

# Weather-Flood-Climate **Knowledge to Preparedness**

Met Éireann Research & Innovation Strategy 2026–2034

Helping Irish society to navigate  
and respond to weather and climate risks



An Roinn Tithíochta,  
Rialtais Áitiúil agus Oidhreacht  
Department of Housing,  
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## Foreword

Ireland is entering a transformative decade in weather, flood and climate sciences.

National meteorological services are advancing toward kilometre–hectometre scale forecasting driven by hybrid Artificial Intelligence (AI)-physics operational modelling while developing and managing open, interoperable data ecosystems.

Nationally, research funding organisations, academic institutions and government departments are growing Ireland’s research and innovation capacity, placing strong emphasis on talent development, research integrity, governance and evidence-to-policy translation.

Building on our internal strengths and existing programmes, this Research & Innovation Strategy reflects on all drivers, connecting Met Éireann to global scientific progress, national research priorities and the insights of staff and external colleagues.

Anchored in the goals and objectives of [Met Éireann’s Strategic Plan 2024–2034](#), this Research & Innovation Strategy sets out how we will grow our research and innovation leadership, advance Ireland’s scientific and technical excellence in weather–flood–climate sciences, leverage the potential – and ensure the responsible, sustainable use – of AI, power reliable and accessible public services and strengthen decision-making across society.

Met Éireann’s Research & Innovation Strategy articulates the research needs required to deliver these ambitions, while safeguarding Met Éireann’s trusted authority, maintenance of standards, and 24/7 operational readiness for everyone.

Above all, this Research & Innovation Strategy is designed to turn new **Weather–Flood–Climate Knowledge** into **Preparedness**: protecting lives and livelihoods, enabling informed choices, and contributing to a sustainable, climate-resilient future for Ireland.

May 2026



## Introduction

Met Éireann’s Research & Innovation (R&I) Strategy sets out how we will transform scientific knowledge into preparedness for weather, flood and climate risks. At its core, this Strategy is about ensuring that science is translated into practical capabilities that support decision-making across society, government and sectors of the economy.

R&I indeed must operate as a connected system – one that links science, technology, operations and users – to deliver tangible societal outcomes. This R&I Strategy safeguards Met Éireann’s trusted authority, maintains standards and 24/7 operations, and strengthens Ireland’s resilience by enabling world-class science, effective services and whole-of-society collaboration. It recognises the critical role of R&I in building talent with the essential skills required to understand extreme weather and adapt to climate change, ensuring Ireland is equipped for an increasingly complex and uncertain future.

Met Éireann’s R&I Strategy defines a **Research & Innovation System** marking a shift to:

- more scientific leadership,
- faster innovation,
- greater policy impact,
- deeper partnerships,
- more reliable, actionable public services,
- stronger societal resilience.

This Strategy has been shaped through extensive consultation with national and international stakeholders, including government departments, research funders, academia and operational partners. This process has strengthened the clarity, ambition, and relevance of the Strategy, ensuring alignment with national priorities and international best practice. We are extremely grateful and look forward to our continued collaboration.

**Research** is defined as creative and systematic work undertaken to increase the stock of knowledge and to use this stock of knowledge to devise new applications. This includes three main types: basic research (acquiring new knowledge without a specific application), applied research (acquiring new knowledge for a specific practical purpose), and experimental development (systematic work to produce new or improved products, processes, or services).

An **innovation** is a new or improved product or process (or combination thereof) that differs significantly from previous products or processes and that has been made available to potential users (product) or brought into use (process).

# 2 Met Éireann's Research & Innovation System

## Purpose and Value

The purpose of Met Éireann's R&I system is to create value for society by ensuring that R&I leads to better decisions and outcomes. This is achieved through a clear loop: research generates knowledge, which is translated into services, which inform decisions, which in turn lead to societal impact (and back again). This R&I Strategy operates as a delivery framework under [Met Éireann's Strategic Plan 2024–2034](#), translating strategic ambition into a coordinated R&I system focused on preparedness and societal outcomes.

Value created is both tangible and intangible. For example, it includes avoided losses from extreme events, improved infrastructure and planning decisions and enhanced public safety. It also includes trust: trust in the information provided and trust in the institutions that provide it.

In this context, Met Éireann plays the distinctive role of both a producer of scientific knowledge and of an integrator: bringing together data, models, expertise and partnerships to deliver coherent, authoritative and actionable information. As the national meteorological service, Met Éireann serves as a real-world proving ground for new knowledge, ideas and products: innovations are not only developed but tested, validated and refined in live operational environments, ensuring they are robust, trustworthy and deliver tangible public value.

## Vision

By 2034, Met Éireann's R&I system will have evolved into a fully integrated capability that supports preparedness across all timescales, from immediate weather events to long-term climate risks. Forecasts and projections will be more accurate and more meaningful, translated into impact-based information that people and organisations can act upon.

This vision is not just about better science, it is about better use of science. Decision-makers across sectors – from emergency response to infrastructure planning – will have access to more timely, trusted, and actionable information. Services will be designed with increasing user engagement, ensuring clarity, relevance and accessibility.

Ultimately, this vision positions Met Éireann as a central pillar in Ireland's resilience system: a trusted authority that connects knowledge to action in a rapidly changing environment.

## System

### Engine

Met Éireann's R&I system operates as a coherent, mission-driven engine. It brings together inputs such as scientific expertise, observational data, technology and collaboration, and directs them toward a single objective: preparedness.

This system is dynamic and iterative. Research informs services, services generate feedback, and that feedback shapes future research. In this way, the system continuously evolves, responding to new scientific developments, emerging risks and changing societal needs.

The strength of this system lies not only in any individual component, but in how well the components work together. Integration – across disciplines, organisations and functions – is therefore central to its operation.

### Research Needs

At the front of this system sit research needs, which act as the primary input shaping direction and priorities. These needs are defined through strategic questions grounded in societal challenges, scientific opportunity, and policy demand. They provide a structured way to identify where new knowledge, capability, and innovation are required to strengthen preparedness across weather, flood and climate risks.

### Strategic Goals

At the core of the R&I system are four interdependent strategic goals translating needs into action. These goals act as the core components of the system, each performing a distinct function while working together to deliver a shared outcome. No single goal is sufficient on its own: impact depends on their alignment and synchronised delivery.

