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List of Abbreviations

DSP	Data Sharing Platform
GHG	Greenhouse Gas
IQR	InterQuartile Range
LAU	Local Administrative Units
NUTS	Nomenclature of Territorial Units for Statistics - the acronym stems from French: Nomenclature des Unités Territoriales Statistiques
R&V	Risk and Vulnerability
RCP	Representative Concentration Pathway
SECAP	Sustainable Energy and Climate Action Plan
GCM	Global Climate Model
RCM	Regional Climate Model
WP	Work Package

Executive Summary

Deliverable D2.5 concerns a database of climate and remote sensing data for all of the 27 EU countries. This deliverable is the final outcome of Task T2.3. The deliverable serves as a successor to D2.4, which concerned the same data for three EU countries - Germany, Poland, and Spain. The purpose of this two-stage approach was to assess potential issues with the data gathering and data processing early on and to establish a uniform workflow and a unified data representation.

Apart from climate data, the climate impact data, i.e. the data relating to hazards that are caused by climate change, is also considered. The climate and climate impact data are considered for different future climate scenarios. The LOCALISED project requires data at a high spatial resolution; the data is therefore collected at the NUTS3 regional level, i.e. the level 3 of the Nomenclature of Territorial Units for Statistics.

The data was gathered from EURO-CORDEX as this provides a common source that has the required data for the member states. Various other metrics are required to perform spatial disaggregation at a later stage in the project; this overlaps with T3.2 and a description of the data and sources collected for this purpose can be found in D3.3.

1. Introduction

This deliverable, D2.5, is the final outcome of Task T2.3, which focuses on the collection and provisioning of climate projections and climate impact data for different climate scenarios, for use in the LOCALISED project. The different levels of warming pose different opportunities and constraints for adaptation options in Work Package (WP) 4. The data will also be used in WP5 for the work on Risk and Vulnerability (R&V) assessment in Sustainable Energy and Climate Action Plan (SECAPs).

T2.3 is closely related to T3.2 in WP3, as both deal with data collection. It was opted to divide the data collection into two themes - climate and non-climate related data. The climate related data is discussed in this report and a discussion on non-climate data can be found in the D3.3 (Verstraete et al. 2023). The idea behind this is to thematically separate the climate data from other data, as both the sources and the data structures tend to be different.

The deliverable is a successor of D2.4, where data was provided only for three EU countries - Germany, Poland and Spain. The idea here was to gather data requirements from different WPs in the project and identify potential issues that can arise during the data collection process for other countries. The insights gained during the data collection for these three countries allowed us to prepare the general workflow.

Please note that this report provides details regarding the data collection process and the datasets collected. The datasets itself can be found in Appendix 1 and 2 of this report and also can be queried using the LOCALISED Data Sharing Platform (DSP).

2. Data Aspects

2.1 Data Collection

The data collected in the LOCALISED project roughly falls into the following three categories:

- *Climate projections*: Examples of climate data are temperature, humidity or precipitation. The climate projections are the future values that are provided under the assumption of a Representative Concentration Pathway (RCP). The datasets, which are determined through simulations and climate models, are openly available.
- *Climate impact data*: These datasets provide the projected hazard frequency, intensity, etc for different RCPs. Examples of hazards are heat waves, cold waves, fire-risk, etc.
- *Non-climate data*: Regional spatial features to support the spatial disaggregation of national decarbonisation pathways to a regional level. For example,

agricultural land, road network, power-plant locations, etc. This last category bears a close connection with the data collected in T3.2. Therefore, this data can be found in the report of D3.3.

2.2 Challenges

2.2.1 Spatial Resolution

The aim of LOCALISED is to provide knowledge at level 3 of Nomenclature of territorial units for statistics (NUTS) region definitions. Where possible, the project aims to provide data at a lower level i.e., Local Administrative Units (LAU) region definitions. The workflow is simplified by downscaling all the collected data to LAU level. If data at a higher level is requested, the data is simply aggregated to the respective level.

