



TRACING ONLINE FLOOD CONVERSATIONS ACROSS BORDERS

A WATERSHED-LEVEL ANALYSIS OF GEO-SOCIAL MEDIA
TOPICS DURING THE 2021 EUROPEAN FLOOD

S. Dujardin, D. Arifi, S. Schmidt, C. Linard, B. Resch

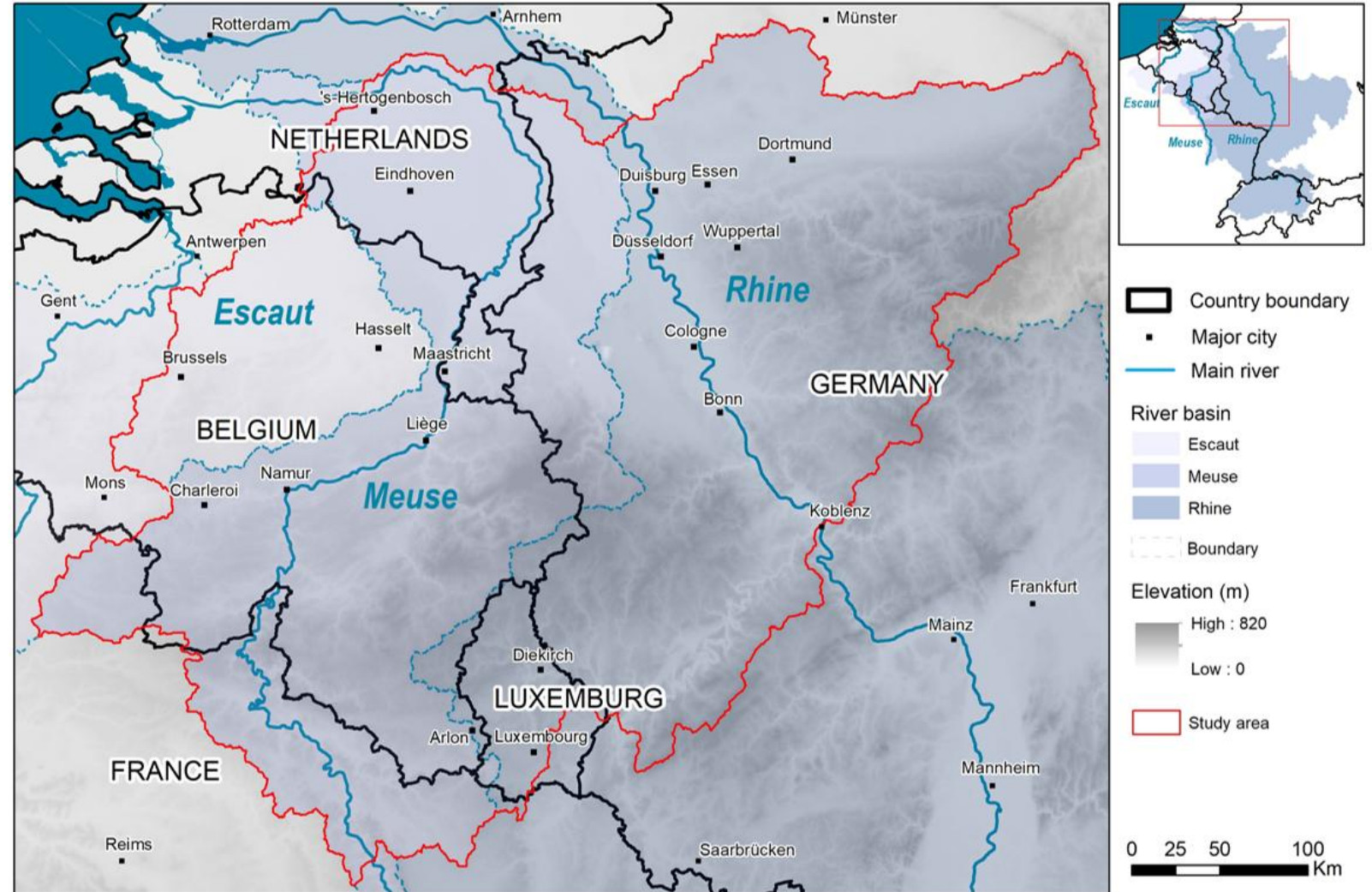
GeoAI Conference 2026, UGhent, Belgium



THE 2021 FLOOD IN WESTERN EUROPE



Study area





TRACING ONLINE FLOOD CONVERSATIONS

Objective

Identify geo-social media users' responses to heavy rainfall and subsequent flooding events in a transboundary river basin context.

