UHI - User Requirements and Service Specifications

Status report Nr. 4 - Quarter 4/2014

http://www.naclim.eu

The research leading to these results has received funding from NACLIM

a project of the European Union 7th Framework Programme (FP7 2007-2013)

under grant agreement n.308299

TABLE OF CONTENTS

1 Aim of the document 2

2 User requirements 2

3 UHI - service specifications 2

3.1 Scenarios 2

3.2 Exposure mapping 3

4 Timing and status work 5

4.1 Work done in current reporting period 5

4.2 Work planned for next reporting period 6

4.3 Summary overview status 6

4.3.1 Scenarios 6

4.3.2 Exposure mapping 6

1 AIM OF THE DOCUMENT

The aim of this document is to update the NACLIM WP4.2 end-users on a regular (quarterly) basis on the progress of the work and the planned activities for the next period.

2 USER REQUIREMENTS

An overview of the main user requirements for mapping the impact of climate change on urban societies is given below. In particular, the Urban Heat Island (UHI) effect is analysed over three different cities (Berlin, Antwerp and Almada) with varying landscape and climate characteristics.

The user requirements have been consolidated in close collaboration with the end-users by means of dedicated **user workshops** and the common **main requirements** have been identified (cf. *NACLIM: UHI - User Requirements and Service Specifications: Status Report 1 – Q1 2014*). After the 4th end-users meeting dd. October 16th 2014 in Berlin, the user needs and expectations have been further fine-tuned.

3 UHI - SERVICE SPECIFICATIONS

Different scenarios are taken in consideration in the framework of NACLIM. This work includes both the preparation of the UrbClim input data layers by GIM and performing the climate model simulations by VITO over the requested time periods and spatial scales. Moreover, using the outputs of the UrbClim simulations the result will be combined with socio-economic datasets to generate heat stress exposure maps.

3.1 SCENARIOS

The table below shows the scenarios that are proposed by GIM and VITO grouped according to different themes and time scales and taking the feedback gathered during the 4th end-users meeting into account.

THEME	ID	SCENARIO	TIME SCALE		
			PAST - PRESENT (1986-2005)	NEAR FUTURE (2026-2045)	FAR FUTURE (2081-2100)
BASE & CLIMATE VARIABILITY	S01	UHI - present situation (EEA data)	X		
	S02	UHI - present situation (end-users data)	X		
	S03	UHI - near future incl. climate variability (no changes)		X	
	S04	UHI - far future incl. climate variability (no changes)			X
MORPHOLOGY CHANGES	S05	Realised projects - no urban expansion		X	
	S06	Realised projects - urban expansion		X	
MITIGATION MEASURES	S07	Increase green roofs (no changes)	X		
	S08	Increase albedo buildings (no changes)	X		
USER-SPECIFIC SCENARIOS	S09	UHI - Almada without presence of Lisbon	X		

Table 1 – NACLIM scenarios (version Q4 2014)

Note that scenarios S06 (lack of data) and S09 (replaced by urban planning scenario for Almada) have not been retained in the project as priority has been given to the urban planning scenarios (realisation of urban master plans) since they are of most relevance to the end-users.

A brief description of the **various scenarios** is given below:

