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# The “cold lava” flow debacle: Media-driven viral proliferation of a confused message over Marapi’s deadly lahars of 11 May 2024

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## Introduction

On 11 May 2024 torrential rain at Marapi volcano (Sumatra, Indonesia) triggered *lahars* that caused widespread damage and took the lives of more than 50 people. The event was first reported via TIKTOK at 23:50 Central Indonesian Time (CIT, GMT+7) on 11 May 2024 under the title:

*Galodo Marapi, Lahar Dingin Menerjang*

[Marapi flash flood, Lahar Hits]

(<https://www.hariansinggalang.co.id/berita/183495/live-di-tiktok-galodo-marapi-lahar-dingin-menerjang>: downloaded 15/05/2024)

The Indonesian phenomena *Lahar Dingin* is a term which the English speaking world has reduced to *lahar*. Lahar is defined by the United States Geological Survey Volcano Hazards Program as follows:

“Lahar is an Indonesian term that describes a hot or cold mixture of water and rock fragments that flows down the slopes of a volcano and typically enters a river valley. Small seasonal events are sometimes referred to as “debris flows” ... A moving lahar looks like a roiling slurry of wet concrete, and as it rushes downstream, the size, speed, and amount of material carried can constantly change.

Lahars generally occur on or near stratovolcanoes ... Eruptions may trigger lahars by melting snow and ice or by ejecting water from a crater lake ... Lahars can also be formed when high-volume or long-duration rainfall occurs during or after an eruption. On steep slopes, rainwater can easily erode and transport fine-grained, loose volcanic sediment and form a slurry.”

(<https://www.usgs.gov/programs/VHP/lahars-move-rapidly-down-valleys-rivers-concrete>: downloaded 17/05/2024)

The word *lahar*, as described above, is a term with which volcanologists are familiar, and a quick check of Ngram Viewer shows the term as had a solid presence in the literature since 1917, peaking in the period 1986–1994. A post-1976 upsurge in its presence in the literature was fueled by the tragedy at Nevado del Ruiz (Columbia) in 1985 when the town of Armero was buried by a lahar with the loss of 24,000 lives (Lowe et al 1986), as well as lahars associated with the 1980 eruptions of Mount St. Helens (Wright et al. 2023) and 1991 eruption of Pinatubo (Major et al. 1996).

However, the literal translation of *lahar dingin* is “cold lava”, where “lahar = lava” and “dingin = cold”. This was the translation that the media used to label the lahar event at Marapi on 11 May 2024. As a result, during the afternoon of 13 May 2024 the Laboratoire Magmas et Volcans (Université Clermont Auvergne, France) was contacted by a French journalist asking the following question:

I'm currently trying to answer the question: Can cold lava be dangerous: True or false? The idea is to explain what cold lava is, how it is formed, why it sometimes flows, and why it is dangerous.

A follow up question from faculty on our internal email list was:

If anyone has the answer to this question, I'd love to hear it!  
What is cold lava?

This question was not intended as a question regarding whether cold lava existed, but was a statement of “*what on earth is this question about*” and “*why is it being asked*”? We had already noticed the arrival of the term in the media, which is *lave froide* in French, as it had appeared in a report covering Marapi in our local newspaper (La Montagne) that morning. Thus one of us (KK) contacted the journalist to explain that cold lava was actually a lahar. Because the journalist had been exposed, over the day, to so many reports of cold lava (and poor definitions/descriptions thereof) in the French media, she was difficult to convince that cold lava was not a different phenomena to a lahar. The quantity of media reporting that talked only about cold lava, meant that it also took a further 15 minutes to convince the journalist that there had been no active lava flows at Marapi on 11 May<sup>1</sup>.

As a result we decided to examine the genesis and evolution of the term in media-reporting through analysis of all on-line articles reporting on the event as published during 12–15 May, 2024. As we report here, we found that use of the term “cold lava” increased unchecked over the four days following the event, its use becoming widespread in French and English language reporting, effectively creating a new, false, phenomena with a very confused, and incorrect or ambiguous, definition.