Together, the goals form a coherent “engine” for preparedness. “**Research Excellence & Talent**” generates the scientific knowledge and capability that powers the system. “**Research to Operations & Innovation Delivery**” ensures that this knowledge is translated into reliable services. “**Research Value, Impact & Evidence for Policy**” directs effort toward societal outcomes and informed decision-making. “**Research & Innovation Partnerships**” amplify impact through collaboration and shared endeavour. Through their combined operation, these goals ensure that scientific advances are not only achieved but also delivered, used and sustained for the benefit of society.

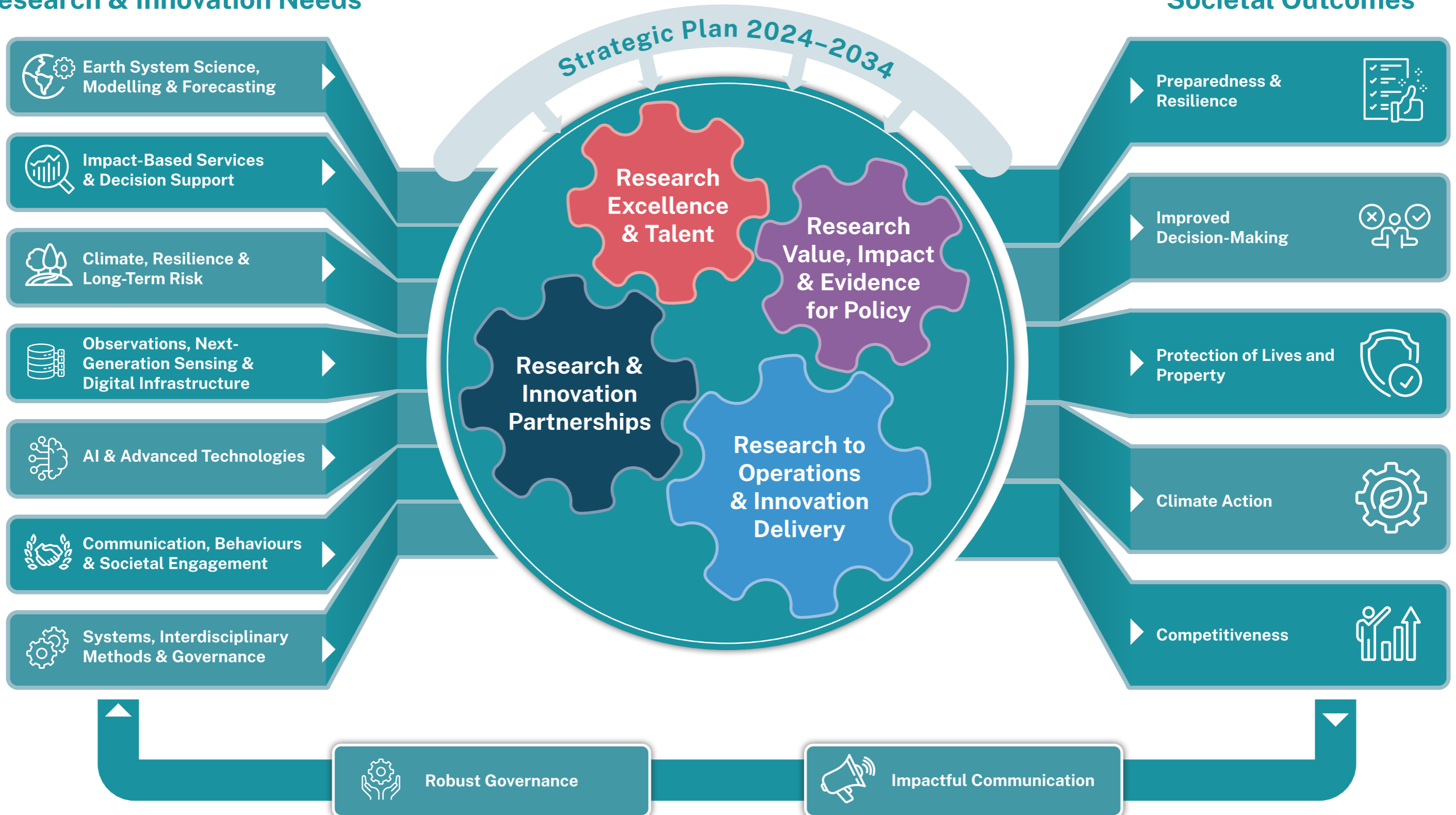
The four strategic goals and their associated objectives provide the mechanism through which research needs are addressed. They translate questions into coordinated action – mobilising talent, advancing science, enabling innovation delivery, embedding impact and building partnerships. In this way, research needs do not exist in isolation; they are continuously interpreted, prioritised, and acted upon through the goals, ensuring a clear loop from identified need → research activity → operational capability → societal outcome (back to need).

The research needs provide the input and direction for this system, ensuring that all goals are aligned to clearly defined societal challenges and national priorities. In turn, the goals and objectives described below provide the mechanisms through which these needs are addressed, translating research questions into tangible outcomes.

# Met Éireann Research & Innovation System

## Research & Innovation Needs

## Societal Outcomes



# 3 Delivering for Society

As Met Éireann evolves and innovates, it remains essential to safeguard core principles and capabilities. These include maintaining its role as a trusted authority, upholding scientific and operational standards and delivering reliable services around the clock.

These foundations are not constraints – they are enablers of long-term success and trust.

Ultimately, this Strategy is about delivering for society. It supports the protection of lives and livelihoods, the development of a sustainable and resilient Ireland, the strengthening of national competitiveness and better decision-making at all levels.

By connecting knowledge to action, Met Éireann contributes to a safer, more informed and more prepared society.



# 4 Conclusion

Met Éireann’s Research & Innovation (R&I) Strategy represents a shift to R&I as a system for national preparedness.

By strengthening excellence, accelerating innovation, embedding impact and intensifying partnerships, Met Éireann will play a central role in supporting decisions, protecting communities and building resilience.

From **Knowledge to Preparedness**, this Strategy ensures that science delivers where it matters most.



