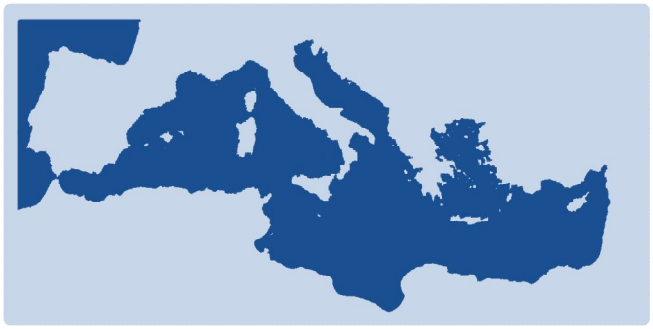
Collaborative Project



CLIM-RUN

Climate Local Information in the Mediterranean region Responding to User Needs

WP 8 – Integrated Case Studies
Task 8.1 - Organization of periodic meetings and surveys

Deliverable Title

Deliverable 8.2 - Workshop report: context and objectives, confrontation of data supply and demand, simulation results, feedback and discussion.

Project No. 265192– CLIM-RUN

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Summary

The overall objective of the Integrated Case Study (WP8) is to analyze the need of climate information and the effectiveness of climate services for the integrated assessment of climate change impacts in coastal zones at the regional to local scale. Two relevant case studies were developed on the western and eastern coast of the North Adriatic Sea: the Italian case study, aimed at the development of climate and risk services for the integrated evaluation of several climate change impacts (e.g. heavy rainfall events, pluvial floods, sea-level rise) in the coastal zone of Veneto and Friuli-Venezia Giulia Regions; the Croatian case study, which includes the whole country and is mainly focused on energy and tourism sectors.
This deliverable presents the results of the second round of workshops organized in the two North Adriatic case studies with local stakeholders. Specifically, Part A describes the objectives and the results of the Italian workshop organized in Trieste by CMCC for the Integrated coastal case study; Part B describes the workshop organized in Zagreb by DHMZ and UNDP Croatia for the energy sector according to the guidelines and purposes of WP5; finally, Part C describes the workshop organized in Zagreb by DHMZ and UNDP Croatia for the tourism sector, in synergy with the activities and guidelines of WP7.
The final conclusions of the research activities of WP8, including the discussion of methods and tools applied for stakeholders engagement and the feedbacks about climate and risk products of the North Adriatic case studies, are presented and discussed in D8.4.

Part A: Italy. Integrated case study

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Introduction

The second one-day workshop organized for the Italian integrated case study, including the coast of Veneto and Friuli Venezia Giulia Regions, was held on 28 May 2013 in Trieste, hosted by ICTP (Figure 1).

Figure 1 Aerial view of the Castello di Miramare, Trieste

According to deliverable 1.1 the second workshop aims at:

- evaluating the relevance of the analysis, simulations and tools produced to address users' needs,
- assessing the usefulness of data produced to improve adaptation decision-making,
- evaluating the quality of the interactions between climate experts and stakeholders,
- analyzing the possibility to expand these interactions to establish more permanent institutional links and procedures towards the development of a MCSN."

Moreover, as decided within WP4, workshop objectives are also to review both the process of interaction between CLIM-RUN scientists and case-study stakeholders, as well as the utility of the products and information developed in CLIM-RUN. The discussion should aim at understanding whether the CLIM-RUN project partners have been successful, how far they are in reaching their goals, and what the remaining problems and/or gaps are. Some suggested questions are:

- Is the information clearly presented – in language that is meaningful and understandable for you?
- Could the presentation/description be improved? If so, how?
- Is the information relevant (and useful and/or usable) for you?
    - If so, how might you use it?
    - If not, why not?

- What additional information would you like?

WP4, accordingly, provided a presentation to be delivered during the workshop to explain:

- The CLIM-RUN process – what has happened since the last workshops (including role of CET/SET in translating user needs – e.g., see Section 7 of D4.2)
- A brief overview of current developments in Climate Services including the Global Framework for Climate Services and the Climate Services Partnership
- Next steps (for the project as a whole)

It was also agreed that each case-study should develop its own specific presentations to include:

- Summary of stakeholder 'requests'
- Summary of what's been done
- What's still to be done or can't be done
- Next steps

The organization of the workshop started with the identification of the stakeholders to be invited: the choice was to invite the same 50 stakeholders who had been selected for the first workshop. To increase the participation from the Friuli Venezia Giulia Region this time the workshop was held in Trieste in facilities made available by ICTP, thanks to the availability of Erika Coppola. Emails were sent to all and follow-up call were made in the case there was no reply. However, stakeholder participation (see Table 1) in total decreased: seven stakeholders came from the Friuli Venezia Giulia Region (five from regional offices, one from the Miramare Marine Protected Area, and one from the Ledra Tagliamento Extension service) an four came from the Veneto Region (three from the Venice Municipality and one from the regional meteorological office).

Table 1 Stakeholders who participated in the workshop
PAES piano d'azione per l'energia sostenibile (action plan for sustainable energy)
The C40 Cities Climate Leadership Group is a network of the world's megacities committed to addressing climate change http://www.c40cities.org/

Veneto	
Regional Met Office	Adriano Barbi
Municipality of Venice: urban sustainability	Sandro Caparelli
Municipality of Venice: PAES and C40	Irene Gobbo
Municipality of Venice: energy agency	Simone Tola
Friuli Venezia Giulia	
Regional geologic service	Antonio Bratus
Regional environmental agency	Giorgio Mattassi
Regional environmental agency	Isabella Scroccaro
Regional environmental agency	Dario Giaiotti
Regional Met Office	Andrea Cicogna
Extension service Ledra Tagliamento	Damiano Furian
Marine protected area of Miramare	Carlo Franzosin

Parallel to this effort, the discussion started among the Stakeholder Expert (Valentina Giannini), the Climate Expert Team (Alessio Bellucci and Erika Coppola) and the Risk Expert Team (Silvia

Torresan and Valentina Gallina) to define the content and methods for the workshop (see section 1 for details).

Finally some discussion was started whether to end the interaction with stakeholders with this workshop, or whether it could be useful to keep the link with stakeholders open. This latter opportunity could be useful to engage those who could not participate in the second workshop, but expressed interest to learn more about what CLIM-RUN has produced, or to have additional feedback on the products which will become available in September, and on the Information Sheets. The feedback from the meeting which took place on 26 September in CMCC's office on the San Giorgio Island in Venice can be found in section 2.

1. CLIM-RUN presentations and stakeholders' feedback

1.1. Introduction

Valentina Giannini, who organized the workshop in coordination with the above listed researchers, opened the workshop giving a presentation that introduced the CLIM-RUN project summarizing objectives and activities carried out to achieve them: the first workshop (September 2011), the questionnaire, the work of the researchers, and the follow-up interactions. Then Valentina defined the objectives of this workshop, presented the agenda (see annex 4.1), and talked about the ongoing CLIM-RUN work (e.g. the web portal and the data portal) including possibilities for further interaction. The presentation ended with some information on what is going on in other research groups with respect to the creation of climate services, e.g. the World Climate Conference-3 Declaration, and the Global Framework for Climate Services.

The word was then given to the stakeholders so that they could present themselves by talking about: (1) the climate data that they use and what they would need, (2) the expectations they have for this workshop, and the motivations that led them to be involved in the CLIM-RUN project.

1) the climate data that they use and what they would need: summary of answers

- climate data, e.g. long term, seasonal, decadal time frames
- impacts of climate variability on meteorological data
- meteorological forecast up to 5 days to model pollutant concentrations
- precipitation and run-off with higher resolution then presented in the introduction (i.e. 15-50 km)
- modelling of the marine environment
- data on hazards and exposures to define risk scenarios and adaptive capacity
- uncertainty ranges of data

2) the expectations they have for this workshop, and the motivations that led them to be involved in the CLIM-RUN project: summary of answers

- model future fish species aggregations that are influenced by a change in salinity
- meteorological forcing to model and manage coastal areas that are investigated within the project SHAPE

- study of the boundary layer evolution to simulate pollution dispersion and to forecasts mesoscale meteo predictions
- learning and training to better communicate climate, and, in particular, climate change to the public
- availability to give data and interest in model outcomes
- improve every-day management (e.g. water budget, water management, ecosystem management)
- identify indicators for monitoring and for risk evaluation, in order to define mitigation potential of technologies
- short-term modelling to understand hydro-geological failure[1]
- long-term modelling to support land-use planning
- knowledge on future scenarios to improve long-term planning for irrigation and renewable energy (turbines and solar) production
- knowledge on future scenarios to design the climate plan, which will guide strategic development

1.2. Climate products

The first of three presentation on the CLIM-RUN products was given by Alessio Bellucci on sea level rise in the North Adriatic basin and uncertainty (using an ensamble of models), and on the predictive skill seasonal forecast of extreme events (precipitation and heat waves).

The second presentation was by Erika Coppola on the analysis of extreme indices derived from simulation of regional model RegCM4, 50 Km resolution for Europe. Data produced includes:

- heat waves (HWD), where heat is higher than 5°C with respect to the average of the maximum daily temperature for five consecutive days
- drought (CDD), maximum number of days in which it did not rain
- extreme precipitation (R95)

After each of the two presentations questions for clarification were asked: the kind of questions asked demonstrates that most of the stakeholders are knowledgeable in climate sciences, and that all have understanding of the information presented. Then a joint discussion followed.