- **S01: UHI – present situation (EEA data)**: analysis of the UHI effect for the past/present situation (1986-2005) using generic European datasets (no end-users data);
- **S02: UHI – present situation (end-users data)**: analysis of the UHI effect for the past/present situation (1986-2005) using urban morphology parameters extracted from local datasets (e.g. 3D city models, LULC, etc.) provided by the end-users;
- **S03: UHI – near future incl. climate variability (no changes)**: analysis of the UHI effect for the near future situation (2026-2045) using urban morphology parameters extracted from local datasets (no changes) and global climate model predictions for the near future ref. IPCC reports (different scenarios + mapping of the uncertainty);
- **S04: UHI – far future incl. climate variability (no changes)**: analysis of the UHI effect for the far future situation (2081-2100) using urban morphology parameters extracted from local datasets (no changes) and global climate model predictions for the far future ref. IPCC reports (different scenarios + mapping of the uncertainty);
- **S05: Realised projects – no urban expansion**: analysis of the UHI effect for the near future situation (2026-2045) using urban morphology parameters extracted from local datasets including realised projects from local urban master plans. Expansion of the city (evolving LULC information) is not included;
- **S06: Realised projects – urban expansion**: analysis of the UHI effect for the near future situation (2026-2045) using urban morphology parameters extracted from local datasets including realised projects from local urban master plans. Expansion of the city (evolving LULC information) is also included;
- **S07: Increase green roofs (no changes)**: analysis of the UHI effect for the past/present situation (1986-2005) using urban morphology parameters extracted from local datasets and with different settings for the coverage of green roofs to analyse the mitigation effect on the UHI exposure;
- **S08: Increase albedo buildings (no changes)**: analysis of the UHI effect for the past/present situation (1986-2005) using urban morphology parameters extracted from local datasets and with different settings for the albedo (reflectivity) of the buildings to analyse the mitigation effect on the UHI exposure;
- **S09: UHI – Almada without presence of Lisbon**: analysis of the UHI effect for the past/present situation (1986-2005) using urban morphology parameters extracted from local datasets and where the city of Lisbon has been removed from the analysis to analyse its impact on the UHI of Almada city.

3.2 EXPOSURE MAPPING

The set of relevant exposure risk maps has been further fine-tuned based on the feedback received during the 4th NACLIM end-users meeting.

Two **socio-economic themes** are taking into consideration: "population" and "vulnerable institutions". The maps that will be produced per city will of course depend on the availability of the required socio-economic data from the end-users.

The data for each socio-economic dataset will be mapped against **heat stress related variables** such as the UHI effect or the estimated average number of heat wave days per year. Moreover, other heat wave statistics such as the average duration and intensity could be extracted if of interest to the end-users.

THEME	ID	EXPOSURE MAP Key variables: UHI effect, # heatwave days / year Optional: average heatwave duration / intensity	TIME SCALE		
			PAST - PRESENT (1986-2005)	NEAR FUTURE (2026-2045)	FAR FUTURE (2081-2100)
Population	E01	Vulnerable population - today (total)	X		
	E02	Vulnerable population - near future (total)		X	
	E03	Vulnerable population - today (age class)	X		
	E04	Vulnerable population - near future (age class)		X	
	E05	Vulnerable population - today (marital status)	X		
	E06	Vulnerable population - near future (marital status)		X	
Vulnerable institutions	E07	Vulnerable population - today (schools)	X		
	E08	Vulnerable population - near future (schools)		X	
	E09	Vulnerable population - today (childcare)	X		
	E10	Vulnerable population - near future (childcare)		X	
	E11	Vulnerable population - today (hospitals)	X		
	E12	Vulnerable population - near future (hospitals)		X	
	E13	Vulnerable population - today (rest homes)	X		
	E14	Vulnerable population - near future (rest homes)		X	

Table 2 – NACLIM exposure maps (version Q4 2014)

A brief description of the various maps is given below:

- Population
  - **E01 - Vulnerable population - today (total):** identification of total vulnerable population affected by the considered heat stress variable for the past/present situation (1986-2005).
  - **E02 - Vulnerable population - near future (total):** identification of total vulnerable population affected by the considered heat stress variable for the near future situation (2026-2045).
  - **E03 - Vulnerable population - today (age class):** identification of vulnerable population affected by the considered heat stress variable classified by age class for the past/present situation (1986-2005).
  - **E04 - Vulnerable population - near future (age class):** identification of vulnerable population affected by the considered heat stress variable classified by age class for the near future situation (2026-2045).
  - **E05 - Vulnerable population - today (marital status):** identification of vulnerable population affected by the considered heat stress variable according to marital status for the past/present situation (1986-2005).
  - **E06 - Vulnerable population - near future (marital status):** identification of vulnerable population affected by the considered heat stress variable according to marital status for the near future situation (2026-2045).
- Vulnerable institutions
  - **E07 - Vulnerable population - today (schools):** identification of vulnerable population with a focus on school institutions affected by the considered heat stress variable for the past/present situation (1986-2005).
  - **E08 - Vulnerable population - near future (schools):** identification of vulnerable population with a focus on school institutions affected by the considered heat stress variable for the near future situation (2026-2045).
  - **E09 - Vulnerable population - today (childcare):** identification of vulnerable population with a focus on childcare institutions affected by the considered heat stress variable for the past/present situation (1986-2005).
  - **E10 - Vulnerable population - near future (childcare):** identification of vulnerable population with a focus on childcare institutions affected by the considered heat stress variable for the near future situation (2026-2045).