Research questions

1. Which topics emerge before, during, and after a flood disaster?
2. Which differences can be observed across upstream and downstream areas?



HARVARD
UNIVERSITY



Center for
Geographic Analysis



TRACING ONLINE FLOOD CONVERSATIONS

Twitter/X database

- Geotweet Archive (< 2022)
- 7 July – 27 July 2021 period
- 14.000+ Geolocated Tweets =
Text information (max. 140 characters) + XY coordinates
- 3-4% of all Tweets



HARVARD
UNIVERSITY



Center for
Geographic Analysis



THE 2021 FLOOD IN WESTERN EUROPE

Semantic classification of Tweets using LLM

Step 1: Data translation

Tweets (FR, NL, DE) translated to English (Google Translate API) for consistency.

Step 2: Disaster classification

Twitter-XLM-RoBERTa model categorizes tweets as 'Related' or 'Unrelated' (Hanny et al. 2024).

Step 3: Topic modelling (BERTopic)

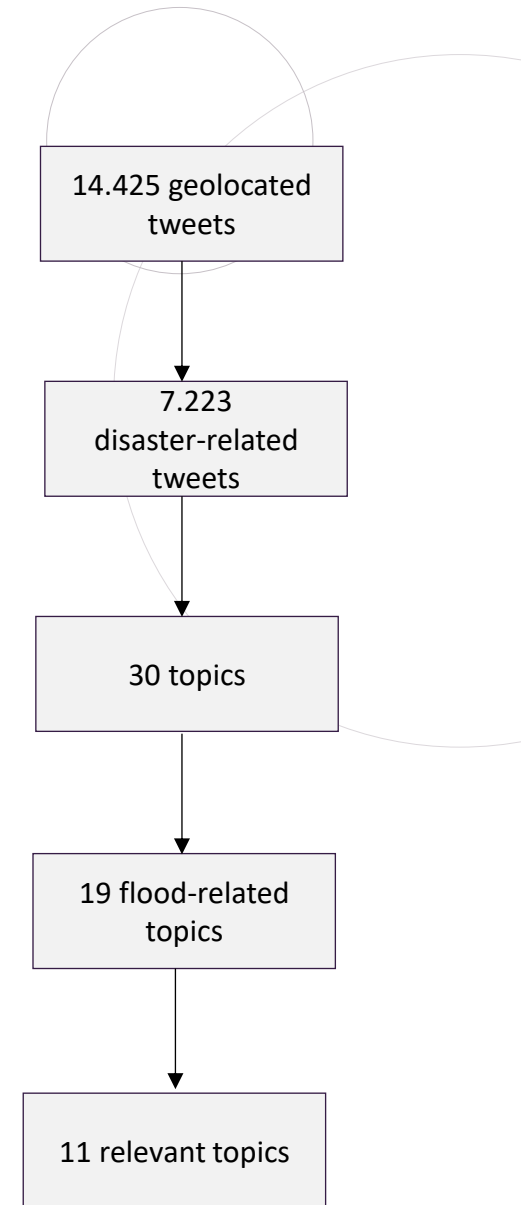
Converts tweets into embeddings (BERT), reduces to 5D (UMAP), clusters (K-Means). Identifies key words per topic (TF-IDF weighting).

Step 4: Topic stability analysis

BERTopic ran 20 times to cope with randomness; 17% similarity threshold ensured stable topics.

Step 5: Identifying key topics

Extracted 30 topics, refined to 19 flood-related; 11 key topics selected/aggregated.



