CLIMATE CHANGE ADVISORY COUNCIL

ANNUAL REVIEW 2026

Our Changing Climate in 2025

Annual Review 2026:
Our Changing Climate in 2025

Submitted to the Minister for Climate, Energy and the Environment on 27 March 2026

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Summary for All

The Council examines national and global climate data in 2025, including observed trends, extreme weather events and their associated impacts, future projections and the implications for Ireland's preparedness for and adaptation to climate change.

Ireland's climate is changing. Provisional data indicate that 2025 was the second-warmest year on record, with 7 of the 10 warmest years having occurred since 2005. Both the spring and summer of 2025 were the warmest on record and drier than average, with average summer temperatures almost 2°C above the 1961–1990 long-term average. A total of 49 public water supplies across 15 counties were declared to be in drought status by Uisce Éireann, leading to prolonged water shortages and water conservation orders. Autumn 2025 was the fourth wettest on record and six of the ten wettest autumns have now occurred since 2001. Storm Éowyn brought record-breaking winds in January 2025 and was the most expensive storm-related insurance event in Irish history, with claims exceeding €301 million. An attribution study[a] found that rainfall during Storm Claudia in November 2025 was nearly 12% more intense than it would have been in a cooler pre-industrial climate.

Extreme conditions continued into 2026. In the lead up to Storm Chandra (26 and 27 January), parts of the south and east recorded three to four times their average rainfall, leaving catchments saturated and rivers already elevated, and resulting in severe flooding in parts of Dublin and Wexford.

Globally, from 2015 to 2025 the world recorded the 11 warmest years in 176 years of observation, and the last 3 years were the 3 warmest. Ocean warming has rapidly increased over the past two decades and ocean temperatures in 2025 were among the highest on record. Rising ocean temperatures are intensifying storms and accelerating sea ice loss and sea level rise. The capacity of the planet's natural carbon sinks to sequester carbon from the atmosphere is decreasing under the stress of rising temperatures, drought and deforestation. In 2025, the ten most costly extreme weather events caused damage costing in excess of €100 billion. Concentrations of major greenhouse gases – carbon dioxide, methane and nitrous oxide – have reached their highest ever recorded levels. Global emissions reduction efforts are failing, leading to continued warming and further increasing the likelihood and intensity of extreme events.

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a An attribution study is an analysis that helps determine how climate change is influencing the likelihood and severity of significant weather events.

Summary of Storm Chandra

Although this publication focuses on Ireland's climate and related events in 2025, it is pertinent to reflect on Storm Chandra, which passed over Ireland on 26 and 27 January 2026. The impacts of the storm have reinforced the urgency of the Council's previous recommendations to accelerate investment in and action on climate adaptation.

Storm Chandra brought strong winds and heavy rain following a prolonged period of rainfall, with many rivers already approaching or exceeding bank-full conditions.[1] The south and east were particularly affected, with some parts of these regions experiencing three to four times their average rainfall over the period of 22–28 January.[2] Met Éireann's January climate statement[3] confirms that County Dublin recorded its second-wettest January on record (behind January 1948). Johnstown Castle in County Wexford had its wettest January since 1996 and the highest 3-month rainfall total on record for November 2025 to January 2026.[3] These antecedent wet conditions amplified the impacts of Storm Chandra, with further rain falling onto already saturated catchments and elevated rivers.

Parts of Wexford and Dublin experienced severe local flooding. In Enniscorthy, County Wexford, floodwaters reached up to 'five feet' in places, with around 20 businesses and 30–40 homes affected.[4] Many of those affected have been unable to obtain flood insurance following previous extreme flooding in the town, most recently in 2015. A total of €55 million was allocated to the Enniscorthy Flood Relief Scheme in 2014,[5] with plans first presented for public exhibition in 2019;[6] however, construction of the scheme, which will provide protection to over 300 homes and businesses, remains stalled due to planning issues.

Storm Chandra also resulted in significant transport disruption in the Dublin area, with a 'major event' declared on the M50 due to flooding and roads in south Dublin becoming impassable, with knock-on disruption to Dublin Bus services.[7] There was also major disruption on the railways, with the Rosslare line and a number of train stations in Dublin and the surrounding areas closed due to flooding, including from severe wave overtopping. Some Dublin residents reported being without a full water supply for up to 10 days as a result of flood-related damage to pumping infrastructure.[8]

A rapid attribution study[9] has concluded that while the 1-day rainfall associated directly with Storm Chandra was 'not particularly remarkable', the 7-day rainfall accumulation was 9% higher than it would have been in a −1.3°C pre-industrial climate. It further concluded that this level of rainfall accumulation over a 7-day period is now almost three times more likely to occur than in a pre-industrial climate, shifting from a 1 in 150-year event to a 1 in 60-year event.

The lessons learned from Storm Chandra will be further reflected on in the Adaptation Annual Review, due for publication in September 2026, as well as in relevant sectoral annual reviews that will be published over the course of the year. These publications will incorporate specific recommendations on improving preparedness for extreme events and increasing the resilience of critical infrastructure and communities.

Abbreviations

Abbreviation	Definition
AMOC	Atlantic Meridional Overturning Circulation
CMIP	Coupled Model Intercomparison Project
DAFM	Department of Agriculture, Food and the Marine
DOY	day of the year
EPA	Environmental Protection Agency
HAB	harmful algal bloom
HCLIM	HARMONIE-Climate
HPAI	highly pathogenic avian influenza
ICHEC	Irish Centre for High-End Computing
IPCC	Intergovernmental Panel on Climate Change
NCCRA	National Climate Change Risk Assessment
RCP	representative concentration pathway
SST	sea surface temperature
WASITUS	Weather Attribution Science Irish Operational User Service

Contents

Key observations (Ireland)

1. The average air temperature in Ireland in 2025 was provisionally 11.14°C. This makes 2025 the second-warmest year on record, with 7 of the top 10 warmest years on record now having occurred since 2005, and it is only the second time in the 126-year record that the annual average temperature has been above 11°C.
2. The summer of 2025 was the warmest summer on record in Ireland, with the average temperature being 1.94°C above Ireland's 1961–1990 long-term average for summer temperatures. This followed the warmest and sunniest spring on record. The summer was particularly characterised by elevated night-time temperatures. Analysis by the Weather Attribution Science Irish Operational User Service (WASITUS) project found that these above-average temperatures were increased and made more likely by climate change. The year's highest temperature of 31.1°C was recorded in Mount Dillon, Roscommon, in July.
3. Drier than average spring and summer seasons resulted in drought conditions being experienced in several locations. There was considerable regional variation and 49 public water supplies in 15 counties were officially declared by Uisce Éireann to be in drought status, leading to prolonged water shortages and water conservation orders in these counties. Severe marine heatwaves were also experienced in the summer months.
4. Evidence shows that warmer spring conditions in recent decades have shifted the seasonal timing of important lifecycle stages across multiple plant, bird and insect species in Ireland.
5. Storm Éowyn, an event with record-breaking winds, occurred in 2025 and was the most expensive storm-related insurance event in Irish history, with claims in excess of €301 million. Damage from the storm and unprecedented power outages caused cascading impacts on livelihoods, telecommunications, health services, and water supply and treatment.
6. The meteorological autumn was the fourth-wettest autumn on record, and six of the top ten wettest autumns have now occurred since 2001. A WASITUS attribution study found that climate change increased both the magnitude and likelihood of the heavy rainfall during Storm Claudia in mid-November, with the 2-day rainfall event in Dublin, Wexford and Wicklow estimated to be nearly 12% more intense than it would have been in a pre-industrial climate.