Overall the discussion proved that climate products from CLIM-RUN are useful and meet the needs and expectations of stakeholders, even if higher resolution and/or longer time series were often asked for. If there was information produced with longer time series, in fact, it could be useful to inform land-use planning making it climate proof, and to design civil protection plans. A resolution higher than 12 km would, on the other hand, probably be required to design the climate change adaptation plan for the city of Venice. Looking at an East-West transect, in fact, from the Lido over the lagoon, the city and the mainland, the micro-climatic zones have different precipitation. Possibly this could be overcome by the environmental regional agencies (ARPA) which have some

[1] hydro-geological failure is the translation of “dissesto idrogeologico”, term used to describe the instability of slopes due to ,e.g., deforestation, and the consequent potential risk of floods and landslides caused by extreme precipitation events

downscaling capability. Also to address this need a group in CLIM-RUN has the task to produce this downscaled information, but only for observed data, and therefore the two regional meteorological offices (OSMER and Teolo) have provided observed data, which is necessary for the model calibration. The nesting technique used for meteorological forecasts, which forces the model with observations in a given point, requires a computational capability which is, at the moment, too high.

As a conclusion to this section it is important to note the ongoing effort to create a Northern Italian database with daily validated data since 1960. This could be useful for agriculture, because soils of the region have low water retention capability, and irrigation is needed. It is, therefore, necessary to forecast precipitation regimes of the next 30 years in order to plan irrigation. Moreover, this data could be used to validate the model and to create drought indexes for the future.

1.3.Climate risk assessment

The presentation concerning climate impact and adaptation products for the North Adriatic coastal zone was given by Silvia Torresan and Valentina Gallina in the afternoon session of the Workshop. The presentation pointed out the importance of integrating three research areas in the development of climate impact and adaptation services, namely: 1. participative process, aimed at understanding the needs and requests of the stakeholders; 2. climate information, providing forecasts and projections about future climate change; 3. climate impacts and vulnerability information, integrating climate data and end-users requests in order to evaluate climate-related risks for different natural and human systems. As shown in Figure 2, each gear (i.e. research area) involves different experts (i.e. Stakeholder Experts, Climate Experts and Risk Expert) working in synergy in the CLIM-RUN project. Specifically, Risk Experts are both users and providers of climate products and services.

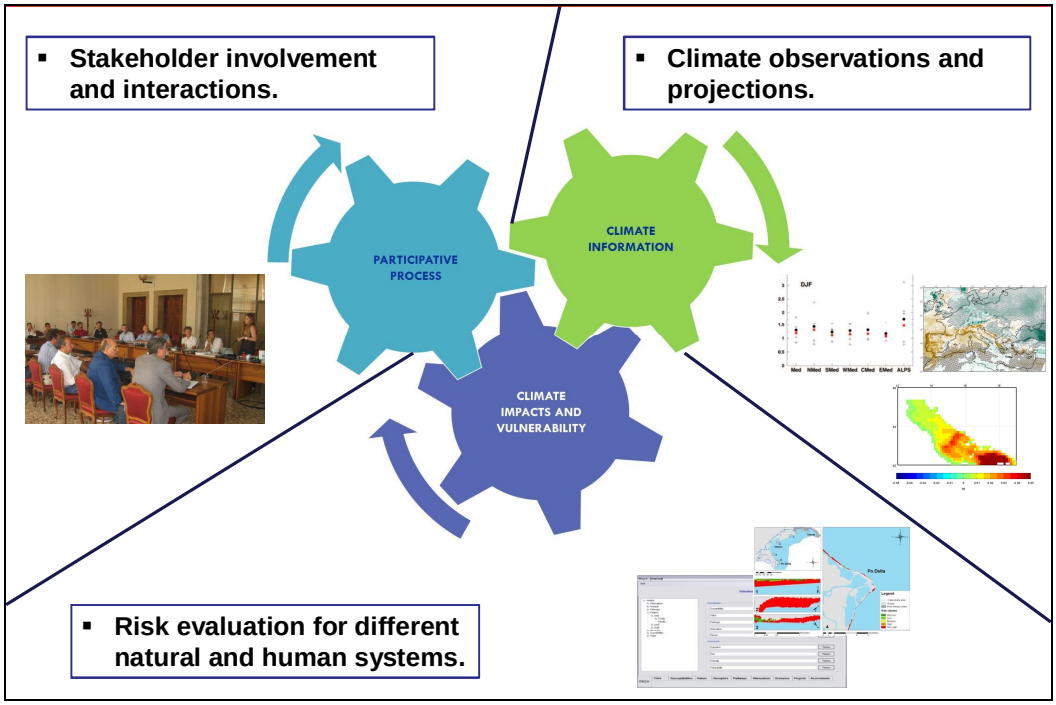

Figure 2. Schematization of the research areas necessary for the development of climate impact and adaptations services.

Then, the presentation was focused on the climate impacts and vulnerability gear and on the description of the Regional Risk Assessment (RRA) methodology applied by the risk experts for the development of climate risk services in the North Adriatic case study. With the aim to rank potential impacts, targets and areas at risk from climate change at the regional scale, the RRA methodology integrates the three main pillars of risk defined by UNISDR (2009) and IPCC (2012) (i.e. hazard, exposure, and vulnerability) and is composed of six main steps: hazard, exposure, vulnerability, risk and damage assessment. Specifically, the RRA requires a preliminary step related to the identification of the problem, the selection of the case study area and the temporal scale to be investigated that can be efficiently performed by integrating stakeholders knowledge and expertise. Moreover, the hazard, exposure and vulnerability assessments need the identification of several input data (i.e. hazard metrics and thresholds, receptors potentially at risk, vulnerability factors, classes and scores) to be considered in the relative risk and damage estimate and the selection of output data (i.e. GIS-based hazard, exposure, vulnerability, risk and damage maps and statistics) that are then used to communicate the potential implications of climate change impacts to stakeholders and decision-makers. These maps can provide suitable information for setting priorities for the definition of adaptation measures, land use planning and integrated coastal zone management. Accordingly, the involvement of stakeholders in the risk assessment process, adopting a bottom-up approach, can be very useful to tailor the definition of input parameters and output maps/indicators according to their perspectives and needs and to produce research products more compliant with their expectations.

After the brief introduction of the RRA approach and of the DEcision support SYstem for COastal climate change impact assessment (DESYCO) adopted by the risk experts for the Italian coast of the North Adriatic Sea, three preliminary climate impact and adaptation products were presented:

1. Sea-level rise inundation risk maps;
2. Pluvial flood inundation risk maps in urban areas;
3. Water stress index for agricultural typologies.

After the presentation of each product, questions for clarification were asked, followed by an interactive and fruitful discussion between CLIM-RUN experts and stakeholders.
Generally speaking, all the stakeholders who came to the workshop showed interest in the proposed methodologies and climate services, and willingness to propose improvements on the presented approaches and products.
The discussion was guided by a questionnaire to collect stakeholders' feedbacks about the presented products and particularly about: testing areas for product's application; input data (i.e. receptors, vulnerability factors, dataset and timescale of the analysis); output data (i.e. typology of risk maps and statistics). Due to time constraints during the event, all the participants agreed to fulfill the questionnaire by e-mail after the workshop; however, only 5 out of 11 definitely fulfilled the questionnaire.

Concerning the first product (i.e. sea-level rise inundation risk maps), stakeholders agreed with the proposed dataset used for the application of the methodology in the North Adriatic coast suggesting more detailed maps for vegetation and subsidence for Friuli Venezia Giulia Region. Moreover, they were involved in the assignation of scores to vulnerability factors representing the socio-economic and environmental value of the receptors potentially exposed to sea level rise inundation (i.e. natural protection, urban typology, agricultural typology, wetland extension, vegetation cover, population density). The stakeholder's judgment was provided assigning scores between 0 (i.e. no value) and 1 (i.e. the higher value) to vulnerability classes in order to represent the relative importance (i.e. the socio-economic or environmental value) of each single class compared to the others. The scores were collected in a table and will be integrated in the RRA methodology by means of Multi-Criteria Decision Analysis for the damage assessment and for the production of GIS-based damage maps and statistics (e.g. surface and percentage of the territory affected by a higher damage).
Moving to the analysis of output data that will be delivered for the sea-level rise impact, 5 stakeholders suggested the visualization of the hazard maps in 3 classes and only 1 stakeholder preferred to use 4 classes. Moreover, in order to define the maximum water level which generate the maximum inundation hazard, the majority of stakeholders (4/5) selected a threshold of 60 cm.
For the pluvial flood inundation risk maps in urban areas risk experts suggested the municipality of Venice as suitable testing area for this impact. The majority of stakeholders (i.e. 4/5) agreed with this choice, while 1 stakeholder was interested to include also urban and extra-urban areas of Udine and Pordenone (Friuli Venezia Giulia provinces) in the assessment. Moving to the exposure and vulnerability assessment, 4 stakeholders considered the proposed receptors and vulnerability factors as appropriate for the analysis and 1 stakeholder suggested a more detailed analysis of the slope influence on inundated areas. Finally, for the hazard assessment, the decade 2041-2050 was

