

Search for meteorites and impact craters :

François Colas – Observatoire de Paris



FRIP^{ON}
Vigie Ciel

**16TH EUROPEAN
SPACE WEATHER WEEK**

18 - 22 November 2019, Liège - Belgium



MUSÉUM
NATIONAL D'HISTOIRE NATURELLE





**Why study
météorites ?**

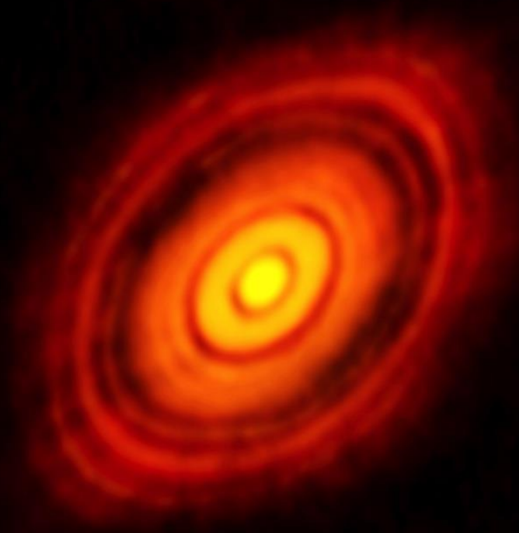
They are space probe...

Kuiper
Belt



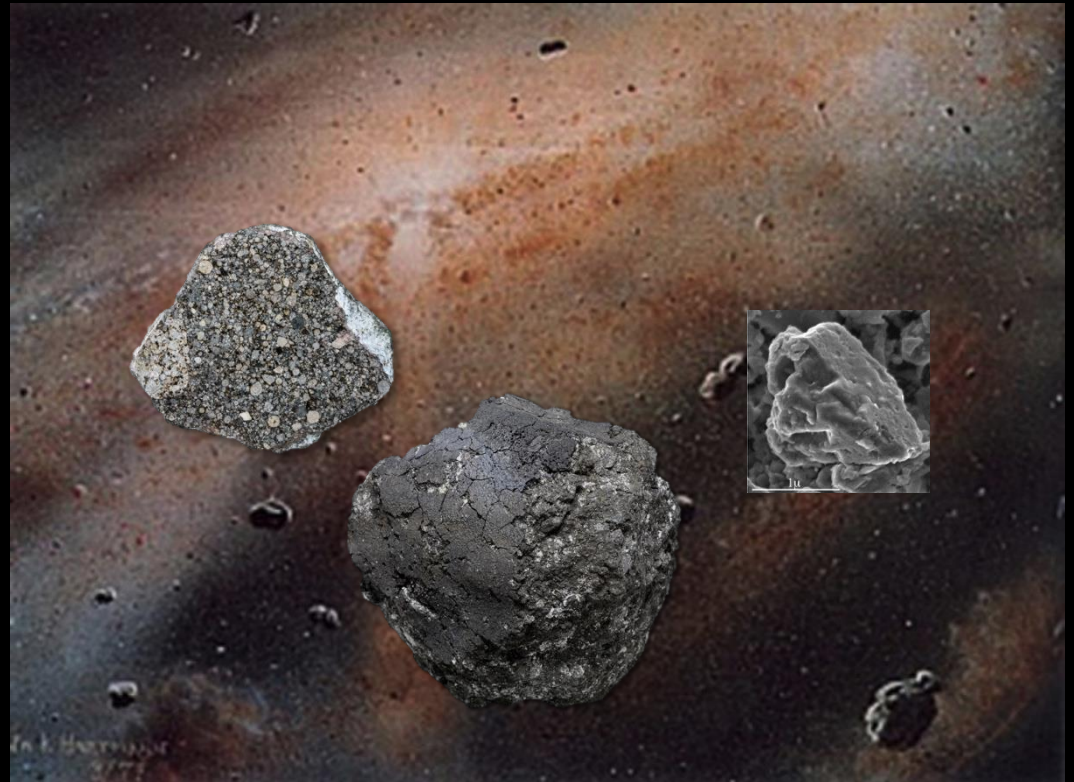
Astéroïds

... and time probe !