- **E11 - Vulnerable population - today (hospitals):** identification of vulnerable population with a focus on hospitals affected by the considered heat stress variable for the past/present situation (1986-2005).
- **E12 - Vulnerable population - near future (hospitals):** identification of vulnerable population with a focus on hospitals affected by the considered heat stress variable for the near future situation (2026-2045).
- **E13 - Vulnerable population - today (rest homes):** identification of vulnerable population with a focus on rest homes affected by the considered heat stress variable for the past/present situation (1986-2005).
- **E14 - Vulnerable population - near future (rest homes):** identification of vulnerable population with a focus on rest homes affected by the considered heat stress variable for the near future situation (2026-2045).

Note that compared to the initial set of proposed exposure maps (as indicated in previous status reports), some items have not been retained (marked in grey) because of less relevance (e.g. marital status) or the absence of the data (e.g. predictions on the number of vulnerable institutions in the near future).

4 TIMING AND STATUS WORK

This chapter gives an overview of the activities performed over the current reporting period and the work planned for the next period. In addition, summary tables are provided showing the progress of the NACLIM work according to the scenarios and exposure mapping analyses that have been identified together with the end-users.

4.1 WORK DONE IN CURRENT REPORTING PERIOD

The activities performed in the current reporting period (Q4 2014) include:

- **VITO**:
  - Presentation of the work performed so far in the project during the NACLIM annual meeting in Berlin.
  - Discussion with the users during the 4th end-users meeting in Berlin.
  - Meeting with GIM to discuss the upcoming work in our final year of the project.
  - Start rerunning the simulations for Almada based on the new UrbClim input layers, delivered by GIM.
- **GIM**:
  - Update of the **UrbClim input layers** for Almada based on the feedback received during the 4th end-users meeting. The work includes (1) the integration of the updated vegetation based land use maps; (2) the integration of the urban green / city parks layer and (3) the extension of the model grid to include entire Almada administrative area. The results have been delivered by GIM to VITO.
  - Review of socio-economic data, urban planning projects and population predictions for the near future provided by the end-users and how to integrate these data in the outstanding scenarios and exposure mapping processes.
  - Setup of a methodology for the urban planning scenarios and the extraction of **UrbClim input layers** for Berlin integrating the urban planning scenarios for 2030. The results have been delivered by GIM to VITO.
  - Setup and run algorithms for the calculation of the **heat stress related variables and statistics** over a user-specified period and for each selected city. First results have been generated over a 20-year time period (1986-2005) and for all three cities, as presented during the 4th end-users meeting.
  - Preparation of a template / layout for presenting the exposure mapping results to the end-users.

4.2 WORK PLANNED FOR NEXT REPORTING PERIOD

The work planned for the next reporting period (Q1 2015) includes:

- **VITO**:
  - Finalise the Almada base simulations.
  - Start running the urban planning scenarios with the UrbClim input data delivered by GIM.
  - Discussing and starting mitigation measures simulations for all three cities.
- **GIM**:
  - Finalise the UrbClim input layers production for the following scenarios: (1) Antwerp – urban densification project – near future; (2) Almada – realisation urban plans – near future.
  - Finalise the template for exposure maps in collaboration with the end-users.
  - Production of exposure mapping results (UHI effect, average number of heat wave days per year) for all cities and for the present situation and validation in collaboration with the end-users.