**“**  
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**”**



# STRATEGIC GOALS

## Goal 1

### Grow Weather–Flood–Climate Research Excellence & Talent



Goal 1 focuses on building and sustaining the scientific foundations of Met Éireann’s mission. Excellence in research is the starting point for everything else: without strong science, there can be no reliable services or impactful outcomes.

At the same time, excellence is not only about outputs – it is about people. Developing talent, fostering collaboration and building national capability are essential to ensuring that Ireland remains at the forefront of weather, flood and climate sciences.

This goal places particular emphasis on growing talent pipelines equipped to understand extreme weather and support climate adaptation, ensuring sustained national capability in weather–flood–climate sciences.

This goal also reflects the increasing complexity of Earth system science. Addressing future challenges requires integrated approaches that connect observations, models and technologies across scales and domains.



From pockets of excellence to Ireland as a Weather–Flood–Climate research powerhouse.

## Objectives

### 1.1 Fund national R&I through targeted and mission-driven calls

Targeted funding plays a critical role in shaping the national research landscape. By focusing on priority areas and societal needs, Met Éireann stimulates research that is both scientifically excellent and directly relevant to Ireland. Mission-driven calls in contrast provide a mechanism to align research efforts around shared challenges and outcomes.

- We will continue to operate targeted funding calls and will expand competitive research funding to include mission-driven calls aligned with national priorities, strategic partnerships and embedded Research to Operations (R2O) pathways.

### 1.2 Strengthen national capacity in Earth & underpinning frontier sciences

Building national capability requires sustained investment in education, training and career development. This objective recognises the importance of developing skills not only within meteorology, hydrology and climatology but also in connected disciplines such as data science, social sciences and humanities.

This objective aims at developing and sustaining national research capability through structured talent pipelines and knowledge mobilisation.

- We will grow doctoral partnerships, research fellowships, internships, mobility schemes, early-career mentoring and innovation training and will strengthen our integration with Irish higher education institutions through co-supervision and strategic appointments.

### 1.3 Develop an integrated Risk → Impact → Decision capability layer

To support decision-making effectively, scientific outputs must be translated into impacts and actions. This objective aims to create a unified layer that connects hazard information with impact modelling and decision support, ensuring consistency and usability across services.

- We will support research and innovation in hybrid modelling, Earth system science and computational methods.
- We will advance seamless km–hm scale modelling, hybrid AI–physics prediction, data curation and assimilation, coastal/fluvipluvial modelling, climate science, Earth system components and state-of-the-art interwoven communication pathways towards an “Enablement Fabric” with an integrated “risk → impact → decision” capability layer.

### 1.4 Establish a modular Observations → Models → Compute → Tools platform

Modern research and operations depend on robust and flexible infrastructure. This objective focuses on building a modular platform that connects observations, modelling systems, computational resources and data access mechanisms, enabling seamless integration and innovation.

- We will expand access to and use of advanced observational datasets, including satellite, radar and in-situ networks.
- We will build a modular scientific data platform and toolbox that supports experimentation, digital twin components, hybrid modelling, reproducibility and open science.



## Goal 2

### Drive Research to Operations & Innovation Delivery



Goal 2 addresses one of the most critical challenges in research and innovation: ensuring that scientific advances are translated into real-world applications. Too often, valuable R&I remains underutilised because it is not effectively integrated into operational systems.

Met Éireann aims to grow a structured and reliable pathway from R&I to operations, ensuring that innovation is not only generated but also delivered and used. This requires coordination across readiness levels, alignment of processes and a strong focus on user needs.

A core focus of this goal is ensuring that user needs are embedded early in the research lifecycle, with continuous feedback loops between research, operations and end users. For example, we will be strengthening the operational interface with emergency planning and response systems, ensuring seamless integration of weather intelligence into crisis management structures.

We will transform how R&I becomes operational reality through systems integration, user understanding, structured knowledge transfer, infrastructure and professional development.

Ultimately, this goal is about making innovation work in practice – safely, efficiently and at scale.



From bespoke knowledge transfer to a system that routinely turns research into services.

## Objectives

### 2.1 Grow a structured Research-to-Operations (R2O) pipeline

A clear and formalised Research-to-Operations (R2O) pipeline ensures that outputs are systematically evaluated, tested and integrated into operations. This reduces risk, improves efficiency and increases the likelihood that deliverables lead to real-world benefits.

Integration is often the limiting factor in innovation. This objective aims to break down silos and ensure that systems, teams and processes are aligned, enabling smoother transitions from research to operational use.

- We will stand up a Project Management / Knowledge Transfer / Evaluation & Impact Office, using change-control governance, a Quality Management System (QMS) for R&I funding, performance and knowledge transfer.
- We will deploy a Met Éireann-R2O “gateway” as a one-stop-shop facility to deploy weather-flood-climate research and innovation outputs into operations, shorten deployment timelines and ensure reliability and trust.
- We will facilitate greater involvement between researchers and operational partners and users, e.g. planners, emergency responders, industry sectors, by easing access to testing and transfer of knowledge.

### 2.2 Develop Testbeds, Living Labs & Place-based approaches

Decision & Impact Testbeds provide a space to experiment, validate and refine new ideas in collaboration with users. This objective focuses on creating a capability that allows products and services to be tested in realistic settings, ensuring they meet user needs before full deployment.

Living labs allow innovation to be tested and refined in real-world contexts. This objective also focuses on creating environments where researchers, users and stakeholders can work together to develop practical solutions.

- We will create a safe, iterative test environment and expert network where new models, observations, communication formats, decision tools and risk products can be trialled.
- We will work with local and regional communities to trial emerging and new products and services in real settings.
- We will work closely with national and local emergency planning and response organisations to co-design and test operational products, including severe weather warnings, impact scenarios and real-time decision-support tools.

### 2.3 Embed user understanding and behavioural insights in service design

Effective services must be designed with users in mind. This includes understanding how people interpret information, make decisions and respond to risk. By incorporating behavioural insights, services can be made more intuitive, relevant and impactful.

- We will establish structured mechanisms for user engagement, co-design and iterative feedback in the development of services.
- We will harness social sciences, accessibility testing, co-creation workshops, innovation learnings and living labs to ensure products and services are people-centred and improve actionability for all users.

