CLIMAAX
climate ready regions

Deliverable Phase 3 – Climate risk management

RISC-RA

France, La Réunion

Version 1 | July 2026

HORIZON-MISS-2021-CLIMA-02-01 - Development of climate change risk assessments in European regions and communities based on a transparent and harmonised Climate Risk Assessment approach

Funded by the European Union

This project has received funding from the European Union's Horizon Europe research and innovation programme under grant agreement No 101093864. Views and opinions expressed are however those of the author(s) only and do not necesSAR-2050ily reflect those of the European Union or the European Climate, Infrastructure and Environment Executive Agency (CINEA). Neither the European Union nor the granting authority can be held responsible for them.

Document Information

Deliverable Title	Phase 3 – Climate risk management
Brief Description	Hydro-climatic risk assessment on Reunion Island. The document contains: • Local profile • Climate risk management • Projection Evaluation • Project Conclusion
Project name	RISC-RA
Country	France
Region/Municipality	La Réunion
Leading Institution	Région Réunion
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Deliverable submission date	31/07/2026
Final version delivery date	31/07/2026
Nature of the Deliverable	R – Report
Dissemination Level	PU - Public

Version	Date	Change editors	Changes
1.0	31/07/2026	Région Réunion	Deliverable submitted

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Abbreviations and acronyms

Abbreviation / acronym	Description
ADEME	Agence de la Transition Écologique — French Agency for Ecological Transition
AFD	Agence Française de Développement — French Development Agency
AFPCNT	Association Française pour la Prévention des Catastrophes Naturelles et Technologiques
ALADIN	Regional climate model used to produce the BRIO downscaled projections
ARS	Agence Régionale de Santé — Regional Health Agency
AROME-SWIO	Convection-permitting atmospheric model, South-West Indian Ocean configuration
BRGM	Bureau de Recherches Géologiques et Minières — French Geological Survey
BRIO	Building Resilience in the Indian Ocean — regionalised climate projections for the SWIO
CASUD	Communauté d'Agglomération du Sud — inter-municipal authority (South)
CATNAT	French natural disaster insurance and compensation regime
CCR	Caisse Centrale de Réassurance — French public reinsurance company managing the natural disaster compensation scheme
CEREMA	Centre d'Études et d'Expertise sur les Risques, l'Environnement, la Mobilité et l'Aménagement
CESER	Conseil Économique, Social et Environnemental Régional
CGCT	Code Général des Collectivités Territoriales — French local government code
CINOR	Communauté Intercommunale du Nord de La Réunion — inter-municipal authority (North)
CIREST	Communauté Intercommunale Réunion Est — inter-municipal authority (East)
CISE	Delegated drinking water and sanitation service operator
CIVIS	Communauté Intercommunale des Villes Solidaires — inter-municipal authority (South-West)
CLE	Commission Locale de l'Eau — Local Water Commission
CLIMAAX	Climate Risk Assessment Framework — Horizon Europe project funding RISC-RA
CNRS	Centre National de la Recherche Scientifique — French National Centre for Scientific Research
COMEX	Comité Exécutif — RISC-RA Executive Committee
CPM	Convection-Permitting Model
CRA	Climate Risk Assessment
CRAHI	Centre de Recerca Aplicada en Hidrometeorologia, Universitat Politècnica de Catalunya
CRM	Climate Risk Management
CSTB	Centre Scientifique et Technique du Bâtiment
CVH	Cellule de Veille Hydrologique — Hydrological Vigilance Unit (within DEAL)
DAAF	Direction de l'Alimentation, de l'Agriculture et de la Forêt — State agriculture and forestry service
DEAL	Direction de l'Environnement, de l'Aménagement et du Logement — State environment, planning and housing service (overseas equivalent of the DREAL)
DECI	Défense Extérieure Contre l'Incendie — external fire-fighting water supply
DICRIM	Document d'Information Communal sur les Risques Majeurs — municipal major-risk information document
DIROI	Direction Interrégionale de l'Océan Indien — Météo-France Indian Ocean Directorate
DRIAS	French national portal for regionalised climate projections
EAIP	Enveloppe Approchée des Inondations Potentielles — approximate potential flood envelope
EDF	Électricité de France — electricity utility
EPCI	Établissement Public de Coopération Intercommunale — inter-municipal authority
EPRI	Évaluation Préliminaire des Risques d'Inondation — preliminary flood risk assessment
ERDF	European Regional Development Fund

EVP	Étude Volumes Prélevables — abstractable volume study
EU	European Union
FEI	Fonds Exceptionnel d'Investissement — Exceptional Investment Fund (overseas)
FPRNM	Fonds de Prévention des Risques Naturels Majeurs — "Barnier Fund"
FSOM	Fonds de Secours pour l'Outre-Mer — Overseas Emergency Relief Fund
GEMAPI	Gestion des Milieux Aquatiques et Prévention des Inondations — aquatic environment management and flood prevention competence
GIEP	Gestion Intégrée des Eaux Pluviales — integrated stormwater management
GREC-Réunion	Groupe Régional d'Expertise sur le Climat de La Réunion — Regional Climate Expertise Panel (launched January 2026)
HMUC	Hydrologie, Milieux, Usages, Climat — water resource balance study framework
IAS	Invasive Alien Species
IDF	Intensity-Duration-Frequency
ILP	Indice Linéaire de Pertes — linear water network loss index
INRAE	Institut National de Recherche pour l'Agriculture, l'Alimentation et l'Environnement
INSEE	Institut National de la Statistique et des Études Économiques — French national institute of statistics and economic studies
IRM	Integrated Rainfall Management — gestion intégrée des eaux pluviales à la parcelle
IPCC	Intergovernmental Panel on Climate Change
KPI	Key Performance Indicator
LaRI	La Réunion Innovation — regional innovation network
NGO	Non-Governmental Organisation — organisation non gouvernementale
OAP	Orientation d'Aménagement et de Programmation — planning and programming guideline within a PLU
OPAR	Observatoire de Physique de l'Atmosphère de La Réunion
ORSEC	Organisation de la Réponse de Sécurité Civile — civil protection response framework
OSU-Réunion	Observatoire des Sciences de l'Univers de La Réunion
P2R	Pathways2Resilience — Horizon Europe adaptation programme
PAPI	Programme d'Actions de Prévention des Inondations — flood prevention action programme
PCAET	Plan Climat-Air-Énergie Territorial — territorial climate, air and energy plan
PCS	Plan Communal de Sauvegarde — municipal safeguard (crisis management) plan
PGRI	Plan de Gestion des Risques d'Inondation — flood risk management plan
PICS	Plan Intercommunal de Sauvegarde — inter-municipal safeguard plan
PIROI	Plateforme d'Intervention Régionale de l'Océan Indien — French Red Cross regional platform
PLU	Plan Local d'Urbanisme — local urban plan
PNACC	Plan National d'Adaptation au Changement Climatique — French national adaptation plan (3rd edition, 2025)
PPE	Programmation Pluriannuelle de l'Énergie — multi-year energy plan
PPR	Plan de Prévention des Risques — natural risk prevention plan (generic)
PPRI / PPRL / PPRMT	PPR for flooding / coastal hazards / ground movement
PRS(-E)	Projet Régional de Santé (Environment)— regional health (and environment) plan
PTGE	Projet de Territoire pour la Gestion de l'Eau — territorial water management project
RCM	Regional Climate Model
REGILIENCE	Horizon Europe project supporting regional resilience pathways
RETEX	Retour d'Expérience — post-event review
REUT	Réutilisation des Eaux Usées Traitées — treated wastewater reuse

RISC-RA	Name of the CLIMAAX-funded project implemented in La Réunion [confirm full expansion]
RPCC	Regional Panel on Climate Change (implemented locally as GREC-Réunion)
RSMC	Regional Specialised Meteorological Centre for Tropical Cyclones — La Réunion
RUNEO	Delegated drinking water service operator
SAGE	Schéma d'Aménagement et de Gestion des Eaux — local water development and management plan
SAR	Schéma d'Aménagement Régional — Regional Land Development Plan; the revision under way is designated **SAR-2050**
SCoT	Schéma de Cohérence Territoriale — inter-municipal strategic spatial planning document
SDA	Schéma Directeur d'Assainissement — wastewater master plan
SDAEP	Schéma Directeur d'Alimentation en Eau Potable — drinking water supply master plan
SDAGE	Schéma Directeur d'Aménagement et de Gestion des Eaux — water management master plan
SDEP	Schéma Directeur des Eaux Pluviales — stormwater master plan
SDIS	Service Départemental d'Incendie et de Secours — departmental fire and rescue service
SISPEA	National information system on water and sanitation public services
SLGRI	Stratégie Locale de Gestion du Risque Inondation — local flood risk management strategy
SOURCEO	Delegated drinking water service operator
SPE	Service Public de l'Eau — public water service (delegated operators)
SPI	Standardised Precipitation Index
SRB	Stratégie Régionale pour la Biodiversité — regional biodiversity strategy
SSP	Shared Socioeconomic Pathway (IPCC scenario family)
SWIO	South-West Indian Ocean
TO	Territoire de la Côte Ouest — inter-municipal authority (West)
TRACC	Trajectoire de Réchauffement de Référence pour l'Adaptation au Changement Climatique — French reference warming trajectory (Decree 2026-23)
TRI	Territoire à Risque important d'Inondation — area of significant flood risk
UDI	Unité de Distribution — drinking water distribution unit
UPC	Universitat Politècnica de Catalunya
WASP	Weighted Anomaly Standardized Precipitation index
WFD	Water Framework Directive (2000/60/EC)
ZAN	Zéro Artificialisation Nette — net zero land take

Executive summary

Motivation. This deliverable is the third and final phase of the RISC-RA project, carried out by Région Réunion and its scientific partners (OSU-Réunion, CNRS, Météo-France, BRGM) under the CLIMAAX programme. It applies the CLIMAAX Climate Risk Assessment (CRA) methodology to La Réunion — a French overseas region exposed to a compounding combination of cyclones, extreme rainfall, torrential floods, coastal hazards, and increasingly severe droughts. The report presents how the CRA results developed in Phase 2 have been translated for local audiences and embedded into the region's climate risk management (CRM) framework. It is designed to be read alongside the Phase 2 deliverable (M16), which contains the detailed workflows and risk maps.

Priority risks and resilience capacity. The CRA identified two priority climate risks: **meteorological drought** affecting drinking water supply, and **extreme precipitation / torrential floods**. Both reach a high current-day priority level and are projected to intensify under all warming trajectories — up to +50 % in the drought risk index by end-of-century, and a rising frequency of impact-triggering rainfall events over urbanized areas. The resilience capacity of La Réunion for both risks is assessed as **Medium**: robust meteorological monitoring, established alert systems and a strong cyclone risk culture coexist with structural weaknesses — a high socio-economic vulnerability, a low home insurance rate, mono-source dependency of several drinking water services, and chronic underinvestment in networks.

Main Phase 3 actions and results. Three lines of work have structured Phase 3. First, an **Atlas of Risks** is under production, it is a synthetic, publicly accessible knowledge-transfer tool intended for elected officials, technical services, and the general public. Second, **a final restitution event and a series of local communication activities** have been organised to disseminate the results to stakeholders. Third, the **CRA framing, methodology and results were embedded in the regional policy cycle** (see the paragraph below). This third line of work proved the most consequential and is described in Section 1.4.

Contribution to the overall project and policy uptake. The RISC-RA outputs are being integrated into the region's CRM framework through multiple pathways: the revision of the Regional Land Development Plan (**SAR-2050**), whose diagnostic chapter and prescriptive rules on natural risks and water security draw directly on the CRA results; the **SAR-2050 Regional Adaptation Strategy**, structured around nine strategic axes and sharing the same evidence base; and the newly launched Regional Climate Panel (**GREC-Réunion**, January 2026), which is expected to host the RISC-RA outputs as one of its founding knowledge bricks to ensure long-term continuity beyond CLIMAAX. Further pathways include the SDAGE 2028–2033 revision, the Pathways2Resilience programme (La Réunion selected for the second cohort, deployed locally through the "Anparé" project), and the drinking water master plans (SDAEP) currently being negotiated between the EPCIs and the State.

Continuation. To overcome the technical constraints identified during phase 3, ensure deep territorial anchoring and complete the torrential flood study with CRAHI, Région Réunion worked to

secure a twelve-month self-funded extension (Phase 4) beginning in September 2026 with the same project team. This extension lies outside the CLIMAAX funding perimeter.

Key take-away messages

Climate risks in La Réunion are increasingly frequent, **compounding and cascading**:

- Water infrastructure is aging, prone to leaks, relies in part on a single water source, and suffers from a significant investment backlog, greatly increasing its vulnerability
- Structures and infrastructure (road, bridges, wastewater treatment plants, stormwater drainage systems, etc.), have not been designed to handle observed and anticipated changes—particularly in terms of extreme precipitation and torrential rainfall
- The impacts of extreme events very quickly affect transportation, mobility, and accessibility for the most vulnerable, as well as access to healthcare, health, and food sovereignty and security, and food supply networks. The limiting factor for CRM is **not risk knowledge alone, but adaptive capacity** — governance coordination, engineering, financing, and risk culture — rated low to moderate across most sectors. Moreover, the territory's socio-economic conditions limit the capacity to finance infrastructure through local taxation.

The convergence of major planning cycles (SAR-2050, SDAGE 2028–2033, PPR, PCAETs) and the launch of GREC-Réunion create **a strategic policy window** to embed the CRA results into durable planning tools. **Continued monitoring and evaluation, structured around a shared set of CRM indicators, are essential to make adaptation a lasting process rather than a project-bound exercise.**

1 Introduction

1.1 Main objectives of the project

Phase 3 of the RISC-RA project (M17–M22) marks the transition from *assessing* climate risk to *managing* it. Phases 1 and 2 delivered the first spatialised, multi-hazard Climate Risk Assessment (CRA) for Réunion Island, following the CLIMAAX Handbook and workflows, and identified two priority risks: (1) **meteorological drought affecting drinking water supply**, and (2) **extreme precipitation** driving natural hazard such as torrential flooding.

Phase 3 was designed to:

- Transfer this knowledge towards the general public as an informative and awareness-raising tool to improve risk knowledge and culture, this was mostly done through the Atlas of Risks– see Appendix 2.
- Use the results as inputs for the co-construction of climate adaptation policies; this was mostly done through the Regional Land Development Plan (SAR-2050) revision.

To do so, three objectives structured this phase.

Objective 1 — Produce the Atlas of Risks (knowledge transfer). The Atlas translates the drought workflow outputs produced in Phase 2 into a cartographic, educational and synthetic narrative. It targets three audiences that the technical deliverables do not reach: elected representatives, municipal technical services, and the general public. A first draft was produced during Phase 3 and is being consolidated ahead of the final dissemination event mid-August 2026 (Appendix 2).

Objective 2 — Organise the final restitution event and local communication activities. A regional dissemination event closing Phases 1 to 3 is scheduled for 20 August 2026. It is open to all regional stakeholders and will be supported by institutional online communication and regional media coverage.

Objective 3 — Embedding the results in the regional policy cycle — proved to be the most consequential. Phase 3 coincided with the revision of the Regional Land Development Plan (SAR-2050) and with the preparation of its mandatory Climate Change Adaptation Strategy. Rather than treating these as parallel processes, Région Réunion deliberately aligned and articulated them, so that the CRA outputs feed the regional planning framework directly and the regional consultation process feeds back into the CRM analysis presented in Chapter 3. The articulation between the two processes is described in Section 1.4.

Across all three objectives, Phase 3 gave particular attention to the equity dimension of climate risk management. A specific workshop on socio-economic vulnerabilities in a climate change context was organised, and the reduction of socio-economic vulnerabilities was designed as a central pillar of the climate adaptation strategy (Figure 3). Both risks analysed through CLIMAAX/RISC-RA CRA fall disproportionately on populations already exposed to social and economic vulnerability: high poverty rate, about 36% of the population, low household insurance rate of around 60 %, … (Caisse Centrale de Réassurance, 2024; Ramaye, 2024). **This means that flood damage is largely uncompensated for the least protected households and more frequent and/or intense hazard will further increase socio-economic vulnerabilities**. These considerations are reflected in the CRM objectives set out in Section 3.1 and in the selection of measures in Section 3.3.

