Deliverable Phase 1 – Climate risk assessment

Gestion Responsable Et Environnementale du Nord 59

(Responsible and environmental Management in the Nord)

France, Departement du Nord

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

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Document information

Deliverable Title	Phase 1 – Climate risk assessment
Brief Description	Getting to grips with the use of the CLIMAAX methodology to analyse the data provided by the consortium, giving priority to the assessment of two risks selected for two scenarios: heatwaves and heavy rainfall. The preliminary results of the interpretation of risks and impacts on the territory, as well as the identification of limitations and guidelines, will be produced in phase 2.
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Abbreviations and acronyms

Abbreviation / acronym	Description
ADEME	French Agency for Ecological Transition
BRGM	Bureau de Recherche Géologique et Minière / French Geological and Mining Research Office
C3S	Copernicus Climate Change Service
CERDD	Centre for Studies and Research on Sustainable Development in Hauts de France
CD2E	Centre for the deployment of eco-transition in companies and regions
CD59	Conseil Departemental du Nord
CDS	Copernicus Data Base
CEREMA	Center for studies on risks, environment, mobility and urban planning
CNRS	National Center of Scientific Reseach
CPAM	Primary Health Insurance Fund
CRA	Climate Risk Assessment (Evaluation des Risques climatiques)
CRM	Climate Risk Management
DDRM	Departemental Major Risks File
DDTM	Departmental Directorate of Territories and the sea (territorial administration representing the central government)
DGA ST	Direction générale adjointe Solidarités Territoriales du Departement du Nord / Deputy General Directorate for territorial solidarity of the Departement du Nord
DPE	Diagnostic de Performance énergétique / Energy Performance Diagnosis
DREAL	Department of Environment, Planning and Housing territorial administration representing the central government)
GES	Greenhouse gas
GIEC /IPCC	Intergovernmental Panel on Climate Change
GREC	Regional expert group on climat
IMT Nord Europe	Institut Mines Telecom / School of Engineering of the Mines of Douai attached to the University of Lille
INSEE	National Institute of Statistics and Economic Studies
IRIS	Ilôts regroupés pour l'information statistique/Statistical information groupings
ITES	Institute for Environmental and Social Transitions - University of Lille
LCZ	Local Climate Zone
NUTS	Nomenclature of territorial units for statistics
PAPI	Flood Prevention and Action Programme
PLUI	Local intercommunal Urban Development Plan
PNACC	Plan National d'Adaptation au Changement Climatique
PPRI	Flood Risk Prevention Plan
RCP	Representative Concentration Pathway
RGA	Retrait gonflement des argiles / Shinkage swelling of clays
SAGE	Water Development and Management Plan
SCOT	Territorial Coherence Scheme
SIGC	Geographic and cartographic Information Service
SSP	Shared Socioeconomic Pathway

TRACC	Baseline Trajectory of Climate Change Adaptation
TGV	Train à grande vitesse / High-speed train
UHI	Urban heat island
UL	Université de Lille /University of Lille
UTC	University of Technology of Compiègne

Executive summary

Several recent events have highlighted the Departement du Nord's need to assess climate risks to anticipate their impact on vulnerable populations and infrastructure, in line with its human and territorial solidarity responsibilities.

The first deliverable, after six months of work, outlines the organizational framework and initial exchanges with the regional scientific community based on preliminary results. The CLIMAAX methodology was applied to two priority risks—heavy rainfall and heatwaves—using IPCC's SSP2-4.5 and SSP5-8.5 scenarios. The findings confirm the need to raise awareness about these threats, which have significant social, economic, health, and material impacts on the department.

At this stage, the regional scientific consensus points to the following conclusions:

- Heavy rainfall: a marked increase in extreme precipitation events (frequency and intensity), with the return period for a 50 mm event in 24 hours expected to halve between 2040 and 2071 under RCP 8.5, alongside longer dry spells and uneven territorial impacts.

- Heatwaves: *EuroHeat* model predicts more frequent heatwaves, while *xclim* results show high variability with no clear trend or difference between RCP 4.5 and 8.5. IPCC projections suggest more frequent, intense, and earlier heatwaves after 2050, but further analysis is needed to confirm these findings and check model biases.

In conclusion, Phase 1 provided a clear understanding of the complex phenomena impacting the territory and produced an initial prospective mapping of these risks. Phase 2 will build upon this foundation by incorporating additional historical and forecast data at a more local scale. This data will be cross-referenced to better reflect the heterogeneity of the situations observed. The importance of continuous dialogue between local authorities and the scientific community—bringing together all relevant stakeholders—is strongly emphasised. Such collaboration fosters a shared understanding of potential risks and promotes a culture of strategic planning among operational teams and decision-makers, enabling more effective integration of adaptation measures into future decisions and policies. Finally, given the large number of stakeholders involved, improved coordination of awareness-raising, information dissemination, and communication efforts is essential to ensure shared ownership and a unified action plan.

Moreover, Phase 2 should focus on seasonality and a more localized approach to capture territorial dynamics, with special attention to drought risks linked to clay shrinkage/swelling affecting 60% of the area.

1. Introduction

1.1 Background

Administratively part of the Region Hauts-de-France, the Departement du Nord is France's most populous departement, featuring significant intra-territorial contrasts. It is both urban and rural, with 2.6 million inhabitants and an average population density of 454.7 inhabitants per km², compared to 106.5 for France as a whole. The territory includes a 35 km coastline and a vast low-relief plain with limited forest cover (9%), crossed by a dense network of waterways. Significant urbanisation — with half of the population living in cities of more than 100,000 inhabitants — combined with industrial and transport infrastructure, strongly influences risk levels [16].

High rates of poverty (18%) and unemployment (12%), particularly in urban areas, along with a high proportion of social housing (20%)[11], further increase vulnerability to the impacts of climate change: frequent heatwaves, spring and summer droughts, increased rainfall, and flooding. Overall, 90% of municipalities in the Nord are considered vulnerable to climate risks, mainly flooding [10].

Faced with these numerous challenges, the Nord Department has committed to an ecological transition policy through the 'Nord Durable' strategy adopted in 2019. The current challenge is to develop a climate change adaptation strategy centered on raising awareness of climate risks, through a better understanding of the phenomena and their impacts on the Department's missions and responsibilities (territorial and human solidarity). The CLIMAAX methodological support thus provides an ideal framework for this approach.

In parallel, the Region Hauts-de-France is also involved in the CLIMAAX project alongside ATLAS and collaborates with GREEN 59 on the analysis of heavy rainfall within their respective jurisdictions. The project teams have agreed to share regular progress updates and have established a joint scientific committee for both projects, supported by GREC, to consolidate their approaches [4].

1.2 Main objectives of the project

Although climate hazards have been clearly identified and confirmed through observations of past and recurring events, their impact on the Departement's areas of responsibility—particularly in terms of social and health issues and economic activity—remains insufficiently understood. A lack of consistent adaptation planning, limited past experience with major risks, and a low level of prevention are likely to worsen the consequences of future events, which will be more intense and more frequent. These aggravating factors will weaken the community's ability to respond and its overall resilience. The Department must therefore anticipate these challenges and adopt appropriate adaptation measures.

The first objective is to assess the risks:

- **Establish an initial departmental Climate Risk Assessment (CRA)** for heavy rainfall and heatwaves, using observed and projected climate data, as well as vulnerability and exposure data across different scenarios. If necessary, improve data collection and monitoring for the two priority risks.
- **Gain a better understanding of the Department's vulnerabilities** (through risk prioritisation and zoning), in order to raise awareness among departmental officials and to inform elected representatives and local stakeholders about future risks.

The second objective is to **implement localised prevention and adaptation measures** to complement existing initiatives already in place within the Department, such as:

- **Territorial:** Improve the management of public facilities, natural areas, and infrastructure to reduce potential damage. Provide targeted development assistance to municipalities and intercommunal bodies based on the identified climate risks and impacts.
- **Social:** Support the most vulnerable and at-risk populations through health prevention initiatives, improved access to services, and the development of crisis prevention plans. This includes adapting reception facilities for specific target groups within the Department.
- **Civil protection:** Strengthen emergency service preparedness and crisis response, particularly in the face of natural and technological hazards, including through enhanced support to emergency services (SDIS).

Finally, the Department aims to **strengthen collaboration with climate scientists and researchers** to ensure that the information shared with elected officials is scientifically accurate and to support the development of suitable, evidence-based adaptation strategies.

The **CLIMAAX methodology**, with its principle of continuous improvement, offers a solid framework for assessing the various stages of the Climate Risk Assessment process and for monitoring climate risks specific to our territory. By repeating analyses, testing scenarios, and cross-referencing results, the Department can consolidate its understanding of climate risks and build a robust set of proposed adaptation measures.

