

ADRIADAPT

Expert Meeting on Strategic Outputs of the WP4 & WP5 Split, 12-13 June 2019 Minutes

Deliverable 4.1.2

Work Package 4
Activity 4.1

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Document History

Name (Institution)	Date	Version
Margaretha Breil (CMCC)	18/06/2019	Draft 0.1.
Daria Povh (PAP/RAC)	21/06/2019	Draft 1.1
Lidija Srnec (DHMZ)	1/7/2019	Draft 1.2
Enrico Scoccimarro (CMCC)	2/7/2019	Draft 1.3
Daria Povh (PAP/RAC)	10/07/2019	Final

1 Background information

Adriadapt – a resilience information platform for Adriatic cities and towns, is a collective effort of 6 Italian and 5 Croatian partners aiming to promote local and regional resilience by developing the knowledge base required to identify suitable climate adaptation and planning options, thereby enabling local authorities to respond to policy needs related to climate action in urban and coastal zones of the project area.

The Project is structured in 5 working packages (WPs), where within WP4 and WP5 strategic guidelines for local and regional authorities are to be developed. These publications will also serve as the backbone of the future knowledge platform. This expert meeting was organized in order to harmonize the approaches and secure efficient collaboration of the partners responsible for WP4 and WP5.

The meeting was attended by the representatives of the partners responsible for all WPs, besides WP 3, but with the representatives of the WP 3 a Skype session was organized. In order to secure synergies and to multiply the project outcomes representatives of similar projects and of potential users were invited to a special session on training and dissemination. The complete list of participants is given in Annex I, the Agenda in Annex II and a group photo is given in Annex III.

1.1 Introduction Session

After the welcome address by Mr. Marko Prem on behalf of the PAP/RAC, Ms Daria Povh Škugor shortly presented the meeting objectives, as follows:

- Secure common understanding of the key terms;
- Harmonize the approaches;
- Co-ordinate key strategic publications for the WP4 and WP5;
- Create synergies: knowledge platform; training, dissemination; and
- Create enabling conditions for follow-up projects.

She presented the agenda, which was adopted with no changes. Ms Margaretha Breil, CMCC, reminded the participants of the project goals and actions envisaged, and then went through the identified partners' needs and expectations from this project. Ms Povh Škugor pointed out the need to secure common understanding of key terms. She proposed to use the IPCC glossary for this purpose. She presented the steps towards success as PAP/RAC sees them. In order to harmonize the approaches, she went through the key articles of the ICZM Protocol relevant for this project (articles 2, 5, 6, 8, 18 and 20). She also pointed out the intended use of the

publication “Guidelines for Adapting to Climate Variability and Change along the Mediterranean Coast” which is under update and adaptation to Italian and Croatian realities. Finally, she presented the first insights into the questionnaire for cities, municipalities and regions, which was filled-in by 17 Croatian stakeholders. The first answers provided indications on the noted impacts of climate change, on the progress in responding to these impacts, as well as on the needs for assistance in terms of guidelines, tools, processes and methodologies.

1.2 Session 1: Strategic guidelines for Adriatic cities

In the first session Mr. Philippo Magni of IUAV presented the planning process and several different methodologies applied by IUAV. He started by presenting the IUAV methodology, pointing out the critical issues in the planning process and the main obstacles to action. He presented the “Resilient Padua”, a shared project of the Planning Climate Change Lab group and the town of Padua providing guidelines aimed at building a climate change adaptation plan. Within the Interreg project Co-evolve, to which both IUAV and PAP/RAC are partners, Guidelines for strategic coastal planning, tourism-driven, compliant with the existing MED visions, ICZM and sustainable tourism goals and main objectives were developed using step-by-step methodology. He presented the methodology and concluded with the parallel presentation of all 3 methodologies to be merged for the Strategic Guidelines for Adriatic cities.

TO DOs:

IUAV: integrate the best qualities of all the methodologies presented to the draft publication to be provided by PAP/RAC

1.3 Session 2: Guidelines for building resilience along Adriatic coast

Ms Povh Škugor introduced this future output by presenting the “Recommendations for building resilience” that were prepared in the framework of the development of the Coastal Plan for the Šibenik-Knin County, Croatia (ŠKC). In order to understand the circumstances of this publication she described the County’s coast and its challenges, and explained the publication aims and contents. These “Recommendations” will represent the starting point for the guidelines to be produced by the ADRIADAPT project, and will be complemented with the information provided in the knowledge base. The initial version encompassed the key challenges for the ŠKC coast, sustainable spatial development and challenges for the narrow coastal belt. The main issues for updating consider the different geographical scale including

different coastal realities of Italy and Croatia, as well as additional topics, such as, for example, social dimensions of resilience.

