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Climate Information Portal

CLIPC DELIVERABLE (D -N°: 7.4)

Guidance on production and use of indicators

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1	24 October	Luis Costa	First draft of the document circulated
1	24 October	Kristin Bottcher	Comments on the examples provided and structure.
1	26 October	Niall McCormick	Further example on uses of indicators for research purposes.
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Abstract

The need for guidance on the data and functionalities the CLIPC portal has been well underlined in the users consultation of WP2, in particular guidance on the use of impact indicators and the production of tailor-made ones via the toolkit functionalities. This deliverable addresses the needs of users by elaborating structured guidance on the production and use of impact indicators in the CLIPC portal.

Based on an evaluation of users' envisaged usage of the data, we elaborate five tasks for which descriptive guidance is provided (at least one task per CLIPC user group is available). In addition to the descriptive guidance, practical examples on how to use the data in the CLIPC portal to complete the formulated tasks are shown. Given that this deliverable focuses on providing guidance on the use and elaboration of impact indicators, the practical examples of guidance focus on the elaboration of vulnerability and risk assessments – a need particularly noted by Intermediate Organization and Impact Scientist user categories. A brief discussion on the challenges of providing guidance is presented and concluding remarks wrap up this deliverable.

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1 Executive Summary

Objectives:

The objectives of this deliverable can be summarized as follows:
- To develop stylized guidance on the use and production of indicators.
- To tailor the guidance according the needs of CLIPC user groups climate scientists, impacts researchers and intermediary organizations.
- To enumerate the CLIPC functionalities and data required in order to operate the stylized guidance.
- To practically illustrate the guidance steps in the CLIPC portal.
- To formulate suggestions for future work concerning provision of guidance to end-users.

Results:

Building on the specific requirements of potential users, this deliverable elaborates structured guidance on 4 simulated tasks regarding the use and production of climate impact indicators in the CLIPC portal. These tasks use concrete "data usage purposes" suggested by potential end-users in *D2.2 User requirements, Part 2*. The tasks have been structured according to the potential user-groups of CLIPC, and can be summarized as follows:
- Give advice on data and climate impact indicators to others (Intermediary organizations, Climate Scientists and Impacts researchers)
- Create awareness (Intermediary organizations)
- Perform risk and vulnerability assessments (Impact researchers)
- Input in research on climate change (Impact researchers)

In addition, a section elaborates how to derive relevant information from the file name of CLIPC datasets, guidance requested by the users during the consultations.

Perspectives:

With the need for guidance taking a very prominent role during the elaboration of the CLIPC portal and the user consultations, it is expected that a similar requirement from the side of end-users will emerge in forthcoming work promoting the use of climate information portals to wider audiences. Accordingly, the examples of guidance on the use and elaboration of impact indicators by user group can facilitate future similar work.

2 Introduction

The user consultation taking place in WP2 has highlighted the need to provide potential users of the CLIPC portal with generic guidance on 1) using existing climate impact indicators, and 2) the production of additional tailor-made indicators (made possible by the functionalities of the toolkit). Given the heterogeneity of potential users, one can imagine a full continuum of individuals differing in terms of skills, knowledge and - most importantly - objectives, for which the CLIPC portal could provide interesting information and functionalities. This continuum of potential users has been bounded by four user-categories in WP2 (see Table 1), ranging from *climate scientists* to *societal end users* (Groot et al, 2015). Most relevant for the discussion in this Deliverable has been the quantitative assessment of the purpose for which different user groups require climate data and indicators. Guidance should be framed from the *purposes* for which the user intends to apply the data and functionalities of the CLIPC portal. In Deliverable 7.1, the "top three purposes" have been distilled from Deliverable 2.2 (quantitative assessment of user needs), and are highlighted in Table 1.

Table 1 - Top purposes for data and indicators according to potential CLIPC users identified in the WP2 user consultation questionnaire (based on Groot et al, (2015)).

User groups	Top three purposes for climate data and indicators 1st	2nd	3rd
Societal end users	Support the development of adaptation strategies and plans	Create awareness	Make risk and vulnerability assessments
Intermediary organizations[1]	Give advice on data and climate impact indicators to others	Support the development of adaptation strategies and plans	Create awareness
Impact researchers	Make risk and vulnerability assessments	Input in research on climate change	Support the development of adaptation strategies and plans[2]
Climate scientists	Give advice on data and climate impact indicators to others	Input in research on climate change	Mix of awareness raising, adaptation and risk assessment[3]

Different user groups tend to gravitate to similar purposes for which they plan to use data and indicators from the CLIPC portal. Supporting the development of adaptation strategies is a cross-cutting purpose among the user categories of *societal end users*, *intermediary organizations* and *impact researchers*, albeit in varying degrees of interest. Creating awareness appears to be a purpose most relevant for the user groups of *societal end users* and *intermediary organizations*, while giving advice on climate data to others is pointed as the top purpose of a portal like CLIPC to *intermediary organizations* and *climate scientists*. For the category *impact researchers*, the main purpose of using the data in the CLIPC portal is to support risk and vulnerability analysis. Finally, both *climate scientists* and *impact researchers*

[1] These can also be referred to as boundary workers.

[2] The second and third purposes in the user category "Impact Researchers" presented the same number of answers, meaning that the placement of the 2nd or 3rd purposes is in this case arbitrary.

[3] The same number of answers for purposes "Create awareness"," Make risk and vulnerability assessments" and "Support the development of adaptation strategies and plans".

recognize the purpose of the portal as a potential source of data to be used in their own research.

Five main purposes for which users could take advantage of the CLIPC portal can now be defined. These are: "*support the development of adaptation strategies and plans*", "*give advice on data and climate impact indicators to others*", "*input in research on climate change*", "*make risk and vulnerability assessments*" and "*raise awareness*". For simplicity, and given that the objectives are quite inter-twined, we have included the objective of supporting the development of adaptation strategies and plans also under "*making risk and vulnerability assessments*". Given that, from an early stage, CLIPC opted not to look into the category of societal end users explicitly, but rather connect to these users via intermediary organizations, this Deliverable does not propose specific guidance for *societal end users*. Although much attention has been paid to user-friendliness, the vast number of data sources made accessible and the many functionalities make the current version of the portal most relevant for users with some technical skills and time to explore and apply those data and functionalities. Table 2 shows the final *purpose-user* combinations for which guidance has been developed in Deliverable 7.4. Guidance has been developed for the top purpose identified for each of the user groups in Table 1. We opted to include guidance on *awareness raising* by *intermediary organizations*, and *input in research on climate change* for the case of *impact researchers*, so as to have five purposes represented in the Deliverable (note the merging of purposes, described in the footnote to Table 2).

Table 2 - Purposes for which guidance will be developed according to user group.

