Deliverable Phase 2 – Climate risk assessment

Climate-Ready İzmir: Enhancing Resilience Strategies

Türkiye, İzmir

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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 2 – Climate risk assessment
Brief Description	The CRIZ-ERS project aims to strengthen İzmir's climate resilience by addressing risks like extreme weather, floods, droughts, and heatwaves. Through risk assessments, stakeholder engagement, and targeted interventions, it promotes a sustainable urban environment while aligning with international frameworks like the EU Green Deal and Horizon 2020.
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Region/Municipality	İzmir
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Abbreviations and acronyms

Abbreviation / acronym	Description
CRA	Climate Risk Assessment
CRIZ-ERS	Climate-Ready İzmir: Enhancing Resilience Strategies
CRM	Climate Risk Management
DSI	Directorate General for State Hydraulic Works
GCAP	Green City Action Plan
GCM	General Circulation Model
IMM	İzmir Metropolitan Municipality
IRAP	Provincial Disaster Risk Reduction Plan
NGO	Non-Governmental Organization
SECAP	Sustainable Energy Climate Action Plan
SVI	Social Vulnerability Index
RCM	Regional Climate Model
TSMS	Turkish State Meteorological Services
UHI	Urban Heatwave Island

Executive summary

This deliverable presents the outcomes of the second phase of the Climate Risk Assessment (CRA) conducted within the framework of the CLIMAAX project. While the first CRA focused on climate risks at the İzmir metropolitan scale, this report represents a deliberate shift toward a more detailed and localized, district-level assessment, with a specific focus on Konak District. The primary motivation of this phase was to enhance the policy relevance and actionability of the assessment by increasing spatial resolution, integrating local datasets, and incorporating stakeholder knowledge.

In the first CRA, the climate hazards assessed for İzmir included extreme precipitation, coastal flooding, agricultural drought, and heatwaves. In Phase 2, these hazards were reassessed through refined analyses and local validation. Since Konak is a central district, agricultural activities and forest presence are negligible, river flooding, coastal flooding, heavy rainfall, and heatwaves assessed as main hazards for Konak District. Moreover, agricultural drought and wildfires were also assessed in this term, but these assessments were done to improve the analyses done in Phase 1 and main outputs given in Section 2.6 of this report.

Each hazard was evaluated using the CLIMAAX Key Risk Assessment framework, considering severity, urgency, and resilience capacity, and supported by an evaluation dashboard designed for stakeholder engagement. The results show that heatwaves constitute a very high-priority risk due to their increasing frequency and intensity, strong urban heat island effects, and disproportionate impacts on vulnerable populations. Coastal flooding was identified as a high-priority risk, particularly due to sea level rise and the concentration of population, infrastructure, and cultural heritage assets along the coastline. River flooding and heavy rainfall were assessed as moderate-priority risks, though they remain significant due to aging infrastructure, limited drainage capacity, and potential cascading impacts.

In addition to the core hazard set, this phase also included an additional risk assessment for fire, reflecting growing concern over rising temperatures and prolonged heatwaves across the İzmir region. Although fire was not integrated into the main risk prioritization matrix for Konak, the separate assessment classified fire risk as high priority, based on substantial future severity, high urgency, and low resilience capacity. This additional analysis broadens the overall understanding of regional climate risks and informs future adaptation planning.

The assessment was strengthened through the integration of high-resolution socio-demographic data, social assistance records, and spatial exposure analyses, complemented by stakeholder workshops and expert consultations. These processes validated key findings, highlighted spatial inequalities, and revealed critical data particularly regarding income, care needs, and service capacity at neighborhood level.

The main conclusion of Phase 2 is that downscaling climate risk assessments from the city-wide to the district level significantly improves the identification of priority risks and vulnerable areas, while also supporting more equitable and targeted adaptation planning. At the same time, limitations in socio-economic data availability and institutional coordination remain key challenges.

In Phase 3, adaptation actions will be developed for both İzmir province and Konak District, structured under four thematic pillars: urban planning, disaster risk management, socio-economic resilience, and cultural heritage protection. Then, these actions will be integrated into İzmir's Sustainable Energy and Climate Action Plan (SECAP), ensuring that the findings of this CRA directly inform long-term climate governance and implementation.

1 Introduction

1.1 Background

As a continuation and deepening of the previous İzmir city-wide assessment, this Climate Risk Assessment (CRA) narrows its focus to the district scale, addressing the specific characteristics and challenges of Konak. By concentrating on one of İzmir's most socio-economically and physically complex urban areas, the CRA aims to generate more localized, actionable insights that can directly inform district-level climate resilience planning.

CRA for Konak District was designed and implemented in accordance with the key principles outlined in the CLIMAAX Framework, ensuring a process that is socially just, methodologically rigorous, and contextually grounded.

Climate change poses increasing risks to urban areas, especially in densely populated coastal districts like Konak, located in the historic, administrative, and commercial heart of İzmir. While previous CRA have largely focused on the metropolitan or regional level, they often fail to capture localized vulnerabilities, especially those linked to social inequalities, aging infrastructure, and institutional capacity gaps. In this context, Konak presents a critical case for climate resilience planning.

The district faces a range of climate-induced environmental risks, including urban heat island effects exacerbated by limited green space, inadequate drainage infrastructure in flood-prone areas, increasing food insecurity, and barriers to accessing essential social services. At the same time, Konak is home to important historical and cultural assets, such as the UNESCO, nominated Kemeraltı district, which are also increasingly threatened by sea-level rise, extreme weather events, and long-term environmental degradation (*UNESCO* WHC, 2022).

According to Turkish State Meteorological Services (TSMS), İzmir had a population of over 4.4 million in 2022, with net migration exceeding 40,000 people that same year (TSMS, 2022). Although Konak ranks among Türkiye's most developed districts (SEGE, 2022), intra-district inequalities remain stark. Certain neighborhoods experience deep socioeconomic vulnerability, including precarious housing conditions, dependence on social assistance, and exclusion from urban transformation efforts. These conditions amplify the district's sensitivity to climate impacts, weakening adaptive capacity at the community level.

Moreover, Konak's dense and aging urban fabric, shaped by historical land use patterns and a legacy of fragmented planning, presents additional challenges for integrating climate adaptation into the built environment. The risk of cascading effects, from flash floods to heat-related health emergencies, is particularly acute in areas where infrastructure, housing, and emergency response systems are under strain. Likewise, the preservation of cultural heritage assets, which are physically and symbolically central to the identity of the district, faces growing threats due to both sudden-onset hazards and chronic environmental stressors.

This CRA, developed under Phase 2 of the CLIMAAX project, represents a shift from a broad, city-wide overview to a high-resolution, neighborhood-scale analysis. The assessment integrates the CLIMAAX Handbook methodology with locally sourced, site-specific data, resulting in a more practical and credible framework for climate adaptation. The work builds upon prior strategic efforts such as İzmir's Sustainable Energy and Climate Action *Plan (*SECAP*) and* the Provincial Disaster Risk Reduction Plan (IRAP), while adding new dimensions of participatory governance, socio-spatial vulnerability analysis, and district-specific prioritization.

Stakeholder engagement was a core element of this process. Through multi-format participation—workshops, online consultations, and socioeconomic impact assessments, the CRA incorporated the insights of municipal departments, civil society actors, technical experts, and community representatives. This participatory approach ensured that both scientific evidence and lived experience inform the analysis, and that local adaptation strategies are grounded in the specific challenges and capacities of Konak.

1.2 Main objectives of the project

The main objective of the Konak CRA is to provide a detailed understanding of climate-related risks and vulnerabilities at the neighborhood level, to support informed, equity-oriented adaptation planning. By scaling down the analysis from the city to the district, the project aims to strengthen the capacity of Konak Municipality and local stakeholders to anticipate, prioritize, and respond to emerging climate threats in a coordinated and effective manner.

In alignment with the goals of Konak Municipality's 2025–2029 Strategic Plan, the CRA focuses on integrating scientific evidence with local realities. Special attention is given to the identification of vulnerable groups, high-risk urban areas, and the underlying social and infrastructural conditions that increase sensitivity to climate hazards. The assessment process also emphasizes collaboration across institutions, drawing on a wide network of participants—from public officials and planners to grassroots organizations and local experts.

In Phase 2, the transition from a broad overview to a high-resolution assessment is driven by merging the CLIMAAX Handbook with site-specific local data. This approach enables the production of a more credible and practical framework, which in turn provides a solid foundation for developing effective and actionable regional adaptation strategies. By combining standardized tools with locally validated insights, the CRA delivers results that are both technically sound and directly relevant to planning, infrastructure investment, and resilience building in Konak.

1.3 Project team

Project Team:

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    - Engin Koç: Technical Advisor (Ecosystem and Biodiversity)
    - Elif İrem Köse Kiper: Technical Advisor

1.4 Outline of the document's structure

This report presents the outcomes of the second phase of the climate risk assessment conducted for İzmir, with a specific focus on Konak district. Building on the findings of the first CRA—which addressed extreme precipitation, coastal flooding, agricultural drought, and heatwaves at the metropolitan scale—this phase expanded the analysis by incorporating river flooding as a newly prioritized risk and performing an additional assessment for fires based on local data and models. Four major climate hazards—river flooding, coastal flooding, heavy rainfall, and heatwaves—were analyzed in detail using a multi-risk framework that included severity, urgency, and resilience capacity. The risk prioritization revealed heatwaves as the most critical risk, followed by coastal flooding and fire, with all risks requiring targeted adaptation actions. Stakeholder engagement, high-resolution socio-economic data, and localized modeling significantly improved the quality and relevance of the assessment. The findings will directly inform the adaptation planning process under Phase 3, including integration into İzmir's SECAP report across four pillars: spatial planning, disaster risk management, socio-economic resilience, and cultural heritage protection.

2 Climate risk assessment – phase 2

2.1 Scoping

2.1.1 Objectives

This Climate Risk Assessment (CRA) focuses on evaluating the specific climate-related threats and vulnerabilities within Konak District, marking a shift from the previous İzmir-wide assessment to a more localized, neighborhood-scale analysis. The objective is to generate actionable insights that inform Konak Municipality's 2025–2029 Strategic Plan, guide local policy development, and strengthen district-level resilience.

The CRA was shaped through close engagement with local stakeholders, including Konak Municipality, Konak City Council, and relevant non-governmental organizations (NGOs). These inputs ensured that the assessment is not only scientifically sound but also locally grounded.

Despite limitations related to data availability and spatial scale, the CRA offers a foundation for targeted, actionable strategies that can support sustainable development and improve community preparedness in the face of increasing climate challenges.

2.1.2 Context

In recent years, the impacts of climate change have become increasingly visible across İzmir, with coastal flooding, extreme heat, and water scarcity emerging as key challenges. While several city-wide initiatives—such as the Sustainable Energy and Climate Action Plan (SECAP) and the Provincial Disaster Risk Reduction Plan (IRAP) have addressed climate-related risks on a metropolitan scale, localized assessments at the district level have remained limited. CRA for Konak District aims to help fill that gap by providing a finer-grained understanding of vulnerabilities and risks.

Konak, as the historical and administrative core of İzmir, presents unique challenges due to its dense urban fabric, aging infrastructure, and socio-economically diverse neighborhoods. Climate hazards—such as river flooding, extreme heat, and urban-interface wildfires—pose growing threats, particularly for communities already facing structural vulnerabilities. This assessment places these issues within the broader system of regional development, emphasizing the need for place-based adaptation strategies.

Governance efforts at the district level are evolving. Konak Municipality has increasingly prioritized climate action through strategic planning processes, including the recently developed 2025–2029 Strategic Plan, which highlights resilience, sustainability, and inclusive development as core objectives. The CRA aligns with and supports this strategic direction. The project has also engaged with local civil society actors, the Konak City Council, and relevant NGOs, ensuring that diverse perspectives shape the risk analysis.

2.1.3 Participation and risk ownership

In Phase 2 a range of participatory activities were carried out, including a stakeholder meeting, a dissemination workshop, online consultations, and interviews with local civil society organizations. These processes ensured that both institutional expertise and local knowledge were incorporated into the assessment. Key stakeholders included departments from Konak Municipality (such as urban planning, disaster affairs, climate change, social services, and GIS), units from Izmir Metropolitan Municipality, the Konak District Health Directorate, and ICLEI. These actors formed the core institutional network guiding the assessment process. In addition, socio-economic impact assessment was conducted with relevant civil society organizations, including BAYETAV, İzmir Women's Solidarity Association, Konak City Council, IZAFED, and İzmir Refugee Solidarity Association (Mülteci-Der), to reflect the perspectives of vulnerable groups and community-based actors.

Risk ownership in Konak is primarily held by the municipality, with responsibilities shared across relevant departments. While formal thresholds for acceptable risk are not yet established, local institutions have expressed the need for clearer criteria and frameworks to guide planning and mitigation. This collaborative approach has helped to foster local ownership, strengthen institutional coordination, and build a shared foundation for future climate resilience efforts.