Mr. Gojko Berlenji, one of the authors of this document, presented the chapter on sustainable spatial development of the Šibenik-Knin coast, which is, for the most part, valid for the entire Croatian coast. Setting coastal adaptation goals into relation with overarching values can provide a useful framework of values to guide planning. The guidelines for coastal resilience building provide a good overview of key issues related to: coastal setback; rational use of coastal land; preservation of the integrated landscape values of the coastal area and the improvement of the built environment.

The topic of shore protection was presented by Mr. Enzo Pranzini. He introduced the topic and provided an overview of Italian experiences particularly regarding beach erosion, where he illustrated many errors. One fundamental conflict between inland and coastal water policies has been identified in the sediment budget, as inland measures against land-slides and water retention measures reduce sediment availability and consequently increase erosion tendencies on the coast. On the coast, most erosion-mitigating measures have draw-backs: displacing erosion to other spots, increasing risk for tourism/bathing activities (rip current), quantification of sand need related to SLR was made (10 cm of SLR 100 m³). Finally, profound uncertainty related to the sea-level rise will make coastal adaptation very difficult. He concluded by presenting physical, technical, economic, social and political aspects of coastal adaptation, as well as an alternative view of the future beach for consideration.

TO DOs:

CMCC: Check terminology of IPCC and of CoM for differences in definition of key terms; in this context the adaptation of natural systems, which is based on natural processes, should be distinguished from planned adaptation for human or socio-ecologic systems.

PAP/RAC: Propose the contents of these guidelines

IUAV: Comment on the proposed contents of the guidelines. Complement publication in order to include Italian realities to the existing chapters, and secure coverage of themes in the fields of IUAV competences.

1.4 Session 3: Special session on training and communication

This session was organized with the particular aim to create synergies and under the motto “The whole is greater than the sum of its parts”. The topics discussed were training,

dissemination, visibility and the opportunities for contributing to the knowledge platform. The fact of recent launching of several projects dealing with the adaptation in Croatia was recognized as a favourable circumstance where collaboration may contribute to improve all of the results. Therefore, the following projects and institutions involved were invited:

- University of Split, Faculty of Civil Engineering, Architecture and Geodesy, Department of Urbanism: MEMUD project
- EIB/HBOR project
- RERA: CHANGE WE CARE project
- Public company "Parks and Horticulture"
- University of Split, Department of Marine Studies

As regards the training opportunities Ms Breil and Mr. Magni presented the training held in Cervia, Italy, which will be re-tailored and repeated in Udine, Italy. Ms Ivana Rogulj of DOOR presented the dissemination plans and the short videos to be filmed.

As regards Croatia, after the discussion with the local partners, it was agreed that a smaller event, focused on the exact project task will be organized for the Šibenik-Knin County and for the town of Vodice in October 2019, while a bigger event will be planned for early next year to showcase and provide moral support for local action. This event, which could be organized with the “TED kind of interventions” could also be used for filming short contributions to be inserted into the knowledge platform.

The project “CHANGE WE CARE” of the Regional Development Agency of the Split-Dalmatia County (RERA) announced the conference to be held later this year in Split where work on pilot sites will be announced, and which may be used as a dissemination opportunity.

As for the “MEMUD” project, a new curriculum for the students of urban design, developed jointly by the Universities of Split, Ljubljana and Wien in such a way as to respond to climate change and other key challenges, is about to be completed. Their participation in the larger event could be related to the announcement of this new curriculum. In addition, Ms Ana Grgić offered their support for the production of short films.

EIB/HBOR project, recently launched in Croatia, participated in the design of the questionnaires by providing comments. PAP/RAC will provide relevant information obtained from the questionnaire that may enhance the realization of the NBS in Croatia. During the Skype session organized in a week prior to the expert meeting between Ms Stefanie Lindenberg, Coordinator of the Natural Capital Facility of the EIB and Ms Povh Škugor, Ms Lindenberg informed that NCF may co-fund events that they find useful for their activities in the countries. If the larger event

would like to use opportunity of such co-funding it should be reported to NCF prior to October 2019, when decision on financing is to be taken for the events in 2020. Due to the nature of the NCF projects, a focus on nature based solutions and green infrastructure would be needed.