Protoplanetary disk of star HL

ALMA - ESO



The planetary disk, 4,57 MY ago

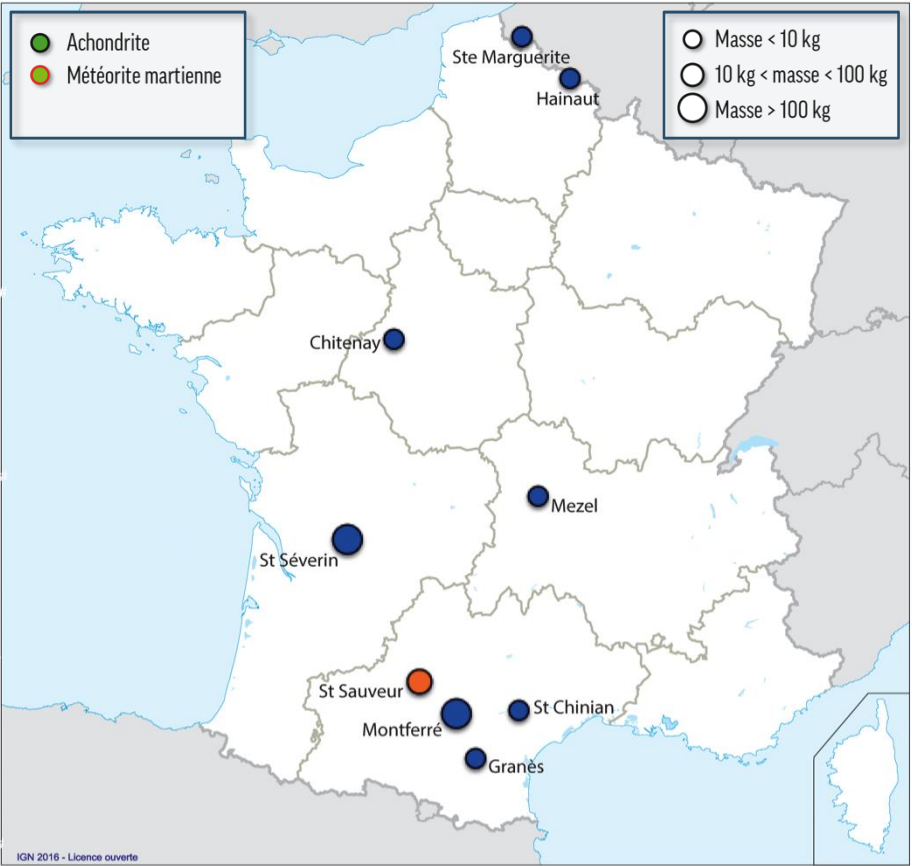
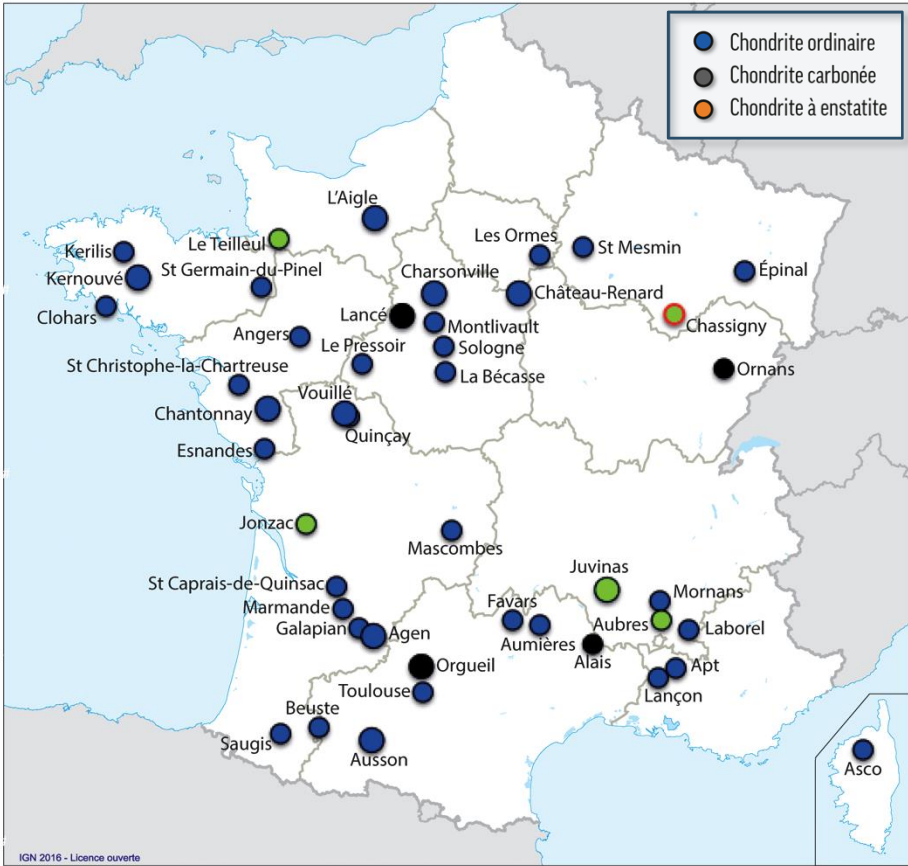
W. K. Hartmann

