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# **Introduction**

## Problem statement

As the increasing heat patterns in the world become hazard and disaster events, actions or policies are needed to protect lives, livelihoods, and assets. However, heat waves and ways to prevent their socio-economic-ecological-demographic effects are often neglected by the public and policymakers. Therefore, there is a need for more research and “documentation” (ENBEL, 2023), regarding the actions and harms to prevent further damage. So, the visibility of the impacts of heat waves and ways to mitigate as well as adapt must be enhanced to increase awareness among decision-makers, provide guidance, and propose policy solutions.

## Research objective

This study will first establish a corpus from the documents related to extreme heat and heat waves. Documents will be gathered from the Prevention Web (UNDRR) database. Then, the **BERT Topic** technique will be utilized on this corpus to identify the main topics that would give ideas about the impacts of heat waves alongside actions for mitigation & adaptation observed in the corpus. The study will use the **coherence score** to evaluate the relevance of the topics.

The main research questions that will guide this objective are:

* How to establish a corpus using documents aiming to mitigate the impacts of heat waves?
* How to identify the topics/characteristics from the documents?
* How can these documents inform the development of comprehensive heat wave mitigation strategies for policymakers?

This is an initial step in the establishment of a specialized corpus. As an initial step, it will focus on identifying recurrent issues, making inferences based on them, and providing a path for the further development of this research to become an officially recognized corpus. Therefore, the main analysis methods are identifying the context(s) in which the tokens exist and the main topics via topic modeling.

# **Literature**

This section gathers information from the literature regarding the main themes of this research. The last part provides some insights regarding the potential benefits of this study.

### Heat wave and heat vulnerability

Human-related activities have been causing disruptions in the “atmosphere, ocean, cryosphere, and biosphere” (IPCC, 2023, p.5) resulting in disruptions in weather events most importantly in extremely hot days with increased duration and extent accompanied by rising land surface temperature, decrease of vegetation, and diminishing water sources.

Heat waves have various impacts on the environment (e.g. droughts, wildfires, etc.), infrastructures (e.g. blackouts) (Stone et al., 2023), health (exhaustion, fatigue, skin irritation, etc.) (WHO, 2004), economy (e.g. damage to labor productivity and GDP losses) (García-León et al., 2021), education (e.g. lower exam scores) (Srivastava et al., 2017), and many more areas. The intensification of these impacts in terms of harm, damage, duration, and extent increases the possibility of heat waves turning into hazards and eventually disasters. Within this context, vulnerability becomes an important concept to identify. It indicates the groups that are more susceptible to experiencing harm and loss considering demographic, socioeconomic, health, and infrastructural factors (Li et al., 2022) experienced by different communities.

Interventions to mitigate the impacts of heat waves, adapt the environment and populations against heating trends, and increase their resilience vary according to many dimensions such as time, location, and target groups.

Heatwave mitigation refers to the actions and strategies aimed at reducing the impacts of heat waves on human health, infrastructure, ecosystems, and the economy. It may involve interventions such as implementing vegetation on roofs (Tan et al., 2023), establishing cooling centers (Meade et al., 2023), etc. Heatwave adaptation involves implementing measures to adjust and respond to the challenges posed by heat waves. It may involve raising awareness regarding the dangers of heat waves, strengthening the infrastructures (Kiarsi et al., 2023), etc.

### Specialized corpus

Within the social and public policy literature, specialized corpora have been established for many tasks such as identifying patterns or trends by gathering policy documents (Ridgway, 2023), developing NLP methods to improve policy analysis (Safaei & Longo, 2024) , and mining public opinions (Zha et al., 2023). DCEP: Digital Corpus of the European Parliament is a good example of a specialized corpus involving unstructured data for policy analysis. Within the climate change mitigation and adaptation literature, there are specialized corpora for processing climate program/project documents to evaluate their alignment with policies (Jin et al., 2023), conducting discourse analysis, examining climate change trends (Volkanovska et al., 2023), and understanding the effects of climate change in different locations (Mallick et al., 2024). Climate Policy Radar is an important example that defines and involves climate policy-related documents across different languages. Within hazard and disaster literature, there are studies investigating the perceptions and sentiments regarding extreme heat (Zhu et al., 2024), responses against heat waves (Zander et al., 2023), detecting air quality (Văduva et al., 2023), and assessing the impact of heat-related hazards (Sodoge et al., 2023) using different sources such as social media, news, and archives.