Key observations (international)

1. The global mean surface air temperature was 1.43°C above the pre-industrial level in 2025 (with a margin of uncertainty of ±0.13°C), making it one of the three warmest years on record. The past 11 years, 2015–2025, have been the 11 warmest years in the 176-year observational record, with the past 3 years, 2023–2025, being the 3 warmest years on record.
2. The levels of carbon dioxide, methane and nitrous oxide in the atmosphere have reached their highest points in recorded history. The record high concentrations are accelerating global warming and turbocharging more extreme weather events, which continued to have cascading impacts on lives, livelihoods, food systems and ecosystems around the world in 2025.
3. The global average concentration of carbon dioxide increased by 3.5 parts per million between 2023 and 2024. This was the biggest annual increase since records began and was driven by the continued burning of fossil fuels and a spike in wildfires. Global efforts to reduce greenhouse gas emissions and enhance carbon removals are failing to materialise at the pace and scale needed to keep the Paris Agreement's temperature goal within reach. This underscores the need for sectors to plan for and address the risks of overshooting global temperature goals (e.g. higher warming scenarios exceeding 1.5°C or 2°C).
4. Ocean temperatures were among the highest on record. Ocean warming has rapidly increased over the past two decades and is intensifying tropical and subtropical storms, accelerating sea ice loss and driving sea level rise.
5. Climate change continues to increase both the likelihood and intensity of extreme weather events, including floods, heatwaves and tropical cyclones. Throughout 2025, severe climate-related disasters caused major economic disruption, social upheaval and significant loss of life, including unprecedented wildfires in Los Angeles, the rapid intensification of Hurricane Melissa across the Caribbean and a prolonged drought in West Asia. World Weather Attribution analysed 157 extreme events in 2025 that caused major humanitarian impacts, finding the vast majority to have been altered by human greenhouse gas emissions. The top ten most costly extreme weather events were responsible for damage costs exceeding €100 billion.

1. Introduction

This part of the Annual Review summarises the most recent developments in the understanding of Ireland's changing climate in the context of broader global climate changes. It examines how the climate is currently changing and considers projected future changes. This information highlights the urgency of both adaptation and mitigation actions in the global and Irish contexts. It is based on recent developments and information sources, including international and national 'state of the climate' reports and other relevant research.

2. Latest scientific evidence for observed climate change

2.1. State of Ireland's climate

The average air temperature in Ireland in 2025 was provisionally 11.14°C.[10] This makes 2025 the second-warmest year on record, with 7 of the top 10 warmest years on record now having occurred since 2005, and it is only the second time in the 126-year record that the annual average temperature has been above 11°C.[10]

This section summarises the main findings from Met Éireann's Annual Climate Statement for 2025 and its monthly weather statements and climate statements for each season in 2025.[11] For meteorological and climatological purposes, the Irish seasons are classified into 3-month periods: winter – December to February; spring – March to May; summer – June to August; and autumn – September to November.

Winter 2024/25 brought Ireland's highest wind gust on record during Storm Éowyn, which was followed by the warmest and sunniest spring on record and the warmest summer on record. Autumn was the fourth wettest on record, with both rainfall totals and temperatures being above average at all meteorological stations.

More detailed information on the climate impacts affecting different sectors of the economy, including Agriculture, Biodiversity, Electricity, Transport and the Built Environment, was presented in the relevant sectoral annual reviews published in 2025.[12] These publications include specific recommendations to strengthen preparedness for extreme events and to enhance the resilience of critical infrastructure and communities.

2.1.1. Calendar of notable weather events

A calendar of notable weather events observed in Ireland in 2025 is presented below (Figure 1).

Figure 1: Calendar of notable weather events observed in 2025.
(Source: Met Éireann.[10])

2.1.2. Elevated temperatures

Ireland experienced its warmest summer on record in 2025, following on from the warmest and sunniest spring on record. Summer 2025 surpassed the summer of 1995 to become the warmest on record, with an average temperature of 16.19°C, which is 1.94°C above Ireland's 1961–1990 long-term average and marginally warmer (0.08°C) than the previous warmest summer in 1995.[13] Of the top ten warmest summers in Ireland, six have now occurred since 2000 (Figure 2).

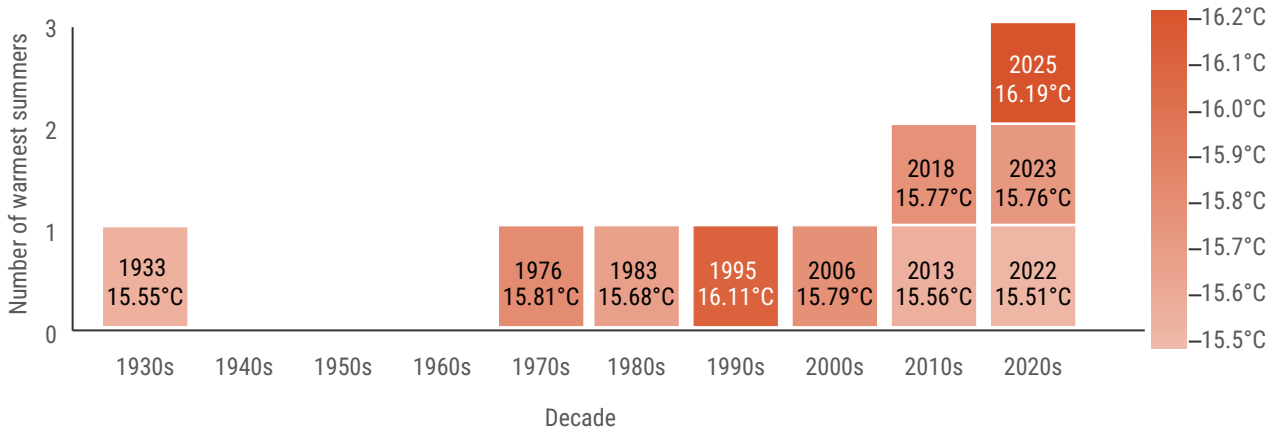


Figure 2: Top ten warmest summers on record for Ireland by decade.
Mean summer temperature shown in degrees celsius. The mean temperature for 2025 is provisional. (Source: Met Éireann.[13])

The warmest summer on record in 2025 was driven by a combination of factors, with climate change being an underlying aggravating factor in the following:[13]

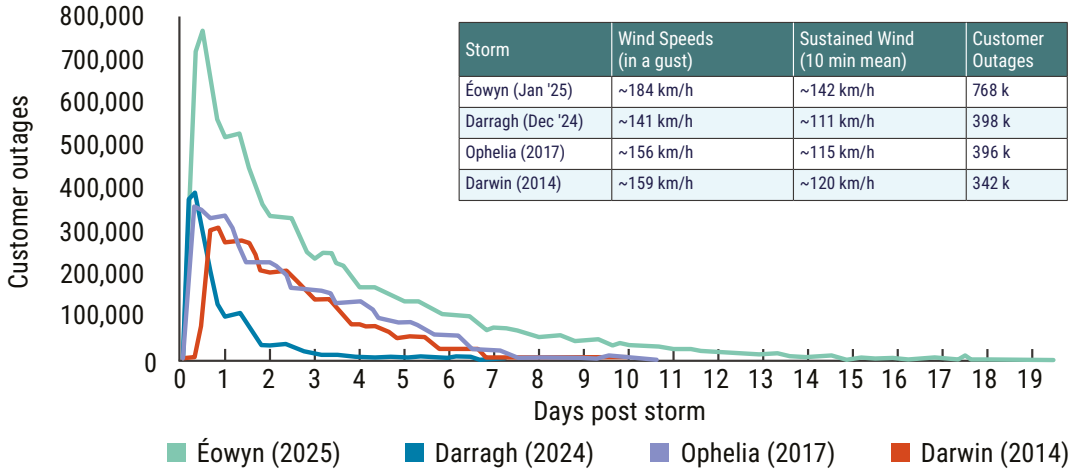
- **Dry soils** – Following the warmest spring on record, with dry and sunny conditions across the country, soils were very dry. With less evaporative cooling, heat builds up and lingers for longer.
- **Heat domes to the south** – Heat domes over western and central Europe (which caused a number of heatwaves there) occasionally pushed hot air masses over Ireland, bringing relatively short hot periods during each summer month.
- **Marine heatwaves** – While the severe marine heatwave of May 2025 eased off, sea surface temperatures (SSTs) remained elevated around the coasts of Ireland during the summer. Marine heatwaves, although less severe, lingered throughout all three summer months, especially to the south of Ireland. This meant that the warm air masses moving up from the south during the summer retained more heat.
- **Warm nights** – Most Met Éireann observing stations recorded their highest mean minimum temperature for summer on record, and several long-standing stations had their highest number of warm nights on record. With less sunshine and fewer hot days (days with maximum temperature > 25°C) compared with the next two warmest years on record, 1995 and 1976, the higher minimum temperatures during summer 2025 were a critical factor pushing the overall mean summer temperature higher. The elevated SSTs helped to keep night-time temperatures higher in general. According to a Weather Attribution Science Irish Operational User Service