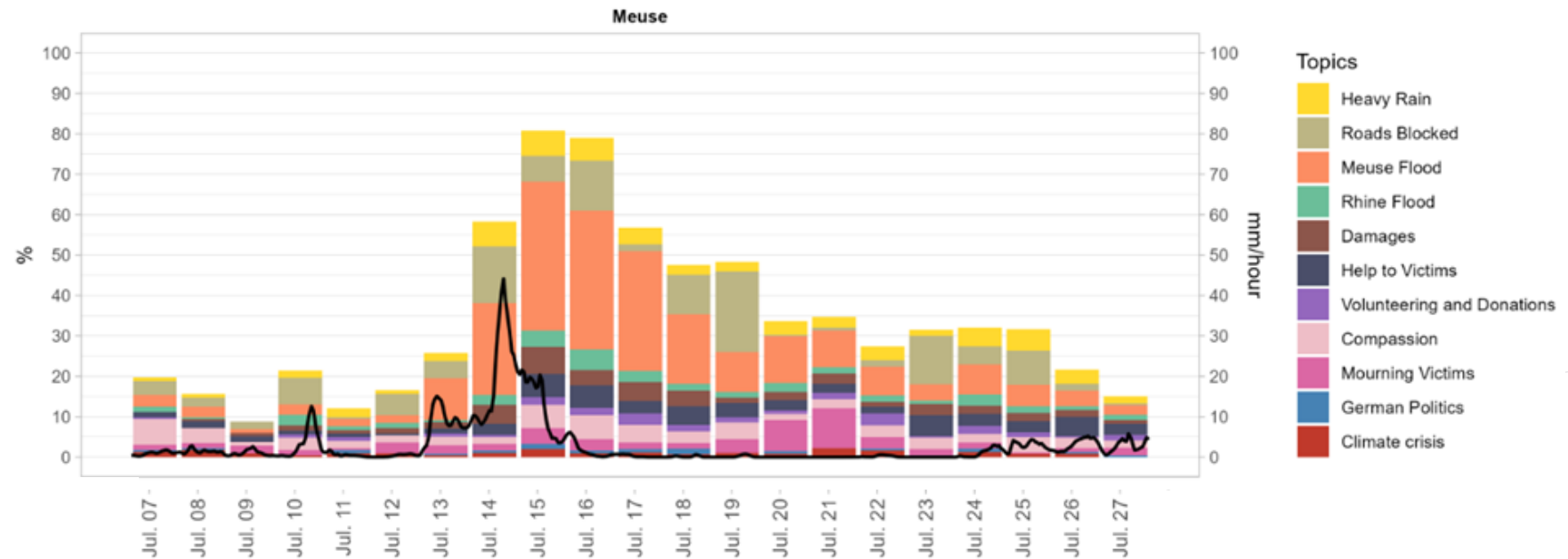


TRACING ONLINE FLOOD CONVERSATIONS

Topics like *heavy rain* and *damages* peaked during the precipitation peak

Topics like *volunteering* or *mourning victims* emerged after the precipitation peak

Topic emergence over time



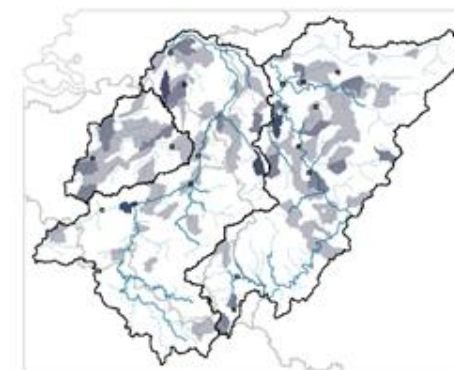
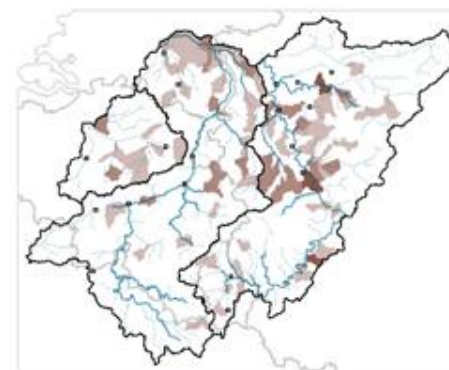
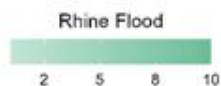
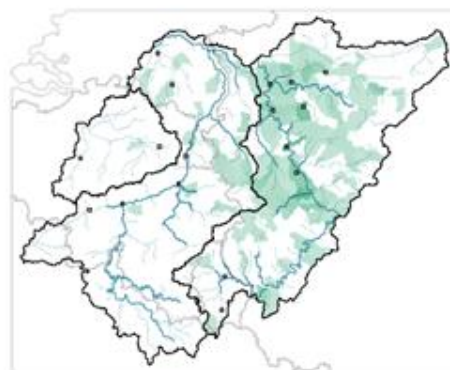
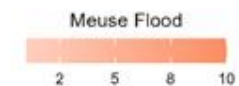
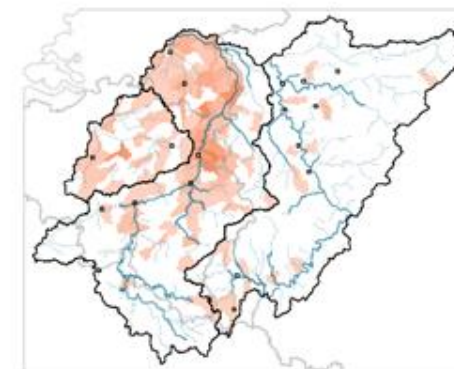
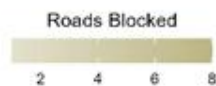
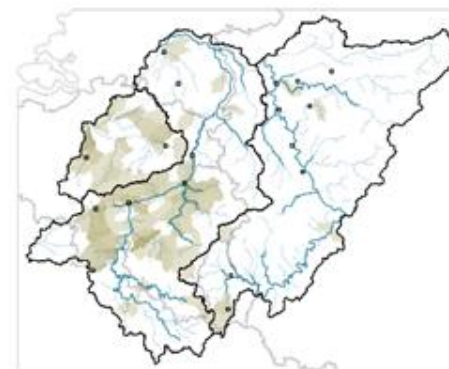
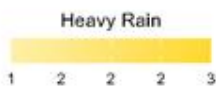
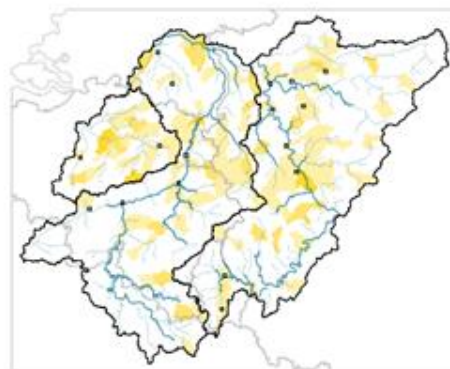


