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Advanced Screening Agios Dimitrios

Study summary

Short name: AgiosDimitrios
Study goal: Advanced Screening Study for AgiosDimitrios.
Sector: Public Administration – Social Protection
Country: Greece
City/Region: ATHINA

Study type

Advanced Screening: Urban Infrastructure

Project category that involves transformative actions on the built environment (buildings and/or open spaces) within a urban context. Different urban planning and design actions across multiple scales are included, ranging from new developments and urban regeneration actions (city to district level), to single neighbourhood-scale interventions on buildings and open spaces (e.g. a new/retrofitted residential and/or mixed use building blocks, new public spaces and green area, etc.). Urban infrastructure design actions can also be related to specific sectors of intervention promoted by metropolitan/city/district planning departments, such as the realization of urban parks and green areas, urban street network improvement, hydraulic works on river banks and coastal areas, etc.

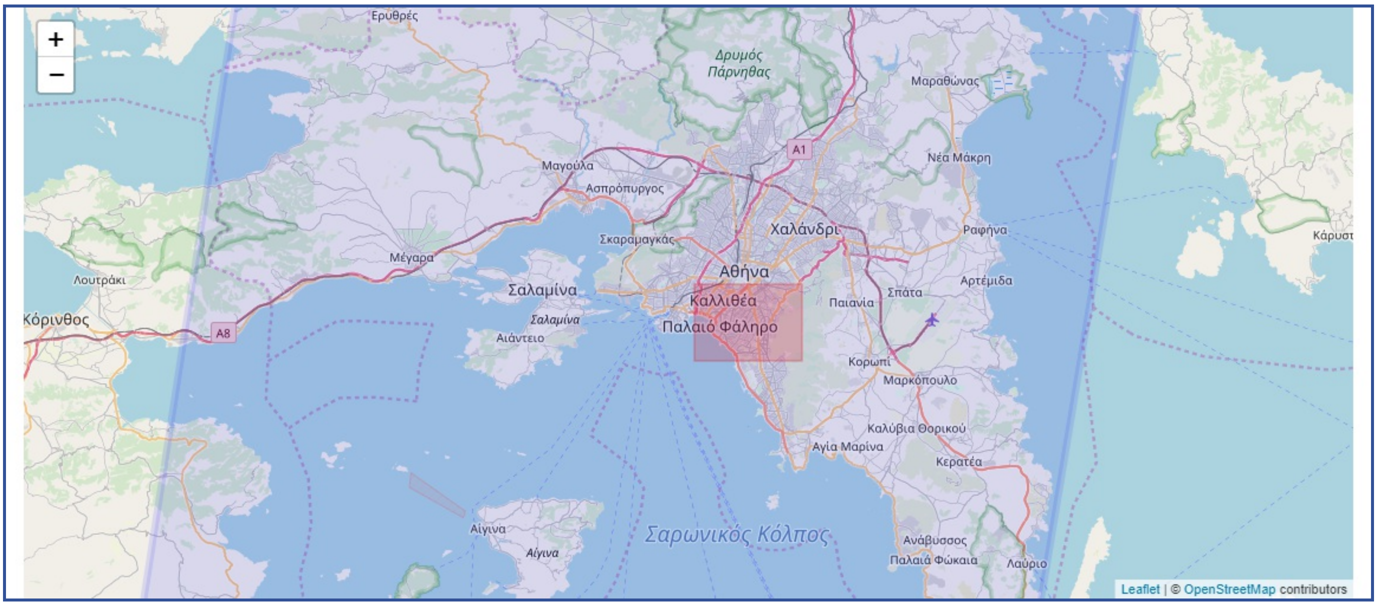
This study type triggers the screening process that estimates the impact of the heat and flooding, as well as the effects of the adaptation options on the fly.

Study presets

- Baseline, Period: historical, Scenario: Historical, Frequency: yearly, Variant: no Adaptation Options

Study area maps

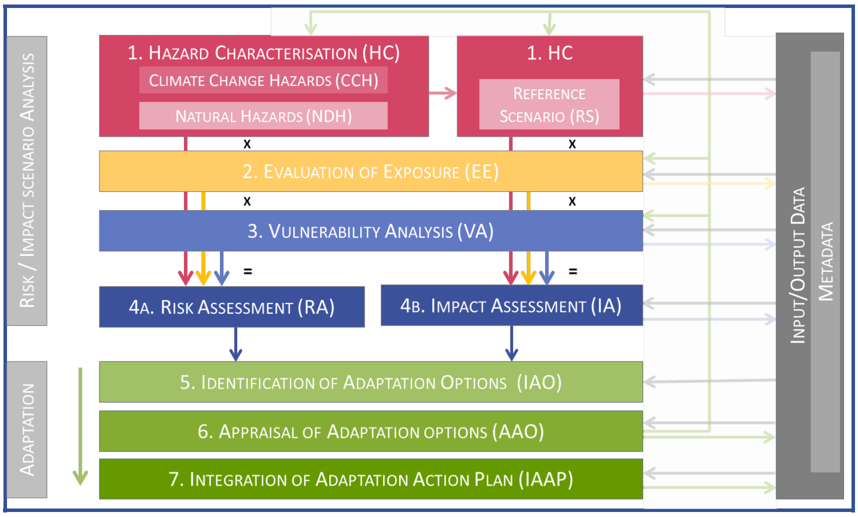
Screenshot with overview of Study area



Red square marks the Study area for this project

Methodology

The EU-GL methodology



This section outlines the working methodology adopted within CLARITY, identifying the background scientific approach in the field of climate and risk sciences at the base of the CSIS logic and its relation with the procedures identified by the EU-GL.

The figure above illustrates the EU-GL workflow as envisaged within CLARITY. The 7 steps from updated EU-GLs correspond to 4 steps needed to simulate climate risk/impact scenarios and 3 additional steps needed to assess the effect of adaptation measures and integrate them in the planning/design process (the back arrow from step 6 to step 1 indicate the need of producing alternative scenarios which simulate the effect of adaptation options and measure the variation in terms of risk/impact deriving from their implementation).

Each step is fed by different types of datasets and connected with the others in terms of input and output.

Update of EU-GL methodology

In relation to the objectives of CLARITY, the EU-GLs have been updated to comply with the IPCC-AR5 approach, adapting the corresponding content both in relation to the scientific methodological shift, and the original objectives underlying the "steps" of the Climate Resilience Toolkit (Table below).

Guidelines for Project Managers, 2013: Climate Resilience Toolkit	**CLARITY**
1. Identify Climate Sensitivity 2. Evaluate Exposure 3. Assess Vulnerability 4. Assess Risks	1. Characterize Hazard (HC) 2. Evaluate Exposure (EE) 3. Vulnerability analysis (VA) 4. Assess Risks and Impact (RA & IA)
5. Identify adaptation options	5. Identify adaptation options (IAO)
6. Appraise options	6. Appraise adaptation options (AAO)
7. Implement	7. Implement/Integrate Adaptation Action Plans (IAAP)

Report details

EEA city factsheet

Introduction

This step showcases the feasibility of adding external applications to CLARITY workflows.

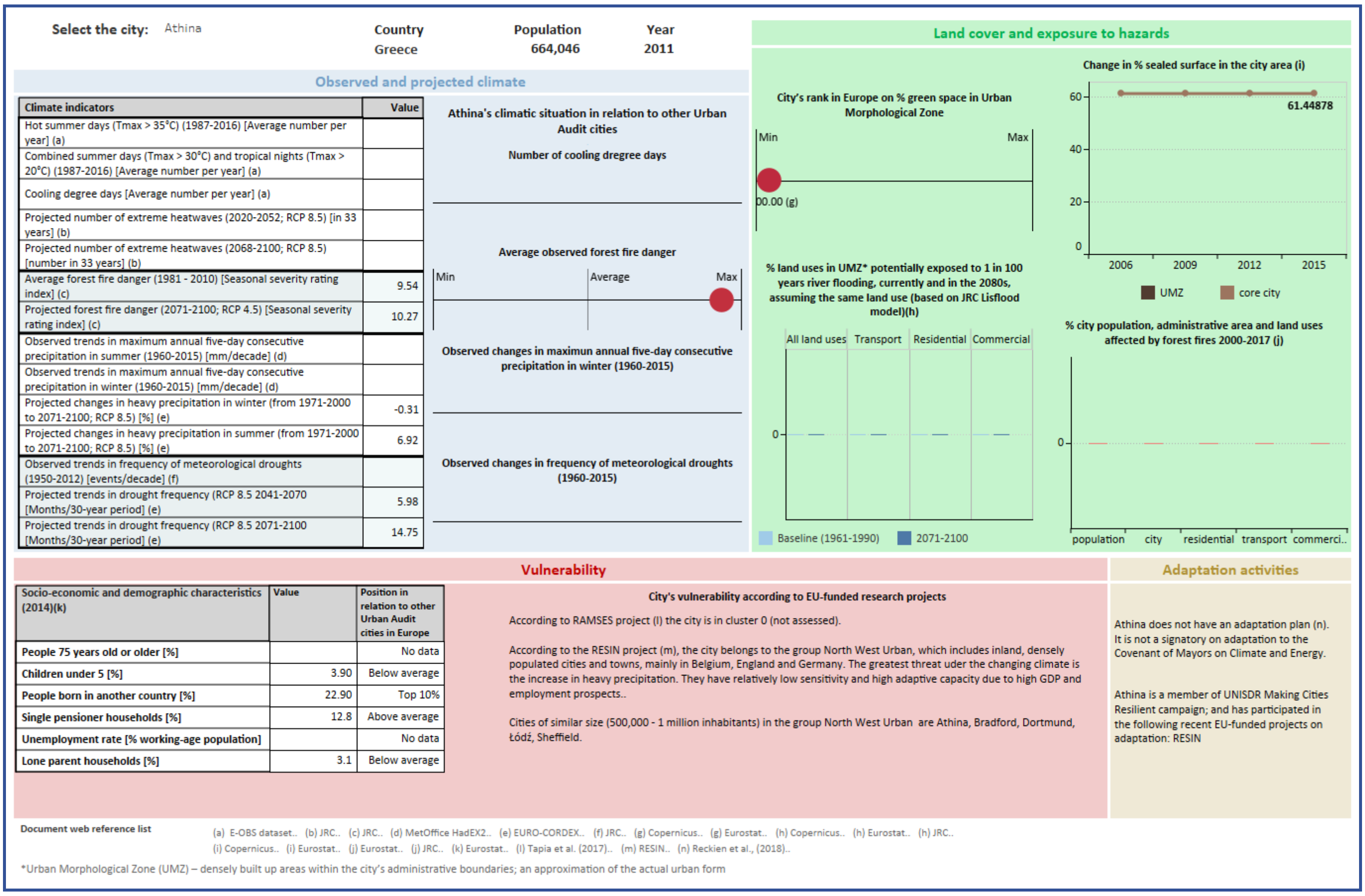
City factsheets are produced by [European Environmental Agency "Climate Adapt" platform]() and the information provided is pertinent to more than one of the EU-GL steps.

Maps

No elements of this type are listed for this step.

Tables

Report image



Athina factsheet, from EEA City factsheets

- *forest fire severity index:*
  - *currently 9.5;*
  - *RCP 4.5, 2071-2100:10,27*
- *projected drought frequency*
  - *RPC8.5, 2041-2071: 5.98*
  - *RPC8.5, 2071-2100: 14,75*
- projected heavy percipitation change from 1971/2000 to 2071-2100, RCP 8.5:
  - slightly less in winter
  - 7% more in summer

RESIN vulnerability classement of Athina likely to be wrong, with droughts, high temperatures and forest fires likely to be more important hazards than heavy percipitation for Athens.

Scenario Analysis

No elements of this type are listed for this step.

Hazard Characterization

Introduction

The first step to build an adaptation strategy is to identify **hazard conditions** in the project area, in relation to a range of climate variables and natural hazards. This has to be done both for the baseline/observed climate and for the predicted future climate in the project area.

Climate variables and hazards related to baseline/observed climate, can be modelled by processing historical datasets. As first step the relevant climate variables are selected and serve as a base to derive climate indices necessary for the hazard analysis. For each climate-related hazard one or more relevant indices, such as probability of occurrence, exceedances over threshold values, are identified. The indices are calculated for a defined climatic period and climate variables can be combined with other parameters to evaluate characteristics of more complex natural hazards, such as landslides or floods. Given a defined hazard scale, the hazard conditions in the project area can be quantified.

In dealing with climate change conditions, it is essential to determine for each climate variable or hazard considered how this may evolve in the future, by examining the outputs of climate models. Uncertainty in climate model projections should be acknowledged and recorded by presenting a summary of climate model outputs using appropriate downscaled data.

Therefore, hazard analysis focuses on three main characteristics: intensity, frequency, and size or location of the natural hazard.

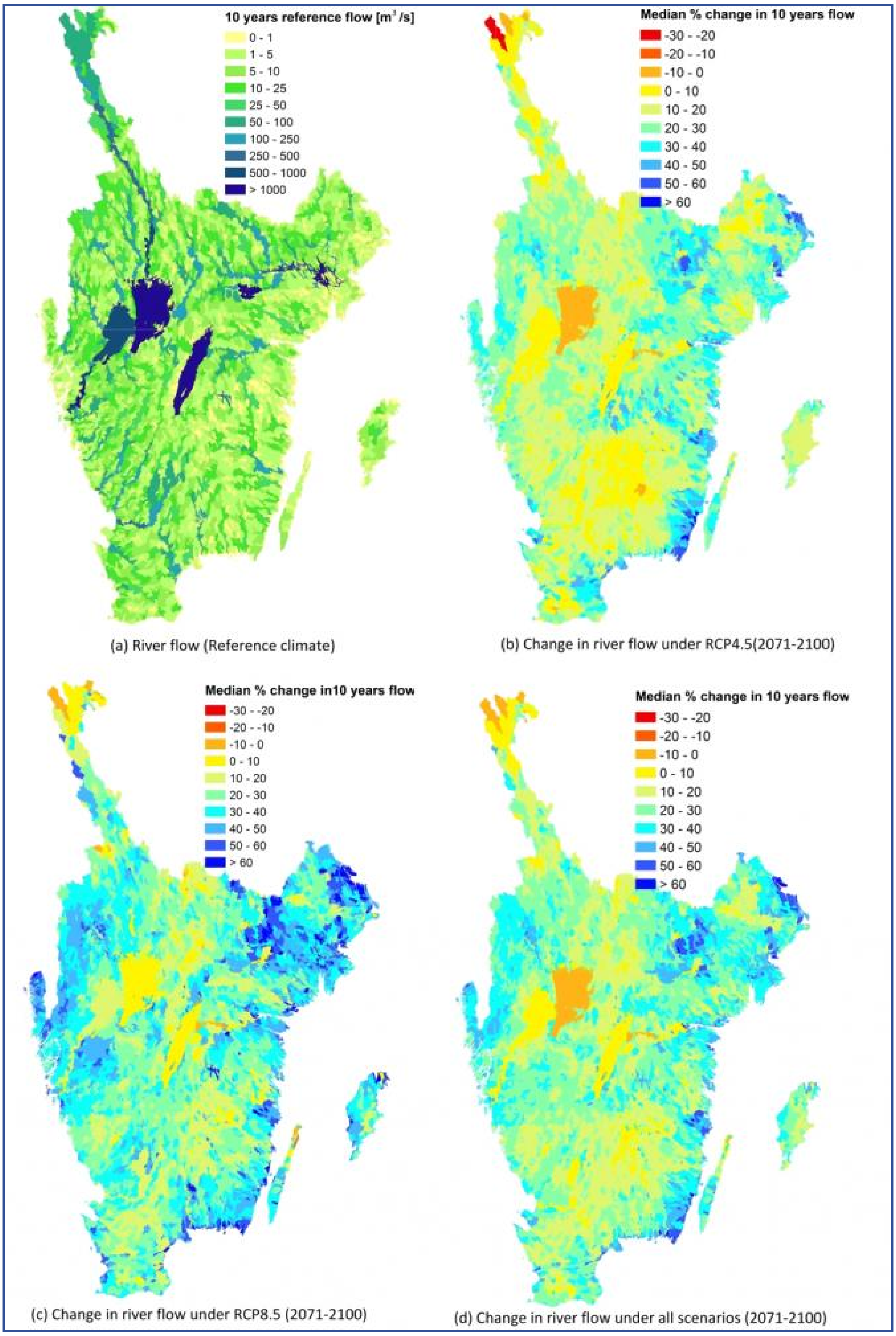
- Intensity is the observed or potential magnitude of a given natural hazard.
- Frequency relates to how often a natural hazard of a particular intensity is likely to occur, or has occurred, in a given location. This probability is often expressed in return periods.
- Location refers to the affected geographical area. A careful analysis must be made of the actual area to be considered in any project, given that on the one hand the intensity of an event may be related to the evolution of a climatic episode in nearby areas, and on the other hand the modification of e.g. drainage and land use conditions in the project area may modify the intensity of threats from adjacent areas.

Concerning hazard assessment and the needed downscaling of climate models in the area of interest, it is of outmost importance to take into account the environmental variables affecting the addressed area in different ways (e.g. urban morphology, surface types, green cover), especially when dealing with urban development and building/open spaces design.