2.1.4 Application of principles

The CRA for Konak District was developed in line with the CLIMAAX Framework, ensuring a socially just, methodologically sound, and locally grounded process. A strong emphasis was placed on equity and inclusion, recognizing that climate risks do not affect all groups equally. The assessment incorporated a Social Vulnerability Index and dependency ratio analysis to map socio-economic fragilities across neighborhoods, capturing how intersecting factors like age, income, gender, health status, and migration shape vulnerability to risks such as heatwaves, sea-level rise, and flooding. Alongside quantitative data, participatory methods were used to reflect community perspectives. Interviews with civil society organizations—including refugee support groups, women's organizations, and Konak City Council commissions—provided critical insights into lived experiences and priorities of marginalized populations. This approach ensured that the CRA addressed both measurable indicators and community-identified challenges, aligning with the principle of just resilience.

Data collection was coordinated by İzmir Metropolitan Municipality, following initial stakeholder meetings. Relevant departments and data-providing institutions were engaged, and findings were refined with input from workshops and civil society interviews. All data sources, assumptions, and limitations were transparently documented. Results were shared through technical presentations, enabling validation and fostering local ownership. This open and inclusive process reinforced the credibility of the CRA and supported alignment with the CLIMAAX Framework's standards of transparency and traceability.

2.1.5 Stakeholder engagement

Stakeholder engagement in the Konak CRA followed a multi-stage participatory process, including a local stakeholder meeting, a dissemination workshop, and targeted online interviews. The initial meeting gathered 69 participants from Konak Municipality, İzmir Metropolitan Municipality, public institutions, and technical experts. Interactive Menti surveys enabled real-time feedback and collective input. The dissemination workshop, attended by 50 participants, focused on climate risks in Konak and the Kemeraltı area. One-on-one interviews with five civil society organizations further enriched the process by highlighting the specific challenges faced by vulnerable communities. Project goals and interim results were presented during the workshop through expert briefings, allowing stakeholders to collectively interpret climate threats and help prioritize risks. Their input was instrumental in identifying high-risk neighborhoods and vulnerable groups, aligning local insights with CLIMAAX tool outputs. Emphasis was placed on the need for integrated planning, infrastructure upgrades, and community-based adaptation, especially for risks like sea-level rise, flooding, heatwaves, and wildfires. Stakeholders highlighted critical vulnerabilities in neighborhoods such as Toros and Çınartepe, and proposed solutions including green infrastructure, drainage improvements, and local capacity building. Many participants expressed interest in applying CRA results in their own institutional planning. However, challenges arose in data sharing, as some stakeholders were reluctant to provide localized datasets, limiting analysis depth in certain areas. Despite these constraints, the engagement process fostered strong local ownership of CRA findings and laid the groundwork for continued collaboration in climate adaptation planning.

2.2 Risk Exploration

2.2.1 Screen risks (selection of main hazards)

İzmir city is exposed to multiple climate-related hazards driven by climate variability and long-term climate change. The most critical climate hazards identified in this context include extreme precipitation and pluvial flooding, which disproportionately impact urban areas with high levels of impervious surface coverage. Riverine flooding also poses a significant threat, particularly in the Küçük Menderes Basin during episodes of intense rainfall. Coastal flooding and sea-level rise, including storm surge events, threaten low-lying coastal zones. In addition, urban heatwaves, intensified by the urban heat island effect, represent a major risk factor for human health, infrastructure, ecosystems, and economic systems. These hazards have the potential to cause widespread damage to buildings and transportation networks, disrupt essential public services, and lead to considerable public health consequences.

During the second phase, several coordination meetings were held with İzmir Metropolitan Municipality authorities, historical climate-related events were reviewed, and relevant local datasets were collected. In contrast, river flooding was identified as a major historical hazard, with climate change expected to further exacerbate its impact. Due to the lack of suitable global or local datasets for the region in Phase 1, river flooding could not be included in the initial analysis. Therefore, in Phase 2, agricultural drought was excluded and a detailed river flooding hazard and risk analysis was carried out instead. According to the Copernicus Climate Atlas, CMIP6 multi-model ensemble projections under the SSP5-8.5 scenario indicate that daily mean temperatures may increase by 7–8 °C by the end of the century. In addition, the number of extreme hot days (Tmax > 35 °C) is projected to rise to approximately 60 days per year compared to the pre-industrial baseline (1850–1900). These changes suggest a substantial increase in the frequency and severity of urban heatwaves, posing significant health risks, particularly for vulnerable populations. While projections indicate a decreasing trend in daily accumulated precipitation, the maximum 1-day precipitation is expected to increase by up to 10 mm by the end of the century. This shift is likely to intensify extreme precipitation events and increase river flood risk in the future. Furthermore, the municipality is already affected by tidal and storm surge events, particularly in coastal districts such as Konak. When combined with projected sea-level rise due to climate change, these factors necessitated a dedicated coastal flooding analysis in Phase 2.

2.2.2 Choose Scenario

Future scenarios were developed by combining ensemble-based climate projections with plausible socio-economic developments to assess climate risks across short, medium, and long-term horizons, in line with the CLIMAAX risk-based framework. For extreme precipitation and river flooding hazards, the analysis focused on the medium-term time horizon (2040–2070), which is particularly relevant for infrastructure planning and risk management. For coastal flooding, the impacts of storm surge were evaluated across short- to long-term return periods (1–100 years). In contrast, the effects of climate change and sea-level rise were assessed specifically under long-term conditions (50–100 years), reflecting their gradual and cumulative nature. In the case of urban heatwaves, the analysis covered a broad temporal range from short-term to long-term horizons, with hazards evaluated continuously from the historical reference period (from 1980) through to the end of the century (2100).

2.3 Regionalized Risk Analysis

The hazard and risk analyses were refined using localized datasets obtained from relevant local and national authorities. In the heavy rainfall workflow, critical infrastructure locations (e.g. hospitals, schools, universities) provided by the İzmir Metropolitan Municipality were used to identify areas potentially exposed to future extreme precipitation. Climate model outputs were analyzed using a multi-model ensemble approach based on 44 RCM–GCM combinations to account for climate model uncertainty. For the coastal flooding analysis, historical sea-level observations from the Menteş stations were used to derive extreme water levels for different return periods along the İzmir coastline. High-resolution (5 m) topographic data were integrated from General Command of Mapping of Turkey into map coastal inundation in detail, considering tidal effects and projected sea-level rise. In the urban heatwave analysis, vulnerable population data for 2024 obtained from the Turkish Statistical Institute (TÜİK) were used to map sensitive age groups (0–10 and >60 years). As there is currently no nationally defined heatwave threshold in Türkiye, a project-specific heatwave methodology was developed and applied. To address climate model uncertainty, projections from 34 RCM–GCM combinations were analysed. For the river flooding analysis, historical extreme precipitation maps were generated using long-term (>40 years) observations from 77 meteorological stations provided by the Turkish State Meteorological Service (TSMS). High-resolution (~5 m) topographic data covering the entire Küçük Menderes River Basin were obtained from the General Command of Mapping of Türkiye. A rain-on-grid hydrodynamic modelling approach was applied to simulate flood hazards across the basin under both historical and future climate scenarios. Flood risk assessment incorporated building exposure data from the İzmir Metropolitan Municipality, classified as residential, public, and commercial/industrial. Affected population estimates were derived using 2024 population data from TSMS.

2.3.1 Extreme Precipitation

Table 2-1 Data overview workflow #1

Hazard data	Vulnerability data	Exposure data	Risk output
Projected increase in extreme precipitation intensity and frequency for different return periods (e.g., 100 mm/24h return period changes)	Infrastructure vulnerability: Schools, hospitals, and critical infrastructure are in areas with a ≥10% decrease in the return period of 100mm/24hr event	Spatial distribution of population and critical infrastructure (schools, hospitals, universities, and other key facilities) across İzmir	The risk map of Projected Changes in Return Period (Frequency) of 100mm/24hr event

2.3.1.1 Hazard assessment

For this analysis, the EURO-CORDEX (EUR-11) climate projections at a 12km spatial resolution were utilized (*Copernicus* Climate Change Service, 2019). The workflow was implemented for the region under two emission scenarios (RCP4.5 and RCP8.5). The analysis was conducted for the western part of Turkey (Aegean region), while the time series were specifically generated for İzmir city extent. The 30-year frames of daily precipitation data were used for the analysis. The selected timeframes are 1976-2005 (baseline or historic simulations), 2041-2070 (mid-century) and 2071-2100 (end of the century). The ensemble approach is essential in climate model analysis because no single model can perfectly represent the climate system. Different models use varying assumptions, parameterizations, and structures, which leads to uncertainty in their outputs. By combining multiple models, the ensemble approach reduces individual biases and errors, producing more reliable and robust projections. It also helps distinguish long-term climate signals from natural variability, while highlighting where models agree and where uncertainties remain. This makes projections more trustworthy and useful for risk assessments, adaptation planning, and clear communication of uncertainty to decision-makers. Therefore, for this analysis, we have adopted multi model ensemble approach. For ensemble approach, 44 GCM and RCM combinations were used and given in table.

Table 2-2 GMC and RCM combinations

GCM	RCMs
CanESM2	CLMcom-CCLM4-8-17, GERICS-REMO2015
CNRM-CM5	ETH-COSMO-crCLIM-v1-1, DMI-HIRHAM5, GERICS-REMO2015, IPSL-WRF381P, KNMI-RACMO22E, MOHC-HadREM3-GA7-05
EC-EARTH	CLMcom-ETH-COSMO-crCLIM-v1-1, DMI-HIRHAM5, KNMI-RACMO22E, SMHI-RCA4
IPSL-CM5A-MR	DMI-HIRHAM5, GERICS-REMO2015, IPSL-WRF381P, KNMI-RACMO22E, SMHI-RCA4
MIROC5	CLMcom-CCLM4-8-17, GERICS-REMO2015, UHOH-WRF361H
HadGEM2-ES	CLMcom-CCLM4-8-17, ETH-COSMO-crCLIM-v1-1, DMI-HIRHAM5, GERICS-REMO2015, IPSL-WRF381P, KNMI-RACMO22E, MOHC-HadREM3-GA7-05, SMHI-RCA4, UHOH-WRF361H
MPI-ESM-LR	CLMcom-CCLM4-8-17, ETH-COSMO-crCLIM-v1-1, DMI-HIRHAM5, KNMI-RACMO22E, MOHC-HadREM3-GA7-05, SMHI-RCA4, GERICS-REMO2009, UHOH-WRF361H
NCC-NorESM1-M	CLMcom-ETH-COSMO-crCLIM-v1-1, DMI-HIRHAM5, GERICS-REMO2015, IPSL-WRF381P, KNMI-RACMO22E, MOHC-HadREM3-GA7-05, SMHI-RCA4

For each model, annual maximum precipitation values were derived and fitted to the General Extreme Value (GEV) distribution. Using these fits, expected precipitation levels were estimated for return periods of 2, 5, 10, 50, and 100 years. The analysis was carried out for both the historical period (1976–2005) and the future period (2041–2070) (not-shown) and (2071-2100) under the RCP4.5 (not shown) and RCP8.5 scenarios. Finally, the median values of the estimated return levels across all models were calculated.

Climate change projections indicate an increase in the frequency and intensity of extreme rainfall events in the region. This trend poses significant challenges for İzmir and a change in the 24-hr precipitation and return periods of events (i.e. 100-year) is significant for the region. The map of expected precipitation for 24hr duration for 100-year return period for future period (2071-2100) and relative change with respect to historical (1976-2005) period for RCP8.5 scenario are presented in Figure 2-1.

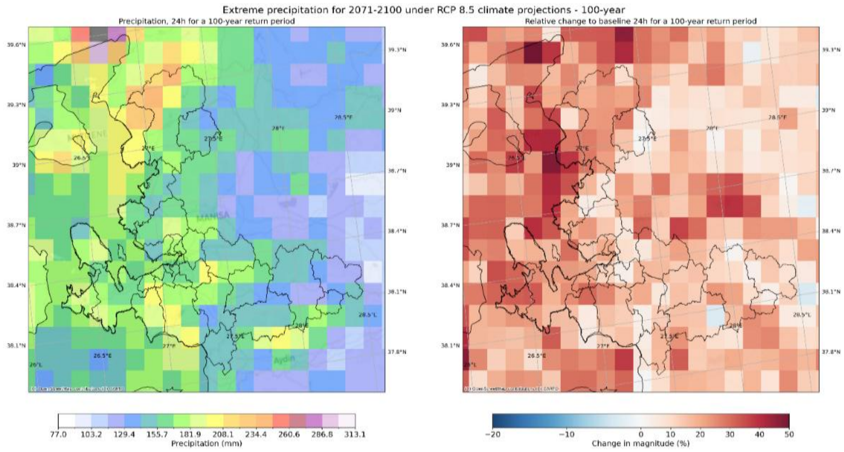

Figure 2-1 The map of expected precipitation for 24hr duration for 100-year return period for future *(2071-2100) period and change (%) w.r.t. historical period (1976–2005)* in *İzmir Region*

Future projections (2071-2100) show a general increase in the intensity of 100-year extremes, with most areas experiencing changes on the order of 20 to 40 percent above the historical values. Some parts of the coastal and northern region exhibit even stronger increases, occasionally surpassing 40 percent. In the region, negative or neutral changes are nearly absent, and the pattern is more coherent across models, indicating stronger extremes under continued high emissions.

