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The science-society interface: a key to a regional adaptation framework

REGION REUNION

Small islands are "sentinels" of climate change impacts. This is particularly true for Réunion Island, a French overseas and European Union Outermost Region in the South West Indian Ocean. It is home to a rich diversity of terrestrial and marine ecosystems and characterized by a pronounced topography and significant climatic contrasts. The island's economy relies mainly on vulnerable and exposed sectors (agriculture, tourism, transport, energy supply). Combined with its insularity and geographical isolation, limited local resources, and dependence on external trade, it makes it particularly sensitive. At last, frequent exposure to climate-driven natural hazards, like tropical cyclones, heavy rainfall, flash floods, landslides, droughts and heatwaves, combined with a fragile socio-economic system, amplify this vulnerability.

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Navigating the complex challenges of climate change adaptation requires strategies tailored to this local context. A dynamic and functional science-society interface is central to ensure that scientific knowledge feeds policy and planning, and that societal needs and local realities shape research initiatives and outputs. However, building this interface on Réunion Island faces several interconnected challenges.

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At the regional scale, Réunion Island's regional council holds keys responsibilities spanning regional planning, economic development, research and innovation (supported by the European Fund for Regional Development - ERDF), and environmental policy, positioning it as a central actor for amplifying territorial adaptation. However, translating this strategic position into effective climate action requires overcoming significant difficulties inherent to the island's unique context. Comprehensive expertise is needed not only on past, present, and future climate but also on their cascading effects across vital sectors – including natural hazards, ecosystems, health, resources, economic development, and land planning. To achieve this, key local challenges have to be tackled.

Key local challenges for adaptation

• Adaptation Constrained by Data Limitations

Réunion Island's unique geography—remote, narrow (75km wide), and highly mountainous (up to 3000m)—poses significant challenges for climate modelling. Standard global climate models operate at coarse resolutions (50-150km), inadequate for capturing the island's complex terrain and distinct microclimates. Its geographical remoteness also excludes it from keys European climate and climate-impact modelling projects. Consequently, the island is often "invisible" or poorly represented in large-scale studies, leading to critical gaps in data for effective territorial adaptation planning. This scarcity extends beyond climate data themselves, encompassing insufficient observational data for certain parameters (like long-term wave patterns for coastal erosion studies) and a critical lack of readily usable data detailing specific vulnerabilities and potential impacts across the island's socio-ecosystems.

Paradoxically, strong local scientific research capacity does exist. CNRS and University of La Réunion host the internationally recognized Observatory of Atmospheric Physics (<u>OPAR</u>) as a <u>WMO</u> global station which is part of European research infrastructures <u>ACTRIS</u>, <u>ICOS</u> and <u>IRISCC</u>. Météo-France (MF) Réunion serves a large weather observation network to monitor tropical cyclones and issues warning as the WMO-designated Regional Specialized Meteorological Center (RSMC) for the South-West Indian Ocean. MF also coordinated the first high-resolution (3km) regional climate projections based on CMIP6 (through the BRIO project). Furthermore, numerous research institutions (University of La Réunion, CNRS, CIRAD, BRGM, IRD) conduct vital local research across diverse fields.

While enhancing scientific knowledge remains essential, data limitations should not be perceived as the only barrier to adaptation. With or without climate change, effectively addressing vulnerabilities often encounters significant hurdles related to coordination, knowledge sharing, and collaboration among local actors.

• Strengthening the science-society interface to produce actionable insights and bridge the science-policy gap

The existing base of local expertise often remains fragmented. Research has frequently developed within disciplinary silos, lacking the interdisciplinary and transdisciplinary integration needed to generate holistic insights and readily usable outputs tailored for territorial decision-making. Several factors contribute to this gap between academic research and policy recommendations or action programs. Findings are often presented in highly technical or specialized language, making them difficult for non-expert decision-makers and other stakeholders to interpret and utilize. So far, studies have mostly focused on climate hazards themselves, with fewer studies dedicated to assessing their concrete, localized impacts across Réunion's socio-ecosystems. Finally, the inherent uncertainties within climate projections often contrast sharply with the practical need for precise, actionable data required for critical local decisions, such as the dimensioning of infrastructure projects.