1.3 Project team

The GREEN59 project team is composed of:

An internal technical team from the Departement du Nord / Deputy Directorate-General for Territorial Solidarity (DGA ST), bringing together staff from various operational departments with complementary skills. The team oversees project leadership, scientific coordination, and administrative and financial management:

- Clément Fabreguettes – European Aid Project Manager (admin/financial monitoring, consortium relations)

- Anne-Françoise Del Litto – Head of Major Projects and Support unit (climate adaptation and resilience strategy)
- Freddy Dolphin – Project Director (operational management)
- Jérôme Vandeville – Head of Geographic Information and Cartography service
- Agathe Dujardin – Energy Manager, Buildings management unit (scientific relations)
- Eddy Le Berrigaud – "*Nord Durable*" Project Manager (carbon footprint assessment)
- Clémence Mabo-Reynaud – European aid intern
- Auguste Van-Eenod – Environmental engineering intern

An external expert committee, composed of academics, researchers, and lab directors within the GREC, contributes critical analysis of the methodology and results:

- Coralie Schoemaecker – Director, CNRS-ITES / GREC Co-director
- Robin MIRI – PhD student, University of Lille
- Guillaume Penide – CNRS Atmospheric Optics Lab
- Luc Douchet – Institut Pasteur de Lille (health & climate change)
- Nathalie Molinés – UTC (urban heat island specialist)
- Jérôme Riedi – University of Lille, Physics Dept. (satellite data)
- Claire Alary – Lecturer-researcher, IMT Nord Europe
- Caroline Norrant – Geographer-climatologist, University of Lille
- François Leconte – Urban microclimate expert, University of Lorraine
- Magalie Franchomme – Geographer, sustainable development
- François Olivier Seys – Geographer, demographic dynamics

Other interested stakeholders may join the steering or scientific committees during phases 2 and 3.

1.4 Outline of the document's structure

The deliverable is structured into six sections:

- **Section 1** outlines the project context and objectives and introduces the dedicated team.
- **Section 2** details the operational steps of a CRA: scoping, risk exploration, and risk analysis. It ends with preliminary results from the key risk assessment and the monitoring and evaluation phase.
- **Section 3** provides a summary of the main conclusions and key findings from this project phase.
- **Section 4** explains how this deliverable and its outputs connect to planned activities in the next phases.
- **Sections 5 and 6** list the supporting documents and references produced during this phase.

2. Climate risk assessment – phase 1

2.1 Scoping

2.1.1 Objectives

The main objective is to identify vulnerable populations, infrastructure, and public buildings to climate hazards in order to prioritize adaptation measures and guide public policy. The expected outcome is the production of usable data and analyses to raise risk awareness, including among non-specialists. Vulnerability maps will support existing frameworks, planning, and risk documents.

The CRA will aid strategic decisions and policymaking, enabling the integration of climate resilience and adaptation in the Department's operational plans. It will also inform opinions on natural risk prevention and development documents.

Challenges include:

- **Data availability and quality:** some datasets are inadequate; for instance, heavy rainfall data covers only 24-hour periods, missing longer or light continuous rainfall events,
- **Workspace size:** storage limitations and script errors,
- **Model configuration:** thresholds and parameters must be carefully chosen, requiring advanced expertise as they significantly impact results,
- **Analysis and interpretation:** require critical evaluation and sufficient perspective,
- **Multiple approaches:** analyses rely on few models, limiting perspective diversity. Using multiple models and cross-comparisons would improve robustness,
- **Spatial resolution:** the grid is relatively coarse, limiting assessment of localized situations in a heterogeneous area, and is unsuitable for departmental-level analysis.

2.1.2 Context

With its "Nord Durable" ("*Sustainable Nord*") roadmap, the Departement du Nord has committed to decarbonizing its activities and renovating its infrastructure. This mitigation approach must now be accompanied by an adaptation strategy for the Department's responsibilities and public policies. However, financial, methodological, and partnership challenges have limited progress on addressing changing climate hazards.

The project must be able to describe the evolution of the main risks in the territory and develop action plans for adaptation, mobilizing the relevant stakeholders. In France, climate risks are managed through policies and plans at several levels of responsibility. The State, together with Parliament, sets national laws and regulations, adapting them to European requirements. It also produces a departmental major risks dossier, revised every five years. Numerous prevention plans and planning documents must be drawn up by sub-national levels.

The French government is taking action regarding local authorities in two main areas. The first concerns regulation and standards. The second focuses on national strategy, particularly the implementation of the Third National Climate Change Adaptation Plan in 2024 and the resulting TRACC trajectory. These guidelines must be integrated into all public policies, including technical standards and sectoral policies. Local authorities are then required to incorporate these guidelines into their own planning documents.

The departmental sectors concerned include 4,500 km of departmental roads and 1,650 engineering structures serving the territory, economic activity zones, over 400 public buildings and facilities (secondary schools, social services, cultural venues, etc.), and 3,260 hectares of natural areas, including 2,367 hectares of owned land.

Climate change also increases social inequalities and further affects vulnerable populations, for whom the Department plays an important role.

Beyond departmental competences, economic and agricultural activities are directly affected by climate change.

The Region Hauts-de-France, of which the North is one of five components, is also a winner of the Climaax (ATLAS) project. The leaders of the two projects have agreed to collaborate on the 'heavy rain' hazard, which affects both communities. They will each contribute their own territorial approach and perspective on the impacts and will also work together to: Mobilise the same Scientific Committee based on the GREC, exchange information regularly, share resources, Coordinate requests to stakeholders.

Several other projects and action plans already underway will strengthen the Department's commitments towards climate resilience, supporting the ongoing work:

- The **Departmental Housing Plan**, which includes social support for families while addressing sustainable development and adaptation issues,
- The **Sustainable Nord Policy** of the Departement du Nord, which will incorporate an adaptation component to climate change within support measures (management of natural areas, reforestation efforts, urban greening, and reduction of impermeable surfaces),
- The **2025–2030 Departmental Plan for Improving Access to Public Services (SDAASP)**, including prevention and information measures in crisis situations,
- The **Strategic Plan of the Departmental Fire and Rescue Service (SDIS)**, integrating intervention and emergency response plans for major crises or climatic events,
- The update of **Municipal Risk Prevention Plans**, particularly concerning flood risk,
- Communication with municipalities through the **DDRM Nord (Departmental Risk Management Document)** to promote risk prevention and awareness among residents and local stakeholders,
- Adaptation of occupational health risk prevention plans and public reception protocols (e.g., during heatwaves),
- Support for research and scientific work by **GREC** and **ITES**, especially at the intersection of social sciences, political sciences, and climate sciences, to aid the implementation of public policies. This initiative will strengthen collaboration between universities and local authorities and responds to scientists' strong demand for practical application of their research;
- Mapping of vulnerable zones and populations to ensure public buildings are adapted to heatwaves and floods (including a planned atlas for awareness-raising);

- Mapping of social vulnerabilities and social risks linked to heatwaves and heavy rainfall hazards.

2.1.3 Participation and risk ownership

The Departement du Nord has internal services to support people in difficulty. Structures such as the Municipal Social Services Centers (CCAS – Centre Communal d'Action Sociale), social welfare associations, and rights advocacy groups provide support and representation for vulnerable populations. It will be important to involve them more in the second phase. The acceptable level of risk will be examined during phases 2 and 3.

The results are communicated to the scientific committee and the GREC. A presentation was given to the Territorial Solidarity management committee.

The results will also be shared with certain departments within the Department, as well as with elected officials responsible for sustainable development. Externally, we maintain contact with government departments. To ensure broader dissemination, the results will need to be reformatted into a specific document that is both accessible and scientifically sound.

2.2 Risk Exploration

2.2.1 Screen risks (selection of main hazards)

The densely populated departement du Nord (453.5 inhabitants per square kilometer) is particularly exposed to climate hazards. It is home to 2.6 million inhabitants, 30% of whom are very young or elderly (under 5 and over 65). More than half of the population lives in urban areas with more than 10,000 inhabitants [16].

The departmental area is home to strategic national infrastructure (the Paris-Lille and Paris-Calais-London motorways, Paris-Calais-London, Paris-Brussels motorways, high-speed rail links to northern Europe and Great Britain, France's third largest seaport, and a nuclear power plant on the coast). Ninety-five per cent of the 650 municipalities are affected by meteorological risks, with 47% exposed to high or medium risk [10].

- **Heatwaves** are becoming increasingly frequent and intense, regularly exceeding the thresholds defined by *Meteo France*. This is exacerbated by the urban heat island effect in cities, with an increase of 15 days of high temperatures recorded between 1955 and 2018 [7]. According to Copernicus, the average maximum summer temperature (20–21 °C) could increase by +4 °C by 2060, resulting in an additional 8 days of temperatures exceeding 35 °C compared to 1900 (+5 days compared to 2025) [7]. This increase poses a greater risk to health.