When it comes to climate data, however, downscaling is not straightforward. The RCP model simulations are grid-based and use fixed pixel sizes. These pixels have no correlation with NUTS or LAU regions. However, in terms of their sizes, the pixels are comparable to NUTS3 regions in most cases. In the light of this, we prepare the final data at LAU level in the following two stages:

1. The datasets are mapped to the NUTS3 regions. This is achieved by determining all the grid cells that intersect with each NUTS3 region and a mean of values in these cells is calculated. A mapping based on weighted average, with area of pixel overlap being the weight, may be considered in the future.
2. The value per NUTS3 region is downscaled to LAU. This is performed in a trivial way: the values for each LAU region matches that of its containing NUTS3. The purpose of this is not to increase the spatial resolution of the data, but to make it easier to align the climate datasets with other datasets. While this is not always accurate, it was identified as the only feasible option.

2.2.2 Missing Data

Climate data tends to be available for large regions, which minimises the risk of data not being available in specific areas. However, it was discovered that the climate indicators were missing for the autonomous Canary Islands in Spain, the autonomous Azores and Madeira islands in Portugal and the overseas territories of France.

Filling the missing values for these regions, based on the values in other regions, is not feasible because these regions tend to have different climate conditions than mainland Europe, given their distance to mainland Europe and also considering that they are islands. Therefore, a separate modelling procedure is required for these regions. This is a lot of effort. Given that the number of such regions is small and the population density is relatively low, the cost of this work is higher than the benefits from such work. Following this discovery, the project and the tools developed in LOCALISED will be targeted to the mainland EU.

3. Data

3.1 Climate Projections

The climate projections data is collected from EURO-CORDEX (D. Jacob et al., 2014). The results of EURO-CORDEX aim to serve as input for climate change impact and adaptation studies, making it a perfect source of data for the work being carried out in LOCALISED.

As per the project proposal, the climate projections should be provided for a 1.5°C, 2°C and 3°C world, corresponding to RCP1.9, RCP2.6 and RCP4.5, respectively. However, ambitious long-term climate commitments at the EU-level and other major emitters (XIA, N. 2022), the evolution of unmitigated global GHG emissions (Friedlingstein et al. 2022) and faster than expected deployment of renewable energies (IEA, 2022) are significantly changing the likelihood of future climate projections. On the positive side, between 2010 and 2019, the unit costs[1] of solar energy, wind energy and lithium-ion batteries have been reduced by 85%, 55% and 85%, respectively (Lee et al, 2023). Even if current mitigation policies were reversed, the cost would continue to fall, reducing the likelihood of RCP6.0, RCP7.0 or RCP8.5 (conceived originally as "no-policy" scenarios). On the negative side, a systematic analysis of 414 emissions scenarios modelled for the 1.5°C special report (SR1.5) of the IPCC (Rogelj et al 2018) concluded only minority (50) of the scenarios offer a fair chance of staying below 1.5°C by the end of the century with reasonable deployment of conventional mitigation options (Warszawski et al, 2021). A systematic evaluation of similar developments and constraints concluded that current policy scenarios are more likely to lead to GHG concentrations between the RCP3.4 and RCP4.5 levels. In case all countries honour their zero emission pledges made at COP26, concentration levels will be close to the RCP2.6 level (Venmans & Carr 2022).

Climate indicators and climate impacts will serve the purpose of informing municipalities on the risks and expected losses from climate change, as well as the choice of feasible adaptation options. Therefore, it is important to limit the range of expected climate change to “more likely” scenarios as opposed to all possible scenarios. Although attributing higher likelihood to emissions scenarios has always been a controversial topic in climate change science (King et al, 2015), when specialists refuse to assign probabilities, users often do so themselves (Hausfather & Peters 2020). Therefore, optimally, the LOCALISED project should align with the best scientific evidence and provide users with an informed and most likely range of climate change indicators for adaptation between about 2°C and 3°C world, corresponding to RCP2.6, RCP4.5 and RCP6.0. Unfortunately, aligning with this strategy would bring the tradeoff of having to operate with low-resolution (typically around 100 and 250 km). CMIP6 data for RCP6.0 has not yet been regionalized by the CORDEX initiative for the European domain - with resolutions between 25 and 44 km. Although recently a subset of CMIP6 data with

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[1] For solar and wind, unit costs refer to installation, capital, operations, and maintenance costs per MWh of electricity produced. For batteries, it refers to costs for 1 kWh of battery storage capacity.

resolution comparable to CORDEX has been released (Noël et al 2022), it does not yet comprise the selection of aforementioned RCPs and is limited to only two climate variables. Given that the LOCALISED scale of NUTS3 demands employing the highest spatial resolution possible for both current and future climate, for the time being the tradeoff is made towards spatial resolution in determinant of a more sensible selection of RCPs. In conclusion, information on climate change indicators in LOCALISED will be provided for RCP2.6, RCP4.5 and RCP8.5.