(WASITUS)[a] attribution study, the experienced average minimum temperatures are 40 times more probable today than they were under conditions in a pre-industrial climate.[14]

2.1.3. Storm events

Five named storms directly affected Ireland in 2025 – Éowyn, Floris, Amy, Claudia (named by the Spanish State Meteorological Agency) and Bram.[10] In the absence of a national climate damage register, it is difficult to compare trends in the impacts of storm events from year to year. Each of the named storms brought strong winds, high rainfall, significant flood damage, widespread power outages and reports of coastal erosion.

Storm Éowyn, which made landfall on 24 January 2025, brought the highest sustained wind speeds and gusts ever recorded in Ireland. Sustained hurricane-force winds resulted in 768,000 customers losing electricity supply (Figure 3), over 200,000 premises being left without water and over one million telecommunications users being left with no broadband or phone coverage.[15,16] It was the most expensive storm-related insurance event in Irish history, with claims in excess of €301 million.[17] Storm Bram resulted in economic losses of €60 million,[18] including severe damage from coastal erosion to the Dublin Bay Great South Wall, which plays a key role in safeguarding and sheltering shipping channels into Dublin Port.[19] The economic damage from these storm events followed losses estimated at €4.1 billion, covering both direct and indirect costs, from flood and windstorm events in Ireland in 2024.[20,21]



Storm	Wind Speeds (in a gust)	Sustained Wind (10 min mean)	Customer Outages
Éowyn (Jan '25)	~184 km/h	~142 km/h	768 k
Darragh (Dec '24)	~141 km/h	~111 km/h	398 k
Ophelia (2017)	~156 km/h	~115 km/h	396 k
Darwin (2014)	~159 km/h	~120 km/h	342 k

Figure 3: Comparison of Storm Éowyn with previous significant storms with respect to customer power outages and days to restore power.
(Source: Department of Housing, Local Government and Heritage.[22])

a WASITUS is delivered by the Irish Climate Analysis and Research Units (ICARUS) Climate Research Centre at Maynooth University. The project aims to develop an operational event attribution capability for Ireland, enabling rapid scientific analyses of how human-driven climate change influences the likelihood and severity of extreme weather events.

The severity of Storm Éowyn prompted the Government to undertake a review of its coordinated response and the Review of Storm Éowyn report was published in October 2025.[22] It contains recommendations according to the thematic areas of:

- coordination of the response to Storm Éowyn,
- review of the communication of safety advice and other relevant information to the public during Storm Éowyn,
- humanitarian support in communities,
- resilience of critical infrastructure and essential services.

The Council notes that an implementation plan is to be developed to ensure that the recommendations are further developed into actionable plans with owners and timelines for delivery. While it is noted that some key actions are under way, the implementation plan has not yet been published. The implementation of actions should be monitored and reported publicly.

2.1.4. Drought occurrences

Both the spring and summer of 2025 were characterised by prolonged dry periods, with Ireland classified under either drought watch, warning or alert by the European Drought Observatory in these periods. Provisional national gridded rainfall figures for 2025 (Figure 4) show below-average rainfall in the spring months, average rainfall in the summer months and above-average rainfall in the autumn months.

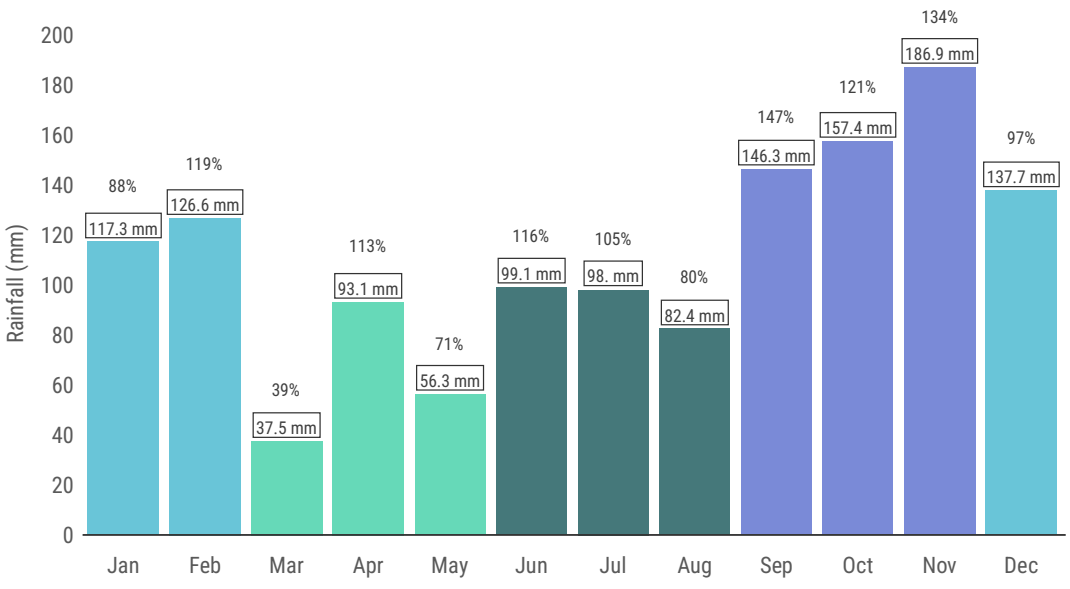


Figure 4: Provisional monthly gridded rainfall anomalies (percentage of 1991–2020 long-term average) together with monthly rainfall totals in millimetres in 2025.
(Source: Met Éireann.[10])

There were numerous climatological dry periods during the spring and summer months. Climatological dry periods are classified as dry spells, absolute droughts and partial droughts.[b] In spring 2025, 3 stations had partial droughts, 11 stations had absolute droughts and 22 stations had dry spells. In the summer months, two stations had absolute droughts and nine stations had dry spells. There was considerable regional variation in the drought impacts (Figure 5), with prolonged water conservation orders being put in place by Uisce Éireann. A total of 49 public water supplies in 15 counties were officially declared by Uisce Éireann to be in drought status,[23] leading to prolonged water shortages and water conservation orders in these counties.