Included data

Showcase: Riverine flooding risk in Southern Sweden

Extreme river flow is modelled using a high resolution process-based hydrological model and high resolution forcing data. Simulations are done for both the present climate and different scenarios of future climate. The results can be used to assess the risk of riverine flooding in areas located along a river within small to meso-scale river basins. The results can, in particular, be used to assess the risk of flash flooding that can result from heavy precipitation of short duration.



Basic Information

Hazards

- flood

Elements at Risk

- buildings
- infrastructure
- population

Showcase: cids GUP-MV (WFD)

The European Water Framework Directive (WFD) commits the member states to achieve a better qualitative status of Europes water bodies. cids GUP-MV is a software to plan and monitor WFD compliant Water body management measures and is a part of the water information system of the German state Mecklenburg-Vorpommern, operated by the State Agency for Environment, Nature Protection and Geology.

The solution supports waterway managers in the organisation and planning of waterway maintenance measures. Key is a seamless integration of required (e.g. hydrologic) information.

Targeted end users are water and information managers of the State Agency, users in four State Agencies for Agriculture and Environment and numerous waterway associations and administrations throughout the state.

Among the supported business processes and functionality are

Development and continuation of waterway maintenance plans

- planning support throughout the complete (legal) life-cycle of waterway maintenance plans. (draft, under coordination, legally binding, historic)
- planning sections, maintenance measures, development- and operational goals, reports and recommendations

- decision support, planning and validation of measures

Visualisation

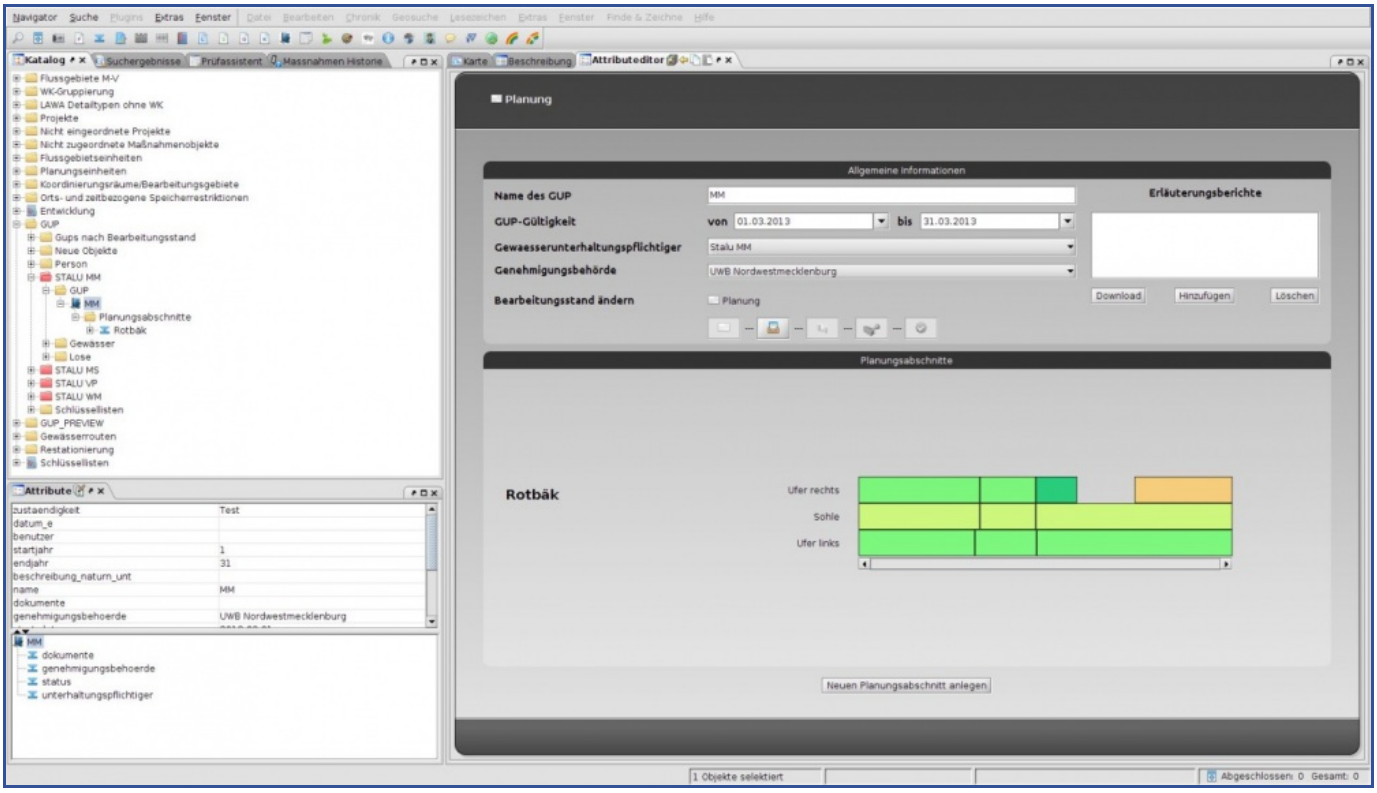
- comfortable (stylized) segment display and interaction
- integrated and synchronized map viewing and interaction
- seamless integration of OGC-compliant external services

Linking context information

- digital maps, water sheds, nature protection areas, municipalities.
- formal approval processes
- cross-administration access
- legal issue detection and visualisation

Support for calls and bidding procedures

- measures, task inventories, quantifications
- GAEB ("Gemeinsamer Ausschuss Elektronik im Bauwesen ") export



Basic Information

Link:
WRRL-MV

Hazards

- flood

Elements at Risk

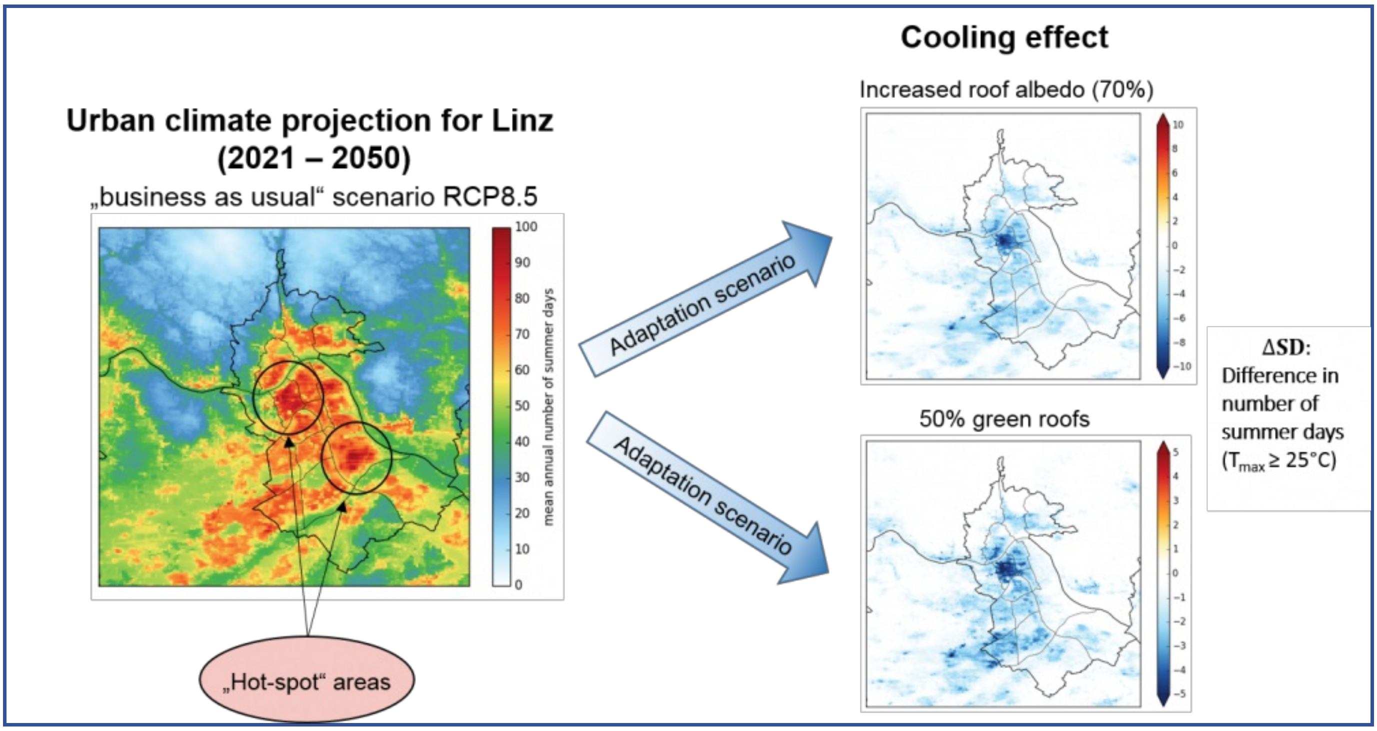
- infrastructure

Showcase: DC3 - Climate adaptation for the city of Linz

Within CLARITY's Austrian demonstration case, the urban climate model MUKLIMO_3, developed by DWD (Deutscher Wetterdienst), is used to:

- investigate current and future urban heat load
- detect "hot-spot" areas
- analyse different adaptation measures and their efficiency in reducing urban heat load

for the city of Linz.



Basic Information

Hazards

- heat

Elements at Risk

- population

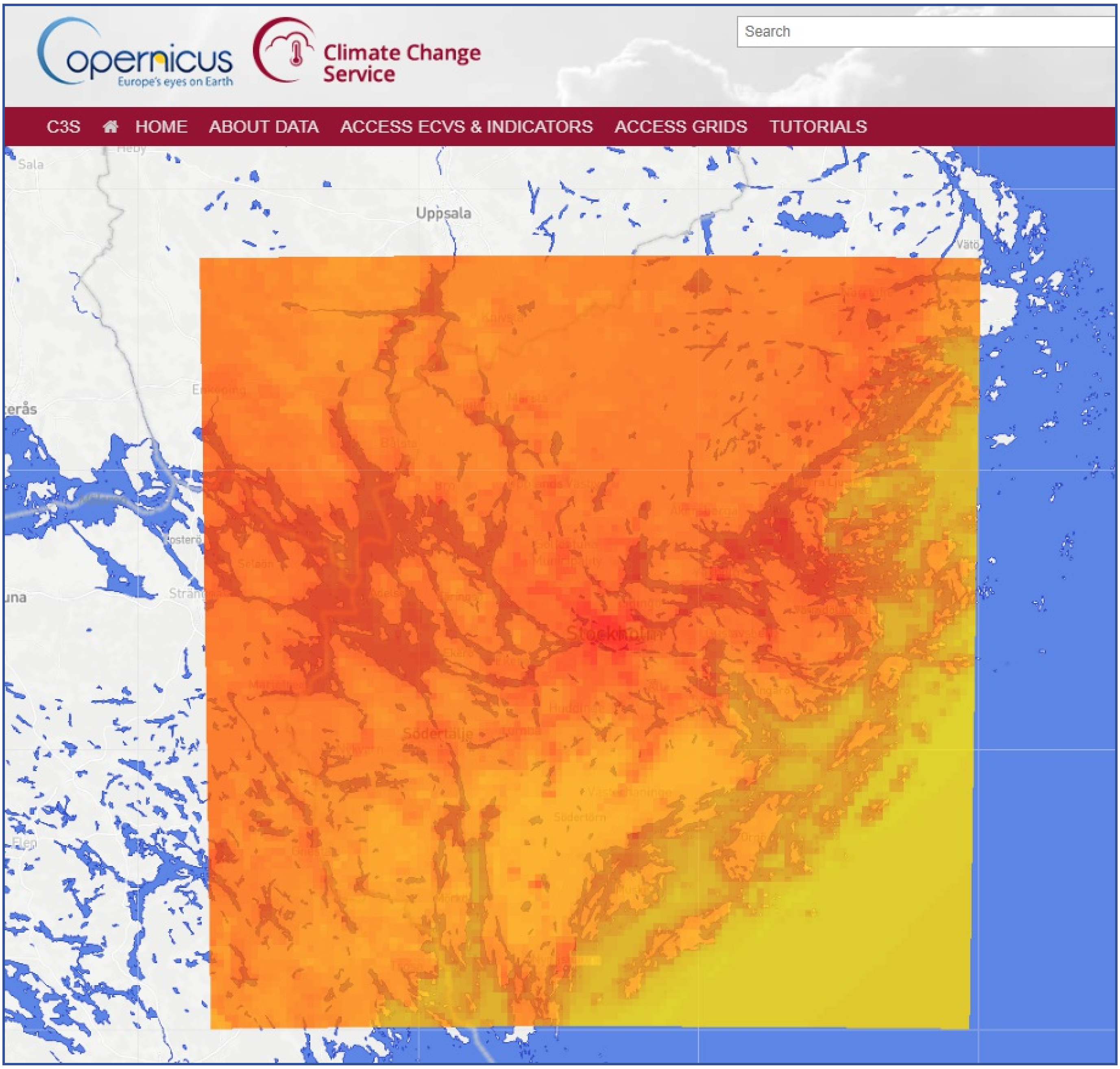
Showcase: Urban SIS climate indicators for Stockholm

Urban SIS, one of the demonstrator projects funded during the proof of concept phase of the programme, provided city-specific climate data and impact indicators to support the infrastructure and health sectors operating in cities.

The impacts of climate-change are a particular concern for those people responsible for the management of urban infrastructure (buildings, transport systems, sewage and drainage systems). Considering the number of people potentially affected, urban infrastructure should be designed to performe well even with extreme conditions (e.g. pluvial and fluvial flooding, heatwaves) was intensity and frequency of occurrence is likely to change as a consequence of climate change.

The objective of Urban SIS (Sectoral Information System) was to develop, demonstrate and test a method to downscale climate and impact indicators to the urban scale (~1x1km2), delivering the information in such format that it is directly useful for consultants and urban engineers/scientists as input to specific/local models or dimensional calculations concerning in particular the following urban hazards:

- Heat waves
- Extreme air pollution levels



Basic Information

Link:
[Urban SIS web site]

Hazards

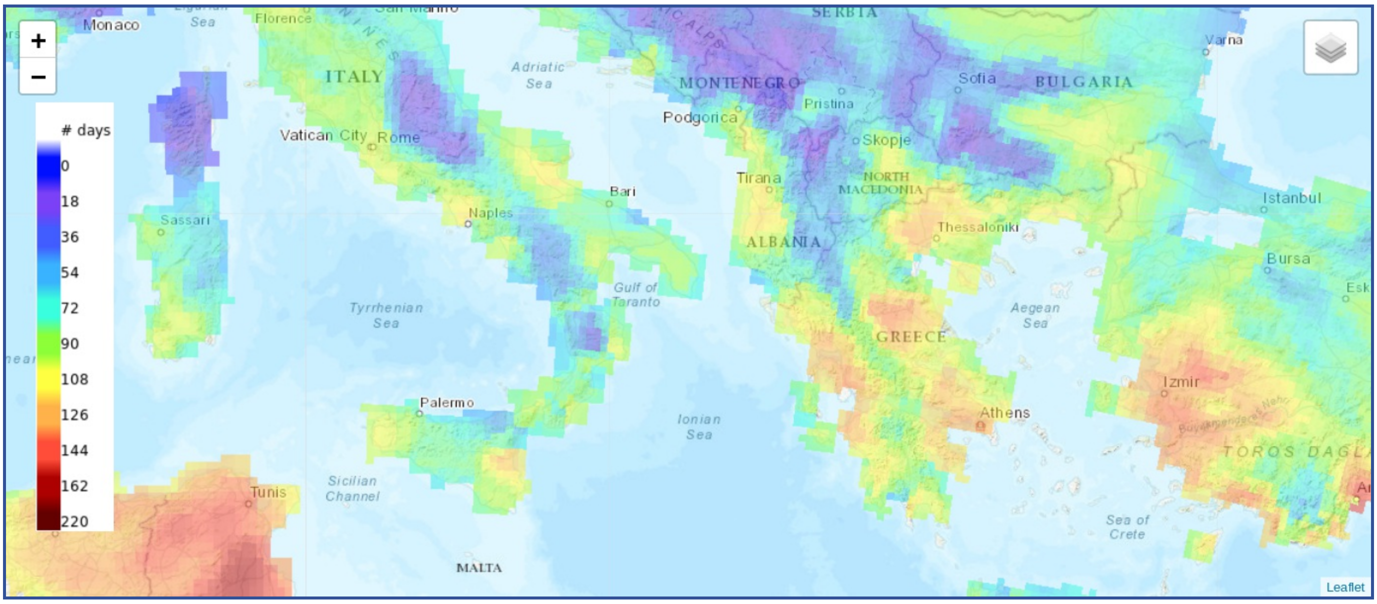
- heat

Elements at Risk

- population

Maps

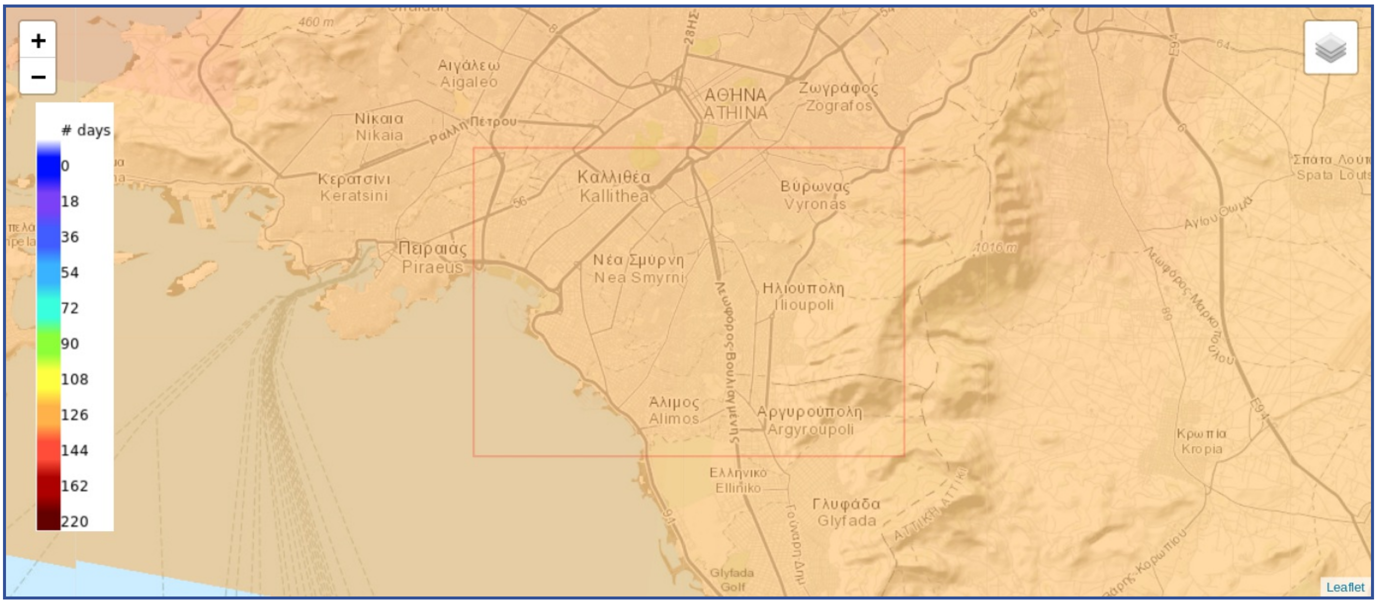
Italy and Greece, rcp85 ,hot days, 2071-2100



In busines as usual scenario, big parts of italy are as hot as Athens is today, North Africa is going out of range.

