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Using Google Trends to Analyze Public Sensitivity to Climate-Related Natural Hazards and its Correlation with Nuclear Topics: A Proxy Approach for Societal Impact and Risk Communication

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Introduction

Purpose of the study:

- Explore how **public search behavior** reflects sensitivity to natural hazards (floods, tsunamis, hurricanes, wildfires, earthquakes).
- Examine the **correlation between hazard-related searches and nuclear topics** (safety, accidents, energy).

Why it matters:

- Public perception strongly influences **nuclear energy policy, acceptance, and emergency preparedness**.
- Natural hazards are **increasing in frequency and intensity**, raising questions about nuclear resilience.
- Understanding information-seeking patterns can improve **risk communication and trust-building strategies**.

Approach

- Analyze Google Trends search data across regions and time.
- Compare spikes in hazard-related searches with nuclear-related queries.

Natural Hazards and Nuclear Safety Risks

1. **Floods** – direct threat to nuclear cooling systems, power supply, and site access (e.g., Fukushima's seawall breach).
2. **Earthquakes** – historically the most powerful trigger of public concern about nuclear safety (Fukushima, Kashiwazaki-Kariwa, etc.).
3. **Tsunamis** – catastrophic risk for coastal nuclear facilities.
4. **Hurricanes / Cyclones / Typhoons** – storm surge + wind damage can threaten cooling, backup generators, and evacuation logistics.
5. **Wildfires** – can damage power lines, disrupt access, force evacuations near nuclear sites (e.g., Chernobyl forest fires).

Source: ChatGPT 5

Methodology

Data source:
- Extracted weekly Google Trends data (12/29/2024 – 9/14/2025).
- Natural hazard terms: floods, earthquakes, tsunamis, typhoons, wildfires.
- Nuclear-relevant terms: safety, accidents, energy.
- All queries taken as **topics** to capture multiple languages and related terms.

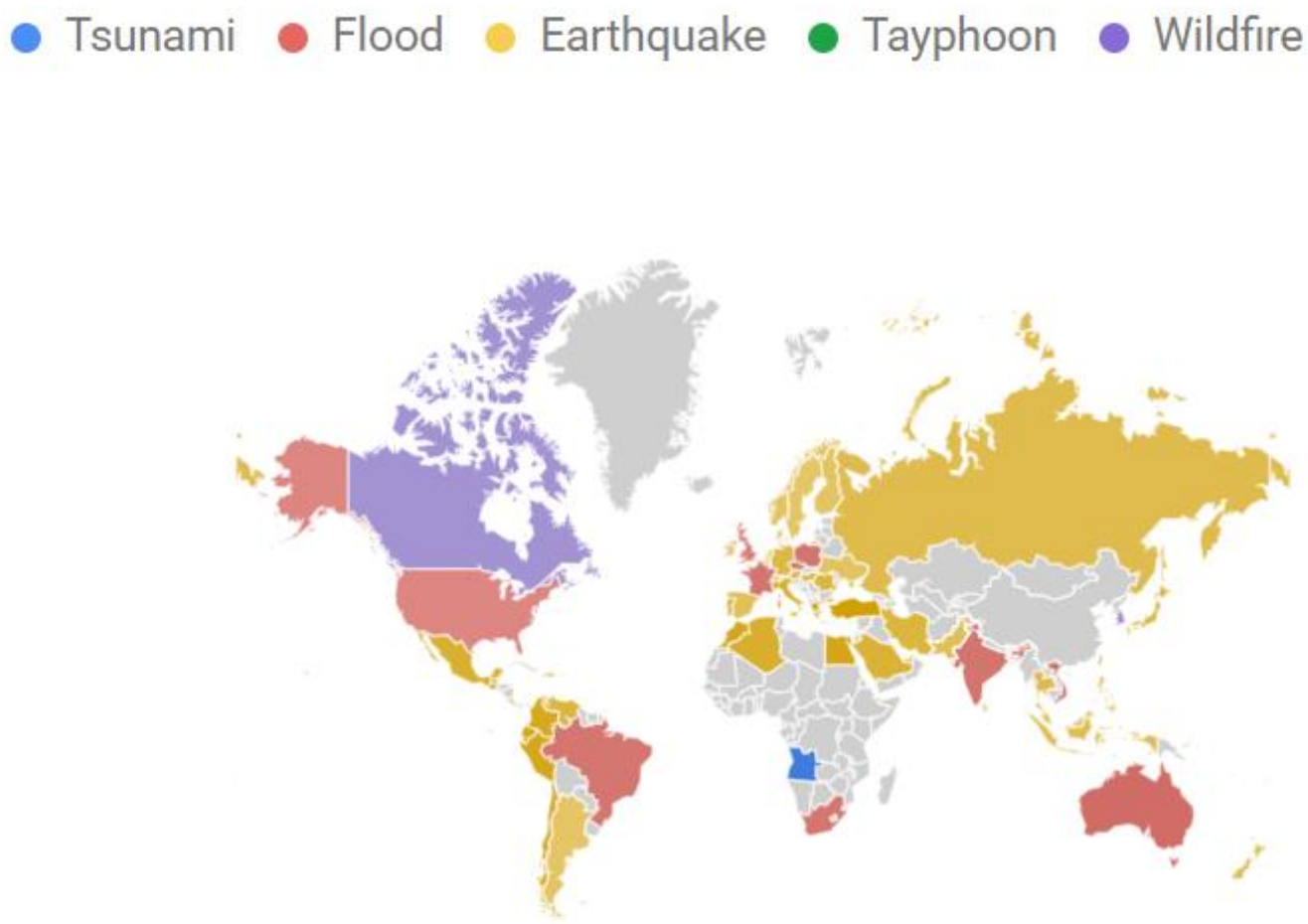
Normalization & comparison:
- Included **drought** as a baseline/control term.
- Allowed calculation of **relative search interest** across hazards and nuclear topics.

