ORIENTGATE QUESTIONNAIRE

Review of the currently used indicators of climate risks

A structured network for integration of climate knowledge into policy and territorial planning

DELIVERABLE INFORMATION	
WP:	WP3 Mapping and Harmonising Data & Downscaling
Activity:	3.1 Review of the currently used indicators of climate risks
WP Leader:	RHMSS
Activity leader:	RHMSS
Participating partners:	RHMSS, NIMH, OMSZ, NMA, DHMZ, RHMZ RS, FHMI BiH, HMSM, OSENU, Ministry of Sustainable Development and Tourism Montenegro
Author:	RHMSS
E-mail:	ariel.milosevic@hidmet.gov.rs
Telephone number:	+381 60 3565412; +381 64 8385282
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COUNTRY AND PERSON COMPLETING THE QUESTIONNAIRE	
Country:	
Institution:	
Name:	
Address:	
Telephone:	
E-mail:	

CONTENT

I Introduction
Dear ORIENTGATE partners,

The questionnaire is final outcome of the first activity in the frame of WP3. The aim of this questionnaire is to review the currently used climate indices in the South-East Europe. Meteorological data are NOT needed, only the information about their availability, accessibility and handling. This approach will help us in defining the set of indices that can be practically applied in each country of the region with particular focus on the pilot areas.

The Questionnaire is composed of 11 tables that are organized in three sections. The first section consists of questions about stations and data, the second one summarizes experiences in dealing with climate indices and in the third section we are asking you to fill in the climate models results section.

Please complete the questionnaire carefully by filling the empty white cells. Do not hesitate to contact the WP3 leader (RHMSS) in case you have any questions. Above all, this questionnaire should be filled in by the WP3 partners (hydmet organizations), nevertheless, it would be much appreciated if other partners such as scientific institutions and policy organizations of territorial development find the time to answer as much questions as they can. These answers will provide useful information about stake-holder needs and contribute to better mapping and harmonizing of data.

In Appendix we have listed common-used indices based on temperature and precipitation.

Thank you for your time and patience.

Yours truly,
RHMSS team

II Information about stations and data

1. Basic information	
Who operates the meteorological and hydrological network(s)?	
Network density (number of met./ hydro stations per 10000km^2)	

2. Information about stations		
2.A Number of stations		
	Total number of stations (per country / pilot area)	**Comments**
Main met. stations		
Climatological stations		
Precipitation stations		
Mountain stations (above 1000m)		
Automatic met. stations		
Hydrological stations		
Other type of station (e.g. phenological stations)		

2.B Number of stations					
	Number of stations with measurements in the last				**Number of stations with measurements since 1971 till 2000 with less then 10% of missing data**
	10 years	**20 years**	**30 years**	**> 30 years**	
Main met. stations					
Climatological stations					
Precipitation stations					
Mountain stations (above 1000m)					
Automatic met. stations					
Hydrological stations					
Other type of station (e.g. phenological stations)					

3. Map of the meteorological and hydrological stations
Please, insert the map of the stations with different symbols for main (■), climatological (●), precipitation (♦), mountain (▲), automatic (□) and hydrological stations (∆) in .jpg format

4. Measurements and observations on stations with measurements with less then 10% of missing data				
4.A Measurements of temperature and precipitation				
	Number of stations with available measurements/observations	**Beginning of measurements/observations**	**Accessibility** 1. Online availability 2. Publicly available 3. Internally available 4. Restricted access 5. Available to buy 6. Not available	**Comments**
Temperature				
Minimum temperature				
Maximum temperature				
Precipitation				

4.B Other measurements and observations				
	Number of stations with available measurements/observations	**Beginning of measurements/observations**	**Accessibility** 1. Online availability 2. Publicly available 3. Internally available 4. Restricted access 5. Available to buy 6. Not available	**Comments**
Wind direction and speed				
Relative humidity				
Duration of sunshine				
Cloud cover				
Soil temperature				
Snow depth				
River discharge				
Foliation				
Blooming				
Leaf fall				

5. Daily data					
5.A Temperature & relative humidity					
	Number of measurements per day	**Measurements time (UTC)**	**How do you calculate daily average?**	**Comments**	
Temperature					
Relative humidity					
5.B Minimum & maximum temperature					
	Measurements time (UTC)	**Period of validity (i.e. 12h/24h)**	**Start & end of period validity**	**Comments**	
Tmin					
Tmax					
5.C Precipitation & snow depth					
	Number of measurements per day	**Start time (UTC)**	**End time (UTC)**	**Date for reporting**	**Comments**
Precipitation					
Snow depth					