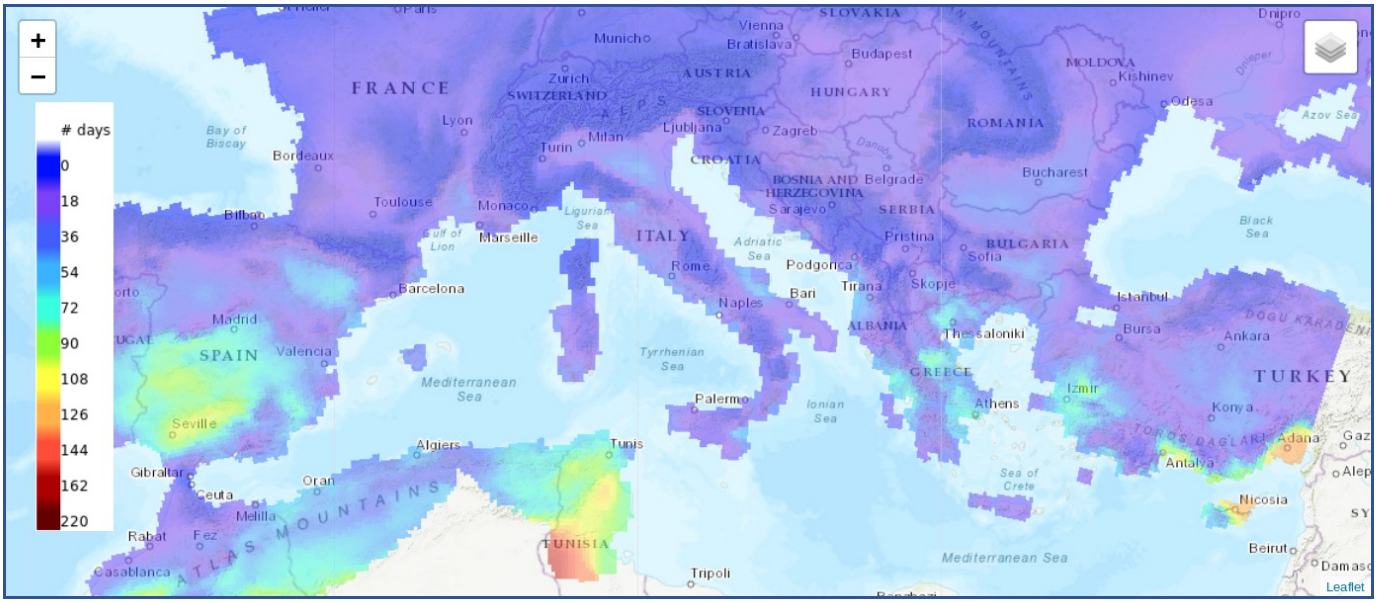
rcp85 ,hot days, 2071-2100

Athens, rcp85 ,hot days, 2071-2100



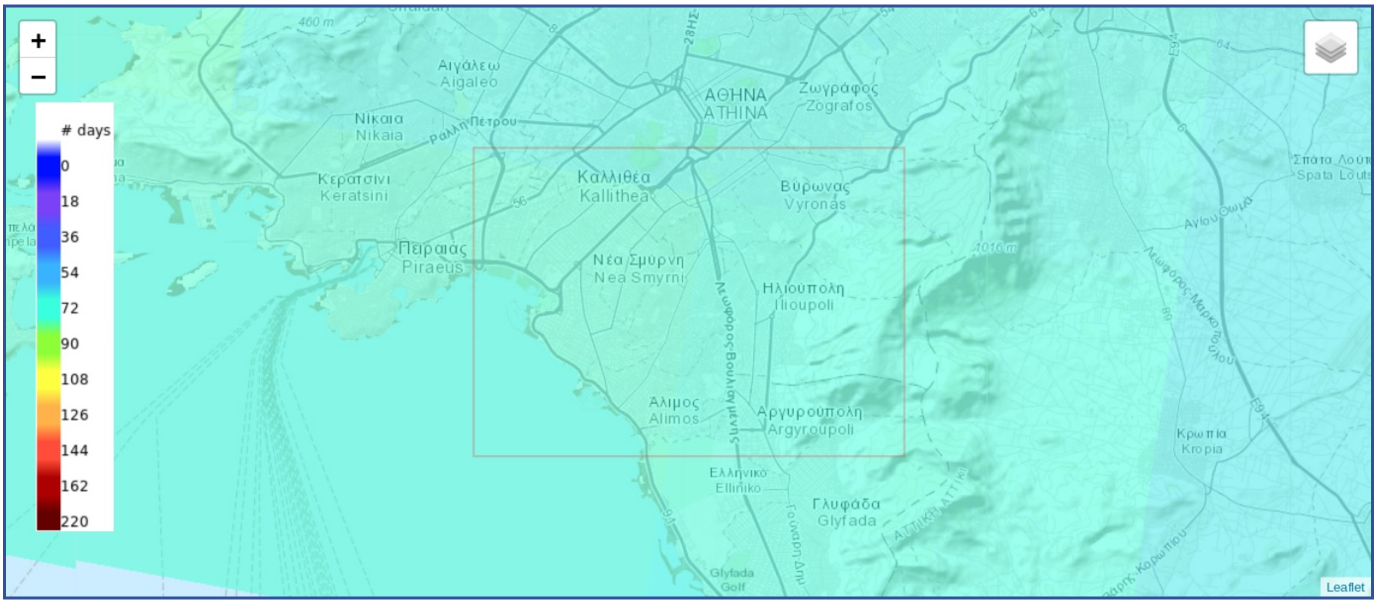
In "bussines as usual" scenario, number of hot days in Athens is expected to almost double compared to current climate (ca 70 today, 120-130 by the end of the century)

Heat hazard big picture (Current climate, yearly events)



Athens is warmer than any Italian city, similar to Izmir but cooler than Sevilla with more than 100 hot days per year.

current climate: Number of hot days



Even without taking into account the urban heat islands effect, Athens is one of the warmest places in Europe, with ca. 70 hot days per year.

Report image

Oid	latitude	longitude	urban_area	country	Hazard Even	Hazard Even	EMISSIONS_	TIME_PERIOI	EVENT_FREQ	Event Descrip	Temp
1131	37.975909	23.729418			1	HW	rcp45	20110101-20	Rare		34.7
1132	37.975909	23.729418			1	HW	rcp45	20410101-20	Rare	43.5_0.066d	34.7
1133	37.975909	23.729418			1	HW	Baseline	Baseline	Rare	39.5_0.066d	34.7
1134	37.975909	23.729418			1	HW	rcp26	20110101-20	Rare	40_0.133d	34.7
1135	37.975909	23.729418			1	HW	rcp26	20410101-20	Rare		34.7
1136	37.975909	23.729418			1	HW	rcp85	20110101-20	Rare	39.5_0.133d	34.7
1137	37.975909	23.729418			1	HW	rcp26	20710101-21	Rare	42_0.133d	34.7
1138	37.975909	23.729418			1	HW	rcp45	20710101-21	Rare	42.5_0.066d	34.7
1139	37.975909	23.729418			1	HW	rcp85	20410101-20	Rare	42.5_0.133d	34.7
1140	37.975909	23.729418			1	HW	rcp85	20710101-21	Rare	45.5_0.066d	34.7
1141	37.975909	23.729418			1	HW	rcp45	20110101-20	Occasional	40.5_0.266d	34.7
1142	37.975909	23.729418			1	HW	rcp45	20410101-20	Occasional	41_0.266d	34.7
1143	37.975909	23.729418			1	HW	Baseline	Baseline	Occasional	38_0.366d	34.7
1144	37.975909	23.729418			1	HW	rcp26	20110101-20	Occasional	39.5_0.266d	34.7
1145	37.975909	23.729418			1	HW	rcp26	20410101-20	Occasional	40.5_0.366d	34.7

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Tables

No elements of this type are listed for this step.

Scenario Analysis

No elements of this type are listed for this step.

Hazard Characterization - Local Effects

Introduction

The hazard characterisation is derived by climate indices that provide an evaluation of relevant parameters for temperature and precipitation and their variation in a climate change perspective. These climate indices are calculated using the EURO-CORDEX dataset which has a spatial resolution of 0.11° (approximately 10 km over Europe). In order to determine the effect of urban adaptation on the potential variation of such climate signals, this information needs to be downscaled on an urban level, i.e. with a finer-grained spatial resolution and considering the influence of urban microclimate variables. This procedure allows to increase the resolution of final outcome of heat wave and pluvial local effect from 10 km to 500 m, since the result is projected on a European reference grid with a resolution of 500 × 500 m.

To this aim, a specific algorithm has been developed and applied, based on a broad literature review and original development, which links the broad-scale climate pattern to small-scale urban features. This method uses as additional input, building, infrastructure and landscape characteristics along with population distribution. This additional data is available for many cities and towns across Europe through platforms such as the Copernicus Land Monitoring Service[1] dataset UrbanAtlas and EuroStat[2] .

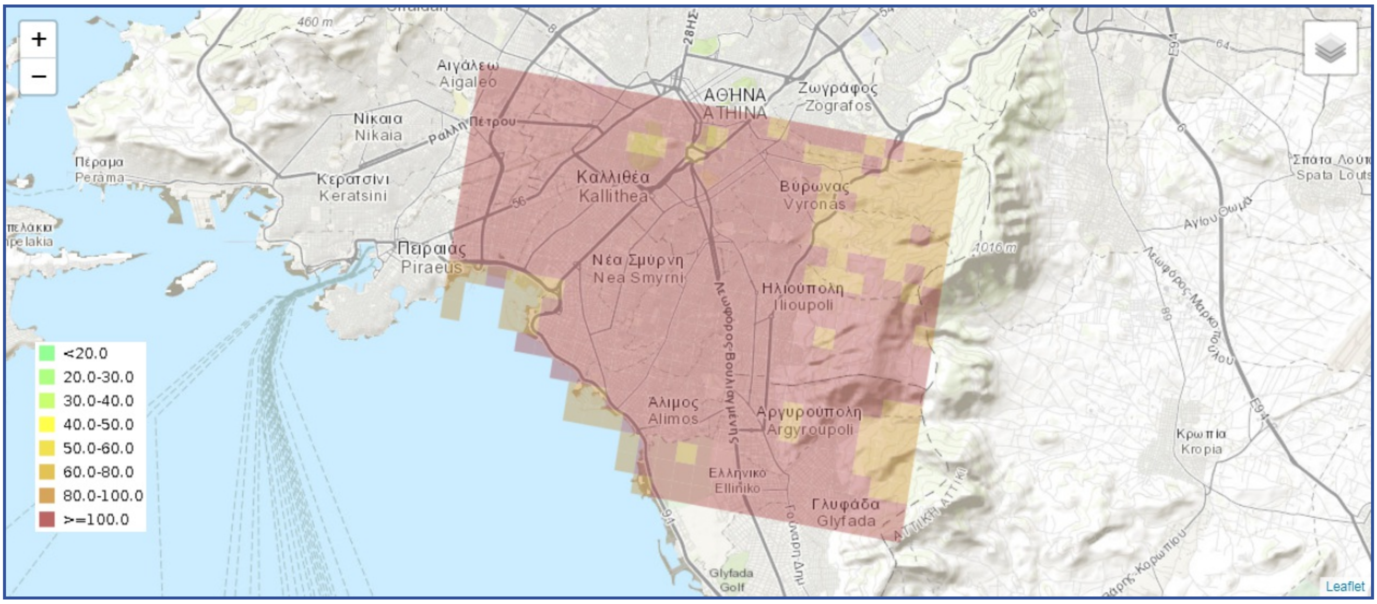
This method is used here as a proof of concept and designed as a feature of the CSIS screening tool, limited to heat and flooding hazards, as most recurring climate change related hazard across Europe.

1 https://land.copernicus.eu/

2 https://ec.europa.eu/eurostat/home?

Maps

MRT in a 20y heat episode - busines as usual, end of the century.

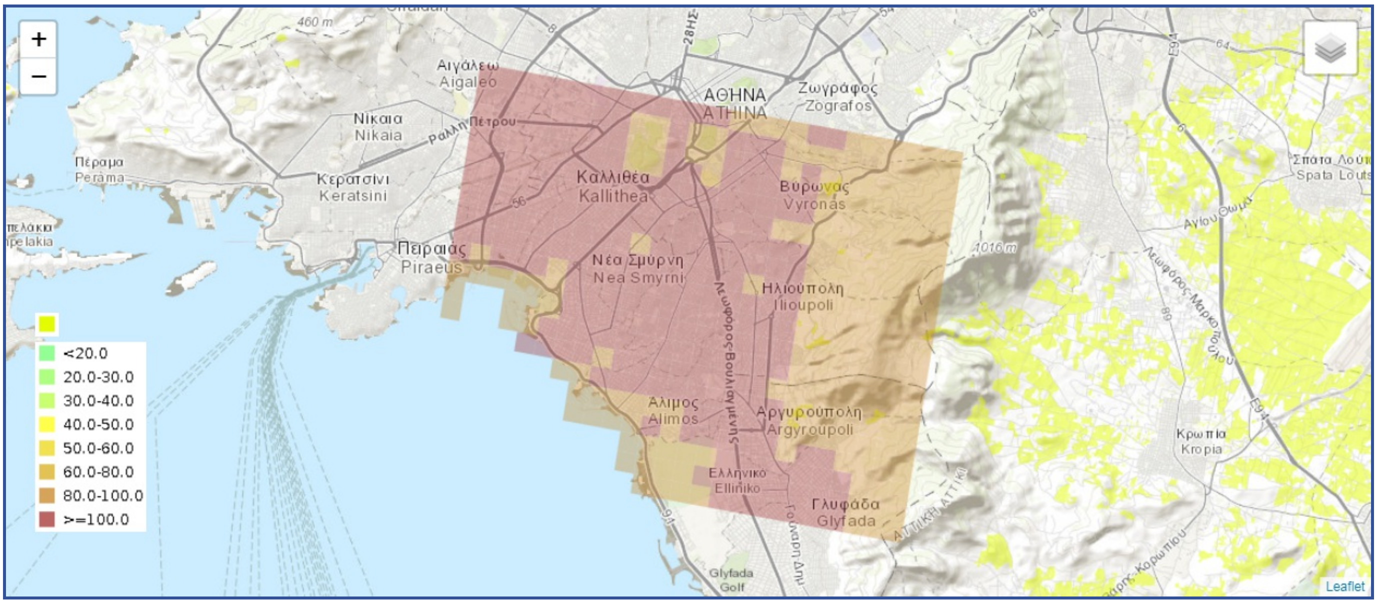


What's the worst that can happen? Well, this is it.