User groups	Purpose for which guidance is developed	
Intermediary organizations	Give advice on data and climate impact indicators	Create awareness
Impact researchers	Make risk and vulnerability assessments[4]	Input in research on climate change
Climate scientists	Give advice on data and climate impact indicators	

The deliverable is structured as follows. In section 3, guidance on how to read file-names in the CLIPC portal is introduced as this underpins the dataset selection for the guidance examples in section 4. In section 4 the guidance is broken down into the issues of i) defining the task at hand in the context of the purposes highlighted, ii) identifying the data/functionalities/processes of the CLIPC portal that would make the completion of the task possible and iii) guidance steps to operate the task. Section 5 enumerates the challenges involved in developing the guidance and how to concatenate it with user requirements. Finally section 6 draws the main conclusions emerging during the elaboration of this deliverable.

[4] Also includes the purpose of "Support the development of adaptation strategies and plans".

3 Reading datasets in CLIPC and compatibility of indicators

One key requirement from the users is guidance on how to interpret the long names of the datasets available in the CLIPC portal. During the project the team providing data or indicators and the team developing the portal interface and architecture were faced with a complicated dilemma. On the one hand a standardized name for the datasets of impact indicators allows for a better integration and organization of datasets in the portal and its use in the CLIPC processing tools. On the other hand a standardized dataset name implies the use of standardized terms to identify relevant characteristics of the datasets (e.g., time period, frequency, experiment, etc.) in an fixed order that is not intuitive for a large majority of users who are not familiar with the specific characteristics of the data in the files and do not want to take the time to check the extensive metadata for each file.

In order to mitigate the deficiency of having long names for the datasets in CLIPC, required to take full advantages of the toolkit functionalities, this section provides guidance on how to "read" the most important information.

In CLIPC there are 2 naming conventions for datasets. The first one ("Naming convention 1") is used for files containing information on indicators that are derived from climatic models, while the second ("Naming convention 2") is used for indicators that require inputs or processes beyond those present in climate models.

Naming of datasets for model-derived indicators:

The name of a file in CLIPC contains a number of elements (see box 1) fundamental to operate the toolkit functionalities. Less experience users are suggested to abstract from many of the element and focus particularly in the 5 highlighted in red and how they map to the name of a real file used in the CLIPC portal (see box 2).

Box 1 - Elements included in the dataset name

[VariableName]*[package][institution]****[GCMName][ExperimentName]****[EnsembleMember][IndicatorRealisation][RCMName][RCMRealisation][domain][BcName][BcObsName][BcRefPeriod]****[frequency][StartTime-EndTime]****[Reference_period][tile-nnnnn].nc*

Box 2 - Example of a dataset name in CLIPC

[cdd] *icclim-4-2-3 KNMI* ***[ens-multiModel] [historical]*** *r1i1p1 SMHI-RCA4 v1 EUR-44 SMHI-DBS43 EOBS10 bcref-1981-2010* ***[yr] [19700101-20051231]****.nc*

The first element of the file name is Variable Name. In box 2 this element maps to ***cdd*** - consecutive dry days. Many users will understand this as the indicator itself.

The next relevant piece of information refers to the name of the GCMName (if only one GCM is used) used to calculate the indicator; or, in case more than one GCM's are used, an indication that the data refers to an ensemble of models. In the example provided, ***ens-multiModel***, highlights the second case. Many users will prefer to use ensemble data given its advantages regarding the incorporation of uncertainty.

The next relevant piece of information is given by the element ***[ExperimentName]***. This element identifies if the data in the file refers to historical data or to projected data. I case of historical data the file-name will contain the labeling ***historical*** (as is the case of the example given). In case the data refers to projection the labeling will be the name of one of the 4 RCPs currently in use by the climate change community, namely, ***rcp26***, ***rcp45***, ***rcp60*** or ***rcp85***.

Lastly, the elements frequency and *StartTime-EndTime* translate ***yr*** and ***19700101-20051231*** in the example provided. They inform that the dataset chosen contains information on consecutive dry days on a yearly basis for the years between 1970 and 2005.

Summing up: The information contained file-name of the dataset presented can be simplified to: A dataset containing information on the **consecutive dry days** from an **historical model ensemble** on a **yearly basis** between **1970** and **2005**. For many users this would already suffice for having a first feeling if the data is of relevance to them.

Naming convention of datasets for the general case:

The second naming convention in CLIPC is used for the cases when impact indicators require the inclusion of inputs or processes that are not exclusive to those used or derived from climate models. For example, indicators from satellite observations or other that require the inclusion of socio-economic data will use the naming convention below (see box 3).

Box 3 - Elements included in the dataset name

[VariableName]*[package][institution]****[sourceDataID][frequency][StartTime-EndTime]****[Reference_period][tile-nnnnn].nc*

Box 4 - Elements included in the dataset name

[gdp] *arcgis-10-4-0 IRPUD* ***[ECFIN-Convergence-OECD-ENV-Growth-SSP1] [5yr] [20151231-20601231]****.nc*

Albeit more simple in its structure, most of the main elements previously identified are also present. Perhaps the major difference is the presence of the element ***sourceDataID*** which broadly contains the information on the input data source, in this example the models (ECFIN and OECD-ENV) and experiments (Convergence and SSP1), ***ECFIN-Convergence-OECD-ENV-Growth-SSP1***. The elements of frequency as well as start and end time read as in the previous example.

An important feature of the CLIPC toolkit it's the flexibility to combine different impact indicators. Although this feature is appealing to end users, it also originates the possibility of users attempting to make combinations that are not always rational. It is not feasible, at the same time, to allow for extreme flexibility and guarantee that only meaningful combinations of indicators are possible. In WP8 and WP4, this problem was balanced by allowing all combination between indicators to be made, but alerting users with warning messages of some issues that the CLIPC team identified are relevant to consider before the user proceeds with the combination.

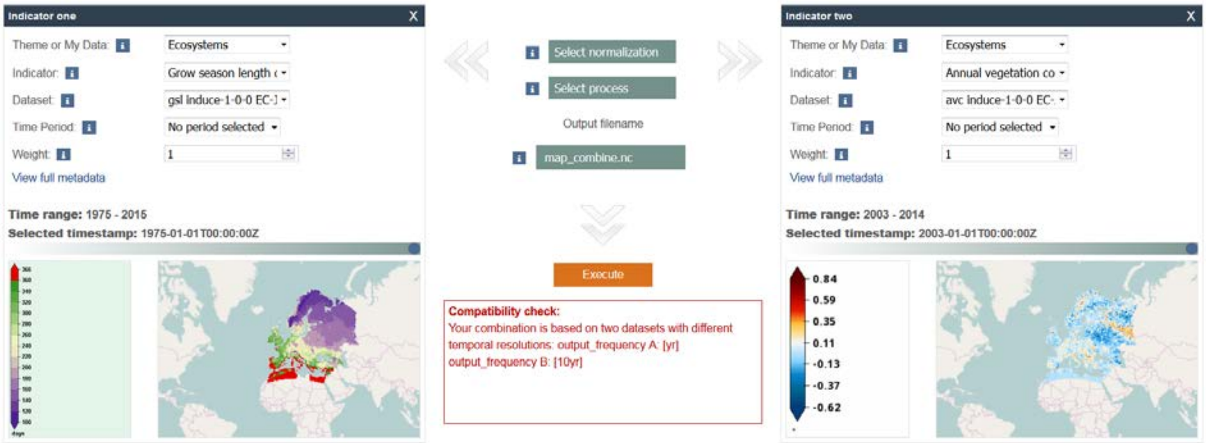


Figure 1 - Example of the compatibility check implementation in CLIPC.