Analysis:
- Examined **correlations** between hazard and nuclear searches.
- Analyzed **country-level distributions** of search intensity.

Interpretation:
- Google Trends acts as a **proxy for public concern and interest**.
- Provides insights into **societal sensitivity and risk communication needs**.

Limitations:
- Search data may be influenced by **media coverage, cultural differences, or access to Google**.
- Not a direct measure of attitudes or policy positions.

Natural Hazards Search Frequency



Source: Google Trends (29.12.2024-14.09.2025)

Natural Hazards by Top 10 Territories

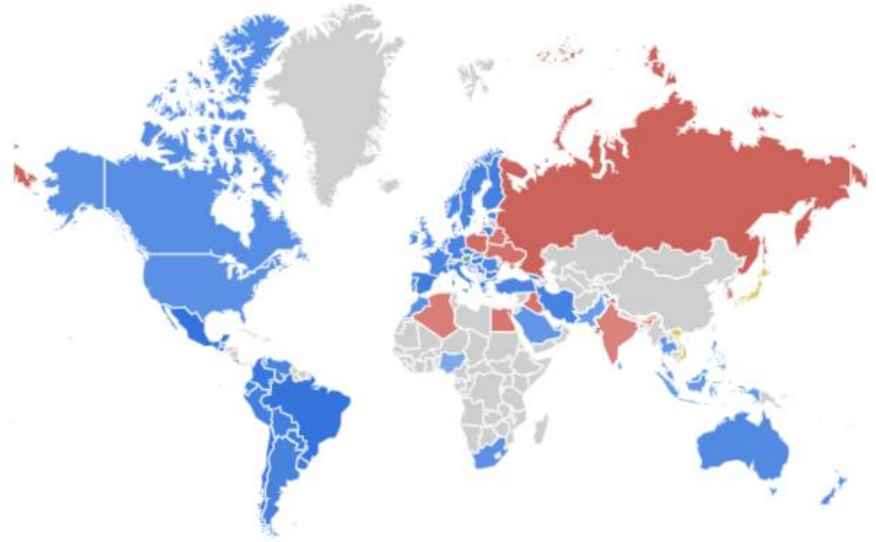
Flood relative	Earthquake relative	Tsunami relative	Typhoon relative	Wildfire relative
Thailand (32.33)	Myanmar (Burma) (100.00)	Japan (99.00)	Taiwan (100.00)	Japan (19.00)
Taiwan (24.00)	Japan (100.00)	Puerto Rico (15.67)	Japan (100.00)	Canada (19.00)
Philippines (24.00)	Türkiye (100.00)	Taiwan (15.67)	Macao (100.00)	South Korea (11.50)
Pakistan (24.00)	Taiwan (100.00)	Chile (13.29)	Hong Kong (99.00)	Hong Kong (7.33)
Argentina (19.00)	Greece (100.00)	New Zealand (11.50)	Philippines (19.00)	Taiwan (6.69)
Singapore (19.00)	Kazakhstan (99.00)	Thailand (10.11)	China (13.29)	United States (5.25)
New Zealand (19.00)	El Salvador (99.00)	Italy (10.11)	Singapore (10.11)	Netherlands (5.25)
Czechia (19.00)	Thailand (99.00)	Dominican Republic (10.11)	Thailand (4.88)	Greece (4.56)
Malaysia (19.00)	Bulgaria (99.00)	Argentina (9.00)	South Korea (4.26)	Ireland (4.26)
Australia (15.67)	Italy (99.00)	Singapore (9.00)	Malaysia (2.85)	United Kingdom (3.76)