- Period: 2071 to 2100,
- Scenario: Business as usual,
- Frequency: 20 years,
- Variant: no Adaptation Options

Not much to see, since the scaling is wrong. Better look at the table

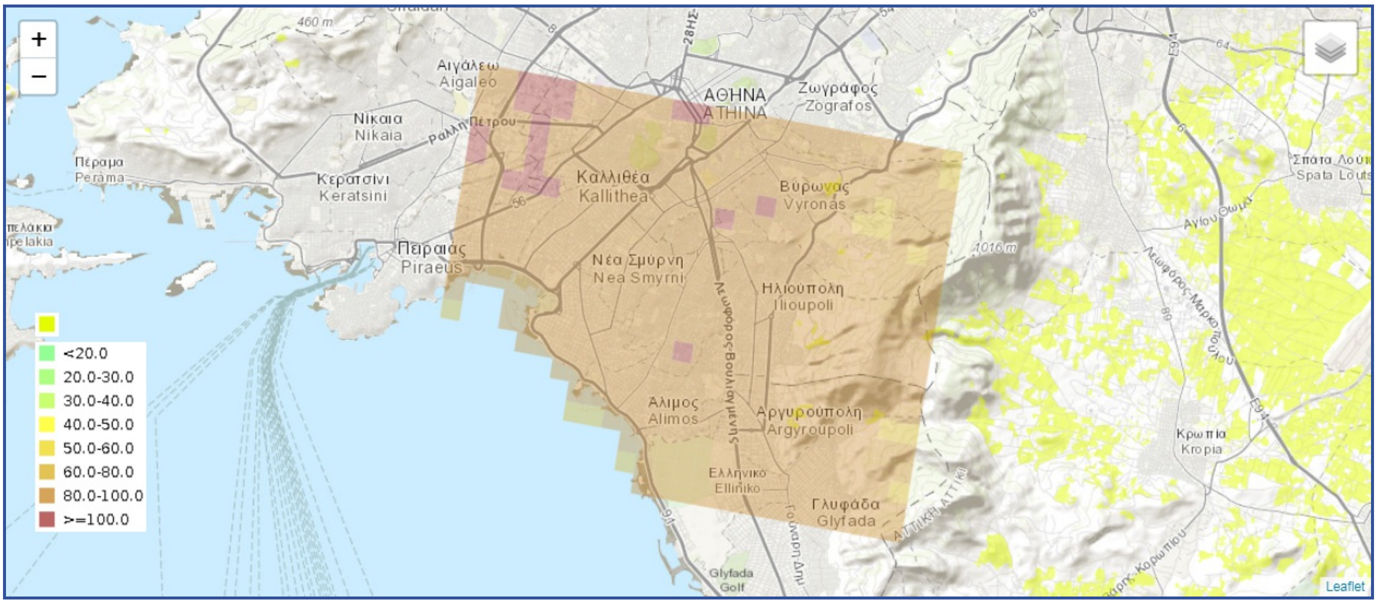
MRT in a yearly heat episode - busines as usual, end of the century.



In a busines as usual scenario, the MRT shoots through the roof. We need to either change the scale or calibrate the model better, or both.

- Period: 2071-2100,
- Scenario: RCP 8.5,
- Frequency: yearly,
- Variant: no Adaptation Options

MRT in a yearly heat episode - current climate



MRT can be quiite high, but it looks too high to me. We'll need to calibrate the model better. Happily, absolute values don't matter al that much to us - what matters is the change i different scenarios.

- Period: historical,
- Scenario: Historical,
- Frequency: yearly,
- Variant: no Adaptation Options

Tables

MRT in a 20y heat episode - busines as usual, end of the century.

GRID_ID	MULTIPOLYG	STUDY_VARIA	TIME_PERIOD	EMISSIONS_S	EVENT_FREQU	T_MRT	T_UTCI	T_A	DISCOMFORT	SZM_SZENAR
500mE46810N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	115.19839929	70.016146385	48.651560812	5	2846
500mE46810N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	114.33314129	69.803379443	48.499219681	5	2846
500mE46815N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	114.06015271	69.736251551	48.451156110	5	2846
500mE46805N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	114.05176471	69.734188942	48.449679282	5	2846
500mE46850N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	113.78722815	69.669139403	48.403103813	5	2846
500mE46815N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	113.42580034	69.580264305	48.339469242	5	3210
500mE46805N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	113.19463981	69.523421930	48.298770102	5	2846
500mE46805N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	112.66173038	69.392379501	48.204943723	5	2846
500mE46815N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	112.63131904	69.384901353	48.199589368	5	2846
500mE55245N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	112.53955359	69.798336228	48.495608739	5	3189
500mE55250N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	112.39599054	69.763034075	48.470332397	5	3189
500mE46825N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	112.34823886	69.315291936	48.149749026	5	2846
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500mE55295N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	111.89294209	69.639334460	48.381763473	5	3189
500mE46805N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	111.89166589	69.203020643	48.069362781	5	2846
500mE46825N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	111.87533744	69.199005477	48.066487922	5	3210
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500mE55245N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	111.67027622	69.584580923	48.342559940	5	3189
500mE46835N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	111.57906253	69.126151476	48.014324456	5	2846
500mE46805N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	111.54876562	69.118701466	48.008990250	5	2846
500mE46815N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	111.51128255	69.109484380	48.002390816	5	3210
500mE55245N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	111.47495892	69.536552400	48.308171518	5	3189
500mE46810N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	111.46190698	69.097342928	47.993697536	5	2846
500mE46835N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	111.40111160	69.082393343	47.982993633	5	2846
500mE46825N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	111.38284073	69.077900535	47.979776783	5	2846
500mE55295N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	111.32517574	69.499720715	48.281800032	5	3189
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500mE46800N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	111.25187197	69.045695318	47.956717848	5	2846
500mE55240N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	111.22328456	69.474665673	48.263860622	5	3189

500mE46845N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	111.19086770	69.030694369	47.945977168	5	2846
500mE55250N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	111.15050051	69.456768076	48.251045942	5	3189
500mE55255N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	111.08078336	69.439624629	48.238771234	5	3189
500mE55300N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	111.04884323	69.431770551	48.233147714	5	3189
500mE46725N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	111.04531621	68.994903257	47.920350732	5	2846
500mE55295N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	111.02295040	69.425403504	48.228588908	5	3189
500mE55330N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	111.01210334	69.422736212	48.226679128	5	3189
500mE55305N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	110.93468448	69.403698913	48.213048422	5	3189
500mE55305N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	110.90284089	69.395868575	48.207441900	5	3189
500mE53645N	POLYGON ((53	BASELINE	20710101-210	rcp85	Rare	110.90172650	67.215594547	46.646365695	5	3209
500mE46830N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.89301919	68.957453420	47.893536649	5	2846
500mE46815N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.87762198	68.953667246	47.890825748	5	2846
500mE46855N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.81961644	68.939403682	47.880613036	5	2846
500mE46885N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.80342587	68.935422423	47.877762455	5	2846
500mE46880N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.80138265	68.934919994	47.877402715	5	2846
500mE53660N	POLYGON ((53	BASELINE	20710101-210	rcp85	Rare	110.80015589	67.190618335	46.628482727	5	3209
500mE55295N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	110.79648480	69.369715612	48.188716378	5	3189
500mE46820N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.72009087	68.914930347	47.863090128	5	2846
500mE46800N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.71674518	68.914107641	47.862501071	5	2846
500mE55300N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	110.68431093	69.342132060	48.168966555	5	3189
500mE46820N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.63853456	68.894875648	47.848730964	5	3210
500mE46815N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.58535365	68.881798463	47.839367699	5	3210
500mE46895N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.58048046	68.880600145	47.838509703	5	2846
500mE46765N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.56004766	68.875575721	47.834912216	5	2846
500mE46855N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.55636425	68.874669970	47.834263698	5	2846
500mE46810N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.44250672	68.846672404	47.814217441	5	2846
500mE46820N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.43581604	68.845027164	47.813039449	5	2846
500mE46840N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.43539214	68.844922929	47.812964817	5	2846
500mE53655N	POLYGON ((53	BASELINE	20710101-210	rcp85	Rare	110.38071327	67.087477395	46.554633815	5	3209
500mE55295N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	110.34292823	69.258186053	48.108861214	5	3189
500mE46855N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.29544475	68.810509864	47.788325062	5	2846
500mE46800N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.26846300	68.803875051	47.783574537	5	2846
500mE46790N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.26640043	68.803367865	47.783211392	5	2846
500mE55305N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	110.26325585	69.238594614	48.094833743	5	3189
500mE46835N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.23210962	68.794935757	47.777174002	5	2846
500mE53645N	POLYGON ((53	BASELINE	20710101-210	rcp85	Rare	110.18795091	67.040077128	46.520695224	5	3209
500mE55265N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	110.18523137	69.219408396	48.081096411	5	3189
500mE46855N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.17914970	68.781912912	47.767849645	5	2846
500mE55310N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	110.16045000	69.213314655	48.076733293	5	3189
500mE46785N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.15012680	68.774776180	47.762739745	5	2846
500mE46795N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.14569458	68.773686297	47.761959389	5	2846
500mE46785N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.12702368	68.769095125	47.758672109	5	2846
500mE46860N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.11954777	68.767256798	47.757355867	5	2846
500mE46790N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.09650348	68.761590206	47.753298587	5	2846
500mE46880N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.07230810	68.755640563	47.749038643	5	2846
500mE46885N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	110.03662364	68.746865753	47.742755879	5	2846
500mE53660N	POLYGON ((53	BASELINE	20710101-210	rcp85	Rare	109.97455540	66.987603175	46.483123873	5	3209
500mE46820N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.96411654	68.729036258	47.729989960	5	2846
500mE46820N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.96380115	68.728958705	47.729934432	5	3210
500mE55300N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	109.92961631	69.156552652	48.036091699	5	3189
500mE55280N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	109.90251194	69.149887688	48.031319584	5	3189
500mE46880N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.81683102	68.692818748	47.704058223	5	2846
500mE46805N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.79066046	68.686383409	47.699450521	5	2846
500mE46830N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.76236817	68.679426334	47.694469255	5	2846
500mE46885N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.75882731	68.678555636	47.693845835	5	2846
500mE46755N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.75246592	68.676991370	47.692725820	5	2846
500mE55285N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	109.74612883	69.111433079	48.003786085	5	3189
500mE46885N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.74405275	68.674922571	47.691244561	5	2846
500mE46825N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.72784370	68.670936766	47.688390724	5	2846
500mE46865N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.71722494	68.668325613	47.686521138	5	2846
500mE55305N	POLYGON ((55	BASELINE	20710101-210	rcp85	Rare	109.71499274	69.103776716	47.998304129	5	3189
500mE46745N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.70285331	68.664791630	47.683990807	5	2846
500mE46835N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.69697636	68.663346489	47.682956086	5	2846
500mE53645N	POLYGON ((53	BASELINE	20710101-210	rcp85	Rare	109.68211035	66.915690935	46.431634709	5	3209
500mE46820N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.67884315	68.658887530	47.679763472	5	2846
500mE46825N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.65248683	68.652406512	47.675123062	5	2846

500mE46830N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.63987816	68.649306040	47.672903124	5	2846
500mE46795N	POLYGON ((46	BASELINE	20710101-210	rcp85	Rare	109.63596712	68.648344316	47.672214530	5	2846

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What's the worst that can happen? - tabular form.

- Period: 2071 to 2100,
- Scenario: Business as usual,
- Frequency: 20 years,
- Variant: no Adaptation Options

Change in T_MRT may not look so impressive, but the ambient temperature in the 40-es is already bad enough. 48°C is hot even for KSA.

Yearly heat episode table - current climate

GRID_ID	MULTIPOLYG	STUDY_VARI	TIME_PERIOD	EMISSIONS_S	EVENT_FREQ	T_MRT	T_UTCI	T_A	DISCOMFORT	SZM_SZENAR
500mE55250N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	102.34599901	58.571741158	40.457366669	5	3189
500mE55255N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	101.82189394	58.442863721	40.365090424	5	3189
500mE55285N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	101.74904625	58.424950475	40.352264540	5	3189
500mE46810N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	101.47362448	56.613224260	39.055068570	5	2846
500mE55310N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	100.99632225	58.239855643	40.219736640	5	3189
500mE55245N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	100.99497938	58.239525430	40.219500208	5	3189
500mE46810N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	100.62141867	56.403666852	38.905025466	5	2846
500mE55255N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	100.61437371	58.145934496	40.152489099	5	3189
500mE55250N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	100.49883109	58.117522565	40.132146156	5	3189
500mE46805N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	100.32725881	56.331332943	38.853234387	5	2846
500mE46815N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	100.28916049	56.321964566	38.846526629	5	2846
500mE46850N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	100.15114611	56.288026829	38.822227209	5	2846
500mE55325N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	99.971550442	57.987864253	40.039310805	5	3189
500mE55235N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	99.825260088	57.951891455	40.013554282	5	3189
500mE46815N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	99.581739310	56.148009696	38.721974942	5	3210
500mE55295N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	99.547418381	57.883570180	39.964636248	5	3189
500mE46805N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	99.463059145	56.118826243	38.701079590	5	2846
500mE55250N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	99.430321026	57.854775940	39.944019573	5	3189
500mE55240N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	99.422487466	57.852849667	39.942640362	5	3189
500mE55300N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	99.261071508	57.813157483	39.914220758	5	3189
500mE55300N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	99.166847343	57.789987761	39.897631237	5	3189
500mE55305N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	99.140852062	57.783595522	39.893054393	5	3189
500mE46815N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	98.984154590	56.001063613	38.616761547	5	2846
500mE46805N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	98.952822402	55.993359028	38.611245064	5	2846
500mE55290N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.754892799	57.688688139	39.825100707	5	3189
500mE55290N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.600778059	57.650791324	39.797966588	5	3189
500mE55260N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.598501183	57.650231441	39.797565711	5	3189
500mE55295N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.584120161	57.646695147	39.795033725	5	3189
500mE46825N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	98.577261615	55.901008631	38.545122180	5	2846
500mE46880N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	98.496951328	55.881260331	38.530982397	5	2846
500mE46825N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	98.399083624	55.857194663	38.513751378	5	3210
500mE55335N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.364661978	57.592730380	39.756394952	5	3189
500mE55295N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.297216558	57.576145551	39.744520215	5	3189
500mE55325N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.292817013	57.575063703	39.743745611	5	3189
500mE55285N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.289987323	57.574367882	39.743247404	5	3189
500mE55285N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.282491435	57.572524644	39.741927645	5	3189

500mE46805N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	98.268045760	55.824972452	38.490680276	5	2846
500mE55245N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.209695868	57.554624214	39.729110937	5	3189
500mE55280N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.167410811	57.544226318	39.721666043	5	3189
500mE55300N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.150916885	57.540170462	39.718762050	5	3189
500mE46815N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	98.066083594	55.775309955	38.455121928	5	2846
500mE55325N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.047077038	57.514636243	39.700479550	5	3189
500mE46835N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	98.009070093	55.761290335	38.445083880	5	2846
500mE55320N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	98.004940397	57.504274843	39.693060788	5	3189
500mE55275N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	97.987372229	57.499954831	39.689967659	5	3189
500mE46805N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.868257379	55.726664489	38.420291774	5	2846
500mE46810N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.811361345	55.712673754	38.410274408	5	2846
500mE46825N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.792525247	55.708041958	38.406958042	5	2846
500mE55235N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	97.783593234	57.449845576	39.654089432	5	3189
500mE46825N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.682975715	55.681103728	38.387670269	5	3210
500mE46800N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.662600992	55.676093584	38.384083006	5	2846
500mE46815N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.660689153	55.675623462	38.383746399	5	3210
500mE55310N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	97.652038334	57.417496226	39.630927298	5	3189
500mE46835N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.561233710	55.651167369	38.366235836	5	2846
500mE46725N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.534278711	55.644539135	38.361490020	5	2846
500mE46855N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.404288573	55.612574560	38.338603385	5	2846
500mE46880N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.378056881	55.606124187	38.333984917	5	2846
500mE55320N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	97.343563426	57.341642246	39.576615848	5	3189
500mE46885N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.317470765	55.591226061	38.323317859	5	2846
500mE55310N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	97.293960543	57.329444897	39.567882546	5	3189
500mE55310N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	97.266571677	57.322709975	39.563060342	5	3189
500mE46815N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.202989312	55.563075072	38.303161751	5	2846
500mE55270N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	97.164381116	57.297581316	39.545068222	5	3189
500mE53645N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	97.148762180	53.805740620	37.044910284	5	3209
500mE46800N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.102208066	55.538292963	38.285417761	5	2846
500mE46855N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.052234213	55.526004393	38.276619145	5	2846
500mE53660N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	97.042724837	53.779666037	37.026240882	5	3209
500mE46820N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.036369725	55.522103315	38.273825973	5	2846
500mE46825N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	97.021277035	55.518392023	38.271168688	5	2846
500mE55285N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	96.978245727	57.251810624	39.512296407	5	3189
500mE46765N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	96.974714977	55.506942412	38.262970767	5	2846
500mE46895N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	96.972773185	55.506464926	38.262628887	5	2846
500mE46820N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	96.945426406	55.499740353	38.257814093	5	3210
500mE46855N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	96.927040044	55.495219146	38.254576909	5	2846
500mE55315N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	96.882458110	57.228256449	39.495431617	5	3189
500mE46815N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	96.877078262	55.482933544	38.245780418	5	3210
500mE46820N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	96.824950353	55.470115291	38.236602549	5	2846
500mE55255N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	96.809731482	57.210372971	39.482627047	5	3189
500mE55235N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	96.803208586	57.208768991	39.481478597	5	3189
500mE46860N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	96.776209548	55.458129928	38.228021028	5	2846
500mE46845N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	96.774486618	55.457706259	38.227717681	5	2846
500mE53655N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	96.769692570	53.712527402	36.978169620	5	3209
500mE46830N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	96.735750569	55.448181065	38.220897642	5	2846
500mE46810N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	96.723803056	55.445243171	38.218794110	5	2846
500mE46855N	POLYGON ((4	BASELINE	Baseline	Baseline	Frequent	96.682329768	55.435044890	38.211492141	5	2846
500mE55290N	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	96.673347505	57.176836151	39.458614684	5	3189