The compatibility warnings are issued when difference of indicator frequency or differences in bias-correction methods are identified between two indicators (see example in Figure 1). The warning is generated, in an automatic manner, after comparing the respective element pairs (frequency and bias correction) in the metadata o the data files. The compatibility check is automatic by taking advantages of the metadata. For a more in depth description on how the compatibility assessment operates please see Del8.1.

4 General guidance for different user-groups

Due the multitude of tasks that can be subsumed by real users under the general described in section 1, this deliverable opted to develop fictitious examples of situations where users require access to indicators or need to produce composite indicators of existing ones. Accordingly, the examples (and guidance steps) included in this deliverable do not aspire to be representative of the full scope of tasks requiring information on impact indicators, nor do they seek to represent state-of-the-art quantitative analysis. Instead, the examples serve as showcases on the use of particular functionalities of the data of the CLIPC portal.

4.1 Intermediate organization (or boundary worker)

4.1.1 Framing the task at hand

Give advice on data and climate impact indicators

An environmental consultant is commissioned to provide information of available data on sea-level rise to a company investing in a coastal resort in Lagos - a touristic city in the south of Portugal – for the purposes of conduct a risk analysis of flooding due to climate change. Accordingly, the consultant decides to provide the following information:

- Range of average sea-level rise data from the latest IPCC for the region of interest.
- First approximation of historical flood depth estimates of the 100yr storm surge for the region of interest.

The consultant opts to communicate its advice both in the form of spatial explicit maps and plots showing relevant ranges and historical flood extent.

NOTE: It is important to note that the collection of scenarios and data proposed constitutes only a fraction of what should be used for a more realistic coastal risk assessment. For more precise information a more in-depth analysis is needed - this should also be communicated to company requiring the data advice.

4.1.2 Data and functionalities for operating the task

For fulfilling the purpose of *advice on data and climate impact indicators to others*, the consultant needs to access the following data and functionalities in the CLIPC portal:

Data

- Indicators (under oceans and coast and precipitation and floods)
  - Sea level rise (rcp26)

- Sea level rise (rcp45)
- Sea level rise (rcp85)
- Flood depth

- Datasets (in the same order as the indicators)
  - slr_R-mean-2-5-2_PIK_ens-multiModel-mean-rcp26_avg_20500101-21000101_ 1986-2005
  - slr_R-mean-2-5-2_PIK_ens-multiModel-mean-rcp45_avg_20500101-21000101_ 1986-2005
  - slr_R-mean-2-5-2_PIK_ens-multiModel-mean-rcp85_avg_20500101-21000101_ 1986-2005
  - historical flood depths in the absence of coastal protection

CLIPC functionalities

- Time series
- Map viewer

4.1.3 Guidance steps on operating the task

Consider:
Entry point in the portal: http://www.clipc.eu/indicator-toolkit
For better results it is suggested that the user is logged in the CLIPC portal

1. Zoom to your region of interest.
2. Select the indicator "sea level rise" under the "Ocean and Coasts" menu in the "Select" tab.
3. Select the following datasets: slr_R-mean-2-5-2_PIK_ens-multiModel-mean-rcp26_avg_20500101-21000101_ 1986-2005; slr_R-mean-2-5-2_PIK_ens-multiModel-mean-rcp45_avg_20500101-21000101_ 1986-2005 and slr_R-mean-2-5-2_PIK_ens-multiModel-mean-rcp85_avg_20500101-21000101_ 1986-2005
4. Adjust the transparency to 50% in the "Active" tab by choosing the "opacity" option.
5. In the "Active" tab select the "time series" function.
6. Now click on the map in an ocean area close to the city of interest. A plot will appear showing the 2048 and 2099 average sea-level rise according to the dataset chosen (in the example below the plot refers to the dataset of RCP26 (see section 2 on reading datasets on CLIPC)).

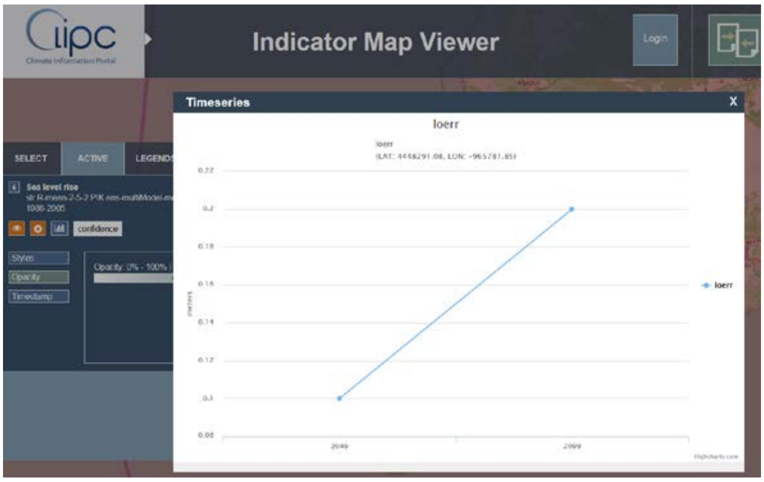


Figure 2 - Summary of the processes covered in steps 1 to 6.

7. Proceed by doing the same analytical steps for the remaining sea-level datasets (RCP45 and RCP85) and pointing down the respective estimates for 2049 and 2099.
8. In the “Select” tab now chose “Precipitation and Floods” the indicator the “100 year flood return level” and the “historical flood depth in the absence of coastal protection”.
9. Navigate to the region of interest and explore the estimate flood depth extent. If you want to know in depth details on how the data as created, consult the “i” button neighbouring each dataset.

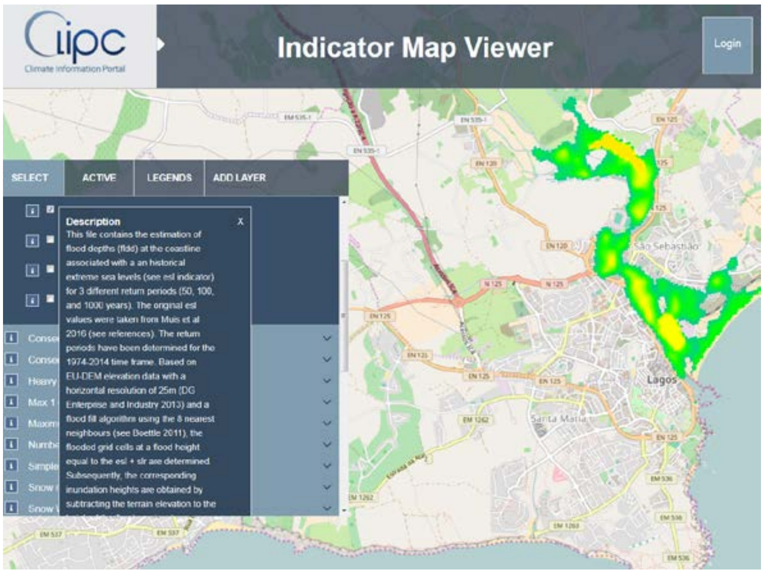


Figure 3 - Summary of the processes covered in steps 8 to 9.