### 2.4 Build robust infrastructure, standards and internal capability

Operational services must be reliable and resilient. This objective focuses on ensuring that infrastructure and standards support long-term sustainability, scalability and performance.

Innovation will be pursued alongside operational reliability, ensuring that new technologies enhance rather than disrupt critical services. This includes investment in scalable compute infrastructure and the adoption of responsible AI frameworks.

Innovation depends on people. Continuous learning and development are essential to ensure that staff have the skills needed to work with new technologies, methods and approaches.

- We will ensure rapid access to computing, networking, storage, instrumentation and digital infrastructure in support of innovation, open data, security, environmental sustainability and long-term maintainability.
- We will guarantee that Met Éireann’s R&I maintains national and international standards, quality assurance and 24/7 operational resilience by building R2O quality metrics and continuous improvement feedback (“Operations to Research”: O2R), providing training and maintaining a strong internal research and innovation mindset.

## Goal 3

### Advance R&I Value, Impact & Evidence for Policy



Goal 3 ensures that R&I is not only conducted but also used by decision makers. It focuses on translating scientific outputs into societal value, including improved decisions, policies and outcomes.

This goal strengthens the science–policy interface, ensuring that R&I outputs are systematically translated into policy-relevant evidence and decision-support tools. Particular emphasis will be placed on integrating weather and climate intelligence across key sectors including health, energy, water, transport and agriculture, ensuring that services are tailored to sector-specific risks and decision contexts. For example, we will work with public health authorities to develop climate-informed health indicators, early warning systems and decision-support tools.

A key aspect of this goal is measurement. Understanding the impact of R&I – such as in terms of avoided losses, improved resilience or better decision-making – is essential for accountability and continuous improvement.

Met Éireann will ensure R&I generates measurable public value through open science, robust evaluation, ethical governance and vehicles that translate science into policy-ready evidence.

This goal emphasises the role of Met Éireann in supporting policy, providing timely and credible evidence to inform national decision-making.



From bespoke knowledge transfer to a system that routinely turns research into services.

## Objectives

### 3.1 Implement outcome-based impact and evaluation frameworks

Evaluating impact requires clear frameworks that go beyond traditional quantitative metrics. This objective focuses also on capturing real-world outcomes, including societal and economic benefits.

Understanding impact helps demonstrate the value of investment in research and innovation. It also provides insights that can guide future priorities and improve effectiveness.

Dedicated structures and processes are needed to ensure that research outputs are effectively translated into practice. This objective focuses on building those capabilities.

- We will create an R&I impact evaluation system that examines societal value, public benefit, service improvements, resilience, competitiveness and evidence uptake.
- We will measure and communicate the societal value of R&I, such as avoided losses and improved preparedness.
- We will strengthen our collaboration with national socio-economic data bodies (e.g. Central Statistics Office – CSO, Economic and Social Research Institute – ESRI) to integrate weather and climate indicators with macroeconomic, sectoral and societal datasets, enabling robust quantification of climate-related socio-economic impacts and resilience metrics.
- We will embed expertise in impact assessment, socio-economic analysis, evaluation frameworks, implementation science and behavioural insights.

### 3.2 Strengthen policy integration through a Rapid Evidence Service

Decision-makers often require timely information. A Rapid Evidence Service provides a mechanism to deliver concise, relevant and credible insights to support policy and planning.

This includes direct support to national emergency coordination structures through rapid provision of scientific advice during high-impact events.

The Rapid Evidence Service will also support economic decision-making by providing climate-informed inputs to cost-benefit analysis, risk assessments and long-term planning.

- We will produce decision-ready indicators, impact dashboards, briefs and integrated assessments to inform e.g. policy, planning, infrastructure and emergency management.
- We will intensify structured engagement with policymakers and public bodies to support evidence-based national decision-making and planning.
- We will provide rapid, scientific and technical weather–flood–climate support services for users e.g. during emerging weather events, extreme weather episodes, climate trends and policy windows.

### 3.3 Embed open and sustainable R&I practices

Transparency, integrity and sustainability are fundamental to public trust. This objective ensures that research is conducted in a way that is open, responsible and aligned with societal expectations.

- We will enable open research practices and drive ethical and sustainable principles across all R&I projects to ensure transparent, equitable and environmentally responsible work.
- We will promote open science, ethical research practices and sustainability.



## Goal 4 Intensify Research & Innovation Partnerships



Goal 4 recognises that collaboration is essential to achieve scale and impact. By intensifying its partnership across academia, government, industry and communities, Met Éireann will continue to extend its reach and enhance its effectiveness.

Partnerships also enable co-creation, ensuring that research and innovation are grounded in real-world needs and contexts. This leads to solutions that are more relevant, accepted and impactful.

This goal includes strengthening collaboration with national research funding organisations, higher education institutions and international partners, ensuring alignment with shared priorities and maximising impact.

This includes strengthening all-island collaboration with partner organisations in Northern Ireland to support weather-flood-climate observation, modelling and response capability.

We will strengthen existing collaborations and coordinating activities, and build new networks that accelerate discovery, innovation and service transformation across Ireland and internationally.



From collaboration to co-creation and national & international capability.

### Objectives

#### 4.1 Develop strategic partnerships and centres & networks of excellence

By leveraging co-funding and expanding its participation in international research programmes, Met Éireann will continue to amplify its impact, access additional expertise and ensure alignment with global scientific advances.

This objective recognises centres and networks of excellence as frameworks for sustained collaboration and knowledge exchange. They help concentrate expertise and create critical mass in priority areas.

- We will shape collaborative and coordination efforts, harnessing strategic national co-funding and external funding opportunities and ensuring leverage of best available international practise and expertise.
- We will fund strategic R&I clusters in weather-flood-climate expertise to deliver societal impacts through deep user understanding & human-centred design.



#### 4.2 Strengthen public-private partnerships based on trust & transparency

Engagement with the private sector can accelerate innovation and delivery. This objective emphasises the importance of trust, clarity, and shared values in these partnerships.

- We will engage with small and large private organisations across multiple sectors to co-develop actionable tools grounded in public value and trust.
- We will support innovation that contributes to national competitiveness and economic resilience.
- For example, we will collaborate with the energy sector to support climate-resilient infrastructure planning and integration of renewable energy systems.

