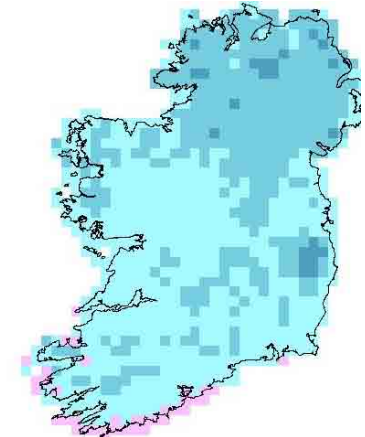


Winter 1961-1990



Winter 2041-2070

Whither the Weather: Implications for Growers in Ireland Challenges and opportunities?

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Department of Geography

National University of Ireland Maynooth



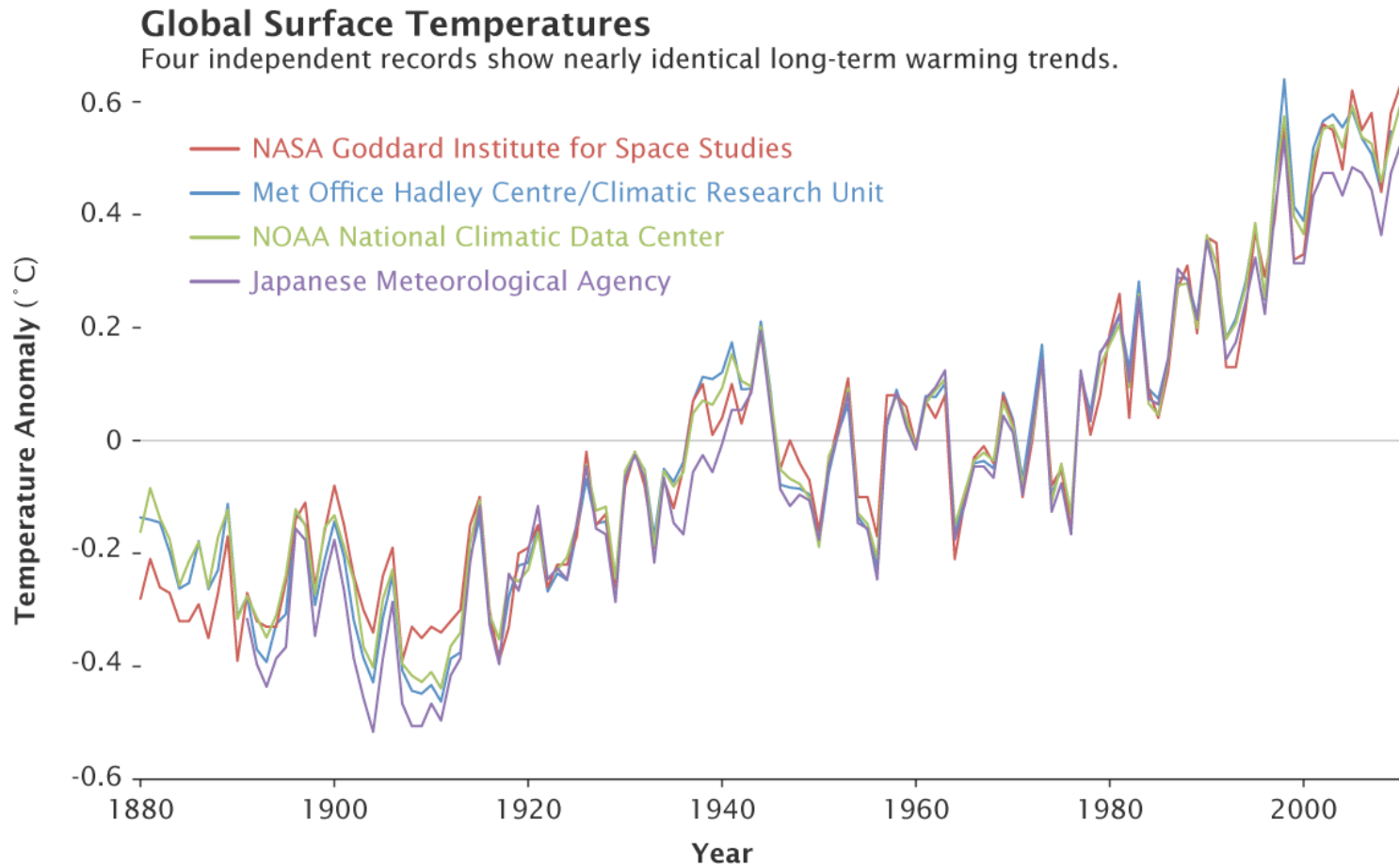
NUI MAYNOOTH
Oileán na hÉireann Mhá Nuad



Whither the Weather

- **Introduction**
- **How Is Ireland's Climate Changing**
 - Evidence from the meteorological records
- **Recent Weather**
 - Natural Variability or Climate Change
- **Future Outlook**
 - (Uncertain) Climate model projections
- **'Robust' Adaptation – A Process, Not An Event**
 - Decision making in an uncertain future

Global land and marine surface temperature record from 1880 to 2010



Credit: NASA Earth Observatory/Robert Simmon

Data Sources: NASA Goddard Institute for Space Studies, NOAA National Climatic Data Center, Met Office Hadley Centre/Climatic Research Unit, and the Japanese Meteorological Agency.

(GISS, 2011)

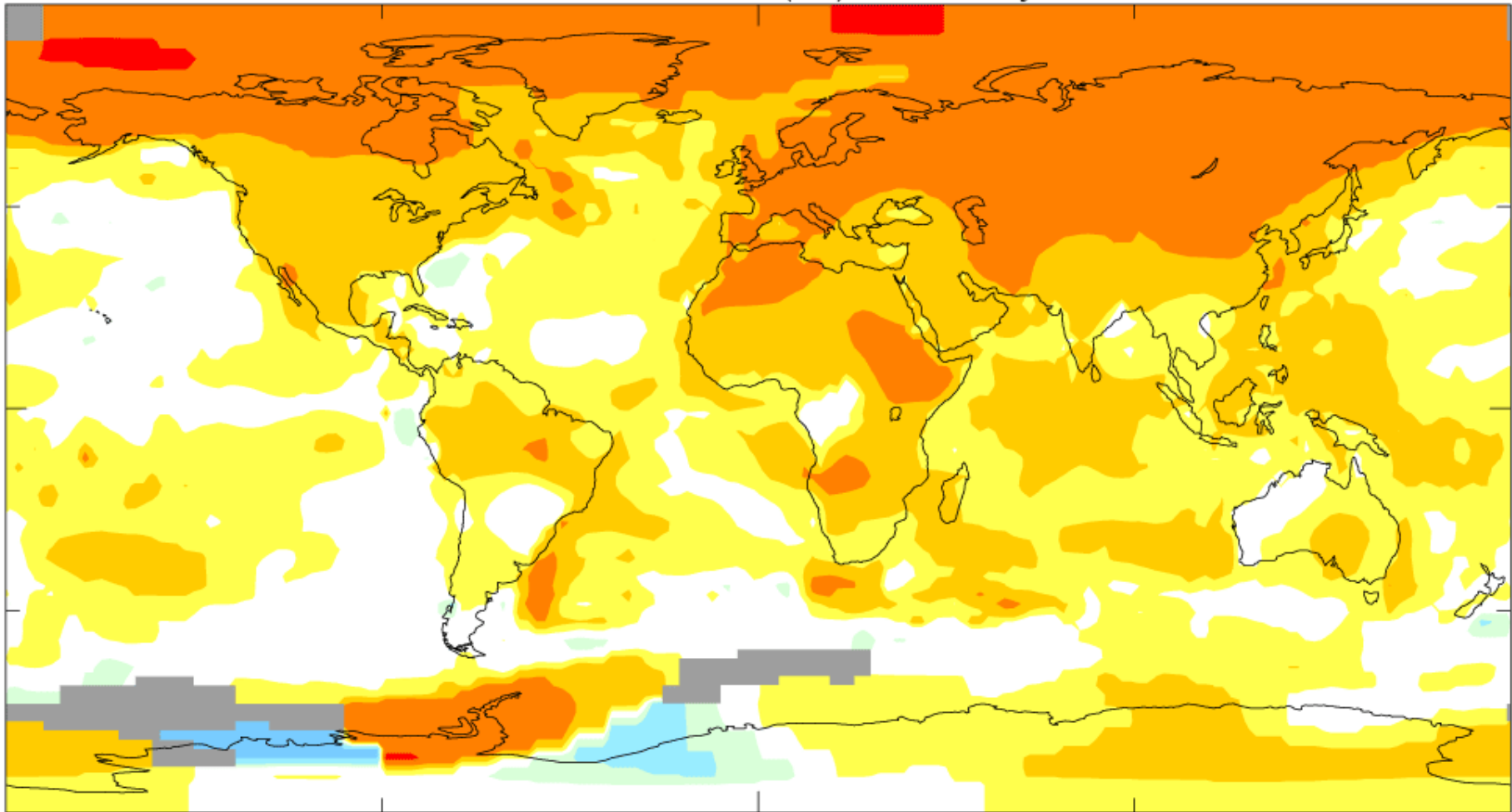
Global surface temperatures in 2010 tied with 2005 as the warmest on record. 2011 was the eleventh warmest year on record.