Advantages of CLIPC:
- Ability to quickly derive regional time series of impact indicators.
- High-resolution datasets on particular impact indicators (e.g., flood depths).

Create awareness

An environmental agency is commissioned to hold a workshop about climate change and its associated impacts on agricultural production for Southern France. For the purposes of awareness raising the organization decides that the best way to raise awareness is to narrow the complex issue of "agricultural production" – something farmers are interested in - to the use of simpler metrics (see Figure 2), namely, future change in the value of yearly precipitation. Additionally, the agency would like to present the results aggregated to administrative levels of France, assuming that farmers would better identify the geographic extension of their activities. Accordingly, the consultant decides to provide the following information:

- Future change in the value of yearly precipitation aggregated by administrative region.

NOTE: It is important to note that in this simplification process a number of factors are not taken into account, so the results may give some idea of what may happen and raise awareness, but for more precise information more in-depth analysis is needed - this should also be communicated to the association and the farmers.

4.1.4 Data and functionalities for operating the task

For fulfilling the purpose of *awareness raising*, the consultant needs to access the following data and functionalities in the CLIPC portal:

Data

- Indicators (under precipitation and ecosystems)
  - Total wet-day precipitation (historical)
  - Total wet-day precipitation (rcp45)

- Datasets (in the same order as the indicators)
  - prcptot_icclim-4-2-3_KNMI_ens-multiModel_historical_r1i1p1_SMHI-RCA4_v1_EUR-44_SMHI-DBS43_EOBS10_bcref-1981-2010_yr_19700101-20051231
  - prcptot icclim-4-2-3 KNMI ens-multiModel rcp85 r1i1p1 SMHI-RCA4 v1 EUR-44 SMHI-DBS43 EOBS10 bcref-1981-2010 yr 20060101-20991231

CLIPC functionalities

- Combine function
- Spatial aggregation

4.1.5 Guidance steps on operating the task

Consider:
Entry point in the portal: http://www.clipc.eu/indicator_toolkit/combine.php
For better results it is suggested that the user is logged in the CLIPC portal

1. Select the precipitation and floods theme on the right side of the combine tool.

2. Load indicator 'total wet precipitation'.
3. Select the following dataset: prcptot icclim-4-2-3 KNMI ens-multiModel historical r1i1p1 SMHI-RCA4 v1 EUR-44 SMHI-DBS43 EOBS10 bcref-1981-2010 yr 19700101-20051231
4. Select the 1971-2000 time period
5. Load indicator 'total wet precipitation' in the left side of the combine tool
6. Select the following dataset: prcptot icclim-4-2-3 KNMI ens-multiModel rcp85 r1i1p1 SMHI-RCA4 v1 EUR-44 SMHI-DBS43 EOBS10 bcref-1981-2010 yr 20060101-20991231
7. Select the 2071-2100 time period
8. Select "none" in the normalization box
9. Select subtract in the process box
10. Name the output as "precipitation-change.nc"
11. Hit execute

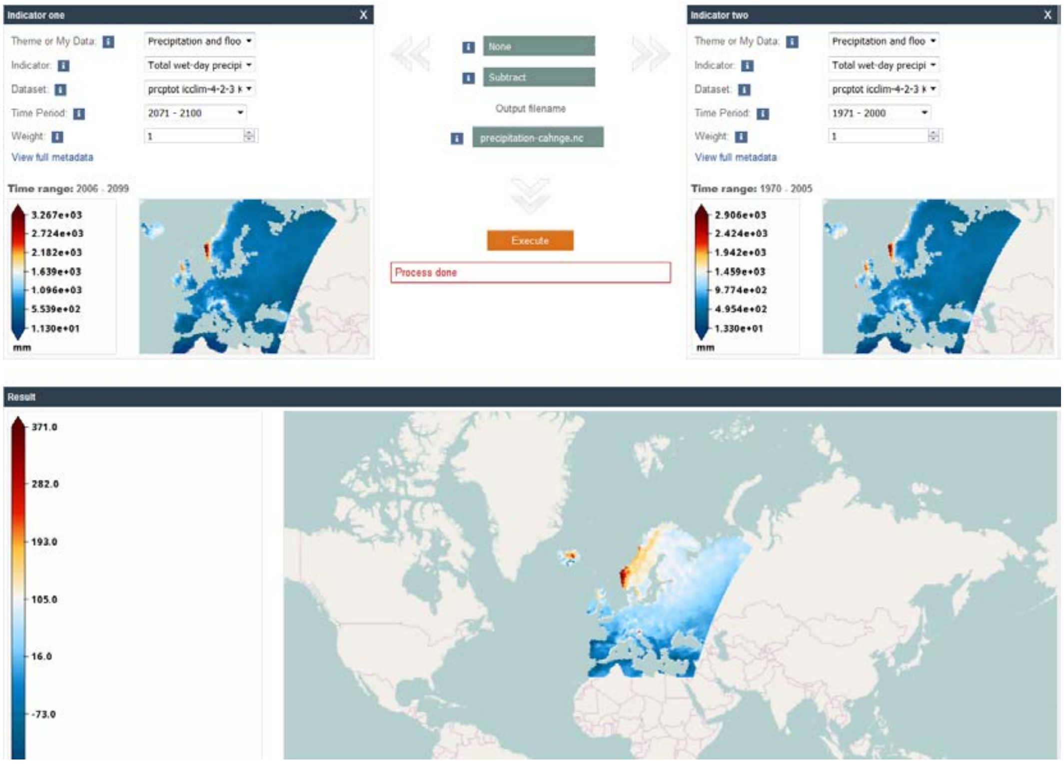
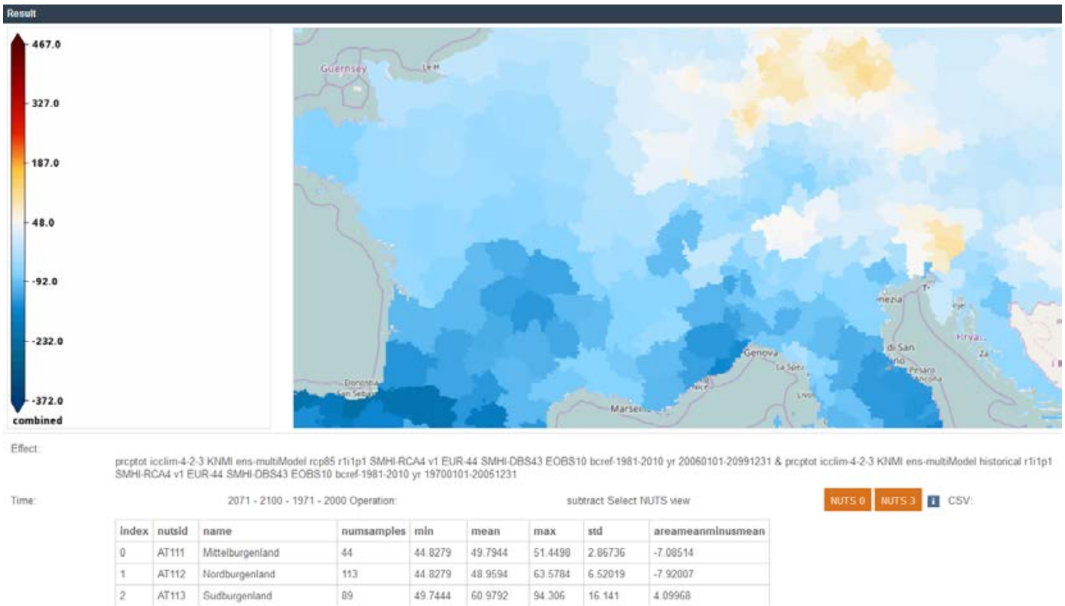