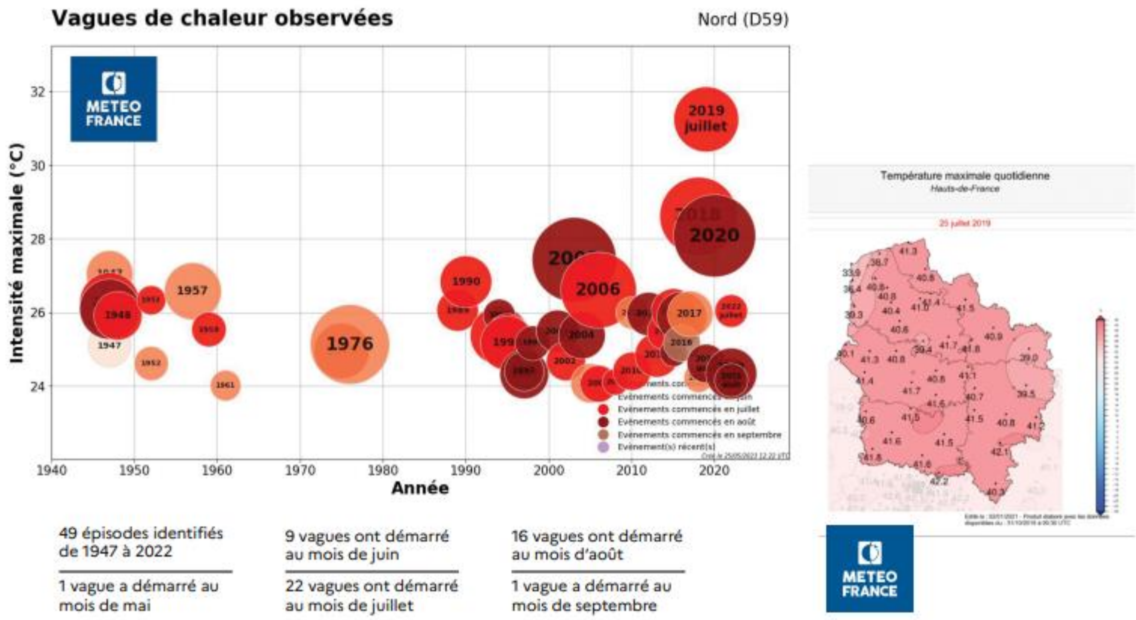

Figure 1: Historical heatwaves occurence per year in CD59 according to Meteo France Data from 1947 to 2022

Traditionally known as a rainy and cool region, the departement du Nord has nonetheless experienced some remarkable episodes, such as in July 2019, with record temperatures of 40–41 °C and a red heatwave alert [8]. In the summer of 2023, the heatwave caused 396 deaths in the Hauts-de-France region (3% of the national total) [3]. *Between 2014 and 2022, summer heat caused more than 33,000 deaths in France, 28% occurred during heatwaves, even though they only account for 6% of summer days* [9].

- **Droughts,** especially in summer, are becoming longer, increasing water stress and affecting water resources and agriculture. The entire Departement is concerned. Farmers, water-dependent industries and the population are feeling the impact, with significant restrictions on usage. According to Copernicus, the average duration of dry spells could increase by around four consecutive days by 2060 compared to 2025. Dunkirk station is already recording an upward trend, with 23.2 days of drought observed [7].

- **Heavy Rainfall and floods:** Extreme rainfall is intensifying, leading to frequent and sometimes sudden flooding in the Deûle, Lys, Scheldt and Sambre valleys, and in the low-lying urban areas of Lille, Douai and Valenciennes. The major episode of winter 2023–2024 in the Audomarois region, with the equivalent of 5 to 6 months of rain in less than a month [15], illustrates this trend.

  Approximately 6.1% of the population (159,000 people) live in flood-prone areas, and 90% of municipalities are at high or medium risk. More than 25% of municipalities exposed to flood risk in Metropolitan France are located in the north alone. According to Copernicus, maximum rainfall over five days could increase by 6 mm by 2060 (an increase of 2–3 mm compared to 2025), while maximum rainfall over one day could increase by 3 mm (an increase of 2 mm). This would increase the risk of flash flooding, surface runoff and rising groundwater levels, which could cause extensive damage to infrastructure and disrupt the movement of people and goods.

- **Marine submersion and coastal erosion** are increasing the vulnerability of the northern coastline, particularly in Dunkirk, Gravelines and Malo-les-Bains. Coastal erosion is damaging beaches, weakening infrastructure and threatening port and tourist activities, exposing several thousand inhabitants. In Dunkirk, sea levels rose by 11 cm between 1956 and 2021, or +1.7 cm per decade [13]. In 2019, 14% of the French inhabitants living in areas prone to marine submersion were in Departement du Nord.

- **Storms and strong winds** are a major risk across the entire country, regularly causing damage to infrastructure and power cuts. Open and coastal areas are the most exposed.

- **Wildires** has become an increasingly significant risk for the territory. Between 2019 and 2022, the Departement du Nord recorded the highest number of fires (204) among the five departements of the Region Hauts-de-France, while reporting the smallest area burned (223 hectares). This contrast can be explained by the limited amount of combustible vegetation, the nature of agricultural soils, and the rapid response of emergency services (SDIS). Despite the relatively high frequency of fires, the Nord department remains classified as a low-risk area [10].

- **Clay shrinkage-swelling risk** is a phenomenon caused by changes in the volume of clay soils depending on their water content: swelling occurs after heavy rainfall (once water infiltrates the ground), and shrinkage happens during dry periods. In the departement du Nord, 170 municipalities have already been affected. Half of the territory is exposed, and 60% of detached houses (approximately 490,045 homes) are located in areas of moderate to high exposure. At the regional level, 90% of the land area and 89% of detached houses are exposed, representing around 3.8 million inhabitants.
  The average cost of a "drought" claim is estimated at €21,000 per house (1990–2015), with over €5 million in compensation paid out in the department in 2022 for damages related to clay shrinkage-swelling (RGA).

- **Other climatic hazards: c**old spells and snowfall persist, with increased variability disrupting agricultural production; proliferation of invasive species affecting wetlands and peri-urban areas, causing ecological imbalance [5].

2.2.2 Workflow selection

Based on the analysis of the above hazards, we defined our workflows by focusing on the most significant and priority risks in the Departement du Nord, particularly those affecting vulnerable populations and infrastructure:

- **Heatwaves** were selected due to their increasing frequency and intensity, especially in urban areas. They pose a threat to the health of vulnerable populations and place stress on infrastructure.

- **Heavy rainfall** was chosen because it leads to more frequent flooding, particularly in river valleys, low-lying urban areas, and areas with sensitive soil types. These events cause substantial damage to homes, infrastructure, and networks, and are expected to intensify with climate change.

Given the scale of recent flooding, this hazard was considered during the application process. However, at the regional level (NUTS 2, which includes the NUTS 3 departement), the focus is on coastal and river flooding as well as extreme precipitation. To optimize investment in climate change adaptation studies, we decided to prioritize extreme precipitation. The focus on heavy rainfall was therefore maintained, in line with departmental policies (e.g., road infrastructure), to facilitate dialogue on this issue.

Following the CRA and analysis of the two selected workflows, uncertainty remains regarding the inclusion of drought in phase 2. Although agriculture is not directly within the Department's remit, the economic impact is a powerful tool for raising awareness among decision-makers—particularly given the region's high agricultural output (notably beets and potatoes). The inclusion of this workflow will depend on the human resources available in phase 2.

2.2.3 Scenarios

As climate change is already affecting the territory and public policies are implemented over several years, the timeframes used are the short and medium term. The aim was to determine when climate change would become a major concern and to assess the level of impact.

To explore the risk related to heavy rainfall, the **RCP 8.5** scenario was used. For **heatwaves**, two combined RCP–SSP scenarios were selected to analyse future climate conditions (2025–2080): **SSP2-4.5** and **SSP5-8.5**. These scenarios were chosen to serve two main purposes: to add nuance to the results, and to support decision-making by both highlighting the potential consequences of inaction through the worst-case scenario (8.5) and presenting the impacts associated with the more likely scenario (4.5).

2.3 Risk Analysis

2.3.1 Workflow #1: Heavy Rainfall

Table 5: Data overview – WF #1 Heavy Rainfall

Workflow	***Hazard data***	***Vulnerability data***	***Exposure data***	***Risk ouput***
EURO-CORDEX from the Climate Data Store: two different 30-year frames (1976-2005 and 2041-2070 timeframes RCP 8.5)	CDS portal data for precipitation (resolution 12x12km) time frame: historical simulations: 1976-2005 Climate projection: 2041-2070. RCP 8.5	Meteo France threshold of orange alert		Visualization of the maximum annual precipitation for 3h duration and evolution of the return period for two selected scenarios.
Risk assessment	Euro-CORDEX climate projections (12kmx12km)			

