



**Making Ireland Weather
and Climate Prepared**



IRELAND'S FUTURE WEATHER AND CLIMATE

Joan Blackburn

Deputy Head of Forecasting



An Roinn Tithíochta,
Pleanála agus Rialtais Áitiúil
Department of Housing,
Planning and Local Government

Met Éireann (DHPLG)



Making Ireland Weather and Climate Prepared

- **Ensure the protection and safety of life and property by issuing public weather forecasts and warnings**

Met Éireann (DHPLG)



Making Ireland Weather and Climate Prepared

- **Ensure the protection and safety of life and property by issuing public weather forecasts and warnings**
- **Enhance support for impact-based decision making for weather events**

Met Éireann (DHPLG)



Making Ireland Weather and Climate Prepared

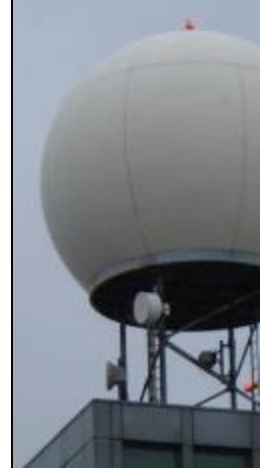
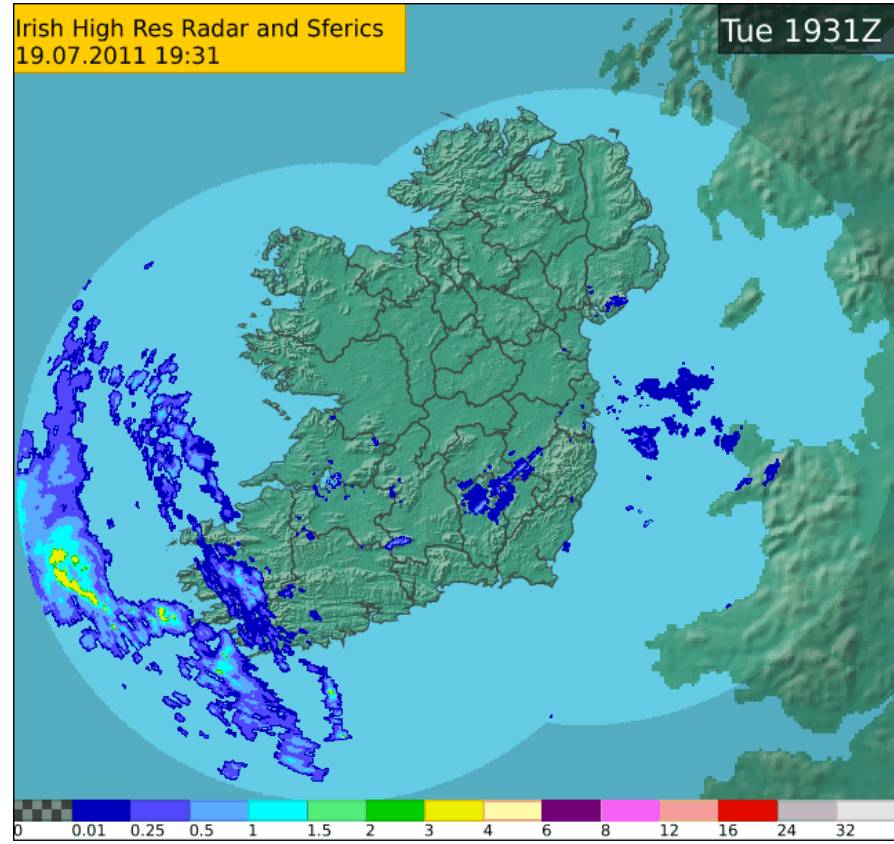
- **Ensure the protection and safety of life and property by issuing public weather forecasts and warnings**
- **Enhance support for impact-based decision making for weather events**
- **Deliver a high quality national flood forecasting service**

WMO Weather & Climate Observational Network

10,000 surface weather stations
1,000 upper-air stations
7,000 ships
100 moored and 1,000 drifting buoys
hundreds of weather radars
3,000 specially equipped commercial aircraft
16 meteorological and 50 research satellites.



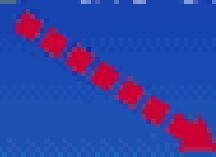
Observation Platforms



Weather Forecasting



Radiation from the sun



Radiation from the atmosphere



Evaporation and heat exchange

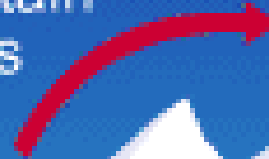


Sea

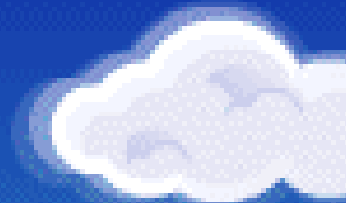
Radiation from the earth



Mountain effects



Formation clouds



Formation of rain and snow



Friction



The Equations of the Atmosphere

GAS LAW (Boyle's Law and Charles' Law.)

Relates the pressure, temperature and density

CONTINUITY EQUATION

Conservation of mass; air neither created nor destroyed

WATER CONTINUITY EQUATION

Conservation of water (liquid, solid and gas)

EQUATIONS OF MOTION: Navier-Stokes Equations

Describe how the change of velocity is determined by the pressure gradient, Coriolis force and friction

THERMODYNAMIC EQUATION

Determines changes of temperature due to heating or cooling, compression or rarification, etc.

Seven equations; seven variables (u, v, w, p, T, q).

$$\frac{du}{dt} - \left(f + \frac{u \tan \phi}{a} \right) v + \frac{1}{\rho} \frac{\partial p}{\partial x} + F_x = 0$$

$$\frac{dv}{dt} + \left(f + \frac{u \tan \phi}{a} \right) u + \frac{1}{\rho} \frac{\partial p}{\partial y} + F_y = 0$$

$$p = R\rho T$$

$$\frac{\partial p}{\partial z} + g\rho = 0$$

$$\frac{dT}{dt} + (\gamma - 1)T\nabla \cdot \mathbf{V} = \frac{Q}{c_p}$$

$$\frac{\partial \rho}{\partial t} + \nabla \cdot \rho \mathbf{V} = 0$$

$$\frac{\partial \rho_w}{\partial t} + \nabla \cdot \rho_w \mathbf{V} = [\text{Sources} - \text{Sinks}]$$



Seven equations; seven variables ($u, v, w, p, T, \rho, \rho_w$).

Numerical Weather Prediction

- Began in the 1920s Lewis Fry Richardson.
- Didn't take off until 1950's.
Advent of the computer and computer simulation that computation time was reduced to less than the forecast period itself. This was in 1950.
- In 1966, West Germany and the United States began producing operational forecasts based on primitive-equation models.
- The UK and Australia follow in 1972.

Numerical Weather Prediction

Core of modern weather forecasts

- Modern weather forecasts powered by weather models.
- Weather models are simulations of the future state of the atmosphere.
- Millions of observations as initial conditions trillions of calculations,
- A 3D picture atmosphere might look like at some time in the future.
- Massive (Super) computers are used to do these calculations at incredibly fast speeds.

The Equations of the Atmosphere

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Determines changes of temperature due to heating or cooling, compression or rarification, etc.

Seven equations; seven variables (u, v, w, ρ, p, T, q).

$$\frac{du}{dt} - \left(f + \frac{u \tan \phi}{a} \right) v + \frac{1}{\rho} \frac{\partial p}{\partial x} + F_x = 0$$

$$\frac{dv}{dt} + \left(f + \frac{u \tan \phi}{a} \right) u + \frac{1}{\rho} \frac{\partial p}{\partial y} + F_y = 0$$

$$p = R\rho T$$

$$\frac{\partial p}{\partial z} + g\rho = 0$$

$$\frac{dT}{dt} + (\gamma - 1)T \nabla \cdot \mathbf{V} = \frac{Q}{c_p}$$

$$\frac{\partial \rho}{\partial t} + \nabla \cdot \rho \mathbf{V} = 0$$

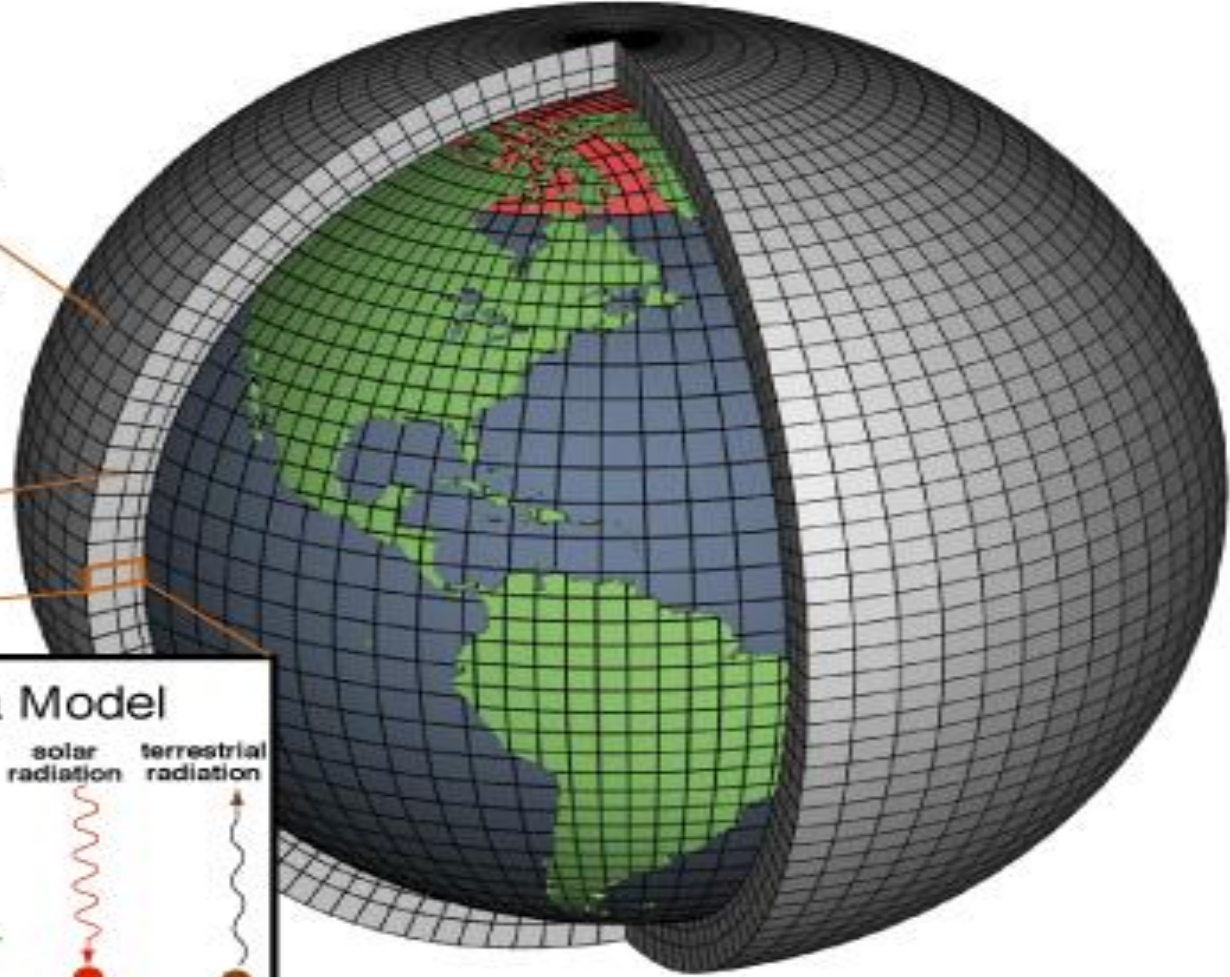
$$\frac{\partial \rho_w}{\partial t} + \nabla \cdot \rho_w \mathbf{V} = [\text{Sources} - \text{Sinks}]$$