considered as appropriate time scale, however 2 stakeholders suggested a more detailed analysis of the outputs (i.e. monthly, annual or seasonal number of events).
For what concerns the water stress index and maps for agricultural typologies the proposed testing area of the Po delta was considered not suitable for this product by 4 stakeholders as it is an impermeable area not very relevant for this kind of analysis. Accordingly, they suggested to shift to the Upper and Lower Veneto and Friuli Plain - out of the coastal zone - where the soil influences the water retention process. Moreover, 4 stakeholders proposed to consider a more detailed and complex analysis of the crop water balance considering the available water capacity of the soil. The following crop typologies were considered as relevant receptors for the analysis: corn, cereals and soybean in not irrigated land, rice fields, vineyards and olive groves. Moreover, 4 stakeholders preferred to visualize the result in single crop maps, while 1 stakeholder preferred the visualization of a total crop map (i.e. all the crop typologies in the same risk map) with a temporal resolution ranging from the annual to the seasonal and monthly period for the 2041-2050 decade.
The risk experts are analyzing the results of the workshop and integrating as far as possible the information, in the application of the RRA methodology and the development of the final climate risk and adaptation services for the North Adriatic coastal zones. The final products will be presented in the Deliverable 1.3 (Future impacts at the case study level) and commented in D8.4 (Cross-cutting conclusions).

2. Follow-up meeting

The smaller stakeholders focus-group gave the opportunity to test the newly released information sheets and to deepen understanding of what still needed to be done to improve climate and risk products. First of all it is important to stress the positive judgment expressed by stakeholders (see list of participants in Table 2): the climate products presented give information which addresses needs expressed in the iterative process between stakeholders and CLIM-RUN project experts.

Table 2 Focus group participants

Veneto	
Regional office for disaster risk reduction	Daniele Piccolo
Extension service Eastern Veneto	Graziano Paulon
Provincial office for disaster risk reduction	Valentina Bassan
Centre for tide forecast and warning in Venice	Alessandro Tosoni
CLIM-RUN	
CMCC, stakeholder expert	Valentina Giannini
CMCC, climate expert	Silvio Gualdi
ENEA, climate expert	Alessandro dell'Aquila
CMCC, risk expert	Silvia Torresan
CMCC, risk expert	Valentina Gallina

However, some general comments and needs voiced at the beginning of the focus-group in the round of presentations can be useful to further improve and finalize the products. Below is a list of the most pressings needs, which were already brought to our attention before, which were presented at the meeting:

- data to support land-use planning
- data with greater resolution and longer time series
- data on climate impacts and risks
- precipitation patterns to improve irrigation
- sea level to plan ahead both agriculture and Venice defenses
- climate variations and extreme events to design irrigation and drainage canals
- seasonal trend for tidal waves
- hydraulic risk

Three climate and two risk assessment products were presented by the CLIM-RUN experts. Below are the comments relative to each.

CLIMATE PRODUCT: Local climate change projections and associated uncertainty: the North Adriatic case study
CLIMATE PRODUCT: Local climate change projections and associated uncertainty in the presentation of intense events: the north Adriatic case study

- The information provided requires flexible policies and management options to address climate impacts.
- Inter-annual variability must be addressed by designing flexible structures which can adapt on a yearly basis.
- Landscape reacts differently because of intrinsic characteristics, not only because of climate variability.

CLIMATE PRODUCT: Sea level rise

- Discussion was centered on the contribution of the different components to sea level rise (e.g. thermal expansion, glacier melting).
- Minimum sea level rise can be evaluated, total sea level rise is still difficult to assess.
- Adaptation options should be flexible, but address minimum rise.

RISK ASSESSMENT: Sea level rise inundation risk maps

- Uncertainty could be most effectively represented as different scenarios of sea level rise (e.g. 10-20-30 cm).
- Existing sea walls and defenses height still need to be added.
- Information on areas that will be flooded is highly important.

RISK ASSESSMENT: Pluvial flood inundation risk maps in urban areas

- Urban flooding does not depend solely on high precipitations.
- Cities could become resilient using this information for planning.
- Civil protection agencies could identify criticalities, e.g. spots were flooding occurs more frequently.
- Map would be needed at regional scale looking at the different watersheds.
- Frequency of events is very relevant.
- Uncertainty should be represented used precipitation scenario coming from different models.

3. Conclusive comments and next phases

In conclusion we present a table (Table 3) which summarizes highlights of what has emerged in the interaction between CLIM-RUN scientists and workshop participants.

Table 3 Summary of stakeholders' feedback

climate data needed	• longer time series of observations • higher resolution • precipitation and winds • precipitation patterns to improve irrigation • climate data • data on impacts and risks
expectations	• understand climate change • acquire information on climate (variability and change) and disseminate it to public • information to improve management options • information and knowledge for land-use planning, disaster risk reduction and early warning systems
synergies with CLIM-RUN	• regional meteorological services (OSMER and Teolo) have provided observed data • regional agencies can do downscaling • in northern Italy a research project is trying to create a repository of daily data since 1960

This workshop ends the stakeholders' consultation designed to understand stakeholders' needs for the CLIM-RUN project, in order to define appropriate climate services in the field of Integrated Coastal Zone Management. The opinions elicited will inform the protocol on climate services. Moreover, the Risk Assessment Experts are evaluating the feasibility of applying and test all the climate impact and adaptation products in the North Adriatic region.

4. Annexes

4.1. Agenda

time		
10:30	**start**	
10:30	Valentina Giannini CMCC	• presentation of workshop for stakeholder involvement in the CLIM-RUN project • presentation of synthesis of stakeholders' requests from first workshop
11:00	all stakeholders	short introduction: • how do I use climate services? • what are my expectations from this workshop? • what motivated me to be involved?
11:30	Alessio Bellucci CMCC	• sea level rise in the North Adriatic basin • seasonal forecast of extreme events (precipitation and heat waves)
12:00	Erika Coppola ICTP	analysis of extreme indices derived from simulation of regional model RegCM4, 50 km for Europe
12:30	Erika Coppola and Alessio Bellucci	discussion on presentations: • is information provided understandable? • will you be able to use it? • if not: how can it be improved? • is information presented relevant for your activities? • what other information would you need?
13:00	**lunch break**	
14:00	Silvia Torresan and Valentina Gallina CMCC	climate impact and adaptation services in the North Adriatic coast • sea level rise inundation risk maps • pluvial flood inundation risk maps in urban areas • water stress index and maps for agricultural typologies
15:30	Valentina Giannini CMCC	next steps
16:00	**end**	

4.2. DESYCO questionnaire

Trieste, 28th May 2013. Stakeholders questionnaire

Name	Surname	Affiliation

Product 1 Sea-level rise inundation risk maps

INPUT DATA

1.1. Do you think that the proposed dataset for the North Adriatic case study is appropriated (Table 1.1)?

□Yes □No

Dataset	Dominio	Fonte
Digital Elevation Model (DEM) 10 m	FVG	FVG, 2007
Digital Elevation Model (DEM) 5 m	VE	VE, 2007
Subsidence map	VE	Carbognin L., Teatini P., Tosi L., 2005. Land subsidence in the Venetian area: known and recent aspects. Ital J Eng Geol Environ 1:5–11. doi:10.1474/GGA.2005-01.0-01.0001
Hydrological basins 1:25000	VE, FVG	VE, FVG, 2000
Corine Land Cover, 1:100.000	FVG,VE	ISPRA, 2006
Protected areas 1:150.000	VE, FVG	VE, 2008, FVG, 2007
Geological and geomorphologic maps 1:50000	VE, FVG	FVG, VE, Province, Autorità di Bacino
Administrative boundaries	VE	VE, 2005
	FVG	FVG, 2006
Population density	VE, FVG	ISTAT, 2010

Tabella 1.1. Dataset available for the north Adriatic case study FVG = Friuli-Venezia Giulia, VE = Veneto.

If not, which other receptors would you suggest to include?

_____

1.2. Which scores and weights would you assign to the value factors proposed in Table 1.2? Please use the linguistic evaluation guidelines (Table 1.3) to assign weights and scores from 0-1 to each of the proposed value classes.

Weight	Factor	Class	Score
	Protection level	National area	
		Regional area	
		Nature 2000	
	Urban typology	Residential buildings	
		Commercial buildings	
		Infrastructures	
	Urban typology	Permanent	
		Stable meadow-Pastures	
		Arable land	
	Wetlands extension (km2)	0 – 19,9	
		19,9 – 39,8	
		39,8 – 59,8	
		59,8 – 79,7	
		79,7 – 99,6	
	Vegetation cover	Natural grassland and meadow	
		Vegetation with shrubbery	
		Forest	
	Population density (inhabitans/region)	< 100	
		100-300	
		> 300	

Table 1.2. Value factors and classes

Linguistic evaluation	Scores
Most important class	1
Weakly less important class	0.8
Rather less important class	0.6
Strongly less important class	0.4
Demonstratively less important class	0.2
Absolutely less important class	0

Table 1.3 Linguistic evaluations supporting the assignation of relative score to value classes.