The numbers represent relative search interest, making them comparable across territories and topics. For consistency, the search topic 'drought' was used as a benchmark, with all other topics calculated in relation to it.

The Most Frequently Searched Nuclear Topics

Chernobyl disaster Nuclear reactor Radiation Nuclear fusion
International Atomic Energy Agency

Chernobyl disaster Nuclear reactor Nuclear fusion
International Atomic Energy Agency



Source: Google Trends (29.12.2024-14.09.2025)

Nuclear Topics by Top 10 Territories (I/III)

Chernobyl disaster relative	Fukushima nuclear accident relative	Nuclear reactor relative	Radiation exposure relative	Radiation relative
Belarus (8.09)	Japan (0.79)	Belarus (9.00)	Taiwan (0.49)	Belarus (32.33)
Czechia (6.69)	Taiwan (0.79)	Russia (5.67)	Qatar (0.27)	Russia (19.00)
Bulgaria (6.69)	Belarus (0.56)	Ukraine (4.00)	Hong Kong (0.25)	Taiwan (13.29)
Georgia (5.25)	Russia (0.52)	Czechia (3.35)	Singapore (0.23)	Ukraine (11.50)
Estonia (5.25)	Italy (0.39)	Slovakia (3.00)	Belarus (0.22)	Czechia (10.11)
Slovakia (4.56)	Austria (0.37)	Bulgaria (2.57)	Chile (0.20)	Slovakia (8.09)
Lithuania (4.26)	Denmark (0.35)	Kazakhstan (2.33)	Bulgaria (0.18)	Kazakhstan (8.09)
Ukraine (3.35)	Czechia (0.32)	Lithuania (1.86)	United States (0.16)	Denmark (7.33)
Austria (3.35)	Singapore (0.30)	Kuwait (1.56)	Kuwait (0.16)	Singapore (7.33)
Italy (3.35)	Hong Kong (0.28)	Iraq (1.44)	Nepal (0.15)	Serbia (6.69)

Nuclear Topics by Top 10 Territories (II/III)

Nuclear safety and security relative	Radioactive waste relative	Small modular reactor relative	Nuclear fusion relative	Nuclear fuel relative
South Korea (0.14)	Taiwan (3.00)	Taiwan (0.92)	Japan (2.12)	Bulgaria (0.32)
Austria (0.12)	Belarus (0.56)	South Korea (0.72)	Taiwan (1.38)	Japan (0.30)
Japan (0.09)	Slovakia (0.43)	Slovakia (0.52)	Nepal (0.89)	Russia (0.25)
Uzbekistan (0.09)	Russia (0.41)	Singapore (0.39)	Vietnam (0.85)	Ukraine (0.22)
Ukraine (0.09)	Japan (0.33)	Czechia (0.35)	Russia (0.79)	Saudi Arabia (0.22)
Kazakhstan (0.08)	South Korea (0.32)	Bulgaria (0.23)	Romania (0.69)	Slovakia (0.22)
Czechia (0.08)	Hong Kong (0.30)	Japan (0.23)	Bulgaria (0.69)	Czechia (0.19)
Russia (0.06)	Germany (0.30)	France (0.22)	China (0.69)	Belarus (0.18)
Hong Kong (0.05)	Finland (0.30)	Hong Kong (0.20)	Hong Kong (0.64)	Taiwan (0.16)
St Helena (0.05)	Austria (0.28)	Finland (0.18)	Türkiye (0.61)	South Korea (0.16)