FRIPON and VIGIE-CIEL to solve the recovery of fresh meteorites

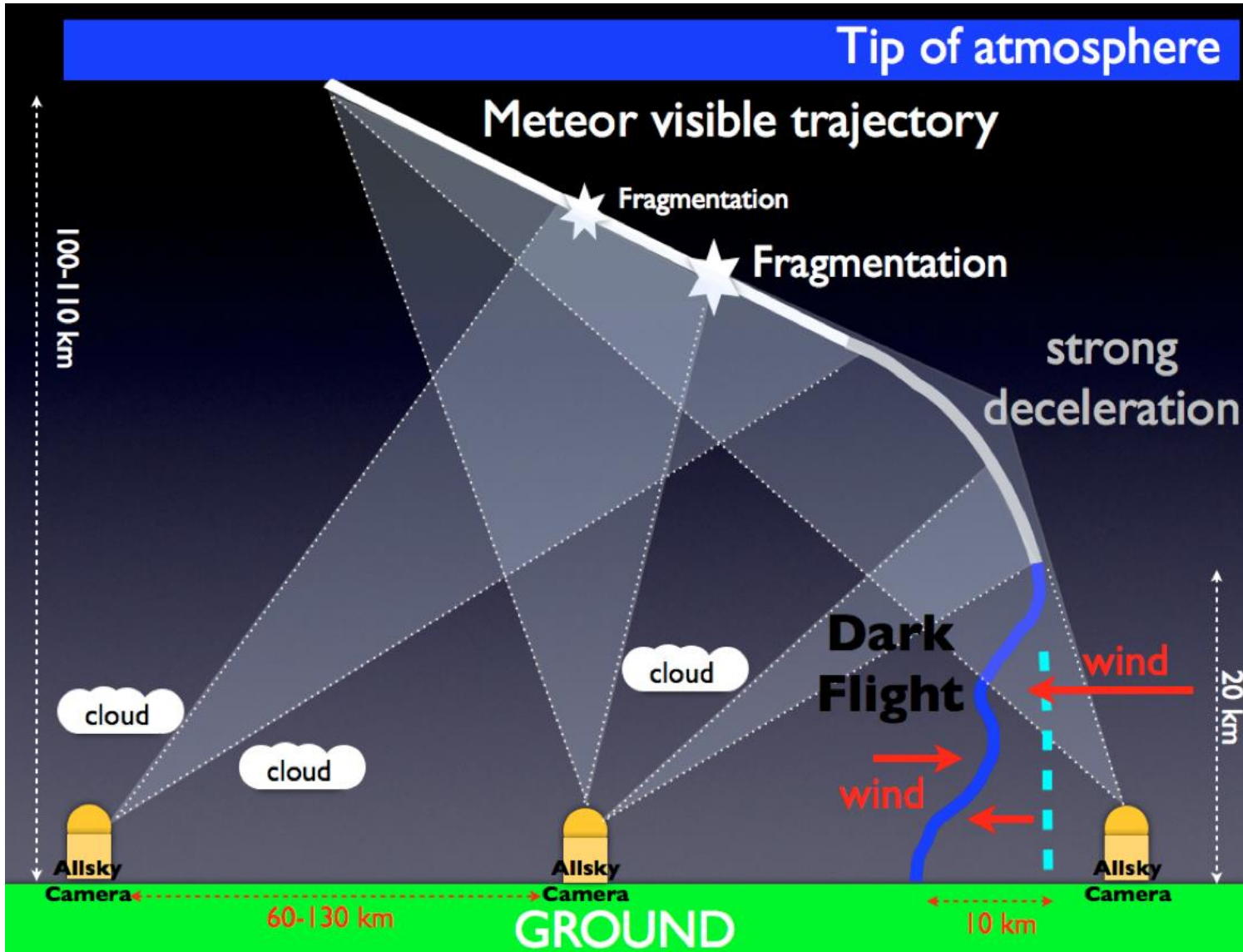
Meteorite falls recovered in France : loss of efficiency in the 20th century

XIXth century : 45 meteorites.