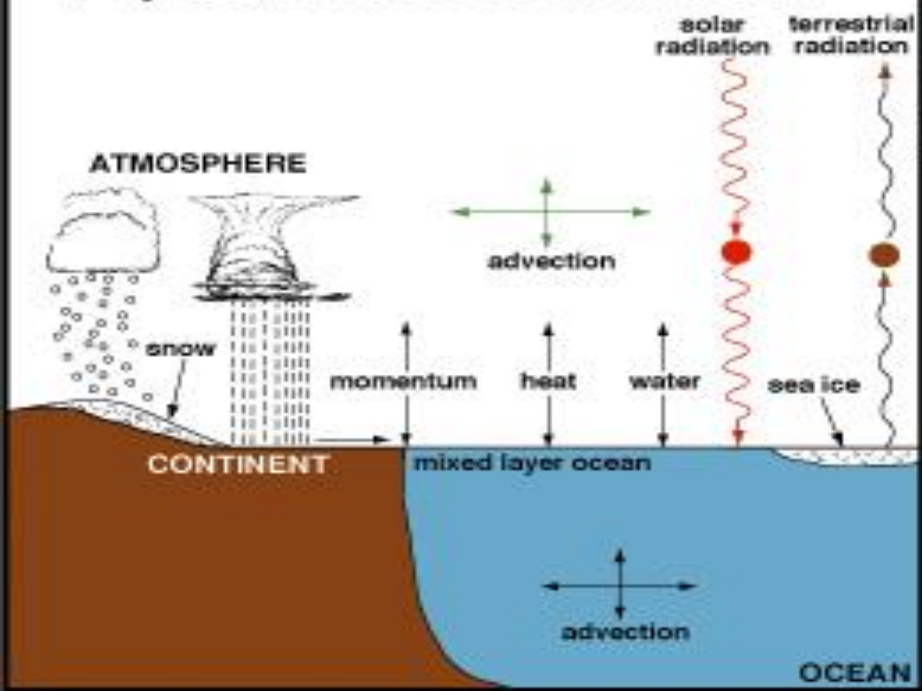
Seven equations; seven variables ($u, v, w, p, T, \rho, \rho_w$).

Horizontal Grid
(Latitude-Longitude)

Vertical Grid
(Height or Pressure)

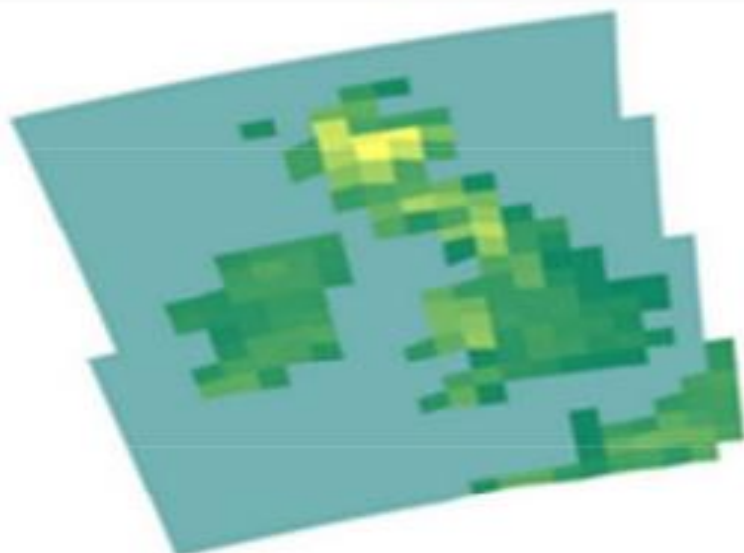


Physical Processes in a Model

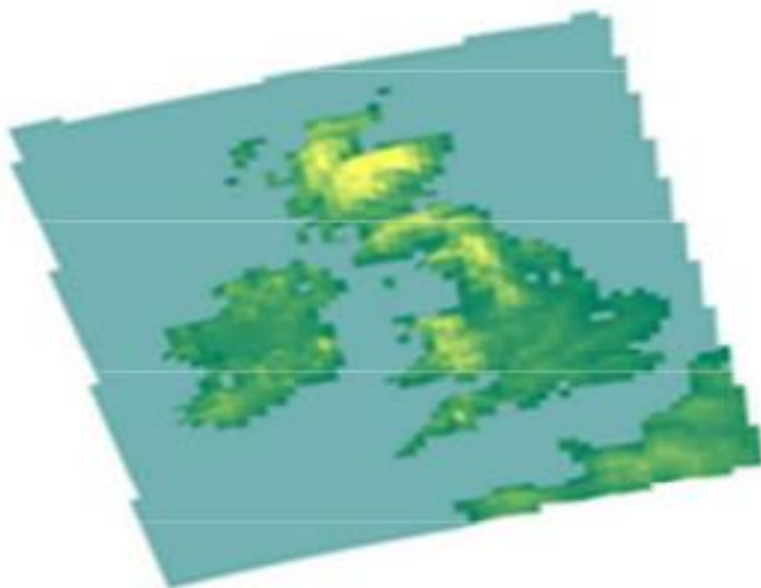




125 km resolution



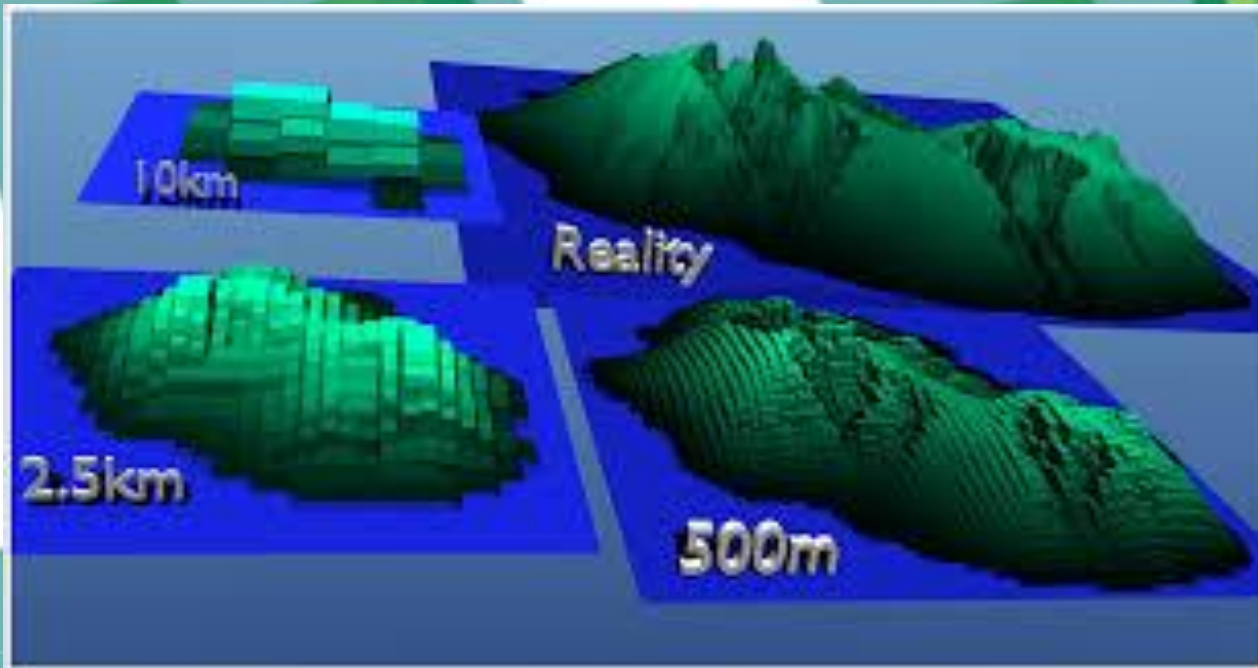
50 km resolution



18 km resolution



4 km resolution



solution

18 km resolution

4 km resolution

The ECMWF's Cray XC30 supercomputer can perform up to 2 quadrillion calculations a second.