These findings suggest that by the end of the century, extreme rainfall events in the İzmir region could become significantly more intense, exacerbating the risk of flash floods, riverine flooding, and urban drainage failures. The robustness of the multi-model ensemble median further strengthens the conclusion that extreme precipitation intensification is a likely outcome under RCP8.5, and it highlights the importance of incorporating climate change considerations into long-term planning.

2.3.1.2 Risk assessment

In this region, extreme precipitation is defined by a 100 mm/24-hour rainfall threshold. This analysis focuses on how climate change may influence this critical limit, consider the rising frequency and impact of such events. This analysis, covering all İzmir, aims to determine how climate change affects the return periods of the 100 mm/24-hour rainfall threshold. Figure 2-2 shows the current return periods for the 100 mm/24h rainfall threshold across İzmir, while the right map displays the expected return periods for the same threshold under the future climate scenario, RCP85 (2071-2100).

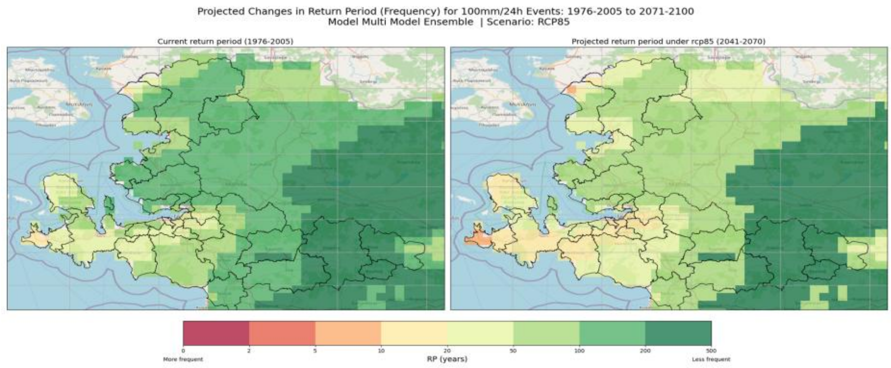

Figure 2-2 Projected Changes in Return Period (Frequency) for 100mm/24h Events: 1976-2005 to 2071-2100 -Multi Model Ensemble | Scenario: RCP85

Future projections (2071-2100) under RCP8.5 shows a clear shift toward shorter return periods of the region, especially in the southern and coastal areas, where return periods decline nearly 50 years in many places. In coastal areas, a sharp decline in return periods was observed, with values dropping below 10 years. This means extreme precipitation events are expected to become far more frequent in these areas.

Figure 2-3 illustrates the percentage shift in precipitation within the İzmir region, highlighting the most significant changes in the frequency of 100 mm/24h events.

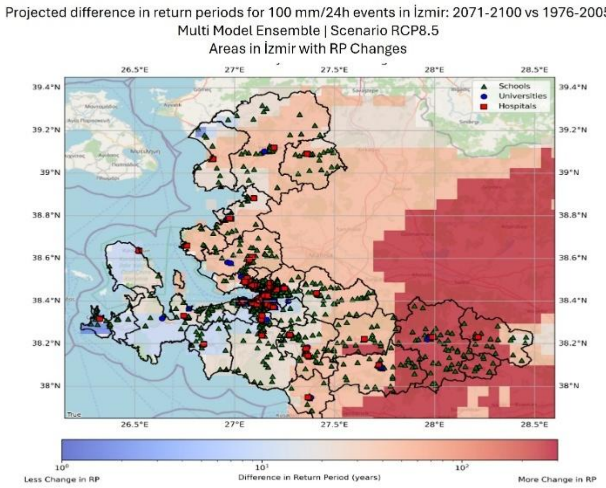

Figure 2-3 Projected difference in return periods for 100mm/24h events in İzmir: 2071-2100 vs 1976-2005 Multi Model Ensemble | Scenario: RCP85

In the eastern and southeastern parts of İzmir, the return periods are projected to decrease markedly, indicating that extreme 100 mm/24h rainfall events will become more frequent in the future. Areas shaded in red represent shorter recurrence intervals, meaning that what was historically a rarer event may occur much more often by the end of the century. In contrast, the western and coastal zones exhibit relatively smaller reductions, but the trend still points towards more frequent extreme events compared with the historical baseline. The overlay of critical infrastructure — schools, hospitals, and universities highlight the exposure of essential services to these changing risks. Particularly in central and eastern İzmir, where population density and infrastructure are high, the combination of shorter return periods and urban vulnerability may increase the likelihood of severe social and economic impacts.

2.3.1.2.1 Risk Assessment Specifically for Konak District

Extreme precipitation poses a growing risk to Konak District, particularly due to its complex geological structure and coastal positioning. Much of the district is composed of alluvial soils and

andesitic-basaltic volcanic rocks, while the upland areas feature clastic carbonate formations. In addition, historical land use and urbanization patterns, especially in the southern and southeastern parts of the historic port city, have resulted in the presence of fill materials and areas prone to slope movement. These characteristics increase the sensitivity of the district to precipitation-triggered geohazards, especially during heavy rainfall events.
The presence of artificial fill in coastal areas and slope-prone zones inland makes Konak particularly susceptible to rain-induced ground instability. In this context, extreme precipitation not only acts as a direct climate hazard but also amplifies geophysical vulnerabilities, increasing the likelihood of landslides and subsidence. This layered risk structure emphasizes the importance of integrating land stability assessments and nature-based drainage solutions into climate adaptation and disaster risk reduction strategies for the district

2.3.2 River Flooding

Table 2-3 Data Overview River Flooding

Hazard data	Vulnerability data	Exposure data	Risk output
Hydrodynamically modelled flood hazard represented by spatially explicit water depth maps for multiple return periods (10, 50, 100, 200, and 500 years)	Global flood depth-damage functions (vulnerability curves) from JRC (*Huizinga* et al., 2017).	Land use/land cover map from CORINE 2018 for urban areas, agricultural fields, infrastructure, and water bodies.	Flood Risks to infrastructure, expected economic damages to buildings and land-use classes, and identification of high-risk zones and damages map for extreme event (10, 50,100 and 500 years)

2.3.2.1 Hazard assessment

In the river flooding hazard workflow, the flood risk in the Küçük Menderes Basin was evaluated. A rain-on-grid hydrodynamic modelling approach was applied to generate water depth maps corresponding to different return periods (2, 5, 10, 50, 100, and 500 years). For this purpose, high-resolution topographic data (5 m) covering the entire basin were obtained from the General Command of Mapping of Turkey. In addition, land cover information was derived from ESA WorldCover (Zanaga et al., 2022), a global land cover product for 2021, which provides 11 land cover classes at a 10 m resolution. These classes were used to assign Manning's roughness values across the basin. The topography and land cover data used for the modelling are presented below.

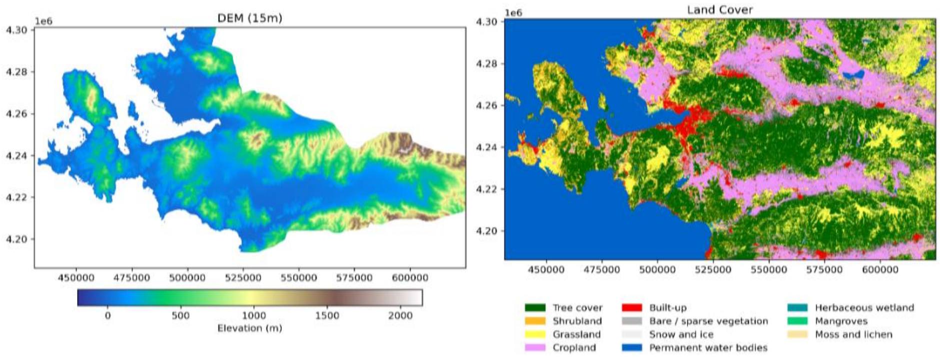

Figure 2-4 The topographic (left) and land cover map (right) in İzmir Region

Historical precipitation maps for different return periods were generated using spatial interpolation (spline) of extreme precipitation values observed in the region. In this process, data from 77 stations with at least 40 years of records, located within and around the Küçük Menderes Basin, were utilized. To estimate future changes, relative differences with respect to the historical period were derived from the heavy rainfall workflow presented in this report. These relative changes were then applied to the historical precipitation maps to obtain projections of future extreme precipitation for return periods of 2, 5, 10, 50, 100, and 500 years. The future period considered was 2071–2100 under the RCP8.5 scenario. Figure 2-5 illustrates the comparison of historical and future (2071–2100, RCP8.5) precipitation for the 100-year return period in the İzmir Region.

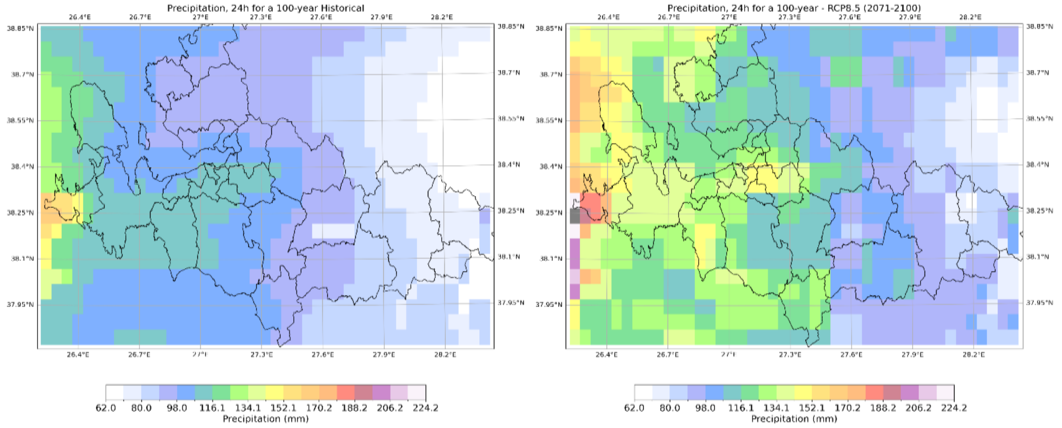

Figure 2-5 The precipitation maps for the 100-year return period in the İzmir Region (left historical, right RCP8.5 -2071-2100)

Both historical and future (2071–2100) periods were modelled using the GPU-accelerated LISFLOOD-FP two-dimensional hydrodynamic model to simulate inundation from extreme events in the İzmir Region (*Sharifian* et al., 2023). Simulations were carried out for six flood return periods, ranging from 1-in-2 years to 1-in-500 years. This approach made it possible to assess not only the historical flood risk but also projected changes under future conditions. The resulting maps cover large river basins such as the Küçük Menderes; however, they do not account for flood protection measures, which may result in overestimated flooding in certain areas. Similarly, the underlying river model excludes water management practices. Consequently, the maps should be interpreted as representations of the overall flood hazard in the region. The figure shows 100-year flooding for future period (2071-2100) and its relative change (%) with respect to historical period.

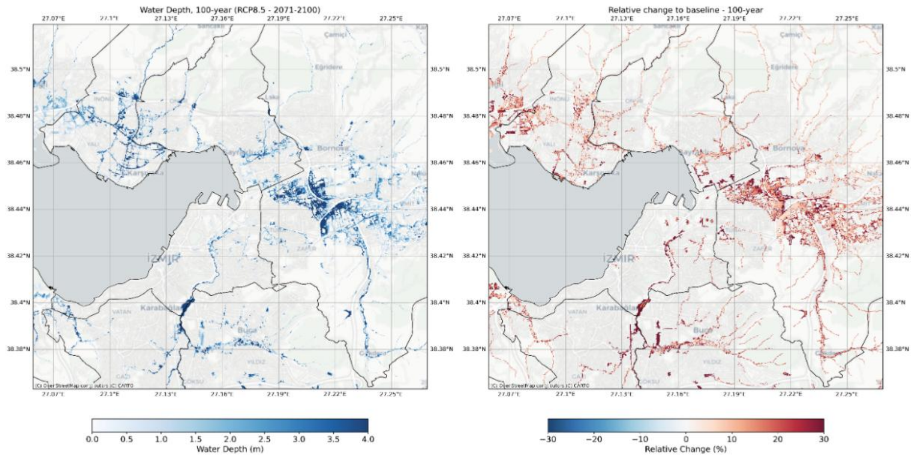

Figure 2-6 The 100-year flooding for future period (2071-2100) and its relative change (%) with respect to historical period (right)

The maps for İzmir illustrate both the projected 100-year return period flood depths under the RCP8.5 scenario for 2071–2100 and the relative changes compared to the historical baseline. The future projection shows that extensive parts of the basin, particularly along the main river corridors, coastal lowlands, and urbanized valleys, are expected to experience inundation depths exceeding 1–2 meters, with some localized areas reaching more than 4 meters. The concentration of deeper flooding around the urban core of İzmir and downstream river stretches highlights the potential risk to densely populated and economically important zones.