The climate indicators we collected projected data for are precipitation, temperature, cooling degree days and heating degree days. For each of these indicators, the data is collected for years 2020-2099. A complete report on this data can be found in Appendix 1 of this report.

Table 1 - Information requirements for hazard assessment in the SECAP template

	Probability of a hazard	Impact of a hazard	Change in hazard intensity	Change in hazard frequency	Time frame
SECAP definition	"Probability" is not explicitly defined, but cities appear to interpret it as events/year.	"Impact" is defined as the hazard effect on "human and natural systems"	Not explicitly defined	Not explicitly defined	Defined as the time frame when risk of hazard frequency/intensity of hazard is expected to change.
Classification	Low, moderate, high, or not known.	Low, moderate, high, or not known.	Increase, decrease, no change or not known.	Increase, decrease, no change or not known.	short-term (20-30 yr from now), mid-term (after 2050), or long-term (around 2100).

3.2 Climate Impact Data

The climate impact data collected in the LOCALISED project complies with the information requirement in the R&V section of the SECAP template as downloaded from the Covenant of Mayors website on 20-09-2022. The R&V section requires that information on hazards is available for five categories: Probability of a hazard, impact of a hazard, change in hazard intensity, change in hazard frequency and time frame (see Table 1). These categories need to be provided for the largest number of hazards affecting a city. In the SECAP template the final information on the five categories takes the form of a qualitative statement as shown in Table 1, for example, "low", "moderate", "high"; or "short-term", "mid-term" or "long-term".

Table 2 - Data sources and methodological details for SECAP hazard analysis

Climate hazard	Probability of a hazard	Impact of a hazard	Change in hazard intensity	Change in hazard frequency	Time frame
Heat wave	**Data:** EURO-CORDEX **GCMs:** NorESM1-M, MPI-ESM **RCMs:** REMO2015, RCA4, REMO2009 **Quantitative method:** The empirical probability of the number of heat waves days within the summer season of June, July, and August between 1971-2005. We define a heat wave day as exceeding the 90th percentile of the daily minimum and maximum temperature for three consecutive days for a 30-year climatology (2071-2000). **Qualitative classification:** See section 3.2.1	**Data:** (Masselot et al, 2023) Seydewitz et al 2023 (in preparation) **Key attribute:** Temperature-related mortality relative risk per age group Annual mean crop damage attributable to heat wave occurrence. **Qualitative classification:** Mortality less than 1% = low, between 1 and 1.5% = moderate, more than 1.5% = high Mean crop damage less than 5% = low, between 5-20% moderate, more than 20% high	**Data:** EURO-CORDEX **GCMs:** NorESM1-M, MPI-ESM **RCMs:** REMO2015, RCA4, REMO2009 **Quantitative method:** We use a Mann-Kendall-Trend test, with an alpha of 0.05, on the total number of heat wave days and the longest heat wave per year between 2021 and 2100. Heat waves are defined according to the description given in the column probability of a hazard. **Qualitative classification:** See section 3.2.2	**Data:** EURO-CORDEX **GCMs:** NorESM1-M, MPI-ESM **RCMs:** REMO2015, RCA4, REMO2009 **Quantitative method:** We use a Mann-Kendall-Trend test, with an alpha of 0.05, on the frequency of heat wave days per summer season from June to August between 2021 and 2100. Heat waves are defined according to the description given in the column probability of a hazard. **Qualitative classification:** See section 3.2.2	**Data:** EURO-CORDEX **GCMs:** NorESM1-M, MPI-ESM **RCMs:** REMO2015, RCA4, REMO2009 **Quantitative method:** We use Pettitt's test for change point detection, with an alpha of 0.05, on the yearly heat wave frequency and intensity sequences. **Qualitative classification:** See section 3.2.3
Cold wave	**Data:** EURO-CORDEX **GCMs:** NorESM1-M, MPI-ESM **RCMs:** REMO2015, RCA4, REMO2009	**Data:** (Masselot et al, 2023) Seydewitz et al 2023 (in preparation) **Key attribute:** Temperature-	**Data:** EURO-CORDEX **GCMs:** NorESM1-M, MPI-ESM **RCMs:** REMO2015,	**Data:** EURO-CORDEX **GCMs:** NorESM1-M, MPI-ESM **RCMs:** REMO2015,	**Data:** EURO-CORDEX **GCMs:** NorESM1-M, MPI-ESM **RCMs:** REMO2015,