Storm Naming

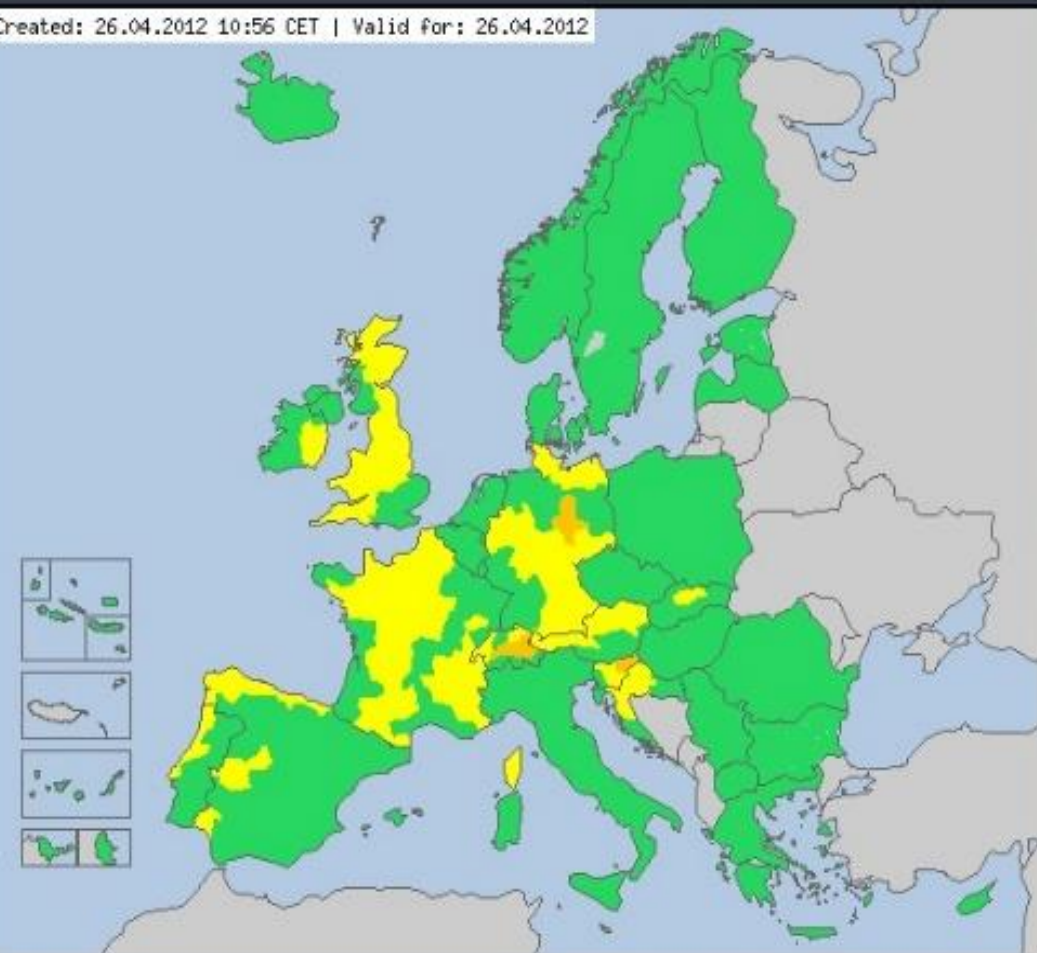
- First introduced by Met Éireann and the UK Met Office in 2015.
- This is the 5th year Met Éireann /UK Met Office, KNMI (Royal Netherlands Meteorological Institute).



Storm Naming Rules

- Storm depression (large)
- Based on Warnings in the Meteoalarm framework (AMBER/ORANGE or REDimpact-based and/or thresholds)
- NMS which first issues the warning names the Storm in consultation with other partners.
- Names picked by NMS's (public suggestions etc)
- It keeps its name given by NHC Miami preceded by ex.

Created: 26.04.2012 10:56 CET | Valid for: 26.04.2012



Weather warnings: Europe



Awareness Reports - You can find detailed information about the warnings in the awareness reports issued for each country. Select the relevant country.

| | | | | | | | |
|----|--|--|--|----|--|--|--|
| AT | | | | IS | | | |
| BE | | | | IT | | | |
| BG | | | | LU | | | |
| CH | | | | LV | | | |
| CY | | | | MK | | | |
| CZ | | | | MT | | | |
| DE | | | | NL | | | |
| DK | | | | NO | | | |
| EE | | | | PL | | | |
| ES | | | | PT | | | |
| FI | | | | RO | | | |
| FR | | | | RS | | | |
| GR | | | | SE | | | |
| HR | | | | SI | | | |
| HU | | | | SK | | | |
| IE | | | | UK | | | |

awareness types:

Display:

Caption:

STORM NAMING COORDINATION FORM

| | | | | | | | |
|----------------------------|--|-----------|---|--|----------|---------------|---|
| PROPOSED NAME | JULIA | | FORECASTED LOW CENTRE LOCATION (at first orange/red wind warning onset time) | Latitude (in decimals) | 45,8°N | | |
| NAMING NMHS/GROUP | IPMA/SW GROUP | | | Longitude (in decimals) | 38,1°W | | |
| FIRST WIND WARNING ISSUING | DATE (YYYYMMDD) | 20190218 | FIRST WIND WARNING ONSET | DATE (YYYYMMDD) | 20190220 | | |
| | TIME (HH:MM UTC) | 18:00 UTC | | TIME (HH:MM UTC) | 0000 | | |
| MAXIMUM WIND WARNING LEVEL | Orange | X | OTHER ORANGE/RED WARNINGS ISSUED | Rain | | Coastal event | X |
| | Red | | | Snow | | Others | |
| REMARKS | Cold front associated with the low will become more and more unstable Monday afternoon on eastern France and therefore gusty winds could reach 100/100 km/h especially on the narrow band of heavy rain. Other reason of naming this low: I don't want the name promoted by DWD "UWE" | | | | | | |
| WARNINGS WEBSITES | KNMI: https://www.knmi.nl/nederland-nu/weer/waarschuwingen/ Met Éireann: https://www.met.ie/warnings Met Office: https://www.metoffice.gov.uk/public/weather/warnings | | | Météo-France: http://vigilance.meteofrance.com/ IPMA: https://www.ipma.pt/en/ AEMET: http://www.aemet.es/en/eltiempo/prediccion/avisos | | | |
| | Meteoalarm: http://www.meteoalarm.eu/index.php?lang=en_UK | | | | | | |

List of names W Group 2018/19: Ali, Bronagh, Callum, Deirdre, Erik, Freya, Gareth, Hannah, Idris, Jane, Kevin, Lily, Max, Niamh, Oliver, Peggy, Ross, Saoirse, Tristan, Violet, Wyn

List of names SW Group 2018/19: Adrian, Beatriz, Carlos, Diana, Etienne, Flora, Gabriel, Helena, Isaias, Julia, Kyllian, Laura, Miguel, Nicole, Oscar, Patricia, Roberto, Sara, Teo, Vanessa, Walid

Reach, engagement and influence for warnings

Authoritative Voice

Single name

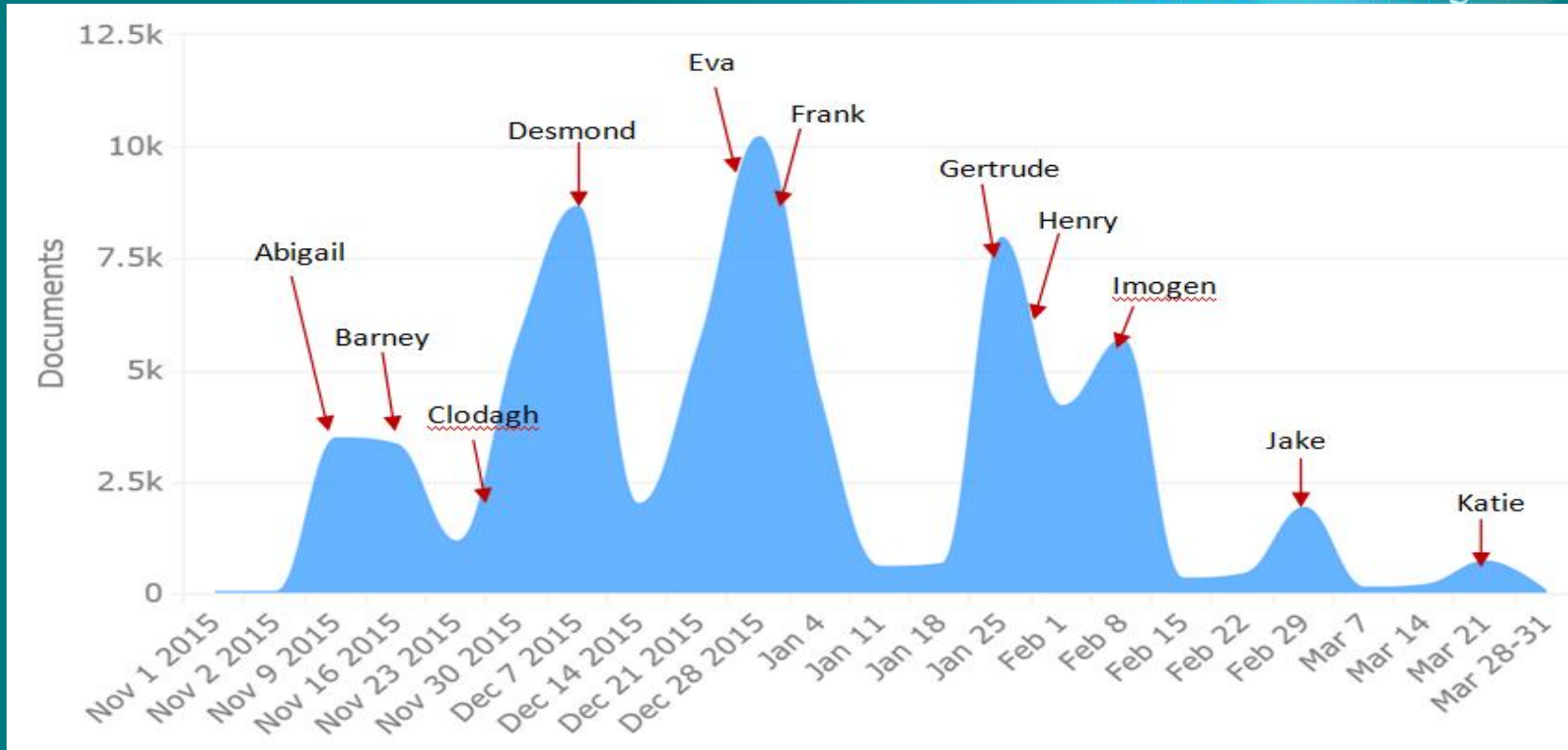
Communication: ‘hashtag culture’

Collaboration with adjoining NMS’s

Useful post-event for reference

Year 1: 2015-16

The Irish Meteorological Service



Storm names for 2019/2020



The graphic features a central dark blue circle with the text "Storm Names 2019/20" and "Ireland United Kingdom Netherlands" below it. Surrounding this central circle is a ring of 20 light grey circles, each containing a storm name. The names, starting from the top and moving clockwise, are: Willow, Aiyah, Brendan, Ciara, Dennis, Ellen, Francis, Gerda, Hugh, Iris, Jan, Kitty, Liam, Maura, Noah, Olivia, Piet, Róisín, Samir, Tara, Vince, and Willow.