TRACING ONLINE FLOOD CONVERSATIONS

The number of days a topic dominates conversations vary from 2 to 10 days.

Some topics are basin-specific, others are dispersed across the study area.

Dominant topics (N days)



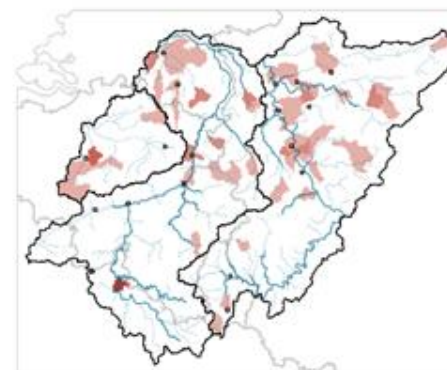
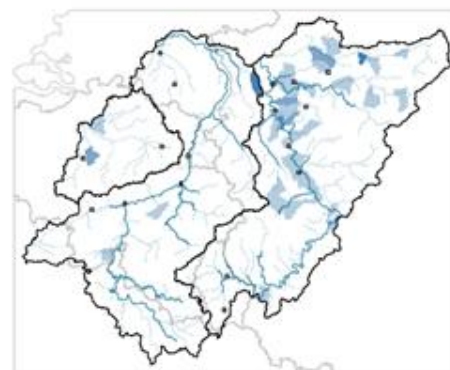
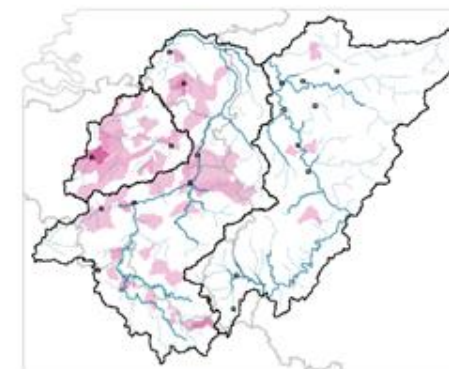
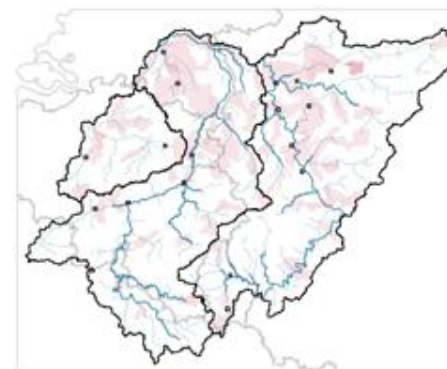
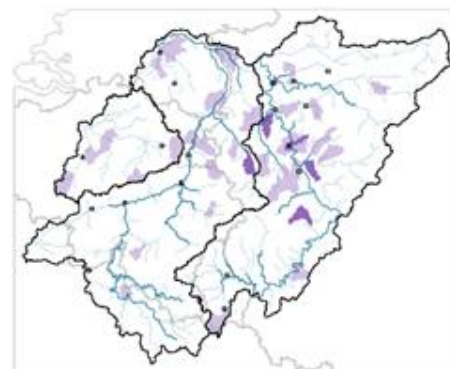


