

# Supporting information for: "From hashtags to hostility: global dynamics of climate denialism on Twitter in the post-COVID ERA"

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## ABSTRACT

The rise of denialism in the general population has been accompanied by a very significant increase in denialist activism on Twitter since the summer of 2022, and increased hostility towards climate scientists.

Through global tracking of Twitter exchanges about climate change between 2019 and 2023, as well as exchanges about COVID-19 pandemics, we analyzed this online trend and its interaction with politics and COVID-19 debates.

Beyond fact-checking, we have shown, through complex networks and semantic analysis, that there are structural differences between these denialist and pro-climate online communities, as well as between the circulation of false information and other climate change-related narratives.

All the evidence suggests that the behavior of deniers is designed to deceive, and that they are over-represented on social networks compared to what they actually represent offline. This is particularly true on "X"/Twitter since Musk's takeover.

We have also highlighted the globalized aspect of this new denialism, its alignment with the interests and visions of powers such as Russia and how it has benefited from the COVID-19 pandemic.

## A Data collection on Twitter

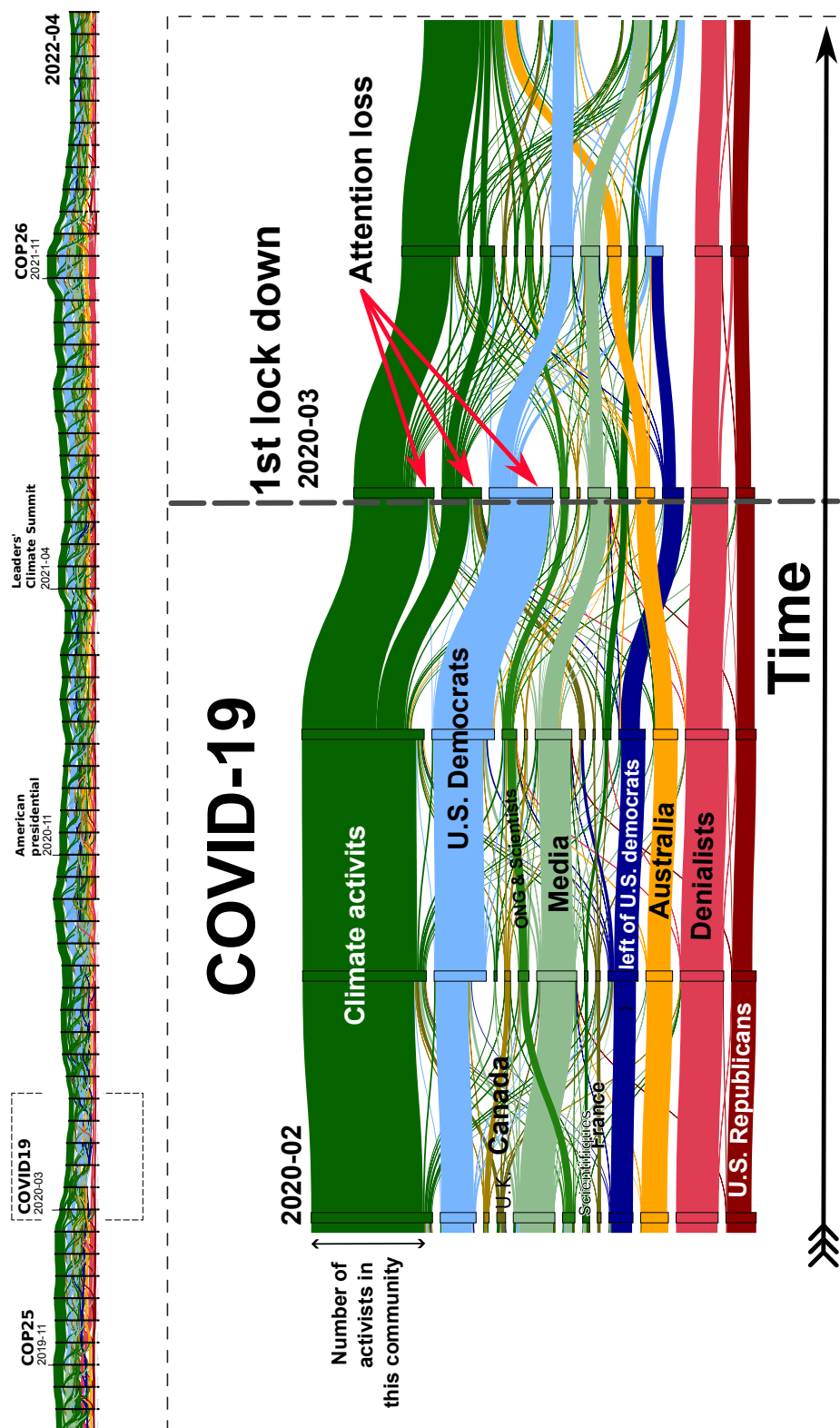
Since 2015, we used the Twitter's track API to collect the tweets associated to a list of several dozens of English and French keywords related to climate change (full list available at <https://doi.org/10.7910/DVN/10REG0>). This list is based on a mapping of the semantic landscape of climate change (cf. [Climate Tweetoscope](#)) from 28,3k Web of Science publications published in 2015 with "climate change" in their topic (title, abstract or keywords). More than 400 million tweets related to climate change were collected until Twitter closed its APIs in spring 2023.

Similarly, we conducted a monitoring of the debates on COVID-19 (2.5 billion tweets over 2019-2023, 77M being vaccine related) and on French politics (711M tweets over 2016-2023<sup>1</sup>), two independently collected databases that allow for cross-reference between societal issues.

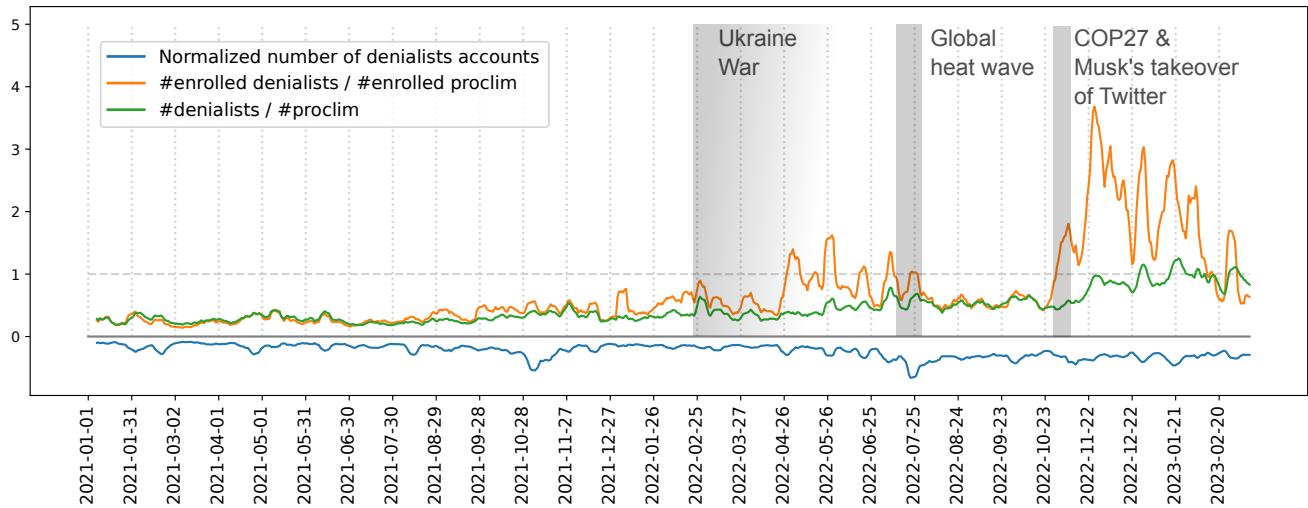
## B Evolution of denialist and proclimate communities

	Pre-Musk			Post-Musk			Variation		
	sources	relays	events	sources	relays	events	sources	relays	events
<b>Pro-clim.</b>	226k	612k	6,566k	150k	456k	3,311k	-33,50%	-25,50%	-49,50%
<b>Denialists</b>	95k	220k	3,463k	86k	221k	3,090k	-10,00%	0,00%	-10,70%

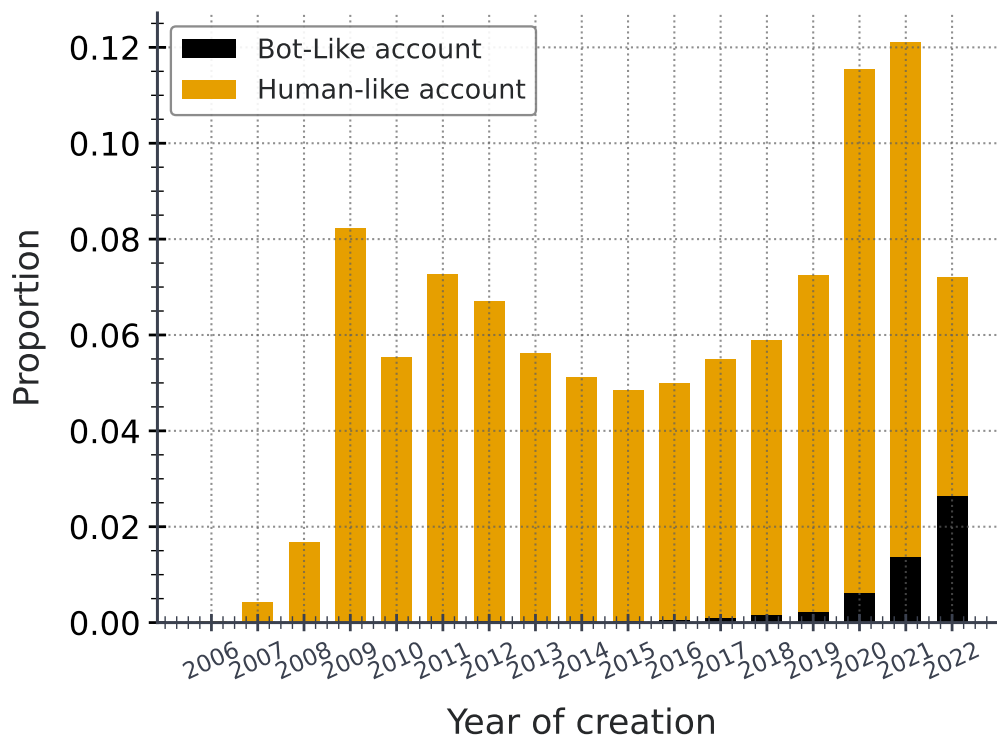
**Table B.1.** Evolution of the global activity of pro-climate and climate denialists accounts between the 92 days pre-Elon Musk (2022-07-22 to 2022-10-22) and post-Elon Musk (2022-11-22 to 2023-02-22). The term "sources" refers to the number of accounts that produced original tweets. The term "relays" refers to the accounts that have produced retweets. These two sets of accounts overlap. The term "events" refer to all types of messages (tweets, re-tweets, comments). A halving of the number of pro-climate publications can be observed right after Musk's takeover.