Figure 4 - Summary of the inputs and processes covered in steps 1 to 11.

12. In the bottom of the combine tool you will find the option to aggregate the results to NUTS3 level. Press the button and wait a few seconds as the process can be computation intensive.
13. Zoom in to Southern France to see the aggregated results both visually (map) and quantitatively (tabular form).



index	nutsid	name	numsamples	min	mean	max	std	areameanminusmean
0	AT111	Mittelburgenland	44	44.8279	49.7944	51.4498	2.86736	-7.08514
1	AT112	Nordburgenland	113	44.8279	48.9594	63.5784	6.52019	-7.92007
2	AT113	Sudburgenland	89	49.7444	60.9792	94.306	16.141	4.09968

Advantages of CLIPC:
- Flexibility to generate "change maps" across several indicators.
- Spatial aggregation of results.

4.2 Impact researcher

A relevant advantage of the CLIPC toolkit is its ability to be used as basis to produce simple vulnerability assessments for Europe with little knowledge requirements on data manipulation from the user side under the assumption that the user has a good understanding of the system to evaluate, and a vulnerability framework to guide the choice of indicators - such as the one shown in Figure 4.

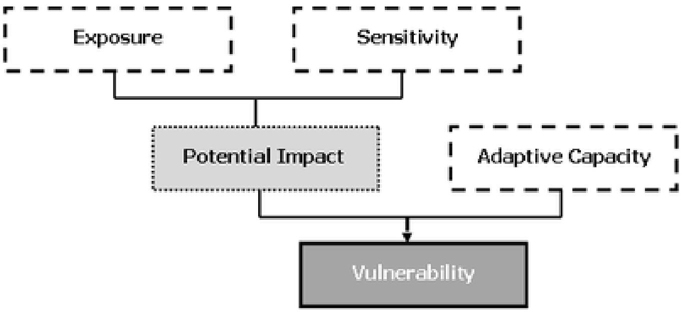


Figure 5 - Framework for vulnerability assessment (IPCC 2007)

For impact researchers, and intermediate organizations, the challenge is twofold: 1) to identify indicators within the CLIPC catalog that inform on the *exposure*, *sensitivity* and *adaptive capacity* dimensions of the systems they are interested, and 2) identify within the CLIPC toolkit the functionalities and operators that allow for a meaningful combination of the indicators in order to determine potential impacts and finally the vulnerability of the system. The advantages for each group of users (impact scientists and intermediate organizations) are obviously different. Impact researchers might use the potentialities of CLIPC to preform quick scans of vulnerable regions in which more in depth research should be conducted, or to quickly explore the potential of new data combinations. Intermediate organizations might be more attracted to the ability of independently combine large datasets without requiring external entities.

Whatever the real use might be, it is important to highlight that the CLIPC portal only delivers the technical possibilities, the input data, metadata information, the and for some cases details on data uncertainty. The portal allows for flexible combinations of data in order to accommodate different approaches to derive, in this case, a vulnerability indicator, but the final responsibility for the results and their interpretation lies with the user.

4.2.1 Framing the task at hand

Make risk and vulnerability assessments

From the perspective of developing a new regional climate adaptation strategy, a group of EU policymakers asks a researcher to do a fast quantitative assessment providing the first indication of regions in the Iberian Peninsula most vulnerable to heat. Since the group of EU policymakers demands for a vulnerability assessment the researcher decides to adapt the common IPCC 2005 understanding of vulnerability as interplay between the dimensions of *exposure*, *sensitivity* and *adaptive capacity* that is also commonly used in Europe, e.g. by the European Environment Agency. Accordingly, the consultant decides to provide:

- An aggregated indicator of the future vulnerability of human population to heat stress in the Iberian Peninsula.

She conceives the simple theoretical framework for a new heat vulnerability index (HVI), see Figure 5 as well as the analytical formulation and indicators required. For each vulnerability dimension (orange boxes) the researcher selects particular climate indicators and the mathematical operations between the indicators.

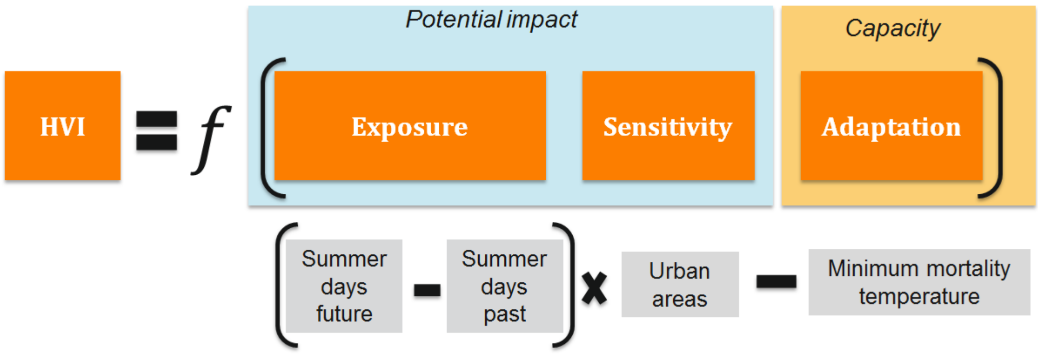


Figure 6 - Analytical vulnerability framework to assess the HVI

In short, the researcher takes the difference between future and past summer days as indication of exposure; future distribution of urban areas as an indication of sensitivity; and minimum mortality temperature as an indication of adaptive capacity.

NOTE: It is important to note that selection and combination of the indicators proposed is only one of many. The approach would certainly be different in case a second researcher would develop his view on the same problem.