1.2 Project team

The RISC-RA project team is the same since the first phase of the project. It is composed of a scientific research group working in collaboration with the Réunion Regional Council. The Core Team include:

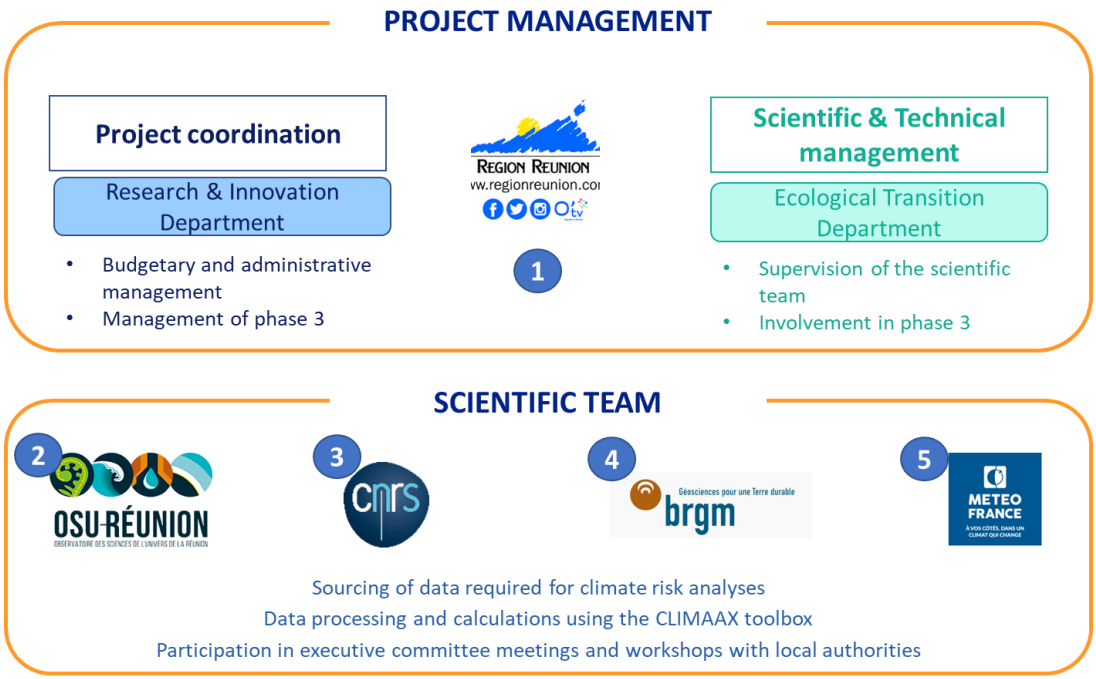


Figure 1 : RISC-RA Project organizational chart

1: **Kevin Lamy**, Natural Risks and Climate Project Manager, and **Elodie Marpinard**, Research and Innovation Officer, Région Réunion
2: **Nils Poncet**, Scientific provider of the RISC-RA project, OSU-Réunion.
3: **Jean-Pierre Cammas**, Research Director, CNRS, OSU-Réunion.
4: **Rémy Belon**, French Geological Survey on the coastal risks (BRGM).
5: **Clotilde Dubois**, Climate Services, Indian Ocean Regional Directorate (DIROI) of Météo-France.

1.3 Outline of the document's structure

This report is organised as follows.

- **Section 1** sets out the objectives of Phase 3, presents the project team, and describes how the RISC-RA project is articulated with the revision of the SAR-2050.
- **Section 2** establishes the local profile. It summarises the priority risks and resilience capacity resulting from the Phase 2 Climate Risk Assessment (2.1), describes the policy instruments and implementation mechanisms that structure climate risk management in La Réunion (2.2), maps the actors and the distribution of risk ownership across institutional levels (2.3), and draws lessons from the recent 2024–2025 drought and from Cyclones Belal and Garance, including their compound and cascading effects (2.4).
- **Section 3** is the core of the deliverable. It defines the CRM objectives and their assessment indicators (3.1), assesses the supportive elements available for effective CRM (3.2), sets out potential CRM measures for each priority risk (3.3), and describes how the results are being

integrated into planning and decision making, together with the synergies, tensions, remaining knowledge gaps and the proposed monitoring and evaluation system (3.4).

- **Section 4** evaluates the project itself: the usability of the results for the different audiences (4.1) and the lessons learned during Phase 3 (4.2).
- **Section 5** presents the conclusions of Phase 3, including the challenges addressed and those that remain open.
- **Section 6** reports progress against the key performance indicators and milestones defined in the Individual Follow-up Plan.
- **Section 7** lists the supporting documentation produced during this phase and deposited in the Zenodo repository, and Section 8 lists the references.

This deliverable is designed to be read alongside the Phase 2 deliverable (M16), which contains the detailed workflows, methodological choices and risk maps. It does not repeat that technical material; it reports what has been done with it.

1.4 Articulation between RISC-RA / CLIMAAX and the SAR-2050 revision

Two distinct processes ran in parallel in La Réunion during 2025 and 2026, both led by Région Réunion. The first is the present RISC-RA project, funded under the CLIMAAX programme, which aims to produce and disseminate a climate risk assessment. The second is the revision of the Regional Land Development Plan (SAR-2050) – the region's binding spatial planning document – whose revised version — designated SAR-2050 throughout this report — is expected to be approved in late 2026 and which must, under article L.4433-7-3 of the CGCT (French local government code), include a dedicated Climate Change Adaptation Strategy based on a territorial vulnerability study.

Although these two processes are legally and financially separate – the SAR revision is a statutory regional planning procedure with its own governance, consultation obligations and budget, while RISC-RA is an EU-funded project with its own work plan and deliverables – they were closely articulated and synergized. This synergy is the primary reason the RISC-RA results are actively informing regional policy rather than remaining a stand-alone study.

What flows from RISC-RA into the SAR-2050

- **Evidence Base:** The CRA outputs provide the spatialised evidence base for the natural risk and water security, directly contributing to the climate baseline assessment of the SAR-2050.
- **Prescriptive rules:** The drought and extreme precipitation projections support the implementation of prescriptive rules (under discussion and validation), in particular the conditionality of urbanisation on demonstrated water availability and the requirement to dimension new hydraulic structures against future rainfall rather than historical records.
- **Monitoring & Evaluation:** The RISC-RA indicators will contribute to the monitoring and evaluation framework of the SAR-2050 and its Adaptation Strategy.
- **Strategic Orientations:** Structured around nine thematic axes and twenty-two orientations, the Adaptation Strategy explicitly cites RISC-RA results as evidence for its water (A13, A14) and natural risk (A15, A16) orientations, while also drawing on them for its knowledge orientation (A02).

What flows from the SAR-2050 consultation back into RISC-RA

- **Stakeholder Consultation:** The thematic workshops organised as part of the SAR revision contributed to the stakeholder consultation on which the resilience capacity assessment presented in Section 2.1 and the adaptive capacity ratings presented in Section 3.2 are based.
- **Integrated measures:** The measures presented in Section 3.3 are drawn from the Adaptation Strategy orientations and refined against the CRA outputs, rather than being constructed independently.
- **Governance Insights:** The key governance obstacles identified in Section 3.4 — fragmentation between sectors and scales, the tension between territorial attractiveness and water availability, and uneven engineering capacity — were surfaced through this consultation process rather than the modelling work.

The workshop series: what was CLIMAAX and what was SAR

Eight thematic workshops were held between January and June 2026 within the framework of the SAR-2050 revision, covering Water Security, Natural Hazards, Coastal Hazards, Terrestrial Ecosystem, Marine Ecosystem, Health, Food Sovereignty and Social Vulnerabilities **(Table 1-1)**. Two of these were designed and facilitated jointly with the full RISC-RA team and used the CRA outputs as part of their working material; they are the workshops reported as Phase 3 CLIMAAX activities in Chapter 6. The remaining six addressed drought and water transversally, because of the cascading nature of the impacts on this system, and their outputs inform Section 2.4. In each of the eight workshops, two questionnaires were completed by participants: the first to characterize risk levels — exposure, susceptibility, hazard, and adaptive capacity — and the second to co-design the adaptation strategy.

Table 1-1: The SAR-2050 thematic workshops and their relationship to RISC-RA.

Workshop	Date	Number of participants	Relationship to RISC-RA	RISC-RA material used	Feeds into
Water Security	19 Feb 2026	21	Co-designed; reported as a Phase 3 CLIMAAX workshop	Meteorological drought workflow; UDI-scale risk index; mono-source dependency analysis. CRA framing and terminology	§2.1 resilience capacity; §3.1 objectives; §3.3 measures
Natural Hazards	24 Mar 2026	28	Co-designed; reported as a Phase 3 CLIMAAX workshop	Extreme precipitation and torrential flood outputs; TRI exposure figures CRA framing and terminology	§2.3 actors; §3.3 measures; §3.4 integration pathways
Coastal Hazards	10 Apr 2026	30	SAR consultation; drought and water addressed transversally	CRA framing and terminology	§2.4 compound and cascading events
Health	18 Mar 2026	6	SAR consultation; drought and water addressed transversally	CRA framing and terminology	§2.4 compound and cascading events

Food Sovereignty	25 Mar 2026	32	SAR consultation; drought and water addressed transversally	CRA framing and terminology	§2.4 compound and cascading events
Social Vulnerabilities	9 June 2026	21	SAR consultation; drought and water addressed transversally	CRA framing and terminology	§2.4; §3.2 equity dimension
Terrestrial Ecosystem	3 Mar 2026	11	SAR consultation; drought and water addressed transversally	CRA framing and terminology	§2.4 compound and cascading events
Marine and Coastal Ecosystem	4Mar 2026	17	SAR consultation; drought and water addressed transversally	CRA framing and terminology	§2.4 compound and cascading events

At each workshop, participants completed two paper questionnaires. Both were built on the IPCC AR6 risk framework, and the definitions of hazard, exposure, vulnerability, sensitivity, adaptive capacity, severity and urgency were distributed to participants before scoring.



Figure 2: Participatory mapping of water resource vulnerabilities — Water Security workshop, 19 February 2026. Working map of La Réunion annotated collectively by the workshop participants. Each sticky note locates an issue raised during the session, positioned on the area concerned.

The first questionnaire — diagnostic — characterises the components of climate risk in **three blocks**: **exposure to climate hazards**; **sensitivity and adaptive capacity**; and **urgency and severity of impacts**. Each item is scored on a **four-point scale** (1 = very low, 2 = low, 3 = high, 4 = very high), accompanied by a self-declared certainty level and a free-text justification. Participants were explicitly instructed to answer only for the areas or sub-systems they know, so that unanswered items indicate absence of declared expertise rather than absence of risk.

Participants were also asked to add on a map qualitative information on the pressures and uncertainties affecting each water resource (Figure 2). The annotations cluster around four recurring concerns: the abstractable volume studies (EVP) under way on the Rivière des Galets, the western coastal aquifer, the Cocos/Gol and Pierrefonds aquifers and the Rivière Saint-Étienne; the East–West transfer and the redistribution capacity of the interconnected network; the quality and quantity of surface and groundwater bodies (ESU/ESOU); and the pressures generated by urbanisation, runoff and soil sealing in the North, West and South.

The three-block structure and the four-point scale are common to all eight workshops. The breakdown of the scoring grids differs by theme, because each required its own analytical unit: for instance, sub-regional catchment areas crossed with asset type for Water Security; one score per hazard for Natural Hazards; coastal water bodies for Coastal Hazards.

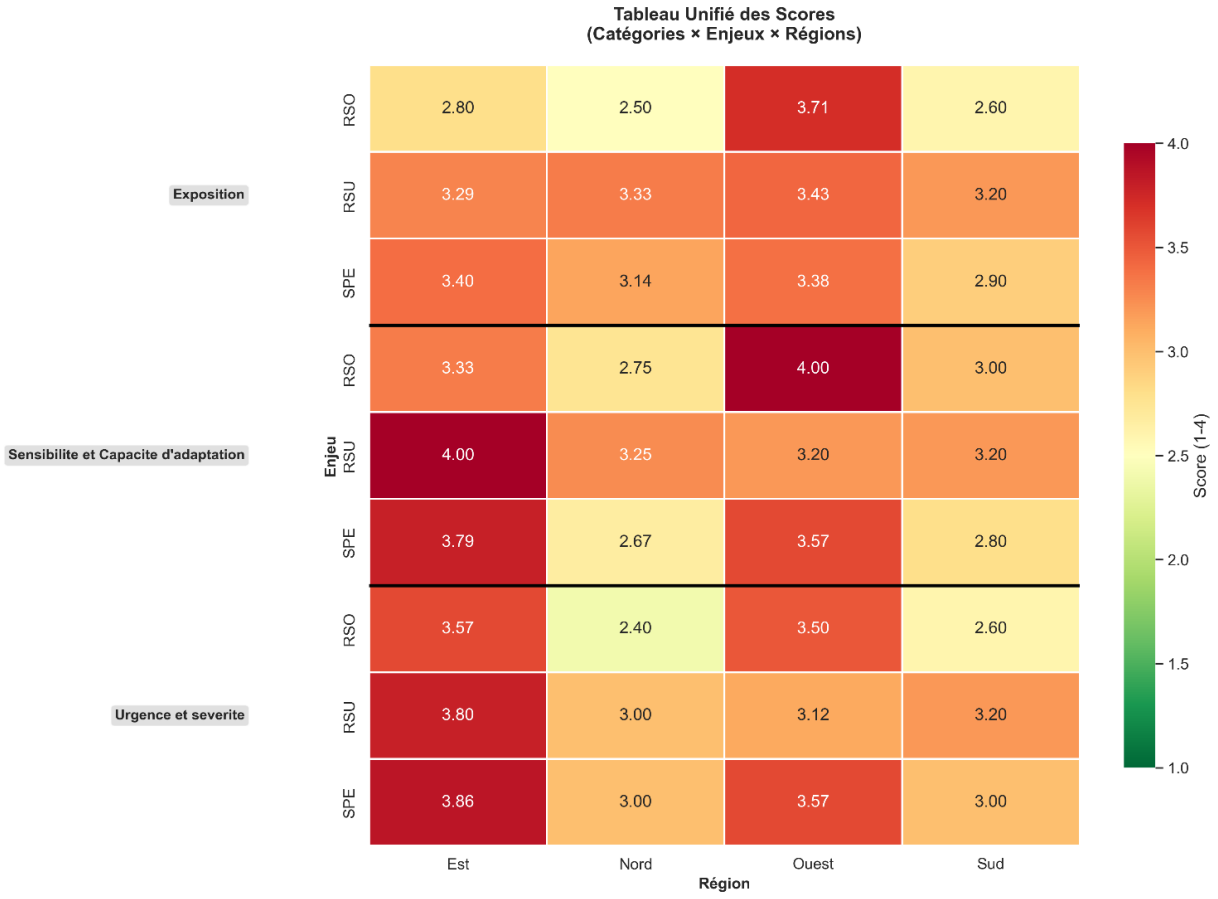


Figure 3: Participants' assessment of the components of drought risk, by resource type and sub-region — Water Security workshop, 19 February 2026.

Mean scores from the diagnostic questionnaire (Appendix 5) completed by the 21 participants. Figure produced in French for the local context; the reading key is given below.

Rows are grouped into the three blocks of the diagnostic questionnaire: Exposition (exposure to the hazard), "Sensibilité et capacité d'adaptation" (sensitivity and adaptive capacity) and "Urgence et sévérité" (urgency and severity of impacts). Within each block, three categories are scored: RSO — groundwater resources; RSU — surface water resources; SPE — public water services. Columns are the four sub-regions of the island: Est (East), Nord (North), Ouest (West) and Sud (South). Each cell gives the mean score on the four-point scale used throughout the questionnaire (1 = very low, 2 = low, 3 = high, 4 = very high); higher values indicate a less favourable situation. Unanswered items are excluded from the means, participants having been asked to score only the areas they know.

An example of the aggregated results of the participants evaluation is shown on **Figure 2 for Water Security.** Two patterns stand out. The East scores highest on sensitivity and adaptive capacity for surface water bodies (RSU) and public water services (SPE), respectively 4.00 and 3.79, consistent with its heavy reliance on surface resources (see Phase 2 results); the West scores highest on groundwater across all three components, peaking at 4.00 for sensitivity and adaptive capacity, consistent with the transfer dependency and saline intrusion documented in Section 2.1. The North and South score consistently lower, which reflects the perception of the participants present rather than a measured difference in risk.

The second questionnaire — recommendations and adaptation strategy — collects, for each measure proposed by the participant: the measure itself, its expected effect, the hazards it addresses, its perceived social and political acceptability on the same four-point scale, its implementation horizon (short, medium or long term), and the levers and barriers identified for putting it into practice.