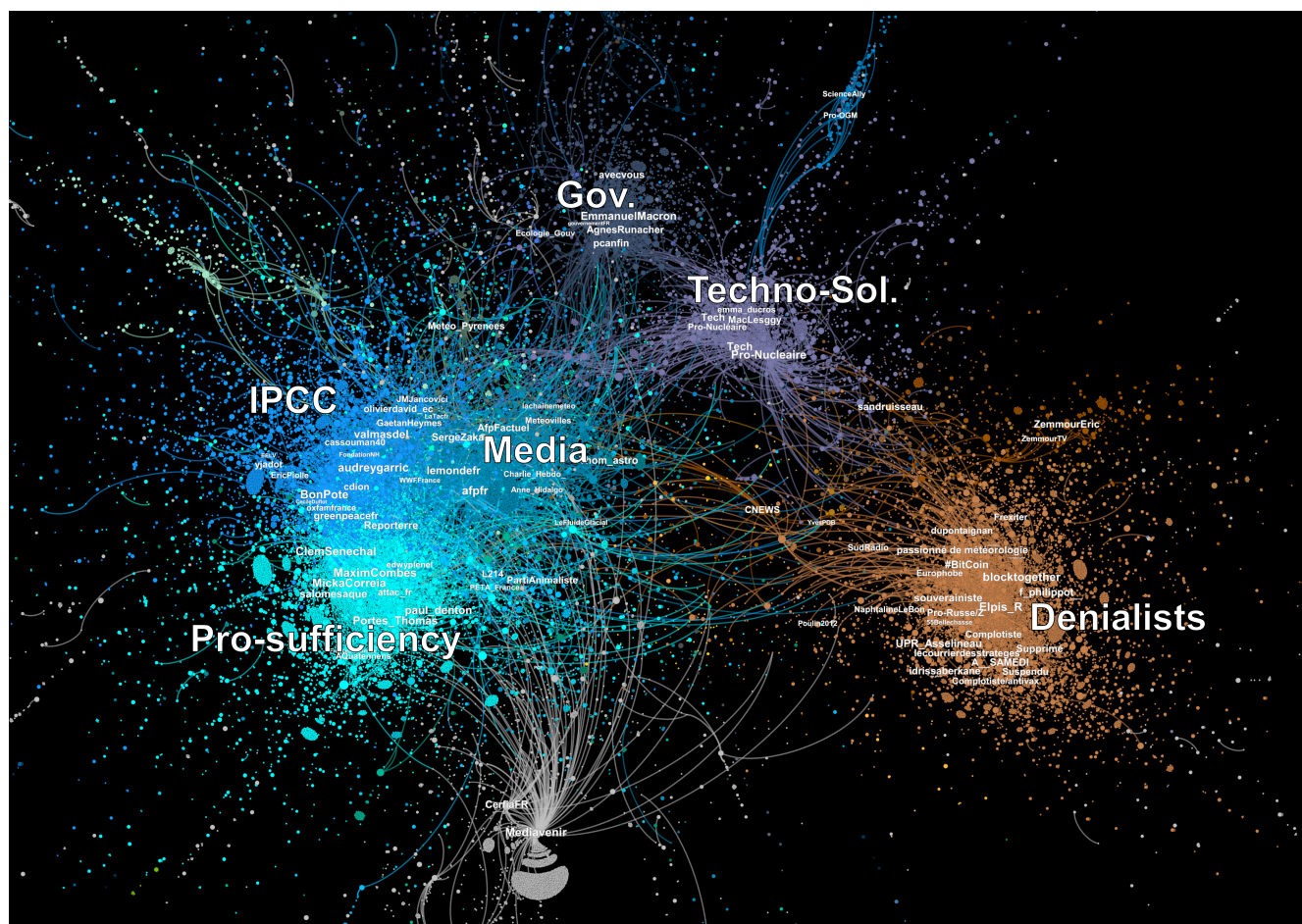
**Figure B.1.** Evolution of the importance of different climate activists' communities over time and news using the reconstruction method of <sup>1</sup> for the period Oct. 2019 - June 2020. Each color represent an online community and the height of a stream is proportional to the number of account participating to the corresponding community. Vertical bars represent the importance of communities in a given month. The main figure corresponds to the moment when the COVID-19 pandemic became the focus of global news mechanically leading to a decrease in activity of the discussions around climate. It is a zoom of the part of the upper figure surrounded by dotted lines and labelled "COVID-19". On this figure, we can see several peaks of activity corresponding to the summits on climate, but also to important political moments such as the American presidential elections of 2020.



**Figure B.2.** Global change in the relative influence of deniers on Twitter between 2021 and 2023. *In green:* The ratio of the number of denialist accounts to the number of pro-climate accounts. *In orange:* the ratio between the number of enrolled denialist accounts (accounts involved in climate discussions for the first time) and the number of enrolled pro-climate accounts. Denialists gradually become the majority on Twitter with a new wave of enrollment in the spring of 2022. As a reference, the number of denial accounts (normalized to 1) was plotted in *blue* on an inverted scale. Data are averaged over a rolling week for better readability.



**Figure B.3.** Proportion of accounts participating in international climate change discussions, by year of account creation, calculated on 5 million active accounts between 2020 and 2022. In black the accounts acting as “bot”, in orange the humans. Note that the near absence of these accounts before 2019 may be due to their suspension by Twitter moderation.



**Figure C.1.** Core of the French climate Twittosphere in the fall of 2022. [\[Animated video\]](#)

## C Zoom on the French case

Until recently, we did not observe in the climatoscope a very structured French denialist community. Things seem to have changed since the summer of 2022, with the birth of a community of several thousand accounts relaying denialist content (bottom right of the figure 1).

### C.1 Structure of the French climate change landscape

A zoom on the set of French Twitter accounts in the figure 1 reveal interesting sub-structures of this opinion landscape over the period from January 2021 to December 2022.

For the sake of readability, even if it is always delicate to summarize the opinions of a whole group by a single label, we have tried to give them names as close as possible to the arguments they develop after a close qualitative and quantitative analysis of the profiles that compose them (see also sect. D) and some of their tweets (cf. sect. E).

As shown in the table C.1, the most important sub-community is a denialist community (which appeared in July 2022), but whose size remains much smaller than that of the whole pro-climate science communities. The most frequent keywords in the profile descriptions of its members are typical of alt-right, far-right or conspiracy accounts. The top 5 five in descending order of frequency, are: *freedom* (76), *right* (69), *patriot* (68), *truth* (57), *frexit* (46).

As for the pro-climate science communities, several components are clearly distinguishable:

- The community of scientists who contributed to the IPCC reports and their first relays (hereinafter called “IPCC community”)
- The “pro-sufficiency”<sup>1</sup> community led by pro-climate science activists (associations, NGOs and political activists).

<sup>1</sup>\* Sufficiency policies are a set of measures and daily practices that avoid demand for energy, materials, land and water while delivering human well-being for all within planetary boundaries. See [IPCC AR6 WGIII SPM](#).



**Table C.1.** French communities: number of accounts and number of tweets over the period 2021-2022.

Community	Size	Tweets
Denialists	9.7k	449,4k
pro-sufficiency	8.3k	359,7k
IPCC	6.3k	285,4k
Medias	5.4k	162,2k
Techno-sol.	4k	207,7k
Gov.	2.5k	88,5k
Far-right	0.9k	20,1k

**Table D.1.** Proportion of “likely-bot”

Community	Jan, 2021	Dec, 2022
IPCC	1.0%	2.2%
Denialists	1.4%	6.2%
TechnoSol.	0.9%	2.2%
Pro-sufficiency	0.7%	2.7%

Most frequent keywords: *policy* (105), *journalist* (102), *left* (86), *science* (72), *feminist* (63),

- A community whose members, without denying the anthropic origin of climate change, believes that there are solutions, such as nuclear power, which make some of the measures defended by other pro-climate advocates superfluous. We will hereafter refer to as “techno-solutionists”. Some of the techno-solutionists are also strongly against the idea of “degrowth”.

Most frequent keywords: *policy* (77), *science* (74), *liberal* (55), *innovation* (44), *right* (40).

As we can see, the main difference between techno-solutionist and pro-sufficiency communities is that members of the former often they describe themselves as liberal of right-wing while members of the later they describe themselves as left-wing.

Last, there are one community structured around the mainstream media and an other structured around government communication, both of which relay pro-climate information.

## D Twitter profiles analysis

In order to give a better intuition of the differences between the pro-climates communities, we provide here the tagclouds of the profiles description for the denialist, techno-solutionist and pro-sufficiency communities. The main difference between techno-solutionist and pro-sufficiency communities is that members of the former often they describe themselves as liberal of right-wing while members of the later they describe themselves as left-wing. As for the denialist community, we find a vocabulary that is typical from alt-right, far right and conspiracist: freedom, patriot, truth, frexit, Zemmour, etc.

### D.1 The growth of the French denialist community

The analysis of the evolution of the size (Fig. D.2) and activity (Fig. D.3) of the different French communities since January 2021 shows a clear evolution of the power relations between communities.

**Community size :** In 2021, the number of active Twitter users belonging to the “IPCC”, “denialist”, “techno-solutionist” and “pro-sufficiency” communities, varied correlatedly and in similar proportions, as shown in Fig. D.2. However, by 2022, the balance of power between communities has changed dramatically, with the sizes of the “denialist” and “pro-sufficiency” communities more than doubling, coupled with strong temporal fluctuations. The first massive increase in denialist accounts occurred during the French presidential election cycle<sup>2</sup>.

The second occurred at the same time as the November 2022 United Nations Climate Change Conference in Sharm El Sheikh, Egypt, which also corresponds to the period when Elon Musk, after buying Twitter, decided to shut down entire departments dedicated to moderation and set out to reinstate suspended accounts.

<sup>2</sup>Presidential campaign in April 2022 and legislative campaign in June.