#### 4.3 Align with national and international research and innovation missions

Collaborations are essential for tackling complex, interdisciplinary challenges and help position Ireland as an active contributor to international research agendas.

This objective focuses on strengthening existing partnerships and developing new ones, both nationally and internationally. It also emphasises the importance of sustained engagement, ensuring that partnerships deliver long-term value rather than short-term outputs.

Alignment ensures coherence and maximises impact. By connecting with broader missions, Met Éireann will continue to contribute to and benefit from collective efforts.

- We will position Met Éireann and Ireland as a partner of choice in weather-flood-climate sciences to share knowledge, shape standards and influence next-generation modelling and services.

#### 4.4 Support a cohesive and collaborative national R&I ecosystem

Met Éireann recognises it operates within a wider national R&I ecosystem, working with colleagues from academia, government, industry and communities.

A well-functioning R&I ecosystem requires coordination and shared purpose. This objective focuses on enabling that cohesion.

- We will work with Government colleagues on cross-departmental missions and shape a cohesive, challenge-driven, national R&I funding and performing environment.



## CROSS-CUTTING SYSTEM ENABLERS

### Impactful Communication

Communication is central to ensuring that research delivers value. It is not enough to generate knowledge: that knowledge must be shared, understood and used.

Effective communication builds trust, enhances visibility and supports informed decision-making.

Communication activities will include traditional scientific dissemination, as well as outreach, education, digital services and media engagement.

### Robust Governance

Strong governance provides the foundation for quality, integrity, and continuity. It ensures that research and innovation activities are aligned with strategic priorities and conducted to the highest standards.

Governance structures such as the Strategy Delivery Board and Scientific Advisory Board will be put in place to provide oversight, guidance and accountability.

Delivery of this Strategy will be supported by a Project Management, Knowledge Transfer and Evaluation & Impact Office, responsible for coordinating implementation, facilitating research translation, and measuring societal impact.

A time-bound Implementation Plan and a Multiannual Funding Plan will be developed to accompany this Strategy, setting out:

- R&I priorities,
- specific actions,
- timelines,
- responsibilities,
- performance indicators,

to ensure effective delivery and accountability.



## RESEARCH & INNOVATION NEEDS FRAMEWORK

Research and innovation needs define the direction of Met Éireann’s R&I system.

R&I needs are:

- driven by societal challenges and decision-making requirements. They are expressed as strategic questions that guide priorities and investments.
- continuously informed by stakeholder engagement, national policy priorities and emerging scientific challenges, ensuring responsiveness and relevance.
- dynamic, evolving in response to new knowledge, technologies, and societal needs. As such, the current list reflects the time of publication, is indicative and non-exhaustive, and will be periodically reviewed and adjusted.

This framework ensures that research remains relevant, focused and aligned with the overarching goal of preparedness.

R&I needs are expressed as strategic research questions, designed to:

- guide national and internal research priorities.
- align scientific effort with societal needs.
- support the development of operational services and policy-relevant outputs.

R&I needs are grouped into interconnected themes reflecting the end-to-end system from observation to decision-making, with preparedness as the unifying objective. Importantly, the needs reflect the sequential and compounding nature of risk and impact, recognising that effective preparedness depends on understanding not only individual hazards but how risks propagate and interact across systems and sectors.



## Theme 1 Earth System Science, Modelling & Forecasting



**Theme 1 focuses on advancing the scientific foundations of forecasting across timescales, moving toward seamless, high-resolution and integrated Earth system approaches.**

- How can scientifically consistent, seamless forecasting systems be developed across timescales (from nowcasting to seasonal and climate prediction), leveraging hybrid AI-physics approaches, automation and statistical post-processing to improve accuracy, efficiency, transparency and operational robustness?
- What advances in observations, data integration (radar, satellite, hydrological, in situ), and km–hm-scale Earth system modelling are needed to enable reliable, high-resolution forecasting and decision-making at national to local (sub-catchment) scales?
- How can integrated modelling approaches improve forecasting of coastal, fluvial, pluvial, and groundwater flooding, such as enhanced lead times in small catchments and the development of national-scale capabilities for groundwater and pluvial flood prediction?
- How can uncertainty in forecasts and projections be robustly quantified, propagated and communicated, and how can flood risks be more effectively conveyed to support decision-making and public response?
- How can compound events (e.g. rainfall and storm surge, heat and drought, wind-driven wildfire risks) and short-duration extreme rainfall be better modelled, forecast and projected?
- What is the added value of regional downscaling, emulation and AI-based approaches for climate projections in Ireland?

## Theme 2 Impact-Based Services & Decision Support



**Theme 2 focuses on translating scientific outputs into actionable insights that support preparedness and decision-making.**

- How can impact-based forecasting and warning systems be standardised and advanced -through improved impact modelling, probabilistic forecasting and uncertainty communication – to deliver consistent risk interpretation and support effective decision-making across individuals, sectors and institutions?
- How can user-centred, scalable early warning systems be developed – incorporating personalised, activity-specific alerts, co-design with stakeholders and citizens, and real-time data integration – supported by robust local and national data infrastructure?
- How can weather and climate information, including monthly and seasonal forecasts, be effectively translated into actionable, sector-specific guidance and embedded into operational and policy decision-making processes?
- What frameworks and approaches best support the integration of scientific evidence into national policy and planning, and how can the societal and economic value of meteorological services be robustly quantified and communicated?
- How can weather and climate information be integrated into public health systems, including early warning for heat stress, cold exposure, air quality and climate-sensitive diseases?