2 Local profile

2.1 Summary of Key Risk Assessment results

The Phase 2 Climate Risk Assessment (CRA) conducted under the RISC-RA project — following the CLIMAAX handbook and workflows — identified two priority climate risks for Réunion Island: meteorological drought and extreme precipitation/torrential floods. Both were assessed through dedicated workflows that combined regionalized climate projections (BRIO ALADIN RCM, AROME-SWIO CPM), spatialised exposure and vulnerability datasets (population, water infrastructures, TRI flood footprints), and vulnerability indicators co-constructed with local water sector stakeholders. **Both risks reach a High priority level under current conditions, though through different pathways.**

Drought risks show a clear and worsening climatic trend. Significant rainfall decrease (of −36 % in 60 years) is observed in the south-west in the historical period (1961-2024). Based on observed and future regionalized climate projection, the currently observed lengthening of the dry season is expected to continue in the future. An exceptional event was observed in 2024–2025 with the driest two-month period in 50 years of observations. These changes require an immediate need for infrastructure adaptation to reduce vulnerabilities such as mono-source dependencies, ageing networks or high leakage rates.

The workflow projects intensification of the drought risk index of up to +50 % by end-of-century (SSP5-8.5), with the highest risk concentrated in the main urban units (Saint-Denis, Saint-Louis, Saint-Pierre) and mono-resource inter-municipal territories.

Extreme precipitation and torrential flooding reflect the already-demonstrated catastrophic potential of individual events (Cyclone Garance 2025 — 300 mm in 3 hours in Saint-Denis, 5 deaths, more than 310,000 people cut off from drinking water, 380 M€ in insurance payouts), a structural gap between existing resilience capacity and the scale of exposure (225,325 people in the approximate potential flood envelope — nearly a quarter of the population), and the urgency of action in the most densely urbanized and exposed sectors, in particular the six TRIs (Areas of Significant Flood Risk).

The resilience capacity for both risks is assessed as Medium, based on the CLIMAAX qualitative scale.

For drought, the score reflects the coexistence of established alert systems and emergency response protocols with chronic underfunding of infrastructure maintenance, structural mono-resource dependency in several territories, limited engineering capacity within water services, and low baseline public awareness.

For extreme precipitation, the Medium score is driven by the strong meteorological monitoring capacity of Météo-France's RSMC (Regional Specialized Meteorological Centre for Tropical Cyclones of La Réunion) and the established crisis management frameworks. Nonetheless, this needs to be tempered by the significant insurance coverage gap (only ~60 % of households insured against ~96 % in metropolitan France), the insufficient scale and pace of ecosystem-based flood management, and the fact that only 5 of 24 municipalities currently have an operational local crisis management plan (or "*Plan Communal de Sauvegarde*" in French).

The two priority risks and their resilience capacities are summarized in the table below (Table 2-1). The priority level reflects the current combined hazard × exposure × vulnerability; the resilience capacity is a distinct axis reflecting the territory's ability to cope, adapt and transform.

Table 2-1: Priority risks analysed in Phase 1 and 2.

Priority climate risk	*Resilience capacity (low, medium, substantial, high)*	*Description of the resilience capacity (such as existing knowledge, planned measures, gaps)*	*Stakeholders, experts and priority groups involved in the key risk assessment & modality of engagement*
Meteorological drought (impacting drinking water supply)	Medium	**Existing knowledge:** • drought vigilance system managed by DEAL and the Office de l'eau, • hydrometric and piezometric monitoring networks, • SDAGE quantitative assessment of masses d'eau, • BRGM hydrogeological diagnostic (2025) at microregion scale, • CLIMAAX/RISC-RA CRA outputs at UDI/groundwater body scale, • prefectoral drought orders. **Planned measures:** SAR-2050 revision integrating water security, drinking water master plans (SDAEP) per EPCI, contrats de progrès, source diversification studies (Hydro-Fournaise, artificial recharge, water reuse), inter-connection projects. Gaps: shortage of qualified engineering staff within water services, chronic underfunding of network renewal, structural mono-resource dependency of several territories, limited application of the "water pays for water" principle, low public awareness of drought risk.	**Inter-municipal water managers**: CINOR, CIREST, CIVIS, CASUD, TO (representing the 24 municipalities). **Water service delegates:** RUNEO, La Créole, CISE, SOURCEO. State services: DEAL, ARS, DAAF, Préfecture. **Water related institutions**: Office de l'eau, Météo-France, BRGM. **Modality of engagement:** 8 thematic meetings/workshops were organised during Phase 2 in connection with CLIMAAX and the SAR-2050 review.

Extreme rainfall / torrential floods	Medium	**Existing knowledge:** • Météo-France RSMC and OPAR observatory (world-class atmospheric monitoring), • heavy rainfall vigilance system with distributed thresholds, • six TRIs covered by PAPI programmes, • ORSEC Cyclone plan, • PPRI/PPRL, • CVH hydrological forecasting service, • RISC-RA CRA outputs on extreme precipitation frequency shifts and torrential flooding methodology at catchment scale. **Planned measures:** SAR-2050 revision integrating projections in dimensioning of infrastructures, PAPI implementation (109 M€ programmed for the 7 TRIs), extension of PCS coverage, densification of sub-daily rainfall monitoring, natural flood expansion zones and ravine maintenance. Gaps: sparse sub-daily monitoring in fast-responding catchments, insurance coverage gap (~40 % of households uninsured), limited operational PCS coverage (5/24 municipalities), slow pace of ecosystem-based flood risk reduction, rapid urbanization of flood-prone areas outpacing protection infrastructures, persistent flash-flood fatalities linked to radier crossings.	**State services:** DEAL (including CVH Hydrological Vigilance Unit), Préfecture, ARS. **Emergency services**: Departmental Fire and Rescue Service (SDIS) **Meteorological expertise:** Météo-France (RSMC), OPAR, BRGM (coastal risks). **Municipalities** (24, especially those covered by TRIs: Saint-Denis, Saint-André, Saint-Benoît, Saint-Paul/Le Port, Saint-Louis, Saint-Pierre/Le Tampon). **Modality of engagement:** thematic workshop (SAR-2050), technical consultations with DEAL CVH and Météo-France to define the flash-flood methodology, participation in the Regional Technical Committee on Risks (Comité Technique des Risques) organised by DEAL, articulation with GREC-Réunion.

Two important conclusions from Phase 2 are decisive for CRM.

First, the dominant risks are **compounding and cascading**: a single cyclone combines extreme rainfall, flooding, landslides, wind, swell and storm surge, and propagates into energy, drinking water, road-access, health and food-supply failures. The 2025 sequence — a drought immediately followed by cyclone Garance — showed how the succession of hazards fragilizes services beyond what any single hazard would.

Second, the limiting factor for CRM is risk knowledge but also **adaptive capacity** — governance coordination, engineering and financing, and risk culture — which the assessment rated low to moderate across almost every sector.

2.2 Key implementation mechanisms and policy context for CRM

Climate Risk Management in La Réunion operates within a multi-level policy framework combining European directives, national French regulations, and regional to local instruments — many of which are currently being revised in parallel with the RISC-RA project. This convergence of revision cycles creates a strategic window for embedding the CRA results into durable planning tools.

At the European level, two directives structure the regulatory environment:

- The **Water Framework Directive (WFD 2000/60/EC)** requires the achievement of good ecological and chemical status for all water bodies and imposes the "water pays for water" cost-recovery principle. It is transposed nationally through the SDAGE (Water Management Master Plan or *"Schéma Directeur d'Aménagement et de Gestion des Eaux"*).
- The **Floods Directive (2007/60/EC)** imposes the identification of Areas of Significant Flood Risk (TRI), which are then covered by Flood Risk Management Plans (PGRI, or *"Plan de Gestion du Risque Inondation"*) and Local Flood Risk Management Strategies (SLGRI). Six TRIs have been identified on La Réunion.

At the French national level, the framework includes:

- The **PNACC 3 (National Climate Change Adaptation Plan)**, which sets the strategic framework for adaptation across sectors.
- The **TRACC (Trajectory of Reference for Adaptation to Climate Change)**, a national framework anticipating a local warming of +2.0 °C by 2050 and +2.9 °C by 2100 for Réunion Island relative to the pre-industrial period (*"Décret n° 2026-23 du 23 janvier 2026 relatif à la trajectoire de réchauffement de référence pour l'adaptation au changement climatique"*, https://www.legifrance.gouv.fr/eli/decret/2026/1/23/2026-23/jo/texte). TRACC shifts the impact assessment paradigm from "when will impacts occur" to "if warming reaches X°C, what will happen", allowing localized planning.
- **DRIAS** and **Climadiag** portals, providing standardized high-resolution climate projections and municipal-level diagnostic tools deployed by Météo-France.
- The **CATNAT (Natural Catastrophe) insurance regime**, the **Barnier Fund** for prevention works, the **Overseas Aid Fund (FSOM)**, and the **Exceptional Investment Fund (FEI)** for emergency response.
- **Natural Risk Prevention Plans (PPR)** — PPRI (inundation or flooding), PPRL (littoral), PPRMT (landslides) — which constitute the regulatory instrument for restricting construction in risk-exposed areas (French Republic, 2026).

At the regional level, the main instrument is the **Regional Land Development Plan (SAR-2050)**, which is under revision since 2023 and is expected to be finalized in late 2026. The SAR-2050 is the top-down planning framework that all lower-level documents (SCoT, PLU) must comply with. Under the article L4433-7-3 of the *Code Général des Collectivités Territoriales* (CGCT), the revised SAR-2050 must include a dedicated climate change adaptation chapter based on a territorial vulnerability

study. In parallel, the SAR-2050 contains a **Climate, Air, and Energy chapter** defining mitigation and adaptation objectives for 2030 and 2050.

The revision has produced two complementary technical documents:

1) **A vulnerability diagnostic on climate risks** including:
   - natural hazards such as floods, landslides, cyclones, fires but also
   - health risks,
   - ecosystem degradation,
   - drought and food security,
   - and aggravation of socio-economic vulnerabilities)
2) And a **Regional Adaptation Strategy** structured in nine axes covering governance, knowledge, water, coastal risks, natural risks, biodiversity, One Health, food security, and social resilience.

Other regional instruments include the **Multi-Year Energy Plan (PPE 2019-2028)**, **Regional Biodiversity Strategy** (SRB), the **SDAGE 2028–2033** (currently under revision), and the **Regional Health Project (PRS)** which will incorporate climate change adaptation.

At the inter-municipal and municipal levels, the main relevant documents are:

- **SCoTs (Territorial Coherence Plans)** and **PLU (Local Urban Plans)**, which translate SAR-2050 orientations into local zoning rules (French Republic, 2020);
- **PCAETs (Territorial Climate-Air-Energy Plans)**, which target adaptation and mitigation at the EPCI (inter-communality) scale (French Republic, 2026);
- **PCS (Municipal Safeguard Plans)** and **PICS (Inter-municipal Safeguard Plans)**, which structure crisis response;
- **Drinking Water Master Plans (SDAEP)** and **Wastewater/Stormwater Master Plans (SDA, SDEP)**, which structure the drinking water and sanitation services and are prescribed by the SDAGE;
- **PAPI (Flood Risk Prevention Programmes)**, which fund structural and non-structural flood prevention works over the TRIs (109 M€ programmed, of which only 25 % has currently been used or committed) (French Republic, 2026).

Recently established or launching bodies include:

- **GREC-Réunion** (Regional Climate Panel, RPCC), officially launched in January 2026 as a science–policy interface following the model of the IPCC. GREC-Réunion will support the deployment of the scientific and technical framing of the Regional Adaptation Strategy. The RISC-RA outputs are among its founding knowledge bricks.
- **The European Union's "Climate Adaptation" charter**, signed by La Réunion, formalizing the regional commitment to structural adaptation.
- **Selection of La Réunion in December 2025 for the second cohort of the "Pathways2resilience" project**, which will support the operationalization of the adaptation strategy on two climate risks: coastal risks and heatwave.

These instruments cover the full range of sectors relevant to the priority risks:

- **water** (SDAGE, SDAEP),
- **land planning** (SAR-2050, SCoT, PLU) (French Republic, 2020),
- **risks** (PPR, PGRI, PAPI, PCS) (French Republic, 2025b),
- **biodiversity** (SRB, Parc National) (French Republic, 2025c),
- **health** (PRS) (French Republic, 2025d),
- **energy** (PPE) (French Republic, 2025a),
- and **agriculture** (via DAAF and the *Chambre d'Agriculture*).

They also span the local (municipality), inter-municipal (EPCI), regional (Region, State services), national (French State), EU, and include some actors of the private sector (water management delegates and insurers).

2.3 Key actors and systems for CRM

Climate risk governance in La Réunion is not organised around a single risk owner. It results from the superposition of five institutional levels — the State, the regional council, the departmental council, the five inter-municipal authorities (EPCI) and the 24 municipalities — each holding a different kind of competence over the same territory:

- The State, locally represented by the Prefect ("Préfet") and its technical services.
    - The prefectural services are responsible for:
        - implementing crisis management at the supra-municipal level and for supporting municipalities in implementing their municipal emergency response plans.
        - implementing the ORSEC system.
    - The DEAL is responsible for:
        - coordinating regional risk management policy,
        - conducting the necessary review for the certification of PAPI plans (initial, final, and amendments).
        - providing support to the lead organizations in preparing and compiling the application,
        - implementing and monitoring the PAPI plans for which it serves as the coordinating agency.
        - inspecting the safety of hydraulic structures.
- A distinct regional layer with multiple competences related to risk:
    - Regional land planning (SAR-2050) competency
    - National road management,
    - Highschool management,
    - The regional council, as the managing authority for the ERDF (European Fund), is also involved in the financial aspects of the flood prevention programs (PAPI).

- The five EPCIs (CINOR, CIREST, CIVIS, CASUD, TO — all "*communautés d'agglomération*") hold the largest share of operational risk ownership, and are responsible for:
    - incorporating risk considerations into urban planning (implementation of Flood Risk Prevention Plans) both in urban planning documents and during the review of land-use permits.:
    - drinking water, wasterwater and urban stormwater management,
    - waste management.
- the communal level: the mayor is responsible, within the municipal jurisdiction, for:
    - informing residents about the major risks to which they are exposed.
    - drafting the Municipal Information Document on Major Risks (Dicrim),
    - organizing the posting of safety instructions,
    - and overseeing the installation of flood markers.
    - crisis management within the municipal area. He or she establishes the rules for crisis management in the Municipal Emergency Plan (PCS).

Alongside these five levels, three families of non-institutional actors complete the picture:

- the operators (delegated water services, network utilities, port and airport authorities), which hold the operational knowledge of infrastructure vulnerability;
- the knowledge producers (Météo-France DIROI, BRGM, OSU-Réunion, CNRS, University of La Réunion, Office de l'Eau);
- and civil society and organised civil society (association and NGO working on risks which carries risk culture and field access to vulnerable populations.

The following table summarizes the main actors, their roles, motivations, opportunities and barriers, and the modality of engagement in the RISC-RA / SAR-2050 framework.

Table 2-2: Key actors of CRM.