5.D Wind direction and speed, duration of sunshine, cloud cover, soil temperature & river discharge				
	Number of measurements per day	**Measurements time (UTC)**	**How do you calculate daily average?**	**Comments**
Wind direction and speed				
Duration of sunshine				
Cloud cover				
Soil temperature				
River discharge				

5.E Phenology		
	Observations time	**Comments**
Foliation		
Blooming		
Leaf fall		

6. Data quality control	
Do you perform quality control procedures?	
If yes fill the fields below:	
On which data?	
Type of quality control (logical, statistical...)	
Time when procedures are applied	

7. Interpolation of meteorological data	
Do you interpolate meteorological data?	
If yes fill the fields below:	
Parameters you interpolate	
Method of interpolation	
Software used for interpolation	
Do you use some additional data? Which one?	
Software used for visualization	
Form of the output (map, grid)	
Map/grid resolution	
Mapping time-step (daily, weekly, monthly...)	
Who are the users?	

III Climate indices

8. Climate indices	
Have you ever used some indices? (Yes/No)	
If yes fill in the fields below:	
8.A Climate indices based on air temperature and precipitation amount	
Name the indices. Give the definition.	
Which indices are requested by your stake-holders (question for indices provider)?	
Software used for calculation	
Do you calculate indices in grid points or in stations? (Do you interpolate data first or you calculate indices and then do the interpolation?)	
Indices that show the greatest change on your territory	
Have you applied the indices in some impact study? (Yes/No) If yes:	
Name the indices	
Time period used for indices calculation	

8.B Climate indices based on other parameters		
Name the indices. Give the definition.		
Which indices are requested by your stake-holders (question for indices provider)?		
Software used for calculation		
Do you calculate indices in grid points or in stations? (Do you interpolate data first or you calculate indices and then do the interpolation?)		
Indices that show the greatest change on your territory		
Have you applied the indices in some impact study? (Yes/No) If yes:		
	Name the indices	
	Time period used for indices calculation	

8.C If the parameters for the indices calculation has not been stated in the Table 4 fill the fields below				
Parameter	**Number of stations with available measurements/observations**	**Beginning of measurements/observations**	**Accessibility** 1. Online availability 2. Publicly available 3. Internally available 4. Restricted access 5. Available to buy 6. Not available	**Comments**
Add more rows if needed				
8.D If the parameters for the indices calculation has not been stated in the Table 5 fill the fields below				
Parameter	**Number of measurements per day**	**Measurements time (UTC)**	**How do you calculate daily average?**	**Comments**
Add more rows if needed				

9. Coordinates of the stations with measurements with less then 10% of missing data that are used for climate indices calculation					
	Station name	**Latitude (decimal degrees)**	**Longitude (decimal degrees)**	**Altitude (m)**	**Indices**
1.					
2.					
3.					
4.					
5.					
6.					
7.					
8.					
Add more rows if needed					

10. Interpolation of climate indices	
Do you interpolate indices?	
If yes fill the fields below:	
Indices you interpolate	
Method of interpolation	
Software used for interpolation	
Do you use some additional data? Which one?	
Software used for visualization	
Form of the output (map, grid)	
Map/grid resolution	
Mapping time-step (daily, weekly, monthly...)	
Who are the users?	

IV Climate models results

11. Climate change models	
11.A Climate change models output	
Do you have the climate change models output?	
If yes fill the fields below:	
Did you run the model(s)? Name the model	
Are the output data available?	
If yes fill the fields below:	
Through which services? (none, OPeNDAP,THREDDS, FTP, WMS, etc.)	
Formats of the data (if you have NetCDF data, please specify is you are using the NetCDF-CF convention)	
What are the data policies?	
The size in terms of number of files, datasets and GBs/TBs	
Are the metadata information available? If YES, what standard or specification is being used for the schema? (none, ISO19115/ISO19139, METAFOR CIM, proprietary schema, etc.)	

11.B Climate change models output	
Data you need from climate change projections?	
Do you use the climate change models output for indices calculation? If yes, name the indices	

Appendix: ETCCDI indices

The definitions for a core set of 27 descriptive indices of extremes defined by the Joint CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI, see http://www.clivar.org/organization/etccdi/etccdi.php) are provided below.