Using social media to detect sentiments, opinions, and responses against heat waves is the most common research design to understand the impact of heat waves. There are also literature reviews to understand the drivers behind what makes certain groups vulnerable to increasing temperatures (Li et al., 2022) and studies that quantify vulnerability (Bayomi & Fernandez, 2023). However, there is no specialized corpus like DCEP or Climate Policy Radar involving heatwave impacts, mitigation & adaptation interventions, policies, and plans to inform policy/decision makers.

### Modeling and evaluation

The studies in the literature generally use the Latent Dirichlet Algorithm (LDA) model to identify topics, issues, and impacts. LDA is an “unsupervised learning algorithm” (Supiadin & Laksito, 2023, p.3331) that groups relevant words under each topic. Since LDA is a statistical model, it cannot account for the semantic relations between words (Zengul et al., 2023). It is possible to calibrate LDA models with domain knowledge, however, it is time and effort-consuming. Instead, BERT topic can better identify topics in small and unstructured datasets while accounting for the contextual relations.

The coherence score is generally used for evaluating models by quantifying the closeness and interpretability of words within a topic. It is used to assess the appropriate number of topics that cover the features of interest.

### How can this research contribute to the literature?

This study can contribute to the heat wave and heat vulnerability literature by creating a specialized corpus that includes textual documents from multiple sources around the world that accounts for different impacts of heat waves and different groups who are / might be susceptible to experiencing relatively greater harm.

This corpus can become an important international resource for studying the impacts of heat waves on different geographical regions, demographics, and socio-economic groups. Policymakers can use insights from this corpus to develop targeted policies and interventions to mitigate the impacts of heat waves, especially for vulnerable populations.

This corpus can help better understand which groups are most at risk and guide the allocation of resources and the design of effective adaptation strategies. For example, public health officials can leverage the corpus to identify at-risk populations and develop targeted health interventions and communication strategies. This could include heat wave preparedness plans, early warning systems, and outreach campaigns tailored to specific local communities. Educators, media professionals, and even advocacy groups can use the corpus to raise awareness about the impacts of heat waves. It can help disseminate information about heat wave risks and protective measures tailored to different audiences. Moreover, this corpus can encourage further research to include multimodal data (Volkanovska et al., 2023). From the computational social science perspective, this corpus can be used for topic modeling to identify themes and patterns, geospatial analysis the locate impacts and interventions, network analysis for identifying the relations between stakeholders in implementing interventions, and perhaps predictive modeling for creating optimized interventions.

# **Data and methods**

This section introduces and explains the database, the structure of the data, and the methods used.

## Data

The data is gathered from the Prevention Web “Knowledge Base” (Prevention Web, n.d.). The data is gathered from the “Research Briefs” and “Documents & Publications “sections, filtered by hazard (heat wave). Documents in this database are gathered from different sources (government archives, journals, etc.) from around the world.

The documents are in different formats (reports, research articles, discussion papers, policy briefs, policy recommendations, guidelines, reviews, technical notes, briefings, etc.). Therefore, they are unstructured. Meaning that their format (text font & alignment, existence of pictures & alignment, etc.) differ. They are all in PDF format and in English[[1]](#footnote-1). However, some of the documents in this dataset are corrupt, cannot be downloaded from the website, cannot be found on the web, or are unrelated[[2]](#footnote-2).

The PDF documents were downloaded from the Prevention Web and stored on the local machine. There are 528 documents in total ready for this research.

Within the Prevention Web database, each document is categorized under at least one “theme” (Prevention, Web, n.d.) (e.g. governance). The downloaded documents were categorized and analyzed according to these themes for processing efficiency and providing detailed results. However, the documents’ category is based on the domain knowledge rather than solely on the database’s decision.

The categories involve Health and health facilities[[3]](#footnote-3) (108 documents), Socioeconomic impacts and resilience[[4]](#footnote-4) (105 documents), Urban risk and planning[[5]](#footnote-5) (79 documents), Risk identification and assessment[[6]](#footnote-6) (115 documents), and Disaster risk management [[7]](#footnote-7)(121 documents).

## Methods

This paper provides an initial step in the establishment of a specialized corpus. As an initial step, it will focus on identifying main issues, analyzing them, and providing a path for the further development of this research to make it an officially recognized corpus. Therefore, the main methods of this research are identifying the context(s) and the main topics.

Identification of the context(s) is conducted with n-grams as well as TF-IDF scores and identification of main topics is conducted with BERT Topic.