Key actors	*Role and responsibility*	*Motivation and needs*	*Opportunities related to their active involvement in CRM*	*Barriers related to their active involvement in CRM*	*Type of engagement*
Région Réunion, in particular the direction of the Ecological Transition, the direction of Research/Innovation, the direction of Planning and Development)	Regional planning authority; In charge of territorial development planning: develops, pilots and implements the SAR-2050; Also in charge of economic development, professional training, European funds, transport and travel, national roads and part of environmental policies. RISC-RA and GREC-Réunion pilot;	Political commitment to climate action; The need for a solid knowledge base to support SAR-2050 policy decisions in terms of Adaptation Strategy	Convergence of RISC-RA outputs with SAR-2050 revision cycle; Ability to embed CRA findings in the regional planning framework	Coordination across internal departments; Long time horizon of SAR-2050 effects vs short electoral cycles; Multiple areas of responsibility are spread across different entities, which inevitably leads to a certain degree of inertia.	Steering committee of the CLIMAAX/RISC-RA projection. Engaged in the SAR-2050 revision and the RPCC-La Réunion
State services — DEAL (including CVH Hydrological Vigilance Unit)	Responsible for developing and implementing plans to prevent natural and technological risks (PPR, PGRI, PAPI, EPRI,	Regulatory obligation to update risk instruments; Alignment with PNACC 3 and its deployment.	Technical Committee on Risks as a platform to institutionalize CRA findings;	Limited funds	Restitution meetings, participation in Technical Committee on Risks, methodological

	flood monitoring, …) Responsible for organizing prevention, crisis management, and the response to major threats and risks in France		PAPI as vehicle for structural flood measures		consultations on flash-flood workflow
State services — Préfecture	Drought and cyclone alert coordination, prefectoral orders, ORSEC plans	Crisis management responsibility; need for anticipatory tools	Update of ORSEC plans and drought vigilance system based on CRA findings	Focus on emergency vs long-term prevention	Consulted during major events; targeted for restitution event
ARS Réunion (Regional Health Agency)	Drinking water quality control, sanitary monitoring, unified health monitoring of UDIs, health prevention	Sanitary vigilance; need to link water availability to health outcomes	Provided UDI data (via specific agreements) which enabled the RISC-RA drought workflow spatial unit; interface with future Plan Chaleur	Data confidentiality; limited resources for climate integration	Data-sharing agreement (UDIs and drinking water intake data), targeted consultations
Office de l'Eau	Study of water resources, technical assistance to authorities, piezometric/hydrometric monitoring	Long-term expertise on water resources;	Operational partner for the SDAGE 2028–2033		Technical exchanges, workshops "Eau et changement climatique", founding partner for the BRGM 2025 hydrogeological diagnostic
Météo-France (DIROI Indian Ocean, RSMC, OPAR)	Climate data provider, climate services, cyclone forecasting,	Reference climate framework for the region; provider of BRIO/DRIAS projections	High-quality climate data (ALADIN RCM, AROME CPM);	Sub-daily monitoring gap over key watersheds;	Scientific consortium member of RISC-RA COMEX; SAR-2050 contribution partner

	TRACC framework provider (via national)		climate services support to the Region	complexity of tropical cyclone signal in future projections	
BRGM	Geological and hydrogeological expertise, coastal risks, geotechnical studies, hazard mapping	Regional Directorate expertise on groundwater, coastal, and landslide risks	Recent 2025 hydrogeological diagnostic (SAR-2050 contribution) at microregion scale;	Resources spread over multiple assignments	Scientific consortium member of RISC-RA COMEX; SAR-2050 contribution partner
Inter-municipal authorities (EPCIs): CINOR, CIREST, CIVIS, CASUD, TO	Responsible of local land planning (at EPCI scale), of local risk management plan (PICS), of local environment management, of water and sanitation services, GEMAPI, and of climate action plan (PCAET)	Direct operational level for water and risk management; recent awareness reinforced by 2024–2025 events	Ready to engage as demonstrated during the RISC-RA local meetings;	Uneven human and financial resources that are often limited given the scale of the challenges; initiatives carried out in silos	RISC-RA on-site local meetings during Phase 2 (9 meetings); online survey (17 respondents from 10 organizations); contributions to workshops on Adaptation (SAR-2050 & CLIMAAX-RISC-RA)
Municipalities	Responsible local land planning (PLU), risk management plan (PCS), land use and local risk communication at communal scale	Territorial responsibility; direct interface with citizens	Local knowledge of vulnerabilities; interface with associations	Only 5 of 24 have a functional PCS; limited technical capacities; short-term political cycles	Occasional workshops (SAR-2050 consultation), some municipal representatives at EPCI level meetings
Water service delegates (SPE):	Operational management of drinking water and	Operational expertise on network	Sensitive local data on infrastructure	Contractual constraints; commercial confidentiality	Participation in RISC-RA local consultations; contributions to

RUNEO, La Créole, SOURCEO, CISE	sanitation services and infrastructure	performance, ILP, renewal rates	vulnerabilities shared for the CRA		workshops on Adaptation (SAR-2050 & CLIMAAX-RISC-RA)
GREC-Réunion (Regional Climate Expertise Panel, launched January 2026)	Science–policy interface; scientific framing of adaptation	Regional platform for climate expertise and concertation on climate adaptation at science-society interface	Founding brick: RISC-RA outputs among the initial knowledge assets; long-term continuity beyond CLIMAAX lifetime	Recent establishment; capacity ramp-up ongoing	Coordination with GREC-Réunion pilot cell (Région Réunion), integration of RISC-RA into GREC deliverables
Scientific ecosystem of multiple research institutes and units — OSU-Réunion, CNRS, University of La Réunion	Research and expertise on climate impacts, adaptation, and territorial dynamics	Multidisciplinary contribution; recent recruitments in adaptation research	Scoping study for a Climate Change Adaptation Knowledge Centre within GREC-Réunion; contribution to the CNRS Knowledge and Solutions for CC Adaptation in Overseas Territories project	Fragmented funding; science–society gap	RISC-RA scientific provider (OSU-Réunion), COMEX membership
Civil society (associations, PIROI/French Red Cross, AFPCNT, community networks)	Community resilience, education, risk culture	Field access to vulnerable populations; Role in post-crisis response	"Paré pas Paré" educational platform, PIROI operational capacity, sentinelles citoyennes potential	Underfunding; uneven territorial coverage;	Consulted through communication events; targeted for the Atlas of Risks restitution High participation in workshops on Adaptation (SAR-2050 & CLIMAAX-RISC-RA)

Financial actors — Development bank (AFD, CDC, ADEME) and ERDF managing authority	Funding of ecological transition, PAPI, ERDF programmes, banking facilities	Facilitator of adaptation investments	Access to structural financing for adaptation; investment envelope through PAPI (109 M€) and ERDF	Limited access for smaller EPCIs due to ingénierie constraints; slow disbursement	Specific meetings on RISC-RA; targeted for restitution and GREC-Réunion follow-up
Département de La Réunion	Departmental roads, natural sites protection, social policies to reduce inequalities,	Social equity mandate; interface with rural sub-regions	Departmental social policies as levers for social equity of adaptation; departmental roads securing	Distinct competencies from the regional council create coordination needs	Consulted through SAR-2050 revision; targeted for restitution event

2.4 Lessons learned from past events

Réunion Island is one of the French territories most exposed to natural hazards, with 509 natural disaster declarations ("*arrêtés de catastrophe naturelle*" - CATNAT) issued between 1993 and 2025 (BD Gaspar), including 339 for floods and mudflows and 73 for wave-related mechanical shocks. Recent extreme events — the exceptional 2024–2025 drought episode, Cyclone Belal (January 2024), and Cyclone Garance (February 2025) — have provided a compressed sequence of stress tests that exposed structural vulnerabilities in the territory's ability to withstand climate hazards and generated concrete lessons for CRM. These events, and the associated feedbacks ("*retours d'expérience*" - RETEX) conducted by DEAL, Cerema, CSTB, the Préfecture, AFPCNT, and the Office de l'Eau, form a critical evidence base for the RISC-RA project and for the SAR-2050 revision.

2.4.1. The 2024-2025 drought event

The 2024–2025 drought represented the **driest two-month period recorded in 50 years of observations** on La Réunion. It affected the entire island, including the traditionally wetter eastern coast, and generated water shortages, water restrictions under prefectoral orders, agricultural stress, and localized disruptions of the school calendar. Beyond the immediate hardship, the event triggered a shift in perception among stakeholders. Drought, historically considered a marginal risk on a "water-abundant" island, was acknowledged as a "new" hazard for the general public and elected officials, highlighting the fact that the island's water systems were originally designed around abundance and sparking reflection and debate on water infrastructures.

Key lessons:

- Reliance on a single resource is a critical vulnerability: when the sole source of supply runs dry, faces technical delivery challenges, or is affected by turbidity or contamination, entire communities are left without access to drinking water.
- Water quality deteriorates as water volume decreases: reduced river flow concentrates pollutants, coastal aquifers face saltwater intrusion, and regulatory closures of contaminated intake points further restrict the water supply.
- Emergency measures (bottled water, deliveries by tanker trucks) are effective in the short term but entail very high logistical and financial costs, which become unsustainable if such events occur frequently.
- There is a need to bridge the gap between short-term drought management (prefectural early warning system) and long-term structural adaptation (network upgrades, diversification of water sources, and water reuse).
- This event has opened a political and social window of opportunity for structural reform of water pricing frameworks, cost recovery, and infrastructure investments, but this window will not remain open indefinitely.

2.4.2. Tropical Cyclone Belal (January 2024)

Belal was the first tropical cyclone since Colina (1993) to cross directly over La Réunion, and the first since Dina (2002) with winds above 150 km/h affecting the majority of the island. The cyclone triggered the rare "*alerte violette*" (maximum vigilance level, generalized confinement) and caused 5 fatalities, 42,000 CATNAT claims, and approximately 100 M€ in insurance payouts (France

Assureurs, 2025). At peak impact, ~150,000 clients (35 % of EDF customers) lost electricity and ~130,000 people lost access to drinking water, with the Préfecture and gendarmerie reporting that close to 40 % of the island's population was simultaneously deprived of both networks.

The AFPCNT's RETEX conducted with the Préfecture between March and June 2024 collected testimonies from the general public, local authorities, and associations. Its main findings emphasized that early alert and prevention worked well (confinement was respected, evacuations to shelters — 636 people in 158 shelters — were carried out), but that the recovery phase revealed structural fragilities in critical networks and in the coverage of Municipal and inter-municipal Safeguard Plans (PCS) (AFPCNT et al., 2024).

Key lessons:

- Anticipation and early alert systems (alert level: yellow → orange → red → purple) function well; the rare deployment of "*alerte violette*" was accepted by the population and likely saved lives.
- The cyclone did not reach the intensity of a tropical intense cyclone at landfall, yet it caused 100 M€ in damages, a warning that even sub-record intensity events can generate systemic impacts.
- Acts of vandalism affecting a pumping station in La Montagne (Saint-Denis) and equipment failures (captage des Hirondelles, Le Tampon) delayed the restoration of the water network well beyond the initial recovery phase, highlighting the vulnerability of critical single points of infrastructure.
- Insurance coverage: 42,000 CATNAT claims were filed, but ~40 % of households on the island lack home insurance, meaning that a substantial portion of impacted households received no formal compensation.

2.4.3. Tropical Cyclone Garance (February 2025)

Garance is the most severe cyclone to strike La Réunion in more than 25 years. It was classified as a cyclone tropical intense at landfall, with wind gusts of 214 km/h at Roland-Garros airport and up to 234 km/h at Piton Sainte-Rose — the strongest gusts recorded on parts of the island in over 50 years. Precipitation accumulations reached 587 mm at Plaine des Chicots and 537 mm at Cratère Commerson in 12 hours, with ~300 mm in 3 hours in the urbanized area of Saint-Denis. The cyclone caused 5 fatalities, approximately 250 M€ in total damages (first estimate, of which 60 %, ~150 M€ , in agriculture), and ~380 M€ in insurance payouts (France Assureurs, 2025). At peak, ~90,000 homes were still without electricity four days after landfall and ~65,000 people were without running water; more than 310,000 people were cut off from drinking water at some point during the event. The CATNAT procedure was declared and the Minister of Overseas Territories travelled to the island.

The Cerema, DEAL, CSTB, and CVH conducted parallel RETEX covering hydrology and morphodynamics (Cerema/DEAL — sub-daily return periods or observed precipitation, satellite imagery before/after) and building-scale damages (CSTB et al., 2025) evaluation.

Key lessons:

- Precipitation dynamics on a sub-daily scale dominated the impact profile: hourly return periods reached extreme values in the northern and eastern watersheds, confirming the RISC-RA's methodological choice to use hourly CPM data from AROME-SWIO for the torrential flood management process.

- The concurrence of a storm surge and a cyclonic swell amplified the impacts of river flooding at river mouths—thereby validating the SAR-2050's strategic assessment regarding the need to plan flood management at the scale of hydro sedimentary cells and the land-sea continuum.
- Structural damage to homes (roofs, windows and doors) highlighted gaps in the application of cyclone-resistant building codes, particularly in informal and older buildings, but also on newer construction showing maybe the existence of malpractice and the needs for more control.
- The impact on drinking water networks was greater than during Belal despite comparable wind intensity, largely because of damage to water intakes, cliff-side pipelines, and pumping stations without energy autonomy — reinforcing the SAR-2050 Axis 2 orientation on securing essential networks.
- The AFPCNT survey conducted after Garance (in continuity with the Belal survey) demonstrates a gradual evolution of the risk culture among the population, but persistent gaps for non-francophone populations and those in digital or literacy exclusion.
- Rural and mountainous areas have faced prolonged isolation, which confirms the vulnerability assessment and the need for anticipated logistical solutions.

2.4.4. Lessons from compound and cascading events

The succession of a severe drought followed by Cyclone Garance in 2024–2025 highlighted a critical aspect of climate risk in Réunion: hazards tend to occur in combination. The drought had already weakened the island's water reserves and the resilience of its infrastructure when Garance struck. Similarly, extreme rainfall triggers landslides that directly damage water infrastructure or cause power outages that shut down pumping stations, while post-event pollution episodes lead to the closure of water intakes for health and safety reasons. This chain of interdependencies means that climate risk management (CRM) cannot address hazards in isolation.

Structural lessons applicable to future CRM planning:

- **Design thresholds are being exceeded**: flood risk maps (PPRs), drainage networks, and hydraulic structures were designed based on historical statistics. TRACC projections (and a potential increase in baseline reference rainfalls by +10 % to +20 %) must be integrated in the design of new infrastructures and in the revision of PPR — a guideline now explicitly mentioned in the revision of the SAR-2050.
- **Critical networks (water, electricity, telecoms, roads) should be the primary focus to prevent cascading impacts**: securing single points of failure (ensuring energy self-sufficiency for water intakes and pumping stations, burying power lines in the most exposed areas, providing alternative access routes to the higher ground on the island, and maintaining ravines to prevent log jams) generates significant ancillary benefits for all types of risks.
- **Insurance gap (~40 % of households uninsured)**: this is one of the greatest vulnerabilities in terms of social equity in the context of post-disaster reconstruction. The revision of the SAR-2050 explicitly calls for anticipating the insurance crisis through documented monitoring and mechanisms of territorial solidarity.

- **PCS coverage remains insufficient** (5 of 24 municipalities with a fully operational plan), with PICS (Inter-municipal Safeguard Plans) largely absent. This is a first-order priority for reducing the impact of future events.
- **Systematizing RETEX** is essential. The events related to Belal, Garance, and the drought generated an unprecedented volume of lessons learned, but this practice must be institutionalized (as recommended by the SAR-2050 assessment) so that lessons are learned after every significant event and translated into concrete adjustments to climate risk management tools.
- **Cultural memory of past events** — which the SAR-2050's adaptation strategy identifies as a key lever—forms the foundation of risk culture, particularly across generations and for populations facing linguistic, digital, or literacy barriers.

These lessons converge with the resilience capacity assessment produced under RISC-RA Phase 2 (score: *Medium* for both drought and extreme precipitation/torrential floods) and directly inform the CRM objectives and measures detailed in Section 3.

3 Climate risk management – phase 3

3.1 CRM objectives

Table 3-1 outlines the primary and additional objectives alongside corresponding assessment indicators. These indicators address critical challenges such as securing drinking water supply, enhancing coastal ecosystem resilience, and promoting social equity, providing a comprehensive and actionable overview of the key priorities. **It reflects the collective view of the RISC-RA Executive Committee and the consultations carried out with stakeholders, whilst remaining as consistent as possible with the indicators already defined in the current planning documents.**

Table 3-1: List of CRM objectives.

Primary objectives	*Examples of assessment indicators*
Decrease drought risk on drinking water supply	• RISC-RA drought risk index (change % relative to 1985-2014 baseline) at UDI / groundwater body scale; • number of UDIs relying on a single water resource (mono-source dependency); • network efficiency ("*rendement de réseau*" or ILP) by EPCI; • % of UDIs meeting the SDAGE renewal rate target; • number of UDI-days with prefectoral drought restrictions per year
Decrease flood and torrential risk	• Number of people residing in EAIP (currently 225,325 — ~25 % of the population); • Population, services, housing, infrastructures and assets in (PPR) zones of high hazard; • average annual damages from flooding events (EUR/year); • frequency shift of orange- and red-threshold heavy rainfall events (RISC-RA output); • % of TRIs with an updated PAPI programme
Protect water resources — quantitative and qualitative	• % of surface water bodies reaching good ecological status (currently 0 % — SDAGE 2025);

	• % of groundwater bodies with good quantitative and qualitative status; • area covered by the active protection zone for water intakes; • number of priority water intakes covered by an active or realized adaptation action plan; • concentration of nitrates and anthropogenic pollutants (from agriculture, wastewater or industry) in groundwater
Secure drinking water supply and diversify sources	• Multi-source coverage rate of UDIs (water mix); • interconnection between microregions; • % of critical pumping stations with sufficient energy autonomy; • volume of treated wastewater reused (m^3/year); • volume of rainwater harvested for non-potable uses;
Adapt infrastructures and networks to the future climate	• % of new drainage and hydraulic structures dimensioned to withstand future extreme rainfall; • length of underground electrical networks buried in the most cyclone-exposed sectors; • number of rivers crossings replaced by alternative crossings; • renewal rate of the drinking water distribution network per EPCI; • number and repartition of local policy instruments related to stormwater management (SDAEP), wastewater management (SDA), and drinking water management (SDEP) that have been finalized and are currently being implemented
Preserve coastal ecosystems as protective infrastructure	• Ecological status of the four reef water bodies (Saint-Gilles, Saint-Leu, Étang-Salé, Saint-Pierre — currently rated as 3 "moderate" and 1 "poor" in the 2025 SDAGE assessment); • reef carrying-capacity indicator (maximum admissible pressures); • kilometres of restored dune systems and coastal vegetation; • share of catchments draining to reef areas that are covered by an active stormwater master plan.
Reduce vulnerability of buildings and populations in exposed zones	• Percent of buildings assessed for vulnerability in high-hazard zones; • number of individual flood-protection devices installed with public financial support (flood barriers, non-return valves, removable barriers); • number of relocation operations launched in priority retreat areas; • share of buildings in exposed zones that comply with cyclone-resistant construction standards.
Provide safe water and sanitation for all	• Share of the population with continuous access to safe drinking water (including during crisis periods); • share of the population connected to compliant sanitation systems (collective networks and individual on-site systems); • number of service interruptions (measured in person-days per year); • water cost as a share of the median income of the lowest-income households, by EPCI (an indicator developed by RISC-RA together with local stakeholders).