[illegible]	POLYGON ((5	BASELINE	Baseline	Baseline	Frequent	[illegible]	[illegible]	[illegible]	5	3189
500mE46880N	POLYGON ((46	BASELINE	Baseline	Baseline	Frequent	96.665278152	55.430851897	38.208489958	5	2846
500mE55245N	POLYGON ((5!	BASELINE	Baseline	Baseline	Frequent	96.658259058	57.173125902	39.455958146	5	3189
500mE46790N	POLYGON ((46	BASELINE	Baseline	Baseline	Frequent	96.656133900	55.428603326	38.206879981	5	2846
500mE46835N	POLYGON ((46	BASELINE	Baseline	Baseline	Frequent	96.645830103	55.426069622	38.205065849	5	2846
500mE46800N	POLYGON ((46	BASELINE	Baseline	Baseline	Frequent	96.643035361	55.425382395	38.204573795	5	2846
500mE46785N	POLYGON ((46	BASELINE	Baseline	Baseline	Frequent	96.592537303	55.412964922	38.195682884	5	2846
500mE46795N	POLYGON ((46	BASELINE	Baseline	Baseline	Frequent	96.587411963	55.411704601	38.194780494	5	2846
500mE55295N	POLYGON ((5!	BASELINE	Baseline	Baseline	Frequent	96.548321583	57.146092277	39.436602070	5	3189
500mE46785N	POLYGON ((46	BASELINE	Baseline	Baseline	Frequent	96.545782097	55.401467817	38.187450957	5	2846
500mE46885N	POLYGON ((46	BASELINE	Baseline	Baseline	Frequent	96.521102562	55.395399120	38.183105769	5	2846
500mE55275N	POLYGON ((5!	BASELINE	Baseline	Baseline	Frequent	96.507105922	57.135957346	39.429345460	5	3189
500mE46790N	POLYGON ((46	BASELINE	Baseline	Baseline	Frequent	96.505195767	55.391487639	38.180305149	5	2846
500mE53645N	POLYGON ((5:	BASELINE	Baseline	Baseline	Frequent	96.471253269	53.639141178	36.925625084	5	3209
500mE55255N	POLYGON ((5!	BASELINE	Baseline	Baseline	Frequent	96.467947862	57.126328379	39.422451119	5	3189

Previous Page 1 of 10 100 rows Next

The table shows estimated values of ambient, UCTI and mean radiant temperature, as well as the comfort index for every cell in the project area. Not very useful IMO - should be replaced with average min/max, for each of the presets (currently we allow only one)

- Period: historical,
- Scenario: Historical,
- Frequency: yearly,
- Variant: no Adaptation Options

I tried to check some values of T_UCTI using http://www.utci.org/utcineu/utcineu.php and they don't fit. Someone is wrong - either us or them. Where are we getting the wind and humidity data from anyway?

Scenario Analysis

No elements of this type are listed for this step.

Exposure Evaluation

Introduction

Once the **hazard characterization** in the project area has been assessed, the next step is to evaluate exposure to climate hazards of the elements at risk considered (e.g. population, buildings, infrastructures, etc.) relevant at the project location(s).

The exposure is the quantitative distribution, in space and time, of elements exposed (people, buildings, infrastructures, etc.) grouped on the base of their behaviour under effect of the hazard into categories (called "vulnerability classes"), defined on the base of specific characteristics (i.e., age for people, structural-typological characteristics for buildings, etc.), able to influence the damageability of the elements exposed against hazards.

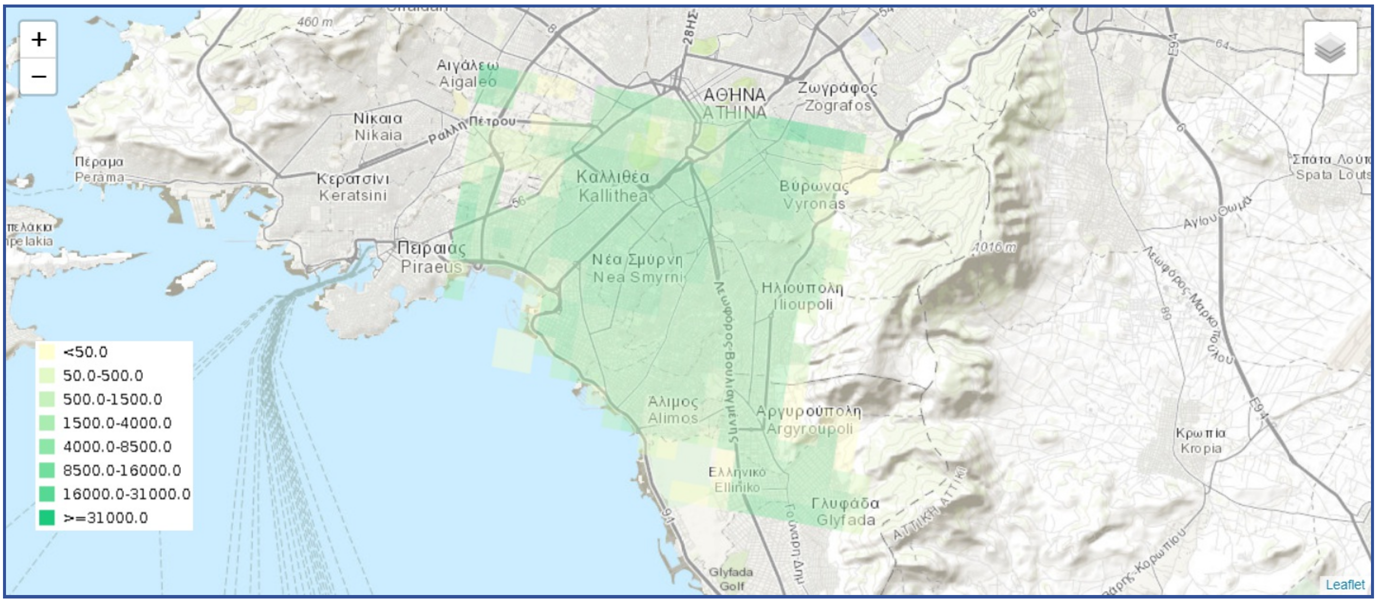
Due to differences in assessment approaches between AR4, the nature of the EU-GL modules 2a and 2b changes in CLARITY, resulting in:

- **Module 2a - Baseline exposure**, that is based on the current distribution of the elements at risk in the area of interest. Baseline exposure can be estimated by combining the available data on e.g. population distribution, land use and land cover. Exposure must be calculated separately for each element at risk type.
- **Module 2b – Future exposure**, that is based on the planned distribution of the elements at risk in the future. In CLARITY, this will usually correspond to the planned project and the expected distribution of the elements at risk will have to be provided by the user or by an expert working on their behalf.

Due to a combination of ethical and technical considerations, in the CLARITY project will not be specified individual elements at risk. Instead, all elements at risk of a certain type in a certain area will be grouped together, resulting in a per element at risk exposure map.

Maps

Population density



Color coding is terrible, it all just looks the same. Important part: we have just about everything here, from very dense city areas to deserted hill slope.

Tables

Population per cell

GRID_ID	Population
500mE55315N17640	17422
500mE55235N17640	16557
500mE55320N17640	15319
500mE55325N17640	15154
500mE55310N17640	9825
500mE55235N17605	9603
500mE55240N17640	9045
500mE55305N17625	8443
500mE55305N17620	8443
500mE55300N17620	8443
500mE55300N17625	8270
500mE55235N17595	7914
500mE55305N17635	7498
500mE55305N17630	7498
500mE55265N17605	7403
500mE55265N17600	7403
500mE55260N17605	7403
500mE55260N17600	7403
500mE55300N17630	7257
500mE55315N17620	7114
500mE55310N17625	7114
500mE55310N17620	7114
500mE55310N17630	6965
500mE55315N17625	6841
500mE55300N17635	6639
500mE55275N17615	6617
500mE55275N17610	6617
500mE55270N17615	6617

500mE55270N17610	6617
500mE55265N17615	6436
500mE55265N17610	6436
500mE55260N17610	6436
500mE55290N17620	6371
500mE55310N17635	6346
500mE55335N17545	6056
500mE55330N17545	6056
500mE55270N17640	5837
500mE55285N17615	5819
500mE55285N17610	5819
500mE55280N17615	5819
500mE55280N17610	5819
500mE55285N17625	5726
500mE55285N17620	5726
500mE55280N17620	5726
500mE55235N17635	5714
500mE55290N17625	5673
500mE55285N17605	5654
500mE55285N17600	5654
500mE55280N17605	5654
500mE55280N17600	5654
500mE55265N17625	5618
500mE55265N17620	5618
500mE55295N17620	5411
500mE55260N17625	5276
500mE55235N17600	5243
500mE55275N17620	5155
500mE55270N17625	5155
500mE55270N17620	5155
500mE55325N17545	5059
500mE55275N17640	5029
500mE55305N17640	4934
500mE55275N17605	4909
500mE55275N17600	4909
500mE55270N17605	4909
500mE55270N17600	4909
500mE55320N17545	4880
500mE55235N17610	4663
500mE55290N17615	4621
500mE55290N17610	4621
500mE55295N17615	4582
500mE55260N17615	4562
500mE55330N17640	4527
500mE55275N17595	4495
500mE55275N17590	4495
500mE55270N17595	4495
500mE55270N17590	4495
500mE55265N17585	4421
500mE55265N17580	4421
500mE55295N17610	4372
500mE55285N17595	4328
500mE55285N17590	4328
500mE55280N17595	4328
500mE55280N17590	4328
500mE55260N17580	4298
500mE55265N17575	4221
500mE55295N17605	4058
500mE55295N17600	4058
500mE55290N17605	4058
500mE55290N17600	4058
500mE55245N17600	4037
500mE55255N17605	3851
500mE55255N17600	3851
500mE55250N17600	3851
500mE55320N17605	3850

500mE55320N17600	3850		
500mE55250N17605	3835		
500mE55315N17635	3767		
500mE55275N17585	3748		
500mE55275N17580	3748		
500mE55270N17585	3748		
Previous	Page 1 of 4	100 rows	Next

This table shows the population for each cell within the project area. Again, it looks like an overkill to me - average, min and max should be enough.

We should also add the population density.

Scenario Analysis

No elements of this type are listed for this step.

Vulnerability Analysis

Introduction

In addition to exposure, the vulnerability of the elements at risk to the current and to the expected future climate needs to be assessed.

The vulnerability is the probability that a given exposed element of assigned characteristics is damaged by a given hazard intensity.

EU-GL foresees two sub-modules here, one for assessing the vulnerability to the current climate and one for assessing the vulnerability to the future climate. However, AR5 defines the vulnerability is an inherent function of the elements at risk. Therefore, the EU-GL classification of modules 3a and 3b is obsolete and what needs to be done at this stage is to **assess the vulnerability of all element at risk types** that are present / expected to be present in the area of interest (from 2a/ab) **to the significant climate-induced hazards**[1].

Following the CLARITY methodology, we intend to work with “vulnerability classes” rather than allocating individual vulnerability function to each element at risk. Thus, an element at risk of the type “residential building” might belong to one of a few vulnerability classes for each of the significant hazards (e.g. “low” for fire, “high” for flood, “medium” for heath waves etc.) and the vulnerability analysis proceeds in two steps:

1. Define the vulnerability classes for all relevant element at risk types. E.g. low/medium/high vulnerability classes for buildings; “children/adults/elderly” classes for people etc.
2. Define the vulnerability functions for all relevant element at risk type/hazard combinations.
3. Allocate all the elements at risk in the area of interest (from exposure analysis 2a/ab) to vulnerability classes, for each hazard type.

Since the elements at risk of a certain type in a certain area are be grouped together in exposure assessment step, their vulnerability will have to be expressed as a vulnerability matrix that indicates which percentage of the elements of risk of a certain type belongs to which vulnerability class for which hazard in this area. An example of such matrix, for a generic element at risk category, is shown in the table below.

Example of a vulnerability matrix of a specific vulnerability class of a given element at risk under effect of a specific hazard.

VULNERABILITY CLASS i				
	Hazard Intensity (HI)			
Level of	**HI 1**	**HI 2**	**HI 3**	**...**

damage				
Low	5%	20%	50%	...
Medium	10%	30%	70%	...
High	20%	50%	80%	...

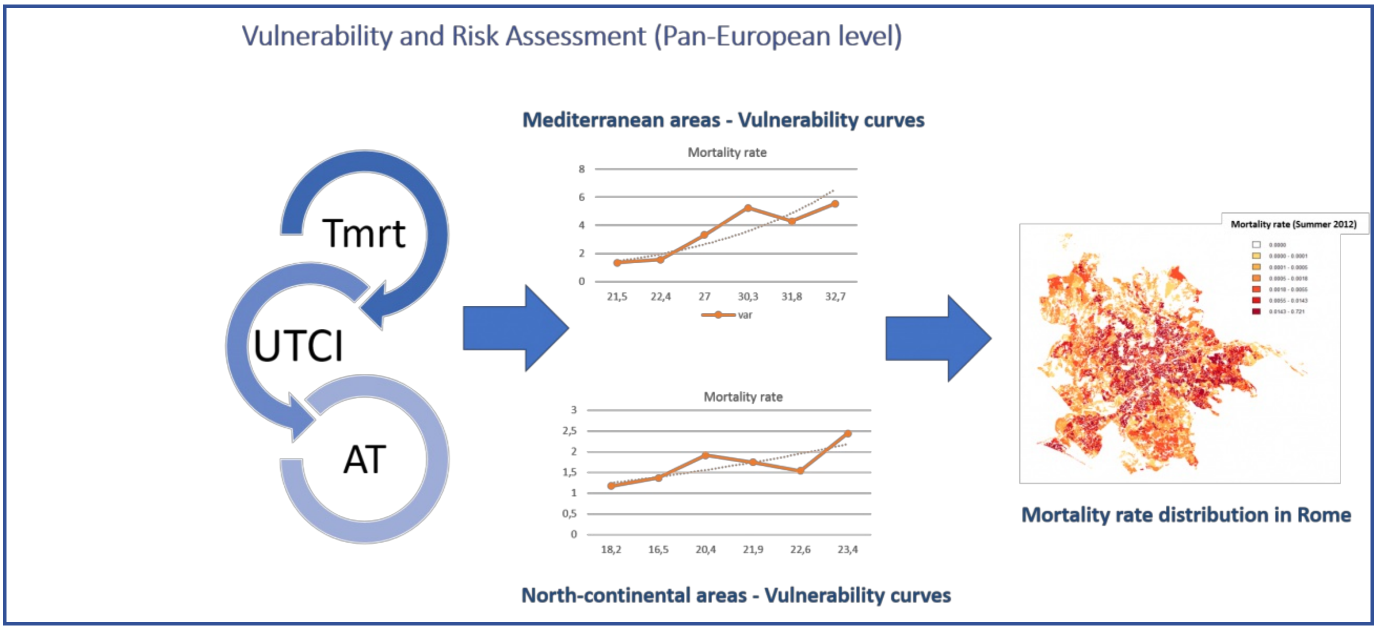
The uncertainty, inherent in the assessment, should also be acknowledged in the final vulnerability classification, which is tricky as various uncertainties come together (modelling uncertainty resulting in hazard, uncertainty in projecting share and distributions of elements at risk, uncertainty in capability to better adapt and coping with the expected exposure.

1 "Significant" hazards are those that are either already present in the area or that are expected to become gain significance due to the future climate change (from module 1).

Included data

Vulnerability: Heat mortality vulnerability

TODO: add some text



Relevant hazard

- heat

Element at risk

- population

Maps

No elements of this type are listed for this step.

Tables

Vulnerability curves

For now, we are just showing how the vulnerability curves look like. Adding the actual data to them and making sure the EMIKAT uses it for impact calculation is on TODO

Scenario Analysis

No elements of this type are listed for this step.

Risk and Impact Assessment

Introduction

This module provides a structured method of analysing climate hazards and their impacts to provide the fundamental information for decision-making.

In line with the updated approach as outlined in the IPCC-AR5, this evaluation is derived by the general relation R=H x E x V.

The risk and impact assessment[1] process work through taking into account the magnitudes and likelihoods of the impacts associated with the hazards identified in Module 2 - Evaluate exposure to climate hazards and assessing the significance of the assessed risks to the success of the project. Risk and impact assessment may well identify issues which have not been picked up in the vulnerability analyses.

- **Risk assessments**: aim at defining a synthetic index/coefficient, representing the convolution of the probabilities of different hazard intensities (H), in relation to the exposure (E) and vulnerability (V) conditions in a given area. Such a risk index is useful to allow high-level comparisons between alternative project options but does not allow detailed quantification of impacts on considered elements at risk.

  To produce reliable results that can be a sound basis for decision making in the field of infrastructure development, risk assessment should be always based on numerical modelling procedures. Probabilistic quantitative risk assessments can be undertaken in the early phases of the asset lifecycle, with different levels of detail (including the spatial resolution of the models' output) depending on the availability of exposure and vulnerability. This requires running various scenarios and comparing the results with respect to the frequency of event occurrence and event magnitude by means of a probability distribution.