## Theme 3 Climate, Resilience & Long-Term Risk



**Theme 3 addresses Ireland's long-term climate risks and supports adaptation, resilience, and policy development.**

- How can climate projections and seamless forecasting systems (from nowcasting to seasonal and long-term scales) be improved, kept up to date and translated into sector-specific, decision-ready climate services – leveraging national datasets such as TRANSLATE, new technologies, and tailored approaches for sectors such as agriculture, energy, transport, health and biodiversity?
- What are the projected impacts of short-duration extreme rainfall, compound climate events and large-scale Earth system changes (including Atlantic Meridional Overturning Circulation “AMOC” variability), and how might these influence Ireland’s climate, infrastructure, environment, and human health, including potential tipping points and worst-case scenarios?
- What are the projected frequency, intensity and impacts of climate-driven hazards such as heatwaves, droughts and wildfire in Ireland, and how can these be effectively monitored, forecast and integrated into preparedness and adaptation planning?
- How can climate and weather data support the resilience and optimisation of energy systems, including renewable generation forecasting, grid stability and long-term energy planning?
- How can integrated hydrological and climate information support sustainable water resource management, including drought planning, water quality and competing demand pressures?
- How can rescued historical data, long-term observations, and enhanced national datasets be used to improve understanding of climate variability and change, and to support more accurate, nationally relevant climate projections and services?
- What methodologies are most effective for attributing weather events to climate change, developing standardised adaptation indicators and integrating biodiversity and nature-based solutions into climate services and adaptation strategies?
- How can uncertainty in climate projections be reduced, characterised and communicated, and how can decision-makers be supported to act effectively under uncertainty in emergency response, policy development, infrastructure planning and long-term investment decisions?



## Theme 4 Observations, Next-Generation Sensing & Digital Infrastructure



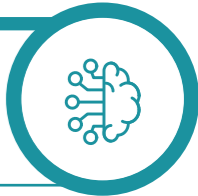
Theme 4 focuses on strengthening the observational backbone and data systems that underpin all forecasting and climate services.

- How can national observing systems be maintained, enhanced and future-proofed – ensuring long-term representativeness, continuity, and resilience – while integrating next-generation and non-traditional observation technologies (including radar, satellite, marine, coastal, and in situ systems) to improve detection and monitoring of local-scale extremes and compound hazards?
- What data architectures, centralised platforms and digital infrastructures are required to support a modern, integrated national meteorological and climate data system – enabling seamless data integration, accessibility, interoperability, and support for research, operations and downstream applications?
- How can data homogenisation, standardisation, and governance frameworks be advanced – aligned with international standards – to support open data policies while ensuring data integrity, attribution, stewardship and sustainable use?
- What are the most effective approaches for long-term digital preservation and stewardship of meteorological and climate data, and how can datasets be made more accessible, user-friendly and interoperable through improved tools, interfaces and documentation?
- How can observational capabilities be expanded – through high-frequency measurements and sector-relevant variables (e.g. solar radiation, degree-days) – to better support forecasting, modelling and decision-making across operational, planning and policy contexts?

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*How can citizen science, participatory approaches and co-designed tools be leveraged to enhance trust, improve data quality, strengthen early warning systems and increase climate literacy and public engagement?*

## Theme 5 AI & Advanced Technologies



Theme 5 harnesses AI and emerging technologies in transforming forecasting, climate science and service delivery.

- How can Ireland establish leadership in AI-enabled weather and climate science by developing frameworks that ensure transparency, explainability, trustworthiness and responsible governance – while evaluating, mitigating and managing risks, and ensuring the sustainable use of AI technologies?
- How can AI and machine learning be safely and effectively integrated into meteorological and climate workflows, including hybrid AI–physics systems, automation and statistical post-processing, while balancing rapid innovation with operational reliability and scientific rigour?
- Which forecasting and modelling applications offer the greatest added value from AI, and how can these methods enhance high-resolution nowcasting (e.g. fog and severe weather), data assimilation, uncertainty quantification, model emulation and regional downscaling for climate projections?
- What data ecosystems, compute architectures and system designs are required to support advanced AI-enabled forecasting, including hybrid systems with transparent uncertainty and auditability, and how can high-quality, multi-source datasets be secured and integrated?
- How can emerging technologies such as digital twins and advanced simulation environments be developed and applied to enhance preparedness, scenario analysis and decision-making across weather and climate contexts?

## Theme 6 Communication, Behaviour & Societal Engagement



Theme 6 addresses how information is understood, trusted and acted upon by different users.

- How can weather and climate communication – across language, visualisation, formats and channels – be improved to enhance public understanding, including more effective communication of uncertainty and clearer interpretation of risk across different audiences?
- How can social and behavioural sciences be applied to better understand how different groups interpret weather and climate risks, and how can user needs be systematically identified and integrated into the design of services, warnings and decision-support tools?
- How can citizen science, participatory approaches and co-designed tools be leveraged to enhance trust, improve data quality, strengthen early warning systems and increase climate literacy and public engagement?
- How can feedback loops, social media insights (e.g. sentiment analysis) and domain-specific AI tools be used to continuously improve weather and climate services, including verification and refinement of severe weather warnings and increased accessibility of information?
- How can “social sensing” approaches be used to understand public perception, response and emerging risks, particularly in the context of increasingly diverse, segmented and polarised audiences?
- How can Met Éireann strengthen its role as a trusted, authoritative national voice on weather and climate, and how can communication strategies enhance the visibility, uptake, and societal impact of its research and services in an increasingly complex digital environment?