TRACING ONLINE FLOOD CONVERSATIONS

The number of days a topic dominates conversations vary from 2 to 10 days.

Some topics are basin-specific, others are dispersed across the study area.

Dominant topics (N days)



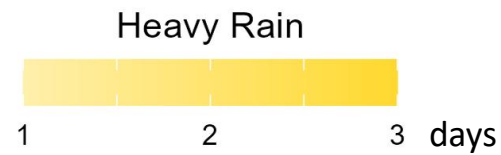
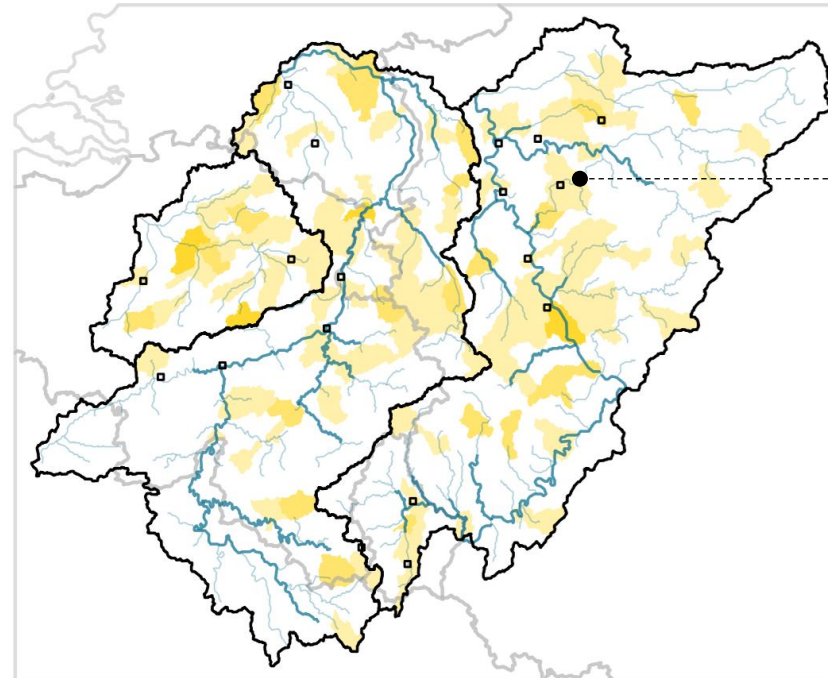
N/A



TRACING ONLINE FLOOD CONVERSATIONS

Tweets reporting heavy precipitations were dominant in the upper part of the river basins