The change map provides additional insight into how these conditions deviate from the historical period. The positive value across the region indicates that flood hazard will generally intensify, with many areas projected to face 10–30% higher water depths compared to the past. This increase is especially pronounced in Bornova, Çiğli and Balçova areas where land use and topography exacerbate flood accumulation. The spatial pattern suggests that urban centers, infrastructure corridors, and peri-urban regions are particularly exposed, reinforcing the link between climate change and growing urban flood risks.

2.3.2.2 Risk assessment

River flooding risk was evaluated to estimate the potential economic damage to buildings, the exposure of critical infrastructure, and the displacement of the population by integrating flood hazard data with population and building datasets. Flood depths simulated within the hazard workflow were analyzed for 10, 50, 100, and 500-year return periods. Population data were sourced from the Turkish Statistical Institute (TUIK) for the year 2024, while building data were obtained from the İzmir Metropolitan Municipality (IBB), including classifications for Residential, Public, and Commercial/Industrial structures. The assessment covered the entire İzmir metropolitan area; however, the maps presented focus on the city center (Konak district). Figure 2-7 presents two maps side by side: the left map illustrates building categories, while the right map shows population density, representing the number of people per pixel in İzmir. The number of people per pixel was calculated by using neighborhood-level population data and the number of pixels within each neighborhood, and the results were mapped.

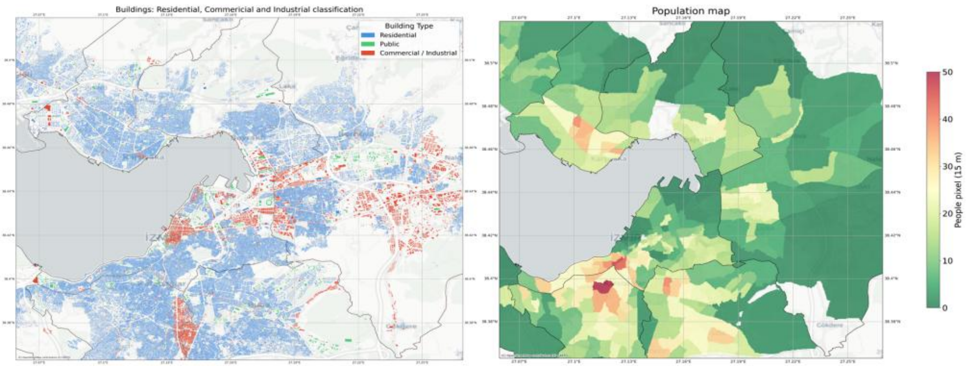

Figure 2-7 Building categories (left) and population map (right)

To evaluate flood-related damage to buildings, including damage fraction, reconstruction costs, and the value of building contents the Joint Research Centre (JRC) methodology was applied (*Huizinga* et al., 2017). This approach establishes the relationship between water depth and the extent of damage. Initially, buildings exposed to flooding were identified, and the maximum flood depth at each building location was determined. Subsequently, for each flood return period, the corresponding flood depth for every building was calculated. Based on the modelled flood water depths, the damage to buildings (reconstruction costs) and their contents were estimated using the JRC damage functions for fractional building damage. The fractional damage values were multiplied by the maximum damage cost per square meter and the building's footprint area. In this way, the total economic damage was assessed for each individual building. Figure 2-8 shows the maximum flood depth at buildings and economic damage to buildings for 100-year return period.

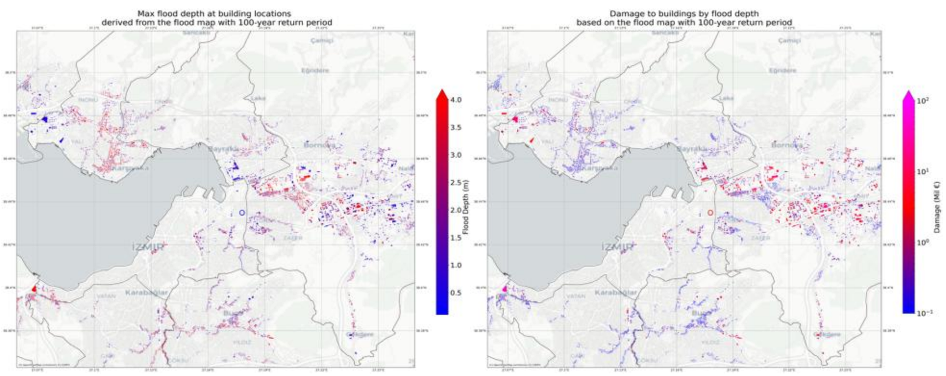

Figure 2-8 Maximum flood depth at buildings (left) and economic damage to buildings (right) for 100-year return period

The flood depth map highlights that the most affected zones are concentrated in the flat and densely built districts of Bornova, Bayraklı, Karşıyaka, and parts of Buca. In these areas, flood depths often exceed three meters, indicating the potential for severe inundation. The highest economic losses occur in Bornova and Karşıyaka, where deep flooding coincides with high building density and property value. In some parts of these districts, the maximum estimated economic loss reaches up to 45 million euros, reflecting the combined effect of deep inundation and valuable urban assets. This spatial overlap between hazard intensity and urban exposure explains the concentration of high-damage zones in central and northern İzmir.

Based on the modeled flood depth maps, the population exposed to flooding was identified by overlaying the population and flood maps datasets. This spatial comparison allowed the estimation of the number of people located within flooded areas for each return period. Similarly, the displaced population was derived as a subset of the exposed population, representing individuals residing in areas where flood depths exceed a defined threshold (>1.0 m) indicating conditions severe enough to force temporary or permanent displacement. Population and flood depth maps were compared to identifying these high-risk zones. Figure 2-9 shows the exposed and displaced population for 100-year return period.

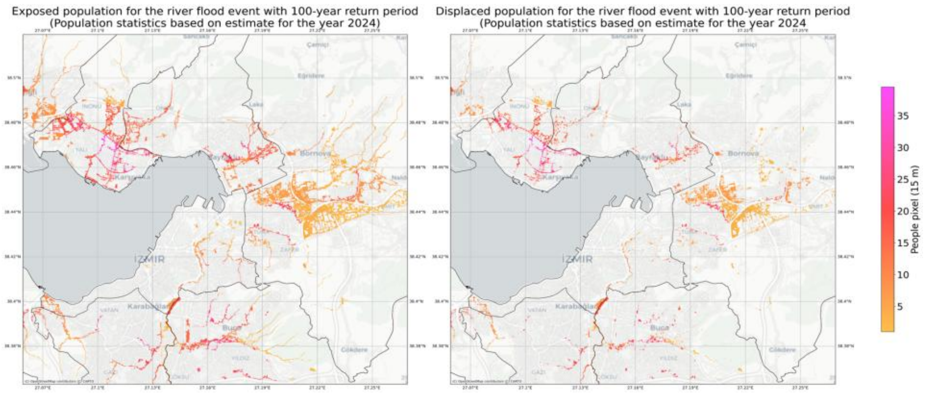

Figure 2-9 The exposed (left) and displaced population (right) for 100-year return period period

High population densities in flood-prone zones are evident along the Bornova, Meles, and Laka stream corridors, as well as in the low-lying districts of Bayraklı, Karşıyaka, and Buca. These areas contain large residential neighborhoods and commercial zones that coincide with flood extents, making them particularly vulnerable. The displaced population is concentrated in the same regions as the exposed population but in more limited areas where floodwater depths are severe enough to render buildings temporarily uninhabitable. This pattern is particularly visible along the lower reaches of the Meles and Bornova streams and the coastal neighborhoods of Karşıyaka. These areas show clusters of intense displacement potential, reflecting both deep inundation and high population density.

Overall, the findings demonstrate that flood risk in İzmir is driven not only by hydrological factors but also by the distribution of people and assets within flood-prone areas. The combination of dense populations, valuable infrastructure, and poor drainage in floodplains makes potential damage significantly worse. The analysis clearly shows the need for integrated flood management. Structural protection, land-use regulation, and early warning systems must be employed to reduce both economic losses and human displacement. Prioritizing resilience in the critical districts of Bornova, Bayraklı, Karşıyaka, and Buca is essential for sustainable urban development and climate adaptation in İzmir.

2.3.2.2.1 Risk Assessment Specifically for Konak District

River flooding resulting from sudden and extreme rainfall events represents a significant and growing climate risk for the Konak district. The presence of densely urbanized areas along streambeds, combined with sealed surfaces, limited infiltration capacity, and outdated drainage infrastructure, amplifies the risk of overland flow and riverine flooding. Under the Q500 return period scenario using RCP 8.5 projections, 54 neighborhoods and approximately 461 buildings in Konak are identified as being directly exposed to floodwaters. This spatial concentration of risk is especially prominent along the Meles Stream and its tributaries, where flood depth is modeled to exceed 5–6 meters in certain low-lying zones.

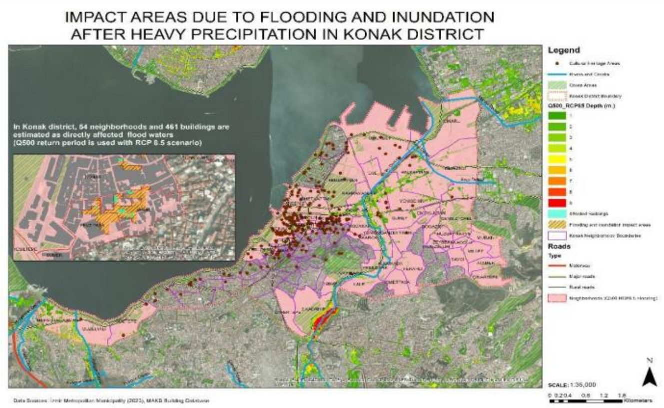

Figure 2-10 The map of river flooding specifically for Konak district

As illustrated in Figure 2-10, many of the highest-risk areas are located in neighborhoods such as Mersinli, Halkapınar, Umurbey, and parts of Kültür, where modeled inundation intersects with high population density and socio-economic vulnerability. The map clearly highlights how vulnerable urban clusters and critical infrastructure areas overlap with flood-prone zones, emphasizing the systemic nature of the risk. These overlapping vulnerabilities create "composite risk zones" that require immediate attention. With projections pointing toward more frequent and intense rainfall episodes, adaptive measures such as drainage upgrades, blue-green infrastructure, and early warning systems become essential to reduce future flood risk in Konak.

2.3.3 Sea Level Rise and Coastal Flooding

Table 2-4 Data overview for Sea Level Rise and Coastal Flooding

Hazard data	Vulnerability data	Exposure data	Risk output
Statistical indicators derived from water level time series for different return periods (10, 50, 100, 200, 500 years) and NASA Sea	Global flood depth-damage functions (vulnerability curves) from JRC (*Huizinga* et al., 2017).	Land use/land cover map from JRC (LUISA Base Map 2018) for urban areas, agricultural fields, infrastructure, and water bodies.	Flood Risks to build infrastructure, flood and associated damages maps for extreme event in (5, 10,50 and 100 years)

Hazard data	Vulnerability data	Exposure data	Risk output
Level Projection tool for future periods			

2.3.3.1 Hazard assessment

In the sea level rise and coastal flooding hazard workflow, historical water level observations from the Mentes stations were used. 10 min interval water level observations from Mentes stations in İzmir coast were obtained for the period of 2000-2025. This dataset was used to derive extreme water levels for different return periods in İzmir coastal area using extreme distribution fitting. The location of the Mentes station is given in Figure 2-11.

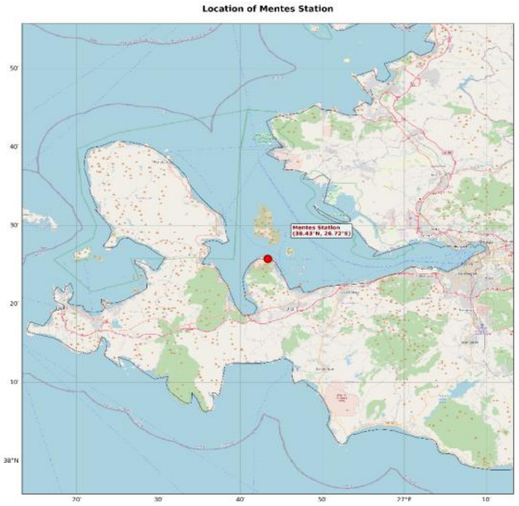

Figure 2-11 Location of the Mentes station

Additionally, the daily and monthly maximum water levels recorded over the 25-year period were also obtained and presented in Figure 2-12.

Figure 2-12 The daily and monthly maximum water levels at the Mentes station

First, the annual maximum observations were identified. These values were then fitted to seven parametric probability distributions, namely GEV (Generalized Extreme Value), Weibull, Log-normal, Exponential, Pearson, Beta, and Gumbel. For each distribution, AIC and BIC were calculated to evaluate model performance. The fitted distribution curves, Q–Q plots, and corresponding test metrics are presented.