Identifying the context within a collection of documents involves analyzing the important words operationalized by TF-IDF scores and examining the frequent word co-occurrences based on n-grams. Identifying main topics involves examining the results of BERT topic and their coherence. The topic model involves,

* min\_topic\_size[[8]](#footnote-8)
* top\_n\_words[[9]](#footnote-9)
* n\_gram\_range[[10]](#footnote-10)
* calculate\_probabilities[[11]](#footnote-11)

as main parameters. Each parameter is adjusted to get the most meaningful and appropriate results according to the context of each category.

The evaluation of the context is based on the domain knowledge. On the other hand, the evaluation of the topics is based both on coherence scores and domain knowledge.

The analyses are conducted separately according to each category. However, they all share the same workflow[[12]](#footnote-12) :

* Generating text data from PDFs,
* Preprocessing & word tokenization
* Defining token dictionary
* Defining bag of words (BoW) representation
* TF-IDF modeling
* N-grams modeling
* BERT topic modeling
* Calculating coherence scores for each topic

# **Results**

This section explains the results of topic modeling and evaluation. The results will be discussed according to each category.

## Health and health facilities

This category involves 108 documents and 27005 unique word tokens.

### Identifying the context

#### TF-IDF score

After several trials, it was decided that tokens that have a score above 0.05 should be considered appropriate for analyzing the context. Unfortunately, due to the problems with stop words mentioned in the workflow, there are non-relevant words that have a score above 0.05. Still, it is possible to observe some important occurrences[[13]](#footnote-13) that overlap with the domain knowledge.

As can be observed from the TF-IDF table[[14]](#footnote-14), this category is mainly about the impacts of heat waves and extreme heat on pulmonary health, pregnancy, internal organs, neonatal development, morbidity, and mortality. Moreover, women, children, and the elderly seem to be the most identified vulnerable groups.

#### N-grams

After several trials, it was decided that trigram (with three tokens) n-grams provide the most meaningful results. Unfortunately, problems with the stop words persist in the n-grams results. Therefore, a domain knowledge filter was required. Moreover, due to the sheer number of n-grams, only the important results will be discussed. You can refer to the code to access the entirety of n-grams.

Alongside the mentioned groups above, it is possible to observe connotations that highlight the importance of **socioeconomic status** ('disadvantage', 'neighbourhood', educational', 'attainment’) as functions of **vulnerability**. As impacts, some connotations identify different **health aspects** that do not exist in TF-IDF scores ('bacteriological', 'histological', 'confirmation', 'cardiovascular', 'disorder', 'originate').

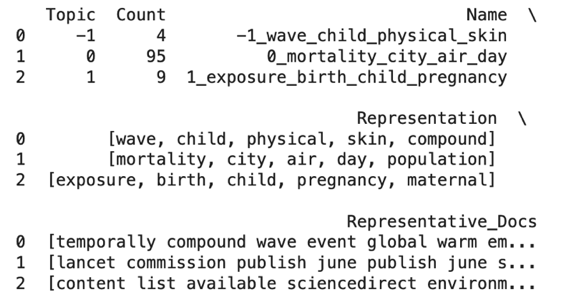
### Identifying the topics

#### Topics and coherence scores

The BERT topic model for this category involves “min\_topic\_size=5” and “top\_n\_words=5” for the most meaningful results.

The BERT topic model and coherence score created the results below[[15]](#footnote-15).

A black text on a white background

Description automatically generated

One topic with a coherence score below 0.5 was disregarded.

A number of digits on a white background

Description automatically generatedThe **first** topic involves,

with a coherence score of 0.51. Deriving from domain knowledge, extended exposure to heatwaves results in skin irritation/diseases and increases the possibility of infectious disease occurrence, spread, and extent.

The **third** topic involves,

A number of black numbers

Description automatically generated with medium confidence

with a coherence score of 0.76. Deriving from domain knowledge, pregnant women, children, newborns, and infants are one of the most vulnerable groups against exposure to heat waves.

### Discussion

The topics, their coherence score, and the patterns identified seem to perpetuate each other. It seems that the BERT topic mainly generates topics that are measured as important by the TF-IDF model. However, not every relation (even though they can be considered meaningful) captured by the n-grams model is identified as a main topic.

## Socioeconomic impacts and resilience

This category involves 105 documents and 33894 unique tokens.

### Identifying the context

#### TF-IDF score

As can be observed from the TF-IDF table, this category is mainly about the impacts of heat waves on work conditions (especially outside work such as agriculture), livelihoods, productivity, and health. In this category, it is possible to observe emphasis on the health impacts of heat waves. This could be because socioeconomic and health situations are closely intertwined and the documents in this category are mainly about the impacts of heat waves on outside workers.