As regards the venue for the larger event, some participants from Split stated their interest. Due to the fact that more potential beneficiaries could benefit from such an event in Split, decision is to be taken between Vodice and Split.

TO DOs:

Šibenik – Knin County, Vodice and PAP/RAC: Define project task in more detail and provide specification on the needs for training to be organized in October 2019, as well as the training needs for a larger event in spring 2020.

IUAV: Prepare tailor-made training for a smaller project group in October 2019. Design larger training for spring 2020.

PAP/RAC: Maintain communication among the projects in order to secure synergies and collaboration

1.5 Session 4: Guidelines for mainstreaming adaptation into coastal management:

This document builds on the previously published PAP/RAC document “Guidelines for Adapting to Climate Variability and Change along the Mediterranean Coast”. Unlike the Recommendations which were drafted for a rather small coastal region, the Guidelines were prepared for the entire Mediterranean. While the Recommendations focus on topics, this document takes the reader through a step-by-step process of preparing a plan. In that regard, it is very similar to what IUAV presented and envisaged for the Strategic Guidelines for Adriatic Cities. In the first stage entitled “Establishment” the publication presents the legal and policy framework for adaptation along the coastal zones. In the second stage of analysis it introduces the climate challenges and future projections, including impacts on sectors. The publication leads the reader through setting the vision stage, designing the future and realizing the vision. These Guidelines will represent the backbone for the knowledge management platform to be produced for the Adriadapt project and will be complemented with the information provided in the knowledge base. PAP/RAC and the expert engaged, Mr. Emiliano Ramieri, will try to merge the Climate Adapt Adaptation Support Tool and the ICZM Process. The draft publication will be sent to IUAV who will merge their methodology, as well as the other insights, as for

example those from the Co-evolve project. It was concluded that, since the processes presented by IUAV and by PAP/RAC are rather similar, there was no point producing 2 process-kind of guidelines. In addition, PAP/RAC will provide one more input for the process guidelines, prepared jointly with UNESCO-IHP and the GWP-Med entitled “Integrated management framework for management of coastal areas, river basins and aquifers”, which was also presented online at the Coastal Wiki. The two publications aiming to lead the user step-by-step through the adaptation planning process will be merged. Finally, the observation from the first 17 questionnaires filled-in in Croatia stating that stakeholders are less interested in the process, and more in the topics themselves added to the decision to focus on both approaches equally.

Finally, Mr. Berlengi provided an update related to the Croatian Government’s intentions related to adaptation. Namely, the Croatian Government is drafting a new law in which measures for adaptation to climate change will be envisaged. This law, which is currently circulating in the Ministry, will specify the obligation for adaptation plans to be prepared. It was decided that these developments should be taken into consideration, so that the delivery date for the final version of this publication, which will take into account the implications of this law for Croatian local authorities, will be postponed.

TO DOs:

PAP/RAC: Finalize the draft publication by the end of June and send it to IUAV for integration. Get informed about the plans of the Ministry of Environment regarding the adaptation plans and the supporting guidelines. Postpone the delivery date of this publication in order to integrate the Croatian legal approach.

IUAV: Comment on the draft guidelines adding the IUAV approach.

CMCC: Define glossary. Provide comments on the draft publication.

IUAV: Finalize the publication

1.6 Session 5: Integrating WP3 inputs: Skype session with Mr. E. Scoccimarro (CMCC) and Ms L. Srnec (DHMZ)

Mr. Enrico Scoccimarro (CMCC) explained the procedure for generation of climate projection data in support of local stakeholders.

How are ADRIADAPT climate data produced?

