Post-Doctoral Fellowship: Proposal Outline

Topic	Status of Ireland's Climate (Climate Status Report for Ireland 2027)
Research Theme(s)	Climate Change: Understanding key climate trends in the oceanic, terrestrial and atmospheric domains. Climate observing infrastructure: oceanic, atmospheric and terrestrial. This research aligns with national, global and regional priorities to improve our understanding of how Ireland's oceanic, terrestrial and atmospheric domains are reflecting and responding to climate change.
Background and Rationale (including Strategic Priority)	As an island on the western boundary of Europe facing the Atlantic Ocean, Ireland is ideally positioned to measure and assess the drivers of climate change, ongoing changes and their consequences for natural and managed systems. This is achieved through sustained long-term measurements of essential climate variables (ECVs) which have been identified by the Global Climate Observing System (GCOS) and United Nations Framework Convention on Climate Change (UNFCCC). ECVs include measurements of greenhouse gases and other atmospheric constituents that change the global energy balance and drive climate change by trapping more energy in the Earth's climate system, terrestrial systems including land use and hydrology and Oceans, with over 90% of this additional energy is absorbed by the ocean, which is undergoing unprecedented changes. The Intergovernmental Panel on Climate Change (IPCC) has stated that warming of the Earth's climate system is unequivocal, as is evident in the global temperature records. It is virtually certain that the global ocean has increasingly warmed since 1970 and that the rate of ocean warming has more than doubled since 1993. There has been a doubling in the frequency of marine heatwaves since 1982. Moreover, as a result of absorbing more carbon dioxide, there has been increasing ocean surface acidification. Ireland's climate and that of northwest Europe is dominated by the Atlantic Ocean, and its coastal zones are affected by sea level rise. Understanding how the Atlantic Ocean is responding to climate change through monitoring of climate parameters is therefore vital. Similarly, monitoring of climate-related changes to the land surface and hydrological regimes (including rainfall and river flows) is essential, given their centrality to and influence on the socio-economic environment. They also include carbon stocks and sinks in soils and biomass. Ireland still has extensive areas of peatland that play an important role in carbon and water storage. Their health and that of other terrestrial carbon systems is very sensitive to changes in climate.

	The 1992 United Nations Framework Convention on Climate Change (UNFCCC), and its 2015 Paris Agreement, recognise the need for systematic observations of the climate system. In response to this need the World Meteorological Organization together with other UN bodies and related organisations established the Global Climate Observing System (GCOS). Its objective is to provide a framework for the development of systematic observations and to ensure the sustained provision and delivery of reliable data from observations of ECVs for the total climate system. This includes the atmospheric, oceanic and terrestrial domains. It is through the monitoring of ECVs that we can both assess the trends, changes and status of Ireland's climate and compare it with what is occurring across Europe and the rest of the world. The first The Status of Ireland's Climate report was published in 2013. A second Status report was published in 2021. These reports look at the ECV data available for Ireland and the robustness of the systems in place to ensure the adequacy and sustainability of these to provide long term data. The second report incorporated new datasets and analyses as well as reporting ongoing climate observations over the last 5 years. The GCOS-Ireland Committee was also established in this period by the Environmental Protection Agency (EPA), Marine Institute, Teagasc and Met Éireann with Met Éireann chairing the committee and acted to steer this work on ECV's and the provision of the 2021 Status Report. Work carried out by the proposed postdoctoral fellowship will contribute to Ireland's ongoing commitment to the UN Framework Convention on Climate Change (UNFCCC) and Paris Agreement. It will align with Ireland's Climate Action and Low Carbon Development (Amendment) Act 2021 and other national climate strategies to provide reliable data, to support evidence-based mitigation and adaptation responses to climate change . The project objectives are relevant to several Marine Institute, Met Eireann and EPA strategic priority areas (e.g. environmental knowledge, advice and services, climate and biodiversity, research and innovation, Blue Economy, stakeholders and society). The proposed research will support objectives and actions in Ocean Knowledge 2030 addressing the objective of "providing evidence to understand both baseline conditions and patterns of change linked to climate change". It contributes to the EPA's strategic plan through helping to deliver knowledge to drive climate action and providing data to deliver a protected and healthy environment: EPA Strategic Plan 2022 - 2026 (2025 Revision) | Environmental Protection Agency. The project also address Met Éireann's strategic objectives following its latest Strategic Plan 2024-2034 preparing Ireland for changing weather and climate, including the augmentation of its monitoring infrastructure to support weather, flood and climate services.