Spatial Pattern of Warming

Annual J-D 2000-2009

L-OTI(°C) Anomaly vs 1951-1980

.51

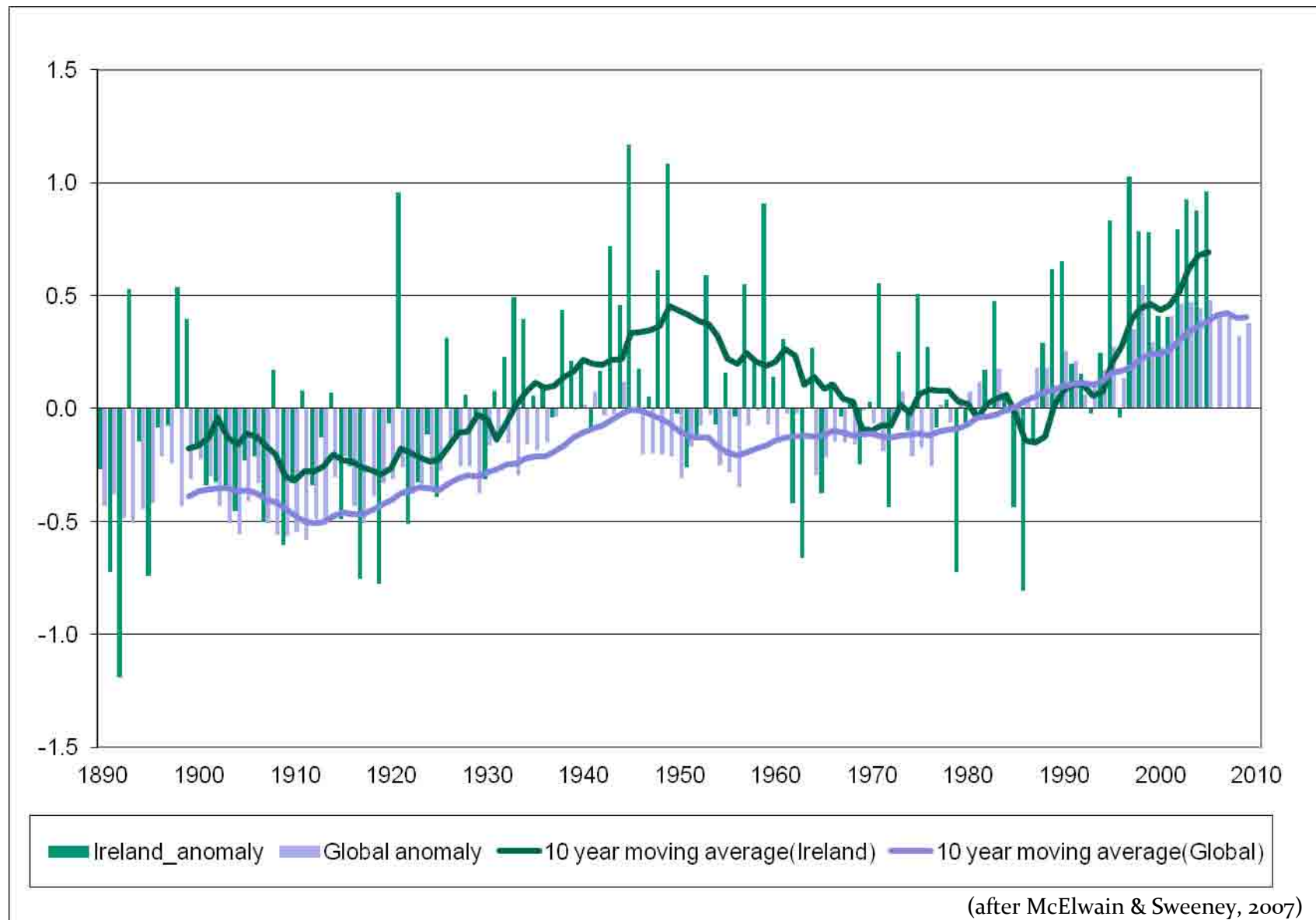


-4.1 -4 -2 -1 -.5 -.2 .2 .5 1 2 4 4.1

The decade 2000-2009 has been the warmest decade in the instrumental record

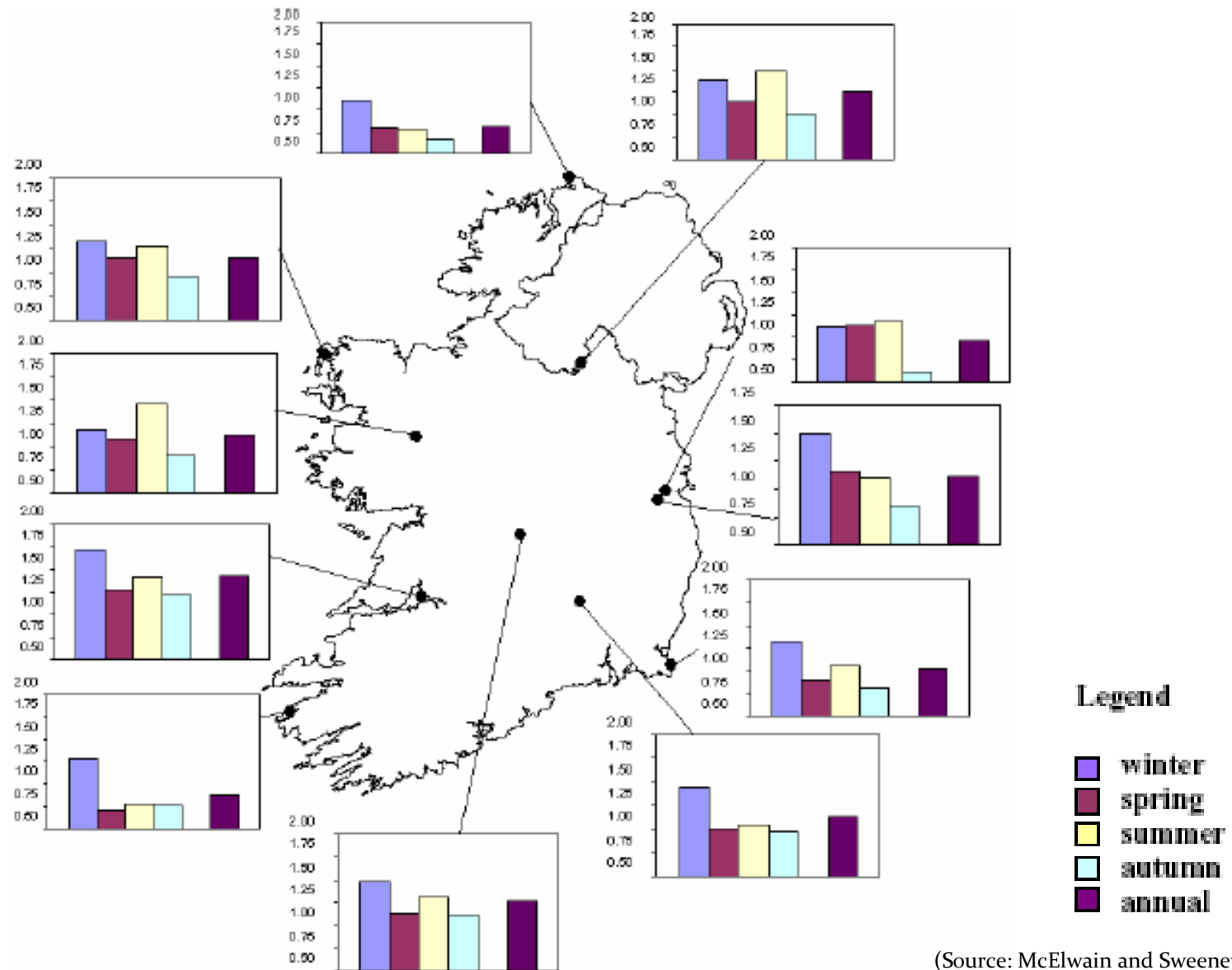
(Source: <http://www.giss.nasa.gov/>)

Annual Air Temperature Anomalies



Global and Irish air temperature anomalies for 1890-2005 period. Anomalies are calculated from the 1961-1990 reference period mean.

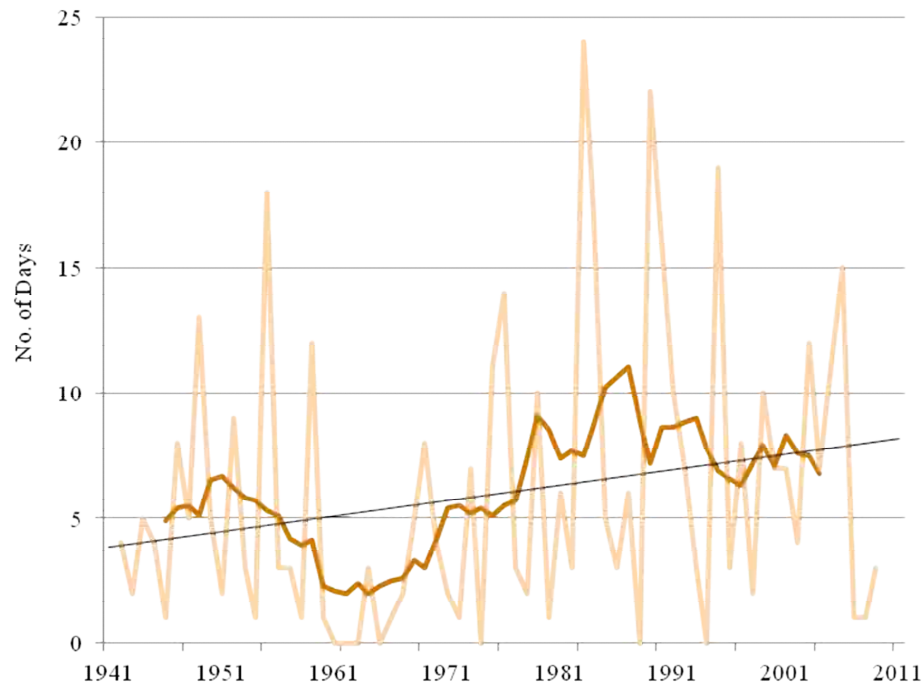
Annual and Seasonal Mean Temperature (1961-2005)