The data provided are generated, as described in the Adriadapt deliverable 3.1, in two different ways: first, the Regional Climate Model results at about 10 km resolution are collected in a multi-model and multi-scenario framework, then, in order to increase the horizontal resolution at a higher level of detail, suitable for urban and local needs, statistical downscaling is applied over certain sub-domains. Although already presenting a higher spatial detail with respect to the global climate models they are derived from, the Regional Climate models still have a relatively high spatial resolution (10 km). To make the analyses complementary, statistical downscaling approaches will be used to increase the spatial detail. These methods use the climate observation data from the past obtained from local climate stations in the project area for adapting the large-scale information to the very specific local climate conditions. The observational data needed for this statistical downscaling of climate data are already available for the Emilia Romagna Region, while suitable data for Friuli (UDINE) and the area of the Šibenik-Knin County and Vodice are currently being prepared by ARPAE and DHMZ.

Which data will be available?

Regional climate data for climate data projections will be produced for two different future climate scenarios: one is based on the “RCP 8.5 “ scenario which simulates a sort of worst-case scenario with a very high concentration of greenhouse gases in the atmosphere, and the “RCP 4.5” which is often described as a “business-as-usual scenario”¹. Data resulting from the scenarios are produced for long-time series, from now until the end of the century.

The daily data on temperature, rainfall, relative humidity and wind need to be aggregated into indicators in order to be meaningful for local decision making. In this context of adaptation, the frequency and intensity of extreme events rather than slow changes of mean conditions are of particular interest, both with respect to high and low temperatures and to rainfall extremes. With respect to rainfall two dimensions will be of particular interest: how often will longer periods of prolonged low rainfall occur, and how often will intense rainfall events occur, including which quantities of rainfall can be expected under such events. With regard to heat waves, different parameters are relevant, including average daily temperatures, but also maximum day and night temperatures and the relative humidity which contributes to negative health impacts during heat waves. These parameters will be filtered from the scenario data

¹ RCPs or Representative Concentration Pathways are used in the climate impact assessment for estimating different development scenarios and the consequent emissions resulting, *inter alia*, from demographic and technological development and energy efficiency. In particular the RCP 8.5 scenario does not assume specific mitigation targets to be achieved and assumes the greenhouse gas emissions and concentrations to increase considerably over time, resulting in a leading to a radiative forcing of 8.5 W/m² at the end of the century. The dimension of “radiative forcing” describes how much energy (sunlight) is reflected back to space rather than being absorbed on the surface of the Earth.

using statistical measures for the identification of heat extremes: for instance, identifying from 30 years of data, the 99 percentiles, which corresponds to the hottest 1% of days. In the same way the intense heat (assumed to be the 95percentile) and on the other side of the extremes, the lowest temperatures (1 and 5 percentiles) can be used to represent relevant parameters for future climate conditions.

For the Adriadapt local partners, climate data will be reassumed describing the situation as it may unfold under the two selected scenarios (the medium range RCP 4.5, and the extreme RCP 8.5 scenarios) for the time slices 2021-2040, 2041-2060, 2061-2080, 2081-2100 for a list of climate indicators which is presented in deliverable 3.1 and in Annex 4 to this document. The scenario data will be compared to the present situation represented by climate data from the period 1986 – 2005.

1.7 Wrap up and conclusion

1.7.1. Strategic outputs of the WP 4 and WP5

Strategic outputs will consist of the following 2 publications:

1. Strategic Guidelines for Adriatic Cities
2. Guidance for building resilience along Adriatic coast

Both publications will be developed by PAP/RAC and IUAV in collaboration, and with CMCC support. The following steps to develop the publication 1 will be performed in the coming months:

- PAP/RAC will deliver the draft input for the first publication by the end of June 2019;
- IUAV will integrate their approach, using comments and track changes
- CMCC will provide comments
- PAP/RAC will report on the inputs from the new Croatian legislation and from the follow-up documents
- IUAV will proceed with finalizing the publication

The steps to develop the publication 2 will be the following:

- PAP/RAC will propose the contents of this publication
- IUAV and CMCC will provide comments on the contents
- All partners will contribute to the development of the contents in the domains of their competence

1.7.2. Training, communication, dissemination

- Šibenik – Knin County and Vodice, assisted by PAP/RAC, will define their project tasks in more detail and provide specification on training needs to be organized in October 2019, as well as the training needs for a larger event in spring 2020.
- IUAV will prepare tailor-made training for a smaller group for October 2019.
- Design for the larger training in spring 2020 will take into account local pilot needs, needs for the development of a short video and films for the knowledge platform, as well as opportunities to involve more beneficiaries.