According to these results, the most vulnerable groups identified in this category are outside workers, poor individuals and households, the elderly, women, and the young.

#### N-grams

Alongside the connotations that perpetuate the relationships mentioned above, there are emphases on the **educational impacts of heat waves** ('low', 'test', 'score') and the **conditions of students** ('school', 'locate', 'hot'). Moreover, there are emphases regarding **food safety** ('food', 'security', 'alert'), **economic volatilies** ('baseline', 'inﬂation', 'volatility') ('growth', 'shock', 'wealth'), **inequalities** ('inequality', 'consumption', 'inequality') ('black', 'hispanic', 'population'), and **violence** ('crime', 'violent', 'sexual')

### Identifying the topics

#### Topics and coherence scores

The BERT topic model for this category involves “min\_topic\_size=2” and “top\_n\_words=6” for the most meaningful results.

The BERT topic model and coherence score created the results below.

A white text with black text

Description automatically generatedA screenshot of a computer screen

Description automatically generated

Four topics with coherence scores below 0.5 were disregarded.

When all the topics were evaluated with domain knowledge, it was decided that only four topics involved the most interpretable and meaningful results.

A number and digits on a white background

Description automatically generatedThe **third** topic involves,

with a coherence score of 0.83. Deriving from domain knowledge, increased exposure of outdoor workers to heat decreases labor productivity and results in serious physical strain as well as stress.

The **eighth** topic involves,

A number and a number of numbers

Description automatically generated with medium confidence

with a coherence score of 0.58. Deriving from domain knowledge, increasing the extent and duration of heat days increases the possibility of in and out-migration. Moreover, as hazards escalate to disasters, the inhabitable circumstances increase the probability of forced and mass migrations. Also, as economic activity slows down, the tourism sector loses its productivity and consumers.

The **twelfth** topic involves,

A number of different sizes and numbers

Description automatically generated with medium confidence

with a coherence score of 0.62. Deriving from domain knowledge, increasing the extent and duration of heat days increases the possibility of drought and consequent vegetation lost. This situation also results in economic losses.

The **fourteenth** topic involves,

A number on a white background

Description automatically generated

with a coherence score of 0.70. Deriving from domain knowledge, increasing the extent and duration of extreme heat days increases the land surface temperature (lst) and the possibility of the urban heat island effect (uhi), especially in urban areas. This results in excess mortality especially among very young and old populations.

### Discussion

This category involves diverse subthemes that may be difficult to aggregate to create meaningful topics. That is why, the minimum number of documents to be observed by BERT topic was limited to two. The topics seem to perpetuate the results gathered from TF-IDF and n-grams analyses, however, the relations between poverty and heat waves seem to be missing in the topic model results. Of course, this depends on the number of documents that investigate this topic.

Even though the coherence scores of some topics are above 0.5, they do not make much sense when the topic words are considered from the domain perspective.

## Disaster risk management

This category involves 121 documents and 35629 unique tokens.

### Identifying the context

#### TF-IDF score

The results in the TF-IDF table seem to be sparse. Impacts such as overheating (e.g. fires) seem to be the risks related to heat waves and extreme heat according to this category. As for the management part, it is possible to observe governance-related means (e.g. policy and warning) and a mention of technology. There seems to be no mention of vulnerable groups.

#### N-grams

Alongside the connotations that perpetuate the relationships mentioned above, there are emphases on **vulnerability** ('predict', 'neighborhood', 'vulnerability') ('government', 'organization', 'vulnerable'), increase in emissions ('energy', 'demand', 'emission'), **food security & malnutrition** ('malnutrition', 'rate', 'increase'), and **industrial activities** ('oil', 'palm', 'plantation') as risks. **Community engagement for enhancing resilience** ('community', 'science', 'involve'), **residential cooling** ('residential', 'heat', 'cool'), **the use of information technology** ('information', 'technology', 'enable'**), the leveraging of science** ('integrate', 'available', 'science'), **collaboration** ('coordination', 'collaboration', 'agency'), **sustainable agriculture** ('sustainable', 'agricultural', 'practice'), **conservation** ('protection', 'natural', 'ecosystems'), and **inclusion** ('indigenous', 'crop', 'traditional') as management strategies.

### Identifying the topics

#### Topics and coherence scores

The BERT topic model for this category involves “min\_topic\_size=5” and “top\_n\_words=6” for the most meaningful results.

The BERT topic model and coherence score created the results below.