- **Impact scenario analysis**: as a complement to the risk assessment, by choosing in a "deterministic" way one or more reference events (among actually occurred past events or as a result of numerical hazard simulation models) the corresponding "impact scenario analyses" can be performed using numerical impact models, providing detailed damage evaluation on selected elements at risk following specific event(s) (Here again one has to consider the uncertainty delivered by the risk-modelling, and vulnerability modelling and the exposure modelling with respect to future distribution of the elements at risk..

Unlike the risk assessment, the impact scenario analysis represents a simulation of the expected impacts of a specific hazard (in terms of intensity, location, etc.), derived from the application of an impact model able to correlate hazard (H), exposure (E) and vulnerability (V) characteristics to produce a detailed quantification of damage on elements at risk considered (e.g. population, buildings). An analysis based on the output of the impact models can be used to support decision-making, e.g. by applying multi-criteria and/or cost-benefit analyses on a number of relevant impact scenarios.

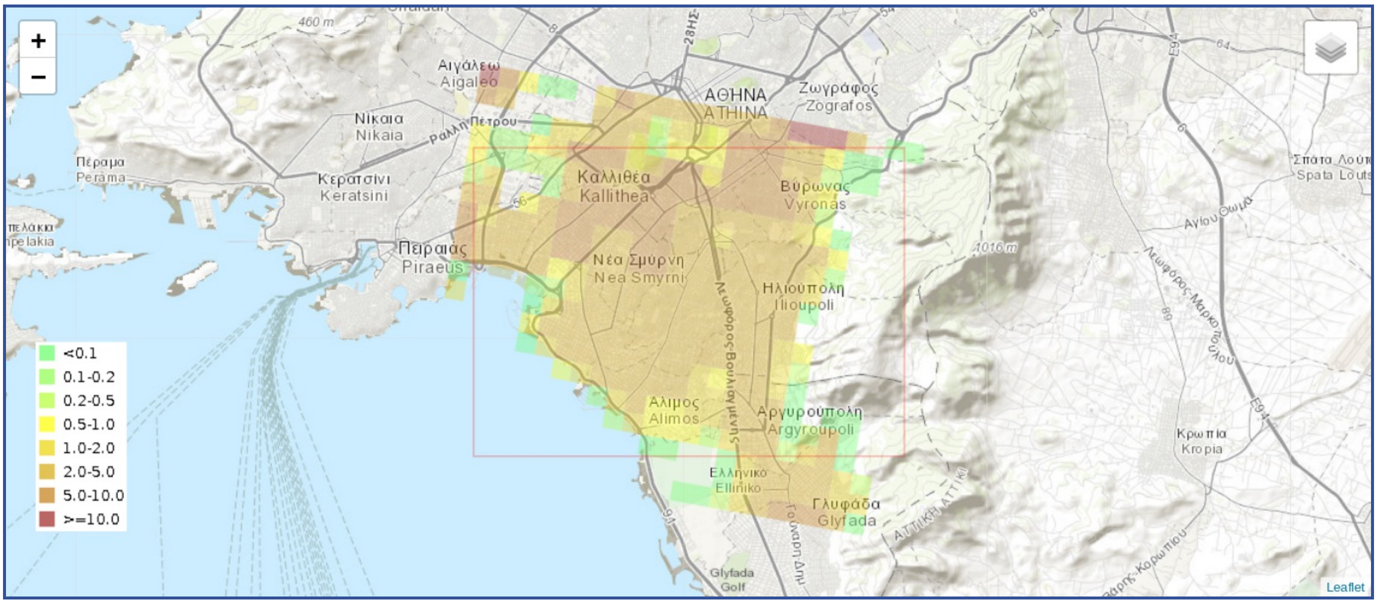
Probabilistic assessment and uncertainty evaluation are provided also in relation to impact scenario analyses, mainly related to the probability of occurrence of the hazard type and intensity at the location of the analysis.

The detailed risk assessment and/or scenario analysis is divided into 3 steps: (1) It involves an analysis (e.g. refinement of hazard properties, exposure distribution, and algorithms to model the relations between H, E, V) by specialists to quantitatively evaluate risks while taking into account climate (and socio-economic) change. (2) Aspects and characteristics of the most relevant climate hazards need to be defined (e.g. magnitude and direction of change, statistical basis, averaging period and joint probability events). In addition, it is also essential to determine the aspects and characteristics related to exposure and vulnerability parameters relevant for the elements at risk considered in the area of interest. (3) The ability of the project to cope with existing climate variability and with future climate hazards should be assessed. This typically involves the use of numerical models (e.g. climate impact models), that describe some element of the project, namely the relevant exposure and vulnerability parameters likely to be affected by the hazard(s) considered (e.g. spatial and technical characteristics of ground and underground floors of a building in a flood-prone area). The assessment should involve a number of climate models (e.g. hydrological, flood risk, heat wave models, etc.) as well as specific vulnerability functions in relation to the hazard(s) and element(s) at risk considered. A range of future climate scenarios should be investigated based on a number of climate models and a range of greenhouse gas emissions scenarios, such as RCP4.5 and/or RCP8.5.

1 Risk is a probabilistic measure that relates to a cumulative effect of all (likely) hazard occurrences, whereas the impact merely indicates the effects of specific reference events.

Maps

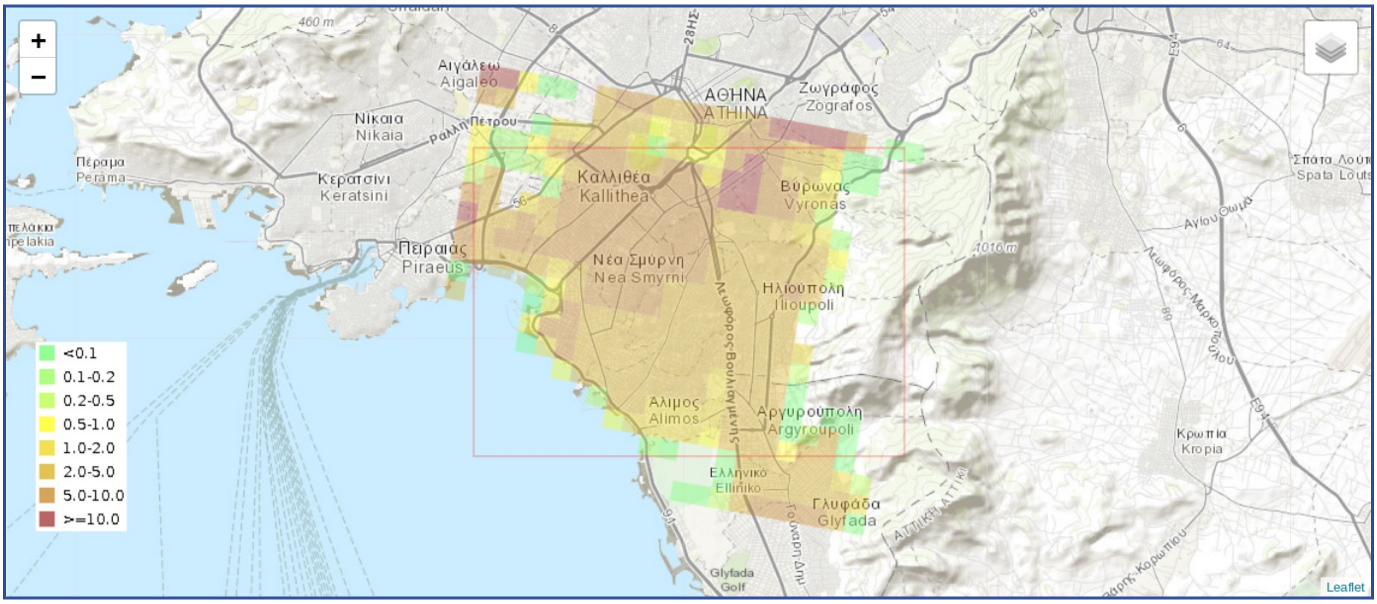
End of the century with "effective measures" taken.



End of the century mortality in the case the effective measures are taken soon

- Period: 2071 to 2100,
- Scenario: Effective measures,
- Frequency: 20 years,
- Variant: no Adaptation Options

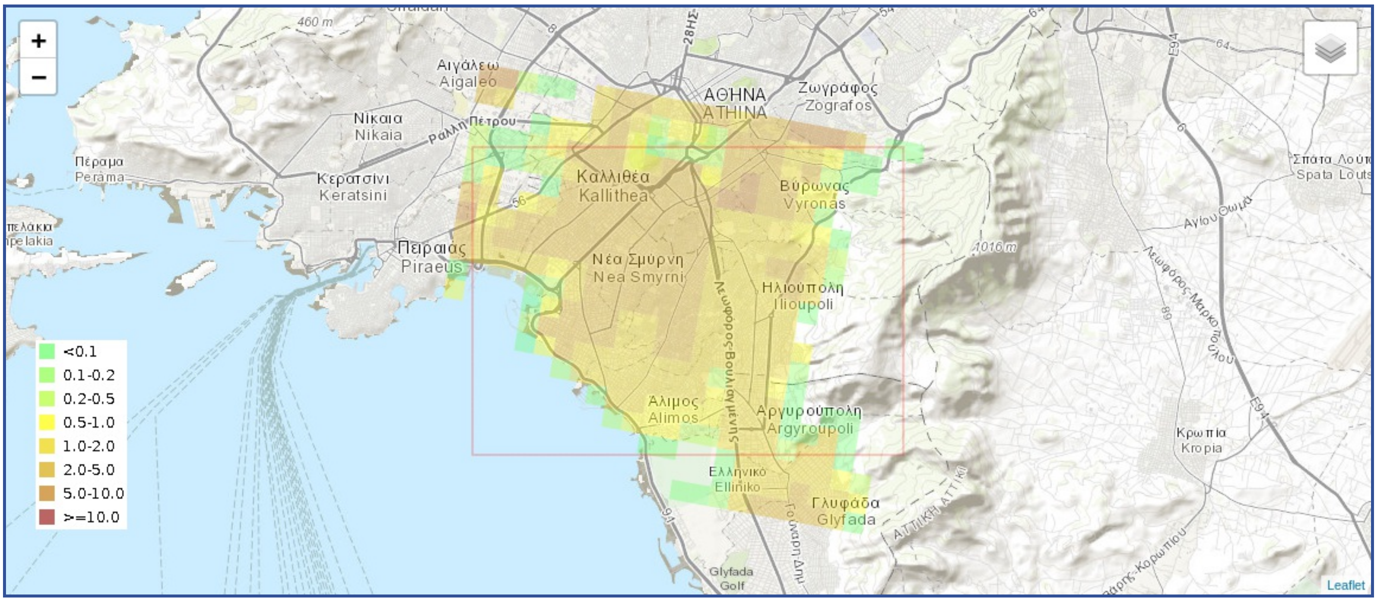
End of the century with no measures taken.



This is the scenario with highest mortality.

- Period: 2071 to 2100,
- Scenario: Business as usual,
- Frequency: 20 years,
- Variant: no Adaptation Options

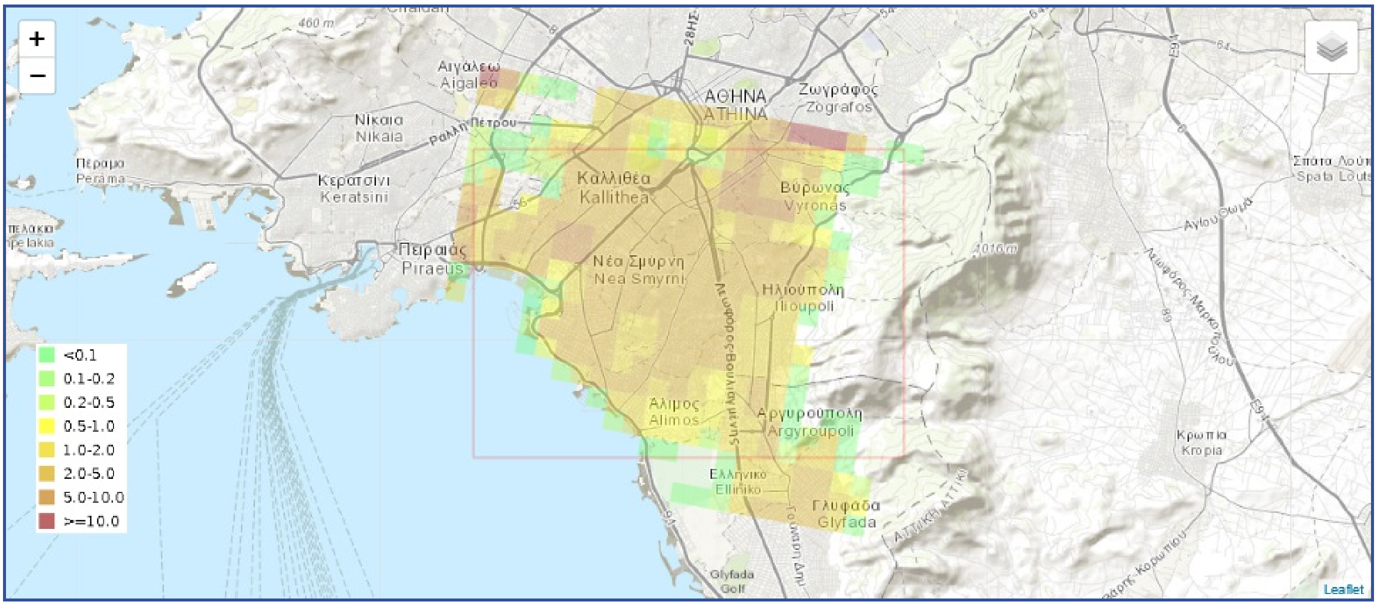
Current situation: mortality for Occasional heat events



This is the current situation, mortality risk/impact from 5-year events

- Period: historical,
- Scenario: Historical
- Frequency: 5 years
- Variant: no Adaptation Options

Current situation: mortality for Rare heat events



This is the current situation, mortality risk/impact from 20-year events

- Period: historical,
- Scenario: Historical,
- Frequency: 20 years,
- Variant: no Adaptation Options.

Tables

Areas with the highest mortality

STUDY_VARIAN	TIME_PERIOD	EMISSIONS_SC	EVENT_FREQUE	EXPOSEDQUAN	DAMAGEPROB	DAMAGEQUAN	GRID_ID	MULTIPOLYGO	SZM_SZENARIO
BASELINE	Baseline	Baseline	Frequent	17422	0.000400209058	6.972442216876	500mE55315N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	15154	0.000447198748	6.776849829808	500mE55325N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	15319	0.000441176043	6.758375807592	500mE55320N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	8443	0.000457758018	3.864850953796	500mE55300N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	9189	0.000416041910	3.823009119432	500mE46805N1	POLYGON ((468	2846
BASELINE	Baseline	Baseline	Frequent	9189	0.000409084389	3.759076455234	500mE46805N1	POLYGON ((468	2846
BASELINE	Baseline	Baseline	Frequent	8270	0.000448093679	3.705734731175	500mE55300N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	9825	0.000353528823	3.473420688168	500mE55310N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	7403	0.000456591788	3.380149010077	500mE55265N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	7403	0.000453271048	3.355565573573	500mE55260N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	7403	0.000451968783	3.345924902280	500mE55260N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	7403	0.000441799919	3.270644807568	500mE55265N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	7114	0.000448966595	3.193948357860	500mE55315N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	8168	0.000386038727	3.153164328305	500mE46790N1	POLYGON ((467	2846
BASELINE	Baseline	Baseline	Frequent	8083	0.000390090891	3.153104678948	500mE46820N1	POLYGON ((468	2846

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Areas with the highest mortality rate

STUDY_VARIAN	TIME_PERIOD	EMISSIONS_SC	EVENT_FREQUI	EXPOSEDQUAN	DAMAGEPROB	DAMAGEQUAN	GRID_ID	MULTIPOLYGO	SZM_SZENARIO
BASELINE	Baseline	Baseline	Frequent	7	0.000480733393	0.003365133752	500mE55255N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	2340	0.000480066501	1.123355613367	500mE55285N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	3688	0.000467120144	1.722739093425	500mE55290N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	2201	0.000466441949	1.026638730212	500mE55300N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	121	0.000465933255	0.056377923904	500mE55255N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	3617	0.000465514006	1.683764163000	500mE55295N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	5059	0.000464036343	2.347559864265	500mE55325N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	3241	0.000463624331	1.502606458122	500mE55330N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	3158	0.000462327873	1.460031424430	500mE55300N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	5618	0.000461967875	2.595335524223	500mE55265N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	1223	0.000461679039	0.564633465194	500mE55255N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	3158	0.000460843130	1.455342605011	500mE55300N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	3432	0.000460279591	1.579679558868	500mE55295N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	4582	0.000460073333	2.108056012417	500mE55295N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	6617	0.000459499888	3.040510761343	500mE55270N1	POLYGON ((552	3189

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Mortality and mortality probability, part 2

STUDY_VAR	TIME_PE	EMISSION	EVENT_FREC	EXPOSED	DAMAGEPROBABILITY	DAMAGEQUANTITY	GRID_ID	MULTIPOLYC	SZN
BASELINE	Baseline	Baseline	Frequent	1565	0.00033376960980627566	0.5223494393468214	500mE46900N19815	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	814	0.00032001612813484053	0.2604931283017602	500mE46720N19875	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	2832	0.00033574094090255407	0.9508183446360332	500mE46785N19800	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	3468	0.0003837337452102077	1.3307886283890002	500mE46865N19815	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	3468	0.0003719486266156657	1.2899178371031286	500mE46860N19815	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	1644	0.00038309479699707603	0.629807846263193	500mE46850N19815	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	1853	0.0003469721363732237	0.6429393686995836	500mE46895N19775	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	23	0.0003299718361631893	0.007589352231753354	500mE46890N19875	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	871	0.0003023648515051856	0.26335978566101664	500mE46765N19840	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	123	0.0002906060743144764	0.035744547140680594	500mE46725N19885	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	871	0.0003505231482298078	0.3053056621081626	500mE46900N19840	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	288	0.00030527118548525137	0.0879181014197524	500mE46725N19880	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	802	0.0002988851709596171	0.2397059071096129	500mE46710N19885	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	141	0.0003109707119842178	0.04384687038977471	500mE46750N19790	POLYGON ((4	284
BASELINE	Baseline	Baseline	Frequent	2965	0.0003413032309918687	1.0119640798908907	500mE46755N19805	POLYGON ((4	284

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Showing so many decimals is completely useless. For probability, just express it in percent, for both probability and absolute values stick to at most 1 or two decimals - and even that is just pretending we have accuracy that we don't have.