Annex 1: Participants list

ADRIADAPT expert meeting on strategic outputs of the WP4 and WP5

PAP/RAC premises, Split, Croatia, 12 June 2019

NAME	SURNAME	AFFILIATION	NOTE	SIGNATURE
1	Margaretha Breil	CMCC		
2	Ivana Rogulj	DOOR		
3	Filippo Magni	IUAV		
4	Francesco Musco	IUAV		
5	Daria Povh Skugor	PAP/RAC		
6	Ivan Sekovski	PAP/RAC		
7	Golko Berlengi	Invited expert - HBOR/EIB project		
8	Enzo Pranzini	Invited expert - University of Florence		
9	Emiliano Ramieri	Invited expert - ETC CCA		
10	Martina Deur	Šibenik-Knin County		
11	Damir Lučev	Šibenik-Knin County		
12	Sanja Slavica Matešić	Šibenik-Knin County		

ADRIADAPT expert meeting on strategic outputs of the WP4 and WP5

PAP/RAC premises, Split, Croatia, 12 June 2019

NAME	SURNAME	AFFILIATION	NOTE	SIGNATURE
13 Damir	Slamić	Šibenik-Knin County		
14 Marko	Lugović	city of Vodic municipality		
15 Vedran	Petrov	Invited expert		
16 Ivo	Andrić	Invited expert - FGAG Split		
17 Hrvoje	Bartulović	Invited expert - FGAG Split		
18 Martina	Baučić	Invited expert - FGAG, Split		
19 Ana	Grgić	Invited expert - FGAG, Split		
20 Maja	Krželj	Invited expert - Department of marine studies, University of Split		
21 Igor	Belamaric	Invited expert - Public company "Parks and horticulture", Split		
22 Jasna	Talić	Invited expert - Public company "Parks and horticulture", Split		
23 Ivan	Samardija	Invited expert - RERA, Split-Dalmatia County		

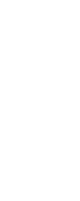
ADRIADAPT expert meeting on strategic outputs of the WP4 and WP5

PAP/RAC premises, Split, Croatia, 12 June 2019

	NAME	SURNAME	AFFILIATION	NOTE	SIGNATURE
24.	MARCO	PESM	FAP/RAC		
25.	BENVINO	DMETKOVIC	FAP/RAC SPLIT		

ADRIADAPT expert meeting on strategic outputs of the WP4 and WP5

PAP/RAC premises, Split, Croatia, 13 June 2019

NAME	SURNAME	AFFILIATION	NOTE	SIGNATURE
1 Margaretha	Breil	CMCC		
2 Ivana	Rogulj	DOOR		
3 Filippo	Magni	IUAV		
4 Francesco	Musco	IUAV		
5 Daria	Povh Skugor	PAP/RAC		
6 Ivan	Sekovski	PAP/RAC		
7 Golko	Berlenji	Invited expert - HBOR/EIB project		
8 Enzo	Pranzini	Invited expert - University of Firezne		
9 Emiliano	Ramieri	Invited expert - ETC CCA		
10 VEDRAN	PETROV	Invited expert		

Annex 2: Agenda

Adriadapt Expert Meeting on Strategic Outputs of the WP4 & WP5

Agenda

PAP/RAC, Split
June 12-13, 2019

DAY 1 - Wednesday, June 12, 2019

08:30-09:00 Registration

09:00-10:00 Welcome address

Marko Prem, PAP/RAC Deputy Director

Introduction to the meeting: How to make the most out of Adriadapt project:

Introducing strategic outputs and the first results of the questionnaire

Margaretha Breil, CMCC

Daria Povh Škugor, PAP/RAC

Discussion

10:00-11:00 Strategic guidelines for Adriatic cities (IUAV)