Rialtas na hÉireann
Government of Ireland

Met Éireann

Storm Names 2019/20
Ireland
United Kingdom
Netherlands

In association with:

Met Office

Royal Netherlands
Meteorological Institute
Ministry of Infrastructure
and Water Management

Ireland's Weather Warnings will be issued at www.met.ie/warnings

@meteireann
#Stoirm

USEFUL KNOWLEDGE

- The timing and geographical location of a weather event, as well as recent weather conditions, can impact significantly on the individual and on society
- Heavy rain can turn to snow when temperatures are close to zero
- Winds can exceed general warning thresholds in exposed areas such as coasts and high ground and also in some low lying areas due to funnelling effects
- High waves can occur on lakes as well as along coasts
- Ice is not always visible on roads and surfaces
- Fog/ice can persist all day
- Hail showers can result in potentially lethal road conditions as the hail gets quickly compacted by traffic
- Heavy downpours can lead to flash flooding and poor visibility
- Thunderstorms: Be aware of the dangers of lightning and DO NOT take shelter under an umbrella or a tree. It is dangerous to be out over open water. Be careful of landline phones or any metal that connects with the ground. Lightning can strike the same spot twice

Keep yourself informed about the meteorological conditions from Met Éireann with detailed 7-day forecasts available for over 3,000 locations on www.met.ie and mobile App.

Please subscribe to push notifications of Warnings on the Met Éireann App.

GENTLE REMINDER: CHECK ON YOUR OLDER RELATIVES AND NEIGHBOURS



If it's difficult for you to get around it will be impossible for them.

- Do you have their phone number(s)?
- Phone them or call around
- Make sure they have enough fuel, food supplies and necessary medications
- If in doubt call the Gardaí and ask them to check

You can get more information from:

- www.met.ie (weather)
- www.iws.ie (water safety)
- www.hse.ie (health)
- www.rsa.ie (road safety)
- www.tii.ie (transport systems)
- www.flooding.ie (OPW)
- www.emergencyplanning.ie

BE WINTER-READY



Met Éireann's

Weather Warnings



LoCall OEP: 1890 252 736 or 0761 001 608
e-mail: oepe@defence.ie



www.winterready.ie
@emergencyIE



Rialtas na hÉireann
Government of Ireland

WEATHER WARNINGS

Met Éireann is the National Meteorological Service of Ireland and one of its most important roles is to issue weather forecasts and warnings for Ireland. This Public Weather Service mandate is primarily to protect life and ensure citizen safety. The service also supports the activities of the citizen and other agencies to mitigate damage to property and reduce disturbance to economic activity.

Met Éireann's main suite of warnings are issued between 10am and midday and these are updated as new information becomes available. In general, warnings will not be issued more than 48-hours ahead of the expected adverse weather but advisories on potential hazards can be issued up to a week in advance.

Local authorities are the lead agencies for co-ordinating the response to severe weather emergencies. Where weather emergencies are judged to impact public safety at national level a National Emergency Coordination Group (NECG) is activated by the Office of Emergency Planning on request from the Department of Housing, Planning and Local Government which is the Lead Government Department for weather emergencies.

Met Éireann provides the weather briefings at the NECG, which brings together all Government Departments and relevant agencies and organisations, to support the locally led response and ensure coordination across the "Whole-of-Government" for the duration of the emergency.

COLOUR CODING EXPLAINED



STATUS YELLOW: Weather that does NOT pose a threat to the general population but is potentially dangerous on a localised scale.

Be aware about meteorological conditions and check if you are exposed to danger by nature of your activity or your specific location. Do not take any avoidable risks.



STATUS ORANGE: Infrequent and dangerous weather conditions which may pose a threat to life and property.

Prepare yourself in an appropriate way depending on location and activity. All people and property in the affected areas can be significantly impacted.

Check your activity/event and delay or cancel as appropriate.



STATUS RED: Rare and very dangerous weather conditions from intense meteorological phenomena.

Take action to protect yourself and your property. Follow instructions and advice given by the authorities under ALL circumstances and be prepared for exceptional measures.

This colour coding is used throughout Europe via the Meteoalarm system www.meteoalarm.com

STORM NAMING

Naming storms by National Met Services has been shown to raise awareness of severe weather. It provides a clear, authoritative and consistent message to the public and prompts people to take action to prevent harm to themselves or to their property.

Met Éireann, the UK Met Office and KMNI (Netherlands) collaborate in forecasting and naming storms. The names are chosen from public suggestions and are in alphabetical order, alternating between gender.

- A storm is named by a National Met Service when Orange Level wind warnings are forecast to impact over a wide area overland
- Orange or Red level gusts can occur in exposed areas without the event being named

Once a storm is named by a National Met Service the name is retained. For example: Ophelia was named by the National Hurricane Center (USA) and Emma by IPMA (Portugal).

Marine Warnings

Small Craft Warning: Beaufort Force 6 or 7 forecast out to 10 nautical miles offshore around Irish Coasts.

Gale Warning: Gale Force 8 or higher forecast out to 30 nautical miles offshore (Irish Coastal Waters) and the Irish Sea.

Yellow Gale Force 8/Strong Gale Force 9

Orange Storm Force 10

Red Violent Storm Force 11/Hurricane Force 12

Met Éireann Warnings



STATUS YELLOW: Weather that does NOT pose a threat to the general population but IS potentially dangerous on a localised scale.

Be aware about meteorological conditions and check if you are exposed to danger by nature of your activity or your specific location. Do not take any avoidable risks.

Met Éireann Warnings



STATUS ORANGE: Infrequent and dangerous weather conditions posing a threat to life and property depending on location and activity.

Prepare yourself in an appropriate way (taking advice) for the forecast conditions as all people and property in the affected areas can be impacted on significantly.

Check your activity/event and delay or cancel as appropriate.

Met Éireann Warnings



STATUS RED: Rare and very dangerous weather conditions from intense meteorological phenomena.

Take action to protect yourself and your property. This action could be by staying indoors or moving your family out of the danger zone temporarily. Follow instructions and advice given by the authorities under ALL circumstances and be prepared for exceptional measures.

STATUS YELLOW :
Weather Alert –
Be Aware

STATUS ORANGE:
Weather Warning –
Be Prepared

STATUS RED:
Severe Weather
Warning - Take Action

WIND (Gusts km/h): >130 110 90

RAIN (mm): >80 50 30

SNOW / ICE: > 30cm 10 >3

HIGH TEMPS (C): >30/20 >30/20 >27

LOW TEMPS (C): <-10 -5 to -9C <-3

THUNDERSTORMS:

FOG:

COASTAL WIND WARNING: >F11 F10 F9

STATUS YELLOW :
Weather Alert –
Be Aware

STATUS ORANGE:
Weather Warning –
Be Prepared

STATUS RED:
Severe Weather
Warning - Take Action

Snow Warning

Accumulations below 250m AMSL:

YELLOW: 3cm or greater in 24 hrs.

ORANGE: 3cm or greater in 6 hrs / 6cm or greater in 12 hrs / 10 cm or greater in 24 hrs.

RED: 10cm or greater in 6 hrs / 15cm or greater in 12 hrs / 30cm or greater in 24 hrs.

**STATUS YELLOW :
Weather Alert –
Be Aware**

**STATUS ORANGE:
Weather Warning –
Be Prepared**

**STATUS RED:
Severe Weather
Warning - Take Action**

Low Temperature Warning

YELLOW: Minima of minus 3C or minus 4C expected over a wide area.

ORANGE: Minima of minus 5C to minus 10C (or lower) expected over a wide area.

RED: Minima of minus 10C (or below) for three or more consecutive nights or more.
Maxima of minus 2C.

**STATUS YELLOW :
Weather Alert –
Be Aware**

**STATUS ORANGE:
Weather Warning –
Be Prepared**

**STATUS RED:
Severe Weather
Warning - Take Action**

High Temperature Warning

YELLOW: Maxima in excess of 27C expected and minima in excess of 16C over a wide area for at least 36 hours (>27/16/>27).

ORANGE: Maxima in excess of 30C for three days and minima of 20C for two nights (consecutive) expected over a wide area for at least a 48hr period (>30/20/>30/20).