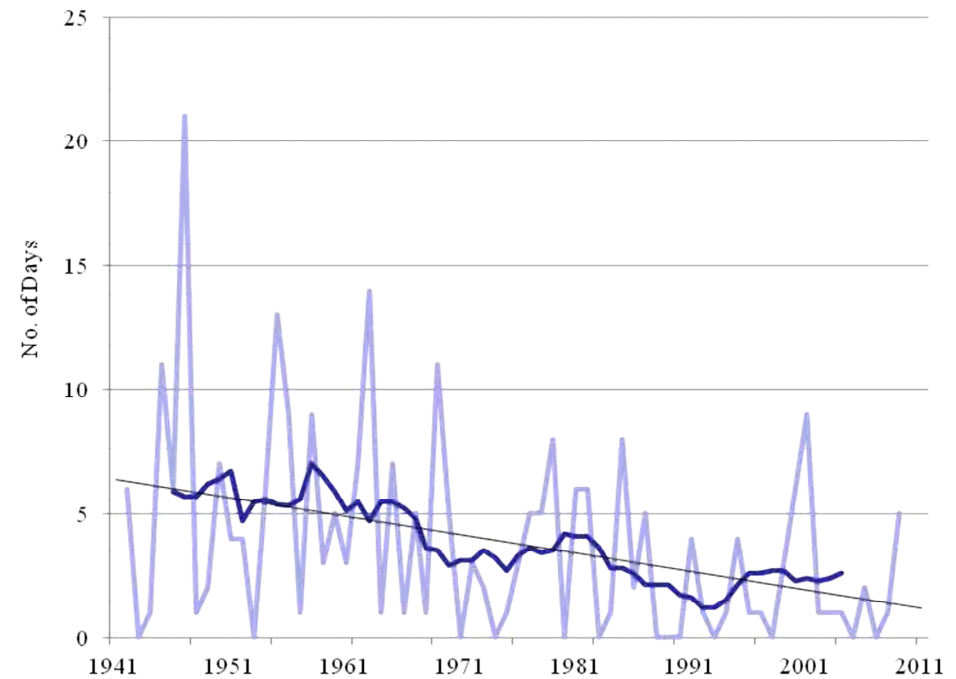
(Source: McElwain and Sweeney, 2007)

Change in annual and seasonal mean temperature for the 1961-2005 period. Vertical scale is change in temperature over that period.

Frequency of 'hot' and 'cold' days at Dublin Airport



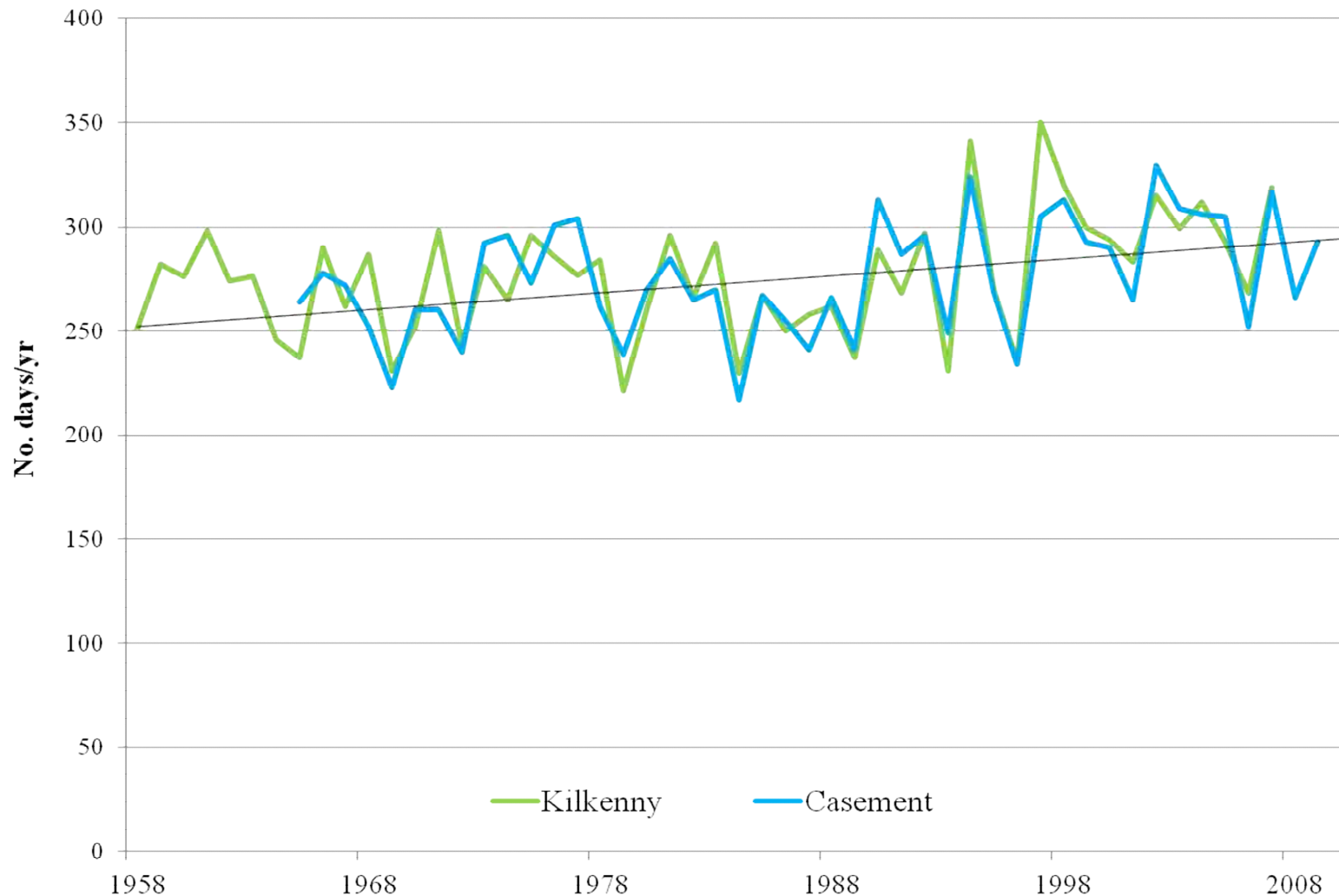
'Hot' day = mean temperature > 18°C



'Cold' day = mean temperature < 0°C

The average annual number of 'hot' days in eastern Ireland has increased, while 'cold' days have decreased, over the past 70 years

Growing Season Length (1958-2009)



Over the period of record, an increase is evident in the number of grass growing days (6.0°C air temperature threshold) per year.

Winter 2010 - Coldest December for almost 30 years, coldest January for at least 25 years and coldest February since 1986



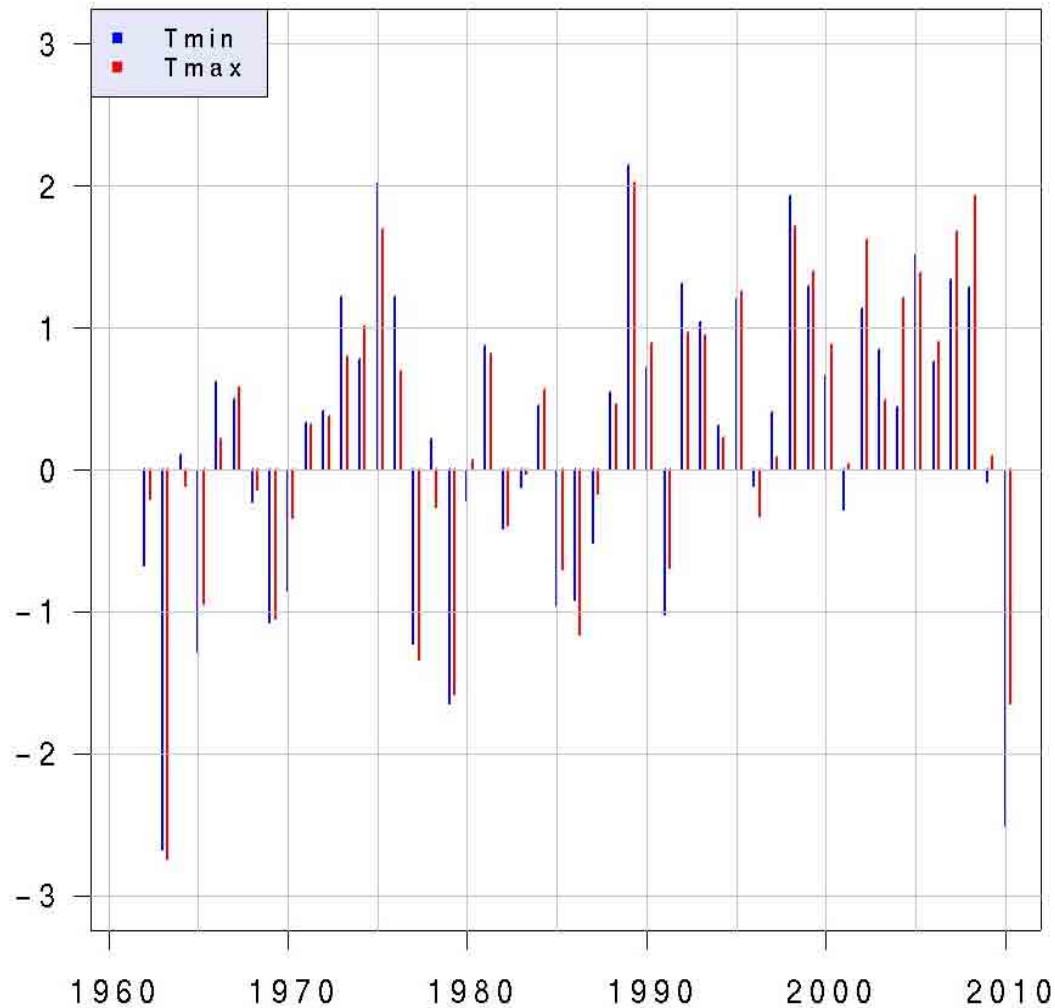
25 December , 2010



Stillorgan Road, Dublin, 1 January 2010
(Photo: Irish Times)