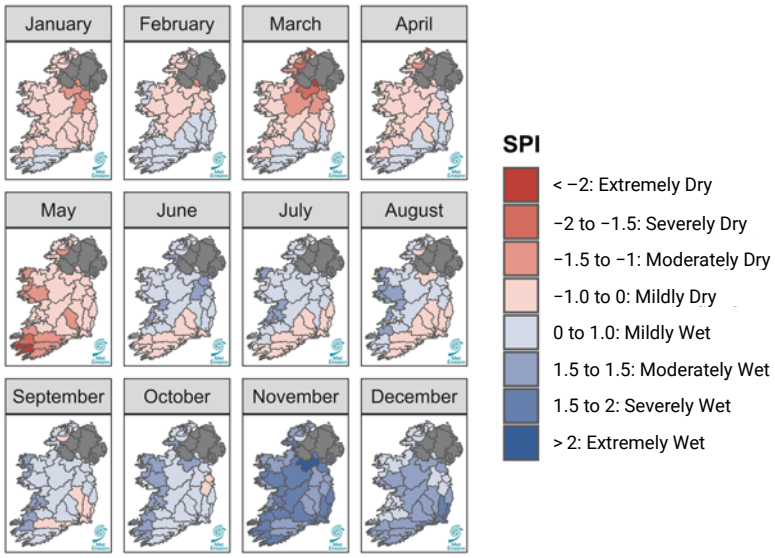


Figure 5: Monthly precipitation anomalies observed at the catchment level in Ireland in 2025 using monthly Standardized Precipitation Index (SPI) values, comparing conditions with those of the previous 3 months.
Standardized Precipitation Index indicators allow for estimating the potential impacts of meteorological drought. The lower (more negative) the indicator, the more intense the drought. (Source: Met Éireann; personal communication.)

2.1.5. Marine heatwaves

Marine heatwaves, occurring when the SST is significantly above average for a long period of time, were again observed in the summer of 2025, particularly in the months of May and August. The UK Met Office placed the May marine heatwave at the extreme end of the spectrum, with SSTs up to 4°C

b A dry spell is a period of 15 or more consecutive days to none of which is credited 1.0 mm or more of precipitation (i.e. daily total < 1.0 mm). An absolute drought is a period of 15 or more consecutive days to none of which is credited 0.2 mm or more of precipitation. A partial drought is a period of at least 29 consecutive days, the mean daily rainfall of which does not exceed 0.2 mm.

above average.[24] The August marine heatwave was rated as severe for most of the western and eastern coastal areas (Figure 6). These episodes are expected to become more intense, longer and more frequent in response to anthropogenic global warming.

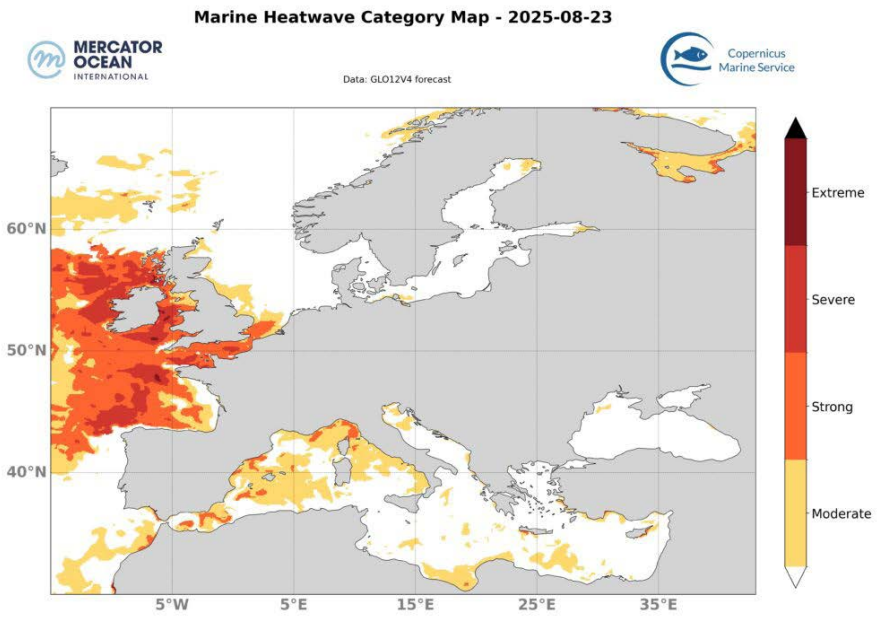


Figure 6: Example of marine heatwaves experienced in August 2025, as observed by the Copernicus Marine Service. 'Severe' and 'extreme' SSTs can be seen on the coasts around Ireland.
(Source: Mercator Ocean International.[25])

2.1.6. Impacts on other variables

Climate change impacts continued to interact with and exacerbate existing environmental stresses.

Outbreaks of diseases and alien invasive species

The National Climate Change Risk Assessment (NCCRA) identifies the increase in occurrence of invasive species due to changes in climatic conditions as a substantial risk by 2050 and a critical risk by 2100, according to both representative concentration pathway (RCP) 4.5 and 8.5 scenarios.[26] Climate change continues to alter environmental conditions, with milder winters and warmer summers expected to make Ireland more favourable to outbreaks of disease and the spread of invasive species, enabling them to thrive and disrupt local ecosystems and outcompete native flora and fauna in terrestrial ecosystems.

In 2025, the continued prevalence of diseases such as ash dieback and outbreaks of highly pathogenic avian influenza (HPAI) and blue tongue showed the vulnerability of the Agriculture and Forest sectors and native biodiversity to diseases. Ash dieback was first detected in Ireland in 2012 and is estimated to affect approximately 16,000 hectares of ash forests.[27] There is increasing evidence that climate change is accelerating the global spread and emergence of new avian influenza variants.[28]

Avian migratory patterns and routes are changing and migratory waterfowl are particularly susceptible to avian influenza viruses.[29]

The National Farmed Animal Biosecurity Strategy (2025–2030) recognises the risk of climate change increasing the extent of disease vectors and outlines the need for measures including risk assessments, monitoring programmes, training and strengthened on-farm biosecurity.[30] In 2025, five outbreaks of HPAI were confirmed on poultry premises in Ireland,[31] while 68 wild birds tested positive for HPAI across the country.[32] The HPAI situation resulted in the closure of Fota Wildlife Park in County Cork from October to December 2025. Species alerts were issued for the Asian hornet (*Vespa velutina*), with one nest identified and removed in Cork city and another in Cobh in September 2025, while a single Asian hornet was also recorded in Dublin in July 2025.[33] While the pathways of introduction for these species are not known, the sightings have highlighted the risks to Ireland's native biodiversity and economy and the urgent need to strengthen systems for the surveillance and control of both alien invasive species and diseases.

Harmful algal blooms

High seawater and freshwater temperatures exacerbate eutrophication pressures and contribute to the development of harmful algal blooms (HABs).[34] Research funded by the Environmental Protection Agency (EPA) identified climate change, particularly increased temperatures and high-rainfall events, as one the causes of the 2023 Lough Neagh HAB, in combination with excess nutrients and the presence of invasive zebra mussels.[35] The research also evaluated the threat and potential impact of HABs on 35 Irish lakes, drawing lessons from the case of Lough Neagh and finding that 7 of the 35 lakes face a high potential threat of serious HAB events due to a combination of factors like those implicated in the Lough Neagh bloom. Several cases of severe HABs were reported during the summer of 2025, including in Lough Derg, Lough Corrib and Lady's Island Lake. HABs pose a significant challenge to water supply and have significant and complex impacts on human health, biodiversity and ecosystem functioning in aquatic environments. The environmental and economic impacts of these HABs and the costs of restoration will continue to increase with warmer temperatures and longer and more frequent heatwave periods.