	Quantitative method: The empirical probability of the number of cold wave days within the winter season of December, January, and February between 1971-2005. We define a cold wave day as falling below the 10th percentile of the daily minimum and maximum temperature for three consecutive days for a 30-year climatology (2071-2000). **Qualitative classification:** See section 3.2.1	related mortality relative risk per age group Annual mean crop damage attributable to cold wave. **Qualitative classification:** As above	RCA4, REMO2009 **Quantitative method:** We use a Mann-Kendall-Trend test, with an alpha of 0.05, on the total number of cold wave days and the longest cold wave per year between 2021 and 2100. Cold waves are defined according to the description given in the column probability of a hazard. **Qualitative classification:** See section 3.2.2	RCA4, REMO2009 **Quantitative method:** We use a Mann-Kendall-Trend test, with an alpha of 0.05, on the frequency of cold wave days per winter season from December to February between 2021 and 2100. Cold waves are defined according to the description given in the column probability of a hazard. **Qualitative classification:** See section 3.2.2	RCA4, REMO2009 **Quantitative method:** We use Pettitt's test for change point detection, with an alpha of 0.05, on the yearly cold wave frequency and intensity sequences. **Qualitative classification:** See section 3.2.3
Heavy precipitation	**Data:** EURO-CORDEX **GCMs:** NorESM1-M, MPI-ESM **RCMs:** REMO2015, RCA4, REMO2009 **Quantitative method:** The empirical probability of the number of days with a total precipitation above 20mm between 1971-2005. **Qualitative classification:** See section 3.2.1	**Data:** (Rentschler et al, 2022) (Paprotny & Mengel, 2023) (Lange et al, 2020) **Key attribute:** First two datasets population and GDP exposed to pluvial flooding. Annual fraction of land exposed to floods. **Qualitative classification:** Contingent to	**Data:** EURO-CORDEX **GCMs:** NorESM1-M, MPI-ESM **RCMs:** REMO2015, RCA4, REMO2009 **Quantitative method:** We use a Mann-Kendall-Trend test, with an alpha of 0.05, on the total number of days with precipitation above 20mm and the	**Data:** EURO-CORDEX **GCMs:** NorESM1-M, MPI-ESM **RCMs:** REMO2015, RCA4, REMO2009 **Quantitative method:** We use a Mann-Kendall-Trend test, with an alpha of 0.05, on the frequency of days with precipitation above 20mm year from	**Data:** EURO-CORDEX **GCMs:** NorESM1-M, MPI-ESM **RCMs:** REMO2015, RCA4, REMO2009 **Quantitative method:** We use Pettitt's test for change point detection, with an alpha of 0.05, on the yearly heavy precipitation frequency and intensity sequences.

		the value of land area flooded.	maximum five days precipitation per year between 2021 and 2100. **Qualitative classification:** See section 3.2.2	December to February between 2021 and 2100. **Qualitative classification:** See section 3.2.2	**Qualitative classification:** See section 3.2.3
Fire-risk	**Data:** EURO-CORDEX **GCMs:** MPI-ESM, EC-Earth **RCMs:** RCA4 **Quantitative method:** The empirical probability of moderate, high and very-high fire-risk days within the fire season from June-September between 1971-2005. We define moderate, high, and very-high fire-risk days according to the European Forest Fire Information System (EFFIS) classification schema for the fire weather index. **Qualitative classification:** See section 3.2.1.	**Data:** (Lange et al, 2020) **Key attribute:** Annual relative fraction of land burnt. **Qualitative classification:** Contingent to the value of land area burnt fraction.	**Data:** EURO-CORDEX **GCMs:** MPI-ESM, EC-Earth **RCMs:** RCA4 **Quantitative method:** We use a Mann-Kendall-Trend test, with an alpha of 0.05, on the total number of moderate, high, and very-high fire-risk days per year between 2021 and 2098. Fire-risk days are defined according to the description given in the column probability of a hazard. **Qualitative classification:** See section 3.2.2	**Data:** EURO-CORDEX **GCMs:** MPI-ESM, EC-Earth **RCMs:** RCA4 **Quantitative method:** We use a Mann-Kendall-Trend test, with an alpha of 0.05, on the frequency of moderate, high, and very-high fire-risk days per fire season from June to September between 2021 and 2098. Fire-risk days are defined according to the description given in the column probability of a hazard. **Qualitative classification:** See section 3.2.2	**Data:** EURO-CORDEX **GCMs:** MPI-ESM, EC-Earth **RCMs:** RCA4 **Quantitative method:** We use Pettitt's test for change point detection, with an alpha of 0.05, on the yearly moderate, high, and very-high fire-risk frequency and intensity sequences. **Qualitative classification:** See section 3.2.3