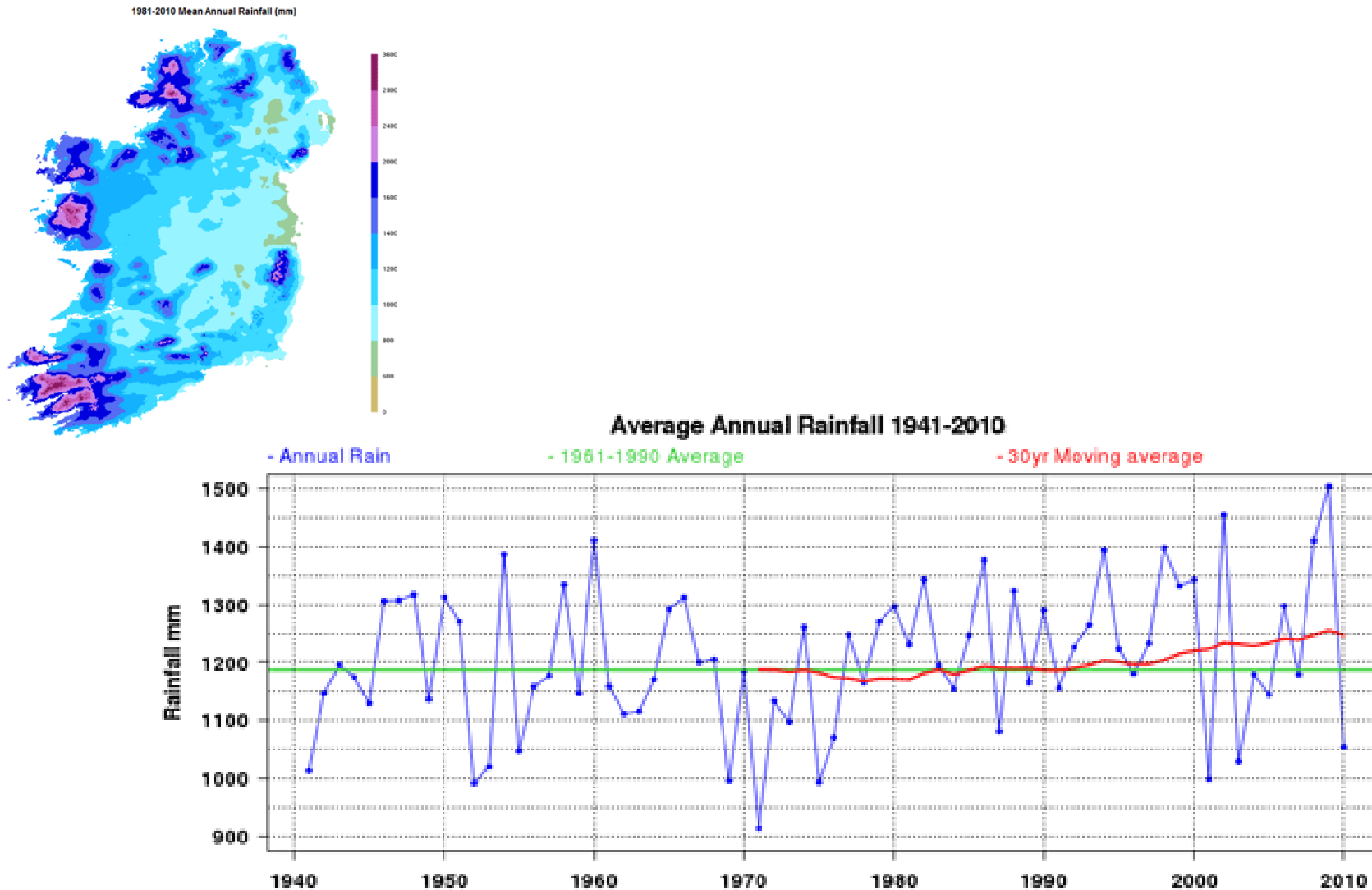
The lowest December air temperature ever measured in the country, -17.5°C , was recorded at Straide, Co. Mayo, on the 25th, while Casement Aerodrome's minimum value of -15.7°C was the lowest temperature of any month ever recorded in the Dublin area.

Winter Temperature (1960-2010)



Maximum (red) and minimum (blue) temperature anomalies (°C) 1961-2010. The data are based on average values for the winter season (December, January, February) representative of the country as a whole.

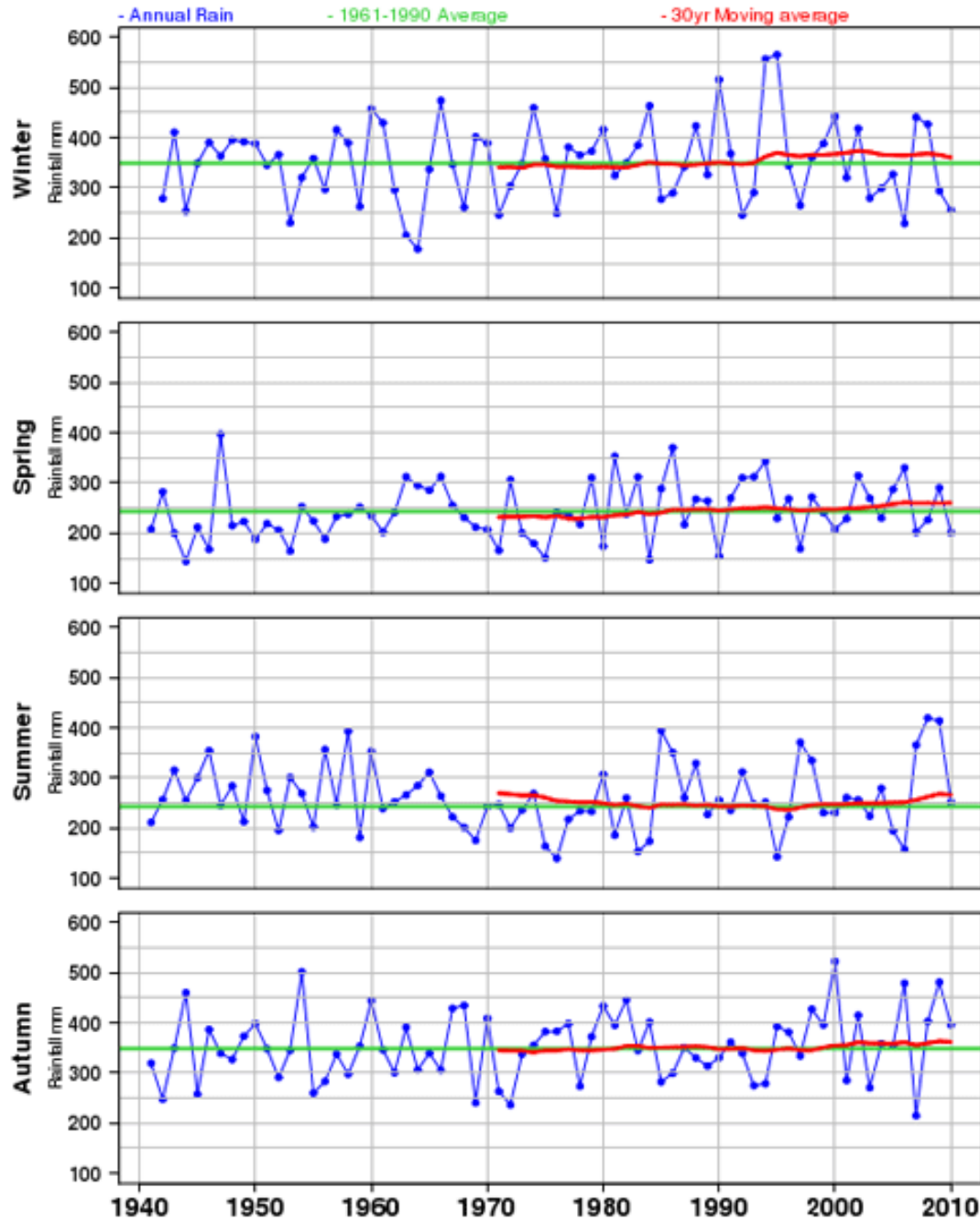
Annual Average Rainfall (1941-2010)



(Source: Met Eireann)