## Methods and Data

Unless otherwise stated all dates and times given herein are in the ISO 8601 format dd/mmThh:mm GMT+2 (i.e., Central European Time). Between 12 and 15 May 2024, we searched twice a day at 09:00 and 16:00 for instances of “cold lava”, or the French equivalent *lave froide*, using Google. For any on-line article with the two key words in their titles, we recorded the date and time of article release, article headline and web-link. We then searched each article for sources used, definitions applied, and use of the word “lahar”. We also made a search on Italian (*lava fredda*), German (*Kalte lava*) and Spanish (*lava fría*) equivalents. At the same time, we recorded all Indonesian language reports with a headline containing “Banjir Lahar Dingin” for 11–14 May 2024. Finally, we checked for all incidences of the term “cold lava” (in the sense as applied to lahars) prior to May 2024. The data base is given as a spreadsheet in the Supporting Material (*Cold Lava.xls*). Please refer to this data base for all source citations given herein.

## Results

In Indonesia, we found a total of 582 uses of “Lahar Dingin” as headlines in Indonesian language articles (Fig. 1). Beginning at 23:50 (CIT) on 11 May appearance of articles increased at a rate of 61 posts per hour until 09:25 (CIT) on 12 May when the rate increased to 255. The rate of increase then held steady until the end of our analysis at 14:00 (CIT) on 14 May (Fig. 1).

In headlines for English, French, German, Italian and Spanish language reports of the Marapi tragedy, over the period 12–15 May we found 122 uses of “cold lava”, with French and English language coverage spread across seven and 11 countries, respectively (Fig. 2). No headline included the word

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<sup>1</sup> The article, “*Vrai ou faux? Même froide, la lave est dangereuse*” [True or False ? Even cold lava is dangerous] appeared in Mon Quotidien on 22 May 2024 (<https://monquotidien.playbacpresse.fr/article/vrai-ou-faux-meme-froide-la-lave-est-dangereuse-2024-05-22-002753>)

“lahar”. This trend was reflected by our analysis of the body text where we found 266 uses of “lave froide”, and 220 uses of “cold lava”.

Prior to May 2024, we found just two uses of the word “cold lava” in a headline, this being in the Global Times (published in China) on 7 February 2022, and in the New Sarawak Tribune (published in Malaysia) on 19 April 2024. We also found the use of the word “cold lava” in body text, but never in the headline. For example, in an edition of Italy’s Il Tirreno newspaper published on 2 July 2017, under the headline *Eruzione vulcano in Indonesia, 10 feriti* [Volcanic eruption in Indonesia, 10 injured], written in the body text was:

*Secondo un funzionario della Protezione civile, 10 persone sono rimaste ferite dalla fuoriuscita di lava fredda, fango e ceneri che hanno raggiunto i 50 metri di altezza.*

[According to a civil defence official, 10 people were injured by the outflow of cold lava, mud and ash that reached a height of 50 metres.]

While French language articles accounted for 58 of the published articles, English language articles accounted for 43, with France leading the way in terms of usage of “cold lava” (Fig. 2). Usage included all major news agencies (CNN, BBC, Sky News, TF1) and newspapers, including all of the main nationals (e.g., Le Monde, Le Figaro, The Guardian, The Sun, The New York Times) and most regionals in France. Totals would have been much higher had we made complete body-text searches. For example, the on-line edition of the French newspaper “Le Petit Journal” published on 12 May did not include “cold lava” in the headline, and so was not included in our count. The article did, though, use “cold lava” in the body-text; the term “lahar” was not used in either the headline or the text.

Although the term “cold lava” first appeared in an English language publication (India’s The Economic Times on 12/05 at 05:30), the first European media outlet to pick up on the term was France’s “Groupe EBRA” (Fig. 3), who publish the four newspapers: Dauphiné Libère, Le Progrès, L’Alsace and Vosges Matin. At 07:06 on 12 May all four newspapers published the same story under identical titles:

*Au moins 34 morts dans des crues subites et des coulées de lave froide*  
[At least 34 dead in flash floods and cold lava flows]

Throughout the day, reporting came in clusters as different French media groups picked up on the story (Fig. 3). For example, at 14:08 the two newspapers published by Groupe La Provence, Corse-Matin and La Provence, both released the same story under the headline:

*Indonésie: au moins 34 morts dans des inondations et des coulées de lave froide*  
[Indonesia: At least 34 dead in floods and cold lava flows]

Coverage in the USA began in the mid-afternoon of 12 May, with AP News publishing a piece at 16:51 entitled,

Flash floods and cold lava flow hit Indonesia’s Sumatra island, causing numerous deaths

Coverage in the UK began at 03:19 on 13 May with a piece published by The Guardian headlined,

Dozens killed in cold lava mudslides on Indonesian island of Sumatra.