Table 2 provides an insight into the data collected and methodologies developed thus far. Beyond the challenge of data availability and developing methodologies to identify and quantify various hazards and impacts at the European scale, there is the particular imposition of SECAPs demanding quantitative impact data to be translated into qualitative statements - see Table 1. In the context of local communities, the conversion of quantitative statements into qualitative ones for the purposes of SECAP reporting has been conducted for each hazard specified in Table 2 (Manzan et al, 2022). Guidance on how to undertake such classifications are partly in the SECAP guidelines and constrained to the case of probability of hazard (first category in Table 1). In this regard, the guidance is that probabilities above 5% are classified with the statement "high"; probabilities between 0.05% and 5% are classified with the statement moderate; probabilities between 0.005% and 0.05% are classified with the statement "low"; and finally, the non-observation of the phenomenon or the inability to determine its probability in a reliable manner is classified with the statement "not known". For the remaining information categories in Table 1, no instructions are reported in the SECAP on how to transform quantitative hazard data into qualitative statements. This implies that to some extent the definition of the classification method is left to the analyst and hence we detail below the approach followed in LOCALISED.

First of all, it is important to consider the categories dealing with information on the hazard (columns 1, 3, 4 and 5 - Table 1) and those dealing with information on impact (column 2 in Table 1) in a distinct way. While for the case of hazard, the data used for quantification is almost exclusively in the form of climatic time series (modelled); for the case of impact quantification data, this is more-often-than-not a specific methodology that takes into account climate data but also goes beyond it to align with the SECAP definition of impact as the effect of climate in natural and human systems. In the light of this, this deliverable proposes the approach detailed in the following sections.

3.2.1 Probability of a Hazard

The conversion of quantitative "hazard probability" data into qualitative statements follows the guidelines proposed in the SECAPs summarised beforehand. We introduce an extra class, "uncertain", to account for the multi-model setup used in our analysis of hazard probabilities. Uncertain is used as a qualitative statement if the model majority does not agree with a qualitative statement. If the model majority agrees on a qualitative statement, the corresponding classes low, moderate or high are used - see Table 3. For fire-risk and heavy precipitation hazards, we adapted the schema of Manzan et al. (2022). For Cold- and heat waves, we modified the p-value limits due to the percentile-based analysis, which yields empirical probabilities scattering around the selected percentile.

Table 3 - Adopted qualitative classification for the case of hazard probability. P-values highlighted with (1) account for fire-risk and heavy precipitation hazards, and p-values for heat- and cold waves are highlighted with (2).

Qualitative statement on the probability of a hazard	**Probability (p) derived from quantitative data analysis**
High	$p \geq 0.05^{(1\ 2)}$
Moderate	$0.005 \leq p < 0.05^{(1)}$, $0.025 \leq p < 0.05^{(2)}$
Low	$p \leq 0.005^{(1)}$, $p \leq 0.025^{(2)}$
Uncertain	Majority of the models do not agree on the qualitative statement
Not Known	Non-observation of the phenomenon or the inability to determine its probability in a reliable manner

3.2.2 Change in Hazard Intensity and Frequency

We employ the Mann-Kendall-Trend test on the annual hazard frequencies and intensities from 2021 to 2100 to predict changes in the intensity and frequency of future hazards. Our methodology aligns with the approach used by Manzan et al. (2022). Table 4 presents the conversion of the quantitative test statistics into qualitative statements. The majority of the model must agree on the chosen qualitative statement derived from the test statistic; otherwise, the future trend cannot be determined with certainty.