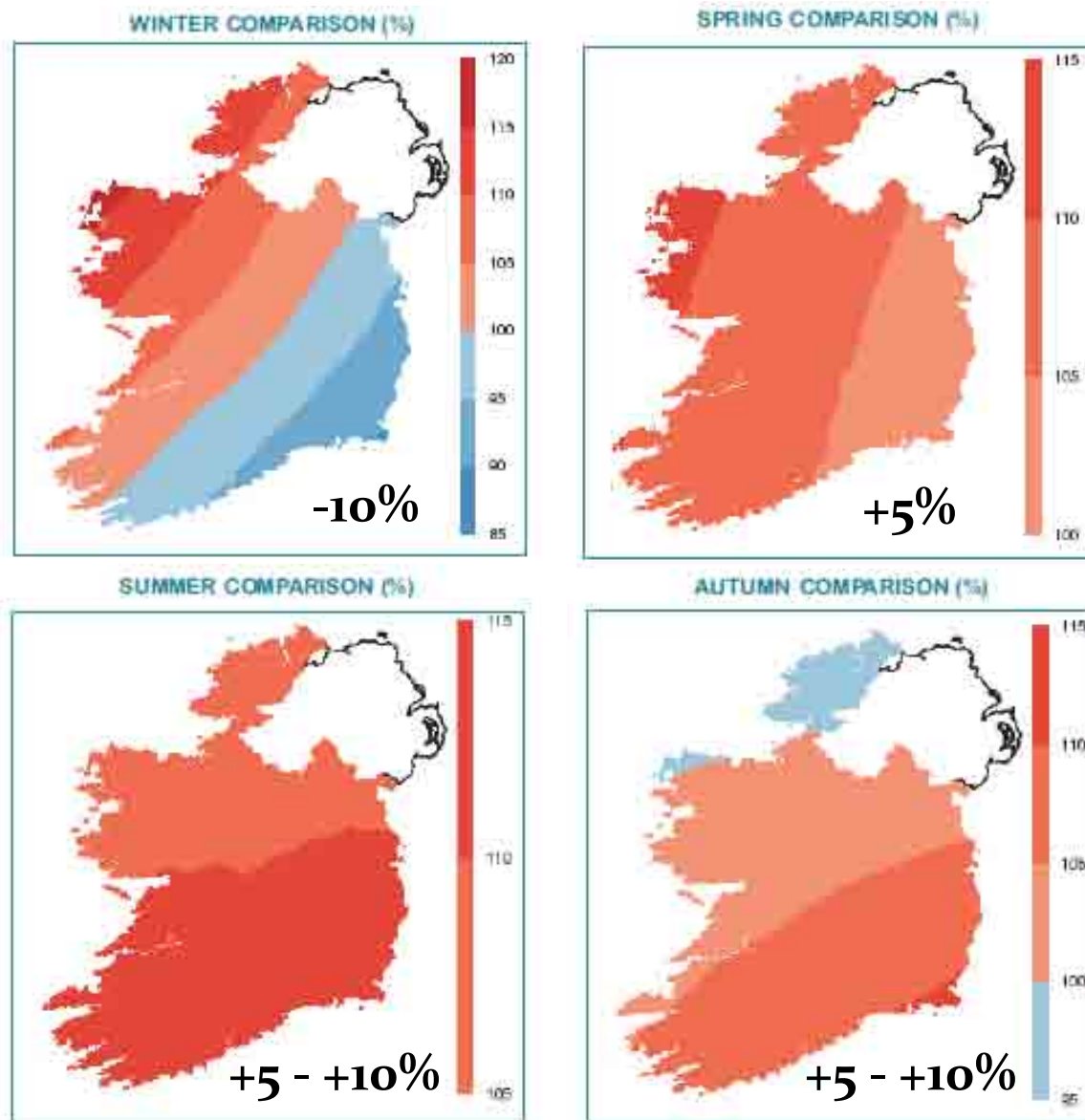
Annual average rainfall has increased by ~70mm (~3in) over the last two decades

Average Seasonal Rainfall 1941-2010



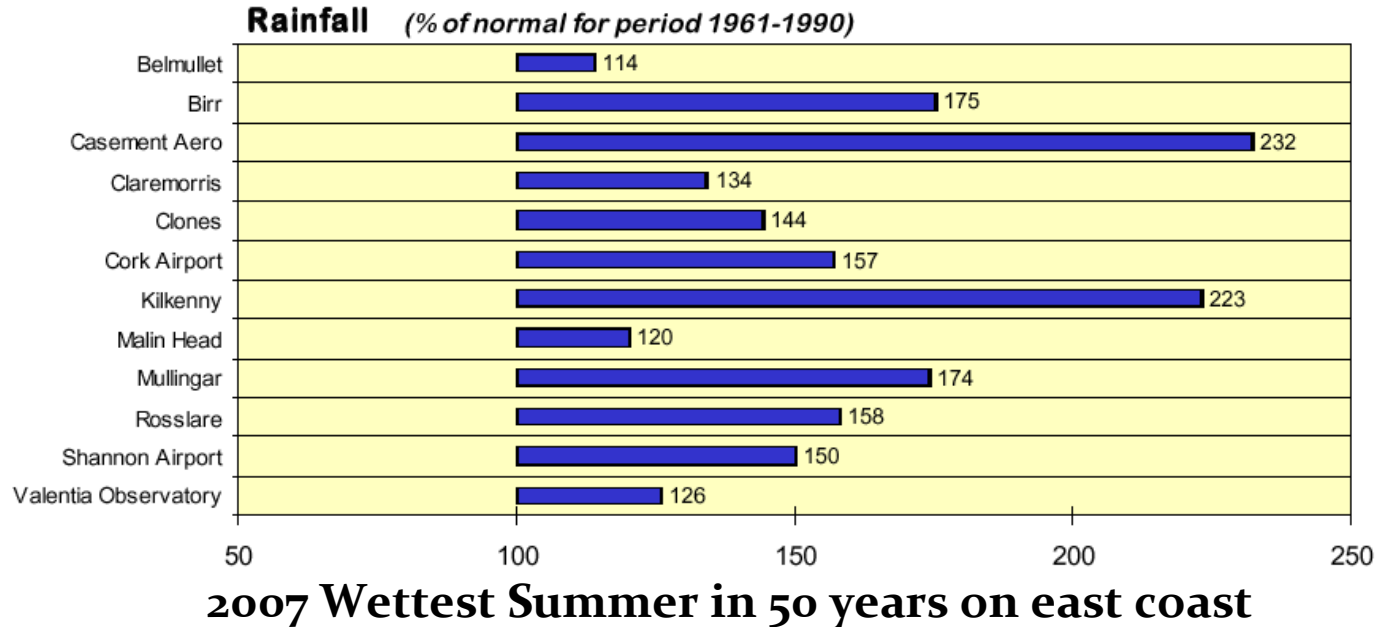
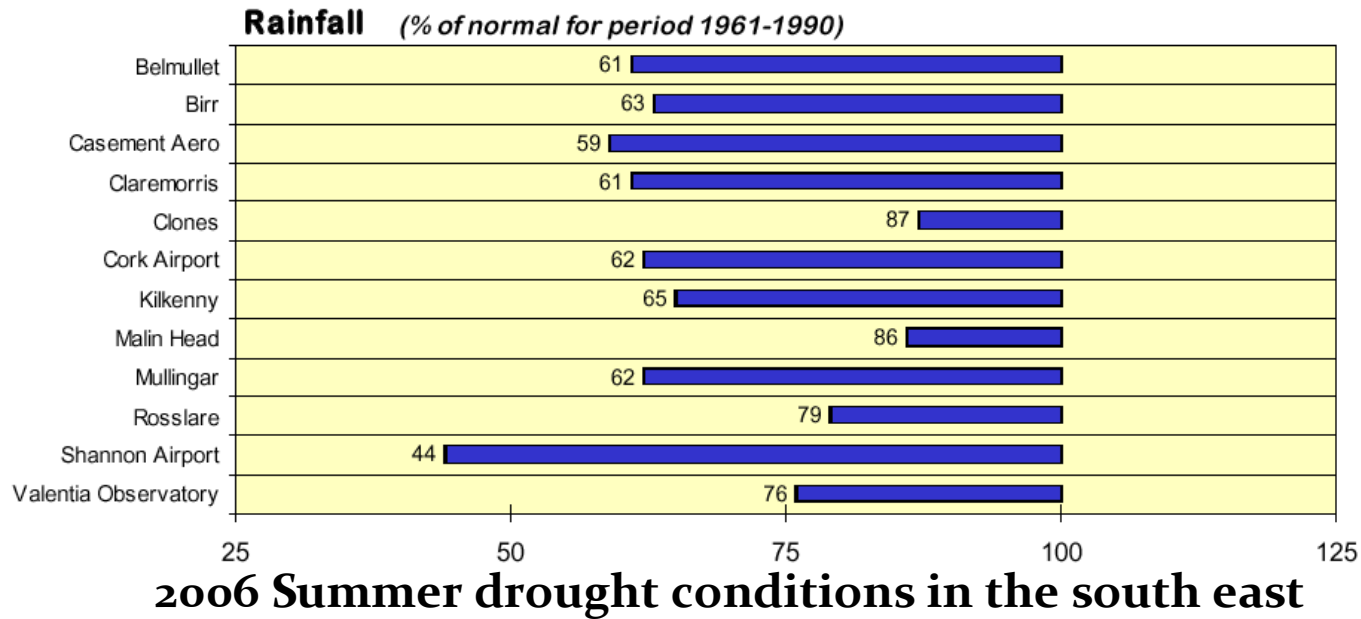
While significant year to year variability is evident in the average seasonal rainfall series, no significant trends are apparent.

