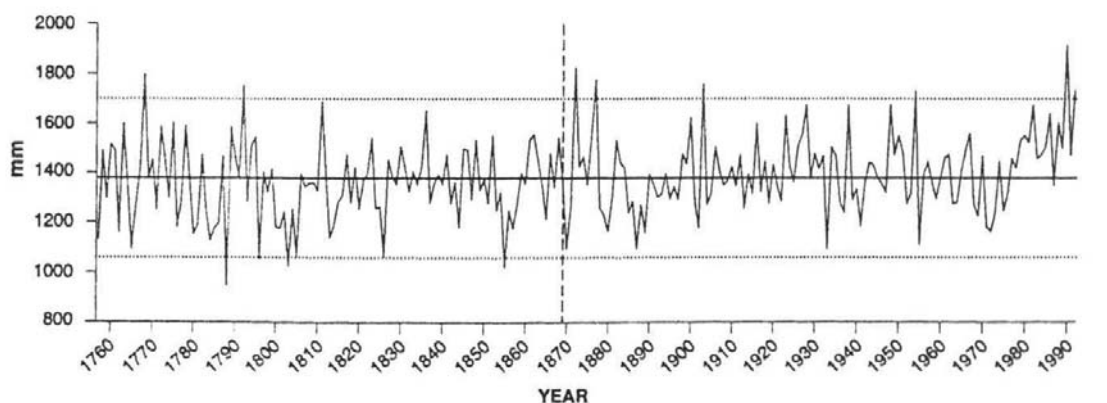
Precipitation refers to rain, sleet, hail or snow. With the enhanced greenhouse effect leading to changes in the hydrological cycle through increased rates of evaporation and evapotranspiration, spatial and temporal precipitation patterns are affected.

Precipitation has a major influence on vegetation. High rainfall may encourage peatland or forest habitats, sometimes prolific with mosses, whilst areas of low water availability are associated with species adapted to water stress. Seasonal precipitation patterns can also be influential whilst the volume and intensity of precipitation may influence the physical structure of a habitat and rates of erosion. The chemical quality of the precipitation may also affect ecosystems, both terrestrial and freshwater.

Across Scotland there is a west-east precipitation gradient due to the prevalence of westerly winds. There are also marked contrasts between lowland and upland sites with areas above 400 metres in elevation generally receiving more than 1,000 mm of precipitation a year.

- Annual levels of precipitation increased by 0.5-1.0% a decade in most locations in the high latitudes of the Northern Hemisphere during the twentieth century, contrasting with a decline in rainfall in the subtropics (Folland *et al.*, 2001).
- By 1993, the two wettest decades on record ended in 1990 and 1992, both of which had about 14% more than the average decadal value (Smith, 1995) (Figure 1).

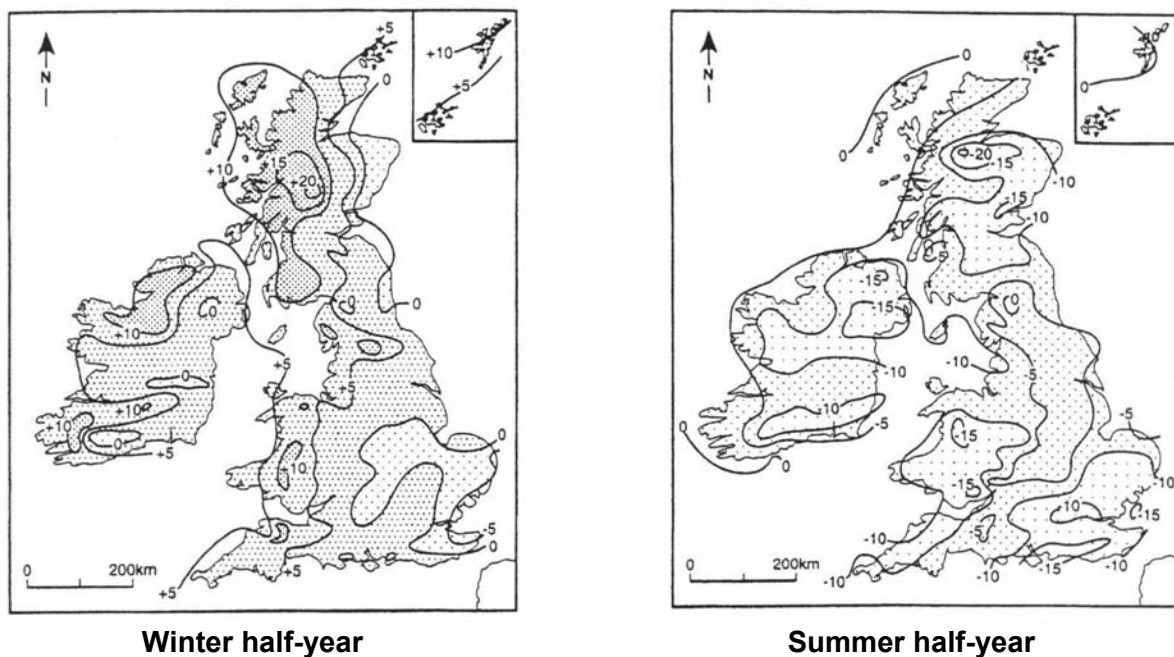
Figure 1 Annual precipitation over Scotland 1757-1992: annual values (mm) showing the mean and +/- 2 standard errors.