Mortality

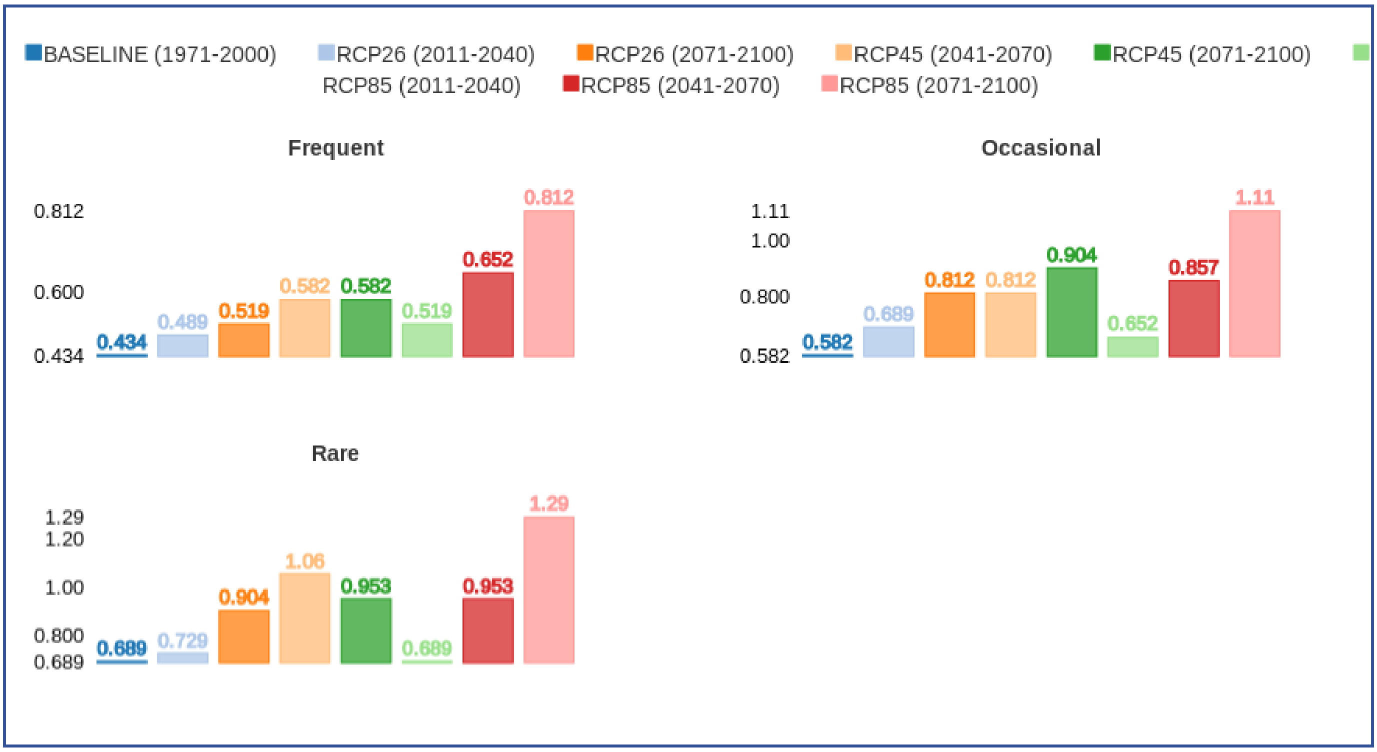
STUDY_VARIAN	TIME_PERIOD	EMISSIONS_SC	EVENT_FREQUI	EXPOSEDQUAN	DAMAGEPROB	DAMAGEQUAN	GRID_ID	MULTIPOLYGO	SZM_SZENARIO
BASELINE	Baseline	Baseline	Frequent	17422	0.000400209058	6.972442216876	500mE55315N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	15154	0.000447198748	6.776849829808	500mE55325N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	15319	0.000441176043	6.758375807592	500mE55320N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	8443	0.000457758018	3.864850953796	500mE55300N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	9189	0.000416041910	3.823009119432	500mE46805N1	POLYGON ((468	2846
BASELINE	Baseline	Baseline	Frequent	9189	0.000409084389	3.759076455234	500mE46805N1	POLYGON ((468	2846
BASELINE	Baseline	Baseline	Frequent	8270	0.000448093679	3.705734731175	500mE55300N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	9825	0.000353528823	3.473420688168	500mE55310N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	7403	0.000456591788	3.380149010077	500mE55265N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	7403	0.000453271048	3.355565573573	500mE55260N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	7403	0.000451968783	3.345924902280	500mE55260N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	7403	0.000441799919	3.270644807568	500mE55265N1	POLYGON ((552	3189
BASELINE	Baseline	Baseline	Frequent	7114	0.000448966595	3.193948357860	500mE55315N1	POLYGON ((553	3189
BASELINE	Baseline	Baseline	Frequent	8168	0.000386038727	3.153164328305	500mE46790N1	POLYGON ((467	2846
BASELINE	Baseline	Baseline	Frequent	8083	0.000390090891	3.153104678948	500mE46820N1	POLYGON ((468	2846

Previous | Page 1 of 67 | 5 rows | Next

Somewhat unsurprisingly, the highest mortality is in the area with the highest population density. However, the highest mortality rate isn't.

Scenario Analysis

Mortality bar charts



Graphical presentation of mortality for all time periods and rcp scenarios.

TBD:

1. 2071-2100 Data is missing for rcp26 and rcp45. Why?
2. why is mortality for "rare" events in 2011-2040 period higher in rcp45 (orange) than for the rcp85 (red)? Is this plausible?

Report image

Indicators	BASELINE (1971-2000)	RCP26 (2011-2040)	RCP26 (2071-2100)	RCP45 (2041-2070)	RCP45 (2071-2100)	RCP85 (2011-2040)	RCP85 (2041-2070)	RCP85 (2071-2100)
Mortality Rate following Heat Wave Events								
Frequent	0.434 ‰	0.489 ‰	0.519 ‰	0.582 ‰	0.582 ‰	0.519 ‰	0.652 ‰	0.812 ‰
Occasional	0.582 ‰	0.689 ‰	0.812 ‰	0.812 ‰	0.904 ‰	0.652 ‰	0.857 ‰	1.111 ‰
Rare	0.689 ‰	0.729 ‰	0.904 ‰	1.056 ‰	0.953 ‰	0.689 ‰	0.953 ‰	1.290 ‰

Indicator Table

Identify Adaptation Options step

Introduction

In order to take into account climate vulnerabilities and risks that have been identified through application of Modules 1 to 4, it is necessary identify adaptation options, followed by a detailed qualitative and quantitative assessment of the options.

The application of an adaptation option within the project implies a variation in the risk assessment or in the impact scenario analysis compared to the "baseline" of the project, since it:

- modifies relevant microclimate variables (e.g. albedo, runoff, etc.),
- modifies exposure of elements at risk (e.g. delocalization of residential areas),
- modifies the vulnerability function of a given element at risk (or of its component) in relation to the hazard parameter considered (e.g. improved thermal efficiency of the building envelope)
- modifies the exposure level (e.g. extending the flood plain of a channel reduces the flood level and consequently the exposure of the elements at risk).

Thus, the selection of one or more adaptation options allows performing an “alternate run” of risk and impact models and their comparison in terms of impacts.

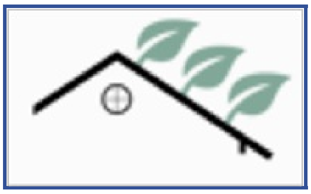
Identifying adaptation options typically involves diverse fields of expertise and stakeholders’ domain, to allow project managers to gain a more detailed understanding of the pros and cons for each option. Technical experts and external stakeholders should attend such workshop to realistically estimate potential effects. To be well prepared for the workshop, project managers should make themselves familiar with respective guideline documents, best practice adaptation examples, engineering standards etc.

After identifying available adaptation options, the next step is to select a shortlist from the available options for the specific project. This shortlist should contain a clear benchmarking of the benefits of the adaptation options, both in terms of hazard, exposure and vulnerability reduction (see Module 5 Identify adaptation options), both of related socio-economic co-benefits (such as increase in liveability, biodiversity, and selection ability to respond to multiple hazards, etc.)

Included data

Adaptation Option: Green roofs

Overview



tbd

Cost estimate

Cost for new development: €€
Cost for retrofitting: €€€
Cost for maintenance: €

Adaptation Option effects

Local effects change

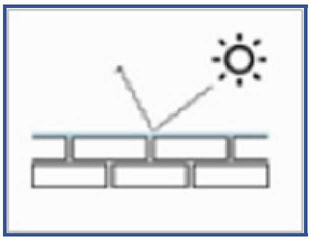
- indoors heat --
- Albedo = 0.5
- Surface emissivity +10%
- hillshade-green-fraction +10%
- transmissivity +10%

Co-benefits

- Multifunctional space usage: ++
- Social and economic importance: ++
- Air quality: +
- Energy efficency: ++
- Biodiversity: +++

Adaptation Option: Cool paving and building materials

Overview



tbd

Cost estimate

Cost for new development: €
Cost for retrofitting: €

Adaptation Option effects

Vulnerability change

- extreme-heat / infrastructure : **---**
- extreme-heat / buildings : **---**

Local effects change

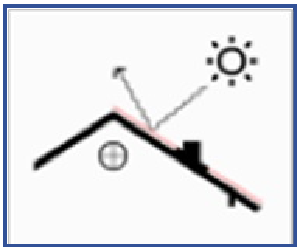
- Albedo = 0.5

Co-benefits

- Multifunctional space usage: +
- Energy efficency: +

Adaptation Option: Cool (reflective) roofs

Overview



tbd

Cost estimate

Cost for new development: €€

Adaptation Option effects

Local effects change

- Albedo = 0.5
- Surface emissivity +10%
- transmissivity +10%

Co-benefits

- Multifunctional space usage: +

Showcase: Negative example: how soil sealing augments the "urban heat islands" effect

Sealed surfaces are usually used as a negative example of urbanisation measures that lead to higher risk of pluvial flooding, lowering the groundwater level and a risk of overflowing the gutters. The linked article from ORF.science (in German) points out that the sealed surfaces also increase the "urban heat island" effect.

*"**Concrete example:** At Schönbrunn, on the outskirts of Vienna, in the middle of the fresh air channel from the Vienna Woods, a huge parking area is being sealed with asphalt - a measure that will have an effect on the heat throughout the city, says Tschannett: The area is going to heat up during the day and then heat up the fresh, and hopefully cool, incoming air at night (thus further warming up the city centre). "*

"Generally, the less asphalt and sealed surfaces, the better the city can 'breathe' and absorb heat. Unsealed surfaces have a cooling effect and also catch the heavy downpours in bad weather."

Illustration: [Kate Ter Haar]

Basic Information

Link:
Wien europaweit am stärksten betroffen (science@orf.at)

Hazards

- heat

Elements at Risk

- population

Showcase: Climate information on 1km scale over Stockholm

Urban SIS: Climate Information for European Cities was a project funded by Copernicus. The goal of the project was to provide a proof-of-concept of a service offering Essential Climate Variables (ECV) and impact indicators based on temperature and other climatic variables together with air pollutant concentrations. This information will bring more consistent and useful data to different sectors operating in urban areas, e.g. related to infrastructure and health. Note also that ozone and aerosols are part of the atmospheric ECVs, as defined by GCOS. Stockholm was one of the cities studied in the project.

Basic Information

Link:
The Urban SIS portal

Hazards

- heat
- drought

Elements at Risk

- population

Maps

No elements of this type are listed for this step.

Tables

No elements of this type are listed for this step.

Scenario Analysis

No elements of this type are listed for this step.

Data used in this study

European Wide Data Package

The purpose of this data package is to provide general purpose resources covering the whole Europe that can be reused when creating other more specific data packages (e.g., Naples Data Package).

Data Package summary

keywords:

- Europe

Contributors:

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Organization: AIT Austrian institute of Technology GmbH.

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In some cases the personal use may be allowed free of charge.

Price
0.00 EURO

Resources

Vulnerabilities

- Heat mortality vulnerability
- Vulnerability test 1 (flood/buildings)

Vulnerability analysis relations

Vulnerability:
Heat mortality vulnerability
VA inputs:
HI_hot-days_rcp85_20110101-20401231_ensmean

European Population Distribution
Local effect apparent temperature
VA outputs:
Heat mortality risk/impact screening

Adaptation Options

- Blinds
- Pergolas and canvas above streets
- Porous pavements
- Cool paving and building materials
- Cool (reflective) roofs
- Green roofs

Other resources

Maximum consecutive days (summer) 75th percentile, emissions scenario (baseline), period (1971-2000), ensemble mean

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the baseline emissions scenario in the 1971-2000 period (ensemble mean)

Licenses: CORDEX

Contributors:

- **Robert Goler**
  E-mail: robert.goler@zamg.ac.at
  Organization: ZAMG

Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp85), period (2071-2100), ensemble mean

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp85 emissions scenario in the 2071-2100 period (ensemble mean)

Licenses: CORDEX

Contributors:

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  Organization: ZAMG

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp85), period (2041-2070), ensemble mean

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp85 emissions scenario in the 2041-2070 period (ensemble mean)

Licenses: CORDEX

Contributors:

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  Organization: ZAMG

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp85), period (2011-2040), ensemble mean

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp85 emissions scenario in the 2011-2040 period (ensemble mean)

Licenses: CORDEX

Contributors:

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Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp45), period (2071-2100), ensemble mean

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp45 emissions scenario in the 2071-2100 period (ensemble mean)

Licenses: CORDEX

Contributors:

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  Organization: ZAMG

Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp45), period (2041-2070), ensemble mean

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp45 emissions scenario in the 2041-2070 period (ensemble mean)

Licenses: CORDEX

Contributors:

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Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp45), period (2011-2040), ensemble mean

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp45 emissions scenario in the 2011-2040 period (ensemble mean)

Licenses: CORDEX

Contributors:

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  Organization: ZAMG

Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp26), period (2071-2100), ensemble mean

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp26 emissions scenario in the 2071-2100 period (ensemble mean)

Licenses: CORDEX

Contributors:

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  Organization: ZAMG

Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp26), period (2041-2070), ensemble mean

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp26 emissions scenario in the 2041-2070 period (ensemble mean)

Licenses: CORDEX

Contributors:

- **Robert Goler**
  E-mail: robert.goler@zamg.ac.at
  Organization: ZAMG

Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp26), period (2011-2040), ensemble mean

description
Maxium number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp26 emissions scenario in the 2011-2040 period (ensemble mean)

Licenses: CORDEX

Contributors:

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Sources

- EURO-CORDEX

Vegetation Areas in Europe

description

Vegetation Areas in Europe

Licenses: Copernicus

Contributors:

- **Denis Havlik**
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  Organization: AIT Austrian institute of Technology GmbH.

Sources

- Copernicus Land Monitoring Service - Street Tree Layer (STL) 2012
- Copernicus Land Monitoring Service - Urban Atlas 2012

Trees Areas in Europe

description
Trees Areas in Europe

Licenses: Copernicus

Contributors:

- **EEA - Copernicus**
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  Organization: European Environment Agency (EEA) under the framework of the Copernicus programme - copernicus@eea.europa.eu

Sources

- Copernicus Land Monitoring Service - Urban Atlas 2012
- Copernicus Land Monitoring Service - European Settlement Map 2012

Streams in Europe

description
Streams in Europe

Licenses: Copernicus

Contributors:

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Sources

- Copernicus Land Monitoring Service - Integrated EU-Hydro Database

Roads Transport Infrastructure in Europe

description
Roads Transport Infrastructure in Europe

Licenses: Copernicus

Contributors:

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Sources

- Copernicus Land Monitoring Service - Urban Atlas 2012

Railways Transport Infrastructure in Europe

description
Railways Transport Infrastructure in Europe

Licenses: Copernicus

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Medium Urban Fabric Spaces in Europe

description
Medium Urban Fabric Spaces in Europe

Licenses: Copernicus

Contributors:

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Sources

- Copernicus Land Monitoring Service - Urban Atlas 2012

Low Urban Fabric Spaces in Europe

description
Low Urban Fabric Spaces in Europe

Licenses: Copernicus

Contributors:

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Sources

- Copernicus Land Monitoring Service - Urban Atlas 2012

Dense Urban Fabric Spaces in Europe

description
Dense Urban Fabric Spaces in Europe

Licenses: Copernicus

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Sources

- Copernicus Land Monitoring Service - Urban Atlas 2012

Built Open Spaces in Europe

description
Built Open Spaces in Europe

Licenses: Copernicus

Contributors:

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Sources

- Copernicus Land Monitoring Service - European Settlement Map 2012

Built-up Areas in Europe

description
Built-up Areas in Europe

Licenses: Undefined

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Basins Areas in Europe

description
Basins Areas in Europe

Licenses: Copernicus

Contributors:

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Public, military and industrial areas in Europe

description
Public, military and industrial areas in Europe

Licenses: Copernicus

Contributors:

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Sources

- Copernicus Land Monitoring Service - Urban Atlas 2012

Water Areas in Europe

description
Water Areas in Europe

Licenses: Copernicus

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Sources

- Copernicus Land Monitoring Service - Urban Atlas 2012

Agricultural Areas in Europe

description
Agricultural Areas in Europe

Licenses: Copernicus

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  Organization: European Environment Agency (EEA) under the framework of the Copernicus programme - copernicus@eea.europa.eu

Sources

- Copernicus Land Monitoring Service - Urban Atlas 2012

Adaptation Options

description
General list of possible adaptation options for application

Licenses: Undefined

Flood recurrence

description
Flood recurrences are given as daily river flows that correspond to return periods of 2, 5, 10, 50, and 100 years. The return period values are calculated using a Gumbel distribution fitted to the yearly maximum river flows for a given 30-year period.