OUTPUT DATA

1.3. How many classes should be represented in the hazard map (e.g. 3 high, medium, low hazard)?

_____

1.4. Which threshold better identify the water level that generates the maximum inundation hazard (e.g. 10, 60, 100 cm)?

_____

Product 2 Pluvial flood inundation risk maps in urban areas

INPUT DATA

2.1. Is the proposed area (Province of Venice) appropriate for the study?
□Yes
□No

If not, which areas should be included?

_____
_____

2.2. Are the proposed receptors (Table 2.1) appropriate for the study?

Receptors	Source
Population	ISTAT,2010
Infrastructure	Corine Land Cover, 1:100000, Land use, 1:25000 ISPRA, 2006
Buildings	Corine Land Cover, 1:100000, Land use, 1:25000 ISPRA, 2006

Table 2.1. Receptors considered for the pluvial flood risk assessment.

2.3. If not, which other receptors would you suggest to include?

_____
_____

2.4. Are the proposed vulnerability factors (Table 2.2) appropriate?

Bio physical and environmental vulnerability factors
Slope
Land use
Recently flooded areas

Table 2.2. Bio physical and environmental vulnerability factors considered.

If not, suggest which others factors should be included

_____

_____

OUTPUT DATA:

2.5. Is the proposed time scale (i.e. number of events in the decade 2041-2050) appropriate?
□Yes
□No

2.6. Which should be the most appropriate time scale for the study?
□ Monthly number of events;
□ Annual number of events;
□ Seasonal number of events;
Other:_____

Product 3 Water stress index for crops

INPUT DATA

3.1. Do you think the case study area considered (Po river delta) is appropriate for the study?
□Yes
□No

If not, can you suggest others areas to investigate?

_____

3.2. Which crop typologies (Table 3.1) should be consider as priority for the application of water stress index?

Livello 1	Livello 2	Livello 3	Livello 4	Livello 5
Superfici agricole utlizzabili	2.1. Seminativi	2.1.1. Seminativi in aree non irrigue	2.1.1.1. Colture intensive	2.1.1.1.1 Mais in aree non irrigue 2.1.1.1.2 Soia in aree non irrigue 2.1.1.1.6 Foraggere in aree non irrigue
			2.1.1.2. Colture estensive	2.1.1.2.1 Cereali in aree non irrigue
		2.1.2. Seminativi in aree irrigue	2.1.2.6 Piante oleifere in aree irrigue	2.1.2.1.1 Mais in aree irrigue 2.1.2.1.2 Soia in aree irrigue 2.1.2.1.3 Barbabietola in aree irrigue 2.1.2.1.4 Girasole in aree irrigue 2.1.2.1.6 Foraggere in aree irrigue
			2.1.2.4. Orticole in aree irrigue	2.1.2.4.1 Orticole in pieno campo in aree irrigue 2.1.2.4.2 Orticole in serra o sotto plastica in aree irrigue
		2.1.3. Risaie		
	2.2. Colture permanenti	2.2.1. Vigneti 2.2.2. Frutteti e frutti minori 2.2.3. Oliveti 2.2.4. Arboricoltura da legno	2.2.4.1 Arboricoltura da legno 2.2.4.2 Pioppeti in coltura	

Table 3.1. Corine Land Cover for agricultural areas of the Po river delta

OUTPUT DATA

3.3. Which temporal resolution should be consider for the water stress index scenario for the 2041-2050 period?

□ Annual;
□ Monthly;
□ Seasonal;
□ Other: _____

3.4. Would you prefer the visualisation of the results in a single crop maps or a total crop map (i.e. all the crop typologies in the same risk map)?

_____

Part B: Croatia. Energy case study.

Authors Part B: Robert Pašičko, Zoran Kordić (UNDP), Čedo Branković (DHMZ)
Corresponding author: Čedo Branković (cedo.brankovic@cirus.dhz.hr)

Summary

As the nexus between meteorology and energy gets more attention with the growth of investments in renewable energy, it also instigated an increased interest from potential energy stakeholders to participate in the second CLIM-RUN workshop on renewable energy and to discuss both available climate services and the Product Sheets prepared within the project. The second stakeholder workshop in the energy field was co-organized by DHMZ and UNDP Croatia. Local stakeholders were represented from academic, research, business, consultancy and regulator's organizations and companies (all together 28 participants).

In the last few years, the energy policy in Croatia has changed considerably allowing a stronger development of renewable energy sources. There is already a large share of renewables installed (in wind 320 MW in 2013 compared to 6 MW in 2007), but mostly in hydro power – about 50% of total installed energy capacity in Croatia is in hydro. Most of these hydro plants are located in the Mediterranean basin (southern part of Croatia) where climate change is expected to be the most pronounced.

How important are seasonal, decadal and long term forecasts for electricity generation in hydro power plants was discussed during the panel at the end of the workshop. The panel also highlighted the needs of the stakeholders (mainly the Croatian Power Utility HEP) related to existing hydro-climatic data from Croatian Meteorological and Hydrological Service (DHMZ).

1. The CLIMRUN workshop

The workshop in Zagreb was co-organized by DHMZ and UNDP Croatia. Local stakeholders were represented from academic, research, business, consultancy and regulator's organisations and companies, and with the members of the organizers' personnel, the total number of participants was 28. A list of possible participants was first drawn up and most of invitees eventually participated in the workshop. The full list of the workshop participants is attached in chapter 5 (Resources), and a copy of their signatures is in ANNEX III. The workshop programme is attached to this document as ANNEX II.

The opening remarks were given by Cedo Brankovic (DHMZ), the national coordinator of CLIM-RUN project in Croatia, who presented basic information on workshop goals and on the project. It was followed by two presentations, each focusing on one climate variable – wind and hydro – recognised as important renewable energy sources. Alica Bajic (DHMZ) stated that according to the results from Regional Climate Models, the increase of the mean wind speed in the period 2040-2070 in Croatia in some regions is projected to be significantly higher than today's mean wind speed. According to the well-known rule, the energy yield from a wind generator is directly proportional with the cubic relation of the wind speed. However, a large increase in wind speed will not automatically lead to a possibly high energy generation because it depends on wind distribution. Renata Sokol Jurkovic (DHMZ) focused on the importance of climate information on energy production from hydro power, showing the case from the hydro power plant Senj in Croatia. Robert Pasicko (UNDP) gave presentation on interactions between climate change and energy generation

from renewable energy sources. He concluded that by the mid-century in Croatia a neutral impact of climate variables is expected on the energy generation from photovoltaics (PV), a positive impact on generation (in terms of higher value) from wind parks and a rather negative impact on generation from hydropower because of potentially more frequent periods of droughts.

During the animated panel discussion it was emphasized that due to complexity of interactions between climate and renewable energy sources, it is important to have the communication between climate experts and users open, i.e. to combine both the bottom-up approach with the top-down approach, in order to get a better understanding of respective activities. That was most evident in communication between Croatian Power Utility (HEP) and Croatian Meteorological and Hydrological Service (DHMZ).

2. Main Results

In the discussion that followed the value of climate information in planning electricity generation from hydropower plants was addressed and analysed from various points. The potential areas of interaction between CLIM-RUN and stakeholders in the energy sector in Croatia were discussed as well. The overall conclusion was that more cooperation is needed in this area; end users are not aware of all climate services that can be provided, while experts on climate forecasts and modeling need to listen carefully what are the needs from stakeholders from this sector. Renewable energy sources have specifically great need for strengthened climate information as they completely depend on weather conditions.

Because of complexity and uncertainties of both weather and the Earth climate system, the DHMZ forecasts are mostly based on probabilistic approach. The end users, such as HEP Trade, currently do not appreciate such an approach. They do not consider this as being complete climate (weather) information on which they would build agreements for electricity import. However, since the deterministic approach to weather forecasts is becoming increasingly less in use, they will consider integrating the probabilistic approach into their energy planning whereas DHMZ will provide more tangible information on probabilistic forecasts.

All participants, agreed on huge importance in matching energy planning and climate information. In Croatia, DHMZ is the only authorized organization that provides relevant climate information to potential stakeholders. On the other hand, the HEP Trade is in need of various kinds of climate information so that they can plan their trade contracts.. They also questioned why the DHMZ hydro information is not free of charge as it is the case in some other countries.

Responsibility for taking the risks of wrong forecasts was the other question raised during the panel. DHMZ explained that probabilistic forecast means a span of possibilities and that the end user should eventually decide on how to use it. Of course, DHMZ is willing to provide some guidance, but the final decision should be linked to the cost/loss ratio at stake. Furthermore, HEP Trade indicated their need for climate forecasts, such as changes in the level of precipitation, as the major factor in hydro energy planning.

HEP warned on disadvantages in the legislative regulations that are linked with the use of renewable energy; now the investors in renewables in Croatia are not obliged to pay penalties for their possibly wrong forecasts of energy generation. Therefore HEP considers the investors in renewables as “a nuisance” on the national grid. According to the current limits in distribution grid and difficulties in planning electricity generation, Croatia may not fulfil its commitment under the EU RES Directive to achieve a 20% share of renewables in the gross energy consumption by 2020.