RED: As Orange criterion, but persisting for five or more 24hour periods..



www.met.ie/warnings

| | STATUS YELLOW | STATUS ORANGE | STATUS RED |
|---|---|---|---|
| | <i>Weather that does not pose a threat to the general population but is potentially dangerous on a localised scale.</i> | <i>Infrequent and dangerous weather conditions which may pose a threat to life and property.</i> | <i>Rare and very dangerous weather conditions from intense meteorological phenomena.</i> |
| Wind <i>Mean wind: 10 minute Gusts: 1 minute (higher on coasts/high ground/funnelling effects etc)</i> | Widespread mean speeds between 50 and 65km/h Widespread gusts between 90 and 110km/h | Widespread mean speeds between 65 and 80 km/h Widespread gusts between 110 and 130 km/h | Widespread mean speeds in excess of 80 km/h Widespread gusts in excess of 130 km/h |
| Coastal Wind Warnings <i>Mean speeds up to 30 nautical miles offshore</i> | Gale force 8 or strong gale force 9. | Storm force 10. | Violent storm force 11/Hurricane Force 12. |
| Rain <i>Amounts can be up to double on windward upper slopes & impacts vary with soil moisture deficits</i> | 20mm – 30mm in 6 hrs or less. 30mm – 40mm in 12 hrs or less. 30mm – 50mm in 24 hrs | 30mm – 50mm in 6 hrs or less. 40mm – 60mm in 12 hrs or less. 50mm – 80mm in 24 hrs | Greater than 50mm in 6 hrs or less. Greater than 60mm in 12 hrs or less. Greater than 80mm in 24 hrs or less. |
| Snow/Ice <i>Heavy rain can turn to snow when temperatures are around zero (up to around +4C)</i> | Guidelines only 3cm or greater in 24hrs. | Guidelines only 3cm or greater in 6 hrs 5cm or greater in 12 hrs 10cm or greater in 24 hrs | Guidelines only 10cm or greater in 6 hrs 15cm or greater in 12 hrs 30cm or greater in 24 hrs |
| Thunderstorms <i>Possible flash flooding</i> | Localised thunderstorms/lightning activity/heavy rainfall. | Widespread thunderstorms/severe lightning activity/heavy rainfall/large damaging hail | Exceptional. |
| Low temperature/Ice <i>Ground temperatures can be as much as 10 degrees lower than air temps</i> | Air minima of minus 3C or minus 4C expected over a wide area (localised lower values will occur). <ul style="list-style-type: none"><i>Dangerous surfaces due to ice and/or lying snow. Situation improving.</i> | Air minima of minus 5C to minus 10C (or lower) expected over a wide area. <ul style="list-style-type: none"><i>Dangerous surfaces due to ice and/or lying snow/freezing rain. Situation stable</i> | Air minima minus 10C (or below) for three consecutive nights or more. Maxima of minus 2C. <ul style="list-style-type: none"><i>Dangerous surfaces due to ice and/or lying snow/freezing rain. Situation likely to worsen</i> |
| High temperature <i>High minima can be more impactful than high maxima</i> | >27/15/>27 Maxima in excess of 27C expected and minima in excess of 15C over 36 hrs | >30/20/>30/20/>30 Maxima in excess of 30C for three days and minima of 20C for two nights (consecutive) | As orange criterion, but persisting for five or more consecutive days & nights. |
| Fog (or freezing fog) | Dense fog over a wide area or pockets of freezing fog. | Dense fog/freezing fog persisting over a wide area causing a widespread and significant driving hazard on national primary routes. | Exceptional. |



**Making Ireland Weather
and Climate Prepared**

NATIONAL FLOOD FORECASTING AND WARNING SERVICE



An Roinn Tithíochta,
Pleanála agus Rialtais Áitiúil
Department of Housing,
Planning and Local Government

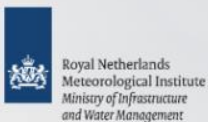




Rialtas na hÉireann
Government of Ireland



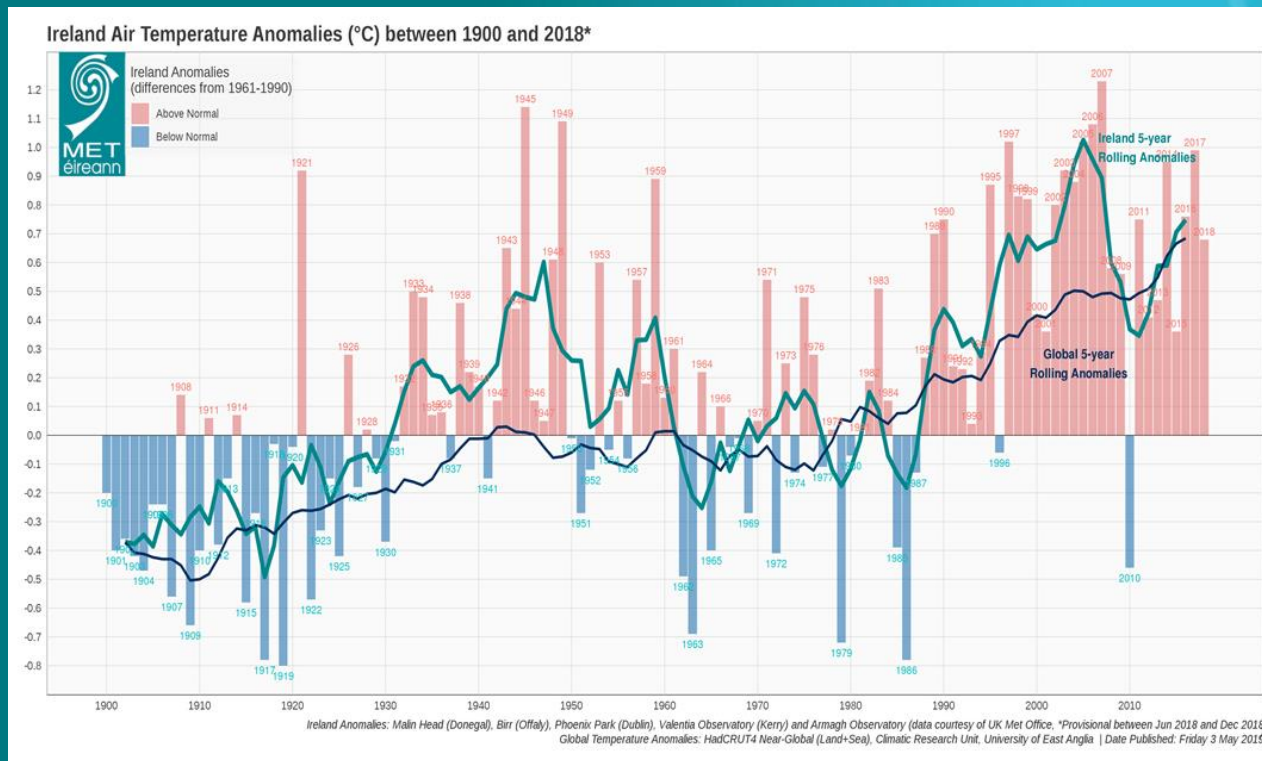
In association with:



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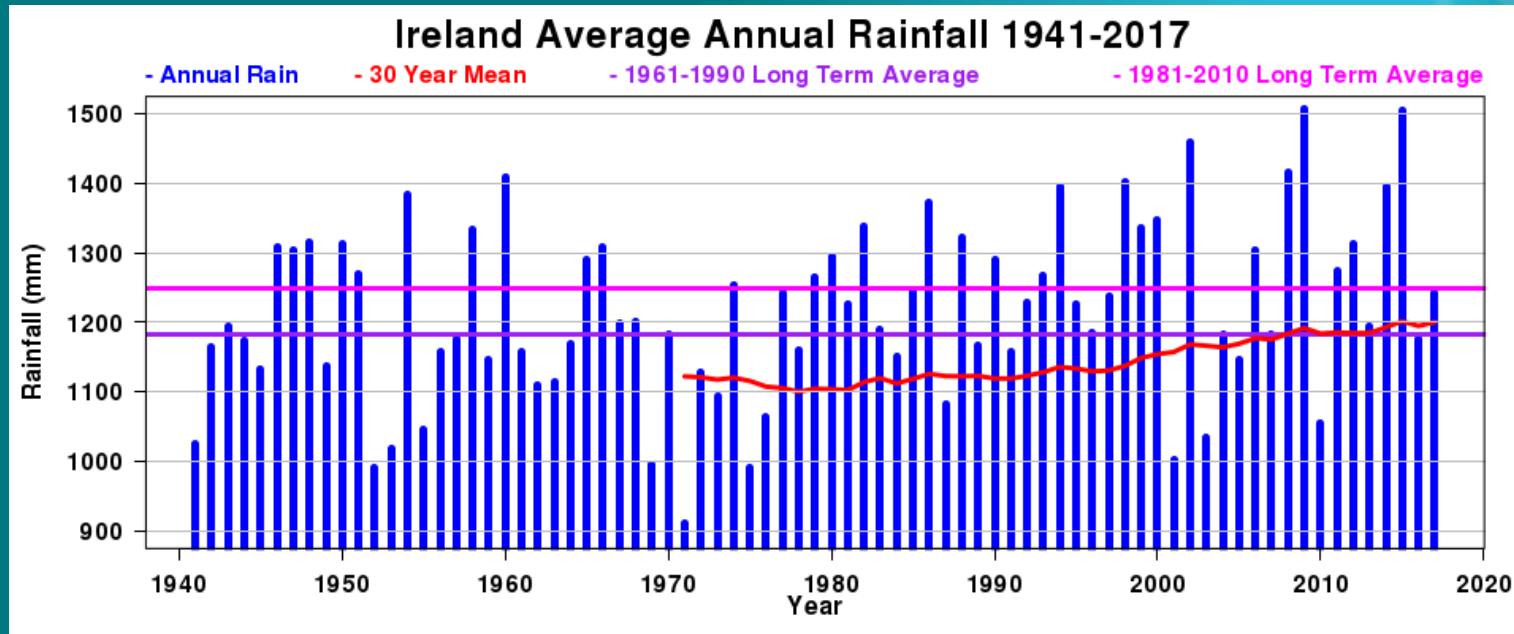
@meteireann
#Stoirm