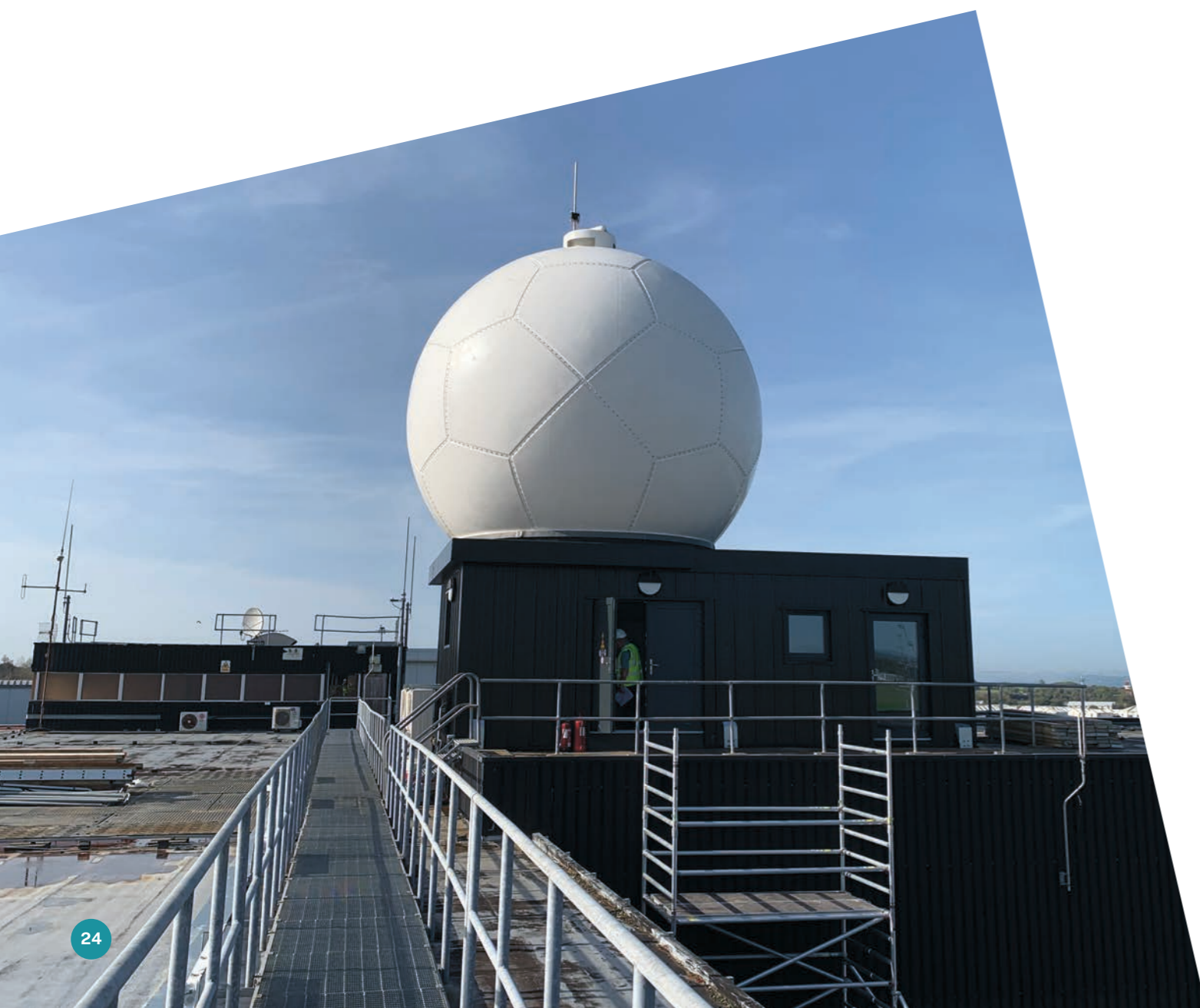
## Theme 7

### System, Interdisciplinary Methods & Governance



Theme 7 ensures that the research and innovation system itself is effective, aligned and sustainable.

- What frameworks and processes are most effective for fostering interdisciplinary collaboration across physical, environmental, technological and social sciences, and how can these approaches enhance co-creation, knowledge exchange and the long-term impact of research?
- How can research activities and governance structures be designed to ensure strategic alignment, maintain quality and integrity, support innovation, and remain value-driven & resilient amid rapid technological and societal change?
- How can Met Éireann strengthen its role within national and international research and innovation ecosystems, leveraging partnerships and international frameworks (e.g., ACCORD, UWC, HCLIM, EC-Earth, EUMETSAT, EUMETNET, ECMWF, WMO) to deliver objectives, share expertise and enhance research outcomes?



## CASE STUDIES

### AI Integration into Weather-Flood-Climate Intelligence

Met Éireann's funding of a national Professorship Programme has catalysed a step-change in Ireland's capability to harness artificial intelligence for weather, flood and climate science. Through the establishment of the AIMSIR Centre at University College Dublin, this initiative brings together operational meteorology and cutting-edge AI research in a single, mission-driven ecosystem.

The programme is delivering tangible outcomes across both **science and capability**. It is developing next-generation forecasting tools – ranging from precipitation nowcasting and impact models for extreme weather to automated observation quality control – while simultaneously building a pipeline of highly skilled researchers through funded PhDs and MSc training.

Beyond research outputs, the real impact lies in **translation to operations**. By co-supervising projects between academia and Met Éireann, the programme ensures that innovations are designed from the outset to strengthen national forecasting systems, improve early warning capability, and enhance preparedness for high-impact weather in a changing climate.



## Climate Modelling

Met Éireann plays a significant role in advancing climate modelling at global, regional and national scales, contributing to major international efforts such as the Coupled Model Intercomparison Project (CMIP) and the development of the EC-Earth global climate model.

Through these collaborations, Met Éireann researchers help generate the simulations that underpin global climate assessments while also producing **Ireland-relevant projections**. Research into critical systems such as the Atlantic Meridional Overturning Circulation (AMOC) strengthens understanding of how global processes influence regional climate risks.

This work delivers both **scientific leadership and national impact**. By linking international modelling expertise with national applications, Met Éireann ensures that Ireland benefits from the latest advances in climate science – supporting evidence-based policy, risk assessment, and long-term planning for a changing climate.

## TRANSLATE: One Climate Resource for Ireland

The TRANSLATE programme represents a step-change in Ireland’s ability to turn climate science into **actionable decision support**. Funded by Met Éireann and delivered by researchers in academic institutions and research centres, it provides the first standardised, bias-corrected national climate projections, enabling consistent use across sectors.

TRANSLATE goes beyond data provision to deliver **operational climate services**. These include sector-specific tools such as infrastructure stress-testing, overheating risk assessments in buildings, and climate vulnerability indices, all co-designed with users.

Its impact is systemic. By underpinning national frameworks such as the National Adaptation Framework and supporting the National Framework for Climate Services, TRANSLATE ensures that climate information is **accessible, trusted and embedded in decision-making** across Ireland.

## Climate Data Rescue

Met Éireann’s Climate Data Rescue efforts are transforming Ireland’s historical climate record into a modern, accessible scientific asset. Through initiatives such as the Irish Weather Rescue Project, millions of handwritten observations dating back to the 19<sup>th</sup> century are being digitised, preserved, and made available for research and decision-making.

This work supported by one of Met Éireann’s Research Fellows delivers critical **scientific value**: long-term, high-quality datasets that enable improved detection of climate trends, better understanding of extreme events and more robust validation of climate models. At the same time, it demonstrates innovation in **public engagement**, mobilising citizen scientists to contribute directly to national research efforts, with thousands of observations already transcribed.