It is concluded that a better information and understanding of climate data would lead to a more efficient planning in the hydro energy generation. Close co-operation of all involved parties in the process is critical in order to have climate data that exactly represents users needs. The CLIM-RUN Workshop was also seen as a good step forward to get energy and climate circles together and this opportunity will be further emphasized.

3. Next steps

Based on the discussion on potential interactions between CLIM-RUN and local stakeholders in the energy sector in Croatia, it has been agreed that:

- A better communication between energy and climate circles, bringing experts and stakeholders together, must be attained in order to understand the stakeholders’ needs and what kind of climate services could be provided;

- HEP Trade should introduce probabilistic approach to their energy planning – especially this is true for hydro power plants;

- HEP Trade will provide necessary data for a better understanding of the correlation between climate information and power generation from a hydro power plant (such as the research underway for the hydro-power plant Senj);

- Further discussion for using meteorological forecasts in wind energy will be continued at a workshop organized by DHMZ on July 9th (within the EU funded project “Innovative support to wind energy management”)

4. Annexes

4.1 Participants of the CLIM-RUN workshop in the Zagreb, 6 June 2013.

Name	Organization	Contact
Andrea Hublin	Ekonerg	Andrea.hublin@ekonerg.hr
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Zoran Kordić	UNDP	Zoran.kordic@undp.org

4.2 ANNEX I. Program for the CLIM-RUN Workshop in Zagreb, June 6th 2013

CLIM-RUN Project (www.climrun.eu)

KLIMATSKE INFORMACIJE I OBNOVLJIVI IZVORI ENERGIJE

Vrijednost modeliranja klimatskih promjena pri planiranju investicija te srednjoročnih prognoza pri optimiranju

Datum i mjesto radionice: 6. LIPANJ 2013., Zagreb, UNDP Hrvatska, Radnička 41/8

Program

Prvi dio	
9:00	Okupljanje sudionika radionice, kava i keksi
9:30	Otvaranje sastanka i pozdravni govor Upoznavanje sudionika Projekt CLIM-RUN i modeliranje klimatskih promjena u Hrvatskoj (Čedo Branković, DHMZ) Procjena utjecaja klimatskih promjena na proizvodnju iz obnovljivih izvora u Hrvatskoj (Robert Pašičko, UNDP) Klima i energija vjetra (Alica Bajić, DHMZ) Korelacija meteoroloških parametara i mjesečne proizvodnje iz HE Senj (Renata Sokol Jurković, DHMZ)
11:00	**Pauza za kavu**
Drugi dio	
11:30	PANEL - Vrijednost klimatskih informacija za planiranje proizvodnje iz hidroelektrana – od mjesečne do sezonske prognoze (Dunja Mazzocco Drvar, DHMZ; Vesna Pavišić Filipić, HEP; Davor Bošnjak, HEP Trgovina; Ivan Rajšl, FER)
13:00	**Domjenak**

4.3 ANNEX II. Signatures of participants from the CLIM-RUN Workshop in Zagreb, June 6th 2013

CLIM-RUN: Radionica o klimi i obnovljivim izvorima energije, Zagreb, 6 lipnja 2013

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(Molim nastavite na sljedećem listu)

CLIM-RUN: Radionica o klimi i obnovljivim izvorima energije, Zagreb, 6 lipnja 2013

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Part C: Croatia. Tourism case study.

Author Part C: Čedo Branković (DHMZ)

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Summary

The second stakeholder workshop for the tourism sector was co-organized by DHMZ and UNDP Croatia. Local stakeholders were represented from government ministries and agencies, academic, research, business and consultancy organizations (all together 22 participants). Based on interviews and replies from the tourism questionnaire an attempt was made to identify the needs of potential stakeholders in the tourism sector. It was decided that the "tourist climate index" (TCI) would be the most relevant and appropriate product appreciated and easily understandable by all stakeholders and individual tourists. The main reason for such a decision was because in Croatia an extension of the peak tourist season to shoulder seasons is the most likely outcome of projected climate change. This change is for tourism purposes best encompassed by a TCI.

1. Stakeholders' needs

1.1 Summary

Most of Croatia's tourism is based on sun and sea - 96% of the tourism trade is generated in the Adriatic counties which have the most favourable climate. The structure of tourist facilities is very uneven: nearly 50% of tourist accommodation capacities are available in private households, 25% in camps and only 13% in hotels (of which 4* and 5* hotels make only 40%). The tourism sector permanently employs about 95,000, which makes 7% of country's total work force. In 2012, the total number of arrivals was 11.5 millions, about one third in private households, and the total spending accumulated to 7.3 billion Euros. Croatia's tourism is characterised by pronounced seasonality – in 2012, 87% of nights was realised in the period June to September.

Summary of stakeholders' needs for climate information is based on replies that were obtained via: a) the questionnaire defined at the project level, adapted and prepared for the tourism sector and b) one-to-one interviews with stakeholders. In total, 27 replies were received and the stakeholders were represented by individuals from a variety of organisations spanning state ministries, tourism organisations (state and private), tourism associations, and representatives of the end users (hotel groups, consultancy companies, national park, local municipality).

A large majority of respondents stated that climate variability and extreme climate conditions affect, to a certain extent, their business activity and planning and indicated that the risks related to climate (and climate change) are important or very important. The replies indicate that for business activities in the tourism sector the most important are the impacts of droughts, water quality, storms, of atmospheric pollution, a potential loss of biodiversity, coastal erosion and sea level rise. Further important factors are extreme climate events, inter-seasonal variability and the change in the length of (holiday) season, i.e. the beginning and the end of season. The future climate change are envisaged to have largest impact on outdoor activities (including camping), investment in energy efficiency and may pose a threat to the natural attractiveness (e.g. within national parks).

For tourism in Croatia, the most important climate parameter is precipitation (about 75% of all responses) followed by temperature, extreme weather events and winds. The time scales for most

climatic parameters vary from days, weeks to seasons. However, so far no organisation has ever requested seasonal (or monthly) forecast from Croatian Meteorological and Hydrological Service (DHMZ). Short-range weather forecasts are most important for planning immediate outdoor activities.

Based on the above answers of potential stakeholders, it is possible to only broadly define stakeholders' needs relative to relevant climate information. For many users, the extension of the peak season to shoulder seasons is the most "appealing" consequence of potential climate change (confirming that climate change should not be always associated with the negative aspects). Therefore, a kind of the tourist climate index (TCI) for both present and future climate seems to be a widely accepted quantity that would appropriately satisfy stakeholders' needs. It could be defined for any location (region) and any time period (week, month or season) for both present climate conditions and the projected future climate. Though it may look complex because it includes various climatic parameters, it can be made in a simple and widely acceptable format. Its main advantage is that it defines the sense of comfort which is close to human instinctive perception of climate since most tourist appreciate local climate through the sense of comfort (pleasure).

Our impression is that the adaptation of business activities to climate change and associated planning in the (Croatia's) tourism sector is not considered as an important or urgent issue, i.e. in most cases the stakeholders will only take note of potential hazards and warnings but would essentially do nothing to counteract them. The very likely reason for such an attitude lies in the fact that, in comparison with some other countries or regions of the world, the adverse signs and effects of climate change in Croatia are not particularly evident and therefore currently do not cause too much concern. Apart from several heat waves, "weakfish" droughts and local or small-scale storms – which may be considered as a part of climate (and weather) natural variability - no major climate-related disasters had hit Croatia in the past few decades.

1.2 Products' development

One product sheet was developed and it was attached to the Workshop invitation (Annex IV). It is related to bioclimatic potential for tourism in the Croatian coastal area. The work was carried out at DHMZ and is mostly based on research in the field of biometeorology by Dr Ksenija Zaninović. The thermal impact on humans is determined by physiologically equivalent temperature (PET) derived from the equation of thermal balance between human body and the environment. The interpretation of PET is relatively straightforward and it can be easily understood by a non-expert. PET was calculated for the period 1961-1990 (reference climate) and for the future periods 2011-2040 and 2041-2070. For future climate the results were extracted from the regional climate model RegCM3 simulations at a 35-km resolution when the model was forced by the ECHAM5-MPIOM GCM under the IPCC A2 scenario. As an example, the product sheet shows PET at five locations along the Adriatic coast for the reference and future climate periods. Thermal perception is stratified from "very cold" across "comfortable" to "very hot". In the future, thermal perception in the northern Adriatic is increased from "slightly warm" to "hot", and in the southern Adriatic the "very hot" would become dominant.

The other product sheet entitled "Climate index for tourism in Croatia" was produced and distributed after the Workshop (see Annex V). However, at the Workshop some of the results on the climate index for tourism (CIT) were presented and subsequently triggered a lively discussion. CIT

can be designed in such a way as to describe the quality of climate conditions for specific outdoor activity (bathing, sailing, cycling, playing golf, etc.). It could be tailored for virtually any location and time of year (month, season). In CIT, the thermal perception of climate is integrated with aesthetic (cloudiness) and physical (wind, rain) characteristics. From a weather typology matrix, which is specific for each activity, a rating classes (ranging from 1 to 7) could be derived and ultimately reduced to only three conditions (optimal, acceptable, unacceptable) that "characterise" local climate for a particular activity.