Headlines with “cold lava” in the title only occurred in the UK sources during 13 May, but continued in India and the USA through 15 May, as too in the French language, although at a diminishing frequency of publication (Fig. 3).

## Discussion: Media definitions of "Cold Lava" and sources

French language coverage led the way in introducing the term “cold lava” during the May 2024 lahar on Marapi, Dauphiné Libère being the first European report of the event in the on-line media. All reporting was sourced to the Paris-based L'Agence France-Presse (AFP), with 36 of the 39 French language reports published on 12 May citing AFP as their source. All reports used an identical definition of “cold lava”. This being:

*La lave froide est un magma formé par les diverses matières qui composent les parois d'un volcan: cendres, sable et roches. Sous l'effet de la pluie, celles-ci peuvent se mélanger et couler le long du cratère.*

[Cold lava is magma formed from the various materials that make up the sides of a volcano: ash, sand and rocks. Under the effect of rain, these materials can mix and flow away from the crater.]

This definition continued to be repeated throughout 13 and 14 May. In all of the 58 French language articles published during 12–15 May, only one used the term “lahar”. This was an article published by L'Humanité on 14 May at 15:11 that read:

*Les pluies torrentielles ont emporté avec elles les roches et sédiments du Marapi, constituant cette matière épaisse, lourde et grise, appelée « lahar » en langue indonésienne et traduite par « lave froide ».*

[The torrential rains washed rocks and sediment off of Marapi, forming a thick, heavy, grey material known as "lahar" in Indonesian, which translates as "cold lava"].

However, this was the only positive point. Other sources attempted their own definition with RTL, in an unsourced piece published at 07:30 on 15 May, giving the following explanation.

*La lave est composée de roches, de sable, de cendre et de gaz. Cette matière en majorité solide fait que la lave s'écoule en général assez lentement, en moyenne à 10 km/h. Les habitants ont donc le temps d'évacuer leurs habitations menacées. Mais lorsque la lave se mélange à la pluie, elle devient plus liquide, prend de la vitesse et là, ce sont des torrents de boue qui dévalent emportant tout sur leur passage.*

[Lava is made up of rocks, sand, ash and gas. The predominantly solid nature of the material means that lava generally flows quite slowly, at an average of 10 km/h. This gives residents time to evacuate their threatened homes. However, when lava mixes with rain, it becomes more liquid and picks up speed, resulting in torrents of mud that sweep away everything in their path.]

Other media outlets began to pose the question *Mais qu'est-ce qu'une "lave froide"?* [But what is “cold lava”]. On 15 May in response to this question, La Réunion's INFO.RE wrote:

*La "lave froide" se réfère à des coulées de boue résultant du mélange de lave volcanique et d'eaux de pluie. Après l'éruption, des pluies diluviennes se sont abattues sur la région, provoquant des torrents de lave froide. Ce mélange est constitué de roches, de sable, de cendre et de gaz, transformant la lave en une matière semi-solide qui se déplace généralement lentement, à environ 10 km/h. Cependant, lorsqu'elle est mélangée avec de l'eau, la lave devient plus liquide, augmentant considérablement sa vitesse et sa capacité destructrice.*

["Cold lava" refers to mudflows resulting from the mixing of volcanic lava and rainwater. After the eruption, torrential rain fell on the region, causing torrents of cold lava. This mixture is made up of rocks, sand, ash and gas, transforming the lava into a semi-solid material that generally moves slowly, at around 10 km/h. However, when mixed with water, the lava becomes more liquid, considerably increasing its speed and destructive capacity.]