4.2.2 Data and functionalities for operating the task

For fulfilling the purpose of *making risk and vulnerability assessments* and *input in research on climate*, the impact researcher needs to access the following data and functionalities in the CLIPC portal:

Data

- Indicators (under temperature and settlements)
  - Summer days (historical)
  - Summer days (rcp85)
  - Urban areas mainly residential (future)
  - Minimum mortality temperature (current)

- Datasets (in the same order as the indicators)
  - su cdo-1-6-3 GERICS ens-multiModel historical mixed ens-multiModel v1 EUR-11 yr 19700101-20051231
  - su cdo-1-6-3 GERICS ens-multiModel rcp85 mixed ens-multiModel v1 EUR-11 yr 20060101-20991231
  - urban arcgis-10-4-0 IRPUD JRC-LUISA-Landuse 10yr 20100101-2050123
  - mmt R-raster-2-5-2 PIK multi-mixed clim 19810101-20101231

CLIPC functionalities

- Combine tool

4.2.3 Guidance steps on operating the task

Consider:
Entry point in the portal: http://www.clipc.eu/indicator_toolkit/combine.php
You have to be logged in the CLIPC portal to complete this example

1- Select the temperature theme on the left side of the combine tool.

2- Load indicator ‘summer days’.

3- Select the following dataset: su cdo-1-6-3 GERICS ens-multiModel rcp85 mixed ens-multiModel v1 EUR-11 yr 20060101-20991231

4- Select the 2031-2050 time period

5- Load indicator ‘Summer days’ in the right side of the combine tool

6- Select the following dataset: su cdo-1-6-3 GERICS ens-multiModel historical mixed ens-multiModel v1 EUR-11 yr 19700101-20051231

7- Select the 1981-2000 time period

8- Select “none” in the normalization box

9- Select subtract in the process box

10- Name the output as “su-change.nc”

11- Hit execute

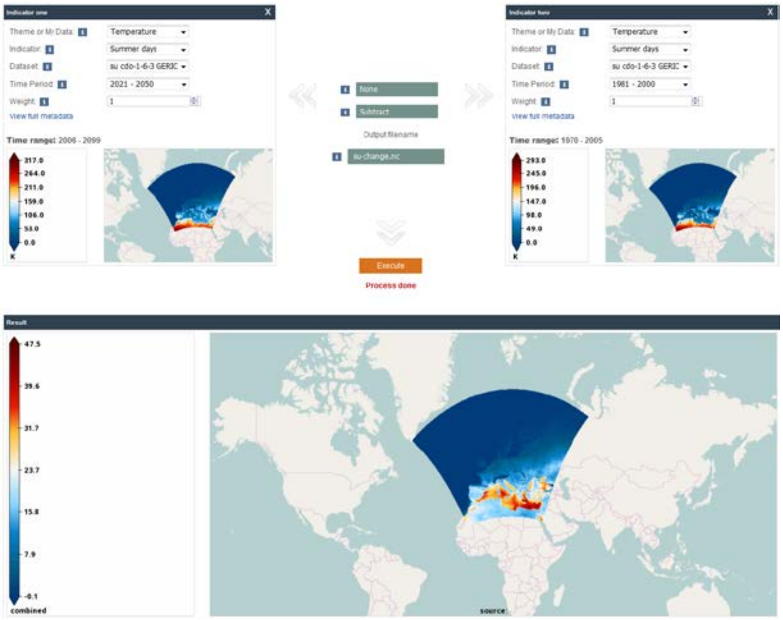


Figure 7 - Summary of the inputs and processes covered in steps 1 to 10.

10. Load the “su-change.nc” dataset (“my data” dropdown) on the left side of the combine tool (note that you need to be logged in to access this functionality!)

11. Select the “settlements” theme in the right side of the combine tool

12. Select the indicator “Area of urban, mainly residential land”

13. Select the following dataset: urban arcgis-10-4-0 IRPUD JRC-LUISA-Landuse 10yr 20100101-2050123

14. Select the 2021-2050 time period

15. Select “min-max” in the normalization box

16. Select “multiply” in the process box

17. Name the output file as “su-urb.nc” and press execute.

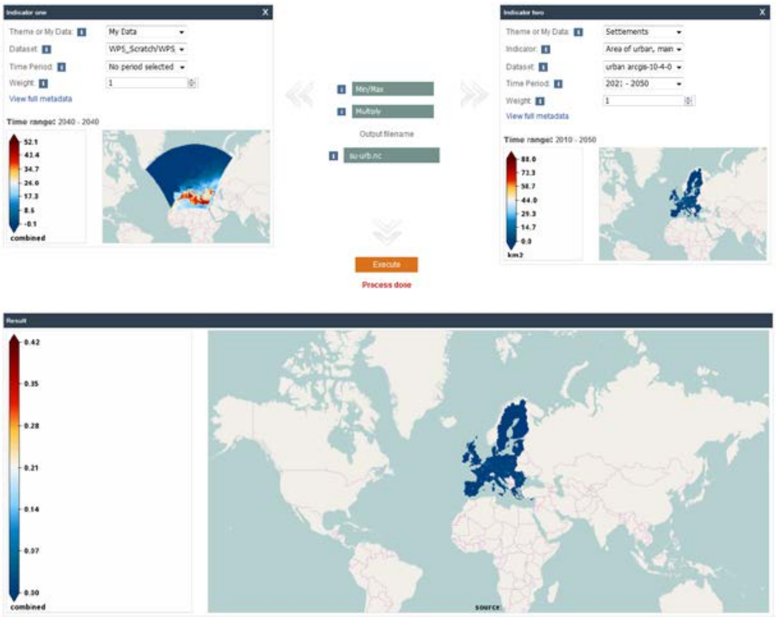


Figure 8 - Summary of the inputs and processes covered in steps 11 to 18.

18. In the combine tool load the “su-urb.nc” indicator on the left
19. On the right side select the “settlements” theme
20. Select the indicator “Minimum Mortality Temperature”
21. Select the following dataset: mmt R-raster-2-5-2 PIK multi-mixed clim 19810101-20101231
22. Chose “min-max” in the normalization box
23. Chose “subtract” in the process box
24. Save your results as “hvi.nc”

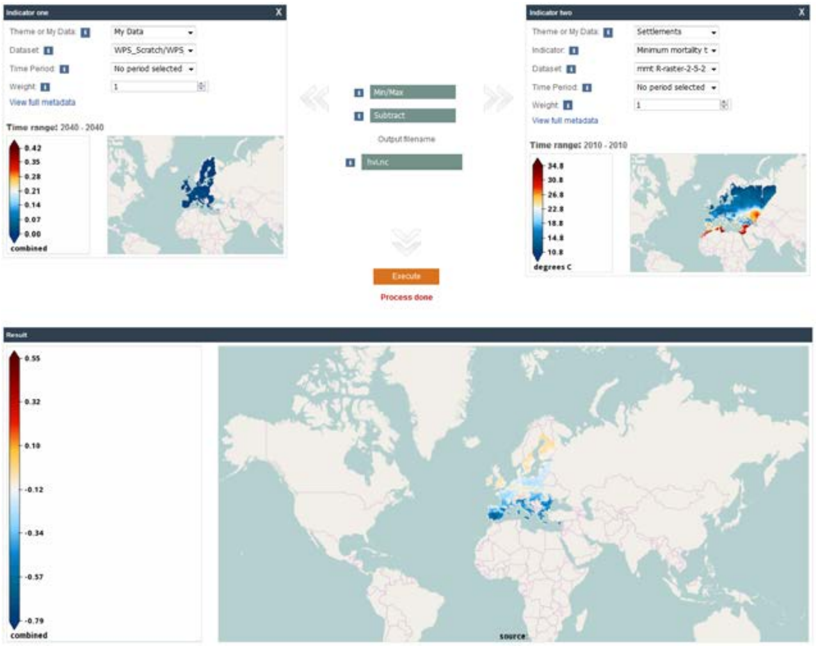


Figure 9 - Summary of the inputs and processes covered in steps 19 to 25.