1.3 The CLIM-RUN workshop, 4 June 2013

The preparations for the Workshop were thorough and many potential participants were contacted well in advance by e-mail and by phone. In these preliminary contacts, special attention was paid to those who already participated in the first workshop (September 2011) and to those who took part in the direct interviews conducted at an earlier stage of the project. Also, preliminary contacts were made with all those who replied to the questionnaire on tourism. Many contacts expressed their readiness to take part in the second workshop and some of them even praised the initiative to organise such a meeting. Such a "targeted" approach to potential stakeholders was partly due to the failure of the first tourism workshop to attract more tourism-relevant participants.

The e-mail invitation was sent in total to more than 80 addresses, of which 31 to those employed in hotel/resort managements, boards and directorates, 21 to county tourism offices (associations) and the rest to those who work for or their work is related to tourism (ministries, institutes, government agencies, consultants, etc.). A reminder was sent out about ten days before and again few days before the workshop.

As before, the workshop was organised by DHMZ and UNDP Croatia and was held at the UNDP premises in Zagreb. It was reasonably well attended - the total number of participants was 22. There were 10 attendants from outside host organisations DHMZ and UNDP who are, at the institutional level, very relevant for Croatia's tourism. Five participants were from the Government ministries, agencies and institutes and five were from one National park, county tourism association, consultants and university community. Some of those who registered or promised to attend have not turned up in the end due to illness and/or some other more urgent commitments. The list of workshop participants is given in Resources, and a scan of their signatures is in ANNEX III. The program of the workshop is attached to this document as ANNEX II.

Čedo Branković (DHMZ) opened the Workshop and greeted all participants. He briefly explained the main ideas and objectives of the CLIM-RUN project. An overview of responses from the questionnaire conducted among Croatia's potential tourism stakeholders was presented. It was concluded that, in spite of a declarative positive attitude towards the project initiative(s), there is a lack of enthusiasm on the part of stakeholders to actively participate in the project. Although the stakeholders emphasised that climate extremes, (inter)seasonal variability and variable length of seasons are very important for the tourism sector, no stakeholder in Croatia ever queried about, for example seasonal forecasts which would potentially be useful for this kind of climatic conditions. The experiences of other project partners (TEC, GREVACHOT, EEWRC) were also presented. The second part of the talk was dedicated to climate change with the emphasis on the Croatian Adriatic.

Zoran Klarić (Institute for tourism) pointed out that some projected climate changes could be beneficial for the tourism sector. In addition to climate change, the potential global financial and

energy crises are the main threats to tourism. It is imperative to carefully observe climate changes and to adjust the country's development strategy accordingly. Tourism in Croatia has better adaptive capabilities to climate change than in many Mediterranean countries. These include relatively high and steep coast, less vulnerable to a potential sea rise, and less build-up regions required for the future tourism infrastructure. The first ever Strategy of Croatia's tourism (until 2020) now has included climate change as one potentially important (external) factor that may influence the future development of the tourism sector. This came as a clear result of activities within the CLIMRUN project as this issue was discussed at the first CLIMRUN workshop with developers of tourism strategy.

Ksenija Zaninović (DHMZ) presented how the tourist climate index (TCI) may be adapted to the needs of tourist and stakeholders alike. In addition, a version of TCI, the so-called climate index for tourism (CIT) can be specifically designed for virtually any kind of outdoor activity at any location or time (period) in the year (see section 2.2 above). This measure of the quality of climate conditions is relatively simple and easy to understand and interpret. A lively discussion followed and all the participants praised this way of how climatic information can be brought close to and be understood by a potential user (either a tourism stakeholder or individual tourist).

Dunja Mazzocco Drvar (DHMZ) discussed what kind of the extended-range forecasts might be useful for the tourism sector. They range from weekly to monthly to seasonal forecasts and are available at DHMZ on the operational basis. Though these forecasts are normally presented in a relatively simple way, i.e. essentially provide deviations from climate averages at long terms, they could be useful for planning various activities at the stakeholder level (not only during the peak season). Some discussion on the quality of the extended-range forecasts was also given.

Irena Peršić Živadinov (The Kvarner region tourism office) presented some results of the research related to energy efficiency of hotels. Her study covered 47 hotels in Croatia and the results are generally appalling. No hotel was using energy from renewable sources and heating in 92% of hotels was oil fired as well as heating of swimming pools (where appropriate). In 53% of hotels cooling was installed, but most surfaces are covered in glass. The water wastage was enormous and only one hotel was recycling the material from guest rooms and common facilities. Hotel managements associate sustainable construction with an increase in initial investment (though savings through the hotel's life cycle could be up to 20%). The data shown and discussed indicate the lack of education (training) of hotel staff and management.

Finally, **Sandra Lisjak** (Horwath HTL) presented a project of development of a winter tourism resort in Serbia where Horwath HTL actively participated. From the climatic point of view, an interesting analysis of terrain elevations and of the orientation of ridges and slopes with the aim to estimate the resort's potential capacity for the total number of skiers was given. Warm and cold zones were estimated from solar impact at 9, 12 and 15 hours local time.

2. Main Results

In the round table discussion a question of better education of the staff working in the tourism sector, in particular in hotels and at the management level, was again raised. The main problem is how hotels are run; some kind of rules-of-conduct are required that extend from the management

down to a chamber maid. Similar notion was underlined by the representative from the Ministry of Tourism – the responsible and sustainable tourism starts with educated management. Much improved co-operation and co-ordination among various ministries is therefore required in order to attain a better quality sustainable tourism. This could be achieved by promoting, for example, the ISO quality standards. The main focus should be on emphasising financial gains that could obtain through the projects of sustainable tourism. In doing this, it was referred to a new kind of consultant/advisor experts that may be needed for this purpose.

Then the discussion was directed towards the issue on how to attract more tourists if the peak season were extended due to climate change (global warming). Part of the problem lies in the fact that almost 50% of the tourist accommodation capacities is in privately-owned apartments and rooms whose owners essentially are not interested in climate and climate change. Therefore, there is the need to invest in hotels and together with investments in tourist destinations (e.g. pools, amusement and water parks, casinos, etc.) the main season can be extended throughout the year.

To the year 2020 (the extension of the new Strategy) no major impacts of climate change are expected. Since winter tourism in Croatia is essentially non-existent, the mountainous regions must include in their development plans the all-year-round “mountain” tourism (which should include activities like trekking, hiking, cycling, tours, etc.) rather than “winter” tourism which focuses on skiing and related activities.

The stakeholders must be informed what they can get from DHMZ and a more proactive role of DHMZ is required. The approach to (climate) information must be planned carefully, otherwise conclusions may be wrong. Also the raw data are not necessarily valuable pieces of information. For example, temperature and snow are not necessarily directly related – according to thermal conditions last winter in Croatia was, on average, mild but with extreme snow amounts. How to attract potential stakeholders remains a problem. Although DHMZ is the only organization in Croatia licensed for weather and climate information, apart from organizations at institutional level (ministries, institutes, agencies) the interest of potential tourism end-stakeholders for workshops (organised by DHMZ) where they can discuss their needs was rather poor.

3. Next steps

The two product sheets on tourist comfort indices are completed. The first product sheet (Annex IV) was already made available to the workshop participants and all those invited. The second product sheet will be distributed to all workshop participants and those potential stakeholders who took part in interviews and completed our questionnaire. The presentations from the workshop are available on the DHMZ web page:
(http://klima.hr/razno.php?id=projekti&param=climrun).

4.Annexes

4.1.Participants of the CLIM-RUN workshop held in Zagreb, 4 June 2013.

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20	**Ivan Güttler**	DHMZ	Ivan.guettler@cirus.dhz.hr
21	**Kornelija Špoler Čanić**	DHMZ	kornelija.spoler.canic@cirus.dhz.hr
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4.2 ANNEX I. Invitation letter sent for the CLIM-RUN Workshop in Zagreb, 4 June 2013

Radionica o klimi i turizmu, prva obavijest

Postovani,

Izuzetno nam je zadovoljstvo pozvati Vas na jednodnevnu radionicu o klimi i turizmu "Potencijal klimatskih informacija za planiranje u turizmu" u organizaciji Drzavnog hidrometeoroloskog zavoda (DHMZ) i UNDP-a Hrvatska. Radionica ce se odrzati u Zagrebu 4. lipnja 2013 od 9 h u prostorijama UNDP-a, Radnicka cesta 41/8.

Informacije o klimi i klimatskim promjenama postale su nezaobilazan faktor strateskog planiranja u gospodarstvu. Klimatske karakteristike najvazniji su prirodni resurs turizma u Hrvatskoj, a pravodobna prilagodba turistickog sektora varijacijama klime i klimatskim promjenama omogucuju buduci ekonomski rast i odrzivi razvoj. Stoga je ucinkovita razmjena informacija izmedju znanosti i korisnika klimatskih informacija u sektoru turizma od izuzetne vaznosti.

Cilj radionice je razmjena iskustava i saznanja s potencijalnim korisnicima iz turisticke djelatnosti o klimatskim informacijama potrebnim za turisticki sektor. Radionica se odrzava u sklopu znanstvenog projekta Clim-Run (www.climrun.eu) koji financira Europska Komisija. Vjerujemo da cete svojim prisustvom dati puni smisao radionice.