Filippo Magni, IUAV

Discussion

11:00-11:20 Coffee break

11:20-13:00 Guidelines for building resilience along Adriatic coast

Introduction, *Daria Povh Škugor*

Spatial development sustainability and coastal resilience, *Gojko Berlengi*

Protection of the coastal strip against action of sea and water -

Key issues for resilience of the Italian coast: many needs, few experiences

Enzo Pranzini

Discussion

13:00-14:00 Networking lunch & coffee

- 14:00-16:30 Special session on training and dissemination - Integrating WP 2 inputs**
CMCC, IUAV, DOOR, PAP/RAC, ŠKŽ, Vodice, University of Split, Faculty of Civil Engineering, Architecture and Geodesy, Department of Urbanism (MEMUD project), EIB/HBOR project, RERA (CHANGE WE CARE project)
Introduction, *Daria Povh Škugor, Margaretha Breil*
Training and dissemination plans, *Ivana Rogulj, DOOR*
Feedback from the first training session - outlook on contents to be produced to respond to user needs, *Filippo Magni, IUAV; Margaretha Breil, CMCC; Sanja Slavica Matešić ŠKŽ; Marko Lugović, Vodice*
Possibilities for building synergies - Options for training workshops and dissemination in Croatia, *Ana Grgić, Hrvoje Bartulović, MEMUD project; Gojko Berlengi, HBOR/EIB project; Ivan Samarđija, CHANGE WE CARE project; Jasna Talić, Igor Belamarić Public company "Parks and horticulture"*
Integrating guidelines, training and knowledge platform
Wrapping up: plans for training workshops and dissemination in the upcoming 6 months

DAY 2 – Thursday, June 13, 2019

- 09:00-10:30 Guidelines for mainstreaming adaptation into coastal management (PAP/RAC)**
Ivan Sekovski, PAP/RAC Programme Officer
Emiliano Ramieri, PAP/RAC Consultant
Discussion
- 10:30-11:00 Coffee break**
- 11:00-12:00 Integrating WP 3 inputs:**
Skype sessions with Enrico Scoccimarro (CMCC) and Lidija Srnc (DHMZ)
Moderating: *Margaretha Breil*
Discussion
- 13:00 Wrapping up and closure of the meeting**

Annex 3 Group picture



Annex 4 ADRIADAPT climate indicators characterizing extreme events

Field		Field Description	unit
1	Extreme Precipitation	99 percentile of precipitation: rare events	[Kgm ⁻² s ⁻¹]
2	Intense Precipitation	95 percentile of precipitation: moderately rare events	[Kgm ⁻² s ⁻¹]
3	R95N	number of days with daily precip. exceeding the long term 95 th percentile	[d]
4	R10mm - Heavy precip. index	Number of days with precip. higher than 10mm	[d]
5	RL5N	number of days with daily precip. below the 5 th long term percentile	[d]
6	CDD	Consecutive dry days, where dry is defined when precipitation is lower than 1 mm/d	[d]
7	Extr. High Temperature	99 percentile of temperature: rare events of high temperature	[°C]
8	Extr. High Max Temperature	99 percentile of max daily temperature: moderately rare events of high temperature	[°C]
9	Extr. Low Temperature	1 percentile of temperature: rare event of low temperature	[°C]
10	Extr. Low min Temperature	1 percentile of min daily temperature: rare event of minimum daily temperature (representative of min night values)	[°C]
11	High Temperature	95 percentile of temperature: moderately rare events of high temperature	[°C]
12	High Max Temperature	95 percentile of max daily temperature: moderately rare events of maximum daily temperature (representative of max diurnal values)	[°C]
13	Low Temperature	5 percentile of temperature: moderately rare events of low daily temperature	[°C]
14	Low min Temperature	5 percentile of min daily temperature: moderately rare events of minimum daily temperature	[°C]

15	CFD	Consecutive frost days: number of days below the freezing point (0°C)	[d]
16	Tropical nights index	N.of days with temperature newer below 20°C	[d]
17	HWDI	heat wave duration: number of days where, in intervals of at least 6 consecutive days, daily temp is higher than averaged daily temp + 5 °C	[d]
18	HWFI	warm spell days index: number of days where, in intervals of at least 6 consecutive days, daily temp is higher than 90 th perc of temp in the period.	[d]
19	HUMIDEX	Perceived temperature based on temperature and relative humidity.	[]
20	Extreme HUMIDEX	99 percentile of Perceived Temperature: rare events	[]
21	Extreme Wind	99 percentile of daily wind: rare events	[m/s]
22	Extreme Max Wind	99 percentile of daily max wind: rare events	[m/s]
23	HDG	Heating degree-day (indicator for heating energy demand): It is the number of degrees that a day's average temperature is below 18° C, which is the temperature below which buildings need to be heated.	(°C)
24	CDG	Cooling degree-day (indicator for cooling energy demand): It is the number of degrees that a day's average temperature is 18° C, which is the temperature above which buildings need to be cooled.	(°C)