XXth century : 9 meteorites.



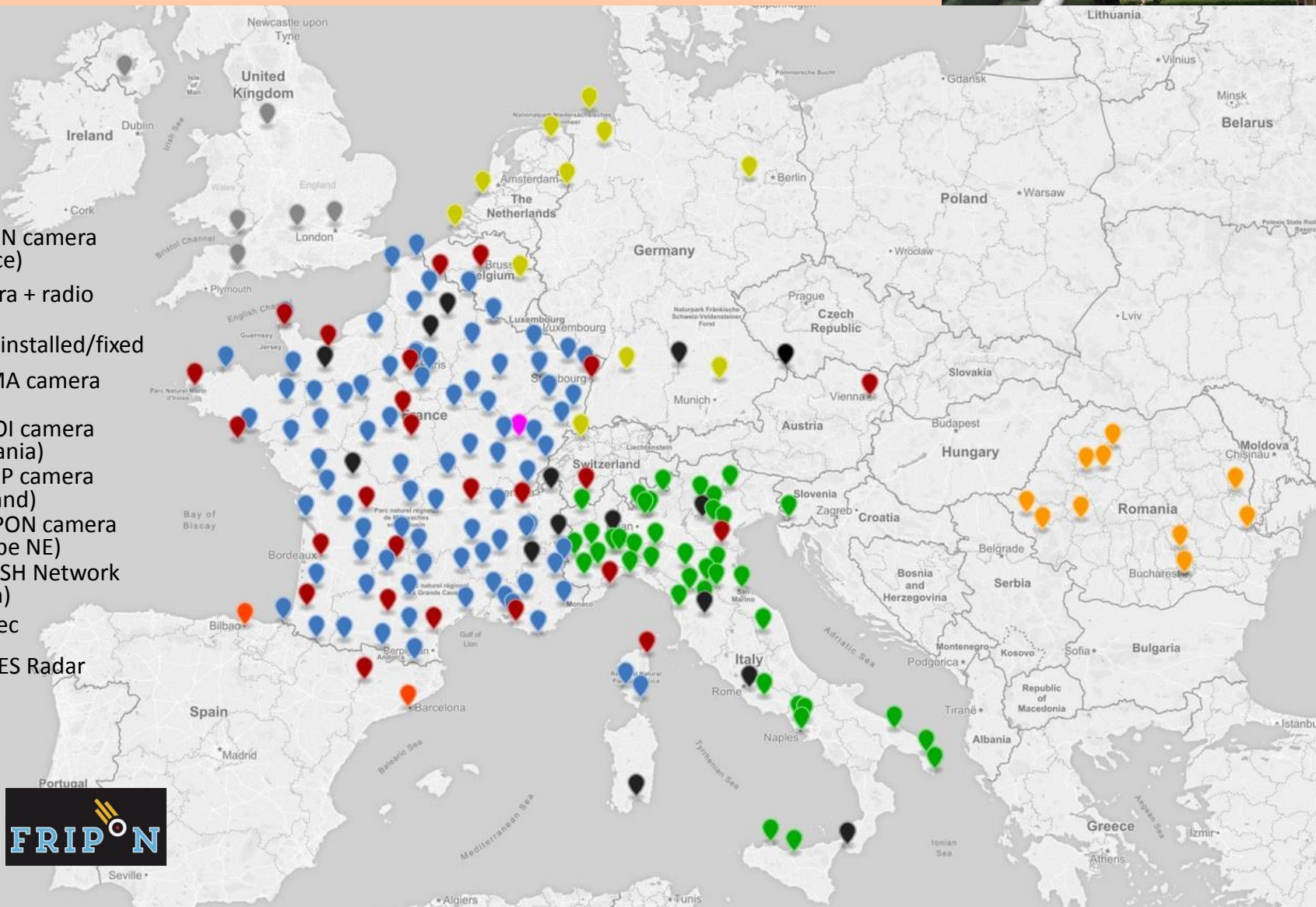
Observations and detections