A compounding effect of the challenge of fragmented knowledge is a disconnect at the sciencesociety interface. Even when relevant fundamental or applied research is conducted, its findings are often not effectively translated or communicated in formats directly applicable to strategic planning and public policy. This results in valuable scientific insights being underutilized, hindering the development of robust, evidence-based adaptation strategies.

• The need for a comprehensive risk impact framework

This underscores a further, critical challenge: the lack of comprehensive risk impact studies. Such studies are needed to systematically link climate-driven hazards with vulnerability and exposure across Réunion's diverse socio-ecosystems, leveraging existing local data. While observation systems are in place, a key gap remains in the establishment of an integrated impact analysis system coupled with corresponding long-term adaptation measures and monitoring. There is a clear need for an analytical framework to structure and strengthen risk knowledge, effectively guiding the connection between national risk management strategies and specific local challenges.

A local response to create a long-term Science-Society interface on climate risks

Recognizing these challenges, Réunion island's regional council and other public stakeholders have initiated concrete actions to develop the science-society interface on climate risks.

• Creation of a Regional Panel on Climate Change (RPCC) for La Réunion

In 2023, the president of Réunion regional council announced the creation of a Regional Panel on Climate Change (RPCC or GREC in French) based on an idea suggested by the CNRS. Its aim is to foster collaboration between experts, decision-makers, and the public, and to help the public authority pursue its health, energy, and food sovereignty goals impacted by climate risks. The soon-to-be-launched "GREC-La Réunion" will provide territorial expertise on climate impact and adaptation, working explicitly to improve the science-society interface and enhance the coordination and funding of climate change adaptation.

• A new Regional Land Development Plan to meet 2050 territorial challenges

The Regional Land Development Plan (SAR in French) is a crucial prescriptive planning document for French overseas territories, providing guidelines for local authorities in implementing their local development and planning strategies. The SAR of La Réunion is currently under revision and includes a dedicated "Climate" chapter, composed of a study of the territory's vulnerability to climate change and the development of a regional adaptation strategy. This process explicitly plans to draw on scientific research results and the expertise of the newly formed GREC-Réunion, directly linking scientific knowledge to long-term territorial planning.

• Participation in the European CLIMAAX project

The European CLIMAAX project is one of the two flagship projects of the "Adaptation to climate change" mission of Horizon Europe funding program. The CLIMAAX local implementation project, called Réunion Island's Climate Risks Atlas (RISC-RA), started on October 1, 2024, and is led by the regional council team and supported by a scientific consortium (Météo-France, CNRS, BRGM). RISC-RA will produce a climate risk atlas by analysing future climate risks using observed and projected climate, vulnerability, and exposure data. Guided by the CLIMAAX methodology, adapted for La Réunion, the project aims to enhance local climate risk knowledge, provide standardized and spatialized risk indicators for public bodies and scientists, and better integrate bottom-up risk reduction needs into top-down policies.

• Complementary Research and Initiatives

Two complementary CNRS-piloted projects further enhance this integrated territorial strategy. The project "Knowledge and Solutions for Climate Change Adaptation of Overseas Territories" (supported by the Ministry of Overseas Territories) is conducting a vital review of scientific literature on climate change impacts and adaptation options specific to French overseas territories. The project "Barriers, levers and constraints to Adaptation in Territorial Public Policy" (supported by Banque des Territoires) is examining the social and political dimensions of implementing adaptation measures.

These combined initiatives demonstrate a growing commitment in Réunion Island to bridging the gap between scientific understanding and societal action. Strengthening this sciencesociety interface is fundamental to developing and implementing an effective regional adaptation framework capable of addressing the complex climate challenges facing the island.

This opinion article is based on the CLIMAAX project's "Deliverable Phase 1 – Climate risk assessment, project RISC-RA, Réunion Island, France" written by Kevin Lamy, Nils Poncet and Elodie Marpinard.

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These projects have received funding from the European Union's Horizon 2020 research and innovation programme under Grant Agreements No. 101036560, No. 101036683, No. 101037424, No. 101037084. This material reflects only the views of the Projects' consortiums and the EC cannot be held responsible for any use that may be made of the information in it.