ANNUAL IRELAND TEMPERATURE RECORD 1900-2018



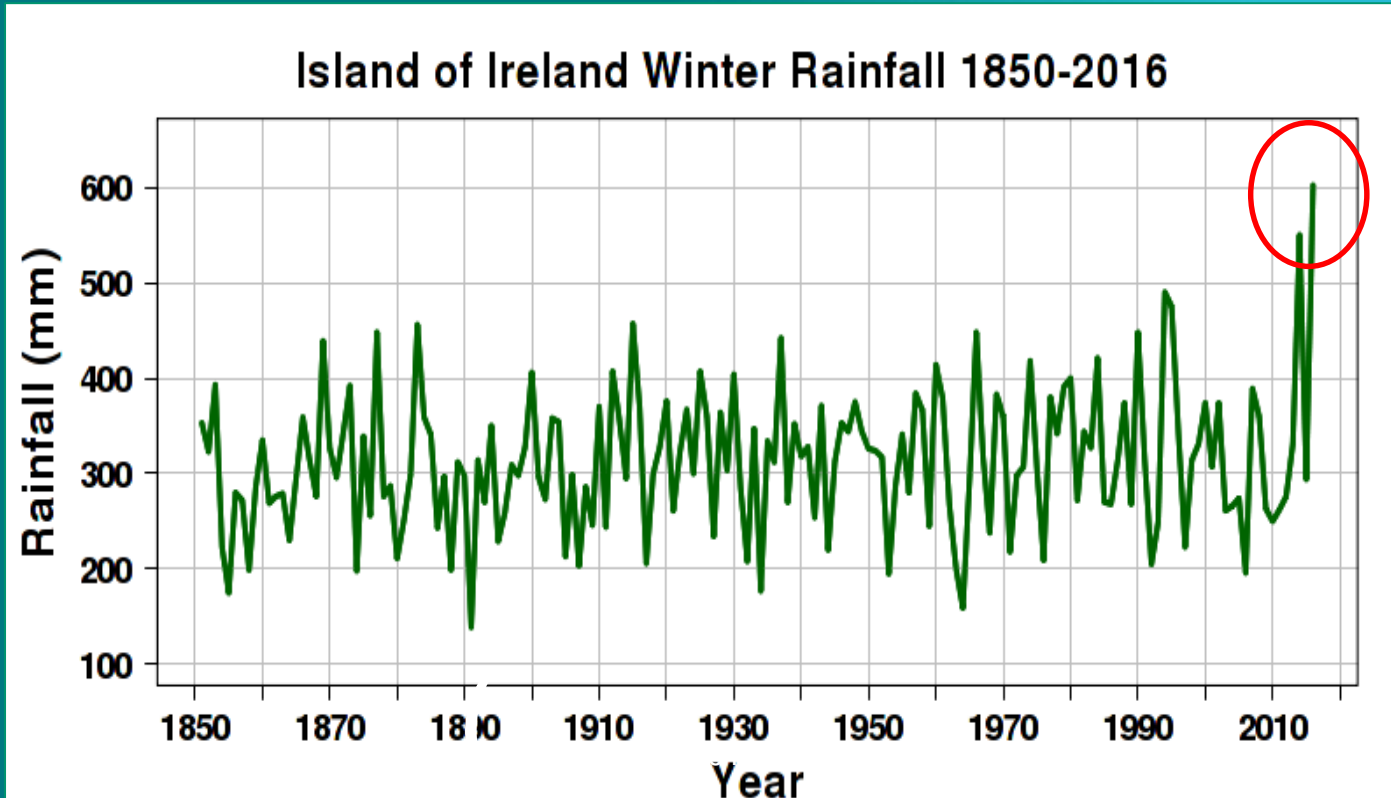
Temperature increasing at an average rate of 0.08 Celsius per decade

ANNUAL IRELAND RAINFALL RECORD 1941-2017

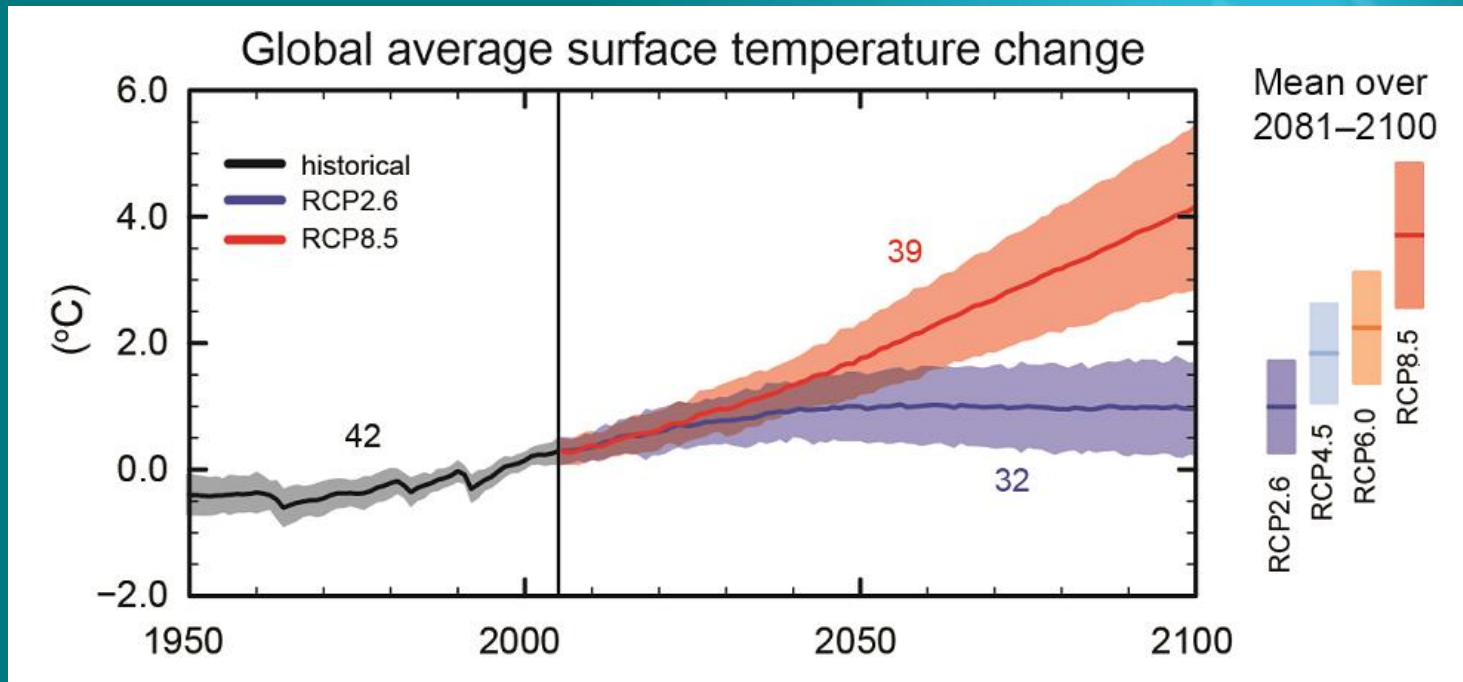


Rainfall increase by 5% comparing 1961-1990
with 1981-2010

IRELAND WINTER RAINFALL 1850-2016



GLOBAL PROJECTED TEMPERATURE



SUMMARY OF GLOBAL CLIMATE TRENDS AND PROJECTIONS

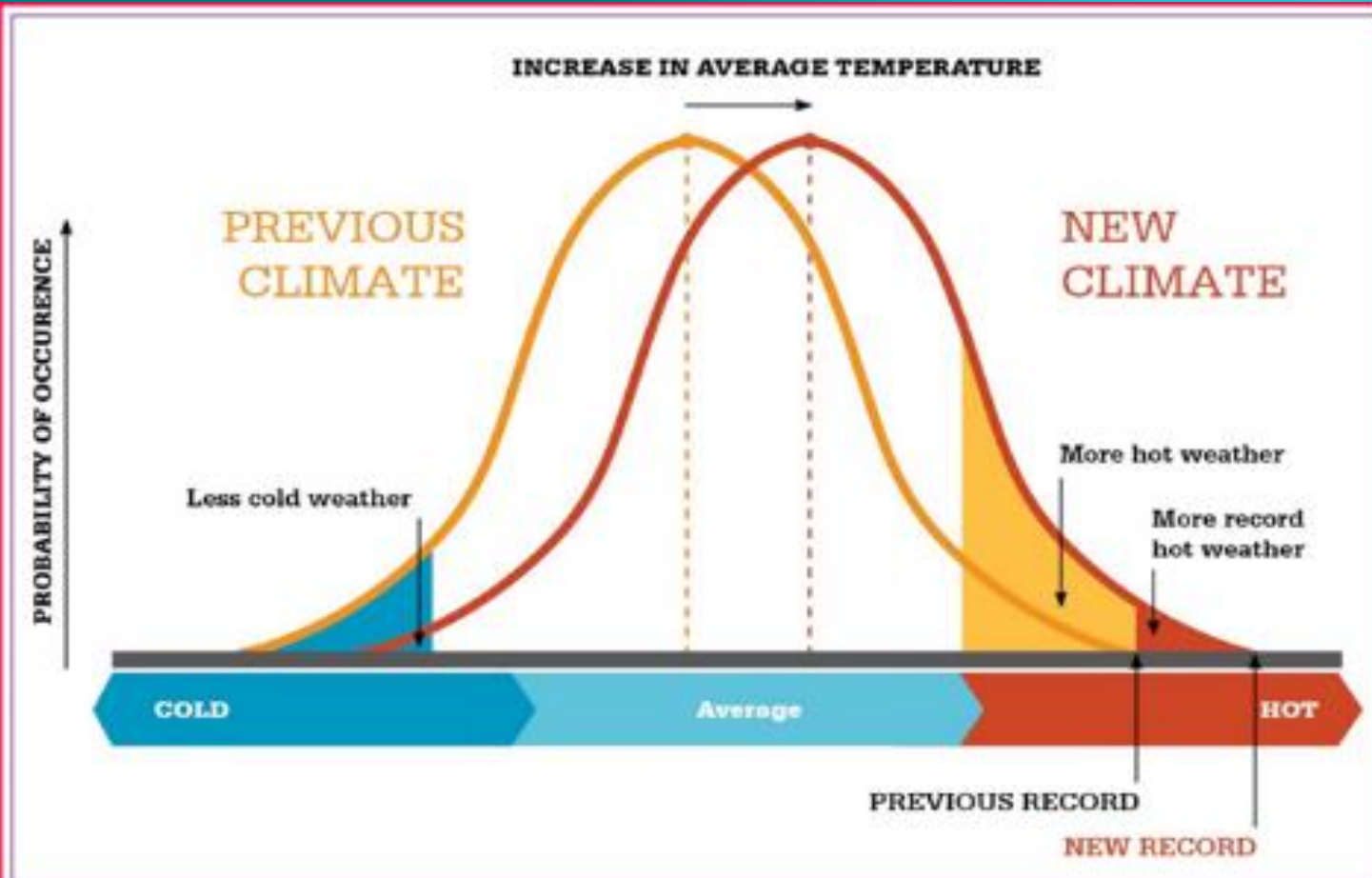
Temperatures have increased by 1°C from pre-industrial levels and are projected to increase by a further 1.5-4.5°C by 2100.