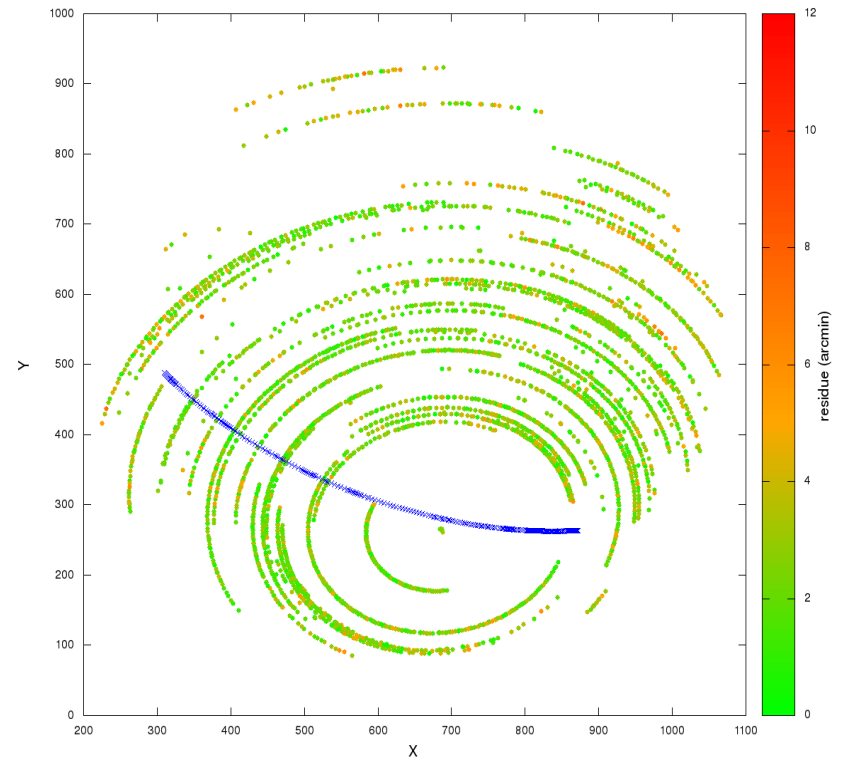
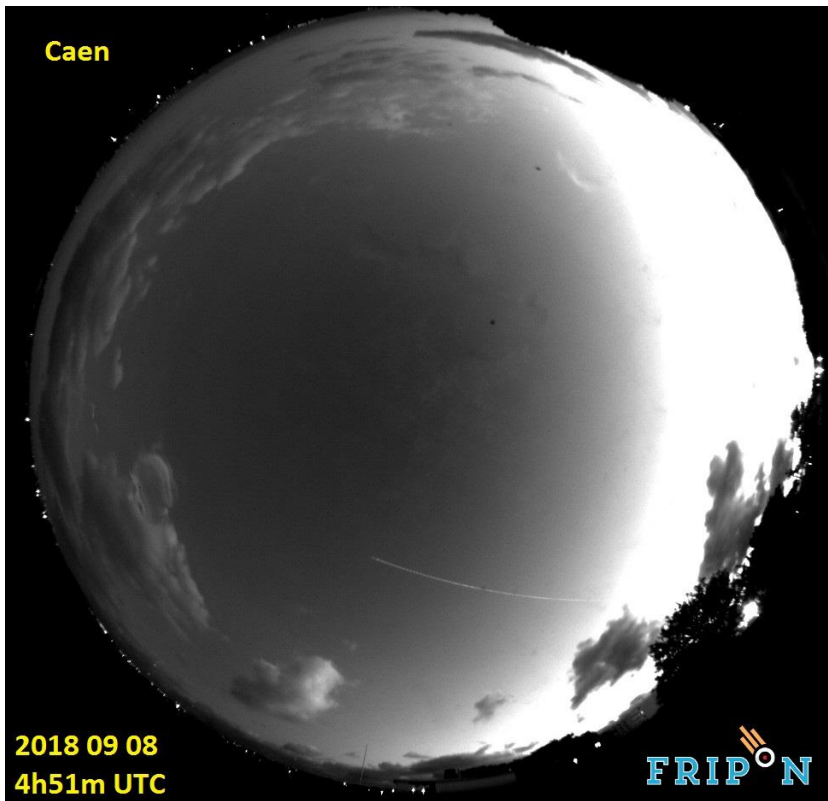