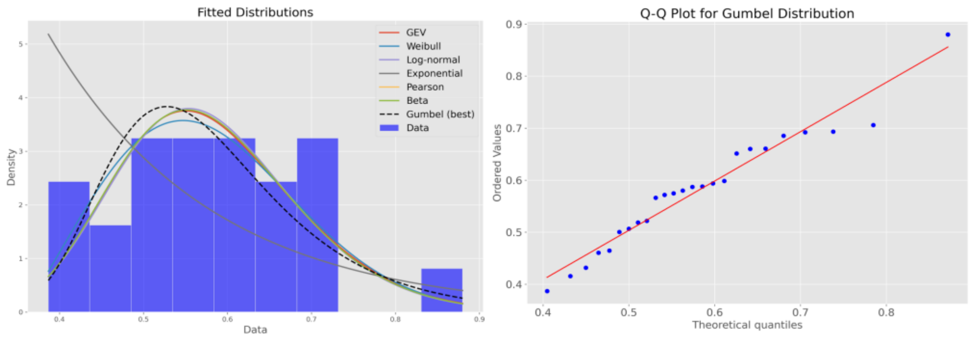

Figure 2-13 The fitted distribution curves (left) and Q–Q plots (right)

Among the tested distributions, the Gumbel distribution provided the best fit for this dataset, yielding the lowest AIC and BIC values at both stations. The results indicate that the data follows an extreme value distribution, making Gumbel particularly suitable for modeling maxima or minima in the dataset. Using the Gumbel distribution, extreme water levels for different return periods were calculated for 2, 5, 10, 25, 50, 75 and 100 years.

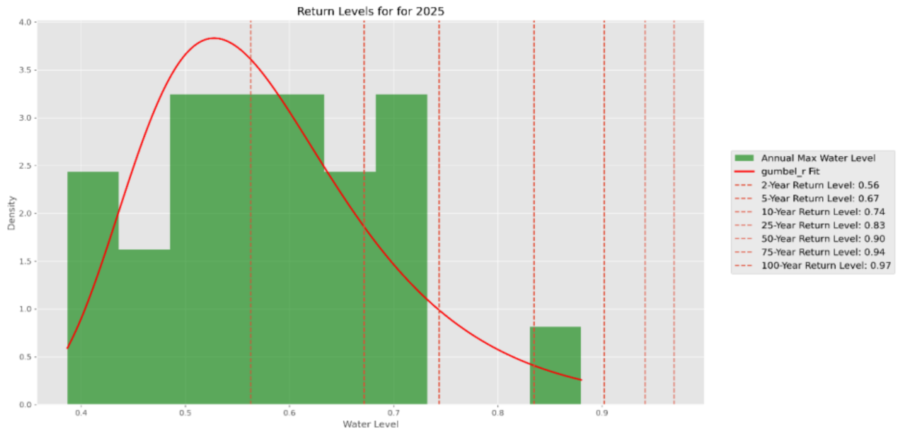

Figure 2-14 Extreme water levels for different return periods for Mentes stations.

Extreme water levels for the 2000–2025 period were calculated for different return periods. To assess future changes, global sea level change indicators covering 1950–2050 were used, derived from reanalysis data and high-resolution CMIP6 climate projections (*Copernicus* Climate Change Service [C3S], 2022). A multi-model ensemble (median) was taken across the CMCC-CM2-VHR4, EC-Earth3P-HR, HadGEM3-GC31-HM, and HadGEM3-GC31-HM-SST models. The same return periods as in the observational analysis were applied. The dataset includes both a historical baseline (1985–2014) and a future period (2021–2050). The methodology involved estimating extreme water levels for both historical and future conditions, calculating their absolute differences, and then adding these changes to the extreme water levels derived from the Mentes station observations. As a result, Table 2-5 presents the historical and projected extreme water levels for different return periods in the İzmir coastal region.

Table 2-5 Historical and projected extreme water levels for different return periods in the İzmir coastal region

Return Period	Historical Reanalysis (1985–2014)	Future (2021–2050)	Difference	Historical Mentes Station (2000–2025)	Future Mentes Station (2021-2050)
2	0.45	0.44	0.01	0.56	0.55
5	0.51	0.49	0.02	0.67	0.65
10	0.55	0.53	0.02	0.74	0.72
25	0.61	0.58	0.03	0.83	0.81
50	0.66	0.62	0.03	0.90	0.87

75	0.68	0.65	0.04	0.94	0.91
100	0.70	0.66	0.04	0.97	0.93

The analysis reveals a slight downward trend in extreme water levels along the İzmir coast. Nevertheless, with extreme water levels reaching 0.93 m for the 100-year return period, the flooding risk remains considerable under current conditions. However, these values only represent historical extremes and do not include the effects of sea level rise, which is expected to exacerbate coastal hazards. To incorporate sea level rise projections, the NASA Sea Level Projection Tool was used to obtain data from the IPCC 6th Assessment Report (AR6) (*IPCC*, 2021). These projections, referenced to the 1995–2014 baseline, consist of multiple model outputs. In this workflow, the median values of these model outputs were selected. The analysis focused exclusively on the SSP5-8.5 scenario, assessing sea level rise by the year 2100. In İzmir, projected sea level rise is assessed for the SSP4-5 and SSP8-5 scenarios using a multi-model ensemble.

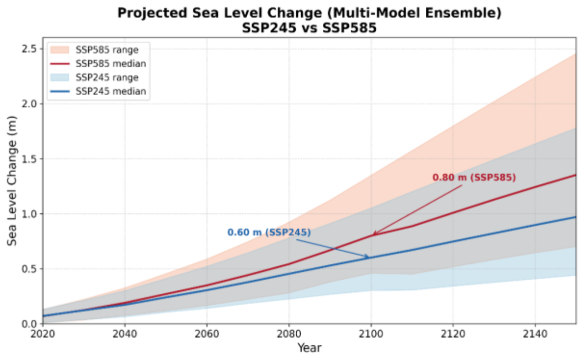

Figure 2-15 Projected Sea level rise for the SSP4-5 and SSP8-5 scenarios

Extreme water levels for different return periods with sea level rise projections in İzmir coastal area were given in Table 2-6.

Table 2-6 Extreme water levels for different return periods in İzmir coastal area

Return Period	Mentes Station (Extreme Water + Sea Level Rise)
2	1.35
5	1.45
10	1.52
25	1.61
50	1.67
75	1.71
100	1.73

With sea level rise included, extreme water levels are projected to reach 1.73 m for the 100-year return period, further intensifying coastal hazards. Under the SSP5-8.5 scenario, sea level in the region is projected to rise by 0.81 m (median estimate). This additional increase will substantially amplify extreme water levels, creating serious risks for coastal infrastructure, urban areas, and overall flood resilience.

2.3.3.2 Risk assessment

Risk assessment was assessed to visualize risks to build infrastructure presented by coastal flooding in the region. The extreme water levels and additional sea level rise calculated in hazard workflow were used for potential water level rise. Land use/land cover maps developed and produced by the JRC (*Batista*& Pigaiani, 2021) were used for various types of urban areas, natural land, agricultural fields, infrastructure and waterbodies. Additionally, for risk analysis global flood depth-damage functions (vulnerability curves) were used by JRC (*Huizinga* et al., 2017). The analysis was performed for 5, 10, 50 and 100-year return periods of extreme water levels in the region. Figure 2-16 show water depth maps for 1 in 100-year extreme events.

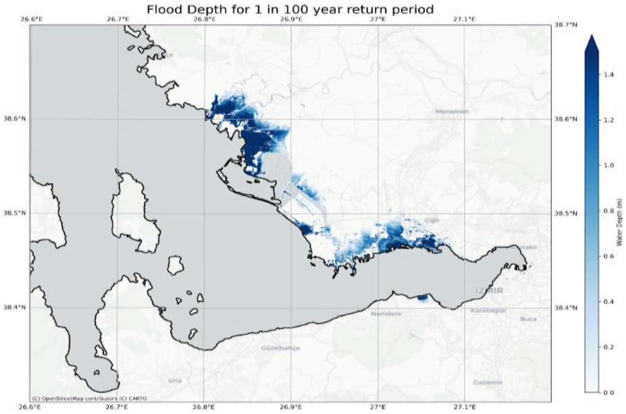

Figure 2-16 The water depth map of 1 in 100-year coastal flood event for SSP585 scenario in 2100 event in İzmir Metropolitan City

The effect of the coastal flooding on the infrastructure was assessed using the potential water depth map, flood depth-damage functions and land cover information. Figure 2-17 show flood damage for 1 in 100-year extreme event and land cover information in İzmir.

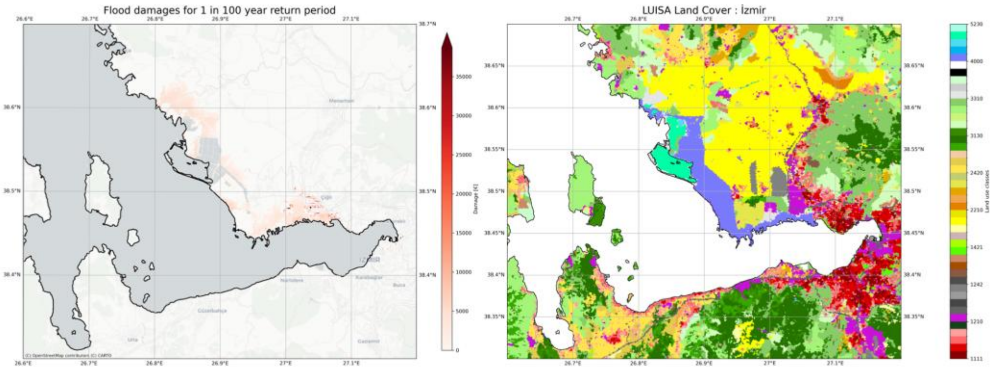

Figure 2-17 The flood damage map of 1 in 100-year coastal flood event for SSP585 scenario in 2100 event (left) and land cover classes in İzmir Metropolitan City

In general, the analysis showed significant coastal flood risks in low-lying coastal areas of the province. The areas most affected by flooding and economic damages are concentrated around Çiğli and the northern coastal zones of İzmir, where urban development and infrastructure are highly exposed to rising water levels. Infrastructure such as roads, ports, and industrial zones in Çiğli and Foça could be significantly impacted by the flooding. Coastal areas closer to Karşıyaka and İzmir city center are affected to a lesser extent. The results indicate that densely populated and industrialized regions face higher financial losses due to flooding in İzmir.

In particular, the risk assessment due to sea level rise and coastal flooding have been studied in detail on two spatial levels; the provincial level and the Konak District level. In both risk assessment steps, the same methodology, which was based on the adaptation of the risk analysis framework of Climaax to the local context, has been utilized. Due to page limitations of this reporting template, details developed provincial level risk assessment and the risk assessment on Konak District are presented in **Annex Document Section 2.3.3.2.1 and Section 2.3.3.2.2** respectively. In the remainder of this section, we summarize the results of the relevant risk study for Izmir Province and Konak District below. As shown clearly on the map (Figure 2-18), risk is predominantly concentrated within the İzmir Gulf area, where the combined presence of extensive coastal inundation, dense urban built up area, and vulnerable social and spatial assets significantly increases overall risk levels. Moving away from the gulf both towards the north and the south, risk levels gradually decrease. Although the extent of inundation is also high in these locations, the lowered levels of risk are primarily due to the lower concentration of exposed urban, cultural, and socio-economic elements. This spatial pattern highlights the strong influence of coastal morphology and land-use intensity on risk distribution, underscoring the need for location-specific adaptation and risk reduction measures, particularly in high-risk coastal zones.

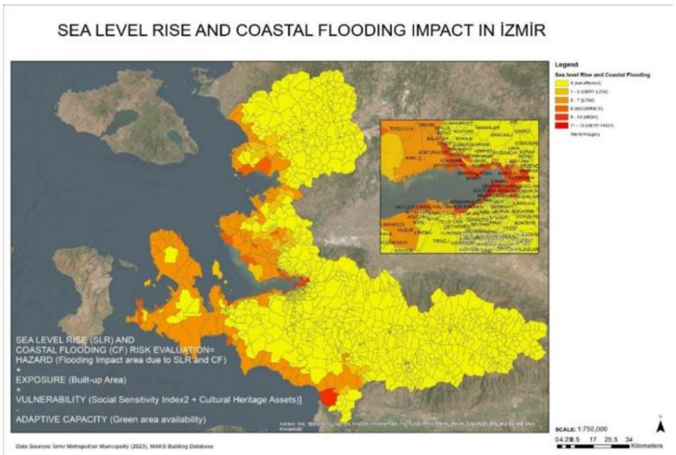

Figure 2-18 Risk assessment map for sea level rise and coastal flooding in İzmir Province

2.3.3.2.1 Risk Assessment Specifically for Konak District

As mentioned in the previous section, coastal flooding and sea-level rise represent one of the most critical compound climate risks in the İzmir Gulf area, where Konak District is located. As Konak District is characterized by the intersection of dense urban settlements, cultural heritage zones, and vital transport infrastructure, it is identified as a high-risk zone. The risk is not solely determined by physical proximity to the coast but is also significantly shaped by social vulnerability of populations residing in flood-prone areas. Factors such as age, income, gender, household structure, and migration status influence the capacity of communities to cope with and recover from the impacts of sea-level rise and coastal flooding. Therefore, both exposure and vulnerability must be evaluated together to understand the full spectrum of risk.