**Figure D.1.** Tag clouds of profile description per community.

The analysis of the average activity of the members of these communities (Fig. D.3) shows that the “denialist” and “pro-sufficiency” communities are the most volatile, and the relative importance of the denialist community has increased considerably, reaching about ten thousand active accounts.

## D.2 The French denialist community develops a toxic discourse

By exploiting a natural language processing model trained to detect toxic content —whether it be obscenities, insults, threats, attacks on gender or religion— we measured the tone of the speeches of actors from different communities. From this point of view, there is a glaring difference between the denialist community and the IPCC community. Indeed, as shown in Fig. D.4, the proportion of messages identified as “toxic” circulating in the denialist community is 3.5 times higher than that of the IPCC community, and 1.5 times higher than that of pro-sufficiency community.

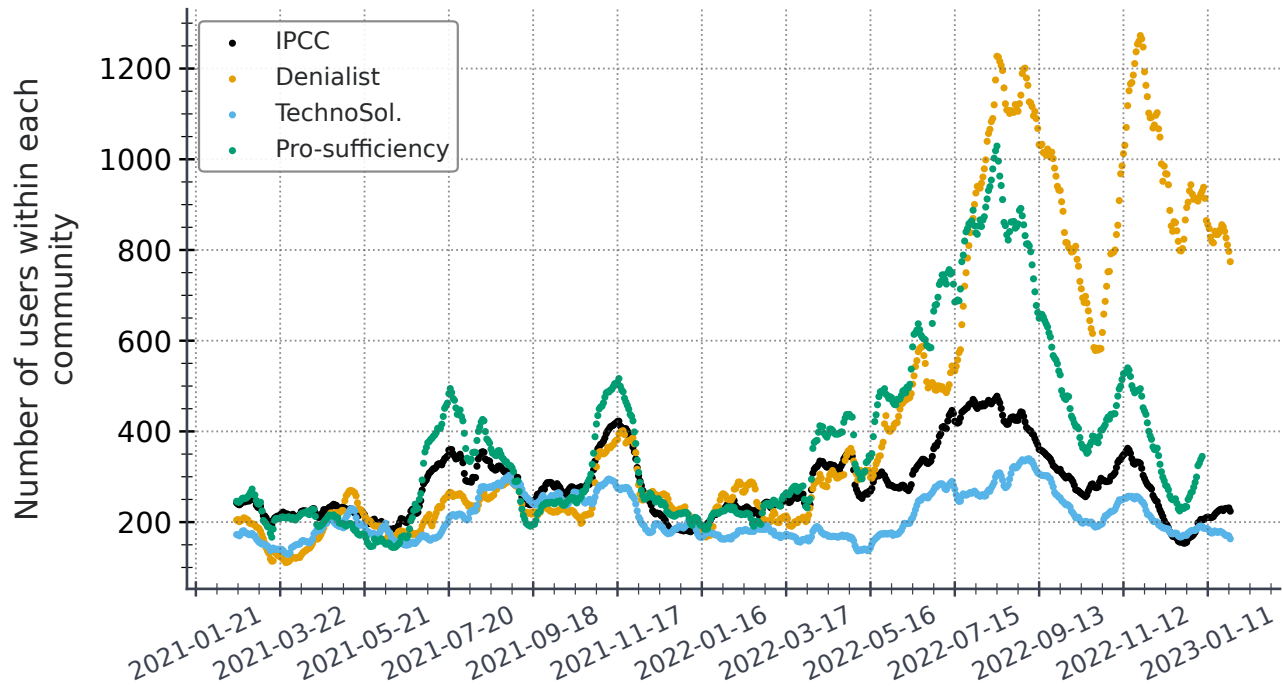
This observation corroborates the fact that there are ten times more suspended accounts in the denialist community. Regarding the first reactions to the French publication of our study, the over-toxicity of the denialist community reached +373.3% compared to the IPCC community (see E), with estimated weights of 60.88% for “insult”, 23.71% for “obscene” and 5.71% for “identity attack” contents.

## D.3 Comparison between political and climate activism in France

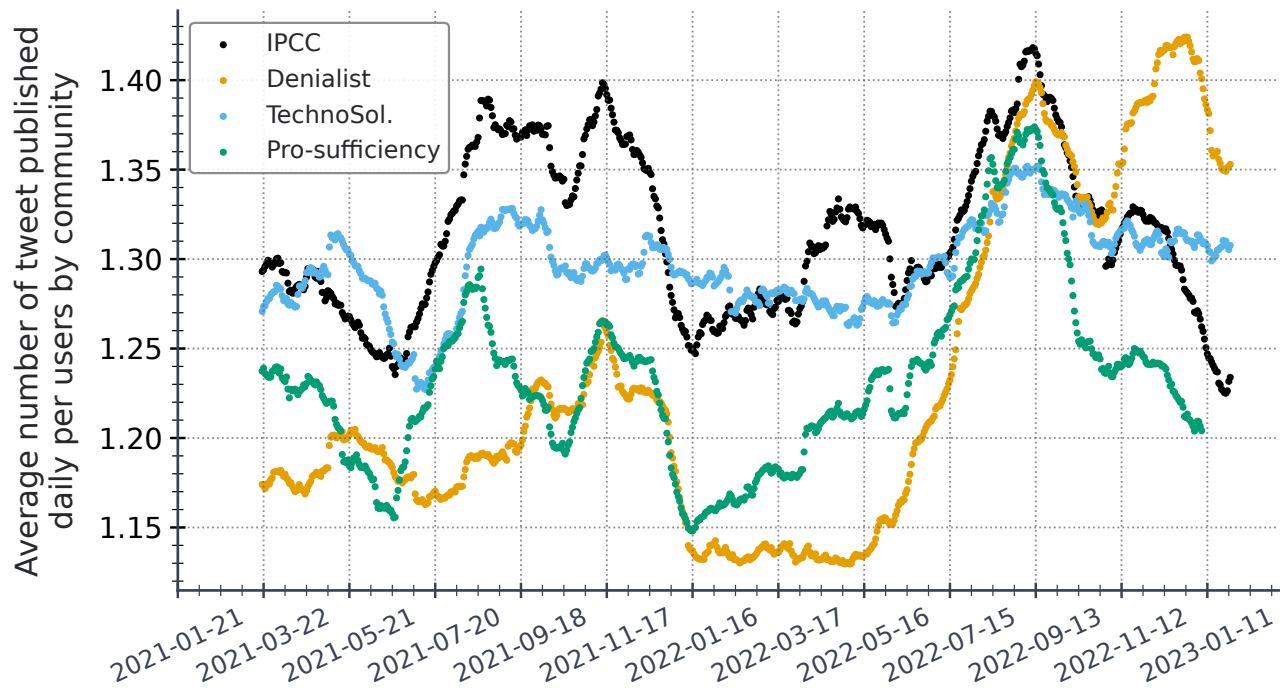
In order to better qualify this terrain, we mobilized the [Politoscope](#) platform (CNRS/ISC-PIF), which is the equivalent of the climatoscope in the field of French political activism. Since 2016, it has been mapping the French political twittosphere<sup>2</sup>, its evolution and the attempts to manipulate French public debates.

Comparing the landscapes of interactions around political and climatic issues as on the figure D.5 allows us to better qualify the state of mind of the French denialist community.

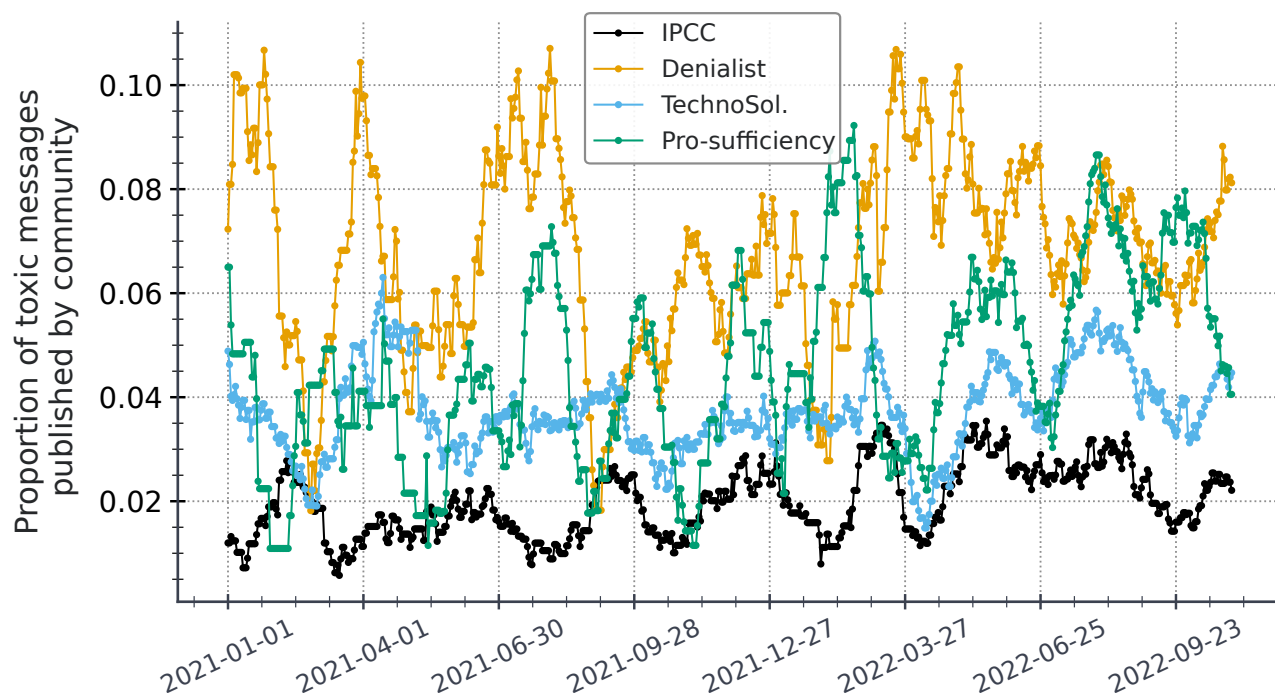
The first thing to note is that, apart from a significant proportion of accounts involved in the informational sphere of Reconquête! (French far-right) who briefly addressed the climate issue during the 2022 presidential campaign, the denialist community is not composed of political activists from traditional parties (LFI, PS, EELV, Renaissance, LR or RN). As the figure shows, the vast majority of the accounts that make up the community and relay political information come from the community that was formed around Florian Philippot and F. Asselineau during the Covid-19 pandemic in reaction to a “sanitary dictatorship”.