English language coverage mostly cited the Associated Press, Reuters and/or local sources, especially Indonesia's National Agency for Disaster Management (Badan Nasional Penanggulangan Bencana, BNPB). The first English language report we could find was published on 12 May by the Jakarta Post and Aljazeera, and -- although the headlines respectively read,

12 dead after West Sumatra flash floods, cold lava flow  
At least 28 dead, several missing in Indonesia flash floods, cold lava flow

the body text in both posts contained the statement:

Cold lava, also known as lahar, is volcanic material like ash, sand and pebbles carried down a volcano's slopes by rain.

Twenty-four of the 43 English language reports included this same definition, and only 11 failed to include the caveat that "cold lava" is actually a *lahar*. In all, there were 44 instances of the use of *lahar* in the body-text. Several of the English language reports also used expert sources, such as the United States Geological Survey, which meant that the definition given by the BBC at 09:00 on 13 May was,

The phrase cold lava is a translation of the term "lahar" in Indonesian and Tagalog. Temperatures range between 0°C and 100°C, according to how they are formed, but are typically below 50°C.

Even if the headline did focus on the "cold lava" spin:

'Cold lava' sweeps villages near volcano, killing 41

This did not stop one or two English-language reports making some rather questionable (and unsourced) definitions, including that made by MoneyControl on 14 May who stated, without reference to lahar and under the headline "What is cold lava and how it unleashed calamity by killing over 40 in Indonesia?", that:

Cold lava remains hot internally due to chemical reactions within the volcanic material, but its external appearance and behavior are more akin to wet concrete.

Other sources became even more confusing by dropping the word "cold" from "cold lava". In the French language reporting we found seven cases of the use of "lava" alone, and six cases of "*coulées de lave*" [lava flows]. For example, Paris Match on 12 May led with the headline:

*Inondations et coulées de lave en Indonésie: les images du désastre meurtrier à Sumatra*  
[Floods and lava flows in Indonesia: images of the deadly disaster in Sumatra]

or from Le Parisien on 13 May:

En Indonésie, le bilan des inondations et des coulées de lave s'alourdit à 57 morts, le temps de plus en plus compté pour les disparus

[In Indonesia, the death toll from flooding and lava flows rises to 57, and time is running out for the missing]

These confused messages implied that “lava flows” (albeit “cold”), and not lahars, were descending Marapi’s flanks, with the most common headline in France on 12 May being,

Indonésie: au moins 34 morts dans des inondations et des coulées de lave froide  
[Indonesia: at least 34 dead from the floods and cold lava flows]

The confusion resulted in definitions becoming jumbled. For example, to answer the question “*Qu’est-ce que la lave froide?*” [What is cold lava ?] l’info.re (on 15 May) wrote:

*La "lave froide" se réfère à des coulées de boue résultant du mélange de lave volcanique et d'eaux de pluie. Après l'éruption, des pluies diluviennes se sont abattues sur la région, provoquant des torrents de lave froide. Ce mélange est constitué de roches, de sable, de cendre et de gaz, transformant la lave en une matière semi-solide qui se déplace généralement lentement, à environ 10 km/h. Cependant, lorsqu'elle est mélangée avec de l'eau, la lave devient plus liquide, augmentant considérablement sa vitesse et sa capacité destructrice.*

["Cold lava" refers to mudflows resulting from the mixing of volcanic lava and rainwater. After the eruption, torrential rains fell on the region, causing torrents of cold lava. This mixture is made up of rocks, sand, ash and gas, transforming the lava into a semi-solid material that generally moves slowly, at around 10 km/h. However, when mixed with water, lava becomes more liquid, considerably increasing its speed and destructive capacity.]

All-in-all the result was the feel that the eruption involved real lava flows that were *cold* but when mixed with water created a flow that was more fluid, faster moving and more destructive than the starting product (lava). At the same time, “cold lava” was apparently a new, exotic and poorly understood “magma” or eruptive phenomena, for which a new term, in need of definition, had suddenly appeared.