	Specifically, this research fellowship will address the action articulated in Ocean Knowledge 2030 to contribute to "the advancement of digital products and innovation to underpin national climate and planning policy and the provision of climate services". The research will also "Ensure essential ocean variables relevant to Irish waters are measured sustainably and meet international requirements for climate monitoring", as recommended in the Irish Ocean Climate and Ecosystem Status Report (Nolan *et al.* 2023).The research fellow will engage with the EPA, Teagasc, OPW, National Parks and Wildlife and other relevant bodies on ECVs related to terrestrial systems including on land use, land use change, land cover. This will include observation related to freshwater systems and hydrological changes. It will review ECVs on atmospheric composition and assess the trends and changes that are occurring, and in particular information from observations supported by Met Éireann and the EPA.
Scope of Research (Scientific/ Technical Challenge)	**This research project aims to** assess the current status of Ireland's observing systems for essential climate variables in the oceanic, atmospheric and terrestrial domains. The proposed project will also elucidate key information and trends in essential climate variables and evaluate the extent to which wider earth observation data including remote sensing data, are or can complement existing climate data gathering efforts, and consider how these can be further integrated in supporting responses to climate change. This will lead to improved climate information and services in all domains for all economic and social sectors and for Irish citizens. **A key objective of the fellowship is** to update of the Climate Status Report of Ireland, (Cámaro García et al, (2021) in 2027. This work should further support Ireland in its commitment to the implementation of UN Framework Convention on Climate Change and Paris Agreement. **The fellowship will address the following key research objectives:** • Review the latest information from GCOS on ECV and their relevance and application to Ireland. • Review, update and reassess the observational information and data for GCOS defined Essential Climate Variables (ECVs) relevant to Ireland identified in the 2020 report and since. • Assess progress in fulfilling the recommendations of the 2020 Status of Ireland's Climate (SOIC) Report; this includes any gap filling activities recommended in the 2020 Report. • Provide an update report on the status of GCOS observational systems for Ireland by 2027, across the oceanic, terrestrial and oceanic domains and including new data sources, such as, but not limited to, European Space Agency/Copernicus observational data.

	• Update the analysis provided of ECVs and highlight changes and trends in ECVs data and their relevance for Ireland. • Identify new, emerging issues for the observational network and its status, including scoping on developing a sustainable long term ECV observation network. • Produce various targeted communications to include a new SOIC report, infographics, policy briefs and peer-reviewed publications outlining the key findings from the SOIC 2027 report. • The report should identify and categorise the range of policy areas for which ECV, or related observations are carried out in Ireland this would include other UN bodies, EU directives and national law. This researcher will be guided by the member of GCOS-Ireland Committee, and specifically Met Éireann, the Environmental Protection Agency (EPA) and the Marine Institute's (MI). It should ensure effective knowledge sharing and adherence to FAIR data principles. It is expected that the project will use an array of observing platforms and data sets across the oceanic, terrestrial and atmospheric domains.
Expected Impact(s)	- Understand vulnerabilities and gaps in Ireland's ability to collect and analyse Essential Climate Variables. - Broaden understanding of key climate trends in Ireland in the oceanic, terrestrial and atmospheric domains. - Contribute to the development of climate observation services at national level. - Improve the evidence base for local authority and sectoral climate adaptation plans. - Strengthen interdisciplinary research between oceanography, climatology, and terrestrial system science. - Produce policy briefs for stakeholders, and publish research findings as widely as possible through peer-reviewed papers, conference presentations, articles, etc.
Outcomes	- An updated Status of Ireland's Climate report with latest observing system status and key climate trends by 2027. - Targeted communication materials for policy makers, the public and scientists e.g. summary for policymakers, infographics, dashboards, scientific publications. - Stronger cohesion in the coordination of the resourcing and data collection of essential climate variables in Ireland. - Insights into new multi-disciplinary climate science that Ireland could undertake in the coming years.

Specific Collaboration	This fellowship is a Marine Institute, Met Éireann and the Environmental Protection Agency award with the GCOS-Ireland Committee.
Location of Fellow	Primarily based in the Marine Institute with research visits to and strong links with activities in Met Éireann, Environmental Protection Agency, Teagasc and other bodies carrying out Earth Observations. The fellow will reside in the Ocean Climate Service Group at the Marine Institute, Rinville, Oranmore Galway. **Contacts:** Glenn Nolan, Marine Institute. Sarah Gallagher, Met Éireann. Kieran Craven, Environmental Protection Agency.
Duration and Funding Available	4 years €100,000 per annum (i.e. total €400,000 maximum for duration of four years) This fellowship is funded by the Marine Institute (42%), Met Éireann (42%) and the *Environmental Protection Agency (16%).
References	Cámaro García, W, Dwyer, N. and Gault, J., 2021 Climate Status Report for Ireland 2020 EPA Research Report 386 (Research_Report_386.pdf) Nolan, G., Cusack, C., Fitzhenry, D. (Eds.) (2023). Irish Ocean Climate & Ecosystem Status Report. Marine Institute, Galway, Ireland, pp 182. http://hdl.handle.net/10793/1844

*EPA co-funding is for the first two years of this award, with further funding to be determined during this period.