The

Advantages of CLIPC:
- Flexibility to combine multiple climate and non-climatic indicators.
- Built-in normalization functions and operators.
- On-demand averaging of impact indicators.
- Ability to process data remotely and use the results as inputs for further calculations.
- Download of results.

Input in research on climate change

In the course of a long drive during early spring, an impact researcher becomes puzzled as to why vegetation growth in some geographic locations in central Europe appears to be well underway, while in other locations it has not even started, even though the ambient temperatures in all locations appear to be the same. He sets out to determine:

- The geographic sensitivity of vegetation growth to temperature in Europe.

For the purposes of evaluating the response function of vegetation growth to temperature the impact researcher conceives a simple theoretical framework shown in Figure 4 (top) as well as the analytical formulation and indicators required (bottom).

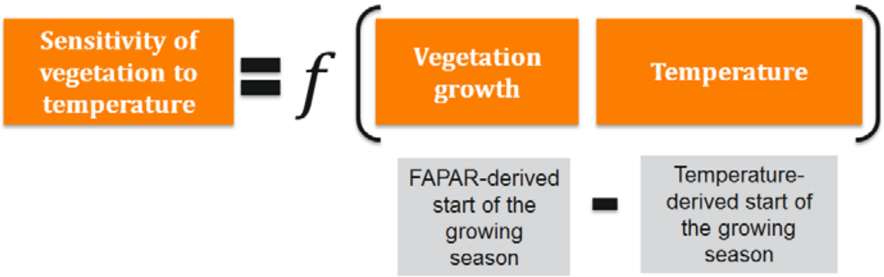


Figure 10 - Analytical framework to assess the sensitivity of vegetation response to temperature

He knows that the start of the growing season is a good indicator of when the conditions are suitable for vegetation to develop. Even better, this indicator seems to be available for two distinct methodologies, namely, one that only makes use of meteorological observations from weather stations (i.e. daily average temperature) and a second one that uses information on vegetation growth measured by satellite (i.e. the so-called Fraction of Absorbed Photosynthetically Active Radiation, or FAPAR). A difference, or time-lag, between the dates for the start of the growing season from these two approaches, indicate the sensitivity of vegetation growth to temperature across Europe.

NOTE: It is important to note that example here provided is fictitious. Sorry for those of you who though it was real. The example is used to highlight the advantage of quickly preforming averaging routing over large data sets in CLIPC and combining them in order to provide first insights on particular questions impact research might want to test.

4.2.4 Data and functionalities for operating the task

For fulfilling the purpose of *making risk and vulnerability assessments* and *input in research on climate*, the impact researcher needs to access the following data and functionalities in the CLIPC portal:

Data

- Indicators (under temperature and settlements)
  - Start of the Growing Season (temperature derived)
  - Start of the Growing Season (FAPAR derived)

- Datasets (in the same order as the indicators)
  - sgs induce-1-0-0 EC-JRC MARS-AGRI4CAST yr 19750101-20151231 1975-2015
  - sgssat pheno JRC 1.0 EC-JRC FAPAR JRC yr 19980101-20111231 1998-2011

CLIPC functionalities

- Combine tool
- Map viewer

4.2.5 Guidance steps on operating the task

Consider:
Entry point in the portal: www.clipc.eu/impact-indicators/direct-access-to-compare-function
For better results it is suggested that the user is logged in the CLIPC portal

1. Select the ecosystem theme on the left side of the combine tool.
2. Load indicator ‘start of the growing season’.
3. Select the following dataset: sgssat pheno JRC 1.0 EC-JRC FAPAR JRC yr 19980101-20111231 1998-2011
4. Select the 2010 time stamp
5. Load indicator ‘start of the growing season’ in the right side of the combine tool
6. Select the following dataset: sgs induce-1-0-0 EC-JRC MARS-AGRI4CAST yr 19750101-20151231 1975-2015
7. Select the 1991-2010 time period
8. Select “none” in the normalization box
9. Select subtract in the process box
10. Name the output as “gst-change.nc”
11. Hit execute

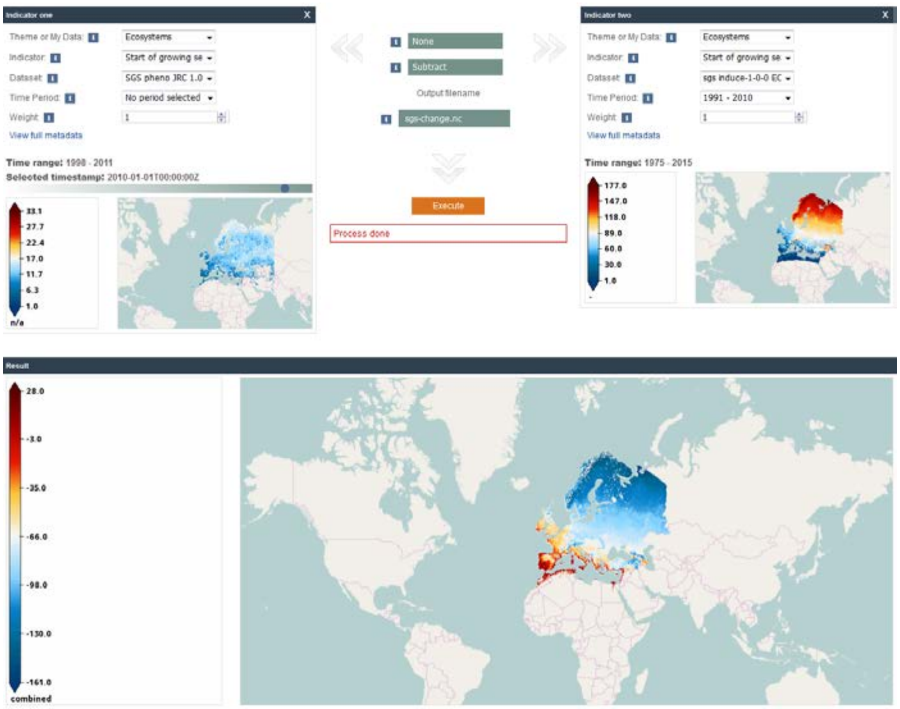


Figure 11 - Summary of the inputs and processes covered in steps 1 to 11.

The result shows, for a given year, the time-lag between the start of the growing season, as defined by the period warm enough for vegetation growth (i.e. average daily temperatures above 5°C), and the actual start of vegetation growth, as measured by satellite. Differences in the time-lag for different geographic locations highlight variations in temperature sensitivity of spring vegetation growth across Europe.