Temperature indices:

1. **FD**, frost days: count of days where TN (daily minimum temperature) < 0°C
   Let TNij be the daily minimum temperature on day i in period j. Count the number of days where TNij < 0°C.
2. **SU**, summer days: count of days where TX (daily maximum temperature) > 25°C
   Let TXij be the daily maximum temperature on day i in period j. Count the number of days where TXij > 25°C.
3. **ID**, icing days: count of days where TX < 0°C
   Let TXij be the daily maximum temperature on day i in period j. Count the number of days where TXij < 0°C.
4. **TR**, tropical nights: count of days where TN > 20°C
   Let TNij be the daily minimum temperature on day i in period j. Count the number of days where TNij > 20°C.
5. **GSL**, growing season length: annual count of days between first span of at least six days where
   TG (daily mean temperature) > 5°C and first span in second half of the year of at least six days where TG < 5°C.
   Let TGij be the daily mean temperature on day i in period j. Count the annual (1 Jan to 31 Dec in Northern Hemisphere, 1 July to 30 June in Southern Hemisphere) number of days between the first occurrence of at least six consecutive days where TGij > 5°C and the first occurrence after 1 July (1 Jan in Southern Hemisphere) of at least six consecutive days where TGij < 5°C.
6. **TXx**: monthly maximum value of daily maximum temperature:
   Let TXik be the daily maximum temperature on day i in month k. The maximum daily maximum temperature is then TXx = max (TXik).
7. **TNx**: monthly maximum value of daily minimum temperature:
   Let TNik be the daily minium temperature on day i in month k. The maximum daily minimum temperature is then TNx = max (TNik).
8. **TXn**: monthly minimum value of daily maximum temperature:
   Let TXik be the daily maximum temperature on day i in month k. The minimum daily maximum temperature is then TXn = min (TXik).
9. **TNn**: monthly minimum value of daily minimum temperature:
   Let TNik be the daily minimum temperature on day i in month k. The minimum daily minimum temperature is then

TNn = min (TNik).

10. **TN10p**, cold nights: count of days where TN < 10th percentile
    Let TNij be the daily minimum temperature on day i in period j and let TNin10 be the calendar day 10th percentile of daily minimum temperature calculated for a five-day window centred on each calendar day in the base period n (1961-1990). Count the number of days where TNij < TNin10.
11. **TX10p**, cold day-times: count of days where TX < 10th percentile
    Let TXij be the daily maximum temperature on day i in period j and let TXin10 be the calendar day 10th percentile of daily maximum temperature calculated for a five-day window centred on each calendar day in the base period n (1961-1990). Count the number of days where TXij < TXin10.
12. **TN90p**, warm nights: count of days where TN > 90th percentile
    Let TNij be the daily minimum temperature on day i in period j and let TNin90 be the calendar day 90th percentile of daily minimum temperature calculated for a five-day window centred on each calendar day in the base period n (1961-1990). Count the number of days where TNij > TNin90.
13. **TX90p**, warm day-times: count of days where TX > 90th percentile
    Let TXij be the daily maximum temperature on day i in period j and let TXin90 be the calendar day 90th percentile of daily maximum temperature calculated for a five-day window centred on each calendar day in the base period n (1961-1990). Count the number of days where TXij > TXin90.
14. **WSDI**, warm spell duration index: count of days in a span of at least six days where TX > 90th percentile
    Let TXij be the daily maximum temperature on day i in period j and let TXin90 be the calendar day 90th percentile of daily maximum temperature calculated for a five-day window centred on each calendar day in the base period n (1961-1990). Count the number of days where, in intervals of at least six consecutive days TXij > TXin90.
15. **CSDI**, cold spell duration index: count of days in a span of at least six days where TN > 10th percentile
    Let TNij be the daily minimum temperature on day i in period j and let TNin10 be the calendar day 10th percentile of daily minimum temperature calculated for a five-day window centred on each calendar day in the base period n (1961-1990). Count the number of days where, in intervals of at least six consecutive days TNij < TNin10.
16. **DTR**, diurnal temperature range: mean difference between TX and TN (°C)
    Let TXij and TNij be the daily maximum and minium temperature on day i in period j. If I represents the total number of days in j then the mean diurnal temperature range in period j DTRj = sum (TXij - TNij) / I.