Source: Smith, K. (1995). Precipitation over Scotland, 1757-1992: some aspects of temporal variability. *International Journal of Climatology*, **15**, 543-556. Reproduced by SNH with permission from the Royal Meteorological Society.

- On average across Scotland, the west has become wetter and the east drier (Mayes, 1996).
- Geographical trends are particularly marked between the seasons, with the west becoming wetter in the winter half-year and the east becoming drier in the summer half-year (Figure 2).

Figure 2 Percentage changes in seasonal rainfall in Scotland between averaging periods 1941-1970 and 1961-1990, for the winter half-year (October-March) and the summer half-year (April-Sept).



Source: Mayes, J. (1996). Spatial and temporal fluctuations of monthly rainfall in the British Isles and variations in the mid-latitude westerly circulation. *International Journal of Climatology*, **16**, 585-596. Reproduced by SNH with permission from the Royal Meteorological Society.

- In Scotland, the largest change in precipitation for any individual month occurred in March when average annual rainfall increased by nearly 32% from 1916-1950 to 1961-1990. The Loch Rannoch area experienced the largest increase (of 57-58%) (Mayes, 1996).
- In contrast May, June and July became distinctly drier. April also became drier but not uniformly throughout Scotland; April precipitation in the west decreased by 20-30%, but in the north-east increased by 20% (Mayes, 1996).
- There has been an estimated 2-4% increase in the frequency of heavy rain events across mid and high latitudes in the northern hemisphere (Folland *et al.*, 2001). The increase in total annual precipitation in Scotland has been associated with an increase in the number of heavy rain events as well as a greater number of days with rain (Smith & Werritty, 1994).

Projected future trends

Autumn and winter are expected to become wetter, the highest projection indicating as much as 30% more precipitation in autumn and winter by the 2080s, whereas summers are

expected to become drier by 10-50% by the 2080s. However, annual precipitation is expected to remain within the range of natural variability (Hulme *et al.*, 2002).

Authorship

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References

Hulme, M., Jenkins, G.J., Lu, X., Turnpenny, J.R., Mitchell, T.D., Jones, R.G., Lowe, J., Murphy, J.M., Hassell, D., Boorman, P., MacDonald, R. and Hill, S. (2002). *Climate Change Scenarios for the United Kingdom: The UKCIPO2 Scientific Report*. Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, Norwich.

Folland, C.K., Karl, T.R., Christy, J.R., Clarke, R.A., Gruza, G.V., Jouzel, J., Mann, M.E., Oerlemans, J., Salinger, M.J. and Wang, S.-W. (2001). Observed Climate Variability and Change. In: *Climate Change 2001: The Scientific Basis. Contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change*, eds. J.T. Houghton, Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell and C.A. Johnson. Cambridge: Cambridge University Press, pp. 99-192.

Mayes, J. (1996). Spatial and temporal fluctuations of monthly rainfall in the British Isles and variations in the mid-latitude westerly circulation. *International Journal of Climatology* **16**, 585-596.

Smith, K. and Werritty, A. (1994). *Hydroclimatic and water functions of Scottish hydro-electric plc*. Unpublished report to Scottish Hydro-electric plc.

Smith, K. (1995). Precipitation over Scotland, 1757-1992: some aspects of temporal variability. *International Journal of Climatology* **15**, 543-556.

This note forms part of the Natural Heritage Trends series, documenting the best information available on rates and directions of change (temporal and spatial) in terrestrial, fresh water and marine environments.

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