4.3 Climate scientist

4.3.1 Framing the task at hand

Give advice on data and climate impact indicators

A climate scientist is asked for advice on data regarding extreme rain fall projections by an insurance company for the purpose of differentiating flood damage insurance rates between different regions in France. The climate researcher is faced with a paradox. On the one hand, she does not want to spend much time on this task, on the other side she fears that wrong decisions might be taken in case appropriate information on uncertainty is not delivered to the insurance company. In order to provide guidance, the climate researcher envisions providing the insurance company basically two products:

1 - A plot showing the multi-model uncertainty ranges of heavy precipitation.
2 - Climate signal map showing the regions in which the change is robust.

The first information would highlight the possible ranges of heavy precipitation in the future while the second product would highlight the robustness, or lack of, of the projections.

NOTE: It is important to note that example here provided is fictitious. The example is used to highlight the advantage of using CLIPC to provide information on ranges of projections and the associated multi-model robustness.

4.3.2 Data and functionalities for operating the task

Give advice on data and climate impact indicators to others

Data

- Indicators (under precipitation and floods)
  - Heavy precipitation days (rcp85)
  - Heavy precipitation days (climate signal map)

- Datasets (in the same order as the indicators)
  - r10mm cdo-1-6-3 GERICS ens-multiModel rcp85 mixed ens-multiModel v1 EUR-11 yr 20060101-20991231
  - r10mm python-2-7-6 GERICS ens-multiModel-climatesignalmap-rcp85-EUR-11 yr 20700101-20991231 1971-2000

CLIPC functionalities

- Time series tool
- Compare tool

4.3.3 Guidance steps on operating the task

Consider:
Entry point in the portal: www.clipc.eu/impact-indicators/direct-access-to-compare-function
You <u>do not have</u> to be logged in the CLIPC portal to complete this example

1. Select the precipitation and floods theme on the left side of the compare tool.
2. Load indicator ‘heavy precipitation days’.
3. Select the following dataset: r10mm cdo-1-6-3 GERICS ens-multiModel rcp85 mixed ens-multiModel v1 EUR-11 yr 20060101-20991231´
4. Select the 2081-2100 time period
5. Load indicator ‘heavy precipitation days’ in the right side of the combine tool
6. Select the following dataset: r10mm python-2-7-6 GERICS ens-multiModel-climatesignalmap-rcp85-EUR-11 yr 20700101-20991231 1971-2000
7. Frame the map window by zooming and panning so that France becomes visible.
8. Tick the “climate signal maps” box under the second map.

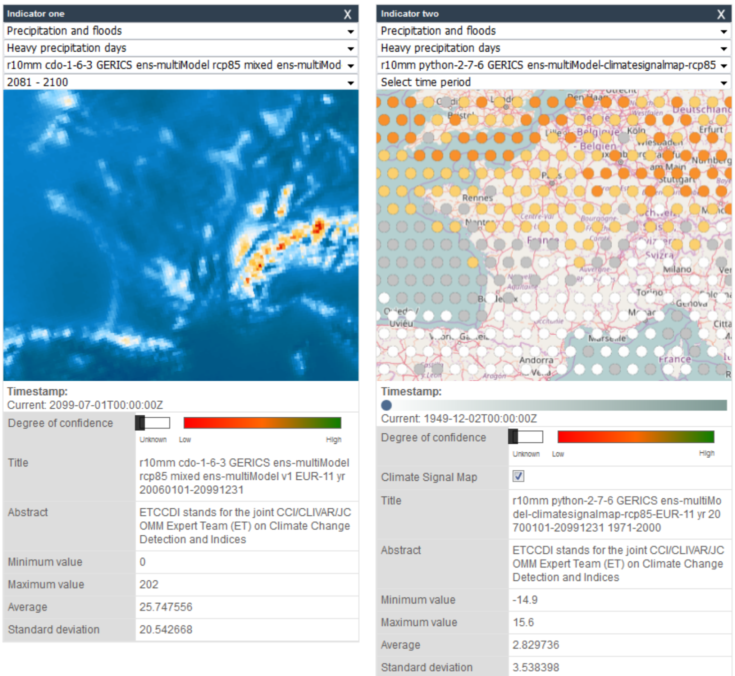


Figure 12 - Summary of the inputs and processes covered in steps 1 to 8.

Advantages of CLIPC:
- Side-by-side comparison of the impact indicator and the robustness of the data.
- Side-by-side comparison of simple data statistics.

5 Challenges

It is not always possible to know in advance the question/task for which particular users require guidance, as well as the heterogeneity of users interested on impact indicators – at least in a climate portal with the characteristics of CLIPC. The formulation of examples of uses of indicators and functionalities of any portal will have to be aware that often guidance can only be formulated on the meta-level, that is, in a general way and for an overarching purpose (e.g., create awareness) and not for the very particular case.

A recurrent point in the consultation feedback was the apparent difficulty of potential users in reading the data-files in the CLIPC portal and toolkit. Although guidance on how to read them has been developed in this deliverable, it is foreseeable that some difficulties will persist within users that are not experienced with the file-naming standard chosen in CLIPC. The challenge for future guidance will be to balance the use of standardized names for the datasets of impact indicators (fundamental for better integration and organization of datasets in the portal and processing tools), while at the same time tailoring the complexity of their names to the user in question. How to achieve this remains in our understanding an open point for debate.

The development of guidance has sometimes to balance the contradictory requests of potential users. An example of this challenge was perceived during the development of the CLIPC portal where users requested both flexibility in the combination of indicators and guidance on the interpretation of the outcomes of the combination. Allowing for enhanced flexibility on the combination of indicators implies at certain extent to rely more on the expertise and knowledge of potential users. This is because the amount of potential combinations is so large that developing guidance on the interpretation of results is not feasible. This highlights the limits for developing guidance in similar portals like CLIPC.

6 Conclusions

The deliverable developed guidance steps on the use and production of impact indicators for a number of purposes reported in Del7.2. The examples here provided were formulated from overarching data usage purposes envisioned by the potential users. Hence they are not comprehensive or entirely specific regarding the full variety of potential purposes. They constitute nevertheless valid entry points for users to get familiar with the CLIPC portal, its main features and its main potentialities. Furthermore, the examples and guidance provided do not replace the need for more expert judgments and consultation. Instead, the examples give users guidance on how to preform simple analysis using impact indicators that can be transposed or adapted to particular needs they have.

Guidance is developed for a total of 5 working examples, contemplating the use of impact indicators along for the purposes of using data as input in research on climate change, raise awareness, make risk and vulnerability assessments, and giving advice on data and climate impact indicators to others. For the latter two examples are provided. In addition to the examples provided, guidance on how to read the data-files in CLIPC was elaborated for less experienced users.

References

Groot A., Betgen C., Dubois G., Roth E., Dhenain S., Swart R., Mañez M., 2015, User requirements, part 2 Climate (impact) data requirements of different user groups, CLIPC deliverable (WP2).

Intergovernmental Panel on Climate Change (IPCC), 2007, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 717-743.