Increased desertification / shifting rainfall patterns.

CO₂ levels are continuing to rise.
Now above 400ppm.

Sea level rising at ~3 mm/year, projected rise of 0.5 to 1 m by 2100 depending on scenario.

Increasing glacial retreat, decreasing Arctic sea ice.



Source: Modified from IPCC, 2007

SUMMARY OF TEMPERATURE TRENDS AND PROJECTIONS FOR IRELAND

Temperatures have increased nearly 1°C from pre-industrial levels. Maximum temperatures are projected to increase by 2.5-3.0°C by mid century

SUMMARY OF TEMPERATURE TRENDS AND PROJECTIONS FOR IRELAND

Temperatures have increased nearly 1°C from pre-industrial levels. Maximum temperatures are projected to increase by 2.5-3.0°C by mid century

There will be fewer days with frost

SUMMARY OF TEMPERATURE TRENDS AND PROJECTIONS FOR IRELAND

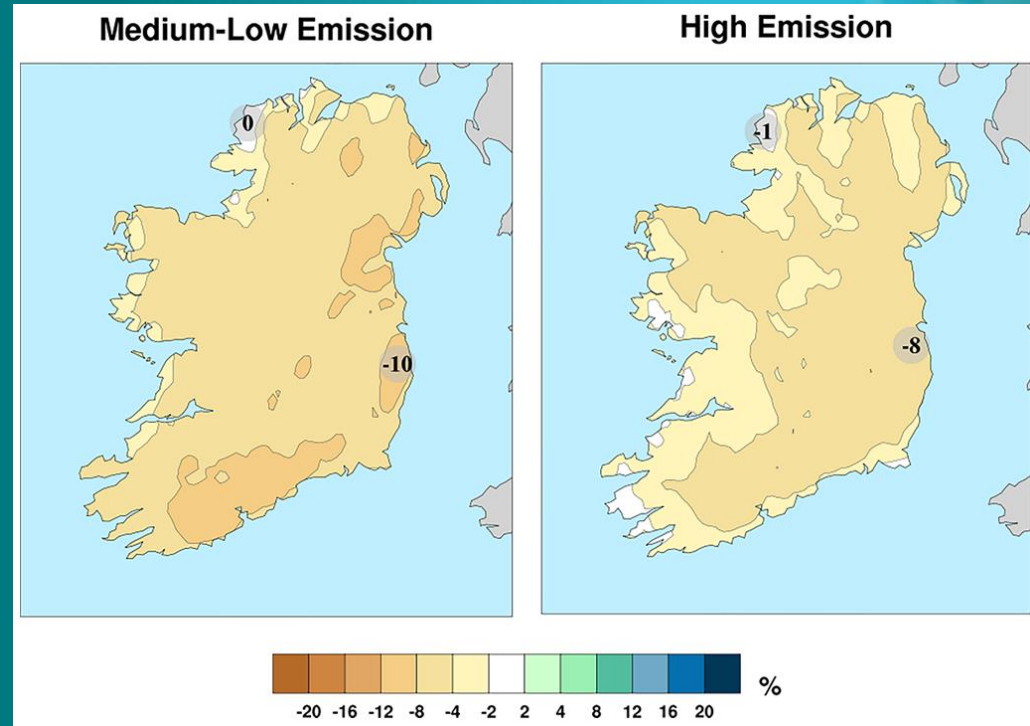
Temperatures have increased nearly 1°C from pre-industrial levels. Maximum temperatures are projected to increase by 2.5-3.0°C by mid century

There will be fewer days with frost

The length of the growing season will increase due to warmer climate but may be reduced due to droughts

MID-CENTURY (2041-2060) PROJECTIONS CHANGE IN ANNUAL PRECIPITATION

Average Annual Rainfall had increased by approx. 5% since mid 20th Century



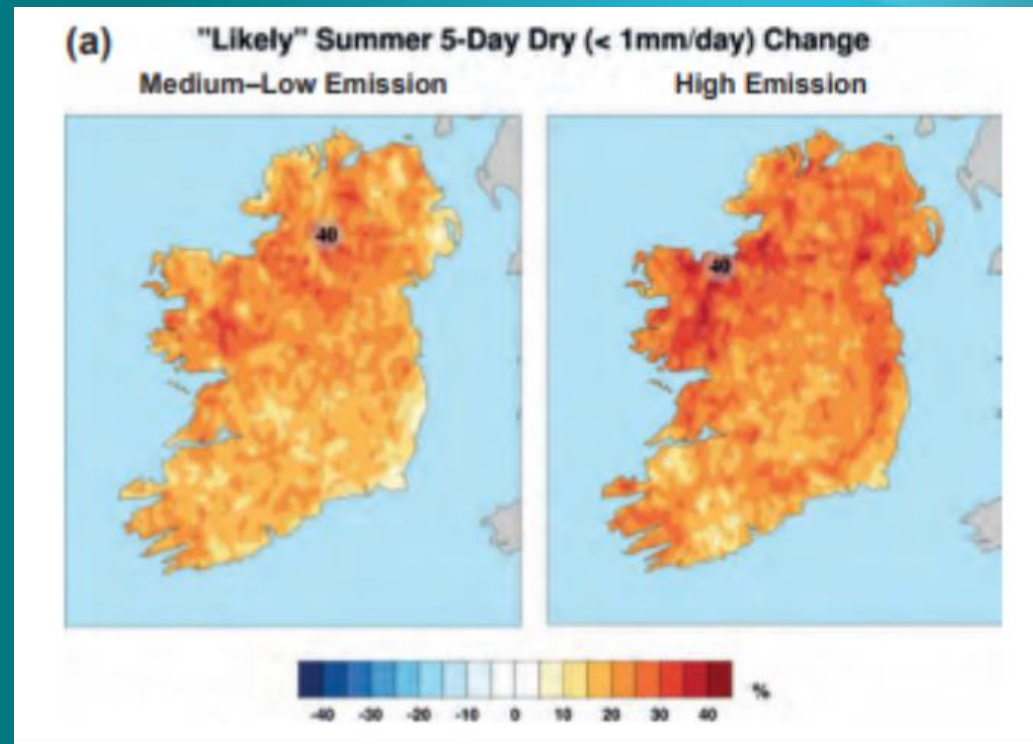
Nolan, 2015)

SUMMARY OF RAINFALL TRENDS AND PROJECTIONS FOR IRELAND

SUMMER PRECIPITATION

Average Annual Rainfall had increased by approx. 5% since mid 20th Century

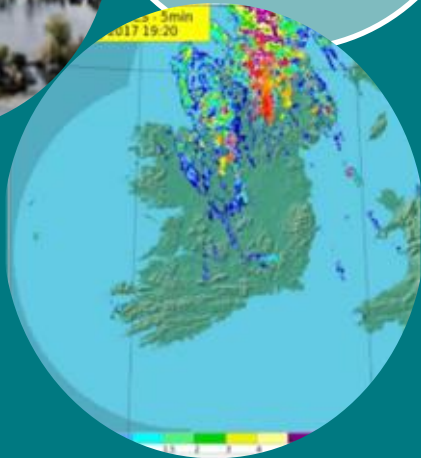
Drier summers, up to 20%, longer drier periods, wetter winters.



SUMMARY OF RAINFALL TRENDS AND PROJECTIONS FOR IRELAND



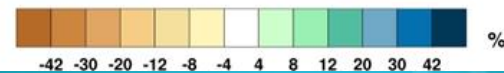
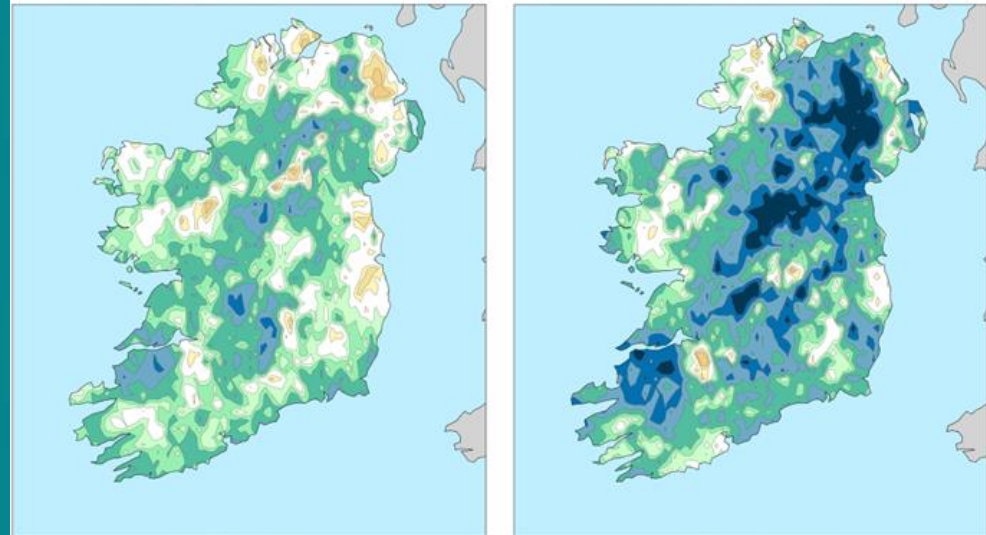
An increase in intense rainfall days especially in winter and Autumn