Wildfires

While Ireland's wildfire regime is different to those of the other regions highlighted in Sections 2.2 and 2.3, it is notable that both Ireland and the UK experienced an increase in wildfires in 2025.[36,37] Changes related to land management, rural demographics and fuel loads on affected lands all have a strong influence on wildfires. Wildfires are identified in the NCCRA as a substantial current risk to forests, with the risk likely to become critical late century under the RCP 8.5 scenario.[26]

The Department of Agriculture, Food and the Marine (DAFM) issued nine fire danger notices in 2025[38] and a total of 4,355 hectares was burned by wildfires in Ireland in 2025 compared with an average of 3,139 hectares in the period 2006–2024 – an increase of almost 39%.[37] A total of 31 wildfires (of approximately 30 hectares or larger) were reported in 2025 compared with an average of 12 wildfires in the period 2006–2024. DAFM has highlighted the considerable damage to forests (both private and state-owned) in recent years as well as the catastrophic impacts of wildfires on upland habitats and rural communities, including endangering lives and property and causing economic losses for the Forestry sector. Conditions favourable to wildfires are likely to occur more frequently with climate change, with increasingly hotter and drier summers and associated higher levels of recreational activity. DAFM continues to advise all forest owners and managers to strengthen preparations for wildfires, including through prescribed burning, fire risk assessments and fire plans for all forests, and increased investment in fire-fighting tools and equipment.

Impacts on phenology

Phenology refers to the study of the timing of biological events in relation to seasonal changes in the environment, including flowering, breeding, migration and hibernation.[39] Climate factors such as temperature, precipitation and availability of sunlight have a fundamental influence on the phenology and structure of biotic communities.

Changes in phenology, including timing of bird migration and plant flowering, are an observed impact of climate change in Ireland.[40] Met Éireann has undertaken phenological tree monitoring at its Valentia Observatory since the 1960s. It conducts regular checks of each tree specimen to document the overall status of the tree and takes note of any phenophases with the date and day of the year (DOY) (1–365). It looks at the indicator of leaf unfolding – the DOY when the first regular structure of the leaf is visible in three to four places on the tree/plant. Figure 7 shows consistent overall earlier leaf unfolding among ten tree species since the 1960s at the Valentia Observatory's phenological garden, with substantial species-to-species and interdecadal variability. Evidence shows that warmer spring conditions in recent decades have shifted the seasonal timing of important lifecycle stages across multiple plant, bird and insect species in Ireland.[41,40]

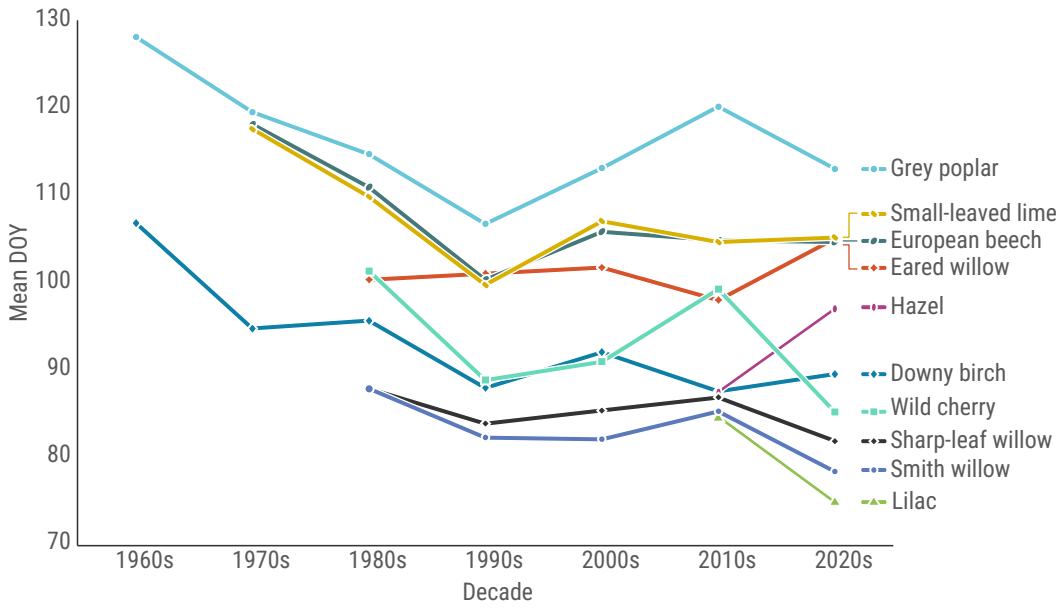


Figure 7: Mean decadal DOY of leaf unfolding phase in trees at Valentia Observatory.
(Source: Met Éireann; personal communication.)

2.1.7. Attribution studies in Ireland – linking climate change and extreme events

The field of event attribution science – the linking of climate change and individual extreme events – continues to evolve, and advances in attribution capability in Ireland now make it possible to rapidly analyse the influence of climate change on a complex range of extreme weather events.

An interesting feature of the warm temperatures experienced in 2025 was that it was record night-time temperatures rather than day-time temperatures that pushed the temperature average up to

break the record for the warmest summer. Most Met Éireann observing stations recorded their highest mean minimum temperature for summer on record. A rapid attribution study, undertaken by the WASITUS[14] project, funded by the EPA and Met Éireann, found that the average minimum temperatures experienced in 2025 are now 40 times more likely to occur than they were in a pre-industrial climate. For possible future climates that are 1.5°C, 2°C or 3°C warmer than pre-industrial levels, similar summer average minimum temperatures will become 63, 126 and 315 times more likely than they would have been without human-caused climate change.

Another rapid attribution study by WASITUS[42] found that climate change has made heavy rainfall events that contributed to flooding during Storm Claudia in November both more intense and more likely. The rainfall magnitude of the 2-day event in Dublin, Wexford and Wicklow has increased by about 12% compared with pre-industrial times. The level of rainfall was also recorded for the 30 days prior to the storm. The magnitude of rainfall from a 30-day event across several eastern counties has increased by nearly 7% due to climate change. Both 2-day and 30-day heavy rainfall events are now twice as likely as they were before industrialisation. Global warming of 3°C could mean that similar 2-day events occur every 1–2 years, and that 30-day events occur every 2 years.

2.2. State of Europe's climate

Europe continues to be the fastest warming continent. In the European region, 2025 was the third-warmest year on record, with an average temperature of 10.41°C – 1.17°C above the average for the 1991–2020 reference period.[43] Portugal and Spain experienced their highest recorded temperatures for June, reaching 46.6°C and 46.0°C, respectively. Türkiye set a new national temperature record of 50.5°C in July. Several regions in France and Germany also registered unprecedented high temperatures. The intense summer heatwaves triggered widespread wildfires and displacements of populations – about 29,000 individuals in Spain, 15,000 in Greece and 50,000 in Türkiye.[44]

Focus on wildfires

A record area in Europe of more than one million hectares was burned by wildfires in 2025, compared with an average of 323,135 hectares during the period 2006–2024. Spain and Portugal were worst affected, with 385,000 and 275,000 hectares burned, respectively. This marked a nearly 484% increase on the 2006–2024 average in Spain and a 286% increase in Portugal (Figure 8). The fires resulted in at least eight deaths, tens of thousands of evacuations and record emissions of carbon, with 41.83 Mt CO_2 emitted in 2025.[45] A World Weather Attribution[c] study found that the hot and dry conditions that exacerbated the fires are now 40 times more frequent and around 30% more intense than in the pre-industrial climate.[46]

c World Weather Attribution is an international scientific initiative that analyses how climate change influences extreme weather events. It quantifies how climate change influences the intensity and likelihood of an extreme weather event in the immediate aftermath of the extreme event using weather observations and computer modelling. World Weather Attribution studies also evaluate how existing vulnerabilities worsen the impacts of extreme weather events.