2.3.1.1 Hazard assessment

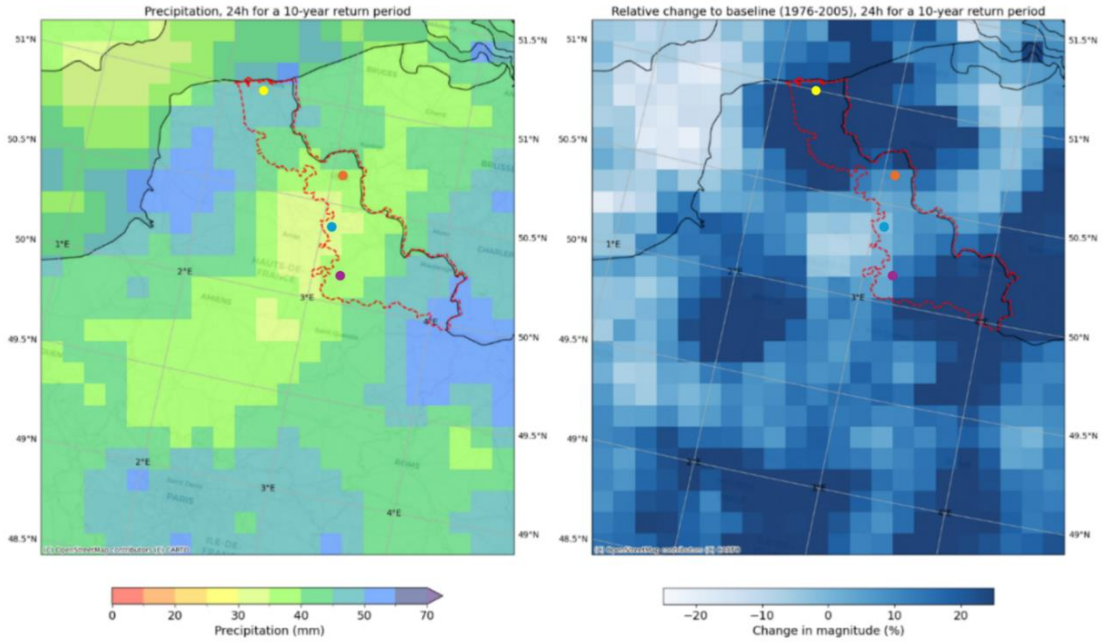

Figure 2: (left) Heavy rainfall hazards over the Hauts-de-France region including the Departement du Nord, for a return a return period of 10 years in the 2041-2071 period in mm/24h (right) Heavy rainfall hazards relative change (in %) between projected period (2041-2071) and baseline period (1976-2005) for a return period of 10 years over the Hauts-de-France region including the Departement du Nord under RCP8.5.

Considering a 24-hour precipitation event with a 10-year return period, quantitative estimates show higher rainfall levels in the southeast and northwest of the territory (i.e., between 40 and 60 mm in 24 hours — see Figure 2, left). Based on historical events, these areas are also experiencing a shift in magnitude, with an increase of 10 to 20% in precipitation compared to the baseline (Figure 2, right).

This raises concerns for the **Dunkirk area** (yellow), where many industries — including a nuclear power station — are located, and where more facilities continue to be developed.

However, for the **European Metropolis of Lille** (orange), **Douaisis** (blue), and **Cambraisis** (red), the trend remains unclear. Rainfall amounts appear slightly lower than in other parts of the Departement du Nord (30–40 mm, Figure 2, left), and precipitation intensity seems to decrease (Figure 2, right).

As discussed with the scientific consortium, identifying precise average trends across the territory remains challenging, as different watersheds may exhibit different dynamics [17]. The current regional scientific consensus points to an increase in extreme rainfall events, alongside longer dry periods and a decrease in effective rainfall.

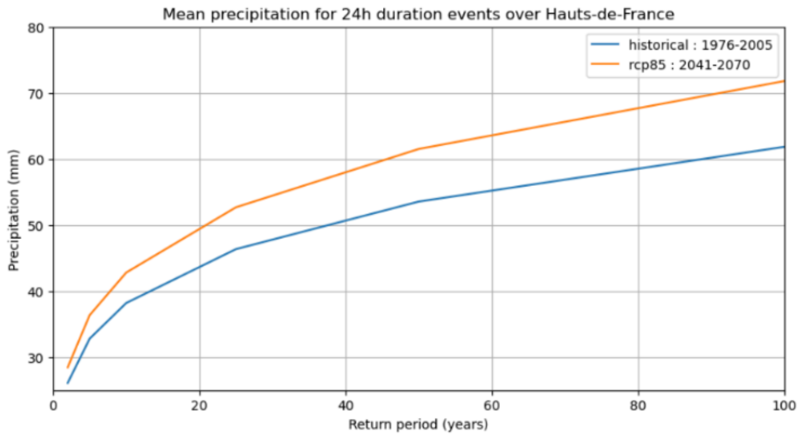

Figure 3: Plot comparison of mean precipitation for 24h duration events for historical data (19176-2005) and projected data (scenario RCP 8.5, midterm timeline 2041-2070) for Hauts-De-France region

Looking at the estimated future return period of 24-hour precipitation events—based on historical data and under the RCP8.5 scenario for the midterm period (2041–2070)—an increase in the frequency of such events is expected.

For example, a 24-hour event with 50 mm of rainfall, which historically occurred every 40 years, is now projected to occur every 20 years. This represents a halving of the return period, indicating a significant rise in event frequency.

2.3.1.2 Risk assessment

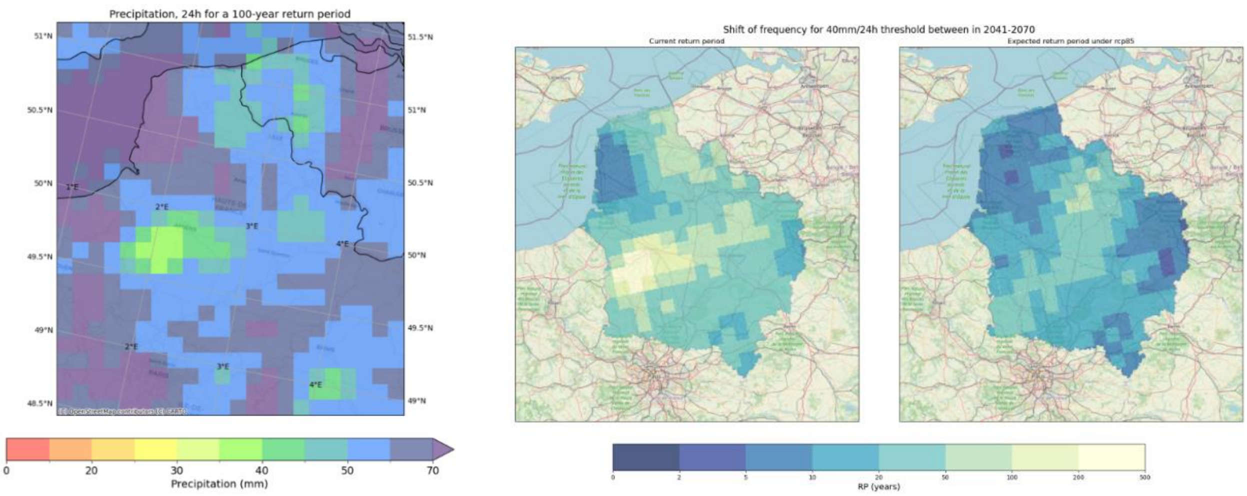

Figure 4 : (a) Expected precipitation (mm) distribution, considering events of 24h for a 100-year return period based on historical data, (b) Shift of precipitation frequency for 40mm/24h events, between current return period based on 1976-2005 data (left) and projected scenario rcp8.5 for mid-term time slice 2041-2070 (right)

As the Departement du Nord and the Hauts-de-France Region are closely linked, the same threshold was used to allow for comparisons at both scales: the **orange alert thresholds** set by Météo-France (the French national meteorological agency). These thresholds generally fall within the range of **40 to 60 mm over 24 hours**, which supported the decision to adopt **40 mm/24h** as the reference risk threshold.

Further work will be undertaken in the next phases to refine this value through consultation with stakeholders.

For events of 24h with a 100-year return period, based on historical data, the amount of precipitation is in a range of 40mm to 60mm of water.

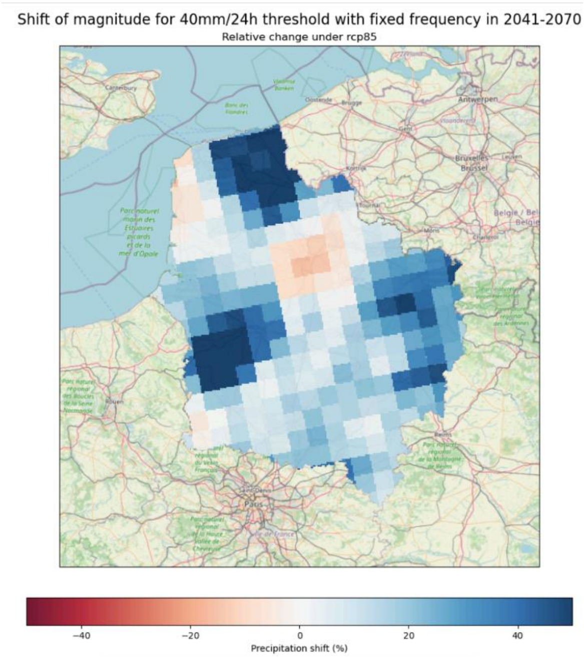

Figure 5: Map depicting the shift of magnitude for 40mm/24h events with fixed frequency in mid-term timeline (2041-2070) for scenario RCP 8.5

For the 2041–2070 horizon under the SSP5-8.5 (high emissions) scenario, a clear heterogeneity in projected changes is observed. Precipitation is expected to increase significantly on the coastal side of the Departement (up to +40% compared to the current state), while a decrease of around -20% is projected in the central part of the territory.

Regarding the impact-based rainfall threshold of 40 mm/24 hours, currently associated with a 25-year return period, two key insights emerge:

- if we aim to maintain the same return period, the magnitude of rainfall would need to increase by 56% compared to the current threshold;
- Conversely, if we want to maintain the same rainfall magnitude (40 mm/24h), the return period would drop from 25 years to just 5 years.