As shown on Figure 2-19, a large proportion of neighborhoods located along the coastline are classified as being at high or very high risk, including especially Alsancak, Kültür, İsmet Kaptan, and Akdeniz Neighborhoods. As these parts of Konak District are in the urban core, they are characterized by high development intensity as well as a dense concentration of cultural heritage assets. Similarly, high risk levels are observed in the southern part of Konak District, particularly in the neighbourhoods of Güzelyalı, Çankaya, and Mithatpaşa.

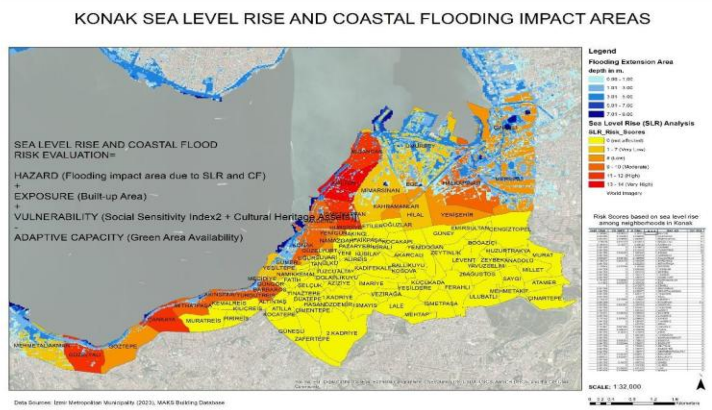

Figure 2-19 Risk assessment map for sea level rise and coastal flooding in Konak District

As expected, risk levels decrease with increasing distance from the coastline and towards inland areas. In this respect, in the northern part of the district, where the neighborhoods of Umurbey, Mimar Sinan, and Kahramanlar are located, overall risk levels appear to be relatively low. This is primarily due to lower building density and a higher presence of open and green spaces in these areas. However, this part of the district is also rich in critical infrastructure facilities. Although critical infrastructure facilities have not been reflected in the current risk assessment, assets such as İzmir Port and major transportation transfer hubs in the Halkapınar area should be considered as risk-increasing elements in these areas.

While inland neighborhoods display lower flood exposure, those with high Social Vulnerability Index (SVI) scores may still face challenges in post-disaster recovery. The convergence of physical exposure and socio-economic disadvantage in certain coastal neighborhoods underscores the importance of prioritizing adaptation efforts in these areas. Overall, the spatial distribution of coastal flooding risk in Konak mirrors both environmental and social inequalities, calling for targeted and equitable resilience strategies.

2.3.4 Urban Heatwaves

Table 2-7 Data overview urban heatwaves

Hazard data	Vulnerability data	Exposure data	Risk output
Heatwave metrics such as the daily maximum (Tmax) and minimum (Tmin) temperature evolution for the period 1980–2100, 90th percentile thresholds of Tmax and Tmin calculated for the 1980–2010 baseline, the annual heatwave frequency and the total duration of heatwave days per year for the historical, and projected periods under SSP245 and SSP585. and Land surface temperature (LST) data from Landsat 8 Satellite (2022-2025)	Vulnerable population data (0-10 years and > 60 years)	Land Surface Temperature - areas that heat up most (UHI)	The heatwave risk map based on the exposure (LST - areas that heat up most) x vulnerability (density of vulnerable population).

2.3.4.1 Hazard assessment

The heatwave hazard in İzmir City (27.16, 38.43) was evaluated using the NASA Earth Exchange (NEX) Global Daily Downscaled Projections (GDDP) for both historical and future periods (*Thrasher*et al., 2022). The NEX-GDDP-CMIP6 dataset consists of globally downscaled climate scenarios originating from the General Circulation Model (GCM) simulations conducted as part of the Coupled Model Intercomparison Project Phase 6 (CMIP6) (*Eyring* et al., 2016). It includes data across the four

"Tier 1" greenhouse gas emissions scenarios, known as Shared Socioeconomic Pathways (SSPs) (*Meinshausen*et al., 2020; O'Neill et al., 2016). The dataset consists downscaled, bias corrected historical (1950 - 2014) and future (2015 - 2100) climate projections, including variables such as humidity, precipitation, near-surface air temperature and wind speed, derived from the outputs of the Sixth Phase of the Climate Model Intercomparison Project (CMIP6). These downscaled products are available at a 0.25-degree horizontal resolution. No single climate model can perfectly represent the climate system, as each uses different assumptions and structures, creating uncertainty. We employ a multi-model ensemble approach to address this by combining outputs from 34 different GCMs (detailed in Table 2-8). This method reduces individual model biases, producing more reliable and robust projections. It also helps distinguish long-term climate signals from natural variability and clearly identifies areas of model agreement and uncertainty, making the results more trustworthy for risk assessment and adaptation planning.

Table 2-8 GMCs used for Heatwave Hazard assessment

Variant	Models
r1i1p1f1	ACCESS-CM2, ACCESS-ESM1-5, BCC-CSM2-MR, CanESM5, CMCC-CM2-SR5, CMCC-ESM2, EC-Earth3, EC-Earth3-Veg-LR, GFDL-CM4, GFDL-ESM4, IITM-ESM, INM-CM4-8, INM-CM5-0, IPSL-CM6A-LR, KACE-1-0-G, KIOST-ESM, MIROC6, MPI-ESM1-2-HR, MPI-ESM1-2-LR, MRI-ESM2-0, NESM3, NorESM2-LM, NorESM2-MM, TaiESM1
r1i1p1f2	CNRM-CM6-1, CNRM-ESM2-1, GISS-E2-1-G, MIROC-ES2L, UKESM1-0-LL
r1i1p1f3	HadGEM3-GC31-LL, HadGEM3-GC31-MM
r3i1p1f1	CESM2-WACCM, FGOALS-g3
r4i1p1f1	CESM2

The daily maximum and minimum temperature data from each model and scenario were extracted, and their medians were used to create an ensemble dataset. An example analysis was conducted using the mean of daily maximum temperatures over the years. The 1981–2010 period was chosen as the baseline, and temperature anomalies relative to this baseline were calculated for both future scenarios. The figure also presents the ensemble median along with the lower (10th percentile) and upper (90th percentile) bounds across models. Results indicate that under the moderate scenario, temperatures are projected to rise by approximately 3 °C by the end of the century, while under the high-emission scenario, the increase could reach up to 6 °C. These findings suggest that the frequency and intensity of heatwaves and their associated impacts are likely to intensify in the future.

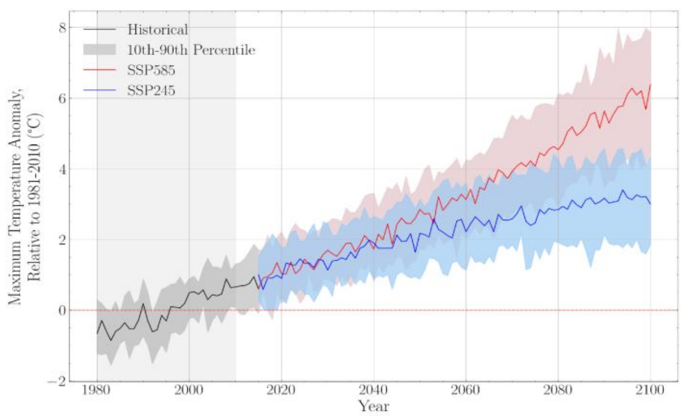

Figure 2-20 Maximum temperature anomaly relative to baseline in İzmir (1981-2010)

There is no National heat-wave definition in Turkey by the authorities, therefore a different methodology was adapted for İzmir City. For the summer months (June to August), a heat wave is defined as a period of at least five consecutive days when: The daily maximum temperature (Tmax) exceeds its monthly 90th percentile threshold, and the daily minimum temperature (Tmin) exceeds its monthly 90th percentile threshold. Each threshold (90th percentile) is calculated separately for June, July, and August, using a reference or control period (1981–2010). Therefore, Tmax condition captures extremely hot daytime conditions that cause heat stress and Tmin condition ensures that nights remain unusually warm, preventing physiological recovery from the daytime heat.

Specifically, the frequency, total number of heatwave events, and total yearly days of heatwaves were determined for the historical (1981-2010) and projected (2015-2100) periods, under SSP585 (SSP245 not shown). The results show the daily maximum (Tmax) and minimum (Tmin) temperature evolution for the period 1980–2100, 90th percentile thresholds of Tmax and Tmin calculated for the 1980–2010 baseline, the annual heatwave frequency and the total duration of heatwave days per year. The results of these calculations are visualized in Figure 2-21.

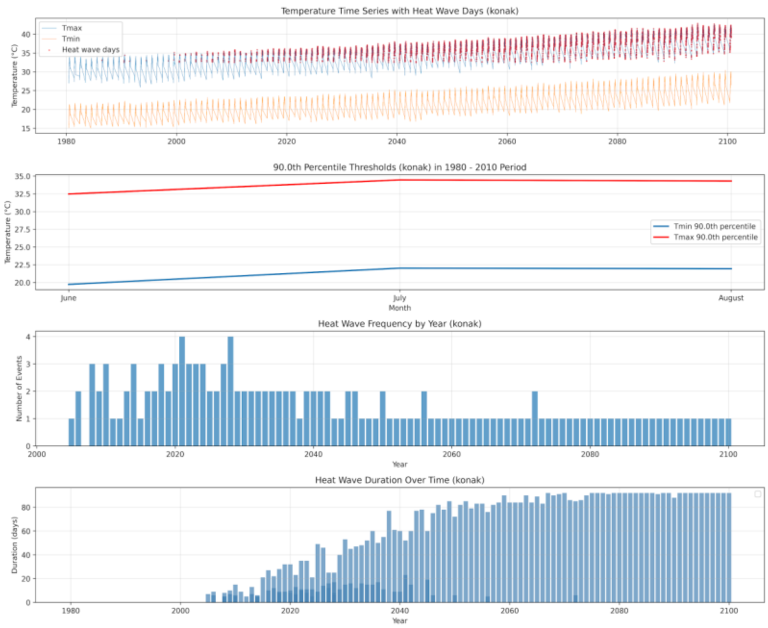

Figure 2-21 The daily maximum (Tmax) and minimum (Tmin) temperature evolution for the period 1980–2100 (a), 90th percentile thresholds of Tmax and Tmin calculated for the 1980–2010 baseline (b), the annual heatwave frequency (c) and the total duration of heatwave days per year (d)

The analysis indicates a pronounced and continuous intensification of extreme heat conditions toward the end of the century. For the annual heatwave frequency, between 2000 and 2030, İzmir experiences on average 2–4 distinct heatwave events each summer however, in later years, these individual events tend to merge into longer, almost continuous periods of extreme heat. Duration of heatwave days per year shows a dramatic upward trajectory. In the historical period, total annual duration rarely exceeded 5–10 days, while by 2050 it commonly reaches 40–60 days. Toward the end of the century, durations often surpass 80–90 days, implying that under SSP585, İzmir may spend virtually its entire summer under heatwave conditions. The analysis shows that under a high-emission scenario, İzmir is projected to experience a threefold to fourfold increase in heatwave duration and a strong upward shift in both daytime and nighttime temperatures.

2.3.4.2 Risk assessment

Urban Heat Island (UHI) is a phenomenon where urban areas experience higher temperatures than their surrounding rural areas due to human activities, land cover changes, and urbanization and İzmir is significantly affected by the UHI effect. Therefore, the risk assessment workflow integrates Landsat8 Land Surface Temperature (LST) data with vulnerability population data to estimate the risk for the overheated areas (*Sayler*, 2023). Atmospherically corrected land surface temperature derived from the data produced by the Landsat 8 OLI/TIRS sensors were used (U.S. Geological Survey [*USGS*], 2020). The thermal infrared (TIR) band processed to orthorectified surface temperature obtained for the period of 2022 to 2025 and only June and August months were selected. Only the images that has cloud coverage lower then 20% are processed. The total of 33 images were retrieved from this time in İzmir City region. Final LST maps were produced taking the mean of all satellite data retrieved from this time. The mean LST for Konak distinct versus date is given in Figure 2-22.

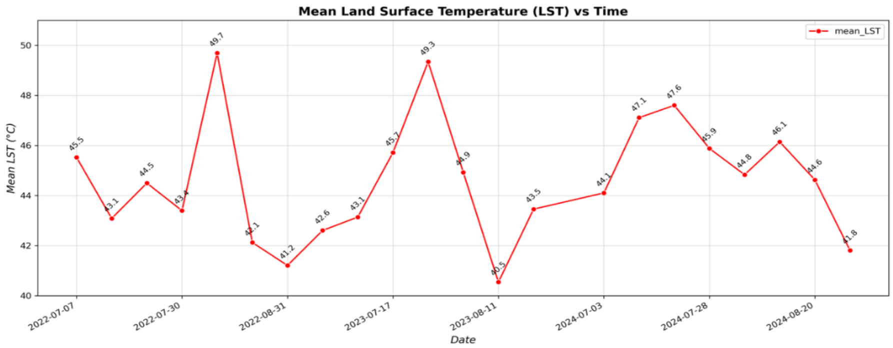

Figure 2-22 Mean LST in Konak distinct versus Landsat 8 images

The mean LST in İzmir City also given in Figure 2-23.