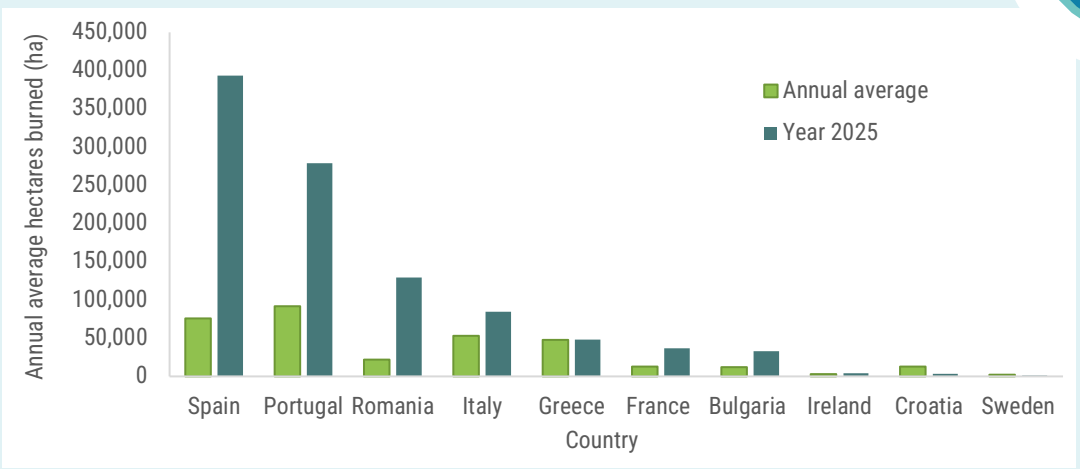


Figure 8: Area in hectares burned per country in 2025 compared with the annual average for 2006–2025.
(Source: European Forest Fire Information System.[37])

2.3. State of the global climate

The year 2025 was one of the three warmest years on record.[47] The global mean surface air temperature was 1.43°C above the 1850–1900 average (with a margin of uncertainty of ±0.13°C).[44] The past 11 years, 2015–2025, have been the 11 warmest years in the 176-year observational record, with the past 3 years being the 3 warmest years on record.

The State of the Climate 2025 report by the World Meteorological Organization[44] showed that records were once again broken in 2025 for greenhouse gas concentrations, global and regional surface temperatures (Figure 9), ocean heat and acidification levels, sea level rise, Antarctic sea ice cover loss and global glacier retreat.

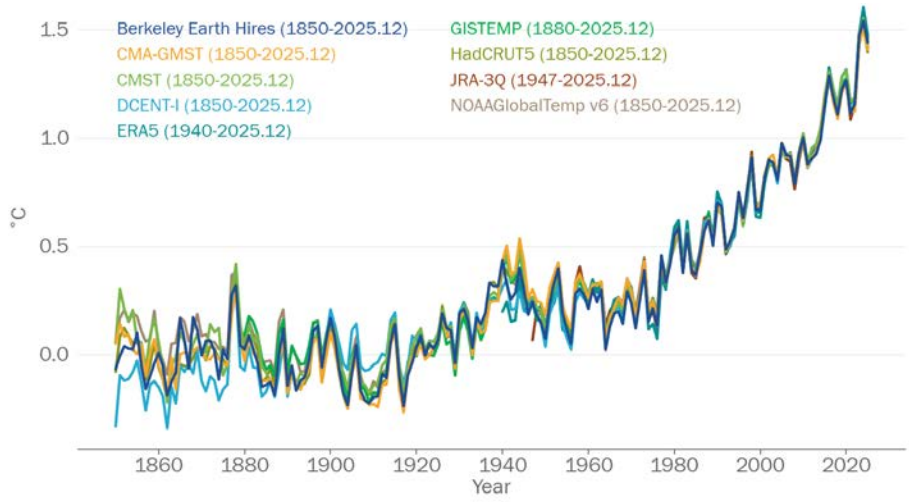


Figure 9: Annual global mean temperature anomalies relative to the 1850–1900 average, shown from 1850 to 2025 for eight datasets.
CMA-GST, China Meteorological Administration global merged surface temperature; CMST, China merged surface temperature; DECENT-I, Dynamically Consistent Ensemble of Surface Temperature; ERA5, European Centre for Medium-Range Weather Forecasts Reanalysis version 5; GISTEMP, Goddard Institute for Space Studies Surface Temperature Analysis; JRA-3Q, Japanese Reanalysis for Three Quarters of a Century; NOAAGlobalTemp v6, National Oceanic and Atmospheric Administration Global Surface Temperature Dataset version 6.
(Source: World Meteorological Organization.[47])

Key messages from the 2025 report[44] are that:

- The global annual mean SST in 2025 was 0.39°C above the 1991–2020 average and around 0.12 ± 0.03°C cooler than in 2024, consistent with the shift from El Niño to La Niña conditions, but it still ranked as one of the three warmest years on record.[48] The long-term rate of sea level rise increased. The year 2024 set a new record for the annual global mean sea level as measured by satellites. Since satellite measurements began, the rate of sea level rise has risen from 2.1 mm per year between 1993 and 2002 to 4.1 mm per year between 2016 and 2025. This upward trend is driven by ocean warming and thermal expansion, alongside the ongoing loss of ice from glaciers and ice sheets.
- The levels of carbon dioxide, methane and nitrous oxide in the atmosphere reached their highest recorded values in 2024, the most recent year for which global consolidated figures are available. Preliminary data suggest that concentrations of all three key greenhouse gases have risen further in 2025. The global average concentration of carbon dioxide increased by 3.5 parts per million between 2023 and 2024. This was the biggest annual increase since records began and was driven by the continued burning of fossil fuels and a spike in wildfires.
- In 2025, the global upper-2000 m ocean heat content rose by approximately 23 ± 8 zettajoules relative to 2024. This increase is equivalent to roughly 200 times the total global electricity generation in 2024.[48]
- Ocean warming rates have increased significantly over the past two decades (Figure 10) and are intensifying tropical and subtropical storms, accelerating sea ice loss and contributing to

sea level rise. The average rate of warming was 0.6 ± 0.1 watts/m^2 from 1971 to 2024 and 1.0 ± 0.1 watts/m^2 from 2005 to 2024. This indicates that the Earth is currently absorbing more energy than it releases, resulting in an increasing energy imbalance.

- In the latest reference hydrological year of 2023/24, data from a set of reference glaciers indicate a global annual mass negative balance of 450 gigatonnes, nominally the largest loss of ice on record since 1950. In addition, 2024 was the third consecutive year in which all 19 of the monitored glaciated regions around the world recorded net mass loss.
- In 2025, both the Antarctic and Arctic sea ice extents remained below the average. The Arctic sea ice reached its annual peak of 14.19 ± 0.40 million km^2 between 20 and 21 March 2025, marking the lowest recorded maximum extent since satellite tracking began in 1979.
- River discharge is one of the key indicators of the global water cycle, revealing shifts in precipitation and temperature patterns. In 2024, about two-thirds of the global catchment area was outside normal discharge rates compared with data recorded from 1991 to 2020. This continues a 6-year pattern of disruption and highlights persistent disturbances, with many regions experiencing either excessive or insufficient water flow.