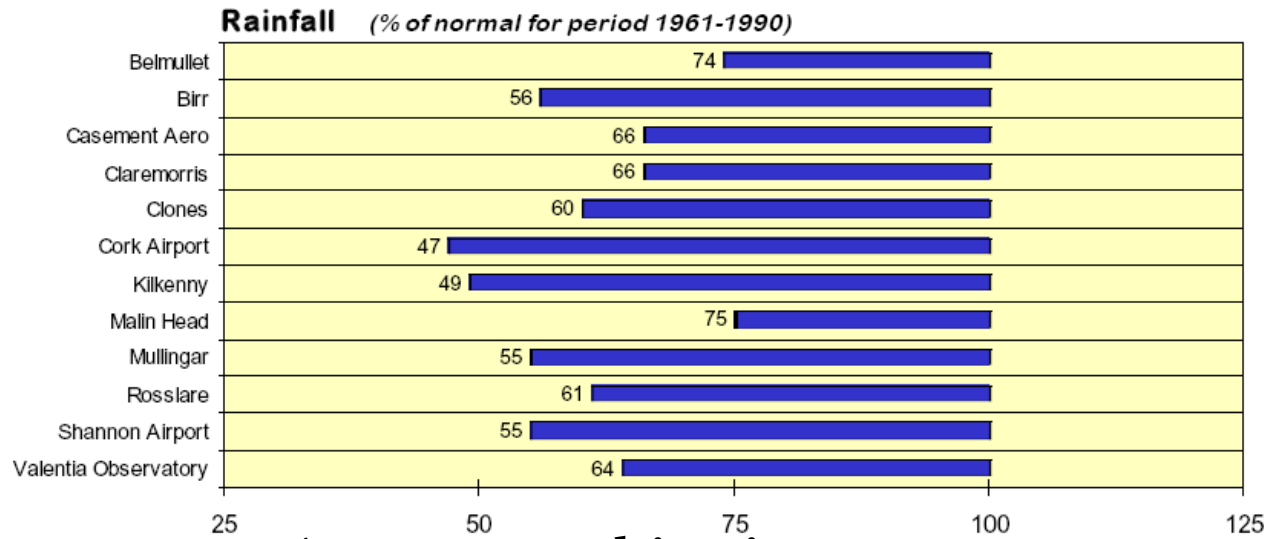
1981-2010 averages as a % of 1961-1990 averages (%)



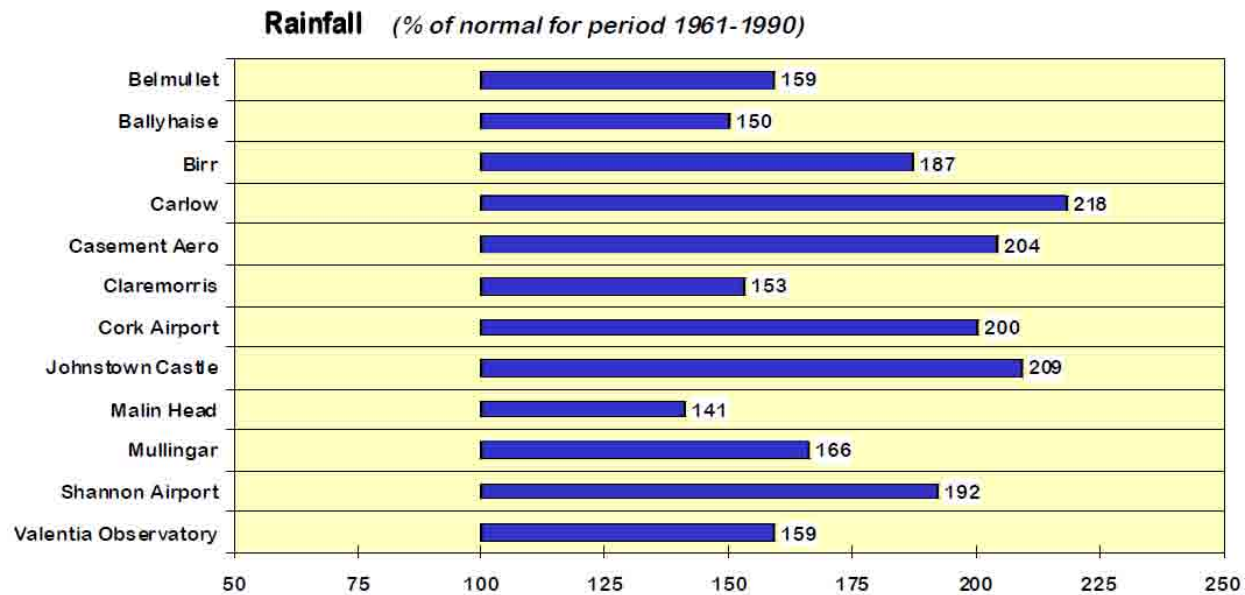
(Source: Met Eireann)

Decreases of up to 10% in rainfall in the south and east in Winter, while Spring and Summer show increases of between 5 to 10%.