2.3.2 Workflow #2: Heatwaves

Table 6: Data overview – WF #2 Heatwaves

Workflow	***Hazard data***	***Vulnerability data***	***Exposure data***	***Risk ouput***
Hazard assessment (EuroHEAT)	Heatwave days based on CDS data (available on a 12 × 12 km grid).	-	-	Visualization of yearly heatwave occurrence from 1986 to 2089 under

				RCP4.5 and RCP8.5 scenarios.
Hazard assessment (Xclim)	EURO-CORDEX data (12 × 12 km grid of daily minimum and maximum air temperature at 2 m height from 1971 to 2100) and user-defined temperature/duration thresholds using Xclim. Models: GCM-RCM: ipsl_cm5a_mr – ipsl_wrf381p	-	-	Provides the annual frequency and total duration of heatwaves, identified directly from climate models.
Risk assessment (satellite-derived data)	-	WorldPop Hub data, considering only populations under 5 and over 65. ArcGIS data provided by the GIS to include sensitive locations within the study areas (e.g., medical centers, schools, and certain personal care facilities). Data in Géotiff of 100m x 100m grid.	LST database from RSLab, calculated using Landsat 8 (spatial resolution: 15–30 m). LST data used covers the period 2020–2025	Risk map: cross-referencing vulnerabilities and exposure using a risk matrix.
Risk assessment (climate projections)	Use of the EuroHEAT database from Copernicus (12x12km; 1986-2085) Scenario RCP 4.5 and 8.5.	WorldPop Hub data for France including only populations under 5 and over 65.		Enables the generation of canton-level maps showing the relative change in heatwave occurrence, the distribution of vulnerable populations across the territory, and a risk map at the territorial scale.

2.3.2.1 Hazard assessment

The heatwave risk assessment was carried out using the coordinates of Lille (50.62; 3.05). In the CLIMAAX workflow we demonstrate how EURO-CORDEX data can be processed to assess heatwave hazard using two different methodologies: EuroHEAT and Xclim.

- **Results from the EuroHeat climatic model**

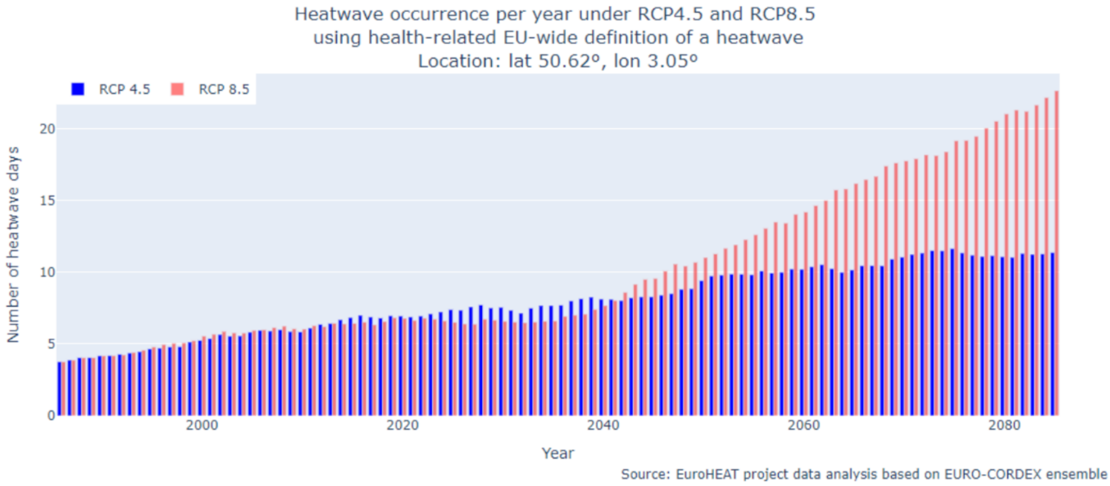

Figure 6: Graph of the number of heatwave days per year according to the RCP 4.5 and 8.5 scenario

According to this model, in the RCP4.5 scenario, this number could increase by approximately 3.5 times, from 3–4 days per year to approximately 12 days by 2080. In the RCP8.5 scenario, it could increase by approximately 6.5 times, reaching almost 23 days per year by 2080 (figure 6.

- **Results from the xclim model**

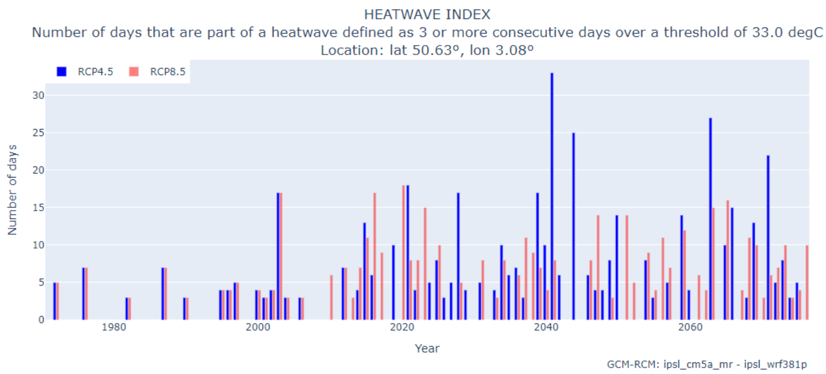

Figure 7: Graph of the number of heatwave days in a year based on historical data (1976–2005) and projection data (2006–2080) based on the scenarios indicated.

The IPCC report, under the RCP 4.5 and RCP 8.5 scenarios, shows that heatwaves will become more frequent, more intense, and occur earlier in the season, particularly after 2050 [2]. However, the **IPSL_CM5A_MR – IPSL_WRF381P** model shows no significant difference in the number or frequency of heatwave days between the two scenarios, with high interannual variability (ranging from 0 to 50 days). RCP 4.5 projections even show more heatwave days than RCP 8.5 for the 2040–2070 period. While this could be due to natural climate variability, this hypothesis seems unlikely, as previous results do not align with those from other models.

The analysis of these results highlights a potential bias in the **IPSL_CM5A_MR – IPSL_WRF381P** model. To consolidate the findings and identify the model-dependent component, a comparison will be made with other models used by our scientific consortium in Phase 2.

2.3.2.2 Risk assessment

To enable comparison between the cities studied, the reference period was set to cover the summers from 2020 to 2025, with cloud cover of less than 50%. This was chosen as an alternative to using data from just one particularly hot summer in a single year, as this could differ from city to city. The average LST value obtained in this way is approximately 33°C.

In addition, data on vulnerable populations (under 5 and over 65), provided by WorldPop has been incorporated, along with geolocated information on sensitive buildings (schools, hospitals, medical and social services, colleges and nurseries), from the SIGC. The data was combined in a risk matrix to produce a summary map of risk areas in studied territories. This visual tool makes it possible to target the most sensitive sectors and guide prevention actions.

This analysis focuses on the city of Valenciennes to illustrate the contrasts in vulnerability and exposure to heat at the urban level.

2.3.2.2.1 Risk assessment for Valenciennes

Overheated areas are relatively evenly distributed across the territory. In the southwest, a zone of very high heat exposure corresponds to Valenciennes' industrial district, characterized by dense concrete surfaces (slag depots, steelworks, etc.). As expected, green spaces and the lake area show significantly lower exposure to extreme heat. In the northeast, the former sorting center plateau—now largely abandoned—has been partially reclaimed by vegetation, resulting in locally reduced LST. The Scheldt Canal also functions as a green corridor, helping to moderate temperatures along its course. These features highlight the strong spatial contrast between heat exposure and natural cooling areas, which is clearly reflected in the combined heat risk map. Population vulnerability follows the city's demographic patterns, with the highest concentrations found in the city center and along major traffic routes.

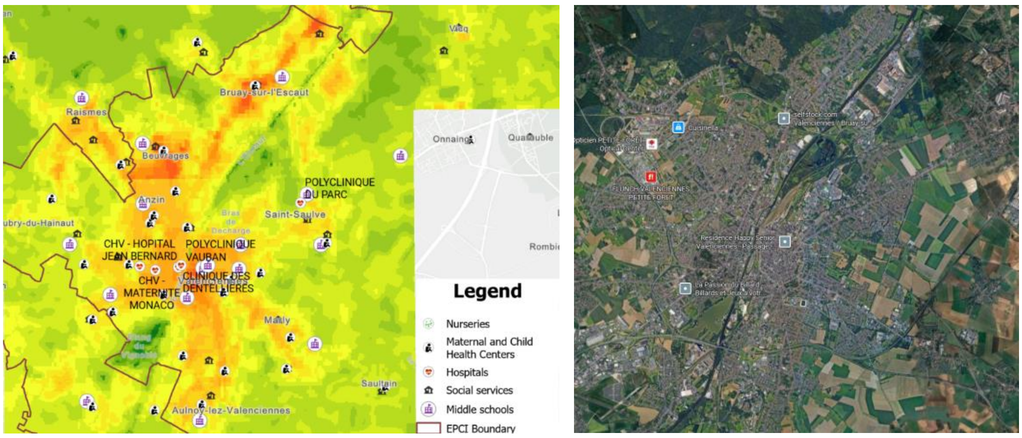

Figure 8: Map of Valenciennes city highlighting the possible heat risk level to vulnerable population and related infrastructures (left) and satellite map of Valenciennes city (right)

2.3.2.2.2. Risk assessment for heterogenous Nord's territory

Considering different areas within the Departement du Nord, the results show that territorial inequalities are already evident, even under heatwaves of average intensity exceeding 33°C (based on average LST values). Some areas appear significantly more vulnerable than others to the impacts of global warming. The results were visualized in ArcGIS Pro using a consistent color scale across all selected areas, allowing for direct territorial comparisons. It would be valuable to extend the study by identifying the highest LST value recorded in each territory and comparing it with a heatwave index. Given the known differences between LST and air temperature [9], the risk may be underestimated.