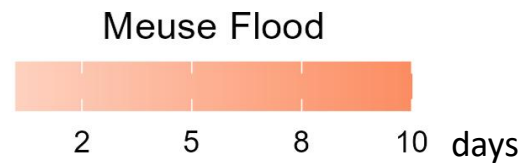
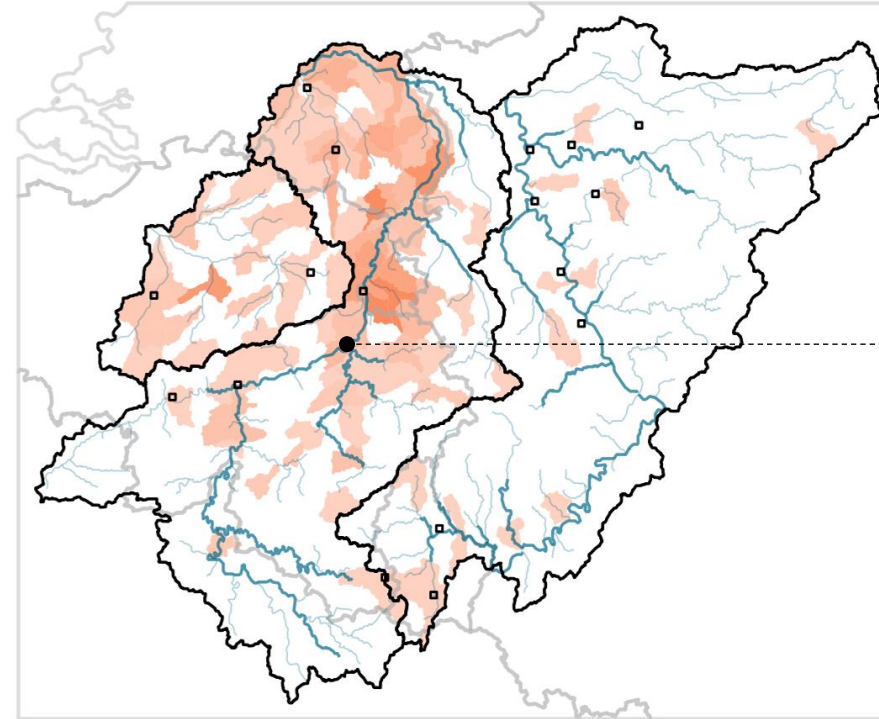
Spatial patterns of dominant topic



TRACING ONLINE FLOOD CONVERSATIONS

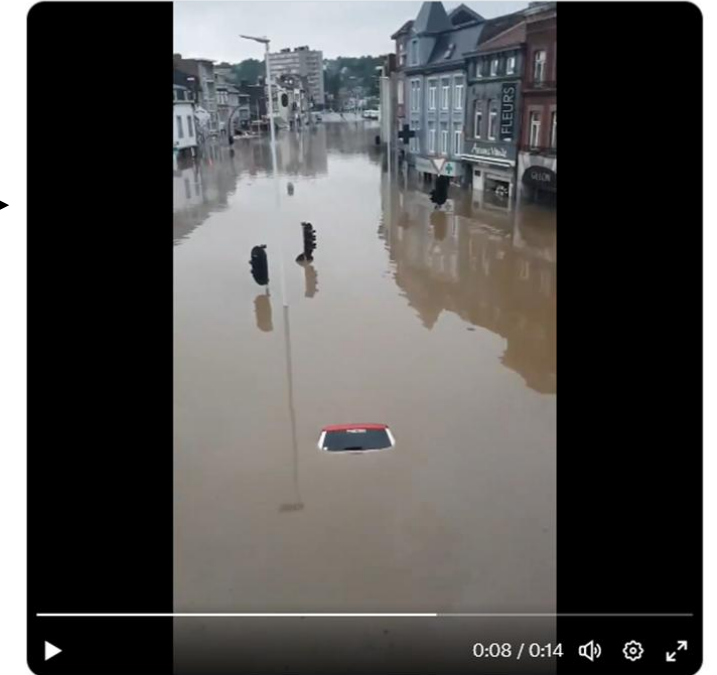
Tweets describing the Meuse floods clustered along the most impacted rivers, but lasted longer in downstream areas (> 10 days)

Spatial patterns of dominant topic



Abdel-Salam
@MonsieurBT

Ma maison complètement inondée, je ne sais même pas y accéder. Je suis dévasté! [#Liege](#) je devais être dans l'avion ce matin pour Lomé. Au lieu d'être dans les airs, je suis sous l'eau. Liege se relèvera plus belle et plus forte. [#UnderWater](#) [#Liege](#) [#Urgences](#)