Program radionice i informacija o utjecaju jedne komponente klimatskog potencijala na turizam nalaze se u privitku. Molimo Vas da prijavu za sudjelovanje posaljete najkasnije do petka 31. svibnja 2013 na e-mail: cedo.brankovic@cirus.dhz.hr.

S postovanjem
M.Sc. Ivan Cacic, ravnatelj DHMZ

4.3 ANNEX II. Program of the CLIM-RUN Workshop in Zagreb, 4 June 2013

CLIM-RUN Project (www.climrun.eu)

Radionica o klimi i turizmu

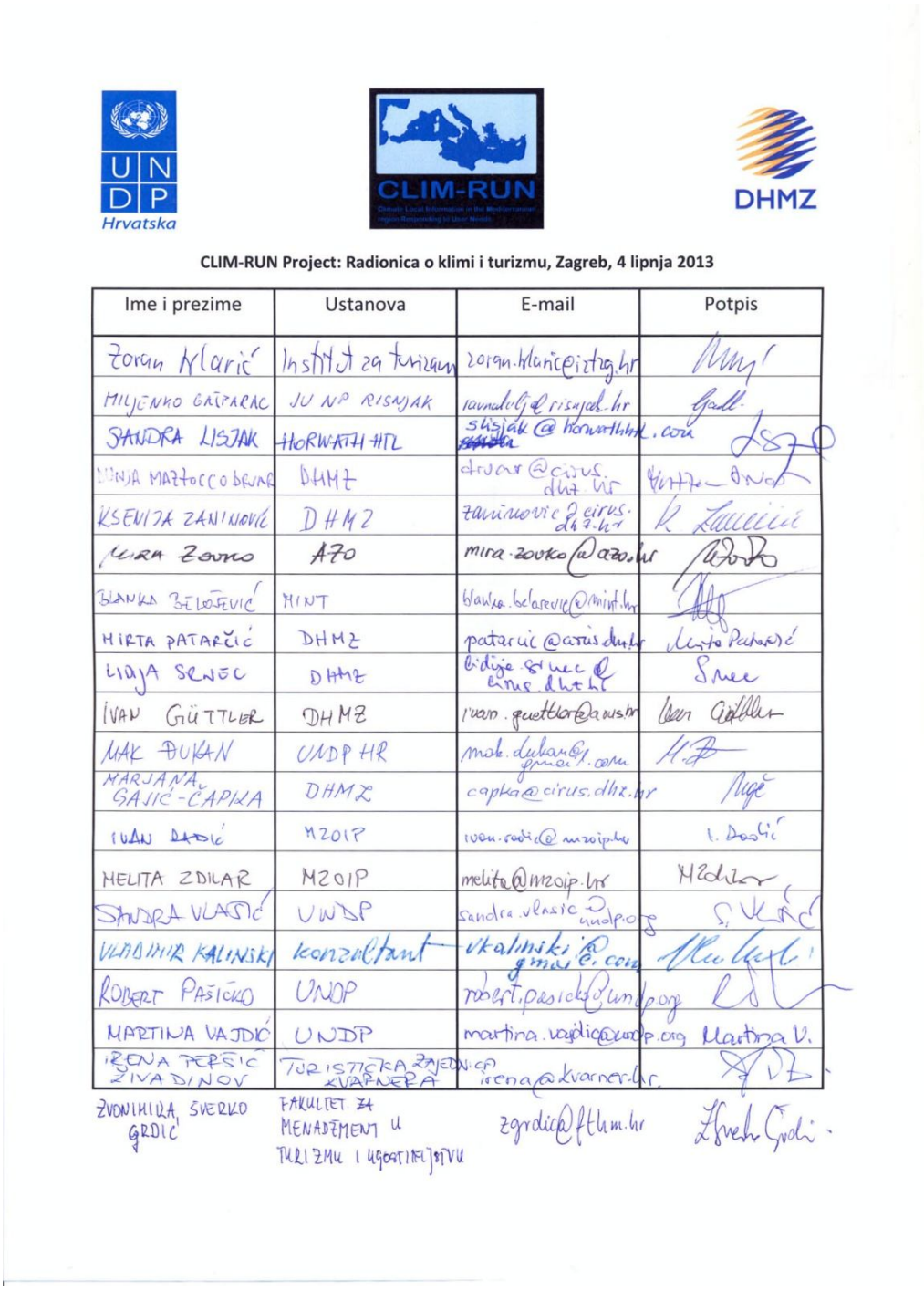
Potencijal klimatskih informacija za planiranje u turizmu

Datum i mjesto: utorak 4. lipnja 2013., Zagreb, UNDP Hrvatska, Radnička cesta 41/8

Program radionice (korigiran)

Prvi dio	
9:00	Okupljanje sudionika radionice
9:15	* Otvaranje sastanka i upoznavanje sudionika * CLIM-RUN projekt i klimatske promjene u Hrvatskoj (Čedo Branković, DHMZ) * Strategija hrvatskog turizma u svjetlu klimatskih promjena (Zoran Klarić, Institut za turizam) * Turistički klimatski indeks danas i sutra (Ksenija Zaninović, DHMZ) * Dugoročne vremenske prognoze u službi turizma (Dunja Mazzocco Drvar, DHMZ)
10:45	**Pauza za kavu**
Drugi dio	
11:15	* Ublažavanje klimatskih promjena kroz ekonomsku i ekološku učinkovitost hotela (Irena Peršić Živadinov, Turistička zajednica Kvarnera) * Primjer razvoja planinskog resorta na Staroj planini (Sandra Lisjak, Horwath HTL) * **Panel diskusija** o klimatskim informacijama potrebnim za planiranje u turističkom sektoru (moderator Vladimir Kalinski, konzultant)
13:00	**Domjenak**

4.4 ANNEX III. Signatures of the participants in the CLIM-RUN Workshop in Zagreb, 4 June 2013



CLIM-RUN Project: Radionica o klimi i turizmu, Zagreb, 4 lipnja 2013

Ime i prezime	Ustanova	E-mail	Potpis
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[illegible] MAZZOCCO BEVAR	DHMZ	[illegible]	
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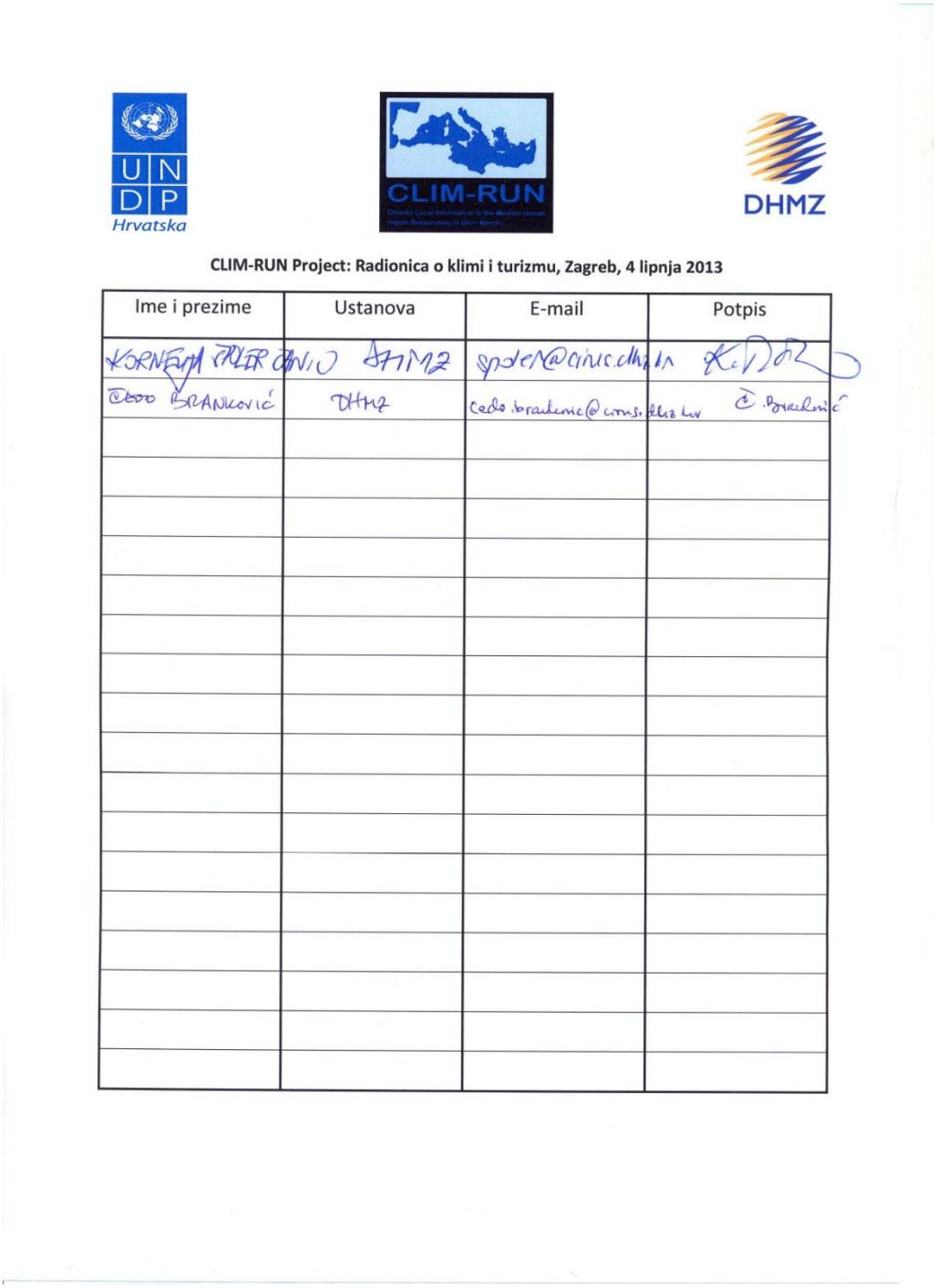