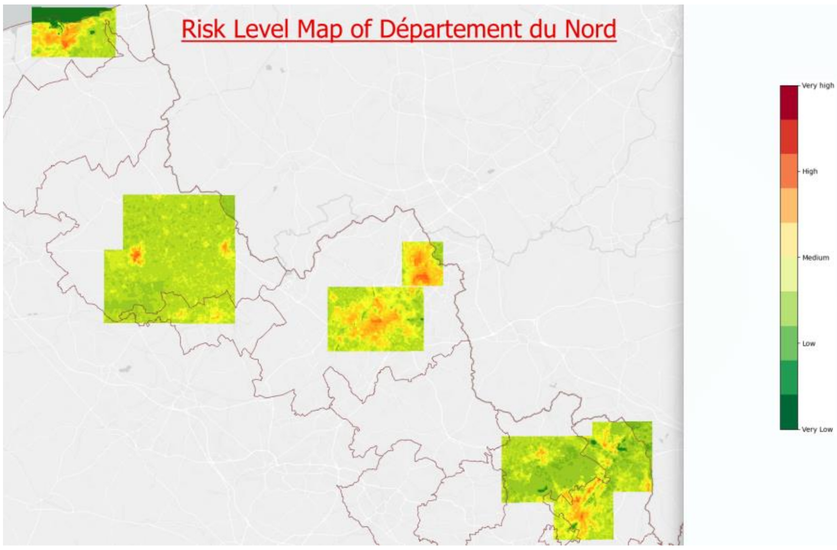

Figure 9: Map of Risk level caused by heatwaves in Departement du Nord, based on LST

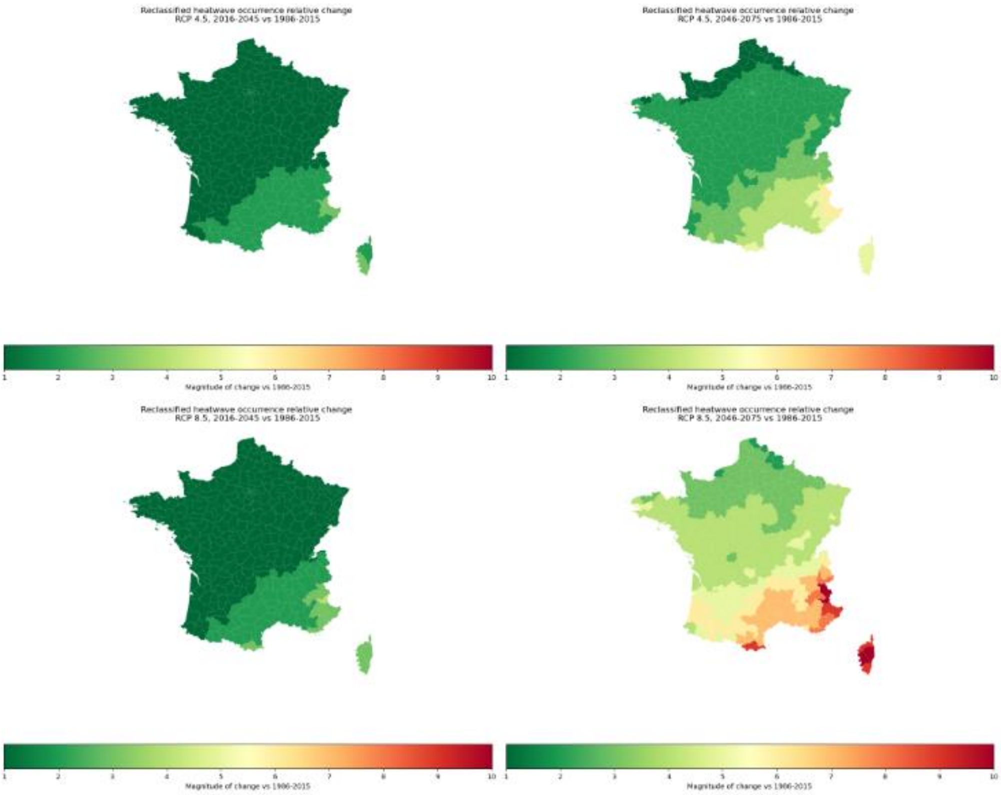

Figure 10: Map of heatwave occurrence relative change for RCP 4.5 (top) and RCP 8.5 (bottom), for short term (left) and mid-term (right) timelines in France. Between each magnitude level, there is an approximate 72% increase in the occurrence of heatwaves.

For short-term projections, both scenarios depict a similar tendency in heatwave occurrence, showing a low magnitude of change in northern France compared to the rest of the territory.

However, for medium-term projections, scenario 4.5 highlights a low magnitude of change in northern France (including the Departement du Nord), whereas scenario 8.5 shows slight increases in magnitude.

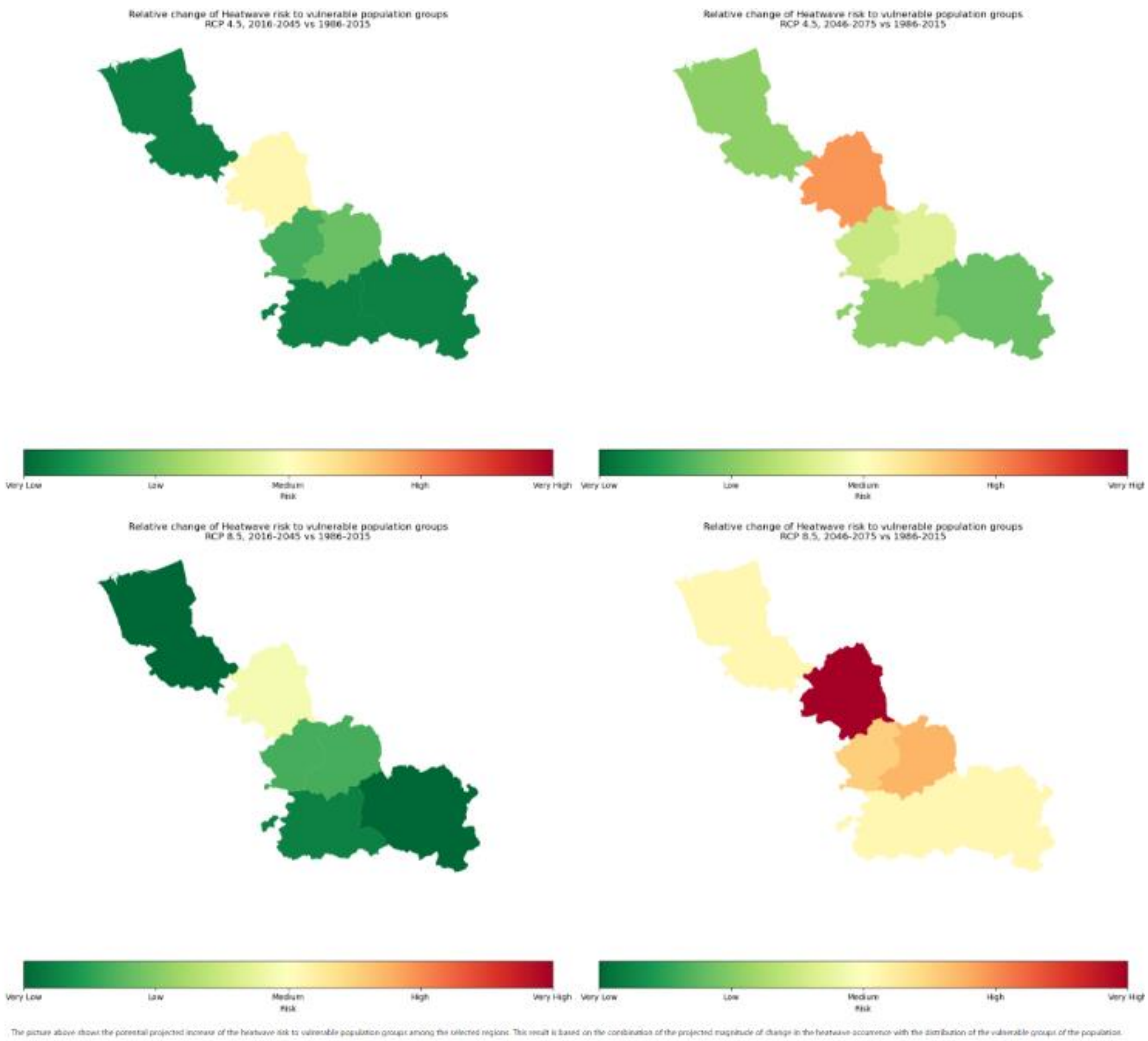

Figure 11: Map of the Relative change of heatwave risk to vulnerable population groups for short term timeline (left) and mid-term timeline (right) and RCP 4.5 (top) and RCP 8.5 (bottom) in Departement du Nord

The analysis at the departmental scale confirms the region-scale results, as follows:

- **For the horizon 2016–2045:**
  - **RCP 4.5:** As expected, the relative change in heatwave risk is higher in high-density areas, such as the urban area of the Métropole Européenne de Lille (European Metropolis of Lille). This appears to be driven more by the density of vulnerable individuals than by differences in exposure between territories.
  - **RCP 8.5 (high emissions):** The trend in heatwave risk is nearly identical to that of RCP 4.5 within the Departement du Nord.