**Figure D.2.** Daily number of active Twitter accounts belonging to the “IPCC”, “denialists”, “techno-solutionists”, “pro-sufficiency” communities (one month moving average)



**Figure D.3.** Average number of tweets published daily by accounts belonging to the “IPCC”, “denialist”, “technosolutionist” and “pro-sufficiency” communities over time (moving average over one month)



**Figure D.4.** Proportion of toxic messages posted by each community

As documented in *Toxic Data* (Chavalarias D., Flammarion 2022), this community, now one of the most important in the political twittosphere, emerged in November 2020 after the announcement of the discovery of the vaccine against COVID-19. Antivax, and more generally “anti-system”, this community has been the seat of a radicalization of its members, under the effect of conspiracy speeches, disinformation and most probably astroturfing from the Kremlin.

## E Analysis of the reactions to the first publication of this study

A first version of this study was published as a pre-print in French in order to analyze the reactions of the different communities to such studies. The 7,718 original tweets published within twelve days of the pre-print release have been collected, 1,604 being produced by accounts categorized in Fig. C.1.

These tweets have generated a total of 2.4M impressions, 1.3M retweets, 17.7k likes and discussions involving 3,920 replies and 400 quotes.

The patterns of the reactions of the 1,604 categorized accounts matches what is described in sect. 3.3.1, namely that denialist reactions are far more toxic than those of IPCC community members.

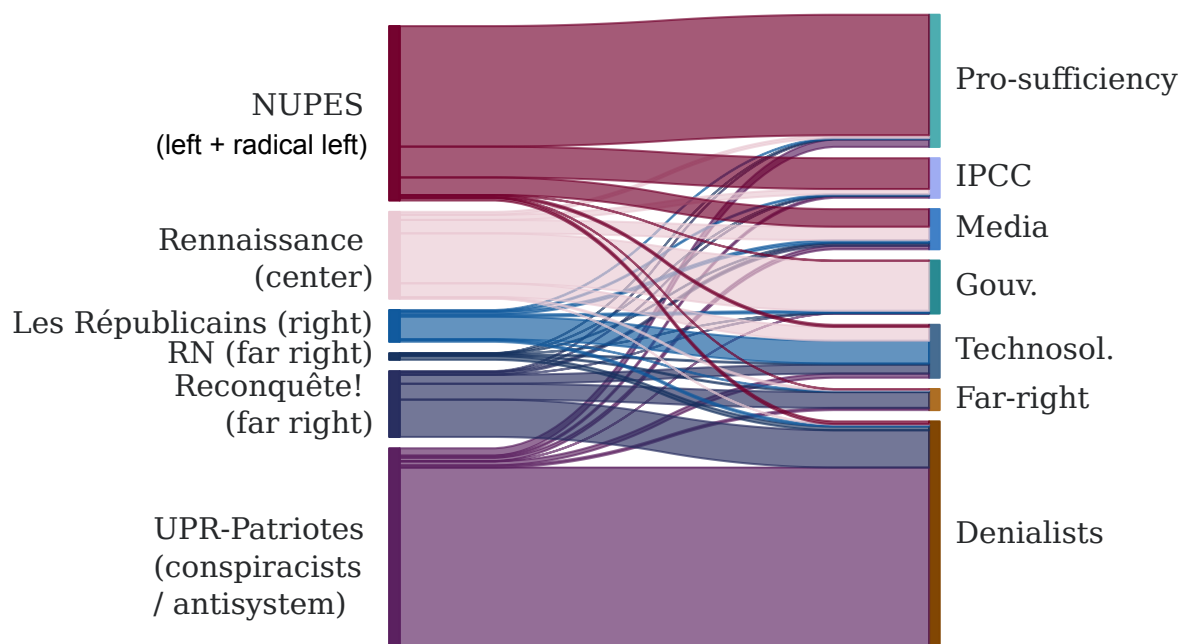
More specifically, the denialists’ reactions to this study has an overall toxicity score 373.3% higher than those of IPCC (cf. table E.1, with estimated weights of 60.88% for “insult”, 23.71% for “obscene” and 5.71% for “identity attack”).

On the other hand, the techno-solutionist community has an over toxicity of 106.7% and the pro-sufficiency community of 26.7%. These levels of toxicity of these two latter communities could be explained mainly because this study has generated polemical Twitter exchanges between members of the techno-solutionist and pro-sufficiency communities on the question of techno-solutionism or its definitions, although this was not at all the focus of the study. These exchanges reveal the strong antagonism between these two communities which, although they both accept the anthropogenic origin of climate change, spend time confronting each other on the response to be made. On the other side, the media and government communities have an average score respectively of -36.4% and -93.9% lower than the one of IPCC community.

Note that although the denialist community has been the most active in terms of tweets, its impression numbers are far below the one of IPCC (more than twenty times less), which puts their influence on Twitter into perspective.

The detailed analysis of the reactions to this study (close reading of tweets, quantitative analysis with the NLP tools [GarganText](#) and summary with ChatGPT 3.5) gives more insight into the overall motivations of each communities and confirms that these groups are homogeneous in their approach to climate change issues and associated research findings:

- **The techno-solutionists’ reactions** emphasize several issues :



**Figure D.5.** Shared accounts between the French political twittosphere (Politoscope, left) and the French climate twittosphere (Climatoscope, right) [18,060 shared accounts]. The width of the bands indicates the number of accounts that are shared by the different categories.

- **Defending nuclear power:** Some members of this Twitter community actively defend the use of nuclear power as a viable solution to climate change. They believe that nuclear power should play a central role in the energy transition.
  - **Criticism of the name "techno-solutionist":** Some messages question the categorization of pro-nukes as "techno-solutionists" and point out that this can lead to a problematic assimilation with climate skeptics. They suggest that there is a need to distinguish between the different shades of opinion within the pro-nuclear community.
  - **Questioning the Climatoscope Study:** Several posts questioned the methodology and conclusions of the Climatoscope study mentioned in the tweets. Some feel that the study lacks nuance and that the categories used are simplistic, which undermines its credibility. Many simply denigrate the study or its authors without further arguments.
  - **Criticism of anti-nuclear activists:** Some tweets criticize anti-nuclear activists, accusing them of blocking progress in the fight against climate change by opposing the use of nuclear power. Some also question the anti-nukes' vision for funding alternatives.
- **The denialists' reactions** highlights several aspect of their mindset:
    - **Rejection of consensus on climate change and denigration of IPCC.** They express an ideological position that challenges the scientific consensus on climate change. Some users criticize the behavior of climate scientists, accusing the IPCC of ethical violations and ignoring uncertainty. They go so far as to consider their work as fraudulent.
    - **Victimization and call for debate.** They reject the idea of categorizing individuals and accuse those who call them "denialist" of sowing discord. Some users feel that being labeled as a climate skeptic or denialist for questioning the IPCC's dire scenarios and expressing doubts about proposed actions is unfair. They believe that debate is a

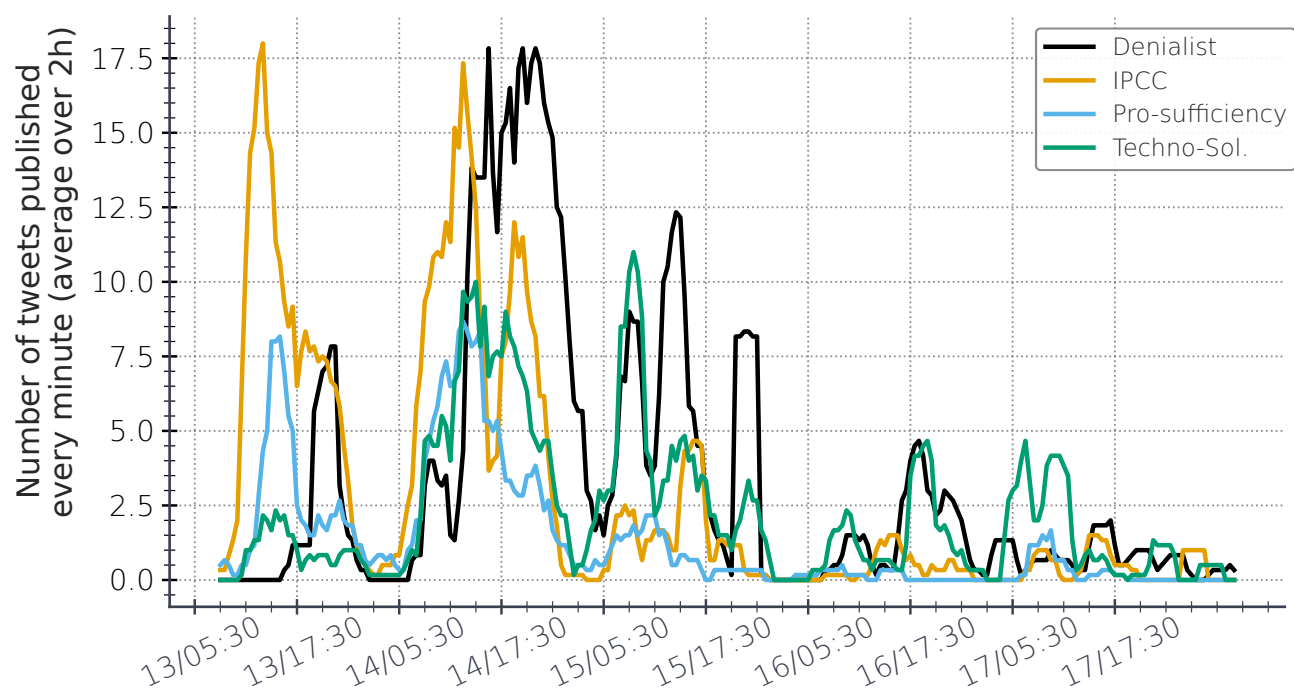


**Table E.1.** Number of Original tweets in reactions to the French pre-print of the study (Feb. 13-25 2023) with the total number of impressions and average toxicity per community .

Community	Tweets	Impressions	<Relative toxicity>	<Toxicity>
IPCC	334	492,388	0.015	0%
Pro-sufficiency	227	357,302	0.019	+26.7%
Techno-sol.	399	115,147	0.031	+106.7%
Denialists	485	31,614	0.071	+373.3%
Medias	114	11,291	0.007	-53.3%
Gov.	45	993	0.004	-73.3%
Total / avg	1,604	1,008,735	0.065	

more productive means of action than simply discrediting them (although, as we have already mentioned it, they refuse in practice to debate in the sense of a discussion that would aim at finding a common vision of the world).