Table 4 - Adopted logic to classify the hazard intensity/frequency

Qualitative statement on the intensity/frequency	**Logic based on quantitative data analysis**
Increasing	$p < 0.05$ and positive slope
Decreasing	$p < 0.05$ and negative slope
No Change	$p \geq 0.05$
Uncertain	Majority of the models do not agree on the qualitative statement
Not Known	Non-observation of the phenomenon or the inability to determine its trend

3.2.3 Time frame

We use Pettitt's test for change point detection to evaluate the expected changes in the frequency and intensity of hazards. The test statistic determines the change year, which is then assigned to a time frame based on Table 5. To determine the future trend with certainty, the majority of the models must agree on the chosen time frame. If the change time frames differ between hazard frequency and intensity, we use the earliest time frame as the expected change point.

Table 5 - Adopted logic to determine the time frame classification of a change point (c) in hazard frequency and intensity in future

Qualitative statement on the time frame of a hazard	Logic based on quantitative data analysis
Short-term	$2021 \leq c \leq 2050$
Mid-term	$2051 \leq c \leq 2080$
Long-term	$2081 \leq c \leq 2100$
Uncertain	Majority of the models do not agree on the qualitative statement
Not Known	Non-observation of the phenomenon or the inability to determine its change point

3.2.4 Impact of a hazard

The information needed in terms of hazard impact is one of the most challenging aspects of the R&V analysis for two reasons:

1. The first is related to the definition of impact as effects on natural and social systems
2. The second is the absence of guidelines on what constitutes relevant attributes of natural and social systems that are most relevant (given that there are multiple attributes that can potentially be considered).

It is not possible within the project to undertake a comprehensive analysis of impacts - as defined in the SECAP - across an undefined number of natural and social attributes that are sensitive to climate change. In light of this limitation, it is decided to isolate a "key attribute" in natural and social systems - see Table 2 column *Impact of a hazard* - to be taken as a metric of hazard impact closely related with the universe of hazards proposed in the SECAP. In order to be as comprehensive as possible, the project uses as much as possible peer-reviewed data on impacts that have already been published. Currently, impact data is available in the as-published format and does not comply with the required spatial and quantitative classification for the LOCALISED project. Therefore, this data must be downscaled and disaggregated to correspond to project standards. The involved disaggregations and downscaling operations aren't able to ensure a proper representation of the spatial impact relation. Therefore, we have low confidence in the impact data provided outside the as-published target extent.

The data collection and processing is a continuous process during the course of the project. As such, the current deliverable provides an insight into the data collected and the methodologies identified and/or developed thus far. Development of methods to process data for additional hazards such as floods and droughts and hazards upon request of the project partners, e.g. wind hazards, is ongoing. Data on these hazards can be expected during the course of the project. Furthermore, the further processing of the impact data for all hazards will be carried out in the coming months. The processing of this additional data and their quantification will comply with the described SECAP template and the qualitative classifications described in the previous sections. A complete report on the climate impact data collected so far can be found in Appendix 2 of this report.

4 Data provision

The LOCALISED project aims to open-source all the collected, synthesised and downscaled data. For this purpose, the LOCALISED Data Sharing Platform is being developed in WP3. A first version of the DSP is designed and is already online; it can however, only be accessed with a confidential API key. Currently, this key is only shared with the LOCALISED partners and the reviewers. The details of this DSP can be found in D3.3. Using this DSP, the climate-related data discussed in the current deliverable can also be queried.

5 Conclusion

The aim of D2.5 was to report on the climate and climate impact data collected for all of the 27 EU countries. This data is processed and provided for the Representative Concentration Pathways 2.6, 4.5 and 8.5.

The climate data is available for the mainland EU regions. In the light of this, the project will focus on the mainland EU regions only. This means that the autonomous Canary Islands in Spain, the autonomous Azores and Madeira islands in Portugal and the overseas territories of France will not be included in the project.

The collection of climate impact data has proven to be more challenging owing to unclear methods and classification of various aspects of different types of hazards in the Sustainable Energy and Climate Action Plan template. However, data on heat waves, cold waves, fire-risk and heavy precipitation is provided for all EU 27 countries. Work is in progress to provide data on additional hazards such as floods and droughts and also for the impact of the hazards.

6 Reference

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