"Likely" Increase Very Wet Days (> 30mm/day). High Emission Scenario

Annual

Autumn

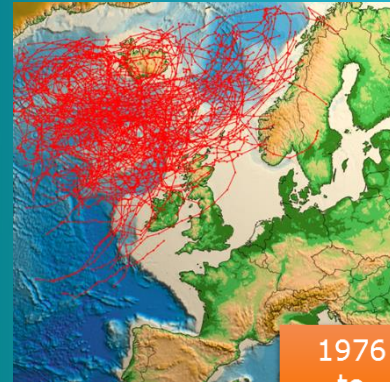


SUMMARY OF SEA AND STORM TRENDS AND PROJECTIONS FOR IRELAND

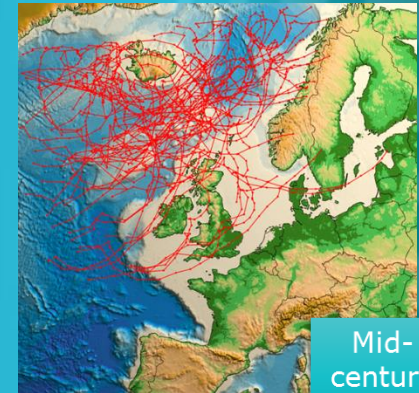
Sea level rising at approx. 2-3mm/year and will continue to rise by up to 800mm by 2100

A projected small increase in extreme winds especially in winter

These will lead to increase storm surge



1976
to
2005

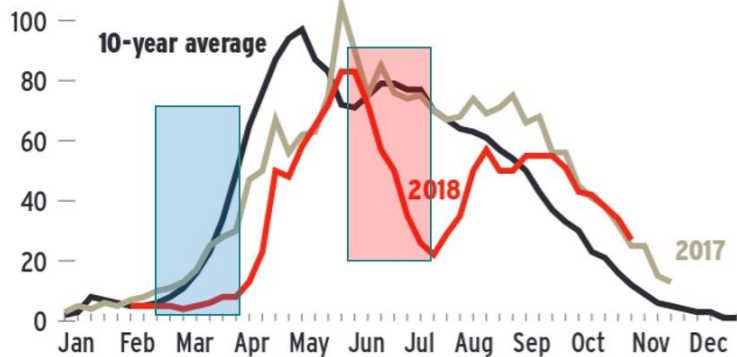


Mid-century
RCP8.5

IMPACTS ON AGRICULTURE

10-year average grass growth

kg DM/ha/day



- Longer growing seasons, more extremes
- Droughts, plant stress, SMDs
- Slurry storage and spreading
- Increased heat stress on animals and crops
- Changes in profile of plant and animal diseases
- Changes in dynamics of pest species
- Increased occurrence of invasive species
- Biodiversity – changes in phenology

IMPACTS ON FORESTRY

- Forest Fires
- Soil Moisture Changes
- Frost damage/early late growth



IMPACTS ON SEAFOOD

- Ocean Acidification
- Migration of fish stocks
- Algal blooms
- Damage to fleets and harbours



IMPACTS ON INFRASTRUCTURE



Deric Ó h'Artagáin  @deric_hartigan · Feb 12
#TV3Weather "@andrewcareyik: Probably the scariest picture you will see from #limerick in the wake of #StormDarwin pic.twitter.com/Jswe85o1fB"

- Damage to farm buildings
- Interruptions to power supply/Energy Security
- Disruption to Transport Networks/Marine Sector
- Breaks in Supply Chains
- Communications Breakdown
- Coastal Erosion

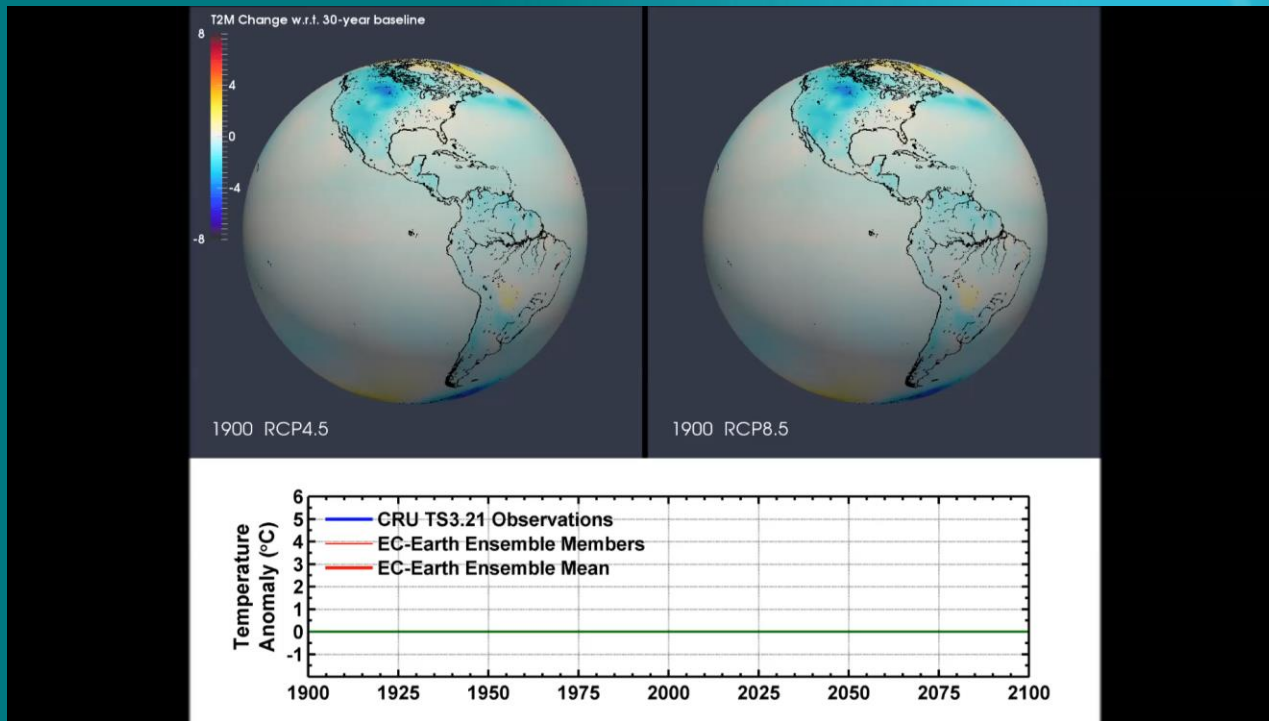
CHALLENGES TO ADAPT TO A CHANGED CLIMATE

We must prepare for a changed climate.

- Extreme weather events will become more frequent and severe
- Infrastructure in coastal and low lying areas will become more vulnerable to erosion and storms.
- Increased occurrence and intensity of extreme rainfall events will bring increased risk of flooding.
- Changes in temperature will provide opportunities but also some risks.



THANK YOU!



(Credit P Nolan, ICHEC)

CHALLENGES TO ADAPT TO A CHANGED CLIMATE

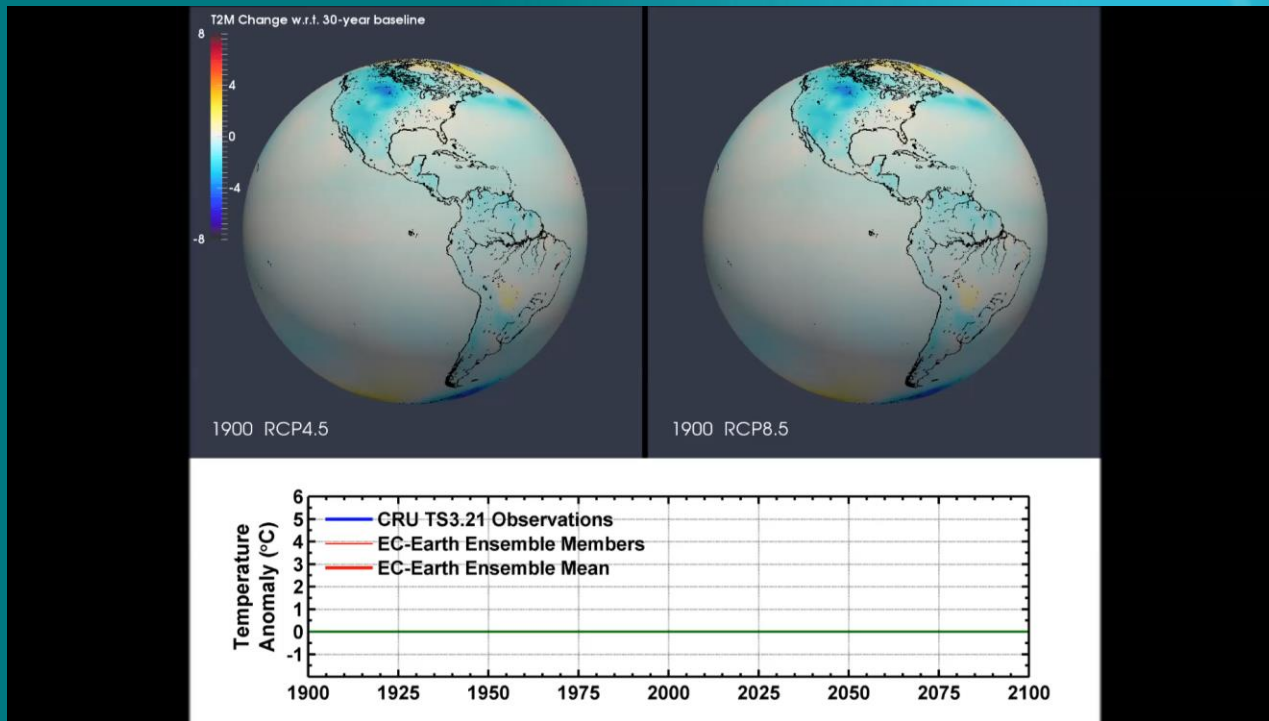
Sectoral adaptation plans, have been published for public consultation, they are due to be adopted by end of September.

Sectors include: Agriculture, Health, Communications, Flooding, Heritage, Biodiversity, Water Quality, Energy, Transport, etc.

Four Climate Action Regional Offices have been established to assist Local Authorities in planning to deal with Climate Change



THANK YOU!



(Credit P Nolan, ICHEC)