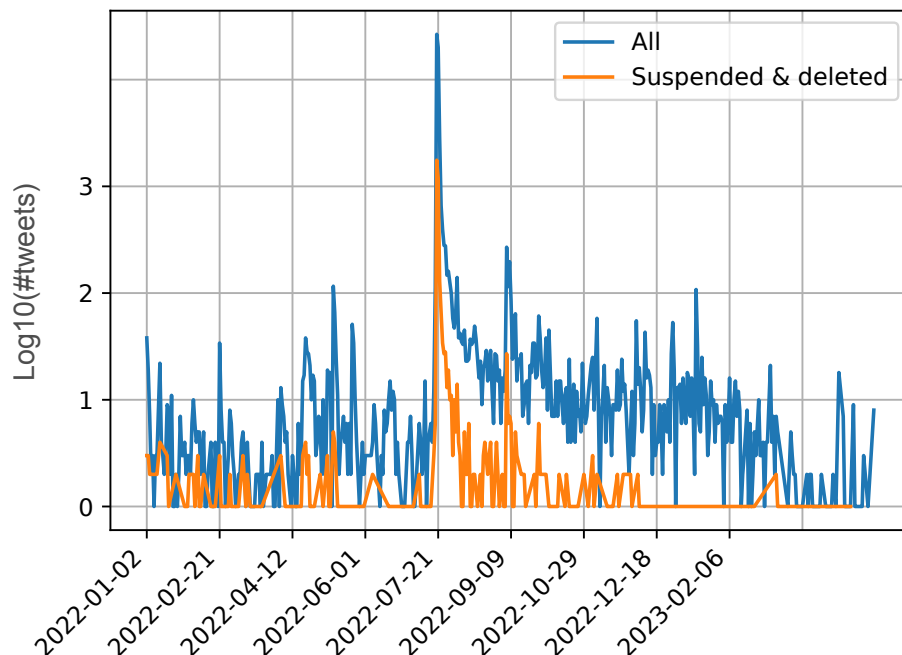
- **Attacks on the CNRS and the authors of the study.** Some users also criticize the CNRS (Centre national de la recherche scientifique) for what they see as the decrepitude of the organization. They denounce an extremist religious totalitarianism that refuses any other explanation or consideration. Some use extremely toxic language that is common in conspiracy circles such as "pedophile".
- **Members of the pro-sufficiency community** accurately relay the results of the study and also raise concerns about the dissemination of scientific knowledge and IPCC findings due to the presence of denialists and techno-solutionists on Twitter.
- **Members of the IPCC Twitter community** accurately relay the results of the study, emphasize the importance of the recognition of climate change due to human influence and criticizes the practices of disinformation and manipulation aimed at sowing doubt about this scientific reality. They support scientific research and warns against the consequences of polarizing society on scientific issues.



**Figure E.1.** Reaction to the first French pre-print of our study within five days of release. Number of tweets per minute, averaged over 2h.

## F Project Veritas

### F.1 Evolution of the number of tweets

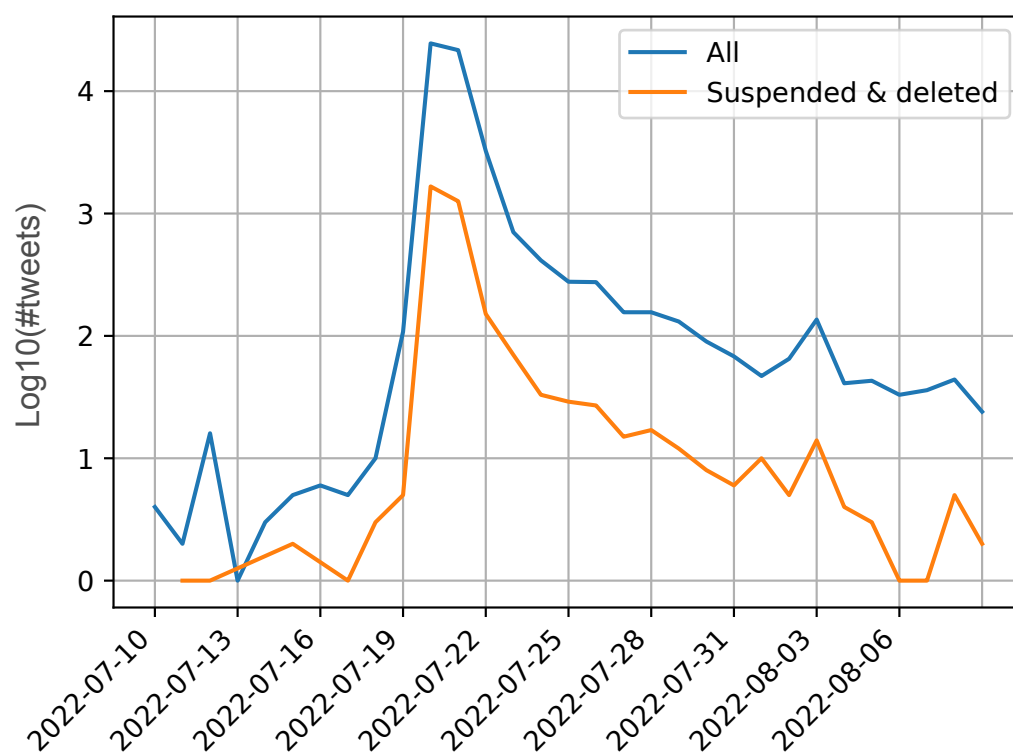


**Figure F.1.** Evolution of the number of tweets relaying the Project Veritas narrative (log scale) . Suspended and deleted accounts have been flagged thanks to Twitter/X Compliance API on Feb. 2 2023

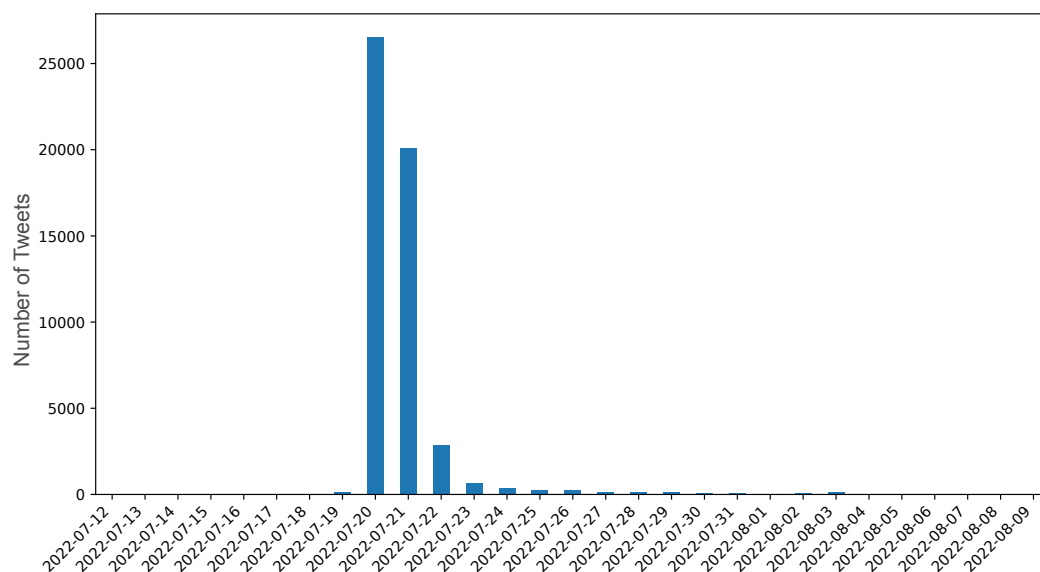
#### F.1.1 Tweet Capture

### G Example of inauthentic temporal patterns

Looking at some of the topics mentioned in 3.3.2., we can exemplify an other inauthentic pattern revealing inauthentic behavior among the denialists community. For example, the daily volume of tweets on a topic such as “the CO<sub>2</sub> is good for plants”/“there would be no life without CO<sub>2</sub>”, a near-weekly cycle emerges over the period of November to December 2019 (Fig. G.1) while over the same period the pro-climate community shows no activity. This suggests that some denialist accounts establish narratives which they then endeavor to program in a planned way, in the hope that the repetition of a narrative will result in its appropriation. As noted in<sup>3</sup>, this example of scheduling can help find accounts with anomalous behavior.



**Figure F.2.** Evolution of the number of tweets relating the Project Veritas narrative around July 20th 2022 (log scale). Suspended and deleted accounts have been flagged thanks to Twitter/X Compliance API on Feb. 2 2023.



**Figure F.3.** Evolution of the number of tweets relating the Project Veritas narrative around July 20th 2022.



**Hunter Buydon** 🧑🏻 🧑🏻  
@LetsgoBrandonDE

...

Project Veritas look at CNN climate change strategy

4:59 AM · 1 janv. 2022



**Figure F.4.** Announcement of the 'fear factor' narrative in the US. "Project Veritas look at CNN climate change strategy"  
<https://twitter.com/LetsgoBrandonDE/status/1477127280044482566>



**AuBonTouiteFrançais** 🍷 🍷 🍷  
@VictorSinclair3

...

Le discours Covid est en train de mourir.  
Préparez vous à un gros retour en force du réchauffement climatique.  
Ce sera la même bande d'ordures qui en parlera et les mêmes abrutis  
tomberont dans le panneau.