Additional objectives	*Examples of assessment indicators*
Social well-being and social resilience	• Share of municipalities with a functional and regularly exercised Municipal Safeguard Plan (PCS) — baseline: 5 of 24; • share of neighbourhoods equipped with emergency intervention kits and social hubs (tiers-lieux sociaux); • number of proximity services deployed in case of emergency; • share of households insured — baseline: ~60 %; • social vulnerability index cross-referenced with hazard exposure.
Environmental quality — ecosystems as infrastructure	• Kilometers of vegetation and buffer strips restored; • area of urban surfaces de-sealed each year; • area of protected natural spaces and ecological status; coverage of the coordinated eradication programme for Invasive Alien Species (IAS); • number of native-species nurseries and size of the seed bank.
Justice and equity in CRM	• Coverage of prevention and alert messages in French, Réunion Creole and the other main languages spoken on the island; • share of vulnerable households receiving individual adaptation support; • share of relocation operations carried out within the same living area (bassin de vie) as the original site; • representation of civil society and vulnerable groups in CRM governance bodies.
Food sovereignty and adaptation of agriculture	• Local production ratio for the main food categories; • irrigated area equipped with modernised systems; • area cultivated using agro-ecological practices; • number of local seed varieties and genetic resources conserved; • volume of strategic food stocks; • share of collective catering (schools, hospitals, etc.) supplied with local products.
Culture and knowledge — appropriation of adaptation	• Number of schools running adaptation and risk-education modules; • number of RETEX carried out after significant climate events (annual target); • number of citizen sentinel networks in operation; production of prevention and alert materials in Creole and other languages; • inclusion of traditional Reunion knowledge (local knowledge) in territorial CRM strategies.
Governance — integrated and operational CRM	• Number of Local Water Commissions (CLE) reactivated and functioning; • existence of an inter-EPCI GEMAPI network; • adoption of a Territorial Water Management Project; share of PLUs updated with climate projections and TRACC integration; • coverage of master plans (drinking water SDAEP, sanitation SDA, stormwater SDEP) at EPCI scale.

3.2 Supportive elements for effective CRM

Table 3-2 details the enabling elements across six key dimensions. These elements highlight both the existing assets—such as advanced observation infrastructure, operational early warning systems, and strong community engagement—and the gaps that need to be addressed to strengthen CRM. **It reflects the collective judgment of the RISC-RA COMEX and stakeholder consultations.**

Table 3-2: List of supportive elements for effective CRM.

Supportive elements for effective CRM	*Description*
Knowledge and data (institutional capacity, risk understanding)	**Assets:** • world-class atmospheric and cyclone observation infrastructure through OPAR (Atmospheric Physics Observatory of La Réunion https://www.osureunion.fr/en/observation-stations/opar/identity-sheet/) and Météo-France's Regional Specialised Meteorological Centre (RSMC); • recent availability of high-resolution climate datasets; • the RISC-RA outputs — the first comprehensive, spatialised, multi-hazard climate risk assessment for La Réunion, covering drought (at drinking-water distribution unit and groundwater body scale), extreme precipitation (with locally-distributed impact thresholds), and torrential floods (at TRI catchment scale); • parallel SAR-2050 territorial diagnostics (natural risks, water resources, and the 2025 BRGM hydrogeological diagnostic); • the launch of GREC-Réunion in January 2026 as a permanent science–policy interface; • recent CNRS-led initiatives on adaptation in overseas territories and on the barriers and levers to adaptation. **Gaps:** • sub-daily rainfall monitoring is sparse over key mountain watersheds; • no multi-model ensemble is available for extreme precipitation; • vulnerability data at fine spatial and demographic resolution remain incomplete (soil sealing dynamics, informal housing, urban growth projections); • the costs of adaptation — and even more so the costs of inaction — are not systematically documented.
Technology and infrastructure (early warning systems, monitoring platforms, water and drainage networks, green and grey infrastructure)	**Assets:** • operational meteorological and cyclone alert systems; • DEAL Hydrological Vigilance Unit (CVH) providing hydrological forecasting; • hydrometric and piezometric station networks operated by the Water Office (Office de l'eau); • Cyclone Crisis Management plan (“Plan Orsec”) for all territory and Municipal Safeguard Plans (PCS) where they are operational; • the cross-island transfer aqueduct moving water from the wet east to the drier west; • National risk prevention plan (PPRI, PPRL) and local declinaison of the EU Flood Directive over six areas of the islands; • coastal protection infrastructure. **Gaps to upgrade:** • insufficient monitoring of sub-daily precipitation in fast-response watersheds; • stormwater drainage systems that are undersized relative to current and future extreme precipitation events and land sealing; • an insufficient renewal rate for the drinking water system (significant volumes lost due to leaks); • several water supply units (UDIs) dependent on a single water source; • water mains running along cliffs and exposed to landslides; • pumping stations without energy self-sufficiency; • insufficient maintenance of riverbeds and banks to prevent log jams and reduce the risk of river flooding; • limited coverage of stormwater management plans (“SDEP”);

	• remaining non-separate sewer systems which contribute to the pollution of water resources.
Social and behavioural aspects (behaviour change, risk awareness, social capital, trust, social norms)	**Assets:** • a strong culture of cyclone risk prevention, rooted in the island's long history marked by major events; • an active educational platform on risks, coordinated with education authorities and civil protection (the "Paré pas Paré" project); • an operational intervention platform for post-disaster relief: the PIROI (French Red Cross Regional Response Platform for the Indian Ocean https://piroi.croix-rouge.fr/?lang=en); • field surveys conducted by a risk prevention association (AFPCNT) following Cyclones Belal and Garance (AFPCNT et al., 2024); • the growing recognition of Réunion's traditional knowledge—in the areas of water management, mutual aid, food preservation, and construction—as a lever for adaptation. **Gaps:** • Insufficient awareness of torrential flood risks: casualties are still reported, particularly among pedestrians and motorists attempting to cross flooded low-water crossings (radiers); • Historically low awareness of drought risks, although it has risen sharply following the 2024–2025 crisis; • A weak risk culture regarding emerging or underestimated hazards, such as heatwaves and shrink-swell clay soils; • Standard prevention and alert messages fail to reach a significant portion of the population, specifically non-French speakers, illiterate individuals, or those facing digital exclusion; • Strong attachment to one's living environment limits the acceptability of structural measures, such as relocation.
Citizen engagement	**Assets:** • the post-Belal and post-Garance AFPCNT surveys showed that citizens are willing to take part in RETEX and to shape adaptation responses; • participation in public consultations for the SAR-2050 revision; • local associations acting as relays in vulnerable neighbourhoods (food aid, shared gardens, social hubs); • potential of citizen sentinel networks for surveillance (ravine water levels, precursor signs of landslides), currently at pilot stage in some municipalities (St-Pierre); • growing engagement with the "Paré pas Paré" school programme. **Gaps:** • No structured framework for integrating civil society into decision-making bodies on climate risk management; the RPCC should address this; • The resources allocated to community-level adaptation initiatives are limited; • The contributions of citizen observers and citizen science remain limited.
Finances and resources	**Assets:** • Multiples funds existing: CATNAT insurance regime (natural disaster insurance), the Fund for the Prevention of Major Natural Hazards (FPRNM or "Barnier"); the Overseas Aid Fund (FSOM) and the Exceptional Investment Fund (FEI) for emergency response and structural investments; European Regional Development Fund (ERDF) programs that co-finance water infrastructure and flood mitigation infrastructure; • A dynamic research ecosystem: Multiple research institutes are located in Reunion Island.

	Gaps and structural constraints: • The "water pays for water" principle is insufficient given the necessary investments and catch-up efforts, especially since the territory's social and economic vulnerability limits the ability to raise water taxes; • Several EPCIs maintain low, politically sensitive water rates, which generate insufficient revenue for infrastructure renewal; • Maintenance budgets suffer from chronic underfunding; • Small local governments face significant constraints in terms of technical capacity to access available funds; • A major "investment wall" looms for drinking water infrastructure; • A dynamic research ecosystem: although there are many research institutes, the resources specifically dedicated to climate change, risk management, or action research with and for society remain very limited.
Governance arrangements and political leadership (coordination mechanisms, mandate clarity)	**Assets:** • a multi-level regulatory framework combining European instruments (Water Framework Directive, Floods Directive), national instruments (PNACC 3, TRACC, PPR), regional instruments (SAR-2050, currently under revision; GREC-Réunion), intermunicipal instruments (PCAET, SCoT, GEMAPI), and municipal instruments (PLU, PCS); • strong regional political commitment, reaffirmed by the president of the Regional Council in 2023, and now formalized by the signing of the European Charter on Adaptation and the launch of GREC-Réunion in January 2026; • the convergence of major revision cycles (SAR-2050, SDAGE, PGRI), creating a strategic window for policy development. **Gaps:** • Many subregional or local governance bodies either do not exist or are not functioning, such as the Water Management Plans (SAGE) and the Local Water Commissions (CLE); • the GEMAPI's responsibilities remain unclarified and unstructured; • coordination between the State, the Region, the Department, the EPCIs, and the municipalities varies from one issue to another; • sectoral governance remains siloed, which limits integrated management (land use planning/water; risks/biodiversity; social vulnerability/exposure); • there is no permanent cross-sectoral governance for adaptation at the level of the entire territory; the RPCC should address this; • short political cycles create tensions with the long-term time horizon of adaptation plan

3.3 Potential CRM measures

For each priority risk identified in Phase 2, the table below outlines potential measures combining structural, non-structural, nature-based, human/social, and governance interventions. Measures are drawn from the SAR-2050 Regional Adaptation Strategy (Axes 1 to 9, **Appendix 1)** and refined based on the RISC-RA CRA outputs and the adaptation workshops conducted with EPCIs, water service delegates, State services, and technical partners. **Effectiveness ratings and timelines are indicative and reflect the collective judgment of the RISC-RA COMEX and stakeholder consultations**.

Table 3-3: Potential CRM measures per priority risk

Key climate risk	*CRM measure*	*Effectiveness / Risk reduction (high, medium, low)*	*Contribution to CRM objectives*	*Possible co-benefits*	*Timeline (short, medium, long term)*	*Responsible organisation*	*Possible adaptation limits*
Meteorological drought	**Structural Efficiency of Networks**: Reduce leaks in drinking water and irrigation networks by prioritizing the renovation of the networks with the highest leak rates and the areas with the highest rates of service interruptions.	High	Reduces drought risk on drinking-water supply; secures drinking-water supply; helps provide safe water for all.	Reduced energy consumption for pumping; reduced pressure on water resources; reduces the impact of low water levels on aquatic biodiversity in rivers; economic savings for water services.	Medium term (5–15 years)	EPCIs, delegated water operators (SPE), Water Office.	Very large investment needed ("investment wall") on infrastructure; engineering capacity constraints in the smallest EPCIs.

Meteorological drought	**Structural — resources diversification**: • diversify the water supply sources for each drinking water distribution unit (combination of surface water, groundwater, and unconventional resources); • strengthen interconnections between micro-regions; • tap into underutilized groundwater resources; expand the reuse of treated wastewater (REUT) and rainwater harvesting.	High	Ensures the supply of drinking water and diversifies water sources; adapts infrastructure to future conditions.	Reduces pressure on individual water bodies;	Medium to long term	EPCIs, delegated water operators, Water Office.	▪ Regulatory obstacles and issues related to social acceptance of wastewater reuse; ▪ long completion times for interconnection work; ▪ potential competition with ecological flow requirements.
Meteorological drought	**Nature-based solutions**: ▪ protect and restore infiltration areas and watershed protection zones; ▪ remove impervious surfaces from priority infiltration areas; ▪ implement integrated rainfall management (IRM) at the plot level; ▪ restore wetlands and high-altitude pandanus swamps.	High	Protects water resources (quantity and quality); reduces the risk of downstream flooding; preserves ecosystems.	Reduced risk of downstream flooding; improved biodiversity; reduced transport of sediment and pollutants to the reefs; improved water quality.	Long term	EPCI, municipalities, Réunion National Park, ONF, farmers.	Significant time lag before effects on groundwater recharge become measurable; issues related to land tenure and public acceptance.

Meteorological drought	**Non-structural — sobriety and demand management**: ▪ water saving programmes for domestic, agricultural and municipal uses; ▪ progressive water-tariff reforms consistent with the "water pays for water" principle while protecting low-income households; ▪ make new urban development conditional on water resource availability.	High	Reduces drought risk; helps provide safe water for all; secures drinking-water supply.	Reduced energy costs; lower household bills after leak repair; social justice component if tariff reforms are designed with equity in mind.	Short to medium term	EPCIs, State, water delegated operators, Chamber of Agriculture.	Political sensitivity of tariff reforms; acceptability constrains on conditional urbanization.
Meteorological drought	**Governance**: ▪ (re)activate Local Water Commissions (CLE); ▪ update Water Management Plans (SAGE) for each microregion; ▪ develop a Territorial Water Management Project (PTGE); ▪ set up dynamic-management committees to anticipate water stress under climate change.	High	Improves integrated governance of CRM; protects water resources	Better coordination across users and territories; anticipation replaces crisis response.	Short to medium	Region, State, Water Office, EPCIs, Local Water Commissions	Historical governance gap on SAGE and CLE; requires political leadership and dedicated engineering capacity.

Meteorological drought	**Human and social**: ▪ raise public awareness of drought risk with messages in different languages (including Creole); ▪ promote water-saving behaviours; mobilise traditional knowledge on water management; ▪ support the most vulnerable low-income households facing high water-cost burdens.	Medium	Reduces drought risk; strengthens justice and equity; supports cultural appropriation of adaptation.	Strengthened intergenerational transmission of knowledge; social cohesion; reduced eco-anxiety.	Short to medium	Region, EPCIs, associations, education authorities, municipal social action centres.	Historically low awareness of drought risk; risk of not reaching digitally or linguistically excluded populations.
Extreme precipitation	**Structural — design standards**: ▪ integrate probable rainfall increase into the design of new stormwater drainage networks, hydraulic works, hydraulic structures, and bridges infrastructures; ▪ adapt embankments and dykes to the torrential regime, taking sediment transport into account.	High	Adapts infrastructure and networks to future climate; reduces flood and torrential risk.	Reduced damage to critical infrastructure; reduced insurance losses; safer transport network.	Medium to long term	EPCIs, Region, Department, State, project owners.	Cost and lead time of major hydraulic works; dependence on available engineering capacity and funds;

Extreme precipitation	**Structural — critical networks**: ▪ secure electrical networks in sectors most exposed to cyclonic winds (undergrounding, decentralised solutions); ▪ secure drinking-water infrastructure exposed to landslides (cliff-face pipes in cirques); ▪ provide energy autonomy at water intakes and pumping stations; ▪ develop alternative access routes; replace fords (radiers) with permanent crossings.	High	Adapts infrastructure; secures drinking-water supply; improves social well-being (network continuity, less isolation).	Reduced network downtime after events; fewer flash-flood casualties at fords; equity gains for isolated households.	Short to long term	EDF (electricity), EPCIs, State, Département (roads), delegated water operators.	High retrofit costs; land constraints in the cirques.
Extreme precipitation	**Land planning — reducing exposure**: ▪ update prevention risk plan (PPRI and PPRL) to integrate TRACC climate projections; ▪ maintain and strengthen urbanization breaks; ▪ identify most exposed assets in worsening-hazard zones and start strategic retreat with dedicated financial tools; ▪ prioritize clarification of joint land ownership (“indivision foncière”) in exposed areas.	High	Reduces flood risk; reduces vulnerability of buildings and populations in exposed areas; supports justice and equity.	Coherence between SAR-2050, SCoT and PLU; preservation of natural flood expansion zones; reduced exposure of new assets.	Long term	State (PPR), Region (SAR-2050), EPCIs (SCoT), municipalities (PLU).	Low acceptability of relocation; complex land tenure; strong attachment to living places.