A screenshot of a computer code

Description automatically generated

A table with numbers and letters

Description automatically generated

Two topics with coherence scores below 0.5 were disregarded.

When all the topics were evaluated with domain knowledge, it was decided that only two topics involved the most interpretable and meaningful results.

The **fourth** topic involves,

A number and a number on a white background

Description automatically generated

with a coherence score of 0.60. Deriving from domain knowledge, increasing the extent and duration of heat days depletes the water sources which jeopardizes the agricultural output, crop qualities, and food security.

The **fifth** topic involves,

A number on a white background

Description automatically generated

with a coherence score of 0.68. Deriving from domain knowledge, increasing the extent and duration of heat days increases the demand for cooling (e.g. a/c air conditioning) and energy consumption.

### Discussion

This category also involves diverse subthemes that may be difficult to aggregate to create meaningful topics. Therefore, the topic model results are sparse. The ambiguity in defining the category and selecting the appropriate documents based on it may be one of the reasons for sparsity and inadequate emphasis on mitigation and adaptation actions for managing disaster risks.

## Risk identification and assessment

This category involves 115 documents and 39403 unique tokens.

### Identifying the context

#### TF-IDF score

The results in the TF-IDF table do not provide meaningful interpretations.

#### N-grams

In n-grams results, there are emphases on ('extremely', 'warm', 'summer') and ('concurrent', 'heatwave', 'intensity') as risks that can create harm to lives, livelihoods, and assets. However, there are no meaningful connotations in the model.

### Identifying the topics

#### Topics and coherence scores

The BERT topic model for this category involves “min\_topic\_size=2” and “top\_n\_words=5” for the most meaningful results.

The BERT topic model and coherence score created the results below.

A screenshot of a computer screen

Description automatically generatedA screenshot of a computer

Description automatically generated

One topic with a coherence score below 0.5 was disregarded.

When all the topics were evaluated with domain knowledge, it was decided that only one topic involved the most interpretable and meaningful results.

The **sixth** topic involves,

A number with black circles

Description automatically generated with medium confidence

with a coherence score of 0.76. Deriving from domain knowledge, heat waves increase the possibility of fires in urban and rural areas.

### Discussion

So far, this category produced the worst results. This may be due to the ambiguity in defining the category and selecting the appropriate documents based on it. The documents in this category distantly crosscut the other categories, but do not fit any of them. Combined with the high sparsity of the themes, the results from this category fail to establish a coherent context and produce interpretable topics.

## Urban risk and planning

This category involves 79 documents and 26107 unique tokens.

### Identifying the context

#### TF-IDF score

According to the table, indoor and outdoor overheating seems to be one of the most important risks of heat waves in urban areas. Overheating is affected by building features and surface as well as tree canopy that also affect the cooling effect. The results also include one effect of overheating (e.g. crime), means to tackle harm and vulnerabilities (e.g. policy and financing).

#### N-grams

Alongside the connotations that perpetuate the relationships mentioned above, there are emphases on building modifications ('green', 'roof', 'control'), green infrastructure ('green', 'infrastructure', 'mitigation'), thermal comfort ('thermal', 'comfort', 'island'), greening for cooling ('mean', 'cool', 'tree'), cooling techniques ('green', 'roofs', 'wetland'), warning systems ('warning', 'system', 'evacuation'), increasing community resilience ('enhancement', 'community', 'resilience'), increasing institutional capacity ('institution', 'capacity', 'building'), increasing governance engagement ('encouragement', 'government', 'engagement'), and prioritizing critical infrastructure ('prioritise', 'critical', 'infrastructure') as mitigation strategies. Excess mortality ('summer', 'preventable', 'death'), urban heat island effect ('mortality', 'attributable', 'uhi') and drought '(hotter', 'drier', 'summer')('demand', 'water', 'increase') as the impacts of extreme heats in urban areas. Moreover, ('age', 'ethnicity', 'commute') ('ethnicity', 'commute', 'employment') ('access', 'healthcare', 'service') as identifiers of vulnerability in urban areas.

### Identifying the topics

#### Topics and coherence scores

The BERT topic model for this category involves “min\_topic\_size=6” and “top\_n\_words=5” for the most meaningful results.

The BERT topic model and coherence score created the results below.

A screenshot of a computer code

Description automatically generated

A number of numbers on a white background

Description automatically generated

All coherence scores were above 0.5, there were no disregards.

When all the topics were evaluated with domain knowledge, it was decided that only one topic involved the most interpretable and meaningful results.