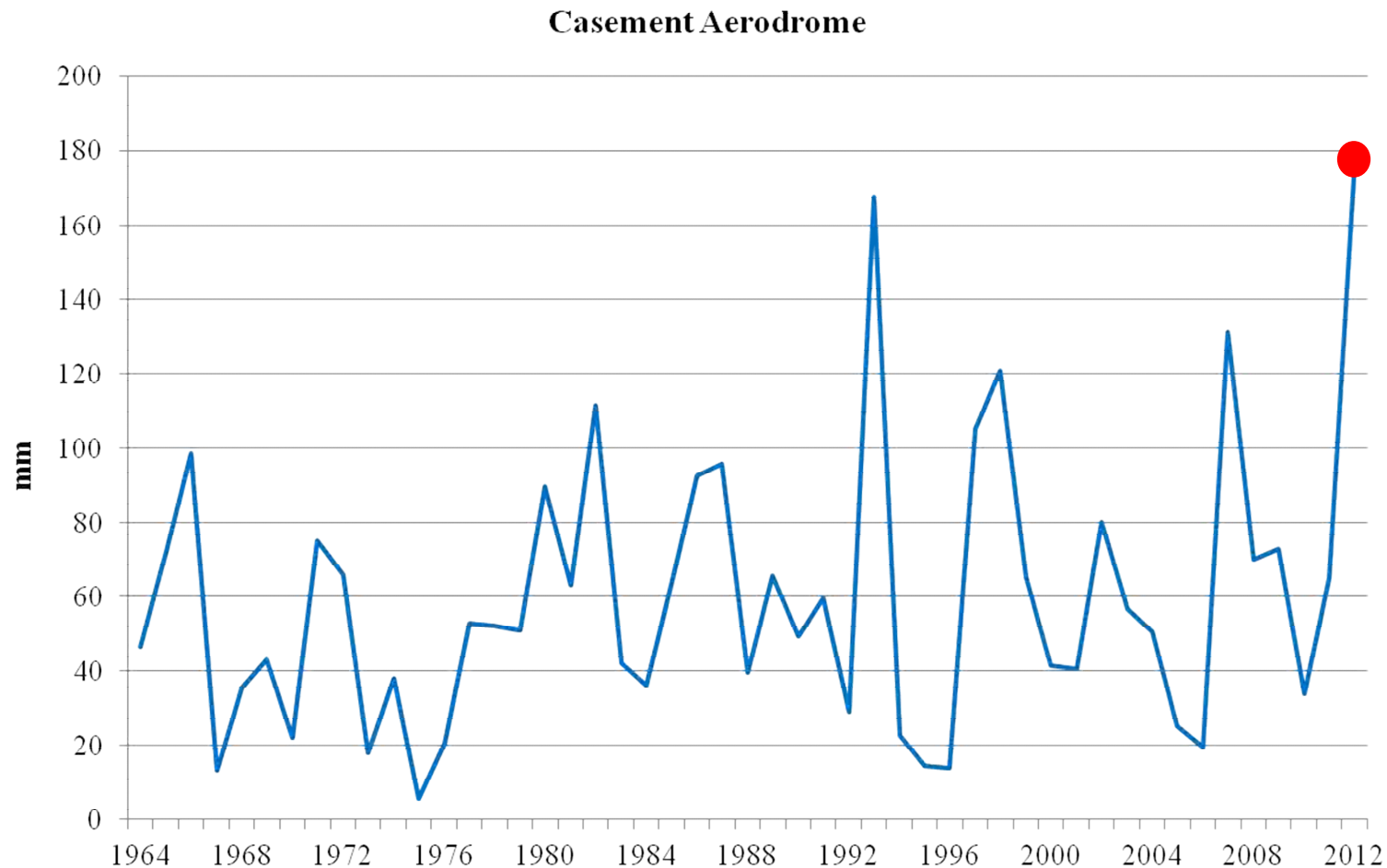


Autumn 2007 driest in over 20 years



Summer 2008 wettest summer on record at Dublin Airport since 1958

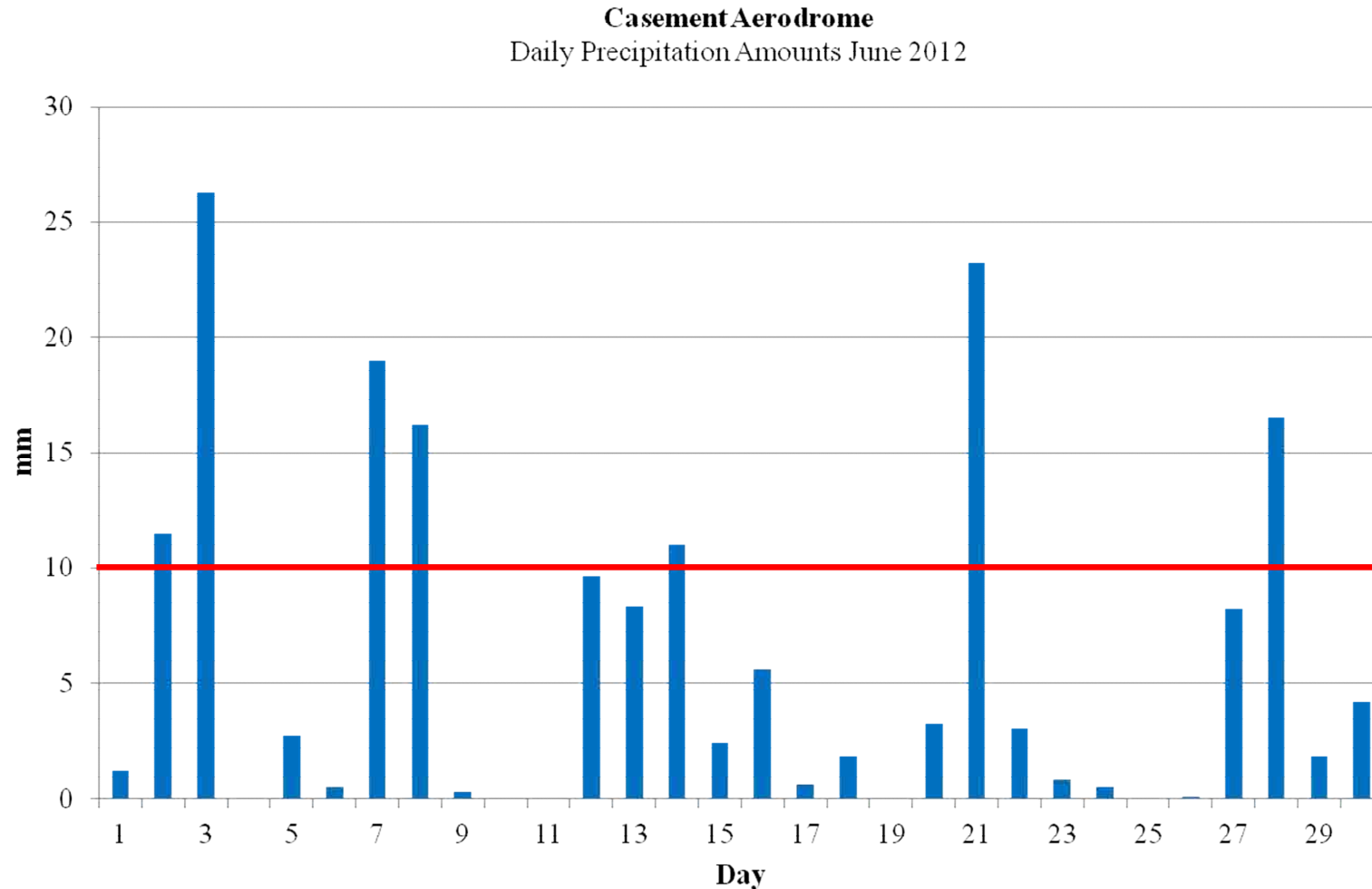
Casement Aerodrome Monthly precipitation June (1964-2012)



In June, 2012, 178.5 mm of rainfall (~286% above the LTA) was recorded at Casement Aerodrome, exceeding the previous June high of 167.7 mm recorded in 1993.

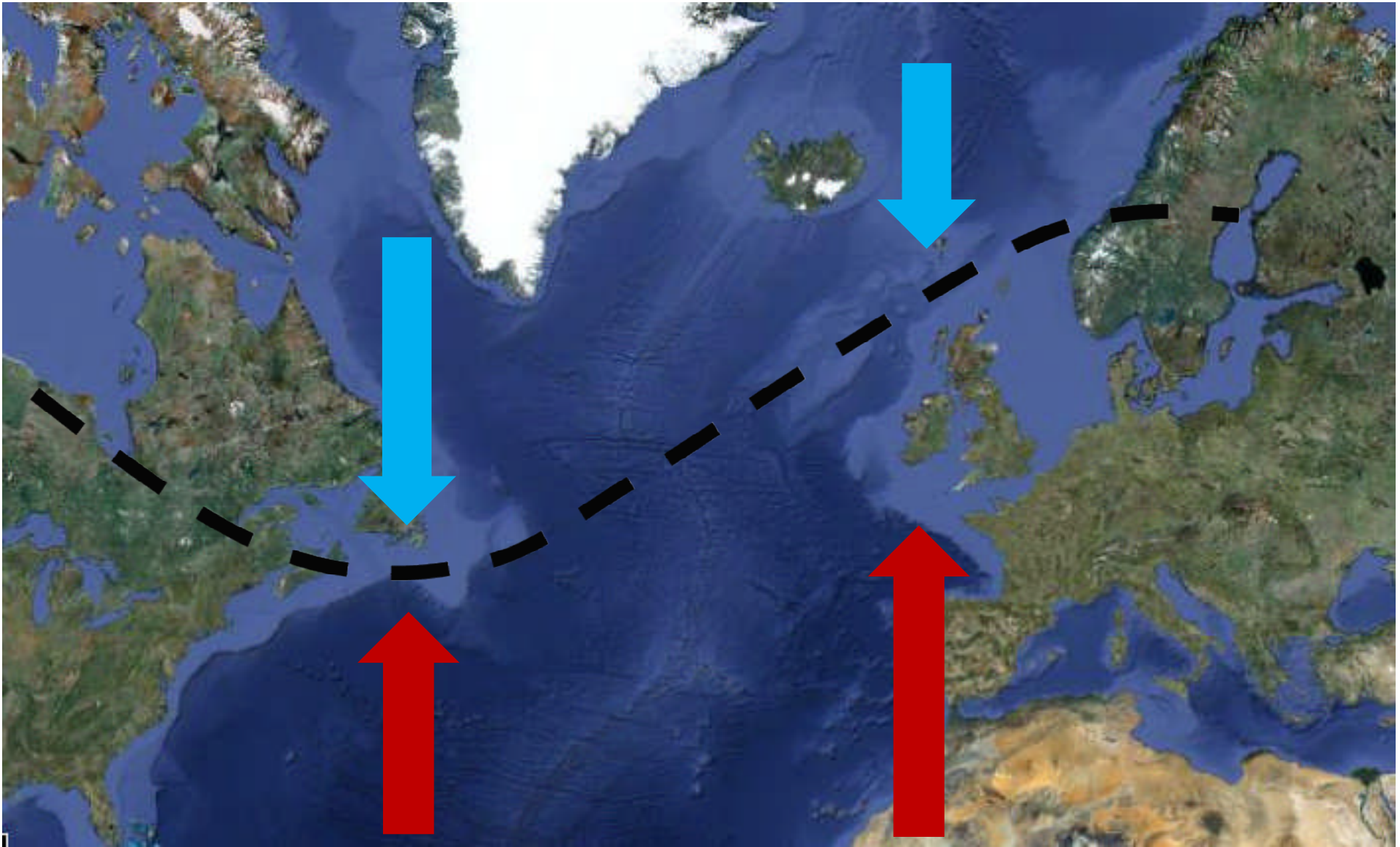
Casement Aerodrome

Daily precipitation June 2012



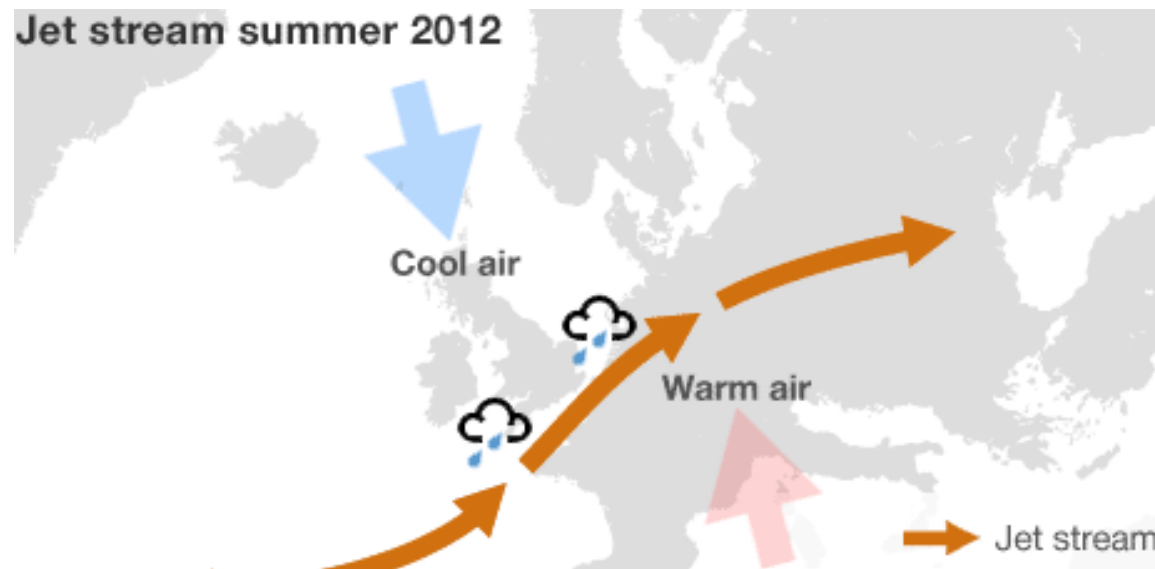
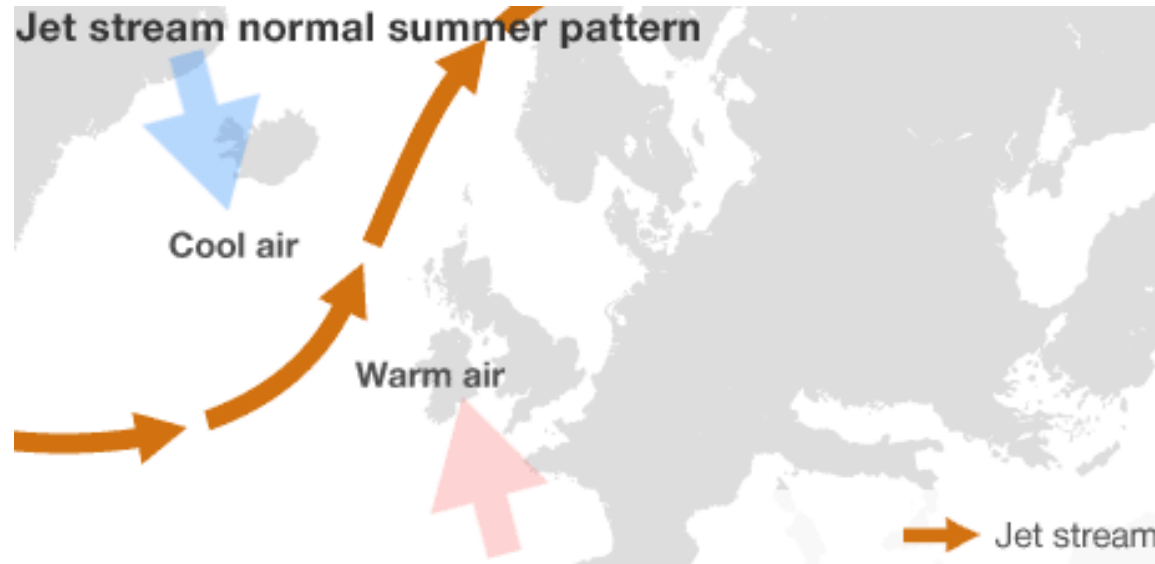
During the month of June, 2012, Casement Aerodrome recorded 19 *wet days* (≥ 1.0 mm) and 7 *very wet days* (≥ 10.0 mm).