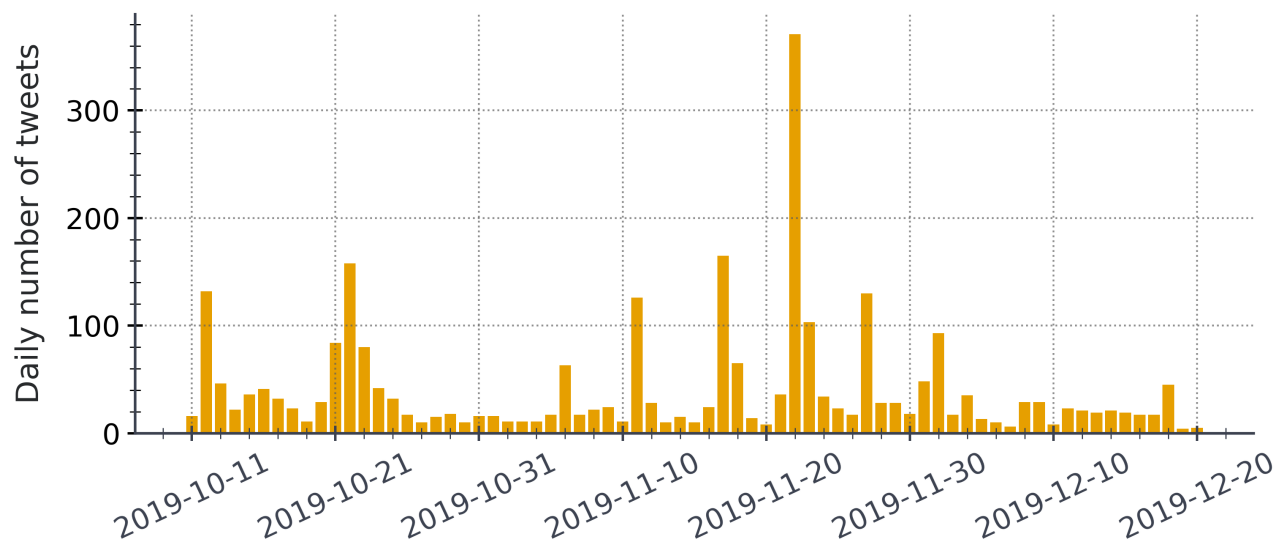
11:03 PM · 14 janv. 2022

**Figure F.5.** Announcement of the 'fear factor' narrative in France. "The Covid discourse is dying. Get ready for a big comeback on global warming. It'll be the same bunch of scumbags talking about it, and the same morons falling for it." This account, VictorSinclair3, has been suspended by Twitter before being rehabilitated by Elon Musk.  
<https://twitter.com/VictorSinclair3/status/1482111221176606721>





**Figure F.6.** French influencer announcing and framing the climate 'fear factor'. **Top July 29th 2022:** "We've gone from #Covid alarmism not based on facts and reality, to #Climate alarmism not based on facts and reality. Can't wait for winter, that'll be one less." ; **bottom July 17 2022:** "I see some who understood for the #COVID, denounced, lying media.... And now endorse them for the #Climat ? #meteo. WHO is for health, what IPCC is for climate, two political control bodies, all based on fears. #Agenda2030" <https://twitter.com/VictorSinclair3/status/1482111221176606721>



**Figure G.1.** Number of tweets describing CO<sub>2</sub> as a “plant food” by climate denialists, as a function of time. This "comb" structure is inauthentic.

## H Elpis\_R



Figure H.1. Elpis\_R profile on Oct. 2023.



Figure H.2. Example of contradictory misleading messages. The first relays a tweet saying “From 1998 to 2015, the temperature did not increase unlike the CO<sub>2</sub>”, the second states “Nobody denies that climate change exists. Climate has always changed but there is no proof it is linked to our emissions.”

Overall, this approach implements a strategy popularized by Sun Tzu, a Chinese general of the VI century BCE that also starts with a "D": *Divide your enemies*<sup>4</sup>.

Note that in the example H.3-e, Elpis\_R presents a truncated excerpt from an IPCC report that says exactly the opposite of what it implies, namely:

*"The climate system is a coupled non-linear chaotic system, and therefore the long-term prediction of future climate states is not possible. **Rather the focus must be upon the prediction of the probability distribution of the system's future possible states by the generation of ensembles of model solutions.** Addressing adequately the statistical nature of climate is computationally intensive and requires the application of new methods of model diagnosis, but such statistical information is essential."*

[IPCC TAR WG1, Working Group I: The Scientific Basis.](#)

Example of Elpis\_R pro-Kremlin messages between 25/02/2022 and 31/07/2022 :

- 11/03/2022: “Inform you, it is now official that there are well bio lab US in Ukraine, because you denounce Russian lies, whereas you make only swallow the Western media propaganda The Occident and the USA them did nothing but lie for each war since years”
- 20/04/2022 - in answer to @BHL admiring Zelensky: “You are a disgrace dear sir, it is high time that the warlord that you are eclipses, you defend Nazi militias, a corrupt regime, put in place by the USA, which has been bombing Russian speakers for more than 8 years.”

It is noteworthy that only 3% of the messages of this denialist influencer are categorized as "toxic" according to our model, a rather polite strategy to win over public opinion. This strategy goes hand in hand with his desire to project the image of an "expert" who claims to have read thousands of articles, with many highly technical tweets that take out of context or distort the results of academic articles.

## H.1 Evolution of Elpis\_R profile descriptions

Profiles descriptions have been translated from French. Each record is organized as follow : Profile description | first date of capture | Account Id | Account screen name | number of followers

- Re-inform against this Orwellian propaganda, through a perspective other than that of the pensée unique. | 2021-09-02T15:45:41Z | 634541534 | Elpis\_Reall | 27 |
- Don't question authority, watch TV, science is your god, stay asleep [http://vk.com/real\\_elpis](http://vk.com/real_elpis) [http://gettr.com/user/real\\_elpis](http://gettr.com/user/real_elpis) | 2021-11-16T00:49:53Z | 634541534 | Elpis\_Reall | 76 |
- Biostatistician, (data analyst) Free spirit, for fair information unbiased by the systemic corruption that plagues this world. I block trolls | 2021-12-23T20:21:37Z | 634541534 | Elpis\_R | 276 |
- Biostatistician - Data Analyst Free Spirit, for fair information unbiased by the systemic corruption that plagues this world. | 2022-04-16T11:13:39Z | 634541534 | Elpis\_R | 620 |
- Free spirit, for fair information unbiased by the systemic corruption that plagues this world. | 2022-06-10T16:20:43Z | 634541534 | Elpis\_R | 696 |
- Disconnected from the matrix since 09/11/2001. | 2022-06-26T18:23:49Z | 634541534 | Elpis\_R | 711 |
- null | 2022-06-29T12:39:42Z | 634541534 | Elpis\_R | 740 |
- "Enemy No. 1 is ignorance..." Julian Assange. "Those who cannot remember the past are condemned to repeat it. George Santayana. | 2022-07-02T11:36:03Z | 634541534 | Elpis\_R | 829 |
- "Enemy No. 1 is ignorance..." Julian Assange. "Those who cannot remember the past are condemned to repeat it" George Santayana. | 2022-07-06T15:40:09Z | 634541534 | Elpis\_R | 864 |
- "Enemy No. 1 is ignorance" Julian Assange. "Those who cannot remember the past are condemned to repeat it" George Santayana. | 2022-07-17T15:57:49Z | 634541534 | Elpis\_R | 924 |
- 97% of scientists agree with whoever funds them. The remaining 3% are banned from social networks and discredited on Wikipedia. | 2022-07-17T18:44:25Z | 634541534 | Elpis\_R | 925 |
- 97% of scientists agree with whoever funds them. The 3% are banned from the networks and discredited on Wikipedia. +0.2°C over 40 years. Météo≠Climat | 2022-07-22T21:41:29Z | 634541534 | Elpis\_R | 948 |
- 97% of scientists agree with the one who finances them. The 3% are banned from the networks and discredited on Wikipedia. +0.2°C over 40 years Météo≠Climat | 2022-07-27T13:22:51Z | 634541534 | Elpis\_R | 1915 |
- 97% of scientists agree with the one who finances them. The remaining 3% are banned from the networks and discredited on Wikipedia. Météo≠Climat | 2022-08-14T10:29:51Z | 634541534 | Elpis\_R | 2294 |
- 97% of scientists agree with whoever is funding them. The remaining 3% are banned from the networks and discredited on wikipedia. Météo≠Climat | 2022-10-15T00:13:28Z | 634541534 | Elpis\_R | 5387 |

- Climate Science Research. | 2022-10-15T23:39:46Z | 634541534| Elpis\_R | 5451 | Climate Science Research. | 2022-11-02T23:49:35Z| 634541534| Elpis\_R | 8470
- Climate Science Research - Climate Realist - Alarmists ignore the geological climate record. | 2023-01-28T18:16:38Z| 634541534| Elpis\_R | 17227
- Climate Science Research (Independent) - Climate Realist - Alarmists Ignore The Geological Climate Record. | 2023-01-30T16:56:12Z| 634541534| Elpis\_R | 17566