UNDP Hrvatska

CLIM-RUN

DHMZ

CLIM-RUN Project: Radionica o klimi i turizmu, Zagreb, 4 lipnja 2013

Ime i prezime	Ustanova	E-mail	Potpis
KORNELIJA PRLER	DHMZ		
Cedo Branković	DHMZ		

4.5 ANNEX IV. Product sheet 1: Thermal component of climate potential for tourism in Croatia

CLIM-RUN Product Information Sheet: May 2013

Thermal component of climate potential for tourism in Croatia

Ksenija Zaninović
Meteorological and hydrological Service of Croatia

Keywords: thermal environment, physiologically equivalent temperature, tourism, projections

Target Groups

- **Tourism institutions**
- **Tourism stakeholders**

Relevance to the Case-Study Requirements

As a natural resource for tourism climate determines the attractiveness of a region and therefore it has a limiting function on the "tourism potential". For Croatia, benefiting primarily from beach tourism, the climate-related change of thermal component of climate potential will become increasingly important. Adaptation to climate change is important not only for tourists but also for many other involved actors in tourism sector.

The Approach

The balance between human body and the thermal environment is complex and depends on air temperature, wind, humidity, solar and terrestrial radiation, but also on the gender, metabolism and clothing. The thermal impact on humans is determined by biometeorological index: physiologically equivalent temperature (PET) which is derived from the equation of thermal balance between the human body and the environment and by taking into account all the components of this relationship. PET is defined as the equivalent temperature at which a person being indoors would feel as in real outdoor conditions. The advantage of this index is that it uses a widely known unit (degree C) thus making the interpretation of the results easier. Besides, is also includes a thermal sensation scale ranging from "very cold" to "very hot".

The PET index was also calculated for the two future climate periods. The mean values for the PET input data were obtained from two randomly chosen runs of the RegCM3 regional climate model which was forced by the ECHAM5-MPIOM GCM under the IPCC SRES A2 emission scenario. The RegCM3 horizontal resolution was 35 km. The PET was computed for 14 CET assuming that this is the time when most of the tourists are outdoors and therefore mostly exposed to atmospheric conditions.

The quantification of the changes in the climate tourism potential was made by applying the changes in the number of days with the heat stress and the frequency of occurrence of the different thermal sensations.

CLIM-RUN Product Information Sheet: May 2013

Thermal component of climate potential for tourism in Croatia

Product Example

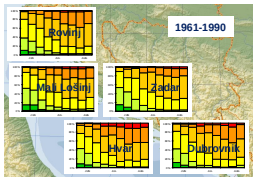


Fig. 1. Distribution of thermal perception (PET) for JJA at 2 p.m. (station data for the period 1961-1990).

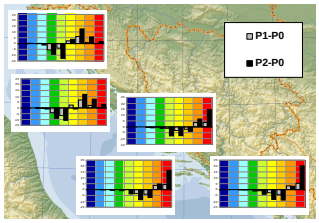


Fig. 2. Differences in probabilities of thermal perception between 1961-1990 (P0), 2011-2040 (P1) and 2041-2070 (P2), 12UTC (1 p.m.)

In the northern Adriatic there is an increase from slightly warm to the hot thermal perception.
In the southern Adriatic there is even a decrease in the occurrence of the warm thermal perception, but an increase in the hot and very hot thermal perceptions.

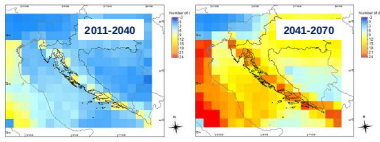


Fig. 3. Changes in number of days with heat stress (PET>35°C)

In the period 2011-2040 heat stress may be expected for 9 more days than in the reference climate along the coast, but in fewer days over some islands in the north and in the southern part. In 2041-2070, the increase in number of days with heat stress varies between 18 to 24 days.

Making the Product Usable

The results already point to hot conditions for outdoor activities in summer during afternoons along the Croatian Adriatic coast resulting in a reduction of the climate tourism potential. In the future, this trend is projected to increase, indicating that the tourism sector in Croatia would need to adapt and make new strategies, especially for the southern Adriatic.

Contact: zaninovic@cirus.dhz.hr **Further information: www.climrun.eu**

4.6 ANNEX V. Product sheet 2: Climate index for tourism in Croatia

CLIM-RUN Product Information Sheet: June 2013

Climate index for tourism in Croatia

Ksenija Zaninović
Meteorological and Hydrological Service of Croatia

Keywords: climate index for tourism, beach tourism, cycling tourism

Target Groups

- **Tourism institutions**
- **Tourism stakeholders**

Relevance to the Case-Study Requirements

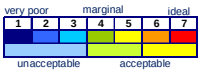
Complex influence of climate variables on tourism can be expressed by quantitative estimate (or an index) of suitability of climate for wide range of tourist activities and leisure. Such an index would enable the assessment of climate attractiveness in order to choose a destination and time for different types of tourism.

The Approach

De Freitas (2008) defined the climate index for tourism (CIT) that integrates thermal (T), aesthetic (A) and physical (P) facets of atmospheric environment important for tourism:

$$CIT = f\,[(T, A) * P]$$

T is a measure of the body-atmoshpere energy balance expressed by some modern biometeorological indices that integrate environmental and physiological thermal variables and is expressed as thermal sensation (e.g. from very cold to very hot) rather than an energy value. The aestheric component includes sky condition, ranging from clear to overcast. The physical components are wind and rain which can have an overriding effect when certain values are exceed. Thermal and aesthetic states are combined in a weather typology matrix and produce the rating class ranging from 1 to 7. If any physical threshold (wind and rain) is exceeded, than P overrides T and A.



CIT should be a descriptor of the quality of climate conditions for a tourism activity for which the index is specifically designed as indicated for the two examples below.

Thermal perception	Cloudiness (≤4/10)	Cloudiness (≥5/10)	Rain (>3 mm)	Wind (≥6 m/s)
very hot				
hot				
warm				
sligh. warm				
comfortable				
sligh. cool				
cool				
cold				
very cold				

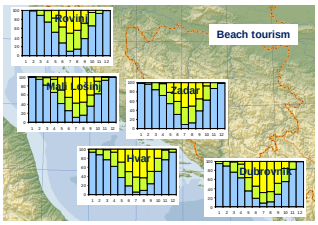
Thermal perception	Cloudiness (≤4/10)	Cloudiness (≥5/10)	Rain >10 mm	Wind (≥8 m/s)
very hot				
hot				
warm				
sligh. warm				
comfortable				
sligh. cool				
cool				
cold				
very cold				

Fig. 1. Climate index for tourism (CIT) for beach tourism (left) and cycling (right) (according to de Freitas, 2008, Bafaluy et all, 2013)

CLIM-RUN Product Information Sheet: June 2013

Climate index for tourism in Croatia

Product Example



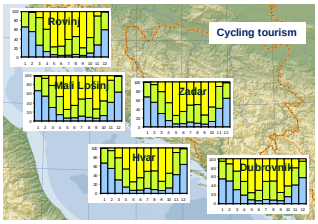


Fig. 2. Annual course of probabilities for suitability of climate conditions for beach and cycling tourism at 2 p.m. period 1981-2010.

The suitability for different types of tourism based on CIT differ along the Adriatic coast. For example, more favourable (ideal and acceptable) conditions for beach tourism are to be found in more southern locations; for cycling tourism, the differences among various locations are small.
Acceptable conditions for beach tourism (≥50% of all days) prevail from June to September in the northern Adriatic, but are extended from May to October in the southern part.
The acceptable period for cycling tourism lasts longer along the whole coast. The conditions for cycling are characterised as unacceptable only during the winter (DJF) and the most suitable period is from May until October. In July and August conditions for cycling are a little less optimal because of unfavourable thermal effect.

De Freitas et al, 2008: A second generation climate index for tourism (CIT) specification and verification, Int. J. Biometeorol, 52: 399-407
Bafaluy D., Amengual A., Romero R., Homar V., 2013: Projections of climate potential for various types of tourism in the Bay of Palma, Spain, *Regional Environmental Change*

Making the Product Usable

The climate index for tourism gives the information on suitability of climate for different types of tourism. It enables tourists to choose the best period for holidays depending on their interest.

Contact: zaninovic@cirus.dhz.hr **Further information: www.climrun.eu**

4.7 ANNEX VI. Interviews about climatic changes (in Croatian; author Dr. Vladimir Kalinski)

(This is a separate file in the PDF format.)