Precipitation indices:

17. **RX1day**, maximum one-day precipitation: highest precipitation amount in one-day period
    Let RRij be the daily precipitation amount on day i in period j. The maximum one-day value for period j is

RX1dayj = max (RRij).

18. **RX5day**, maximum five-day precipitation: highest precipitation amount in five-day period
    Let RRkj be the precipitation amount for the five-day interval k in period j, where k is defined by the last day. The maximum five-day values for period j are RX5dayj = max (RRkj).
19. **SDII**, simple daily intensity index: mean precipitation amount on a wet day
    Let RRij be the daily precipitation amount on wet day w (RR ≥ 1 mm) in period j. If W represents the number of wet days in j then the simple precipitation intensity index SDIIj = sum (RRwj) / W.
20. **R10mm**, heavy precipitation days: count of days where RR (daily precipitation amount) ≥ 10 mm
    Let RRij be the daily precipitation amount on day i in period j. Count the number of days where RRij ≥ 10mm.
21. **R20mm**, very heavy precipitation days: count of days where RR ≥ 20 mm
    Let RRij be the daily precipitation amount on day i in period j. Count the number of days where RRij ≥ 20 mm.
22. **Rnnmm**: count of days where RR ≥ user-defined threshold in mm
    Let RRij be the daily precipitation amount on day i in period j. Count the number of days where RRij ≥ nnmm.
23. **CDD**, consecutive dry days: maximum length of dry spell (RR < 1 mm)
    Let RRij be the daily precipitation amount on day i in period j. Count the largest number of consecutive days where RRij < 1 mm.
24. **CWD**, consecutive wet days: maximum length of wet spell (RR ≥ 1 mm)
    Let RRij be the daily precipitation amount on day i in period j. Count the largest number of consecutive days where RRij ≥ 1 mm.
25. **R95pTOT**: precipitation due to very wet days (> 95th percentile)
    Let RRwj be the daily precipitation amount on a wet day w (RR ≥ 1 mm) in period j and let RRwn95 be the 95th percentile of precipitation on wet days in the base period n (1961-1990). Then R95pTOTj = sum (RRwj), where RRwj > RRwn95.
26. **R99pTOT**: precipitation due to extremely wet days (> 99th percentile)
    Let RRwj be the daily precipitation amount on a wet day w (RR ≥ 1 mm) in period j and let RRwn99 be the 99th percentile of precipitation on wet days in the base period n (1961-1990). Then R99pTOTj =sum (RRwj), where RRwj > RRwn99.
27. **PRCPTOT**: total precipitation in wet days (> 1 mm)
    Let RRwj be the daily precipitation amount on a wet day w (RR ≥ 1 mm) in period j. Then PRCPTOTj = sum (RRwj).

ORIENTGATE QUESTIONNAIRE

MANUAL

Work Package 3: Mapping and Harmonising Data & Downscaling

Activity 3.1: Review of the currently used indicators of climate risks

Responsible Partner: RHMSS

II Information about stations and data

The purpose of this section is to have an overview of the current density of different meteorological measurements in South-East Europe, but also to have an insight of measurement density and type of meteorological parameters available in pilot areas.

Table 1

In Table 1 we need basic information about station networks. Who is responsible for meteorological/hydrological network? If the networks are separated indicate who is responsible for each of them. Provide information about network density for each network in following units - number of stations per 10000 km^2.

Table 2

Please indicate the total number of stations by categories. National meteorological services should indicate the total number of stations for the whole country, while the representatives of pilot areas should cover only their pilot areas.
Main meteorological stations refer to stations with hourly measurements and observations, measurements of minimum and maximum temperature as well as precipitation.
Climatological stations are stations with climatological measurements at 7, 14 and 21h local time (e.g. extreme temperature and precipitation).
Precipitation stations are the one with precipitation measurements including snow cover.
Mountain station can be any type of previously defined stations, provided it is above 1000 m altitude (it is possible for station to be categorized at the same time as mountain station and some other type of station).

Table 2a

Please indicate total number of stations by type.

Table 2b

Please indicate the number of stations by type, according to defined time period.
The last column refers to the period that is determined for verification of climate models which outputs will be used in the pilot areas.