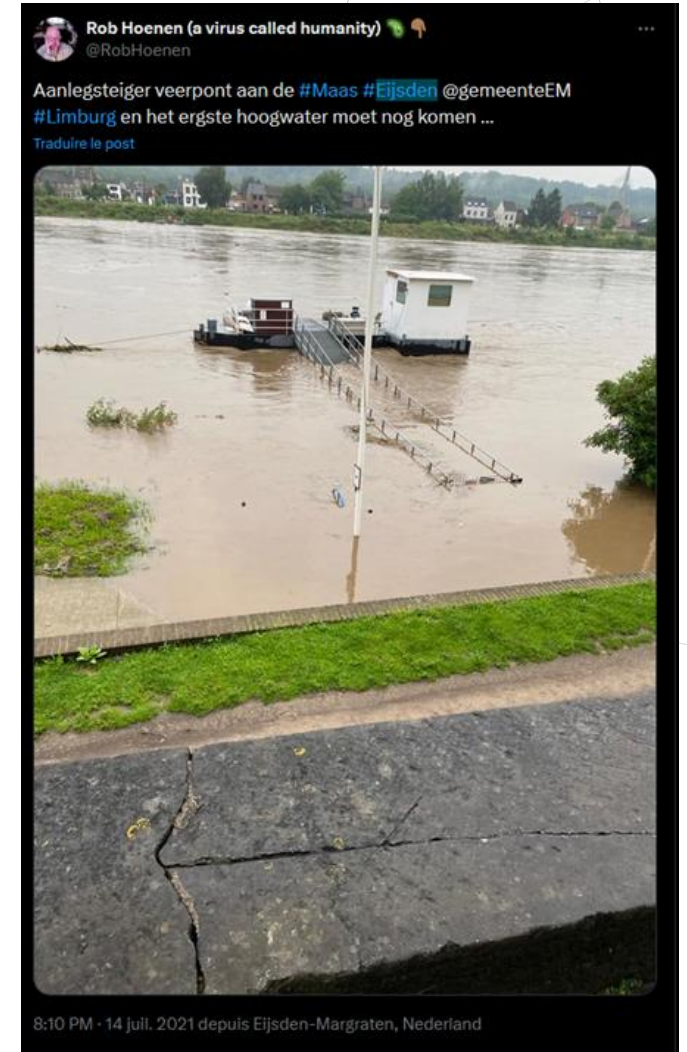
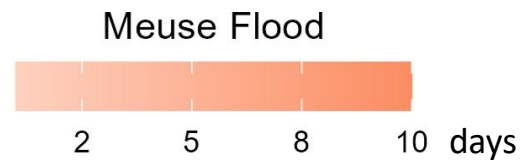
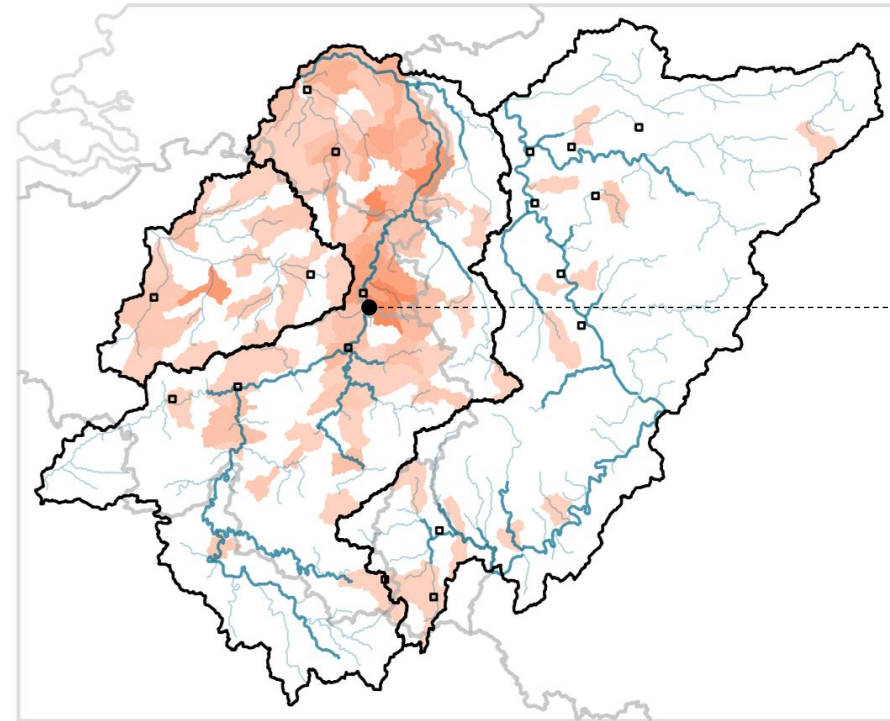
6:34 PM · 15 jul. 2021 depuis Herstal, Belgique

8 5 7 1

TRACING ONLINE FLOOD CONVERSATIONS

Tweets describing the Meuse floods clustered along the most impacted rivers, but lasted longer in downstream areas (> 10 days)