Extreme precipitation	**Nature-based solutions**: ▪ restore natural flood expansion zones upstream of urbanized areas; ▪ re-establish vegetation along the banks of ravines and rivers to limit erosion and sediment transport, and ensure regular maintenance to prevent the formation of log jams; ▪ preserve wetlands; combine Nature-based Solutions with structural solutions (sediment traps, flood-peak reduction structures) where required by the torrential regime.	High	Reduces flood risk; protects water resources; helps preserve coastal ecosystems (via sediment reduction); improves environmental quality.	Biodiversity gains; sediment and pollutant retention; landscape and cultural value; support to downstream reef water bodies.	Medium to long term	EPCIs (GEMAPI), Réunion National Park, ONF, Water Office, associations.	Acceptability issues (common perception that vegetation aggravates floods); local ecological-engineering sector still too small.
Extreme precipitation	**Non-structural — risk culture, alert and crisis response**: ▪ extend Municipal Safeguard Plan (PCS) coverage to all 24 municipalities (baseline 5/24); ▪ develop Inter-Municipal Safeguard Plans (PICS); ▪ run regular exercises; ▪ densify sub-daily rainfall and mudflow instrumentation over TRIs; ▪ deploy citizen sentinel networks; ▪ adapt alert communication for non-francophone, digitally excluded and illiterate populations; ▪ systematize RETEX after each significant event.	High	Reduces flood risk; supports social well-being, justice and equity; strengthens cultural appropriation of adaptation.	Fewer casualties; faster recovery; increased trust and social capital; feedback loop for improving CRM.	Short to medium term	Municipalities (PCS), EPCIs (PICS), Préfecture, DEAL/CVH, Météo-France, PIROI, AFPCNT.	Difficulty reaching most vulnerable populations; limited engineering capacity at municipal level; sustained financing of exercises.

Extreme precipitation	**Financial and social equity**: ▪ anticipate the emerging insurance crisis by monitoring claims trends, developing insurability tools and territorial solidarity mechanisms; ▪ develop post-crisis socio-economic support protocols combining aid, rehousing, return-to-employment and psychological support; ▪ deploy individual protection devices (flood barriers, non-return valves, removable barriers) with financial and technical support.	Medium to high	Improves social well-being and resilience; strengthens justice and equity; reduces vulnerability of buildings.	Reduced post-event inequality; faster recovery; targeted support for precarious households and small businesses.	Short to medium term	State, Département (social action centres), Region (innovation, economic development) EPCIs, municipalities	Rising insurance surcharges; market withdrawal of insurers; Engineering capacity and funds needed to support and deploy individual protection.
Extreme precipitation	**Governance — clarifying responsibilities**: ▪ clarify how the GEMAPI competence is exercised; ▪ structure an inter-EPCI GEMAPI network in coordination with reactivated Local Water Commissions (CLE); ▪ map maintenance responsibilities on watercourses and integrate them into urban planning documents; ▪ shift risk-management doctrine towards adaptation and ecosystem preservation rather than dyke-only protection.	High	Improves integrated governance of CRM; adapts infrastructure; helps preserve coastal ecosystems.	Better coordination across sub-basins; alignment with the SDAGE; more integrated coastal-inland management.	Medium term	State (DEAL), Region, EPCIs, Local Water Commissions , Water Office.	Historical governance gap; requires legislative or administrative clarification; institutional inertia.

	Land use — limit soil sealing and de-seal surfaces: ▪ set quantified targets for reducing net land take, consistent with the Zero Net Artificialisation trajectory adapted for overseas territories; ▪ require open-soil and biotope coefficients in development projects through PLU compatibility; ▪ identify critical sectors where soil sealing worsens flood risk or reef degradation and prioritise them for de-sealing; ▪ require plot-scale rainwater management (GIEP).	High	Multiple: reduces drought risk (recharge); reduces flood risk (runoff); preserves coastal ecosystems by limiting runoff and pollution from rainfall water to coastal water; improves environmental quality; supports habitability (urban cooling).	Multi-hazard benefits; biodiversity; urban thermal comfort; landscape and visual quality.	Medium to long term	Region (SAR-2050 rules), EPCIs (SCoT), municipalities (PLU), project owners.	Political and economic tensions with territorial attractiveness and construction sector; requires strong prescriptive SAR-2050 framework.
	Cultural transformation — appropriation of adaptation: ▪ integrate climate adaptation and natural risks into school curricula at all levels; ▪ develop popular-education activities on water and behaviour change; ▪ produce prevention materials in French, Creole and other languages; ▪ mobilize traditional Reunion knowledge and artistic creation; ▪ support citizen-led resilience initiatives.	Medium	Supports cultural appropriation of adaptation; strengthens justice and equity; improves social well-being.	Stronger intergenerational solidarity; reduced eco-anxiety; anchoring adaptation in local identity.	Short to long term (continuous)	Region, Rectorat (education authorities), associations, cultural institutions, GREC-Réunion (mediation role).	Require sustained financing; outcomes measurable only over long-time horizons.

3.4 Integration into planning and decision making

3.4.1. Direct policy integration pathways

The RISC-RA outputs are being integrated into planning and decision making through four main pathways, which together constitute the primary durable policy impact of the project.

First, the Regional Land Development Plan (SAR-2050) revision is the flagship integration vehicle. The revised SAR-2050 is expected to be finalized in late 2026, and the RISC-RA outputs directly inform three of its components: (i) the diagnostic chapter on natural risks and water security, providing updated, spatialised risk indicators at UDI, groundwater body, and TRI catchment scales that supersede the previous state-of-knowledge; (ii) the planning principles and prescriptive rules — particularly regarding construction restrictions in high-risk areas, the conditionality of urbanization on water resource availability (a principle explicitly requested by all EPCIs in the adaptation workshop), and water infrastructure security requirements; (iii) the SAR-2050 monitoring and evaluation indicators, which will track risk evolution over the lifetime of the plan. This integration embeds the results into the territory's primary spatial planning framework for the coming decades — the most direct and lasting policy impact of the project.

Second, the Regional Adaptation Strategy — the individualized chapter of the SAR-2050 required under article L4433-7-3 CGCT — has been built in parallel with the RISC-RA and shares much of the same evidence base. The Strategy (figure 3) structures nine strategic axes: one transversal, including Governance; Knowledge, monitoring and evaluation, Means and Culture, and eight thematic one: Social and economic resilience; Land planning; Coastal risks and *"terre-mer continuum"*; Water; Natural risks; Biodiversity; One Health; Food sovereignty. The RISC-RA outputs are directly cited as evidence for the water and natural-risk axes and inform the choice of monitoring indicators.

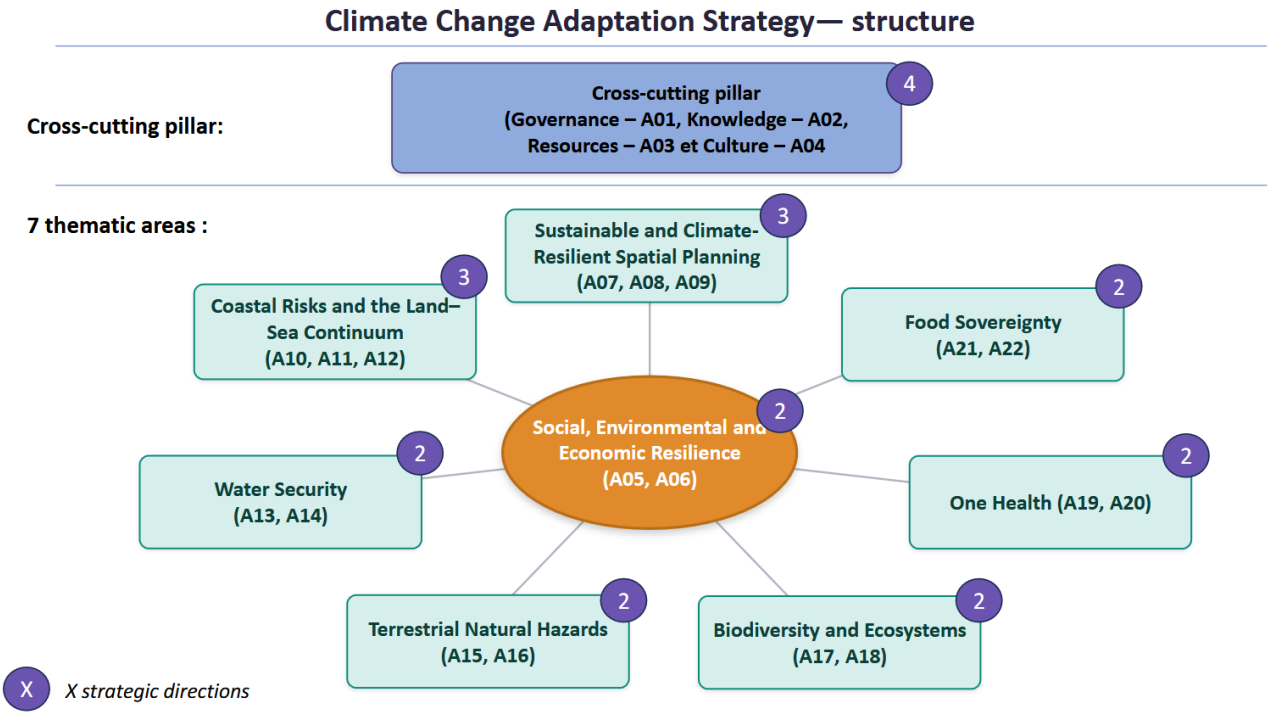


Figure 3: Structure of the SAR-2050 Climate Change Adaptation Strategy

Third, integration into risk governance bodies.

Preliminary results were presented and consolidated outputs will be formally presented within existing risk governance structures — in particular the Technical Committee on Risks ("*Comité Technique des Risques*") organised by DEAL, which brings together the institutional actors responsible for land planning and risk management. Presenting the CRA findings within this framework will ensure that the updated risk knowledge is available to the practitioners directly responsible for translating risk assessment into regulatory land-use and prevention instruments — with particular relevance for the ongoing revision of PPR to incorporate TRACC projections **(SAR-2050 Orientation 1.2).**

Fourth, the GREC-Réunion Climate Knowledge Centre.

Région Réunion and the University of La Réunion (through OSU-Réunion) responded to a national call for projects and have been awarded funds to develop a prefiguration study for a Climate Change Adaptation Knowledge Centre within GREC-Réunion. This centre would serve as a "living lab" combining a permanent resource platform for climate change adaptation knowledge in the South-West Indian Ocean region and recurrent activities (workshop, awareness-raising, formation, …). The RISC-RA results — comprising the first comprehensive, spatialised, and multi-hazard climate risk assessment for Réunion Island — are expected to constitute one of the founding knowledge bricks of this centre, ensuring long-term accessibility and institutional continuity beyond the CLIMAAX project lifetime.

Additional integration pathways include contributions the Pathways2resilience (P2R) programme (La Réunion selected in December 2025 for the second cohort and is currently deploying P2R through its local "Anparé" project).

3.4.2. Synergies and tensions for CRM

Synergies. The concurrent revision cycles of planning documents such as the SAR-2050, the SDAGE (2028–2033) or the PGRI (2028-2033) create a favourable window for coherent integration of climate risk knowledge across planning tools. The launch of GREC-Réunion in January 2026, the signature of the EU Adaptation Charter, and the selection of La Réunion in Pathways2resilience further reinforce the strategic momentum. The RISC-RA scientific consortium (Région Réunion, OSU-Réunion/CNRS, Météo-France, BRGM) is well-positioned to sustain this alignment through GREC-Réunion.

Coordination challenges.

Governance in La Réunion remains fragmented, both between sectors (land planning, water, risks, biodiversity, health), between scales (State, Region, Departmental Council, inter-municipal EPCIs, municipalities), and between time horizons (short political cycles versus the long-time frame of adaptation). The workshops on water security identified the alignment between planning documents as a persistent weakness. There is a tension between the wish to keep the territory attractive — which pushes municipalities to open or maintain areas available for urbanization — and the need to align development with the actual availability of water.

To address these gaps, Axis 1 of the SAR-2050 Regional Adaptation Strategy proposes several concrete responses:

- Set up an integrated, inclusive and operational governance of adaptation, with GREC-Réunion providing scientific and technical steering.
- Reactivate the local water commissions (CLE) and produce updated water management plans (SAGE) for each part of the island.
- Clarify how the GEMAPI competence (flood and aquatic environment management) is exercised, and structure a cooperation network between the EPCIs that hold this competence.
- Define a shared water management project for the territory ("Projet de Territoire pour la Gestion de l'Eau"), and set up dedicated governance bodies — both within sectors and across sectors — to address the combined issues of social vulnerability and climate.

Stakeholder dynamics.

The RISC-RA engagement process showed that EPCIs and technical partners are strongly willing to work on climate risks. However, several structural constraints limit their ability to turn this engagement into concrete action: uneven engineering and project-management capacity across territories, a shortage of qualified staff, and a growing "investment wall" facing water supply and drainage infrastructures. Closing the gap between engagement and operational implementation is a first-order priority and is addressed under SAR-2050 Axis 3, which aims to equip the territory with the skills, engineering capacity and financing needed to deliver adaptation.

Cross-scale tensions.

The 24 municipalities hold land-use authority through their Local Urban Plans (PLU), but only 5 currently have a fully operational Municipal Safeguard Plan (PCS). Natural risk prevention plans (PPR) are a state responsibility, yet their regulatory effects play out on individual plots of land at the municipal level. The current parallel revisions of the SAR-2050, the SDAGE, the PPRs and the municipal planning documents open a rare window to align these different levels — provided that the engineering support foreseen under SAR-2050 Axis 3 actually reaches the EPCIs and municipalities.

3.4.3. Remaining knowledge gaps and needs identified.

No new risk-workflow data were generated during Phase 3. The technical development of the workflows (UDI-scale drought assessment, AROME-SWIO simulations, WASP/SPI cross-validation) is scheduled for the self-funded Phase 4 extension, outside the CLIMAAX funding perimeter. Phase 3 did, however, generate one primary dataset: the two questionnaires completed by participants at each of the eight SAR-2050 thematic workshops, together with their compiled results (see Appendix 5). The project extension (beyond CLIMAAX to enable further analysis and the development of the torrential flood workflow in collaboration with CRAHI) will include:

- Spatialised drought risk assessment at UDI and groundwater body scales, for three SSP scenarios, mid- and end-of-century horizons, with 2050 exposure projections and multi-dimensional vulnerability indicators (socio-economic, water services, water resources, drinking water infrastructures).
- Extreme precipitation frequency-shift maps for three SSP scenarios, using spatially distributed impact thresholds derived from Météo-France's heavy rainfall vigilance system.

- Torrential flood workflow using hourly AROME-SWIO CPM simulation for IDF analysis over selected critical catchments and coupling with TRI flood maps and exposed infrastructure datasets — a first-order territorial exposure estimates for torrential flooding on La Réunion.
- Cross-validation of WASP against SPI drought indices, and a prototype **adaptation trajectory** exploring "what-if" reduction of future drought risk through targeted interventions (network efficiency, source diversification, demand management).

Remaining knowledge gaps (also identified as SAR-2050 Axis 2 priorities on "*Knowledge, monitoring and evaluation"*):

- **Multi-model ensemble for extreme precipitation**: Phase 2 relied on a single climate model (ALADIN RCM), the addition of AROME-SWIO CPM in further development will provides a second independent estimate; a full multi-model ensemble is needed to robustly distinguish the climate change signal from internal variability, especially given the sensitivity to simulated tropical cyclone frequency.
- **Sub-daily observational network** over key watersheds: monitoring density is currently probably insufficient to correctly constrain flash-flood forecasting, and the SAR-2050 revision explicitly calls for instrument densification.
- **Cost of adaptation and cost of inaction**: not systematically documented;
- **Urban and demographic dynamics at fine scale are not accounted for**: soil sealing, informal housing dynamics, migration flows within the island, urban expansion projections beyond 2050.
- **Cross-hazard interactions**: compound and cascading events (2024-drought followed by Cyclone Garance in 2025 and its impact on water network) are not yet formally represented in the current CRA workflows.

Resources and capacities

Several needs (human and financial resources, skills, and capacities) have been identified for the effective implementation of the adaptation strategy developed in the SAR-2050:

- sustained financing for GREC-Réunion;
- recruitment and retention of qualified researchers and engineers in the field of adaptation;
- capacity building (particularly on hydrogeology, nature-based solutions, ecological engineering and climate adaptation financing);
- training and raising awareness of decision-makers (elected officials) regarding the challenges of climate change adaptation.