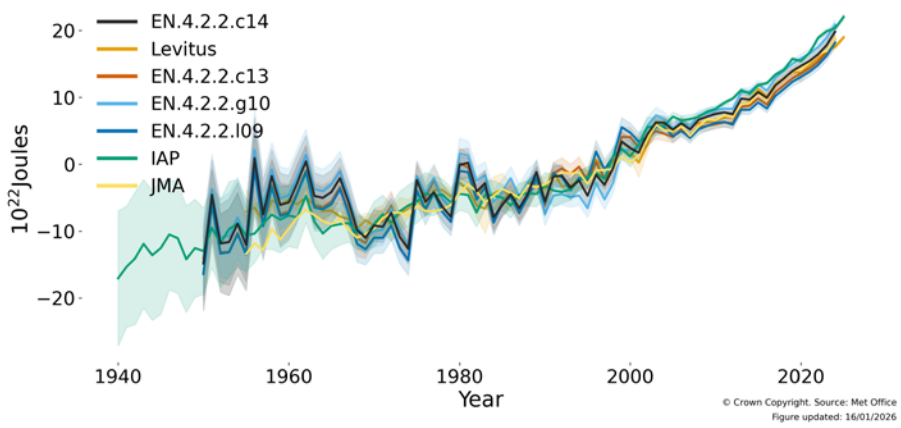


Figure 10: Annual global ocean heat content to a depth of 700 m difference from 1981–2010 average. Four dataset families – EN4, Levitus, Japan Meteorological Agency and Cheng *et al*. – are shown. They agree on the overall warming of the upper ocean.
IAP, Institute of Atmospheric Physics; JMA, Japan Meteorological Agency.
(Source: UK Met Office.[49])

2.3.1. Examples of extreme weather events in 2025

Climate change continues to increase both the likelihood and intensity of extreme weather events, including floods, heatwaves and tropical cyclones. Throughout 2025, severe climate-related disasters caused major economic disruption, social upheaval and significant loss of life. World Weather Attribution analysed 157 extreme events in 2025 that caused major humanitarian impacts, finding the vast majority to have been altered by greenhouse gas emissions from human activities.[50] The top ten most costly extreme weather events were responsible for damage costs exceeding €100 billion.[51]

- **Wildfires in Los Angeles, USA** – In January 2025, wildfires burned more than 9,000 hectares, killed over 400 people and destroyed entire neighbourhoods in parts of Los Angeles.[51] This was the most destructive and expensive wildfire event in US history, with total economic losses exceeding US$60 billion. The weather conditions – including extreme dryness, heat and high winds – that enabled the wildfires to be so devastating are at least 35% more likely in today's climate than they would be in a world without human-induced climate change.[52]
- **Hurricane Melissa, Jamaica, Cuba and the Bahamas** – Hurricane Melissa is the third-most intense Atlantic hurricane on record and was the strongest tropical cyclone worldwide in 2025. The hurricane, which made landfall in October 2025, caused widespread destruction, including severe damage to homes, businesses, critical infrastructure, communication networks and power grids. Estimates of the economic cost vary, as assessments have not been finalised, but preliminary analyses suggest losses of around US$8 billion. Scientists have noted that Melissa's rapid intensification is consistent with climate change, as warmer SSTs provide more energy for such storms. Attribution scientists concluded that climate change enhanced the intensity of the hurricane over Jamaica by 30% and made it about twice as likely to occur.[53]
- **Drought in West Asia and Iran** – A 5-year drought continues to grip large parts of West Asia, including Iran, Syria and Iraq.[51] In Syria, the drought contributed to the severity of wildfires, and in Lebanon, the water level at Lake Qaraoun, the largest body of freshwater, hit an historic low. In Iran, an unprecedented and ongoing water crisis is impacting livelihoods and crops. Local authorities warned that if the crisis persists, the country's capital, Tehran, where nearly ten million people live, might need to be evacuated. The drought has been linked to climate change through at least two studies by the World Weather Attribution team in 2023[54] and 2025.[55] Both studies found that the drought would not have happened in a world without human-induced global warming.

3. Future climate projections, monitoring and impacts for Ireland

As the impacts of climate change worsen, climate services and consideration of climate risks are increasingly needed to inform decision-making. In the Irish context, the provision of robust and timely climate services and information is particularly important to support the implementation of the second iterations of the sectoral adaptation plans, which were published in November 2025.[56] The Government's decision to establish a National Framework for Climate Services in 2022[57] was made with this need in mind.

The first NCCRA,[26] which was published by the EPA in June 2025, also informs national, sectoral and local adaptation planning by prioritising areas where urgent action is needed to build climate resilience. The NCCRA identifies 115 risks and 5 potential opportunities across 9 systems. It highlights 43 significant national risks, including impacts to infrastructure, health, biodiversity and the economy.

3.1. Information and systems to support preparedness for extreme events

Early warning systems are identified as an area requiring focus and continuous improvement in the Review of Storm Éowyn report.[22] The Council supports the need to strengthen early warning systems for the range of climate hazards that Ireland is exposed to. The Council is further concerned that there continues to be limited timely and systematic information available on the economic,

social, health and environmental impacts of specific extreme weather events in Ireland. Information on the economic impacts of extreme events is fragmented across a wide range of stakeholders, such as local authorities, insurance companies and semi-state agencies.

The impacts of these events on critical infrastructure and services, the built environment and productive assets such as agricultural land and forestry are also likely to become increasingly severe. Promising initiatives at the local authority level, such as the Weather Impacts Register (WIRE) app, have not been rolled out effectively to date, although pilot testing is under way at present. While actions to establish sectoral impact registers have been noted in several sectoral adaptation plans, including those for the health sector and the electricity and gas networks, the urgent establishment of a national climate damage register by the Government and relevant agencies is now critical to ensure that a standardised and holistic approach is taken.

The Council welcomes the initial research funded by the EPA on identifying the potential impacts of extreme weather events on Special Areas of Conservation and Special Protected Areas in Ireland.[58] It identifies a vulnerability assessment framework that can be deployed at both national and local levels, and that needs to be rolled out to better understand the impacts of extreme weather events on priority species and habitats. Further research is also needed on the loss of ecosystem services in the Irish context that is being caused by escalating extreme weather events, including storms, intense rainfall events, droughts and marine heatwaves.[40]

3.2. Projections

3.2.1. National climate change projections

TRANSLATE is an established national programme funded and led by Met Éireann (currently beginning its third phase, TRANSLATE-3) that brings together members of the Irish climate action community to develop and mainstream national climate change scenarios for effective, climate-smart decision-making at the national and local levels. The TRANSLATE programme informs and underpins many essential national and local climate directives. It feeds directly into the National Framework for Climate Services to support climate service development, coordination and standardisation across the country. It also underpins projections for Climate Ireland, the national portal for climate adaptation.[59] It is embedded within the National Adaptation Framework[60] and the NCCRA and, as a result, supports local climate action plans and sectoral adaptation plans mandated by the Government.

In 2023, Met Éireann released the first iteration of the TRANSLATE climate change scenarios.[61] These scenarios provide standardised, high-resolution, accessible and bias-corrected climate scenarios for Ireland. The Irish Centre for High-End Computing (ICHEC) produced the full set of input protections for TRANSLATE, which used an ensemble of existing Coupled Model Intercomparison Project (CMIP) Phase 5 (CMIP5)[62] global and EURO-CORDEX[d][63] models that are downscaled over Ireland in line with international best practice, ensuring that projections are consistent with other countries and represent state-of-the-art climate science, while remaining situated within the local Irish context.[64] The TRANSLATE scenarios sample uncertainty from both future emissions and the climate system response to those emissions, ensuring that decision-makers have access to projections for a broad range of plausible futures. These standardised climate scenarios provide the most comprehensive

d EURO-CORDEX is the European branch of the international Coordinated Regional Climate Downscaling Experiment initiative, which is a programme sponsored by the World Climate Research Programme to organise an internationally coordinated framework to produce improved regional climate change predictions for all land regions worldwide.

picture of Ireland's future changes in temperature and precipitation to date across a range of scenarios, or RCPs (RCP2.6, RCP4.5, RCP8.5), up to the end of the century. Climate information is also presented on threshold-based global warming levels (1.5°C, 2°C, 2.5°C, 3°C and 4°C), i.e. showing how Ireland could change if the global average temperature increases by 'x'°C beyond pre-industrial levels. TRANSLATE is free and easily accessible to users in multiple formats to ensure that the standardised data can be utilised across the country and across user skill levels.