## Sum-up

The tragic event that took the lives of more than 50 people at Marapi on 11 May 2024 was a *lahar*. Instead, by being part of the headline in 122 English, French, German, Italian and Spanish language on-line media posts in the four days following the Marapi tragedy, the hazard responsible for the loss became a *cold lava* flow. In the field of volcanology, “cold lava” does not exist as a hazard. Instead, the term *lahar* does, and can be defined as (Whittow, 1984),

“a mud flow composed mainly of volcanic ash lubricated by water from bursting of a crater lake, snowmelt (sometimes during eruption of a snow capped volcano) or from prolonged torrential rain”.

In the *Encyclopedia of Volcanoes*, Vallance and Iverson (2015) define *lahar* as:

“an Indonesian term most commonly defined as a rapidly-flowing gravity driven mixture of rock, debris and water from a volcano”.

Vallance (2000) adds that *lahar* “most commonly means debris flow, transitional flow, or hyperconcentrated flow” and that “although many workers use *lahar* for both the process and the deposits that result from it, it is better to restrict the term to the process.” *Lahar* is similarly defined in widely available and popular French-language volcanology text books for all levels (e.g., Tanguy 1999;

Bardintzeff, 2008; Pradal 2012), as well as both English- and French-language dictionaries (e.g., Foucault & Raoult 2009; Stevenson & Waite, 2011; Michel et al. 2013).

In Indonesian, *lahar* actually means *lava* and when directly translated the Indonesian term for “*a mud flow composed mainly of volcanic ash*” (Whittow 1984), *Lahar Dingin*, becomes “cold lava”. Thus, the term *Lahar Dingin* (cold lava) does exist in Indonesian and has a real (accurate) meaning in the local-regional sense for “*a mud flow composed mainly of volcanic ash*”. However, due to the direct translation of *Lahar Dingin* by L'Agence France-Presse, cold lava (rather than *lahar*) became the focus of attention and, above all, confusion amongst the reporting media. Worse, the phenomena “cold lava” was supported by definitions that were wildly inaccurate. Presented with this *new* phenomena, the subsequent confusion among science and staff writers at various media outlets is clear in the attempts to define this *apparently exotic* phenomena.

We thus need to separate out three problems in media-reporting of natural hazards and disasters which, in order of increasing importance, are:

1. Direct translation of a hazard term that applies locally or regionally, but for which the English language (and in this case other European languages) have a word which cannot be arrived-at through direct translation;
2. Media-driven creation and establishment of a new hazard term (in any language) for which a well-established and defined word, with ascribed meaning, already exists (cf. Harris & Lanfranco 2017);
3. Assignment by the media of an inappropriate, misleading and/or incorrect definition to the phase/word.

Point 1 is the problem that applied on 12 May 2024 for *Lahar Dingin*, and point 3 developed during 12–15 May 2024. For the case of point 2 this, now, needs to be avoided. However, in the case of *lahar*, the community has unfortunately adopted an Indonesian word that translates to *lava* (Pyle 2017). This also has to be recognized and taken into account, although it is likely too late now to change and correct a nomenclature that has been entrenched in volcanology since the early 1920s (Pyle 2017).

## Conclusion

Creation of new terms in such a media-led way is not helpful in hazard and risk communication, as it promotes the feeling that the hazard is somehow new, unknown, poorly understood and, therefore, more frightening (Harris & Lanfranco 2017). For the case of *Lahar Dingin*, this was reflected in the many instances of the question: *What is Cold Lava?* When uncertainty exists it should be the job of the press agency and/or journalist to fact check, as was the case for the Associated Press. The journalist, though, is working on a tight schedule, so needs an answer *now*. Journalists reporting on an on-going natural disaster needs to work to extremely tight time deadlines and a need to publish in near-real time (e.g., Friedman 1986; Williams 2010; Harris 2015). Thus, the journalist will likely not have the time to follow all possible leads.

It should thus be the duty of all scientists to track cases of confusion, and then to reach out to the media so as to correct such mistranslations, assignment of fake words, misconceptions and inappropriate definitions. This needs to be done as soon as possible through direct approach to science and staff writers at media outlets because, as we see with the case of “cold lava”, fake terminology can go viral in a matter of a few hours. Then, as we can see from the French language proliferation of the false term *Lave Froide*, once entrenched in the popular literature can be very difficult to correct.