3.4.4. Monitoring and evaluation system.

At the time of writing, La Réunion does not have a unified monitoring and evaluation system dedicated to CRM at the territorial scale, but several complementary elements are in place or emerging:

- **The SAR-2050 monitoring and evaluation system** (article R4433-2 CGCT) is under construction as part of the revision. It will include indicators covering the individualized chapters, including the climate adaptation strategy. The RISC-RA CRA outputs are

candidates for these indicators (drought risk index at UDI scale, frequency shift of heavy rainfall events).

- **Implementing the EU water framework directive, the SDAGE monitoring programme** already provides a regular assessment of the quantitative and qualitative status of water bodies (Office de l'Eau, 2025), of pressures and impacts (agricultural, urban, sanitation), which will continue under the 2028–2033 cycle.
- **GREC-Réunion is expected to serve as the science-policy platform for continuous evaluation of adaptation on the territory**, drawing on the RISC-RA CRA outputs as a founding evidence brick.
- **Hydrometric and piezometric monitoring networks** managed by the *Office de l'eau* provide continuous observations of surface and groundwater resources, with 20+ years of continuous data.
- **SISPEA** provides annual data on the performance of water services (rendement, ILP, renewal rates) by municipality.
- **AFPCNT surveys** conducted after Belal and Garance illustrate the possibility of systematized citizen-facing RETEX.

Towards an operational Climate Risk Management system at the scale of La Réunion.

Continuous evaluation and monitoring are essential to make adaptation a lasting process. This need has been identified both through the CLIMAAX/RISC-RA project and during the preparation of the Regional Adaptation Strategy of the SAR-2050. It has accordingly been set as one of the main missions of GREC-Réunion for the 2026–2029 period.

A future integrated monitoring system for La Réunion would include the following components:

1. **A set of CRM outcome indicators**, organised by primary objective (see Tables 3-1 and 3-2), aligned with the indicators already used by the SAR-2050 and the SDAGE, and updated at the same pace as the underlying data — annually for water services, every five years for climate projections (via DRIAS), and every ten years for the SDAGE planning cycles.
2. **Impact-oriented indicators,** including:
    - an annual assessment of direct and indirect losses and damage from each significant climate event;
    - systematic feedback (RETEX) after each major climate event;
    - trends in CATNAT insurance claims;
    - the share of households insured;
    - and the coverage of Municipal and Inter-municipal Safeguard Plans (PCS and PICS).
3. **Progress indicators on the adaptation strategy** itself, tracking the actual roll-out of the measures set out in the SAR-2050 Regional Adaptation Strategy — for example: number of measures implemented; share of PLUs (local urban plans) updated to integrate climate projections; surface area of soils un-sealed each year; number of individual protection devices deployed to households in exposed zones ...

4. **A long-term evaluation framework for Nature-based Solutions,** covering 5, 10, 20 and 30-year horizons, as requested under SAR-2050 Axis 2 on knowledge, monitoring and evaluation.
5. **A participatory dimension:** citizen sentinel networks for local surveillance (of ravines, precursor signs of landslides, etc.); participatory surveys carried out after each major event, following the AFPCNT model used after cyclones Belal and Garance; formal representation of civil society within the governance of the monitoring system.
6. **A clear institutional anchor:** GREC-Réunion acts as the science-policy steering body, with a permanent secretariat, publicly accessible dashboards (starting with the Atlas of Risks produced during RISC-RA Phase 3), and an annual report shared with the SAR-2050 monitoring committee and with the Water Basin Committee (Comité de Bassin).

Setting up such a monitoring system is one of the operational priorities identified for the continuation of the project's outputs within GREC-Réunion and beyond the CLIMAAX/RISC-RA project.

4 Project Evaluation

4.1 Usability of the results

As an Outermost Region of the European Union participating in CLIMAAX, Réunion Island demonstrated how the framework can be adapted to a small, remote, and topographically complex tropical island. The RISC-RA project has delivered substantial benefits across policy, spatial planning, scientific knowledge, and institutional capacity.

4.1.1. Development of new knowledge and methodological innovations

Over the three phases, the project advanced the local understanding of observed and projected hydro-climatic risks across the island:

- **Multidimensional mapping of drought risks**: CLIMAAX has enabled the creation of high-resolution maps of hazards and vulnerabilities linked to the 'Meteorological Drought Workflow' through a participatory process involving stakeholders from the four sub-regions. These cross-climate projections with three critical local vulnerabilities:
  - *Socio-economic:* for instance, the financial burden of water bills on low-income households.
  - *Infrastructural:* for instance, water network yield/efficiency.
  - *Resource:* for instance, quantitative groundwater/surface water availability.
- **Granular sub-regional insights:** Thanks to the multidimensional study the project revealed contrastive territorial vulnerabilities, highlighting the East's heavy reliance on vulnerable surface waters versus the West's vulnerability to water transfers and saltwater intrusion in coastal boreholes.
- **A tool for forecasting torrential flooding**: although the climate models currently available struggle to fully simulate tropical cyclones (which are responsible for over 60% of extreme rainfall events), a technical collaboration with the Universitat Politècnica de Catalunya (UPC) has enabled the launch of a study into forecasting torrential flooding.

4.1.2 Policy implications and updates to spatial planning regulations

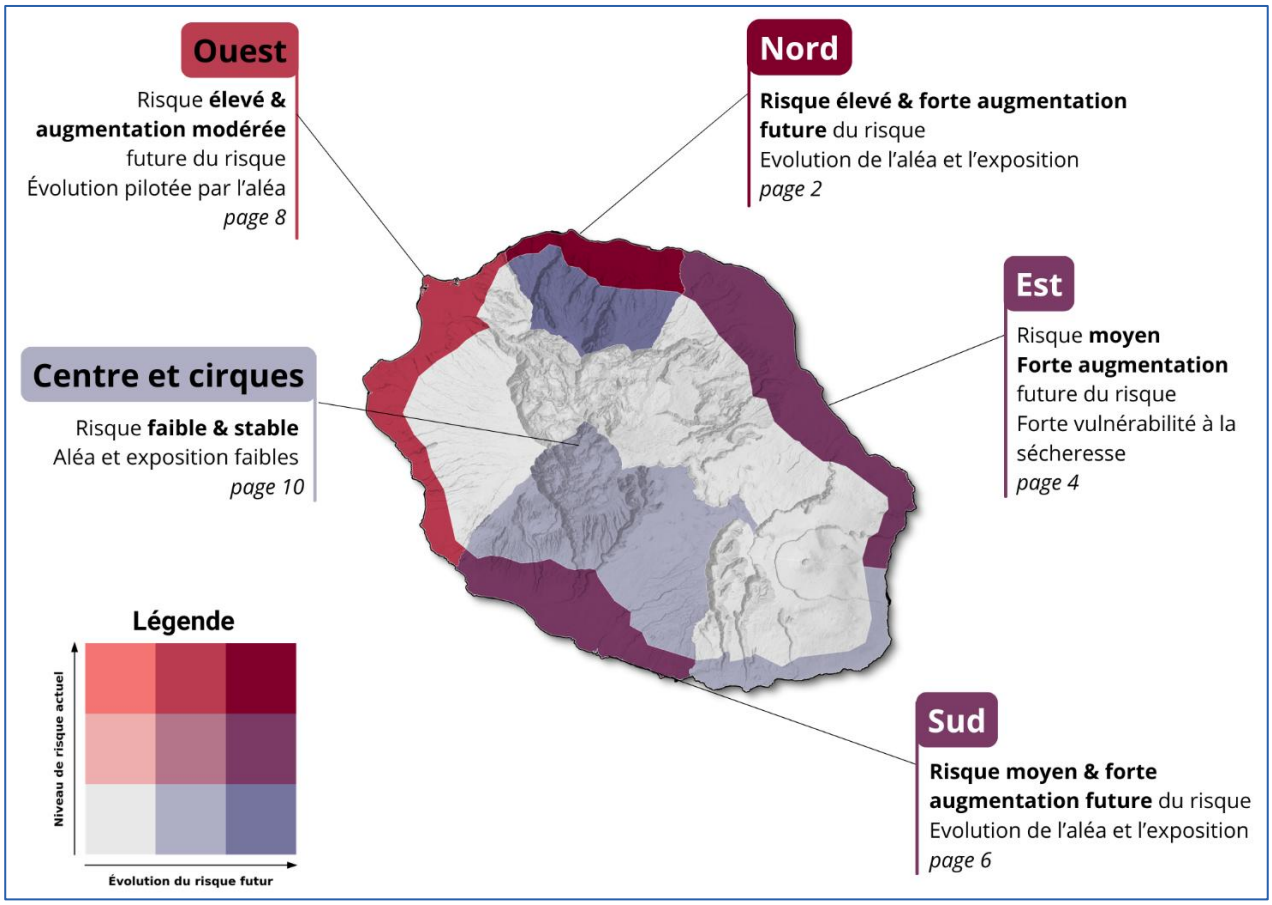
The outputs of RISC-RA/CLIMAAX are directly embedded into the region's core statutory and strategic planning frameworks:

- **Spatial planning regulation (SAR-2050):** risk evolution maps have directly enriched the vulnerability assessment of the "*Schéma d'Aménagement Régional*" (SAR-2050), providing a legal and cartographic baseline to guide future land-use rules, infrastructure protection, and urban development.
- **Regional Adaptation Strategy:** The project's indicators and risk projections serve as a primary technical input for Région Réunion's upcoming Regional Adaptation Strategy (finalization scheduled for September 2026).
- **Science-Society interface (GREC-Réunion):** Through the project's specific governance structure, RISC-RA served as a practical operational springboard for GREC-Réunion (officially launched in January 2026), which aims to bridge the gap between climate science and public decision-making.

4.1.3. Usability for local stakeholders and communities

To ensure maximum usability beyond academia, the project prioritized actionable tools for local actors (municipalities, intercommunal bodies/EPCIs, water practitioners):

- **Public participation and stakeholder ownership**: the project's findings are shared with public authorities to foster a shared understanding of the links between territorial vulnerabilities and climate change. To ensure strong local roots, 31 key organizations were closely involved in the RISC-RA project through workshops, methodological discussions and targeted meetings. This notably resulted in nine local field meetings with inter-municipal water management officials (covering all 24 municipalities), representatives from water services and national institutions responsible for risk management. During Phase 3, two regional thematic workshops (on natural hazards and water security) were organised as part of the SAR-2050 review, culminating in a closing event in August 2026 to present the consolidated results of Phases 1, 2 and 3 to local decision-makers.
- **Actionable cartography & Atlas of Risks:** These scientific findings will be compiled in an Atlas of Risks in La Réunion. This document will provide a cartographic, educational and operational summary of the project's main findings, intended for the relevant stakeholders in the region.
- **Phase 4 of the RISC-RA project, dedicated to strengthening local capacity**: in order to maximise the project's impact, the Réunion Region team has worked to secure a 12-month extension, funded from its own resources, which will begin in September 2026. This Phase 4 will retain the same project team and will help to strengthen local capacity in collaboration with GREC-Réunion.



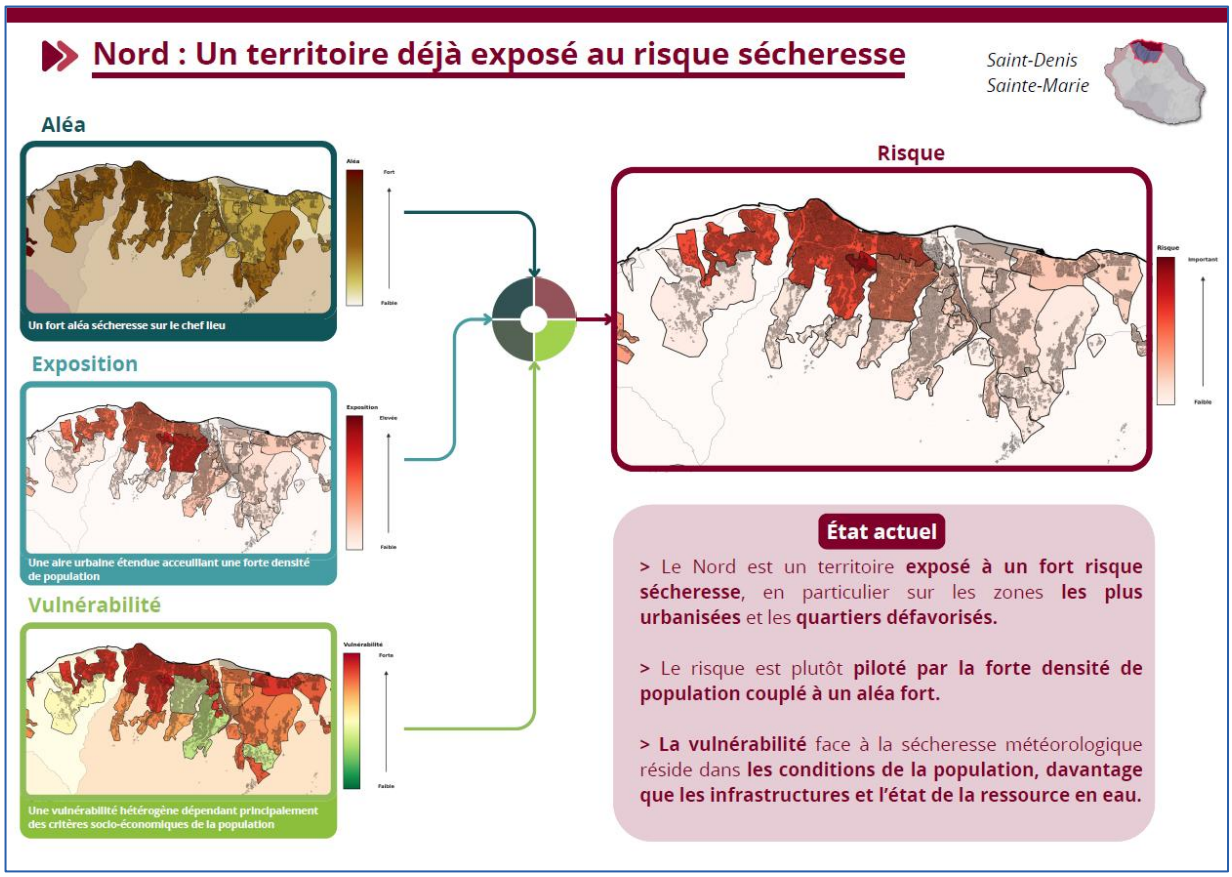


Figure 4: Excerpt from the Risk Atlas (produced in French because it is intended for the local context)

4.1.4. Institutional capacity building and financial leverage

Beyond technical deliverables, the project generated lasting institutional benefits for Région Réunion:

- **Internal expertise:** Joint operational co-steering by the Research & Innovation and Ecological Transition directorates strengthened internal capacity in European project management, communication and dissemination.
- **Strategic leverage:** Successful delivery paved the way for securing a follow-up Horizon Europe grant of **€210,000** under the *Pathways2Resilience* program (started in January 2026), ensuring sustained momentum for regional adaptation efforts.

4.2 Lessons learned

The work aimed at translating climate risk assessment into operational risk management on the ground has yielded important strategic and practical lessons. An analysis of the implementation of Phase 3 highlights both the progress made and the specific operational challenges that shape regional adaptation:

Temporal phasing and the necessity of deep anchor (Phase 4): Of the 22 months over which the RISC-RA project ran, phase 3 was devoted to local knowledge transfer and stakeholder engagement. However, as scientific modelling naturally took up the vast majority of time during Phases 1 and 2, the scope available during Phase 3 to take a step back, synthesise and assimilate the final scientific results proved to be remarkably limited. Although communication initiatives and local workshops had already been launched at the start of the project, genuine local uptake requires time for local stakeholders to assimilate complex data, discuss options and integrate the results into their own practices. Recognising that meaningful ownership by stakeholders cannot be rushed, Région Réunion has committed to securing a self-funded 12-month extension (Phase 4, starting in September 2026). This additional phase will provide the necessary time to consolidate local buy-in and refine the operational tools.

Bridging the Science-to-Public translation gap: One of the key lessons learnt from Phase 3 concerns the particular challenge of translating high-level scientific knowledge and regulatory guidelines on spatial planning, such as those currently consolidated within the SAR-2050, into messages that are simplified and accessible to the general public. Phase 3 successfully translated technical processes for the benefit of professionals, municipal technical departments and water representatives, notably through the development of the first draft of the Atlas of Risks, which will be further refined in preparation for the project's final presentation event, scheduled for 20 August 2026. However, communication efforts aimed at the general public have not yet succeeded in bridging the gap with civil society. To raise awareness amongst the general public, we must go beyond decision-making tools intended for experts and prioritise narratives that resonate with everyday civic life.