Ireland



Ireland lies between $51.5-55.5^{\circ}\text{N}$ and its proximity to the North Atlantic is an important determinant of its weather and subsequently, climate.

Jet Stream



<http://www.bbc.co.uk/news/science-environment-18783422>

The position of the Jet Stream during the summer of 2012 was similar to that of summer 2007

The occurrence of extreme or unusual weather events is not a recent phenomenon



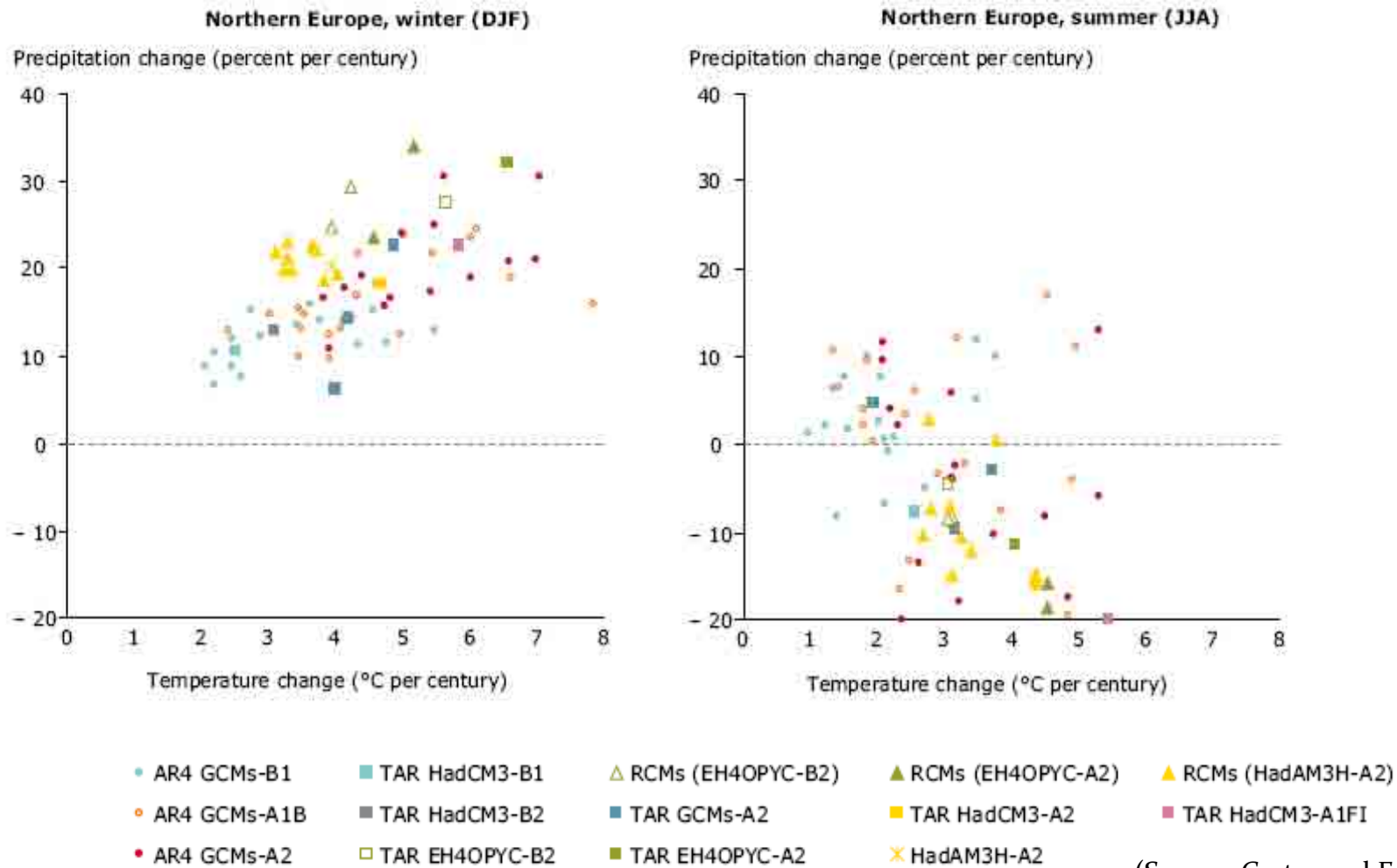
River Liffey at the Old UCD boathouse (Dublin Municipal Boat Club) January 1963



River Shannon 1959

With or without anthropogenic (man-made) climate change, the climate system displays natural modes of variability, operating on timescales ranging from days to weeks, years to decades, decades to centuries.

Climate model simulations for Europe



Projections for the last 30 years of the 21st century relative to simulated present-day climate under different SRES scenarios

(Climate) Challenges for Horticulture



Machinery selection?



Crop/variety choice?



Pests and diseases

Climate Uncertainty and Horticulture

Prediction-based policy analysis requires that we ask

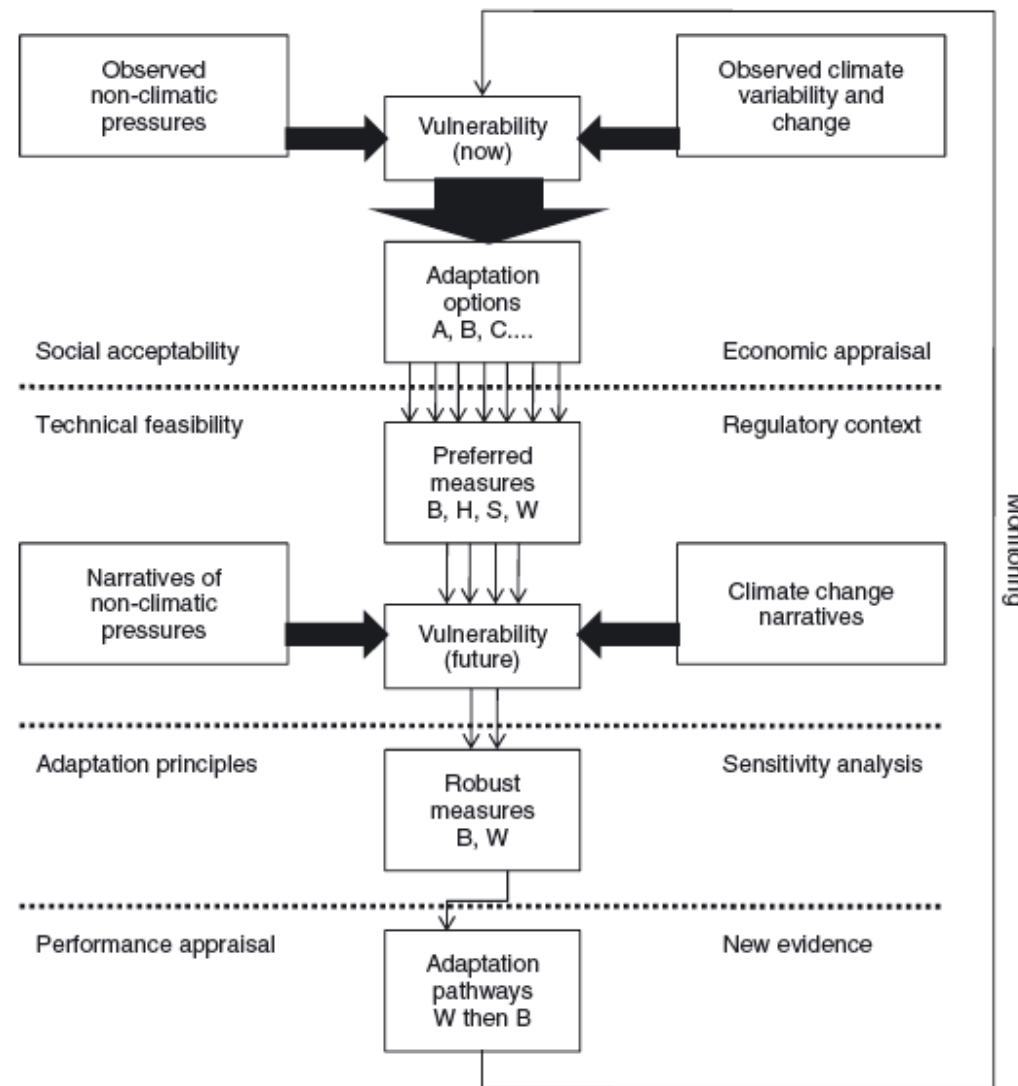
What is likely to happen in the future?

However, the more appropriate question should be

What action should we take, given that we cannot predict the future?

(Source: Lempert and Schlesinger, 2000)

A climate 'scenario-neutral' approach



(Wilby and Dessai, 2010)

Conceptual framework for a scenario-neutral approach to adaptation planning