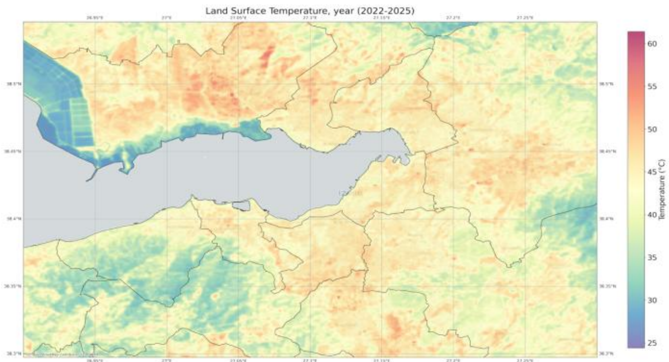

Figure 2-23 Mean LST in İzmir City retrieved from Landsat 8 images (2022-2025)

The vulnerable population data were obtained from Turkish Statistical Institute (TUIK) for 2024 year. The population data contains the age groups of 0-10 and > 60 in the region. Both LST and vulnerable population data were classified into 10 categories (Very low - Very high). Figure 2-24 shows LST (left) and the vulnerable population density in İzmir.

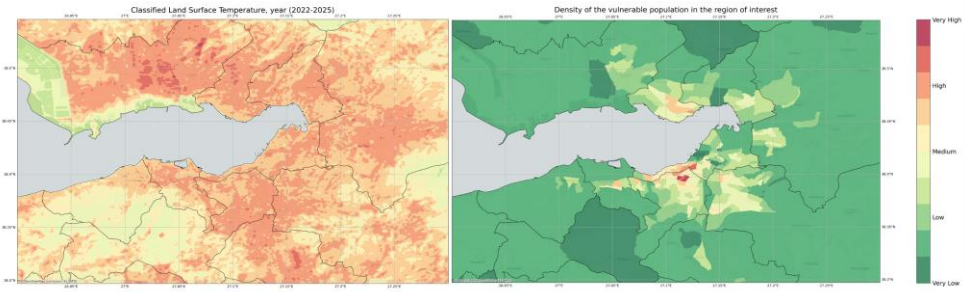

Figure 2-24 Mean LST (left) and vulnerable population density (right) maps in İzmir

The heatwave risk assessment is derived from a 10×10 risk matrix that integrates Land Surface Temperature (LST) with data on vulnerable population density. The resulting heatwave risk map represents the combined effect of exposure (areas with the highest surface temperatures) and vulnerability (the areas where both high temperature exposure and population vulnerability coincide most strongly).

Figure 2-25 shows the heatwave risk map based on the exposure (LST - areas that heat up most) x vulnerability (density of vulnerable population).

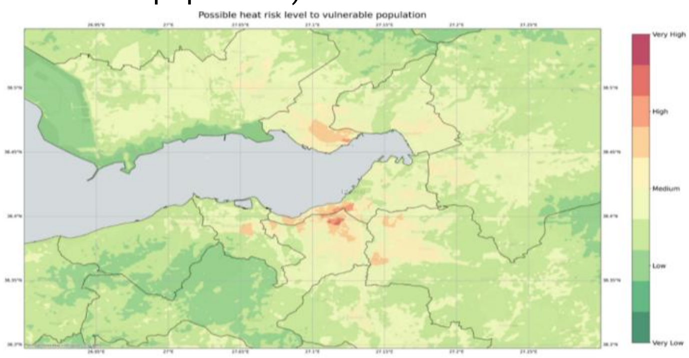

Figure 2-25 Heatwave risk map to vulnerable population in İzmir

The coastal and central urban zones, particularly around the İzmir metropolitan core and the northern shores of the bay, exhibit the highest risk levels. The dense built-up areas where the urban heat island effect intensifies surface temperatures, and where large populations—especially elderly and low-income residents are concentrated.

In contrast, the surrounding rural and mountainous regions indicate low to very low risk. These areas benefit from vegetation cover, lower building density, and greater ventilation, all of which help moderate surface temperatures. The clustering of high-risk zones along the urbanized İzmir Bay corridor highlights the compounding effects of land surface heating and demographic sensitivity.

In future, as İzmir City continues to urbanize, the expansion of impervious surfaces without adequate measures (tree cover and reflective materials) will further amplify heat risks with the effect of the rising temperature due to the climate change in future. Without adaptation strategies, the combined effects of urbanization and climate change could make extreme heat one of the most pressing environmental hazards for İzmir's population.

2.3.4.2.1 Risk Assessment Specifically for Konak District

In densely built urban areas such as Konak, where development densities are high and availability of open and green spaces is limited, extreme heat constitutes a major hazard and risk factor. Heat island effects associated with extreme temperatures pose significant risks to urban infrastructure and service areas in such dense inner quarters of cities, while also creating serious threats to residents and users of these areas. Protecting disadvantaged and vulnerable population groups with limited capacity to cope with such impacts should therefore be a central objective of local climate policy. This inevitable requires first assessment of the risks resulting from extreme heat and heat island effect.

Based on the integrated assessment of all data layers, risk scores were calculated and the distribution of risk levels was classified into five categories at the neighborhood scale (figure 2-30). As seen clearly on the risk assessment map (Figure 2-26), a large proportion of neighborhoods located along the coastline are classified as being at high or very high risk. In particular, the coastal neighborhoods such as Çankaya, Güzelyalı, Piri Reis, and Kılıç Reis in the southern part of the district exhibit elevated risk levels. In the northern section of the coastline, neighborhoods including Alsancak, Kültür, and İsmet Kaptan are also classified as very high-risk areas. Moving away from the coast towards the inner parts of the district, risk levels gradually decrease, with some neighbourhoods assessed as having very low risk. Neighborhoods identified as having very low risk include İmariye, Altay, Kadifekale, Cengiz Topel, and Yeşiltepe.

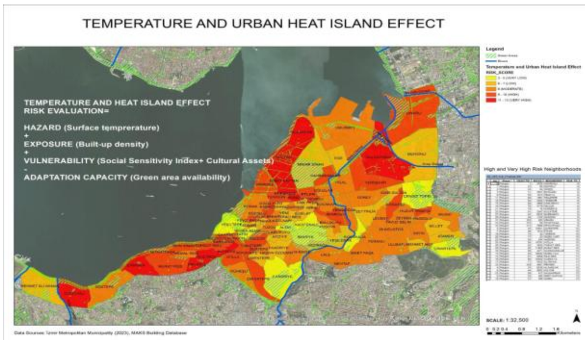

Figure 2-26 Risk assessment map for extreme heat and urban heat island effect in Konak District

Heatwaves and the urban heat island (UHI) effect in Konak District reveal a highly uneven risk pattern shaped by intersecting physical and social vulnerabilities. Dense urban form, limited access to green spaces, aging and poorly insulated housing stock, and high population density increase heat exposure, while socio-demographic factors significantly amplify sensitivity. Elderly residents, young children, households dependent on social assistance, migrants and refugees, and women bearing disproportionate care responsibilities are particularly vulnerable to heat stress. Gender, in this context, does not operate as an isolated risk factor; rather, it intersects with income level, household composition, spatial deprivation, and caregiving roles, intensifying exposure and reducing adaptive capacity. As illustrated in Figure 2- 30, the heat risk map for Konak reveals a strong spatial overlap between high UHI intensity zones and neighborhoods with pronounced social vulnerability. These clusters—where both exposure and sensitivity converge—require special attention in climate adaptation planning. Conversely, lower-risk zones such as parts of the Göztepe shoreline, the Mithatpaşa corridor, and areas near Üçkuyular benefit from greater green space, improved building conditions, and coastal cooling effects. The map reinforces that heat-related risk in Konak is shaped not only by environmental conditions but also by the spatial distribution of social inequalities. As such, adaptation and social policy efforts should focus on the neighborhoods where heat risk and vulnerability intersect most acutely.

2.3.5 Additional assessments based on local models and data

Additional assessments include wildfire risk assessment and improved agricultural drought assessment (compared to Phase 1 study). For these two hazards, methodological risk analyses approach and outcomes are given in **Annex Document Section 2.3.5.1 and Section 2.3.5.2** respectively for the entire province of İzmir due to page limitation of this report.

2.4 Key Risk Assessment Findings

2.4.1 Mode of engagement for participation

As outlined in Section 2.1.5, stakeholder engagement was an integral part of the risk assessment process. A workshop was conducted with key stakeholders—including municipal authorities, civil society representatives, thematic commissions of Konak City Council, and climate-affected community groups—to reflect on preliminary risk analysis outputs. Participatory tools such as interactive presentations, spatial risk maps, and real-time surveys (e.g., via Menti) were used to facilitate input and gather perceptions of severity, urgency, and capacity. The feedback gathered helped to validate technical findings and ensure that local vulnerabilities and adaptive capacities were accurately represented in the final evaluation.

2.4.2 Gather output from Risk Analysis step

The risk evaluation for Konak District was based on outputs from the multi-risk climate assessment, including hazard-specific maps such as heatwave and urban heat island exposure, sea level rise inundation zones, and rainfall flood risk. It also incorporated neighborhood-level analyses of the Social Vulnerability Index (SVI) and dependency ratios, along with overlay maps illustrating the intersection of physical exposure and social vulnerability. Contextual data from stakeholder interviews and workshops further informed the assessment. Together, these sources provided the foundation for understanding current and future risk patterns, interpreted alongside local stakeholder perspectives.

2.4.3 Assess Severity

Climate risks in Konak and the broader İzmir region were evaluated based on current trends, projections, and their impact on communities, ecosystems, infrastructure, and the economy. Multi-risk assessments highlight extreme precipitation, heatwaves, sea level rise, coastal and river flooding as major threats, along with agricultural drought and forest fires to a lesser extent. These risks particularly endanger physical assets and socially vulnerable populations.

Data and stakeholder input indicate that sea level rise is a growing concern, while heatwaves and urban flooding have already reached critical levels, disrupting transportation, public health, and urban services. In Konak, coastal areas like Alsancak, Kültür, İsmet Kaptan, and Güzelyalı are most exposed to sea level rise. Stakeholders stress the need for a coastal buffer zone and limiting land reclamation. Interestingly, the dense row of seafront buildings currently serves as a natural barrier.

Heatwaves are identified as one of the most immediate and severe threats due to the district's dense urban fabric, limited green space, and prevalence of impermeable surfaces—factors that intensify the urban heat island effect. Stakeholders emphasize integrating nature-based solutions and converting gray infrastructure into green networks, especially in central neighborhoods like Alsancak, Kültür, İsmet Kaptan, Güzelyalı, and Çankaya.

Urban flooding is also critical, particularly in areas like Ali Reis, Pazaryeri, and the Kemeraltı historical bazaar, where drainage infrastructure struggles with extreme rainfall. Green spaces and permeable surfaces are seen as key to enhancing resilience.

The intersection of environmental exposure and social vulnerability—such as age, income, migration status, and gender—intensifies risk severity. Even less frequent events can have lasting effects on fragile groups. Risks threatening essential services, cultural heritage, or causing irreversible losses are rated as substantial or critical.

2.4.4 Assess Urgency

Several climate risks—particularly urban and coastal flooding from heavy rainfall and heat stress—are already affecting İzmir, especially vulnerable populations. In Konak, neighborhoods like Hisarönü, Mavişehir, Ali Reis, Pazaryeri, and Kemeraltı experience flash floods due to inadequate infrastructure, while heat stress in the dense central core poses serious health risks, particularly for the elderly and low-income groups.

Although these impacts are already evident, they are expected to intensify between 2040–2070 as climate change effects become more pronounced. Immediate action is required for low- or no-regret measures such as early warning systems, urban cooling strategies, and improved drainage.

Climate projections show that extreme rainfall and heatwaves will increase in frequency and intensity within the next 10–20 years. Gradual processes like sea-level rise will further amplify the impacts of sudden events, especially in storm surges. Urban heat will also worsen due to rising temperatures, limited green areas, and demographic vulnerabilities. Coastal flooding risk will persist and grow, particularly in low-lying or reclaimed areas like Alsancak, Kültür, İsmet Kaptan, and Güzelyalı, where rising sea levels could eventually weaken existing defenses.

The urgency of these risks has been assessed by evaluating both current trends and future projections. Models indicate a near-term escalation of extreme events, making early action critical—especially where adaptive capacity is low. Overall, most risks fall into the categories of "more action needed" or "immediate action needed," due to the rapid pace of change and high potential impacts of delayed responses.