Systemic friction in local policy implementation: Direct feedback gathered during territorial workshops and stakeholder exchanges highlighted the operational difficulties of converting top-

down regulations, norms, and environmental policies into effective local risk management actions. Local field teams and municipal practitioners operate in a state of continuous compromise. Their capacity to act is constantly constrained by strict local budgetary limitations, shifting political mandates across governance cycles, and deeply rooted socio-cultural perceptions of natural hazards. These exchanges confirmed that risk management is rarely a purely technical decision, but rather a complex balancing act between scientific recommendations, financial feasibility, and local socio-political acceptability.

Partnerships for sustainable sissemination: To overcome the public engagement gap and build a lasting regional risk culture, the RISC-RA team recognized that institutional channels alone were insufficient. Consequently, strategic collaborations were initiated with key local non-profit organizations and innovation networks:

- ***Les Petits Débrouillards de La Réunion***, to leverage their expertise in popularizing science through educational games, interactive workshops, and digital media;
- ***AFPCNT*** (French Association for Natural Disaster Risk Reduction), to coordinate local community associations involved in risk prevention;
- ***La Réunion Innovation***, to mobilize the regional ecosystem of research, technology, and social innovation around natural hazards.

Building on these foundational partnerships, Phase 4 will explicitly focus on deploying these co-designed educational and awareness tools directly to civil society, targeting youth, vulnerable populations, and local communities across La Réunion to turn scientific knowledge into widespread territorial resilience.

5 Conclusions from Phase 3

Phase 3 of RISC-RA set out to turn a CRA into CRM. It closes with the risk assessment completed in Phases 1 and 2 and the risk profile and management analysis carried out in Phase 3, with an accessible knowledge-transfer tool in production (the Atlas of Risks), and, most importantly, with the CRA framing, methodology and results contributing directly to the design of the regional planning instruments that will govern land use in La Réunion for the next two decades: the SAR-2050 and its Adaptation Strategy. It also closes with a clear view of what has not been achieved, and of what is needed either to improve knowledge — the assessment of extreme precipitation in particular — or to improve adaptive capacity.

Key findings

The risks selected at the outset were confirmed as priorities, both by the CRA and by recent events: the 2024–2025 drought and the torrential flooding produced by Tropical Cyclone Garance. The CRA concludes that meteorological drought affecting drinking water supply and extreme precipitation with torrential flooding both reach a High priority level under current conditions:

- The drought risk index is projected to increase by up to +50 % by the end of the century under SSP5-8.5 in most part of the island, against a historical baseline that already shows a 36 % rainfall decrease over sixty years in the south-west. The 2024-2025 event, the driest two-month period in fifty years of observation, was not an outlier but probably a signal of change attributable to climate change.
- Tropical Cyclone Garance (February 2025) was the most severe cyclone to strike La Réunion in more than twenty-five years: 587 mm in twelve hours at Plaine des Chicots and around 300 mm in three hours over urbanised Saint-Denis, with gusts of 214 km/h at Roland-Garros airport and up to 234 km/h at Piton Sainte-Rose (Météo-France, 2025). It demonstrated that the return periods against which existing infrastructure was dimensioned no longer describe the events the territory has to absorb.

Knowledge of the hazard and of impact processes still needs to be improved, particularly for extreme precipitation; but the binding constraint lies elsewhere in adaptive capacity, infrastructure, resources and socio-economic vulnerability. Resilience capacity is assessed as Medium for both risks, and the components that hold it there are institutional and financial rather than scientific: uneven engineering capacity across EPCIs, chronic underfunding of water network renewal, structural mono-source dependency in several territories, an insurance coverage gap of roughly one household in three, and only five of twenty-four municipalities with an operational Municipal Safeguard Plan. These weaknesses are not evenly distributed across the territory: mono-source dependency concentrates water insecurity in specific inter-municipal areas, and the insurance gap means that flood damage falls hardest on the households least able to absorb it. Climate risk in La Réunion is, to a significant degree, a social risk.

Risk ownership is dispersed rather than absent. The governance analysis conducted in Phase 3 shows that French law assigns climate risk competences clearly for river flooding and water management, transposing the EU Floods Directive (2007/60/EC) and the Water Framework Directive (2000/60/EC). Implementation, however, remains heavily fragmented among the actors who have to act together: landowners, funding bodies and grant managers, and the authorities delivering environmental permits. This distribution of roles has a rationale — it preserves the independence of

each function and applies the principle of subsidiarity — but it also generates considerable inertia, and at times something close to paralysis of public action.

Impacts are compounding and cascading, and the instruments are not. Cyclone Garance caused five deaths, cut more than 310,000 people off from drinking water, and produced an estimated 380 M€ in insurance payouts (France Assureurs, 2025). The damage propagated from hydrology to water and energy networks, then to mobility, healthcare access, waste management and food supply. A crisis instrument does exist — the ORSEC framework (see section 3.2) (Préfecture de La Réunion, 2025) — which sets out the conduct of crisis management and the respective responsibilities of each public service during a cyclonic event. But it is organised around the response to a single hazard rather than around the propagation of its effects, and it must be continuously refined in the light of the cascading impacts actually observed.

A rare alignment of planning cycles opened a policy window, and it was used. The simultaneous revision of the SAR-2050, the SDAGE 2028–2033 and the next PGRI cycle, combined with the launch of GREC-Réunion in January 2026, the signature of the EU Adaptation Charter and the selection of La Réunion for the second Pathways2Resilience cohort, created a convergence that has helped shape climate risk governance and strengthen risk culture, risk knowledge and risk management, while improving the methodological framework used for territorial analysis. The inclusion of the multiple facets of vulnerability — socio-economic, resources, infrastructure — alongside adaptive capacity was decisive in making the results legible in public debate and usable in public policy.

Ultimately, the integration of the RISC-RA framing, methodology and outputs into the SAR-2050 baseline assessment, and their influence on the Adaptation Strategy from its elaboration through to its monitoring and evaluation, is the durable outcome of Phase 3.

Challenges addressed

- The results were used as inputs for a statutory planning procedure rather than published as a stand-alone study, through the SAR-2050 revision and its Adaptation Strategy — whose water and natural risk orientations (A13 to A16) rest in part on the CRA evidence base.
- Thirty-one organisations were closely involved across Phase 2 and 3, covering all twenty-four municipalities through their inter-municipal authorities, the delegated water operators, State services and the research community.
- Institutional continuity beyond the project is secured through GREC-Réunion, which the Adaptation Strategy designates as the hub responsible for specifying, animating and evaluating regional adaptation.
- The technical bottleneck on extreme precipitation and torrential floods was identified rather than concealed, and a partnership with CRAHI was established to resolve it.

Challenges not addressed

- The extreme precipitation workflow could not be fully exploited in the Atlas of Risks. Reliance on a single climate model that represents tropical cyclones poorly constrains the confidence that can be attached to the projections and releasing them to the general public without that caveat would have been misleading.
- Communication towards the general public has not yet bridged the gap with civil society. Phase 3 successfully addressed professionals, municipal technical services and water sector

representatives; it did not reach households. Expert decision-support tools do not substitute for narratives connected to everyday civic life, and this remains the principal dissemination failure of the phase.

- The multidimensional nature of the drought results, which is what makes them scientifically valuable, also makes them difficult for local stakeholders to translate directly into project decisions. Stakeholders would like a turnkey analysis, but each territory has its own configuration, and the workflow remains limited — it does not yet account for saline intrusion or for interconnections between distribution areas — so a single, simple answer is not available. The workflow nonetheless identifies the main factors driving drought risk in each area and should serve as a decision-support tool.
- The gap between stakeholder willingness and operational implementation was documented but not closed. It depends on engineering capacity and financing that lie outside the project's reach, and is addressed by orientation A03 of the Adaptation Strategy rather than by RISC-RA itself.
- The time available in Phase 3 for stakeholders to assimilate, discuss and appropriate the results proved insufficient, because scientific modelling necessarily absorbed most of the effort in Phases 1 and 2. Genuine local ownership cannot be compressed into the closing months of a project, especially on a subject as sensitive as water management.
- Heat and health remain outside the scope of the CRA, although the Adaptation Strategy devotes three orientations to them (A09, A19, A20). This gap is deliberate and is being taken up through the Pathways2Resilience programme, which addresses heatwave and coastal risk locally.

Outlook

Three developments will determine whether the results of Phase 3 become durable practice. The approval of the SAR-2050, expected in late 2026, will make the adaptation chapter binding on inter-municipal and municipal planning documents, and is the strongest single lever available. The ramp-up of GREC-Réunion will determine whether the knowledge base is maintained and updated or allowed to age. And Phase 4, a self-funded twelve-month extension beginning in September 2026 with the same team, will complete the torrential-flood work with CRAHI and — the reason it was sought — give local stakeholders and civil society the time the CLIMAAX schedule did not allow.

The key takeaway from RISC-RA that applies beyond La Réunion is that a climate risk assessment delivers real policy impact when it is aligned with an existing statutory planning cycle and enhances the baseline assessment but also the framing and methodology of that planning document.

6 Progress evaluation

Phase 3 focused primarily on local capitalization with stakeholders involved in water risks in La Réunion, directly feeding into the **GREC-Réunion** and **Région Réunion's Adaptation Strategy**, scheduled for finalization in September 2026. Several meetings served to **review Phase 2 results with local stakeholders**, notably through **SAR-2050 thematic workshops** (eight workshops held between January and June, two of which were directly linked to RISC-RA/CLIMAAX) and preparations for the **project dissemination event on August 20, 2026**. In total, **31 key stakeholders** were closely involved in the project activities (workshops, methodological exchanges, and one-on-one meetings), alongside a broader audience reached through wider communication efforts (online communications, TV interviews, official launch of GREC-Réunion, and SAR-2050 governance bodies). These 31 organisations are those closely and repeatedly involved in the project through the Executive Committee, methodological exchanges and one-to-one meetings. They are distinct from the 166 individual participants who attended the eight SAR-2050 thematic workshops (Table 1-1), many of whom took part in a single session.

Phase 3 set out to translate the Phase 2 scientific results into an accessible Atlas of Risks. This Atlas has to offer a cartographic, educational, and operational presentation of the project's key findings tailored for regional stakeholders. The August 2026 dissemination event will serve both as a dissemination milestone for RISC-RA and as a key moment to collectively showcase the knowledge produced, aiming to strengthen climate awareness among local actors and support future regional adaptation efforts.

The operational review at the end of Phase 3 highlighted three major technical insights. First, a methodological bottleneck resulting from the use of a single climate model—which struggles to accurately simulate tropical cyclones—**prevented the full exploitation of the Extreme Precipitation Workflow within the Atlas of Risks for the general public**. Second, **the results of the Meteorological Drought Workflow proved particularly valuable but complex for local stakeholders** to fully operationalize due to their multidimensional nature. Finally**, additional technical work**, not originally included in the initial RISC-RA work plan, **proved necessary to successfully complete the torrential flood study in partnership with CRAHI in the future development**.

To overcome these constraints and maximize project impact, the **Région Réunion team worked to secure a 12-month self-funded extension starting in September 2026**. This **Phase 4** will retain the same project team, enhancing local capitalization and pursuing the technical work initiated with CRAHI on the new Torrential Flood Workflow, in direct synergy with GREC-Réunion.

The results of the 3rd phase on Key Performance Indicators (KPIs) and milestones are presented on the followings tables.

Table 6-1: Overview key performance indicators (KPIs) updated and completed during phase 3

KPIs for phase 3	*Progress*
6 Executive Committee meetings with selected scientific and institutional partners in the climate field	**Completed** - 6 Executive Committee meetings have been held since the start of the project, with an average of 10 participants per session, including scientific experts and representatives of Région Réunion. *Meeting dates: December 6, 2024; February 25, 2025; July 29, 2025; November 20, 2025; March 4, 2026; and July 17, 2026.*
1 note for the President of Region Reunion about the Regional Panel for Climate Change (RPCC)	**Already completed in phase 2** - Note dated 21 March 2025 approved by the President of Région Réunion concerning the agreement establishing GREC-Réunion (La Réunion's RPCC). Official launch of GREC-Réunion in the presence of more than 20 national and local institutions on 27 January 2026.
3 dedicated CLIMAAX workshops for local authorities of Reunion Island	**Completed** During Phase 2: **9 on-site local meetings** were held with inter-municipal water managers (representing the 24 municipalities), water service delegates, and national institutions related to water related risks. During Phase 3: **2 thematic territorial workshops** were organised with local stakeholders (the Natural Hazards and Water Security workshops, as part of the series of eight workshops within the framework of the SAR-2050 revision), and **a final global event** is planned in August to conclude Phases 1, 2, and 3 of RISC-RA.
4 online communications about the project (Regional website, LinkedIn, Region open data portal, etc.)	**Already completed in phase 2 and developed in phase 3** Since the start of the project, Région Réunion has published **5 institutional communications online** (four LinkedIn posts and one webpage). The latest post, published during Phase 3, was shared to highlight the team's interview on the local TV program “Mazin Rényon”. 1 online communication was also released via the REGILIENCE project during phase 2, along with personal LinkedIn posts by team members. **1 final institutional communication will be published** following the final event in August 2026.
30 stakeholders (institutions, local authorities, research actors, etc.) involved in the activities of the project	**Completed** - **At least 31 stakeholders have been closely involved in the activities of the projet.** Executive Committee members (**4** organizations): Région Réunion, CNRS/OSU-R, Météo-France, BRGM. Practitioners who contributed to the phase 2 methodology (**11** organizations): CINOR, CIREST, CIVIS, CASUD, TO, CISE, SOURCEO, DEAL, ARS, CVH, Office de l'Eau. Additional stakeholders who participated in Phase-3 SAR-2050 workshops (**6** organizations): DAAF, Prefecture, La Créole, RUNEO, Departmental Council, CESER. Other stakeholders met and involved throughout the project (at least **6** organizations): AFD, CEREMA, INRAE, PIROI-Red Cross, Banque des Territoires, ADEME. Contributors to the final event (**4** organizations): AFPCNT, LaRI, Les Petits Débrouillards de La Réunion, GREC-Réunion.
2 European missions to meet the CLIMAAX consortium and CLIMAAX stakeholders	**50 % completion** **3** members of the RISC-RA team participated in the CLIMAAX **workshop held in Barcelona in 2025**: Kevin Lamy (Project Manager), Nils Poncet (Scientific Expert), and Elodie Marpinard (Administrative and Financial Manager). Their participation included an interview conducted by CRAHI, a project presentation in a plenary session, and active networking. In January 2027, at least one team member will attend the CLIMAAX Conference in Brussels.

Table 6-2: Overview milestones

Milestones for phase 3	*Progress*
M7: 3rd and final workshop with local public authorities	**Completed** - For Phase 3, rather than holding a single workshop, Région Réunion has pooled initiatives to organize **several local targeted meetings since February 2026**: Water Security Workshop (February 19, 2026) and Natural Hazards Workshop (March 24, 2026) utilising the results of RISC-RA/CLIMAAX within the framework of the SAR-2050 revision. Final Dissemination Event on RISC-RA Phases 1, 2, and 3, scheduled for August 20, 2026, and open to all regional stakeholders (planned during the back-to-school week to reach the widest possible audience).
M8: Attend the CLIMAAX workshop held in Brussels.	At least one representative of Région Réunion will attend the final workshop in January 2027. In addition, to involve the scientific team in this workshop, Région Réunion has worked on extending the RISC-RA project for an additional year.

As of the deliverable submission date, all operational indicators within our control have been 100% achieved. The final conference in Brussels is scheduled to take place after the submission of the 3rd deliverable.

Documents and detailed information related to the monitoring and management of the RISC-RA project are available in the appendices.

7 Supporting documentation

The supporting documentation contains 5 appendices:

- **Appendix 1**: Strategic directions for climate change adaptation defined as part of the SAR development process.
- **Appendix 2:** Atlas of Risks for the General Public – Prototype Version.
- **Appendix 3:** Local engagement, communication & dissemination actions.
- **Appendix 4:** RISC-RA PROJECT Governance – Executive Committees listing, content (presentation).
- **Appendix 5:** SAR-2050 thematic workshops — documentation, questionnaires and compiled results. Two questionnaires were completed by participants at each of the eight thematic workshops (risk characterisation; co-design of adaptation orientations). The compiled responses are provided as an aggregated spreadsheet. These materials were produced within the SAR-2050 revision procedure and are available in French only; an English summary of the methodology and of the variables is provided in the Zenodo record.

Supporting documentation is accessible at these Zenodo links.:

- Appendix 1 to 4: https://zenodo.org/records/21672058
- Appendix 5: https://zenodo.org/records/21637136

8 References

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