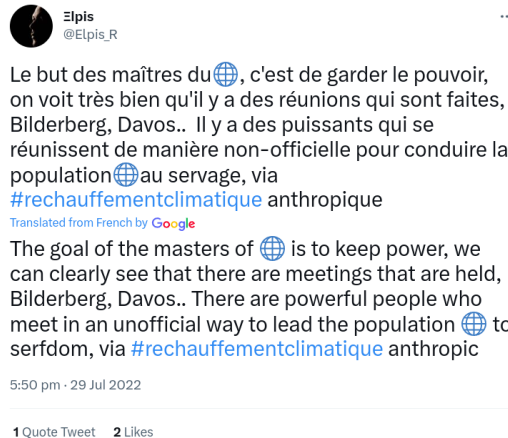
(a) Dismiss



(c) Distort



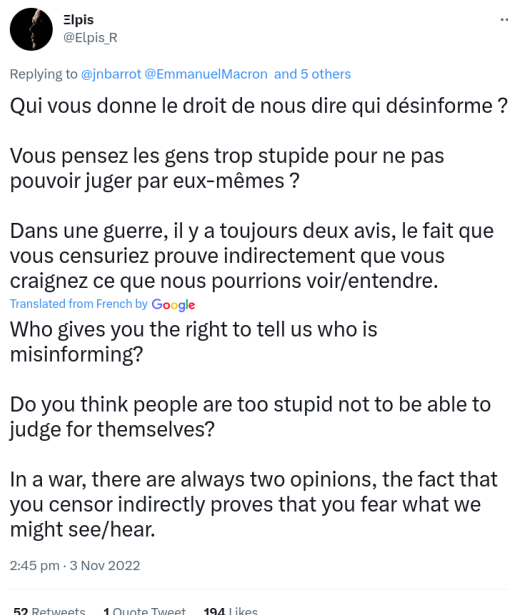
(e) Doubt



(b) Dismay



(d) Distract

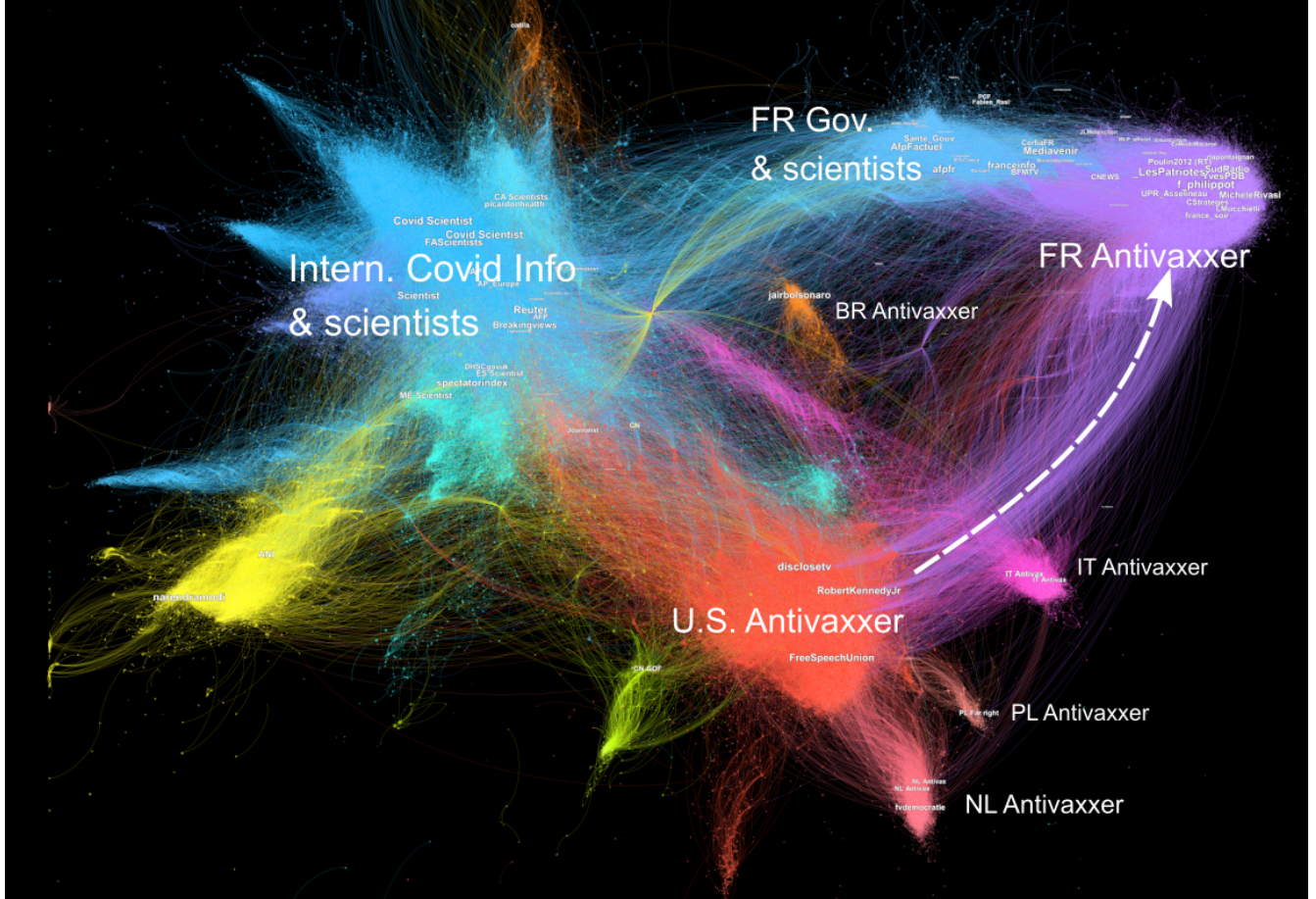


(f) Divide

**Figure H.3.** Examples of messages from *Elpis\_R*. The images and videos have been hidden for readability reasons. The English translations of the tweets are also displayed. 20/24

## I Vaccinoscope

The structure of the COVID-19 discussions about vaccines is different from the one of the climate change: a core formed by the bi-pole of US pro-vaccine vs. "anti-sanitary dictatorship"/anti-vaccine" accounts, with a replica of this dipole structure for each country. Although the "antivax" communities form a less cohesive global structure than for climate change, we clearly see a stream of (dis)information from the main US community to the others. This stream is particularly visible in the case of France, due to the collection method, which focused on English and French keywords.



**Figure I.1.** Twitter COVID-19 landscape for the period Jan. 2020 to Dec. 2022. Accounts commons with the climatoscope. The color of the link is the color of the author of the original tweets. 156k accounts are represented on this picture. Links are threshold to at least five retweets on this period. This map is based on 40M tweets.

## J Inauthentic forms of expertise and Jaccard Index

To understand the relationship between topics, Jaccard indexes between sets of topics-related accounts are computed. If an account tweets or retweets about a topic, it will be considered as related to it. Jaccard index is defined as the number of accounts in the sets' intersection over the number of accounts in the sets union. A threshold is also added to filter nodes based on their number of tweets on the topic.

Let  $w_{n,s}$  be the number of tweets or retweets of the node  $n$  on the topic  $s$ . Let  $s_j$  and  $s_k$  two topics. The Jaccard index with the threshold  $t$  is :

$$J_t(s_j, s_k) = \frac{|\{n \in \mathcal{N} | w_{n,s_j} \geq t\} \cap \{n \in \mathcal{N} | w_{n,s_k} \geq t\}|}{|\{n \in \mathcal{N} | w_{n,s_j} \geq t\} \cup \{n \in \mathcal{N} | w_{n,s_k} \geq t\}|}$$

By varying the threshold, accounts with different activities are selected. A threshold of 5, for example, means only accounts with at least 5 tweets or retweets on the topic are kept. For each pair of topics, the Jaccard index is plotted against the threshold.

A high jaccard index for a high threshold means that the exact same accounts are tweeting or retweeting about the two topics with high volume.

## K Divisive issues from Politoscope

The digital communities associated with the topics of Fig. 8 (see also [the interactive version](#)) were each identified via keyword-based semantic extraction of a set of Twitter exchanges, coupled with structural analysis of the induced social network and qualitative analysis of its communities (see<sup>1,2</sup> for the method). The aim is to understand the overlap between these different digital communities and to estimate the extent to which the denialist community have contributed to those.

All the sub-communities of these induced networks were qualitatively studied by analyzing the profiles of their main influencers before being included in the target communities. Three CNRS/ISC-PIF databases were mobilized: the Politoscope (711M tweets), the climatoscope (415M tweets) and part of the covidoscope dealing with the issue of vaccines (77M tweets). We provide here the semantic perimeters used to identify these communities, as well as a few representative tweets on each topics (the most relayed) to illustrate their positioning.

- **Pro-Kremlin narratives relays (see [the sociopic](#)).** **Definition:** *Pro-Kremlin narratives relays are accounts that relays without any critics narratives that are fabricated by the Kremlin in its hybrid war against democracies. Doing so, they amplifies this propaganda within the target population.* These relays have been identified on the basis of two sets of tweets:

- a first set whose messages mention at least one of the following expressions: {azov, provocations atlantistes, provocation OTAN, conflit OTAN, Minsk, responsabilité de l'Otan, européiste, ukrainiens tuent, OTAN encercle, russophobie, russophobia, ukrainiens qui tuent, dénazification, dénazifier, führer blanc, OTAN expansionniste, biolab, biolabs, usbiolabs, nazis ukrainiens, euroatlantiste, piège ukrainien, opération spéciale en Ukraine, opé spéciale, opération spéciale russe, opération-militaire-spéciale, provoquer la Russie, bataillon néo-nazi, cadavres lever la main, "massacre de Butcha", massacre de Boutcha, humiliation de la Russie, Zelensky ivre, OTAN cherche la guerre, Ukronazis, Boutcha, UkroReich, pantin de Kiev, pantin corrompu de Kiev, ZelenskyWarCriminal, maidan, maïdan, dombass, Donetsk, Kherson, Crimée, appel génocidaire, Trafic de bébés, trafic d'enfants, pédophile satanique, pédophiles sataniques, russie met en cause les états-unis, trafic d'être humain, #Kiev bombarde des habitations civiles, Ils détruisent les familles, fascistes ukrainiens},
- a second set of tweets mentioning at least one expression from each of the following sets of expressions : { zelensky, zelenskyi, zelinski} and { cocain, cocaine, cocaïne, clowns, clown, psychopathe, drug addict, hitler, drug addicts, nazis, néo-nazis, nazi ukrainien, chair à canon, corruption, dictature, kapos, ivre, pantin, Airbus de la République française, crapule, blackrock, livraisons de missiles de tout type, épouse, airbus de L'Élysée, villa en Israël, coup d'Etat}.

**Database:** CNRS/ISC-PIF/Politoscope. **Period:** Janvier 2020 - Février 2023.

Top tweets over the perior 2022-Feb. - Jan. 2023 limited to one tweet per account :

- LA CRAPULE ZELENSKY 13 août Il exige que l'UE refuse tout visa d'entrée à tous les citoyens russes «au nom des valeurs UE» ; 31 août On apprend qu'il loue 50.000 €/mois à un couple Russe la villa italienne somptueuse qu'il a achetée avec des fonds détournés (cf.Pandora Papers)
- "L'explosion du pont du Crimée, la déclaration de Zelensky demandant des frappes préventives contre la Russie et le fonds spécial de Macron de 100 millions pour armer l'Ukraine montrent l'engrenage qui nous précipite vers le suicide de l'Europe ! Arrêtons cette folie !"
- "François Hollande confirme les propos de Petro Porocchenko et Angela Merkel : les accords de Minsk ont été mis en place (côté Kiev, Berlin et Paris) pour gagner du temps et renforcer l'armée UA. Les atlantistes n'ont jamais voulu la paix au Donbass."
- "#UrsulaVonDerLeyen dans sa russophobie propose de ne plus acheter du pétrole à la #Russie en espérant que l'#OPEP va augmenter sa production de pétrole pour l'#Europe ! Elle a oublié que la #Russie est membre de l'#OPEP et que cette organisation a dit non! Quelle gifle !"
- "Répétez : - la Russie c'est mal mais l'Azerbaïdjan c'est bien - la corruption c'est mal mais Zelensky c'est bien - la pollution c'est mal mais le gaz de schiste américain c'est bien -> Voilà vous êtes un parfait européiste, un parfait mondialiste !"

- **French Climate deniers [see [the sociopic](#)].** **Definition:** *French Climate deniers consider anthropogenic climate change to be a hoax created to manipulate the public. They argue that either there is no climate change, or that it is not due to human activity and that man can do nothing about it.* The French climato-denialist community is composed of nearly 10k Twitter accounts in 2022. **Data base :** CNRS/ISC-PIF/Climatoscope. **Period :** July - October 2022. Top tweets between le 2022-09-01 and 2022-12-31

- "L'astrophysicien et fondateur de Weather Action, Piers Corbyn, confirme que le RÉCHAUFFEMENT planétaire/le CHANGEMENT CLIMATIQUE, etc, c'est un CANULAR absolu. « Le climat a toujours changé, mais cela N'A RIEN à VOIR avec L'HOMME"
- "Entre 3 et 18 ans, on leur inculque "les valeurs de la République", le réchauffement climatique, on leur fait faire de la webradio au lieu de leur enseigner géométrie, latin et grec. Entre 18 et 30, ils se collent sur des tableaux de maîtres. Ils sont ce qu'on a fait d'eux."
- "Juin 1989, Antenne 2 annonçait via l'ONU, que le réchauffement climatique allait dans 10 ans faire disparaître de nombreux pays comme les Maldives, Seychelles, Caraïbes, Pays-bas.. 2022, les Maldives ouvrent un nouvel aéroport international."