The **fourth** topic involves,

### A number of different sizes and numbers Description automatically generated with medium confidence

with a coherence score of 0.66. Deriving from domain knowledge, green roofing is one of the most important strategies to provide cooling and save energy.

### Discussion

The category involves fewer documents. Therefore, the topics are not diverse and it is possible to find more content in n-grams results.

# **Conclusion**

This study provided insights and analyses as an initial step in the establishment of a specialized corpus based on the diverse impacts of heat waves and ways to mitigate & adapt. The results gathered from analyzing the context and main topics of the categories, mainly inform about the impacts of heat waves on different groups and issues. There was not much emphasis on mitigation and adaptation measures. Nonetheless, these findings are important in understanding the pressing issues around the world related to heat waves. For this purpose, TF-IDF, n-grams, and BERT topic models were helpful. In identifying the context, the TF-IDF model was quite useful in identifying the most recurrent themes in the categories and n-grams was useful in detailing the themes and showing other connotations that are important for the domain but unaccounted by TF-IDF. However, they are not without their limits. It is an important point of discussion how effective they would be compared to a domain expert.

In every step of the workflow and results, there are biases and errors. The biggest error that affects model results and interpretations is the occurrence of stop words despite cleaning attempts in the preprocessing step. Another error is the categorization of documents. Although categories were based on domain knowledge and Prevention Web’s classification, problems with the number of documents and misclassification resulted in non-meaningful results in some categories. On the other hand, possible erroneous adjustments with the BERT topic model could have lowered interpretability.

Another major problem is with the evaluation. In evaluating the context with TF-IDF and n-gram models, only the domain knowledge was relied upon. Therefore, the terms “meaningful” and “interpretable” remain subjective. This can be problematic in discussing the reliability of the results. In evaluating the topic models using the coherence score, a mixture of domain knowledge and coherence score were relied upon. The problem with this evaluation is that the topic with the highest coherence score does not mean it is the most meaningful one. In this case, the implications of the coherence score remain ambiguous. Moreover, it is observed that running the same code without changing the parameters of the BERT topic provides different topic results. This situation remains unexplainable.

The study also does not involve any quantification of bias that could help explain these errors.

Although there are lots of gaps that remain to be addressed, this study still offers hope in being a one-of-a-kind specialized corpus and source for awareness raising as well as policy guidance. Despite the fallbacks, the study still offers insights regarding the pressing impacts of heat waves, which groups are vulnerable, and what strategies are being deployed. These insights cannot be generalized because they are confined to the context established by the documents and the document dataset is not large enough. However, as the dataset increases and more advanced methods are applied (e.g. named entity recognition for specifically identifying interventions, vulnerable groups, locations, etc.), the study’s potential can be leveraged.

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1. Some of the documents contain foreign words and characters mainly because of the location & author names as well as special terminology used. [↑](#footnote-ref-1)
2. Each document’s summary was examined by the researcher to check for appropriateness for inclusion to the corpus, even though they all exist under the same hazard category. [↑](#footnote-ref-2)
3. Involves documents related to identifying public health risks and ways to prevent them. [↑](#footnote-ref-3)
4. Involves documents related to the socioeconomic (e.g. economy, education, etc.) impacts, vulnerable groups, and ways to increase resilience. [↑](#footnote-ref-4)
5. Involves documents related to mainly infrastructural impacts in urban areas and ways to alleviate them. [↑](#footnote-ref-5)
6. Involves documents that identify & measure multiple risks. [↑](#footnote-ref-6)
7. Involves documents that identify risks and propose solutions to mitigate and adapt. May overlap with the Risk identification and assessment category. [↑](#footnote-ref-7)
8. Defines the minimum number of documents required to consider a topic meaningful and interpretable. [↑](#footnote-ref-8)
9. Defines the number of top words to extract for each topic. [↑](#footnote-ref-9)
10. Defines the range of n-grams to consider when generating features from the textual data. This is important for including words with multiple components. [↑](#footnote-ref-10)
11. Defines the probabilities for each topic, which is always set to “True”. [↑](#footnote-ref-11)
12. Please refer to Annex I for details regarding the workflow. Please refer to the workflow before examining the results. [↑](#footnote-ref-12)
13. The occurrences are filtered from the TF-IDF scores that are above the threshold and overlap with domain knowledge. [↑](#footnote-ref-13)
14. Please refer to Annex II. [↑](#footnote-ref-14)
15. The first topic is ‘Topic -1’. [↑](#footnote-ref-15)