4.3 SUMMARY OVERVIEW STATUS

4.3.1 Scenarios

A summary overview on the status and planning of work (short and long term) for each considered scenario and end-user city is given in the table below. For more detail on each specific scenario, refer to the previous chapter.

THEME	ID	SCENARIO	TIME SCALE			URBAN MORPHOLOGY PARAMETERS	URBAN MORPHOLOGY PARAMETERS PROCESSING STATUS			URBCLIM SIMULATIONS PROCESSING STATUS		
			PAST - PRESENT (1986-2005)	NEAR FUTURE (2026-2045)	FAR FUTURE (2081-2100)	SOURCE DATA	BERLIN	ANTWERP	ALMADA	BERLIN	ANTWERP	ALMADA
BASE & CLIMATE VARIABILITY	S01	UHI - present situation (EEA data)	X			EEA	DONE	DONE	DONE	DONE	DONE	DONE
	S02	UHI - present situation (end-users data)	X			USERS	DONE	DONE	DONE	DONE	DONE	Q1 2015
	S03	UHI - near future incl. climate variability (no changes)		X		USERS	DONE	DONE	DONE	DONE	DONE	Q1 2015
	S04	UHI - far future incl. climate variability (no changes)			X	USERS	DONE	DONE	DONE	DONE	DONE	Q1 2015
MORPHOLOGY CHANGES	S05	Realised projects - no urban expansion		X		USERS	DONE	Q1 2015	Q1 2015	Q1 2015	Q2 2015	Q2 2015
	S06	Realised projects - urban expansion		X		USERS						
MITIGATION MEASURES	S07	Increase green roofs (no changes)	X			USERS	DONE	DONE	DONE	Q1 2015	Q1 2015	Q1 2015
	S08	Increase albedo buildings (no changes)	X			USERS	DONE	DONE	DONE	Q1 2015	Q1 2015	Q1 2015
USER-SPECIFIC SCENARIOS	S09	UHI - Almada without presence of Lisbon	X			USERS						

Table 3 – NACLIM status and planning of work (version Q4 2014)

4.3.2 Exposure mapping

A summary overview on the status and planning of work (short and long term) for the considered exposure mapping is given in the table below.

THEME	ID	EXPOSURE MAP Key variables: UHI effect, # heatwave days / year Optional: average heatwave duration / intensity	TIME SCALE			S02			S03			S05		
			PAST - PRESENT (1986-2005)	NEAR FUTURE (2026-2045)	FAR FUTURE (2081-2100)	Berlin	Antwerp	Almada	Berlin	Antwerp	Almada	Berlin	Antwerp	Almada
Population	E01	Vulnerable population - today (total)	X			Q1 2015	Q1 2015	Q1 2015						
	E02	Vulnerable population - near future (total)		X					Q2 2015	Q3 2015	Q3 2015	Q1 2015	Q2 2015	Q2 2015
	E03	Vulnerable population - today (age class)	X			Q1 2015	Q1 2015	Q1 2015						
	E04	Vulnerable population - near future (age class)		X					Q2 2015	Q3 2015	Q3 2015	Q1 2015	Q2 2015	Q2 2015
	E05	Vulnerable population - today (marital status)	X											
	E06	Vulnerable population - near future (marital status)		X										
Vulnerable institutions	E07	Vulnerable population - today (schools)	X			Q1 2015	Q1 2015	Q1 2015						
	E08	Vulnerable population - near future (schools)		X										
	E09	Vulnerable population - today (childcare)	X			Q1 2015	Q1 2015	Q1 2015						
	E10	Vulnerable population - near future (childcare)		X										
	E11	Vulnerable population - today (hospitals)	X			Q1 2015	Q1 2015	Q1 2015						
	E12	Vulnerable population - near future (hospitals)		X										
	E13	Vulnerable population - today (rest homes)	X			Q1 2015	Q1 2015	Q1 2015						
	E14	Vulnerable population - near future (rest homes)		X										

Table 4 – NACLIM status exposure mapping (version Q4 2014)