- **For the horizon 2046–2075:**
  - **RCP 4.5:** Risks tend to increase uniformly across the Departement's territory.
  - **RCP 8.5 (high emissions):** Relative changes are higher under RCP 8.5 than RCP 4.5. The entire area falls between medium and very high relative changes, with the urban area of the European Metropolis of Lille reaching the high to very high risk categories.

2.4 Key Risk Assessment

2.4.1 Severity

Heavy Rainfall: The CRA indicates an increase in the frequency and intensity of heavy rainfall events in our region. However, results vary depending on the models used, highlighting the need for further studies.

Heatwaves: While changes in hazards remain limited, the risks to the population are significant. The Departement du Nord is historically and in future projections less exposed than southern France. However, its vulnerability is high due to a large proportion of at-risk individuals (under 5 and over 65), low adaptive capacity (low income), and a lack of suitable infrastructure.

For both risks, recent events already show a rise in extreme weather, such as the floods caused by prolonged rainfall in 2023–2024 and the growing number of national heatwave alerts.

2.4.2 Urgency

Considering the results of the Climaax workflows, and given the spread of investments over time as well as the long lifespan of the departmental housing stock (e.g. buildings from 1975 still in use today), action must be taken now to adapt infrastructures. Moreover, as the region is not accustomed to high temperatures, it lags behind southern cities in terms of adaptation. However, this delay could provide an opportunity to learn from successful measures already implemented elsewhere.

Focus on the cities studied: Dunkirk and Valenciennes are still undergoing urbanization, which may increase their exposure to climate hazards. Both cities must continue investing in mitigation and adaptation strategies.

At the national level, results suggest a lower level of urgency in the Nord compared to the southern regions. However, due to a lack of localized risk awareness, it can be hypothesized that the vulnerability of the department is underestimated. Raising awareness among the population is therefore urgent.

Given the lack of definitive conclusions and the need for scientific rigor, further analysis is needed, including a comparison with local models developed by the scientific consortium.

2.4.3 Capacity

Departmental scope:
The Departement du Nord is in the early stages of integrating climate change risk adaptation into its policies.

Through its *Nord Durable* sustainable development strategy, it has committed to including mitigation and adaptation criteria in its support for municipal and inter-municipal projects. For example, the *renaturation* program helps create green spaces and cooling areas on brownfield sites or in urban neighborhoods.

Internally, several adaptation measures have been launched: unsealing of school playgrounds to improve rainwater management, staggered service hours during heatwaves, and adjusted work schedules for outdoor and construction site workers (e.g. road maintenance teams).

The Departement is also a partner in the Interreg VI *Eutopia* cross-border project, which experiments with shared climate adaptation solutions.

However, no specific and comprehensive plan currently exists to address climate risks and their consequences for vulnerable groups under the Departement's responsibility (e.g. elderly, people with disabilities, those in poor health or economic situations, children in care).

Some sectoral policies partly address these issues, including:

- The Action Plan for Housing and Accommodation for Disadvantaged People,
- The Departmental Housing Plan (in partnership with the State),
- The Local Solidarity Pact,
- The Plan to combat energy poverty (heating/cooling).

To strengthen a climate risk culture and develop a dedicated action plan, Departement officials have applied to the P2R program.

The growing intensity of natural hazards (fires, floods, etc.) has also led the departmental fire and rescue service (SDIS) to acquire new specialized vehicles and provide appropriate training.

Watershed and estuary scope:
The Artois-Picardie Water Agency is addressing the link between water management and climate change through five main areas:

1. Sustainable and equitable water resource management,
2. Adaptation of economic and agricultural sectors,
3. Restoration of the ecological status of water bodies and catchments,
4. Territorial adaptation to hydrological risks,
5. Sustainable water governance.

The *Institution Intercommunale des Wateringues* is working with institutional partners, academia, businesses, associations, and citizens, focusing on the Aa river basin and hydraulically connected sectors, including collaboration with Flemish partners.

Regional scope:
Multiple risk measurement and monitoring initiatives are being implemented at national, regional, and local levels.

In terms of climate research, the main actors include:

- The *GREC* (regional scientific consortium), which analyses all dimensions of climate risk,
- The *DDTM*, through its departmental major risks database.

Stakeholder engagement is supported by the regional DREALs and their Climate Plans (COPs), which encourage local governments to implement adaptation measures. Climate risks are also addressed in urban planning tools and frameworks such as the PNACC, SAGEs, PAPI, and PRI.

For the operational roll-out of public action, several support organizations are involved, such as the *Maison de l'Habitat Durable*, *CERDD*, *CD2E*, etc.

National scope:
Nevertheless, other entities are part of the network of action, such as *Santé Publique France* (the national public health agency), which provides health advice when necessary and collects health data related to heatwaves, and *Météo France*, which issues risk alerts and studies climate trends.

Additionally, numerous standards are being developed to encourage local authorities to consider climate risks in their investment projects, such as RE2020.

France has a specific mutual insurance scheme for natural disasters (*CatNat*). In recent decades, climate change has increased the number of claims, prompting greater State contributions to ensure the scheme's financial stability.

However, interaction among partners remains limited, sometimes causing overlaps. Moreover, investment in climate change and sustainable development areas has declined across several levels of public administration.

A parliamentary report presented on July 2 to the Finance Committee of the National Assembly highlights insufficient resources allocated to climate adaptation and weaknesses in agencies supporting local authorities (such as ADEME and the Water Agencies), emphasizing the urgent need to release additional funds (Barnier Fund, RGA Fund, Coastal Erosion Fund).

Ultimately, many actions remain to be implemented, and exemplary projects are still exceptions rather than the norm.

Other measures aimed at mitigating climate risks could be launched and have related benefits:

At the Departement du Nord level, a portion of the building department's budget is allocated to sustainable investments. Until now, this has primarily supported mitigation measures, such as bike parking. Reallocating part of this budget to adaptation actions—particularly those improving summer comfort—could enhance the learning environment for students. Such measures would also support local businesses and help them build expertise in sustainable construction techniques, such as passive cooling systems. Regardless of the specific risk, addressing it can foster the development of shared methodologies and strengthen cross-functional collaboration across departmental divisions.

At the regional and national scope, the joint management of risks could lead to an increase in cross-functional exchanges, and the creation of new jobs and specialties for all qualifications levels, which is interesting regarding the unemployment rates. Considering mitigation of heavy rainfall and urban heat island, the increase of green areas would enhance life quality and outdoor space of encounter, strengthen social cohesion, which is even more interesting as it was shown that the stronger the social bonds, the less impact there is following a disaster [1].

2.5 Preliminary Monitoring and Evaluation

The CRA highlighted the heterogeneity of risks, associated public policies, and the overall risk culture. It also emphasized that, although many analyses have been carried out locally by various stakeholders, the results are rarely shared or compared. The diversity of methods used prevents effective comparison and coordination.

The CRA further demonstrated that training for policymakers and technical staff is a key milestone in building a shared culture of risk.

Overall, the CRA serves as a valuable tool for stakeholder engagement. However, due to differences in European and national definitions, care must be taken when interpreting and sharing results. Similarly, scientific terminology may differ from common French usage, potentially leading to misunderstandings. Therefore, both pedagogy and precision are required to accurately convey ideas in both directions.

Challenges were encountered in analyzing the main risks (i.e. heavy rainfall and RGA), as both involve interconnected or cascading risks. For example, the soil's ability to absorb rainfall is linked to drought conditions and soil composition. Nevertheless, the CRA scripts provide a useful proxy and have helped initiate discussions on these issues with local stakeholders.

While the results provide a broad overview, a more detailed statistical analysis would help quantify the probability of various outcomes.

As expected, this first CRA phase underlined the importance of scientific support to ensure robust, reliable analysis.

The results were compared with those of the Hauts-de-France region. For workflows used in common, the results were identical. Further exchanges are planned to align and enhance the other workflows, to the benefit of both parties.

The scientific council emphasized the importance of cross-comparison with other models used at the regional level, as well as the need for further investigations into urban heat island effects and demographic trends. They stressed the need for nuance and caution when communicating results.

Work carried out by the DREAL on current risk distribution was previewed, and will be published in January. These results will be compared with those obtained using the CLIMAAX methodology.

For Phase 2, additional exchanges are planned with external stakeholders focusing on hazards (e.g. Météo France) and vulnerability (e.g. CPAM, the Red Cross). Internal stakeholder engagement will continue across all operational departments of the Departement du Nord.

Further data sources would be valuable for refining the risk analysis, such as:

- **Geographic data at the IRIS scale**,
- **Additional hazard assessment data**, including government sources (DataGouv, INSEE), and **LCZ classification**.