For the reference period (1971-2000) the absolute values are given, while for the future periods the relative changes are provided.

Units:

Reference period: cubic metres per second (m3/s)
Future periods: percentage change relative to the reference period (%)

Spatial resolution: 5 degree grid, Data for different recurrence periods Based on daily data

Licenses: CC-BY-4.0

Contributors:

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  Organization: SMHI

Sources

- SWICCA

River flow

description
River flow is the volume rate of water flow that is transported through a given cross-sectional area. It is synonymous to river discharge or streamflow.

For each 30-year analysis period, the indicators for river flow are:
- Mean: full period mean of all daily values
- Seasonality: mean values of all Januaries, Februaries etc. that are part of the 30-year period
- Daily: daily time series

For the reference period (1971-2000) the absolute values are given, while for the future periods the relative changes are provided.

Units:

Reference period: cubic metres per second (m3/s)
Future periods: percentage change relative to the reference period (%)

Spatial resolution: 50 km / catchment (irregular grid)

Licenses: CC-BY-4.0

Contributors:

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  Organization: SMHI

Sources

- SWICCA

Water runoff

description
Runoff is the sum of surface and subsurface runoff to streams for each grid cell.

For each 30-year analysis period, the indicators for water runoff are:
- Mean: full period mean of all daily values
- Seasonality: mean values of all Januaries, Februaries etc. that are part of the 30-year period

For the reference period (1971-2000) the absolute values are given, while for the future periods the relative changes are provided.

Units:

Reference period: millimetres per day (mm/d)

Future periods: percentage change relative to the reference period (%)

Spatial resolution: 50 km / catchment (irregular grid)

Licenses: CC-BY-4.0

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Sources

- SWICCA

Roads Transport Infrastructure in Europe (exposure)

description
Roads Transport Infrastructure in Europe

Licenses: Copernicus

Contributors:

- **Denis Havlik**
  E-mail: denis.havlik@ait.ac.at
  Organization: AIT Austrian institute of Technology GmbH.

Sources

- Copernicus Land Monitoring Service - Urban Atlas 2012

HI_summer-days_historical_19710101-20001231_ensmean

description
The average yearly number of summer days in Europe for the baseline period 1971-2000 (ensemble mean). A summer day is a day where the maximum temperature is greater than 25.0C.

Licenses: CORDEX

Contributors:

- **Robert Goler**
  E-mail: robert.goler@zamg.ac.at
  Organization: ZAMG

Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (historical), period (1971-2000), ensemble standard deviation

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th

percentile during summer months (Apr-Sep) for the baseline emissions scenario in the 1971-2000 period (ensemble standard deviation)

Licenses: Undefined

Contributors:

- **Robert Goler**
  E-mail: robert.goler@zamg.ac.at
  Organization: ZAMG

Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp85), period (2071-2100), ensemble standard deviation

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp85 emissions scenario in the 2071-2100 period (ensemble standard deviation)

Licenses: Undefined

Contributors:

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  Organization: Atos Spain

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Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp85), period (2041-2070), ensemble standard deviation

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp85 emissions scenario in the 2041-2070 period (ensemble standard deviation)

Licenses: Undefined

Contributors:

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Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp85), period (2011-2040), ensemble standard deviation

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp85 emissions scenario in the 2011-2040 period (ensemble standard deviation)

Licenses: Undefined

Contributors:

- **Robert Goler**
  E-mail: robert.goler@zamg.ac.at
  Organization: ZAMG

Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp45), period (2070-2100), ensemble standard deviation

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp45 emissions scenario in the 2071-2100 period (ensemble standard deviation)

Licenses: Undefined

Contributors:

- **Robert Goler**
  E-mail: robert.goler@zamg.ac.at
  Organization: ZAMG

Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp45), period (2041-2070), ensemble standard deviation

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp45 emissions scenario in the 2041-2070 period (ensemble standard deviation)

Licenses: Undefined

Contributors:

- **Robert Goler**
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  Organization: ZAMG

Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp45), period (2011-2040), ensemble standard deviation

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp45 emissions scenario in the 2011-2040 period (ensemble standard deviation)

Licenses: Undefined

Contributors:

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  Organization: ZAMG

Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp26), period (2071-2100), ensemble standard deviation

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp26 emissions scenario in the 2071-2100 period (ensemble standard deviation)

Licenses: Undefined

Contributors:

- **Robert Goler**
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  Organization: ZAMG

Sources

- EURO-CORDEX

Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp26), period (2041-2070), ensemble standard deviation

description
Maximum number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp26 emissions scenario in the 2041-2070 period (ensemble standard deviation)

Licenses: Undefined

Contributors:

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Maximum consecutive days (summer) 75th percentile, emissions scenario (rcp26), period (2011-2040), ensemble standard deviation

description
Maxium number of days per year with a mean air temperature at 2 m above ground above the 75th percentile during summer months (Apr-Sep) for the rcp26 emissions scenario in the 2011-2040 period (ensemble standard deviation)

Licenses: Undefined

Contributors:

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Sources

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HI_summer-days_rcp26_20110101-20401231_ensmean

description
The average yearly number of summer days in Europe for the RCP26 emissions scenario in the 2011-2040 period (ensemble mean).
A summer day is a day where the maximum temperature is greater than 25.0C.

Licenses: CORDEX

Contributors:

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HI_summer-days_rcp26_20710101-21001231_ensmean

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HI_summer-days_historical_19710101-20001231_ensstd

description
The average yearly number of summer days in Europe for the baseline period 1971-2000 (ensemble standard deviation).
A summer day is a day where the maximum temperature is greater than 25.0C.

Licenses: CORDEX

Contributors:

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  Organization: ZAMG

Sources

- EURO-CORDEX

European Population Distribution

description
Population distribution. Generated from Eurostat population and CORINE land use (CLC codes 11*) data.

Data is generated by EMIKAT on the fly and for the study area indicated by ${emikat_id}. For testing, you can substitute 2846 for ${emikat_id}.

Licenses: CC-BY-4.0

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- **Denis Havlik**
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  Organization: AIT Austrian institute of Technology GmbH.

Sources

- European Population statistics 2011 GEOSTAT 2011 V2.0.1, European raster of Population in a 1km*1km grid (ETRS89 / LAEA)
- Copernicus Land Monitoring Service - CORINE Land Cover (CLC) 2018;

HI_summer-days_rcp26_20110101-20401231_ensstd

description
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The average yearly number of summer days in Europe for the RCP85 emissions scenario in the 2041-2070 period (ensemble standard deviation).
A summer day is a day where the maximum temperature is greater than 25.0C.

Licenses: CORDEX

Contributors:

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  Organization: ZAMG

Sources

- EURO-CORDEX

HI_summer-days_rcp26_20710101-21001231_ensstd

description
The average yearly number of summer days in Europe for the RCP26 emissions scenario in the 2071-2100 period (ensemble standard deviation).
A summer day is a day where the maximum temperature is greater than 25.0C.

Licenses: CORDEX

Contributors:

- **Robert Goler**
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  Organization: ZAMG

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HI_summer-days_rcp45_20710101-21001231_ensstd

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The average yearly number of summer days in Europe for the RCP45 emissions scenario in the 2071-2100 period (ensemble standard deviation).
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Contributors:

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HI_summer-days_rcp85_20710101-21001231_ensstd

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The average yearly number of summer days in Europe for the RCP85 emissions scenario in the 2071-2100 period (ensemble standard deviation).
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Licenses: CORDEX

Contributors:

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Sources

- EURO-CORDEX

HI_tropical-nights_historical_19710101-20001231_ensmean

description
The average yearly number of tropical nights in Europe for the baseline period 1971-2000 (ensemble mean).
A tropical night is a day where the minimum temperature is greater than 20.0C.

Licenses: CORDEX

Contributors:

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The average yearly number of tropical nights in Europe for the RCP26 emissions scenario in the 2011-2040 period (ensemble standard deviation).
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HI_hot-days_historical_19710101-20001231_ensmean

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Sources

- EURO-CORDEX

HI_hot-days_rcp45_20110101-20401231_ensstd

description
The average yearly number of hot days in Europe for the RCP45 emissions scenario in the 2011-2040 period (ensemble standard deviation).
A hot day is a day where the maximum temperature is greater than 30.0C.

Licenses: CORDEX

Contributors:

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  Organization: ZAMG

Sources

- EURO-CORDEX

HI_hot-days_rcp45_20110101-20401231_ensmean

description
The average yearly number of hot days in Europe for the RCP45 emissions scenario in the 2011-2040 period (ensemble mean).
A hot day is a day where the maximum temperature is greater than 30.0C.

Licenses: CORDEX

Contributors:

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  Organization: ZAMG

Sources

- EURO-CORDEX

HI_hot-days_rcp85_20110101-20401231_ensmean

description
The average yearly number of hot days in Europe for the RCP85 emissions scenario in the 2011-2040 period (ensemble mean).
A hot day is a day where the maximum temperature is greater than 30.0C.

Licenses: CORDEX

Contributors:

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  Organization: ZAMG

Sources

- EURO-CORDEX

HI_hot-days_rcp85_20110101-20401231_ensstd

description
The average yearly number of hot days in Europe for the RCP85 emissions scenario in the 2011-2040 period (ensemble standard deviation).
A hot day is a day where the maximum temperature is greater than 30.0C.

Licenses: CORDEX

Contributors:

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Sources

- EURO-CORDEX

HI_hot-days_rcp26_20110101-20401231_ensmean

description
The average yearly number of hot days in Europe for the RCP26 emissions scenario in the 2011-2040 period (ensemble mean).
A hot day is a day where the maximum temperature is greater than 30.0C.

Licenses: CORDEX

Contributors:

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Sources

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HI_hot-days_rcp26_20110101-20401231_ensstd

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The average yearly number of hot days in Europe for the RCP26 emissions scenario in the 2011-2040 period (ensemble standard deviation).
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Sources

- EURO-CORDEX

HI_hot-days_rcp26_20410101-20701231_ensmean

description
The average yearly number of hot days in Europe for the RCP26 emissions scenario in the 2041-2070 period (ensemble mean).
A hot day is a day where the maximum temperature is greater than 30.0C.

Licenses: CORDEX

Contributors:

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Sources

- EURO-CORDEX

HI_hot-days_rcp26_20410101-20701231_ensstd

description
The average yearly number of hot days in Europe for the RCP26 emissions scenario in the 2041-2070 period (ensemble standard deviation).
A hot day is a day where the maximum temperature is greater than 30.0C.

Licenses: CORDEX

Contributors:

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Sources

- EURO-CORDEX

HI_hot-days_rcp26_20710101-21001231_ensmean

description
The average yearly number of hot days in Europe for the RCP26 emissions scenario in the 2071-2100 period (ensemble mean).
A hot day is a day where the maximum temperature is greater than 30.0C.

Licenses: CORDEX

Contributors:

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  Organization: ZAMG

Sources

- EURO-CORDEX

HI_hot-days_rcp26_20710101-21001231_ensstd

description
The average yearly number of hot days in Europe for the RCP26 emissions scenario in the 2071-2100 period (ensemble standard deviation).
A hot day is a day where the maximum temperature is greater than 30.0C.

Licenses: CORDEX

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Sources

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HI_hot-days_rcp45_20410101-20701231_ensmean

description
The average yearly number of hot days in Europe for the RCP45 emissions scenario in the 2041-2070 period (ensemble mean).
A hot day is a day where the maximum temperature is greater than 30.0C.

Licenses: CORDEX

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Sources

- EURO-CORDEX

HI_hot-days_rcp45_20410101-20701231_ensstd

description
The average yearly number of hot days in Europe for the RCP45 emissions scenario in the 2041-2070 period

(ensemble standard deviation).
A hot day is a day where the maximum temperature is greater than 30.0C.

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HI_hot-days_rcp85_20410101-20701231_ensmean

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A hot day is a day where the maximum temperature is greater than 30.0C.

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description
The average yearly number of hot days in Europe for the RCP85 emissions scenario in the 2041-2070 period (ensemble standard deviation).
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description
The average yearly number of hot days in Europe for the RCP45 emissions scenario in the 2071-2100 period (ensemble mean).
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HI_hot-days_rcp45_20710101-21001231_ensstd

description
The average yearly number of hot days in Europe for the RCP45 emissions scenario in the 2071-2100 period (ensemble standard deviation).
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HI_hot-days_rcp85_20710101-21001231_ensstd

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The average yearly number of hot days in Europe for the RCP85 emissions scenario in the 2071-2100 period (ensemble standard deviation).
A hot day is a day where the maximum temperature is greater than 30.0C.

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  Organization: ZAMG

Sources

- EURO-CORDEX

Local effect apparent temperature

description
Local effect apparent temperature is calculated by EMIKAT on the fly and for the study area indicated by ${emikat_id}.
For testing, you can substitute 2846 for ${emikat_id} and one of the values that are advertised under "Categorisation (tags)" for other variables.

<p/>beware: only the map shows apparent temperature today, tables show all temperatures plus the "discomfort level" in one table!

Licenses: CC-BY-4.0

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  Organization: AIT Austrian institute of Technology GmbH.

- **Denis Havlik**
  E-mail: denis.havlik@ait.ac.at
  Organization: AIT Austrian institute of Technology GmbH.

Sources

- Copernicus Land Monitoring Service - CORINE Land Cover (CLC) 2018;
- Copernicus Land Monitoring Service - Urban Atlas 2012

Heat mortality risk/impact screening

description
This data is generated by EMIKAT **on the fly and for the study area indicated by $emikat_id**.

Licenses: CC-BY-4.0

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Organization: AIT Austrian institute of Technology GmbH.

- **Denis Havlik**
  E-mail: denis.havlik@ait.ac.at
  Organization: AIT Austrian institute of Technology GmbH.

Sources

- European Population statistics 2011 GEOSTAT 2011 V2.0.1, European raster of Population in a 1km*1km grid (ETRS89 / LAEA)
- Copernicus Land Monitoring Service - CORINE Land Cover (CLC) 2018;

PI_consecutive-wet-days_rcp26_20110101-20401231_ensmean

description
The average of the maximum number of consecutive wet days in Europe for the RCP26 emissions scenario in the 2011-2040 period (ensemble mean).
A wet day is a day with at least 1mm of precipitation.

Licenses: CORDEX

Contributors:

- **Robert Goler**
  E-mail: robert.goler@zamg.ac.at
  Organization: ZAMG

Sources

- EURO-CORDEX

PI_consecutive-wet-days_rcp26_20110101-20401231

description
The average of the maximum number of consecutive wet days in Europe for the RCP26 emissions scenario in the 2011-2040 period (ensemble mean and standard deviation).
A wet day is a day with at least 1mm of precipitation.

Licenses: CORDEX

Contributors:

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  Organization: ZAMG

Sources

- EURO-CORDEX

Local effect mean radiant temperature

description

Local effect mean radiant temperature is calculated by EMIKAT on the fly and for the study area indicated by ${emikat_id}.
For testing, you can substitute 2846 for ${emikat_id} and one of the values that are advertised under "Categorisation (tags)" for other variables.

<p/>beware: only the map shows mean radiant temperature today, tables show all temperatures plus the "discomfort level" in one table!

Licenses: CC-BY-4.0

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  Organization: AIT Austrian institute of Technology GmbH.

Sources

- Copernicus Land Monitoring Service - CORINE Land Cover (CLC) 2018;
- Copernicus Land Monitoring Service - Urban Atlas 2012

Local effect UTCI temperature

description
Local effect UTCI temperature is calculated by EMIKAT on the fly and for the study area indicated by ${emikat_id}.
For testing, you can substitute 2846 for ${emikat_id} and one of the values that are advertised under "Categorisation (tags)" for other variables.
<p/>beware: only the map shows UTCI temperature today, tables show all temperatures plus the "discomfort level" in one table!

Licenses: CC-BY-4.0

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- **Denis Havlik**
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Sources

- Copernicus Land Monitoring Service - CORINE Land Cover (CLC) 2018;
- Copernicus Land Monitoring Service - Urban Atlas 2012