The result is a unique combination of **heritage preservation, scientific advancement, and societal participation**, strengthening Ireland’s capacity to understand past climate variability and better prepare for future change.

## Observations

Met Éireann’s observational network forms the backbone of Ireland’s weather, flood and climate capability. From historic sites such as Valentia Observatory to modern radar networks and environmental monitoring systems, the organisation maintains a comprehensive, multi-parameter observing system spanning atmosphere, oceans and land.

Ongoing investment is transforming this capability. The expansion of the national weather radar network – from two to seven radars – will significantly enhance real-time detection of rainfall and severe weather, improving forecasting accuracy and supporting emergency response. These observations feed directly into numerical weather prediction systems, data assimilation processes and climate datasets.

Crucially, this is not just infrastructure – it is a **research platform**. Observations underpin advances in forecasting, enable integration with satellite and AI-driven systems, and ensure the long-term integrity of climate records. Together, they provide the **trusted evidence base** required for both operational services and national climate policy.

## Agricultural Meteorology

Agricultural meteorology demonstrates how research is translated into **direct, sectoral value** for Irish society. Since its establishment, Met Éireann’s Agricultural Meteorology Unit has developed tailored products and services that support farmers, advisors and policymakers in managing weather and climate risks.

These include operational tools such as soil moisture deficit maps, disease warnings (e.g. potato blight) and specialised forecasts, alongside decision-support inputs for national systems such as fire risk indices and animal health advisories.

The unit also drives **applied research and innovation**, working with partners such as Teagasc and universities on topics including grass growth modelling and evapotranspiration. This integration of research, operations and stakeholder engagement ensures that scientific advances translate into **improved productivity, sustainability and resilience** across Ireland’s agri-food sector.



## OUR RESEARCH & INNOVATION IMPACT

Met Éireann's Research & Innovation system is built on a dual foundation: we are both a **research-performing** and a **research-funding** organisation. This dual role is a strategic strength. It allows us not only to generate scientific knowledge internally through in-house expertise, but also to shape and scale national capability by investing in external research aligned with Ireland's weather, flood and climate science needs.

At the core of this system are our **in-house research activities**, where permanent researchers and Research Fellows work at the interface of science and operations. This ensures that research is closely connected to forecasting, warning services and decision support – accelerating the translation of knowledge into preparedness. Alongside this, the **Met Éireann Weather and Climate Research Programme** extends our reach by funding, coordinating and partnering across the wider research ecosystem.

Through this Programme, Met Éireann delivers impact via three complementary funding streams:

- **Research Call Scheme** – Competitive calls fund academic-led projects and a flagship Professorship Programme, building national research capacity while addressing priority challenges in weather, flood and climate science.
- **Research Fellowship Scheme** – In-house Research Fellows strengthen internal capability, advancing targeted research priorities and bridging research and operations.
- **Co-Funding Scheme** – Strategic partnerships with other research funding organisations such as the EPA, Research Ireland, SEAI, the Marine Institute and Teagasc enable co-funding in shared priorities, amplifying impact and fostering interdisciplinary collaboration.

This integrated model ensures that research is not conducted in isolation but as part of a **connected national system**, aligned to societal needs and operational delivery.

## Evidence of Impact

Since 2020, the Weather and Climate Research Programme has demonstrated strong and growing impact:

- **64 peer-reviewed research outputs**, with **76% available in open access**, supporting transparency and accessibility.
- **11 tools, models, platforms and datasets** developed, directly contributing to operational and user-facing capabilities.
- **35 media engagements** and **44 end-user activities**, strengthening public engagement and knowledge exchange.
- **37 researchers supported**, spanning MSc, PhD and postdoctoral levels, building a diverse and future-ready talent pipeline.

At programme level:

- **11 research call projects funded** since 2020, with over **€10 million** of funding.
- **33 co-funding partnerships**, leveraging over **€10 million** in additional research funding.
- **28 Research Fellows** recruited since 2018, embedding expertise within the organisation.

Together, these figures illustrate a system that is not only productive, but purposeful – delivering **scientific excellence, practical tools, skilled people and societal engagement**.

## A System Designed for Preparedness

What distinguishes Met Éireann's approach is not just the volume of research, but how it is **structured for impact**. By combining internal expertise, targeted funding and strategic partnerships, we ensure that research continuously feeds into operations, policy and public services.

In this way, our Research & Innovation system acts as a **national engine for preparedness** – transforming scientific insight into actionable knowledge that protects lives, supports decision-making and strengthens Ireland's resilience in the face of weather and climate challenges.



# GLOSSARY OF TERMS

<b>ACCORD</b>	A Consortium for CONvection-scale modelling Research and Development
<b>AI</b>	Artificial Intelligence
<b>AIMSIR</b>	AI for Meteorological Services, Innovation and Research
<b>AMOC</b>	Atlantic Meridional Overturning Circulation
<b>CMIP</b>	Coupled Model Intercomparison Project
<b>CSO</b>	Central Statistics Office
<b>EC-Earth</b>	European consortium developing a state-of-the-art Earth system model
<b>ECMWF</b>	European Centre for Medium-Range Weather Forecasts
<b>EPA</b>	Environmental Protection Agency
<b>ESRI</b>	Economic and Social Research Institute
<b>EUMETNET</b>	European Meteorological Network
<b>EUMETSAT</b>	European Organisation for the Exploitation of Meteorological Satellites
<b>HCLIM</b>	Regional climate model framework based on the HARMONIE NWP operational model
<b>NWP</b>	Numerical Weather Prediction
<b>O2R</b>	Operations to Research
<b>QMS</b>	Quality Management Systems
<b>R&amp;I</b>	Research & Innovation
<b>R2O</b>	Research to Operations
<b>SEAI</b>	Sustainable Energy Authority of Ireland
<b>TRANSLATE</b>	Standardised, bias-corrected, national climate projections for Ireland
<b>UWC</b>	United Weather Centres
<b>WMO</b>	World Meteorological Organisation



An Roinn Tithíochta,  
Rialtais Áitiúil agus Oidhreachta  
Department of Housing,  
Local Government and Heritage



Rialtas na hÉireann  
Government of Ireland