Regarding **vulnerability**, further analysis could explore categories relevant to the Departement's competencies, such as:

- **Buildings**: number and proportion of energy-inefficient buildings per IRIS, energy performance ratings, and their ability to cope with high temperatures,
- **Roads**: layout of departmental road networks,
- **Social support**: social disadvantage indices,
- **Environment**: location of Natura 2000 sites.

Additional data could also consider the **territory's economic characteristics**, such as:

- commuting patterns,
- location of critical industries (e.g. Gravelines nuclear power plant),
- and the population's individual adaptive capacity (e.g. poverty levels, access to knowledge and education, presence of municipal risk action plans, proximity to health services).

The **health impacts of heatwaves** could be further analyzed using data from Santé Publique France, particularly data on emergency medical interventions and the implementation of existing heat prevention plans.

Beyond data collection, continued dialogue with research teams studying these phenomena is essential.

3. Conclusions Phase 1 – Climate risk assessment

Phase 1 of the operation and analysis of the two selected workflows enabled to:

- Confirm the choice of heavy rainfall and heatwaves, initially selected in the application file as major climatic factors with a significant impact on the Nord department.
- However, attention will be paid in Phase 2 to drought risk, given the proven occurrence of clay shrinkage-swelling (RGA) in the north-western part of the territory.
- Enhance the understanding and identification of the phenomena and provide an overview of the risks the territory is and will be facing during the century.
- Highlight the vulnerabilities of the territory (populated areas, activities, and infrastructure) and risks through graphical visualization and geographical distribution.
- The significant involvement of GREC regional experts and academics in providing scientific support, validating methods, and interpreting results highlights the great interest in continuing the process.

Risk assessments indicate significant and growing threats, such as an overall rise in temperature and precipitation levels, and an increase in the frequency, duration, and intensity of events. These threats will affect the territory in different ways depending on vulnerabilities, cross-exposures, and the models used. The results of the projections show significant differences in terms of impacts and therefore risks within the territory. These situations result from specific local conditions such as vulnerability, exposure, physical criteria, and population density. More in-depth analysis will be required in Phase 2, using more detailed or accurate data, particularly with regard to socio-economic and demographic approaches or at more local scales.

Main conclusions:

- **Heavy rainfalls:** Models and projections based on the SSP8-8.5 scenario confirm a predictable increase in number, intensity, and frequency, but unevenly distributed across the region. However, the workflow only allows for analysis of changes over a maximum period of 24 hours, which does not enable understanding of the recent flooding events of winter 2023-2024, characterized by low daily rainfall but over longer periods, leading to accumulations of water volume. To better assess sudden events (such as thunderstorms), which are often quite localized but absent from the available data, an analysis based on historical damage records could be considered in Phase 2.
- **Heatwave:** Two scenarios were selected, SSP 2-4.5 and SSP 5-8.5. The methodological limitations identified in the assessment exercise based on the two models require a new, more in-depth approach using data that is representative of local conditions and more suited in terms of scale to the climatic realities of the territory. The use of LCZ data available for proximity measurements could provide a technical solution.

These two hazards already pose serious threats to socio-economic stability, the integrity of public infrastructure and facilities, the health and safety of residents, environmental protection, and the quality of the environment.

The absence of adaptation plans and prevention measures, which remain insufficient in scope to cover all affected areas, is an aggravating factor that may impact the capacity of local authorities to respond and be resilient.

Based on the initial results, the Departement du Nord will need to concentrate its efforts on two complementary areas:

- Preventive measures and response plans must be developed immediately to manage events and address the emergencies related to immediate or anticipated hazards (e.g., heatwave alerts). This is particularly important for vulnerable target groups, as well as for sensitive equipment and infrastructure.
- Develop a strategy for gradual adaptation through resilient development, training, and awareness policies for stakeholders, to prevent slow changes and their impacts. This component must be developed in coordination with all relevant stakeholders and actors at the departmental level, in line with regional and state services.

This initial phase raises awareness of the challenges faced by the northern region and its vulnerability. It establishes the department's responsibility for implementing the necessary prevention and adaptation measures, in line with its remit for social and territorial solidarity.

This overall observation of increased risks suggests that the approach should continue to support these initial results. This will consolidate the analyses and refine the available information using new, reliable data that is cross-referenced with internal IACS data on departmental vulnerabilities. This will enable new data and information from stakeholders who are not yet involved, such as Météo France and the DDTM, to be compared.

4. Progress evaluation and contribution to future phases

The results of the initial deliverables provide an essential foundation for the more in-depth analysis to be conducted in Phase 2. The information produced, along with the interpretations resulting from discussions with GREC scientists and experts, has revealed the necessity of 'translating' the scientific results for non-specialists. An adapted version will be communicated and disseminated in an accessible, easy-to-understand format to raise awareness of the issues at stake and help stakeholders and decision-makers to understand them better. This could take the form of a preliminary cartographic atlas to be used during internal presentations and workshops with relevant stakeholders.

Table 7: Overview key performance indicators

Key performance indicators	***Progress***
Number of workflows successfully applied to deliverable 1 o At least 2 workflows applied for the first deliverable on the main risks	Achieved
… Number of stakeholders involved in project activities o At least 8 internal stakeholders o At least 10 external stakeholders. Set up for all phases of our CLIMAAX project	**Internal:** 8 departments: Territory and Transition Department, Roads Department, Rural Environment Department, Buildings Department, Culture Department, Sports Department, Northern Relations and Partnership Strategy Department, Modernisation and Evaluation Department, Social Action Department **External**: University of Lille, University of Compiègne, University of Lorraine, Région Hauts-de-France, DREAL Hauts de France + local authorities during the presentation of the 8th of july (DTTM, health associations, town halls …) Developed in the next phases
Number of data sets integrated into toolbox models in phase 2 o At least two data sets	Next phase
Number of consultation and communication actions carried out to mobilise stakeholders and share the results of the different stages with them o At least 10 consultation and/or communication actions with internal or external stakeholders Set up for all phases of our CLIMAAX project	- Barcelona seminar - Posters A0 - Intranet article - CODIR - GREC presentation (Dunkerque) - Webinar with local authorities - G6 : DGS departments Developed in the next phases

Number of notes for policy makers o At least three notes for policy makers at different stages of the project's progress	Next phase
Number of publications and dissemination actions o At least two summary publications on the project, including a proposal to present the approach to the Departments of the Hauts de France Region and the Departements de France national association. At the end of the project	End of the project

Table 8: Overview milestone

Milestones	***Progress***
Presentation of the joint initiative of Climaax with the Hauts-de-France Region to the GREC	Participation in the GREC meeting on 1 July 2025 in Dunkirk, followed by a questionnaire for participants regarding their interest in the two projects.
Appointment of academic advisors to assist with hazard and risk analysis.	Creation of a joint Scientific Committee GREEN 59 (Nord Department & ATLAS (Hauts-de-France Region) Partnership agreement in preparation between the Nord Department and the University of Lille
Presentation of the approach and results of phase 1 to the 'Nord Durable' Steering Committee	Last quarter of 2025
Presentation of Phase 1 results to representatives of the Joint Scientific Committee and stakeholders	Consultation for opinion and validation at the end of August/beginning of September 2025
...	...

5. Supporting documentation

1. Livrable phase 1 – Rapport Evaluation des risques climatiques
2. Rapport_au_Conseil_Departemental_Projet_Green59_CLIMAAX_20251216
3. Carte Hydrographie et relief du Nord
   Conception : Service Information Géographique et Cartographie (SIGC) - Traitement : DGAST/ SG / SIGC
   Sources : Departement du Nord, ©IGN - BD CARTHAGE ® 2003,© IGN - BD ALTI®. - Edition : mai 2025
4. Carte Densité de population dans le Nord en 2021,
   Conception et traitement : Service Information Géographique et Cartographie (DGAST/ SG / SIGC), Sources : Departement du Nord, INSEE - Edition : mai 2025
5. EXTREME_PRECIPITATION_Hazard_Assessment
6. EXTREME_PRECIPITATION_Risk_Assessment
7. Annual Maximum precipitation for 2'h precipitation in Dunkirk
8. Expected precipitation for 24h event for 2041-2070 period in Dunkirk
9. Graph of the number of heatwaves per year for RCP4.5 and 8.5
10. LST data for Dunkirk for hottest months (june, july, august) of 2020-2025 time period
11. LST data for Valenciennes for hottest months (june, july, august) of 2020-2025 time period
12. Map of Dunkirk highlighting the overheated areas (left) and the density of vulnerable populations (under 5y.o. and up 65y.o.) and sensitive buildings
13. Map of Dunkirk highlighting the possible risk level to vulnerable population (under 5y.o. and up 65y.o.) and related infrastructure
14. Map of Valenciennes highlighting the overheated areas (left) and the density of vulnerable populations (under 5y.o. and up 65y.o.) and sensitive buildings (right)
15. Region map of the relative change of heatwave risk to vulnerable population groups for short term timeline (left) and mid term timeline (right) and RCP4.5 (top) and RCP8.5 (bottom)
16. CLIMAAX_Green59_posterA0_VersionGB_Barcelone_juin_2025
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