- “Klaus Schwab qui dirige le Forum économique mondial de Davos, appelle désormais à l’abattage de millions de chats et de chiens dans le monde afin de réduire l’empreinte carbone” qu’ils produisent en mangeant de la viande...”
- “Personne n’a jamais montré que les émissions humaines de CO2 entraînent un réchauffement climatique... Ils mentent, commettent des fraudes, modifient les mesures... L’idée que les émissions humaines conduisent au réchauffement et que nous devons faire quelque et absolument faux.”

- **Anti-wokism (see the sociopic). Definition:** *Anti-woke people accuse “woke people” of corrupting culture and civilization by introducing deviant behaviors (e.g. LGBT) and being complicit in migratory submersion.* The “anti-woke” digital community is identified from tweets mentioning the terms “woke”, “wokisme”, “indigeniste”, “indigenistes”, “racialisme”, “cancel culture”, “décolonialisme”, “racisé”, “sjw”, “blanchité”.

**Database :** CNRS/ISC-PIF/Politoscope. **Period :** Jan. 2021 - Feb. 2023. Top tweets :

- “L’infâme #Trudeau vient d’appeler à voter Macron ! Une sorte de fusion du mondialisme, du covidisme et du wokisme ! Raison de plus de faire barrage ! #ToutSaufMacron !
- “Résumons : l’État autorise ce jour une manifestation woke du Comité Adama contre un supposé « racisme d’Etat » et envoie les #blindés contre une manifestation pour les libertés publiques ? L’inversion des valeurs, voilà la signature du macronisme à l’agonie. #convoisdelaLiberte”
- “La nomination de Pap #Ndiaye à l’Education nationale est un tournant historique : le racialisme est au pouvoir. Emmanuel #Macron est passé à la phase suivante : il a pactisé avec l’ennemi de l’intérieur qui veut nous décoloniser et nous coloniser.”
- “Demain, entre militantes woke aux cheveux bleus et militantes islamiques aux cheveux couverts, les dernières petites têtes blondes longeront les murs la tête baissée.”
- “Le 23 mars, Emmanuel Macron se disait contre « la woke culture », le 20 mai, il nomme #papndiaye à l’Éducation nationale. La parole politique, c’est quelque-chose.”

- **Israel-Palestine. Definition** *All accounts participating in Politoscope exchanges on this topic. There is no sub-category for this subject, which is an important, albeit divisive, social issue that is only discussed by a fraction of the population.* The aim of this corpus is to measure the extent to which climate-denialists over-invest in this divisive issue, whatever their approach. **Selected keywords:** “gaza”, “palestine”, “Palestinian”, “palestiniennes”, “palestinienne”, “palestinien”, “palestiniens”, “génocide”, “genocide”, “tsahal”, “sionisme”, “sionistes”, “Israéli”, “israel”, “israël”, “netanyahu”.

**Database:** CNRS/ISC-PIF/Politoscope. **Period:** Jan. 2021 - Feb. 2023.

- **Anti-Covid vaccine (see the sociopic). Definition:** *Accounts turning the protest against the COVID-19 vaccination into a political issue and a tool for destabilizing society.*

**Database :** CNRS/ISC-PIF/Covidoscope. **Period:** Jan. 2020 - Dec. 2022.

- “Choisissez la solution que vous préférez face au Covid : - passeport sanitaire, société de surveillance, QR codes partout, confinements réguliers, vaccination tous les 6 mois, centres d’isolement pour cas positifs,... - ou sinon un peu d’ivermectine (8 euros la boîte)”
- “Avalanche vaccins anti-#COVID19 (4) On nous dit que l’hydroxychloroquine, connue depuis 70 ans, doit subir encore des tests double aveugle, randomisés, etc Mais pour les vaccins à peine sortis des labos, pas besoin de temps ni de tests ? Je suis le seul à trouver ça incroyable?”
- “ALERTE : proposition scandaleuse d’un passeport vert accordé aux vaccinés et nécessaire pour accéder à certains lieux publics. Disons NON haut et fort, tout de suite !”
- “Les médecins collabos #soignants #SoignantsSuspendu #DictatureSanitaire et ceux qui savaient et qui ont osé pousser les gens à la #vaccination sont les pires ordures de l’humanité.”
- “Le coup d’Etat contre les Français est en marche. Révoltez-vous ! #vaccination #Vaccin #Covid\_19”

- **Islam-leftism (see the sociopic). Definition:** *Accounts asserting the existence of a category of people, the “islamo-leftists”, who would be enemies from within, allying themselves with radical Islam to corrupt society..* Two non-independent cohorts were extracted: accounts having expressed themselves before Ministers of the Philippe government took hold of this concept (2016 to September 2021), and accounts having spread this concept between February 2021 and February 2023.

**Database:** CNRS/ISC-PIF/Politoscope. **Period:** Aug. 2016 - Feb. 2023. Top tweets :

- < 2020: “Le mâle blanc n’étant pas sur la sellette , les de Haas , Patin , Coffin et autres islamogauchéoécoloféministes sont aux abonnés absentes . Chère @MarleneSchiappa , il me paraît qu’une réaction vigoureuse de votre part s’impose prestement.”
- < 2020: “#Finkelkraut n’a pas été injurié par un #GiletsJaunes mais par un islamogauchiste déguisé en #GiletJaune. Pas pareil. La phraséologie de cet antisémite le trahit : ces mêmes injures abjectes avaient été proférées par l’extrême-gauche de Nuit Debout contre Finkelkraut en 2016.”
- < 2020: “Nouveau dérapage honteux de l’islamo-gauchiste @JLMelenchon qui attribue la défaite des islamo-gauchistes britanniques... au complot juif... Vous avez dit « retour aux heures les plus sombres » ? Vous les avez et c’est la gauche qui nous y ramène !”
- < 2020: “Après avoir défilé avec les barbus ayant scandé “Allah Akbar” dans Paris, les islamogauchistes de #LFI ont le culot de déposer une gerbe devant le Bataclan... A gerber, non ? #Collabos #13Novembre2015”



- < 2020: "Les islamo-gauchistes défilèrent contre l'islamophobie...des élus iront se corrompre avec les ennemis de la République..."
- > 2021: "Reconquête! Vendée mobilisé en force devant le lycée de Luçon contre les islamo-gauchistes qui propagent leur idéologie en t..."
- > 2021: "Quand #Macron disait le contraire de ce qu'il dit aujourd'hui pour draguer les islamo-gauchistes ... de Mélenchon. ..."
- > 2021: "Alors que le Bloc Centriste et le Bloc islamogauchiste partiront unis aux législatives, le RN vient de refuser toute alliance. POURQUOI ? Ca serait une catastrophe pour le camp national."
- > 2021: "Le seul qui a les coucougnette de dire les 4 vérités à ce parti d'islamo gauchistes a une heure de grande écoute, c'est ..."
- > 2021: "#Melenchon avec son #UnionPopulaire vient de créer la première force politique islamo-gauchiste de France ! le grand remplacement d'#EricZemmour prend dès aujourd'hui tout son sens."

- **Great Replacement Theory (see the sociopic). Definition :** *Digital community promoting the concept of the Grand Remplacement as the organized replacement of white populations by people of color in Western societies..* **Selected keywords:** Grand remplacement, grandremplacement. **Database** CNRS/ISC-PIF/Politoscope. **Period:** 2021-2023. **Top tweets :**

- "Éloge de la violence et du grand remplacement, références islamiques, menaces de mort à l'encontre de personnalités patriotes et à mon égard : Yanni, le rappeur et le député LFI @LouisBoyard montrent la dangerosité de l'extrême gauche et ses accointances avec la culture racaille."
- "En France, le grand remplacement fait rage, le prix de l'électricité explose et l'école s'effondre. Pendant ce temps sur la planète médiatique. ..."
- "Macron ne nie plus l'existence du grand remplacement. Il l'assume et il l'aime. Il veut l'organiser avec enthousiasme."
- "Éric #Zemmour : Nous avons eu un été meurtrier à cause du grand remplacement. Nous allons avoir un hiver terrible à cause du grand déclassement. Avec Macron, on vit les quatre saisons de l'enfer."
- "Le Grand Remplacement culturel c'est : S'insurger contre une statue de Saint-Michel, symbole de nos traditions catholiques, mais se féliciter d'une rue renommée au nom d'une épouse de Mahomet, symbole de la culture islamique du nouvel arrivant."

- **Jean-Michel Trogneux. Definition:** *Account promoting the conspiracy theory that the wife of French President Emmanuel Macron is a man.* **Selected keywords:** "jeanmichelTROGNEUX", "Jean-Michel Trogneux", "Jeanmi Trogneux", "JeanMi #Trogneux"
- Database :** CNRS/ISC-PIF/Politoscope. **Period:** Jan. 2021 - Feb. 2023.

- #JeanMichelTrogneux débusqué, Brigitte en sueur, Macron pédale en coulisse pour arrêter la machine en route et Faits & Documents (@faitsetdocs) sur le pont avec ce numéro incroyable qui va faire l'effet d'une bombe
- Observez bien la démarche et la façon de s'asseoir #JeanMichelTrogneux
- Soutien à Natasha Rey interpellée à son domicile, placée en GAV et perquisitionnée dans le cadre de l'affaire #JeanMichelTrogneux de façon totalement disproportionnée, inhumaine et sur des motifs parfaitement fallacieux il y a cinq mois. La dictature macronienne n'a aucune limite
- Ça doit pas mal embarrasser l'Elysee ce #JeanMichelTrogneux en Top Tweet. Ce serait vraiment pas super cool de votre part de RT #JeanMichelTrogneux en plus de cette magnifique photo
- Toutes les informations pour un journaliste qui voudrait faire taire l'odieuse rumeur en retrouvant #JeanMichelTrogneux sont disponibles dans le n° 503 de F&D, avec en couverture, les 14 questions adressées à l'@Elysee en conclusion de notre Vrai visage d'EmmanuelMacron

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