2.4.5 Understand Resilience Capacity

The assessment revealed varying resilience levels across climate risks in İzmir. Coastal flooding was the only risk rated with substantial resilience capacity, largely due to targeted structural interventions such as the storm wall built by İzmir Metropolitan Municipality along the Kordon, which has effectively reduced flood impacts. However, this protection is limited to the central waterfront. Although strategic planning tools like SECAP and the Green City Action Plan indicate institutional support for integrated coastal adaptation, their implementation remains limited, resulting in an overall moderate resilience rating.

River flooding and heavy rainfall were also assessed as having moderate resilience. This reflects the existence of early warning systems, some drainage infrastructure, and risk-sensitive planning, yet gaps remain in implementation, data integration, and equitable access. In contrast, resilience to heatwaves was considered low due to the lack of dedicated measures addressing heat stress or the urban heat island effect, particularly in Konak's dense core. Socially vulnerable neighborhoods are further constrained by limited socio-economic preparedness, inadequate care services, and weak institutional coordination.

For additional risks, such as forest fires and agricultural drought, resilience capacity varies. Recent wildfires exposed significant weaknesses in local response capacity, indicating the need for urgent improvement. On the other hand, agricultural drought resilience is considered substantial, supported by existing measures such as efficient irrigation systems, farmer awareness programs, and crop planning support already in place through various institutions.

Improving data availability on household income, care needs, and service access, along with enhanced institutional coordination, is essential for increasing overall resilience. While İzmir has made progress, advancing from moderate to substantial resilience across all key risks will require more inclusive, data-driven, and long-term adaptation strategies, particularly for the most affected communities.

2.4.6 Decide on Risk Priority

The risk prioritization was guided by the integrated assessment of severity (current and future situations), urgency, and resilience capacity, as visualized in Figure 2-27. Among the four climate hazards assessed, heatwaves emerged as the highest priority risk, due to its substantial current and critical future severity, immediate action requirement, and low adaptive capacity, considering the dense urban development patterns in Konak where there is also aging populations and limited green infrastructure.

Risk Workflow	Severity		Urgency	Capacity	Risk Priority
	C	F		Resilience/ CRM	
River flooding					High
Coastal flooding					High
Heavy rainfall					Moderate
Heatwaves					Very High

Figure 2-27 Key Risk Assessment Dashboard

Heatwaves remain the top priority with a "Very high" ranking, due to their critical severity, immediate urgency, and limited adaptive capacity in vulnerable populations. Coastal flooding and river flooding follow, both receiving "High" priority, respectively, due to significant future impacts and persistent exposure in densely built areas. Heavy rainfall, while lower in overall impact, still warrants attention with a "Moderate" ranking, particularly due to cascading effects in older urban infrastructure.
The matrix confirms that adaptation planning should address all four hazards simultaneously, with special attention to institutional strengthening, cross-sectoral CRM integration, and targeted investments to improve community-level resilience.
Two other hazards have also been evaluated here as additional hazards; drought and forest fires by considering their current and future impacts (Figure 2-27). While not included in the main risk matrix, a separate evaluation was conducted by following the CLIMAAX framework. Related outcomes given in Annex document Section 2.4.6.1.

2.5 Monitoring and Evaluation

The second phase of the CRA integrated hazard, exposure, and vulnerability dimensions into a single analysis, producing more spatially targeted insights for urban risks like heatwaves, coastal and pluvial flooding. High-resolution, locally validated datasets were crucial in identifying neighborhood-level climate impacts and vulnerabilities. However, persistent challenges around the availability, consistency, and update frequency of socio-economic data continue to limit assessment accuracy. Stakeholder engagement was central to data interpretation. Workshops and meetings with local actors ensured validation of results and highlighted critical issues, especially in care-related vulnerabilities and institutional capacity. Vulnerability maps and typologies were seen as valuable tools for planning and policy development, promoting interdepartmental learning and collaboration across social services, urban planning, and risk management.
Table 2-9 summarizes key socio-economic datasets used in the CRA, primarily sourced from national and municipal institutions. These enabled more detailed identification of vulnerable groups. Yet, stakeholders emphasized ongoing data gaps—especially regarding household income, disability, service access, and institutional capacity—that must be addressed to improve future assessments, equity, and scenario modeling. A partial monitoring system exists, based on meteorological and satellite data, but integration with long-term socio-economic indicators remains limited. Strengthening data sharing across institutions and expanding monitoring capacity is essential for a more inclusive and adaptive framework. Despite progress through stakeholder integration and high-resolution modeling, challenges remain in socio-economic data and communicating uncertainty to non-technical audiences. CRA findings will be shared via maps, typologies, and a Key Risk Assessment Matrix, with tailored outputs for diverse stakeholders to support policy and implementation.

Table 2-9 Overview of socio-economic dataset used in CRA for Konak district

Dataset name	Purpose / Use in CRA	Data provider / Institution
Population by age groups (0–14, 65+)	Construction of Sensitivity Index and Dependency Ratio; identification of care-related vulnerability	National Statistical Institute Address-Based Population Registration System, 2024 – Neighborhood-level
Gender-disaggregated population data	Identification of gendered vulnerability patterns	National Statistical Institute Address-Based Population Registration System, 2024 – Neighborhood-level
Social assistance statistics	Indicator of socio-economic disadvantage and coping capacity	İzmir Metropolitan Municipality social assistance data
List of social assistance beneficiaries	Identification of households with limited economic resilience	Konak Municipality social assistance data

Currently, a partial monitoring system exists, based on meteorological and hydrological observations, satellite imagery, and early warning components. Nevertheless, the integration of long-term risk indicators and socio-economic exposure data remains limited. Expanding this capacity and strengthening inter-institutional data sharing—especially around income, care, and social vulnerability—is essential for establishing a more robust, inclusive, and forward-looking monitoring framework. The CRA's findings will be disseminated through risk maps, typology tables, and the Key Risk Assessment Matrix, complemented by tailored presentations for different stakeholder groups to support both technical implementation and policy uptake.

2.6 Work plan Phase 3

In Phase 3, the project will focus on developing and implementing detailed climate adaptation actions for both İzmir province and the Konak District, building directly on the multi-risk assessment and stakeholder engagement conducted in earlier phases. Adaptation measures will be structured under four key pillars—urban planning, disaster risk management, socio-economic resilience, and cultural heritage protection—and will be integrated into İzmir's Sustainable Energy and Climate Action Plan (SECAP). In parallel, the phase will also prioritize closing data gaps (e.g., income, disability, care needs) through institutional collaboration and enhancing the monitoring system by embedding risk indicators into local governance. Communication, learning, and inclusive participation will continue to be central to ensure long-term resilience and policy uptake.

3 Conclusions Phase 2- Climate risk assessment

Phase 2 of the Konak Climate Risk Assessment (CRA) successfully delivered a localized, multi-hazard risk analysis by integrating high-resolution exposure and vulnerability data into previously conducted regional assessments. Through this process, the CRA identified critical hotspots where climate hazards—particularly heatwaves, coastal flooding, and extreme precipitation—intersect with socio-economic vulnerabilities, creating compounding risks for marginalized groups such as low-income households, elderly residents, women-led households, and migrants.

Key findings emphasize that climate risks in Konak are highly spatially differentiated and shaped not only by environmental hazards but also by underlying social inequities. The analysis revealed that heat stress and urban heat island effects are concentrated in dense inner-city neighborhoods with limited green space and aging infrastructure, while coastal areas face growing threats from sea level rise and storm surge, affecting both the built environment and critical heritage assets. Additionally, landslide-prone zones and flash flood risks exacerbate existing vulnerabilities in areas with inadequate drainage and informal settlement patterns.

One of the key achievements of this phase was the development of a detailed risk prioritization matrix, supported by stakeholder-informed evaluation of severity, urgency, and resilience capacity. This allowed the project team to not only assess which hazards require immediate action but also to identify gaps in resilience across physical infrastructure and social systems. However, challenges remain, particularly regarding access to updated and disaggregated socio-economic data; such as neighborhood-level income, care needs, and service capacity which are essential for refining risk analysis and developing truly equitable adaptation strategies.

Despite these challenges, Phase 2 created a strong foundation for actionable adaptation planning. The insights generated will directly inform Phase 3, during which adaptation measures will be developed and mainstreamed into İzmir’s SECAP, with specific actions tailored to both city-wide and district-level needs across urban planning, disaster risk management, socio-economic resilience, and cultural heritage protection.

4 Progress evaluation

In Phases 1 and 2 of the project, a comprehensive multi-risk climate risk and vulnerability assessment (RVA) was conducted for İzmir Metropolitan Municipality and further refined for Konak District as a pilot area. Phase 1 focused on identifying key hazards across the city—heatwaves, coastal flooding, extreme precipitation, and agricultural drought—and established a foundation for understanding regional climate risks. In Phase 2, the analysis was deepened at the district level using high-resolution local data and methods such as SVI and dependency ratio analysis. Based on new evidence and stakeholder feedback, the risk typology was updated: river flooding replaced agricultural drought as a priority hazard, and an additional wildfire risk assessment was conducted for İzmir using composite indices (hazard, exposure, fuel, and adaptive capacity). Key milestones such as the completion of the Konak RVA report, local dissemination workshops, and institutional engagement activities were successfully achieved.

In Phase 3, the project will focus on developing adaptation action plans for both İzmir and Konak, aligned with İzmir's SECAP. The strategy will be built around four thematic pillars: urban planning, disaster risk management, social resilience, and cultural heritage. Outputs will include finalized action plans, a monitoring and evaluation framework, continued training and stakeholder engagement activities, and participation in EU-level dissemination events through CLIMAAX. This phase marks a shift from risk analysis to action, ensuring that the project results lead to targeted, locally grounded adaptation measures.

Table 4-1 Overview key performance indicators

Key performance indicators	***Progress***
Number of detailed neighborhood-level risk assessments completed: 1	*Achieved*
Number of stakeholders involved in the risk assessment and adaptation planning activities: 30	*Achieved*
Number of multi-sectoral RVA reports generated: 2	*Achieved*
Number of workshops, meetings, and training sessions conducted: 6	*5/6 Achieved* *(Phase 3 (Deadline: 31 Jul 2026))*
Number of adaptation action plans developed for Konak district: 1	*Phase 3 (Deadline: 31 Jun 2026)*
Number of publications, digital maps, and dissemination materials produced: 2	*1/2 Achieved* *Phase 3 (Jun 2026)*
Number of conferences and public info sessions held to present RVA findings: 2	*1/2 Achieved* *Phase 3 (31 Jul 2026)*
Number of media articles and mentions about the project: 5	*4/5 Achieved* *(Phase 3 (Deadline: 31 Jul 2026))*
Number of workflows successfully applied to Deliverable 1: 3	*Achieved*

Table 4-2 Overview milestones

Milestones	Progress
M1: Data Collection and Literature Review Completed	Achieved (Jan 2025)
M2: Subcontracting Tender Completed	Achieved (Jan 2025)
M3: Initial Stakeholder Meeting Held	Achieved (Jan 2025)
M4: Data Analysis Completed	Achieved (Feb 2025)
M5: City-Wide RVA Report Prepared	Achieved (Mar 2025)
M6: Dissemination Workshop Held	Achieved (Mar 2025)
M7: Konak District Stakeholder Meetings Held	Achieved (Apr 2025)
M8: Data Collection and Analysis for Konak Completed	Achieved (Jul 2025)
M9: Attend the CLIMAAX Workshop Held in Barcelona	Achieved 2 (Jul 2025)
M10: Socio-Economic Impact Assessment Completed	Achieved (Oct 2025)
M11: Konak District RVA Report Prepared	Achieved (Dec 2025)
M12: Dissemination Workshop for Konak Held	Achieved (Dec 2025)
M13: Stakeholder Engagement on Adaptation Options Completed	Phase 3 (Feb 2026)
M14: Adaptation Action Plan Developed	Phase 3 (Mar 2026)
M15: Training Sessions Conducted	Phase 3 (May 2026)
M16: Monitoring and Evaluation Framework Established	Phase 3 (Jun 2026)
M17: Final Conference and Presentation of Results	Phase 3 (Jul 2026)
M18: Attend the CLIMAAX Workshop Held in Brussels	Phase 3 (Dec 2026)

5 Supporting documentation

The additional documents were uploaded. The content of the files are as follows:

- Main Report (PDF)

Visual Outputs (infographics, maps, charts)

- Heavy Rainfall (extreme precipitation) Workflow (Maps and Graphs)
  - Hazard Workflow Outputs
  - Risk Assessment Outputs
- Heatwaves Workflow (Maps and Graphs)
  - Hazard Workflow Outputs
  - Risk Assessment (UHI) Outputs
- River Flooding (Maps and Graphs)
  - Hazard Workflow Outputs
  - Risk Assessment Outputs
- Coastal Flooding (Maps and Graphs)
  - Hazard Workflow Outputs
  - Risk Assessment Outputs
- Annex of Konak CRA Report
- Adaptation Strategies

Datasets Collected

- İzmir region boundary
- Critical infrastructure location (hospitals, schools etc.)
- İzmir buildings map
- Konak district
- Sea level measurements in Mentes Station
- Historical maximum daily precipitation for 2, 10, 25, 50, 100, 500 year return period
- Return Periods of 100mm precipitation threshold in İzmir based on historical observations
- İzmir population map

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