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## Figure captions

**Fig. 1** Cumulative frequency of the use of Lahar Dingin in Indonesian on-line media posts during 12–14 May 2024

**Fig. 2** Frequency distribution of the use of lave froide, cold lava, lava fría, lava fredda and Kalte lava by country during the period 12–15 May 2024

**Fig. 3** Frequency of on-line publication of an article with lava froide” or “cold lava” in the title in (1) France and (2) all other French language publications, as well as in (3) the USA and (4) the UK, as well as (5) all other English language publications.

Figure 1

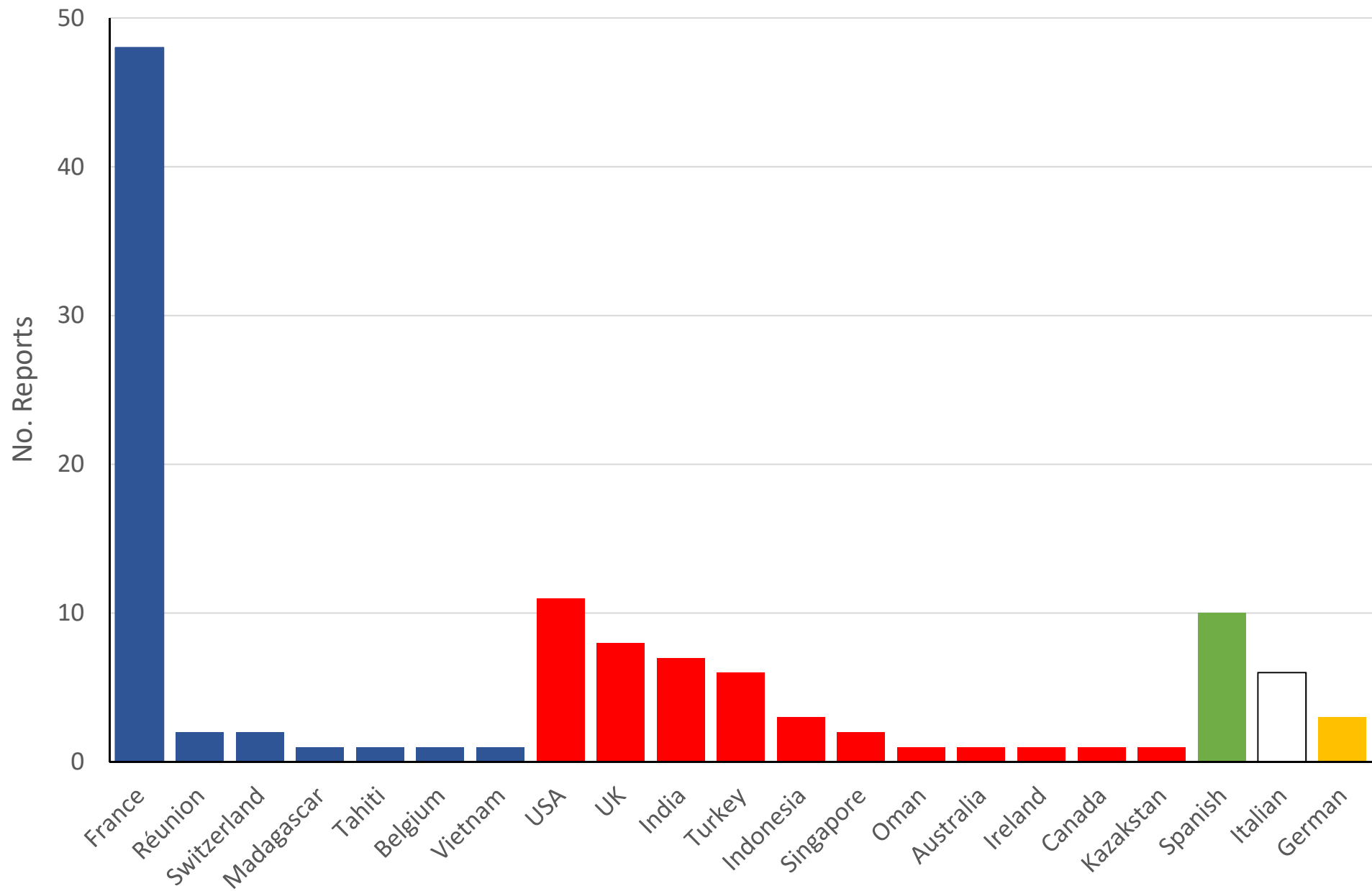


Figure 2

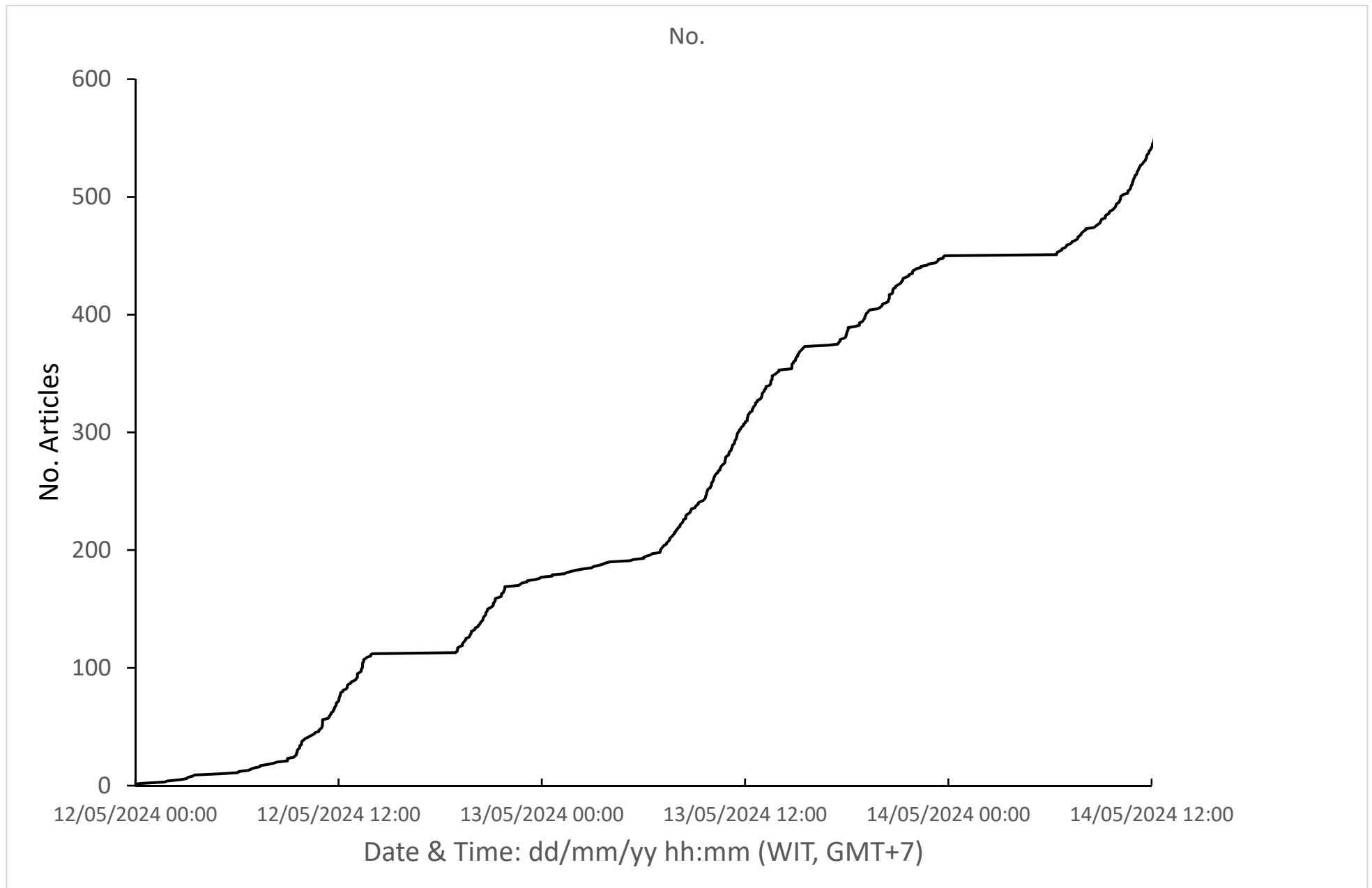
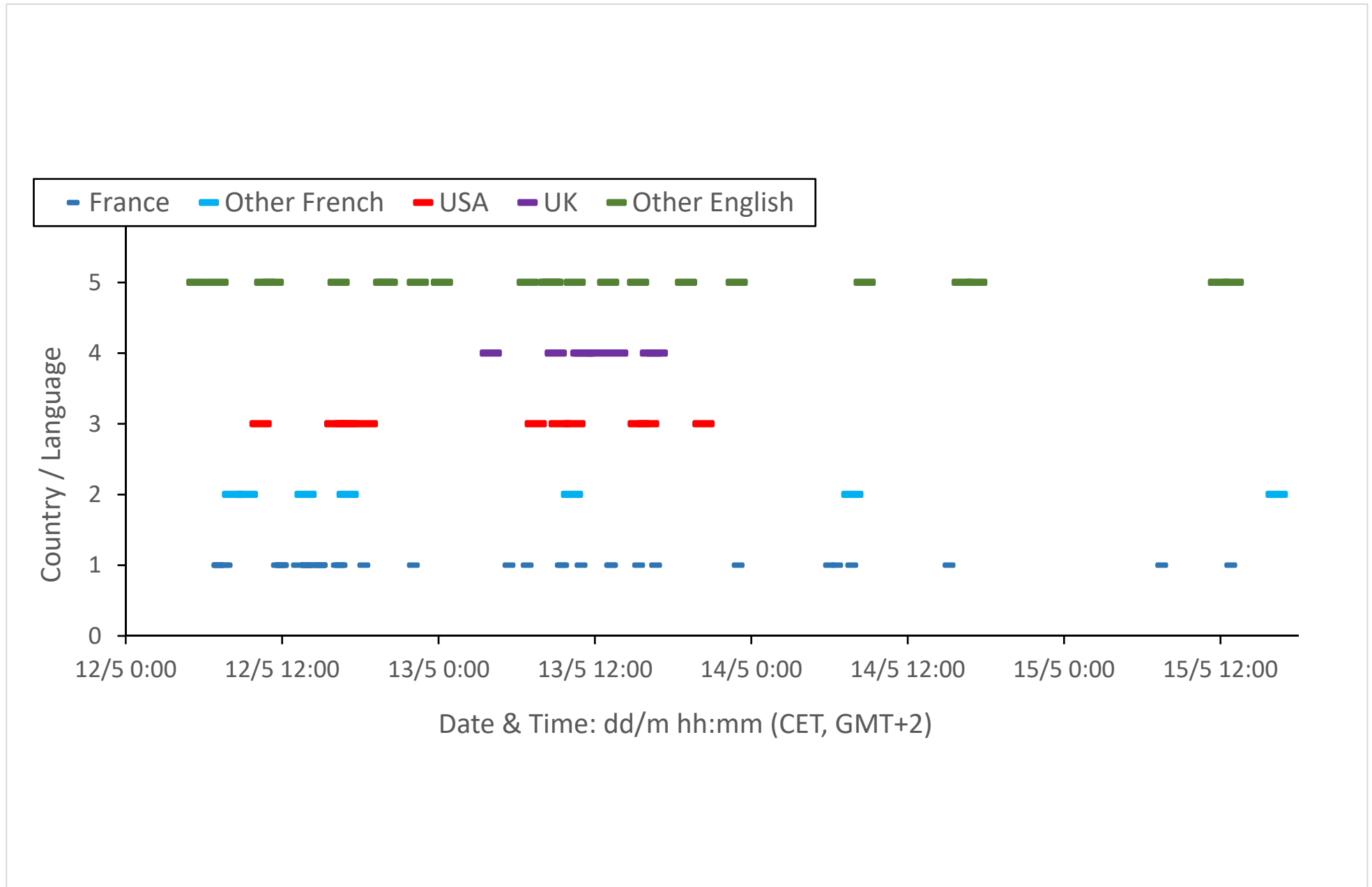


Figure 3





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**Supplementary Material**  
Cold Lava - Data Base.xlsx