To date, the TRANSLATE dataset includes information on the core variables of temperature, precipitation, wind speed, relative humidity and solar radiation, as well as a number of calculated climate indicators associated with these, to aid adaptation planning. These data are freely available from both Met Éireann and Climate Ireland. TRANSLATE-2[65] also developed two risk frameworks (qualitative and quantitative) to address sector-specific impacts and risks associated with Ireland's changing climate.

TRANSLATE-3 commenced in September 2025 and will continue until 2029, building and expanding on the previous TRANSLATE iterations. It has three core pillars: (1) underpinning data, (2) understanding risks arising from climate extremes and (3) developing climate services that convert climate science into practical tools for decision-makers. It aims to expand the national dataset to include annual to decadal information, as well as updating the climate change scenarios from CMIP5 to CMIP6[66] in line with the Intergovernmental Panel on Climate Change (IPCC) Sixth Assessment Report,[67] taking advantage of the updated standardised future scenarios (shared socio-economic pathways). It will examine extreme events and their associated impacts, and evaluate how these could change in the future. Following this underpinning work, climate services will be produced to showcase how this information can be tailored to meet user requirements. Climate storylines for Ireland form a fundamental element of the TRANSLATE-3 communication approach in the form of scenario-, persona- and event-based storylines, increasing the accessibility of climate information across society.

3.2.2. International climate change projections

Both ICHEC and Met Éireann are partners in the Earth system modelling consortium EC-Earth and the regional climate modelling consortium HARMONIE-Climate (HCLIM). Both are European climate modelling consortia consisting of national weather services and universities, with EC-EARTH simulating changes in the global Earth system and HCLIM simulating the regional impacts of global change.

At the European level, coordinated experiments to undertake regional downscaling continue under the auspices of EURO-CORDEX. These model runs are freely available and are downscaled from a broad range of driving Earth system models that participated in CMIP5. EURO-CORDEX is currently in the process of updating from CMIP5 to CMIP6. When completed, the TRANSLATE-3 ensemble will be expanded to include members from this European resource, including projections from the HCLIM model.

The CMIP is a collaborative framework designed to improve knowledge of climate change. Ireland's contribution to CMIP6 consisted of a set of EC-Earth 3 simulations produced by ICHEC, supported by funding from the EPA and Met Éireann.[68] These models underpin the various IPCC iterations. CMIP7,[69] the latest development phase, has been designed to support specific user needs, including supporting the needs of the IPCC Seventh Assessment Report assessment cycle, and will help to further refine the understanding of past, present and future climate changes. The small, targeted, 'fast-track' experiment sets, in addition to the growing number of model intercomparison projects, reflect extensive feedback from the modelling centres and the wider user community.

3.3. Monitoring

Met Éireann, in collaboration with partners, continues to improve Ireland's climate observation networks. In October 2023, a new weather radar system was installed at Shannon Airport.[70] This modern radar system now provides more accurate rainfall information to weather forecasters, the public and researchers. The Weather Radar Expansion Network Project is Met Éireann's strategic programme to expand and upgrade Ireland's national weather radar network, enhancing real-time rainfall detection, strengthening flood forecasting and emergency response, and providing more accurate data for national and local decision-making.[71] The plan will increase the number of radars from two to seven over the next 5 years at locations in Roscommon, Cork, Kilkenny, Donegal and Meath.

The year 2023 also saw the automation of almost 80 climate monitoring stations throughout Ireland. This not only improved the resolution of climate information being monitored but also provides near real-time weather information to support emergency management, including the issuing of weather warnings. Met Éireann also commenced a rainfall automation project that, in tandem with the radar expansion, will better capture rainfall in near-real time.

The Irish Global Climate Observing System National Committee, consisting of members from Met Éireann, the Marine Institute, the EPA and Teagasc, as well as remote sensing experts, continues to review the status of essential climate variables for Ireland, ensuring their sustained long-term measurement and alignment with international standards. The Irish Soil Moisture Observation Network[72] coordinates soil moisture measuring networks in Ireland and, in collaboration with the UK Cosmic-Ray Soil Moisture Monitoring Network, sites in Northern Ireland. Over the past year, further enhancements have been made to the network to improve the monitoring of soil moisture throughout Ireland. Soil moisture, an essential climate variable, plays a crucial role in environmental processes such as the water cycle, weather and climate, vegetation growth and groundwater availability.

Met Éireann, in partnership with the Commissioners of Irish Lights, is conducting nearshore monitoring through a pilot programme that retrofits four navigation buoys with oceanographic, wave and meteorological sensors.[73]

Met Éireann and the Marine Institute are collaborating on improving the availability of tidal data from around the Irish coast. Ongoing research funded by the EPA through the HydroDetect project[74] is developing an updated reference hydrometric network for monitoring and detecting changes in river flows (floods, droughts, season flows) across Ireland. Other research being funded by the EPA and Met Éireann includes the HydroDARE project,[75] which is developing approaches to the attribution of changes detected in hydrological extremes to enhance the ability to discern a climate change signal in floods and droughts. The Council reiterates its recommendation from the 2025 Annual Review publication Our Changing Climate in 2024[76] that the Government should ensure that funding and necessary support, underpinned by appropriate legislation where relevant, are in place to sustain and improve the national climate observation system. This will allow for consistency, with a sustained national contribution to the Global Climate Observing System. The national system should include all critical atmospheric, land and ocean variables.

3.4. Climate impacts for Ireland

Globally, the past 11 years (2015–2024) have been the 11 warmest years on record. Ireland's overall warming trend continues in line with global trends, with 7 of the top 10 warmest years in Ireland having occurred since 2005. The latest Irish climate change projections indicate further warming in the future. This temperature change means that the likelihood of extreme weather events occurring has increased. Irish rainfall patterns are expected to change, with an increase in both dry periods

and heavy rainfall events. Global sea levels continue to rise. Coastal erosion is already a major problem on certain parts of the coast. Storm surge and coastal flooding risks around Irish coasts are expected to increase along with 'compound events' involving a combination of heavy rainfall and high tides.[26] It is currently unclear how the frequency and intensity of storms impacting Ireland will change with climate change. There is high confidence, however, that maximum rainfall rates associated with these storms will increase with warming.

The projected impacts of climate change on eight key sectors in Ireland were identified in Ireland's Climate Change Assessment Volume 3,[40] which was published in early 2024. In June 2025, the NCCRA expanded on this by assessing 115 climate-related risks and prioritising those requiring urgent adaptation action.[26]

With every additional tenth of a degree of global warming, the risk of exposure to potential tipping points increases. One of the most important potential tipping points affecting Ireland is the shutdown of the Atlantic Meridional Overturning Circulation (AMOC). Moving large amounts of heat northwards in the North Atlantic Ocean, the AMOC helps to create Ireland's temperate climate. Observations over recent decades indicate a quasi-stable or slightly weakening AMOC.[77,78] There is growing scientific evidence that a tipping point leading to an abrupt AMOC weakening could be exceeded during this century.[79,80] However, after the tipping point is exceeded it is possible that it would take several decades to a century to bring the AMOC to a fully weakened state, moving a possible AMOC shutdown into the 22nd century.[80] Consistent with this, climate model simulations constrained with observation data show that the AMOC will weaken gradually, reaching a 34–45% decline at the end of this century compared with present day.[81] The potential consequences for Ireland require more research, but global and European studies suggest the possibility of increased seasonality for Ireland (warmer and drier summers along with wetter and stormier winters).[82–84] Furthermore, local impacts on sea level rise around Ireland need to be investigated, including in light of land ice melting in Greenland and Antarctica and its interaction with the AMOC.

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