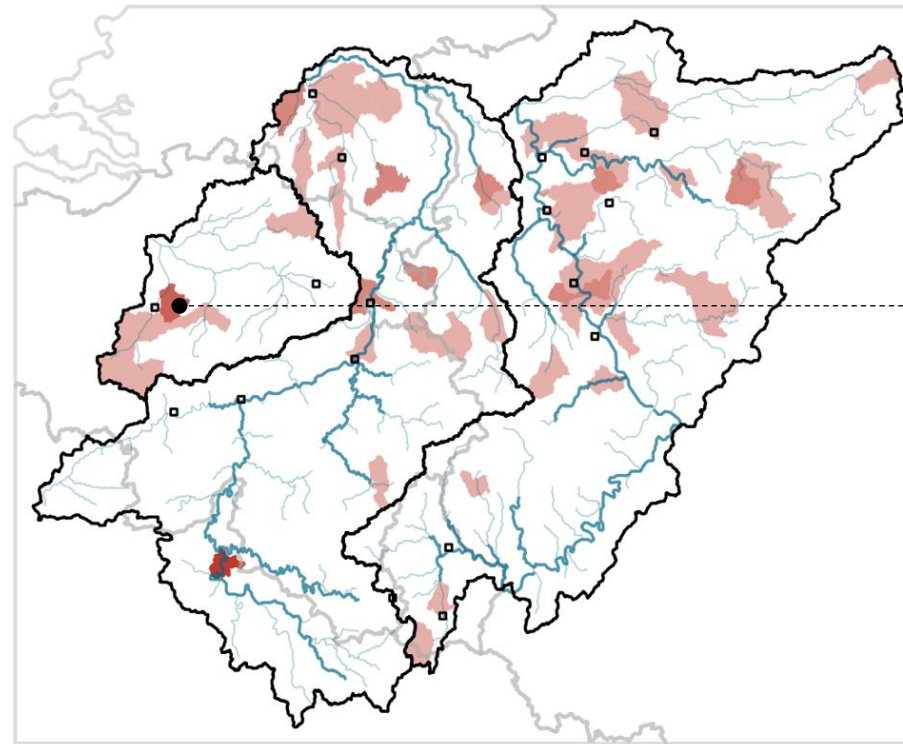
Spatial patterns of dominant topic



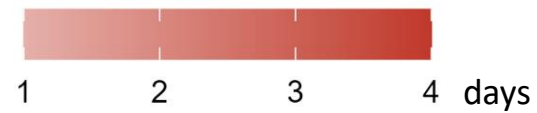
TRACING ONLINE FLOOD CONVERSATIONS

Floods triggered discussion on climate change across all river basins but mainly in urban areas

Spatial patterns of dominant topic



Climate Crisis





TRACING ONLINE FLOOD CONVERSATIONS

Implications for disaster response & recovery

- ✓ Support **transboundary flood risk management**
- ✓ **Issue early warnings:** heavy rainfalls, road traffic issues.
- ✓ **Disaster response recovery:** locate victims and damages, coordinate relief efforts and volunteering initiatives.
- ✓ **Reconstruction:** identify public concerns on disaster causes and (mis-)management practices.

Nat. Hazards Earth Syst. Sci., 25, 2351–2369, 2025
<https://doi.org/10.5194/nhess-25-2351-2025>
© Author(s) 2025. This work is distributed under
the Creative Commons Attribution 4.0 License.



Natural Hazards
and Earth System
Sciences



Tracing online flood conversations across borders: a watershed-level analysis of geo-social media topics during the 2021 European flood

Sébastien Dujardin^{1,2,★}, Dorian Arifi^{3,4,★}, Sebastian Schmidt^{3,4}, Catherine Linard^{1,2}, and Bernd Resch^{3,4,5}

¹Department of Geography, University of Namur, Namur, Belgium

²ILEE - Institute of Life, Earth and Environment, University of Namur, Namur, Belgium

³Department of Geoinformatics – Z_GIS, University of Salzburg, Salzburg, Austria

⁴IT:U Interdisciplinary Transformation University, Linz, Austria

⁵Center for Geographic Analysis, Harvard University, Cambridge, MA, USA

★These authors contributed equally to this work.

Correspondence: Sébastien Dujardin (sebastien.dujardin@unamur.be) and Dorian Arifi (dorian.arifi@plus.ac.at)

Received: 21 October 2024 – Discussion started: 12 December 2024

Revised: 27 March 2025 – Accepted: 13 April 2025 – Published: 15 July 2025

THANK YOU

sebastien.dujardin@unamur.be