Table 3

The purpose of this question is a visual insight of the type and density of different types of stations in order to identify areas with insufficient data. Map should be in .jpg format. Different types of stations have to be represented by following symbols:
(■) main station,
(●) climatological station,
(♦) precipitation stations,

(▲) mountain stations,
(□) automatic stations and
(∆) hydrological stations.

Table 4

The first column of Table 4 should be filled in with number of stations with listed parameters. Fill in the second column with year when measurements started at most of the currently active stations. The third column provides information about their accessibility.
Names of meteorological parameters are defined by World Meteorological Organization (WMO).

Table 4a and 4b

Table 4a is designed for temperature and precipitation, while table 4b is designed for other parameters.

Table 5

This table refers to measurement time and validity period of data. It is possible to introduce different times for measurements of different meteorological elements on a single station, so measurement periods of validity of some meteorological elements might differ for the same station.

Table 5 is divided into 5 parts which summarize information about daily measurements and observations.

Table 5a

Table 5a refers to temperature and relative humidity. Enter the number of measurements per day for each type of station (e.g. main – 'number', climatological – 'number', etc). In the next column specify the terms of measurements (hourly or specific hours; e.g. main – 'time', climatological – 'time', etc). Describe the exact formula for calculating daily average value for each type of station in the third column.

Table 5b

Table 5b relates to minimum and maximum temperature. Fill in the measurement time, period of validity, and start and end of that period. If different type of station have different period of validity or different measurement time, please specify.

Table 5c

Table 5c relates to precipitation and snow depth. Fill in the number measurements per day and start and end of period of measurements. In the fourth column indicate date of reporting as date of the start or the end of measurement periods.

Table 5d

Table 5d relates to wind direction and speed, duration of sunshine, cloud cover, soil temperature and river discharge. Enter the number of measurements per day for each type of station (e.g. main – 'number', climatological – 'number', etc). In the next column specify the terms of measurements (hourly or specific hours; e.g. main – 'time', climatological – 'time', etc). Describe the exact formula for calculating daily average value for each type of station in the third column.

Table 5e

Table 5e relates to phenology. Fill in the observations time for listed elements if data are available.

Table 6

Please fill in this table in case you are performing any kind of data quality control procedure.

Table 7

If you are performing interpolation of data please indicate on which parameters, the method you use, software, form of the output and other information mentioned in the table.

III Climate indices

Table 8

If the answer is YES please fill in the table.

Table 8a

The aim is to collect information about indices that are based on temperature and/or precipitation.
Please specify all indices in use (if any of these indices are listed in Appendix: ETCCDI indices at the end of Questionnaire, just write down their name or acronym; if used indices are not listed in the Appendix please give their description).
Under question number 4 '**Do you calculate indices in grid points or in stations?**' please indicate whether you interpolate data first or you calculate indices and then do the interpolation.
The last four questions should provide information about methodology of indices calculation and application.

Table 8b

Table 8b provides the same type of information as Table 8a for the indices that are not based only on precipitation or temperature or require additional data with temperature and/or precipitation. Under question number 4 '**Do you calculate indices in grid points or in stations?**' please indicate whether you interpolate data first or you calculate indices and then do the interpolation.

Table 8c

Table 8c is similar to Table 4. It provides information about station network, data accessibility of parameter not listed in Table 4.

Table 8d

Table 8d is similar to Table 5. It provides information about frequency of measurements, average values of parameter not listed in Table 4.

Table 9

Table 9 requires the information about station location (latitude, longitude, altitude) for which certain indices are calculated. Name the indices in the 6th column.

Table 10

Table 10 is the same as table 7, only related to interpolation of climate indices. If you are performing interpolation of climate indices please indicate on which indices, the method you use, software, form of the output and other information mentioned in the table.

IV Climate models results

Table 11

Table 11a

If the answer is YES please fill in the table.
In the first question answer whether you made model simulations/projections or you took the output from somebody else and what is the model name.
In the second one, answer whether these data can be shared. If YES define the type of the service though which the data can be access, data format (Grads File, NetCDF, GRIB…), accessibility and the size of the files. If there are metadata about climate models output notify what is the form of it.

Table 11b

Table 11b specifies which data you need for the further research. The first question is mainly addressed to pilot areas (case studies). The second question requires answer YES or NO. If the answer is YES name the indices and if any of these indices are listed in the Table 8, just write down their name or acronym; if used indices are not listed in Table 8 please give their description.