Nuclear Topics by Top 10 Territories (III/III)

Nuclear radiation relative	Nuclear fallout relative	International Atomic Energy Agency relative	Nuclear meltdown relative	Nuclear and radiation accident and incident relative	Nuclear power relative
Bahrain (0.27)	Ireland (0.08)	Austria (3.35)	Japan (0.45)	Japan (1.08)	Myanmar (Burma) (0.37)
Qatar (0.23)	South Korea (0.08)	Belarus (1.38)	South Korea (0.09)	Belarus (0.45)	Singapore (0.35)
United Arab Emirates (0.18)	Finland (0.06)	Armenia (1.33)	Hong Kong (0.06)	Russia (0.30)	Bulgaria (0.25)
Kuwait (0.15)	United States (0.05)	Russia (0.96)	Singapore (0.05)	Singapore (0.27)	Pakistan (0.25)
Pakistan (0.12)	Kuwait (0.05)	Kazakhstan (0.89)	Taiwan (0.05)	Czechia (0.25)	United Arab Emirates (0.22)
India (0.09)	Czechia (0.04)	Georgia (0.75)	Germany (0.04)	Hong Kong (0.23)	Ireland (0.20)
Lebanon (0.05)	Japan (0.04)	Azerbaijan (0.72)	Austria (0.04)	South Korea (0.22)	United States (0.20)
Hong Kong (0.05)	United Kingdom (0.04)	Slovakia (0.64)	China (0.04)	Finland (0.19)	United Kingdom (0.20)
Singapore (0.05)	United Arab Emirates (0.04)	Ukraine (0.64)	Switzerland (0.03)	El Salvador (0.18)	Canada (0.20)
Chile (0.05)	New Zealand (0.04)	Bulgaria (0.61)	Denmark (0.02)	Ireland (0.18)	Philippines (0.20)

Key Findings from Correlation Analysis by Territory

Tsunami with the strongest correlations

- Searches on nuclear meltdown and tsunami are highly correlated (**r = 0.962, p < 0.001**).
- Tsunami strongly correlates with nuclear and radiation accidents/incidents (**r = 0.912, p < 0.001**).

Wildfire associations with multiple nuclear topics

- Nuclear meltdown ↔ wildfire (**r = 0.678, p < 0.001**), nuclear fuel ↔ wildfire (**r = 0.564, p < 0.001**), nuclear safety/security ↔ wildfire (**r = 0.502, p = 0.002**)

Earthquake correlations are moderate

- Nuclear meltdown ↔ earthquake (**r = 0.646, p < 0.001**), nuclear fusion ↔ earthquake (**r = 0.538, p < 0.001**), Fukushima accident ↔ earthquake (**r = 0.468, p < 0.001**)

Flood links are weaker, but non-negligible

- Flood ↔ nuclear power (**r = 0.509, p < 0.001**), radiation exposure ↔ flood (**r = 0.420, p = 0.002**)

Small Modular Reactors (SMR) less hazard-linked

- Correlations are modest: *SMR* ↔ *wildfire* (**r = 0.453, p = 0.003**), *SMR* ↔ *earthquake* (**r = 0.327, p = 0.018**).

Discussion

Public concern reflects hazard-nuclear associations

- Tsunamis show the **strongest correlation** with nuclear accident/meltdown searches.
- Highlights the enduring **Fukushima legacy** in public perception.

Wildfires emerging as a climate-driven nuclear anxiety trigger

- Significant links with **meltdown, fuel, safety, fallout**.
- Suggests that climate change-intensified wildfire events broaden nuclear risk awareness.

Earthquakes remain an important but secondary driver

- Moderate correlations with nuclear terms, reflecting **historical accidents**.

Floods and typhoons are acknowledged but weaker in public sensitivity

- Correlations are lower but still indicate **recognition of vulnerability**.

SMR and new nuclear technologies

- Show **low hazard correlation**, implying that discourse is shaped less by disaster triggers.

Implications for risk communication

Google Trends is a useful **proxy for societal concern**, showing associations between hazards and nuclear risk awareness.

Effective **communication strategies should focus on hazard-nuclear linkages that resonate most with the public**.

Important to address **limitations**: data reflects search behavior, not direct attitudes or policy preferences; correlations and not causations.

Thank You For Your Attention!

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Source: ChatGPT 5