The network in Europe

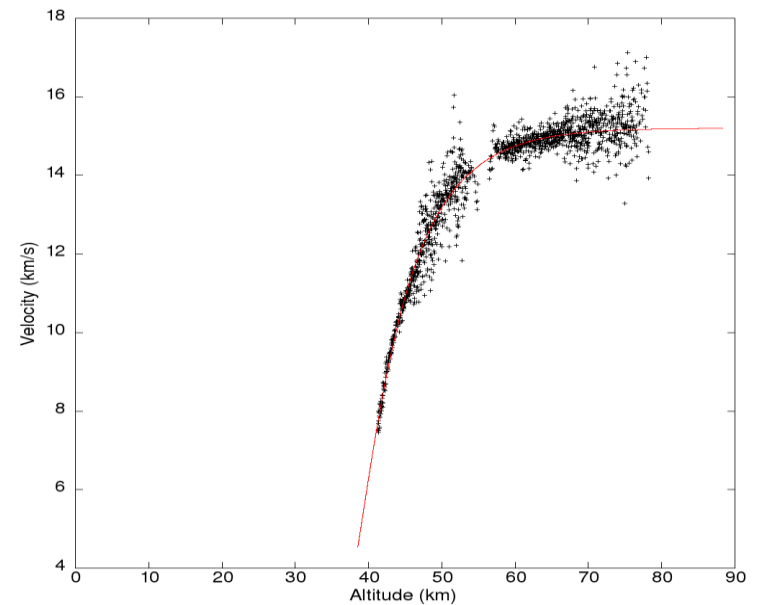
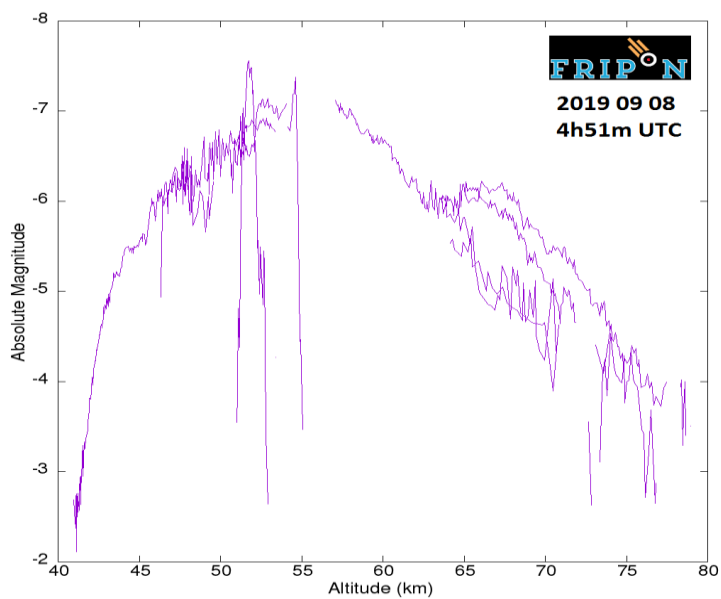
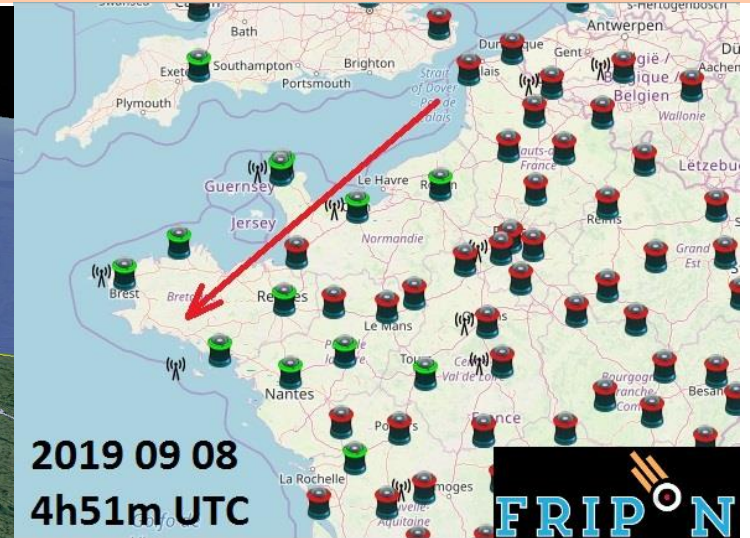
- FRIPON camera (France)
- Camera + radio
- To be installed/fixe
- PRISMA camera (Italy)
- MOROI camera (Romania)
- SCAMP camera (England)
- E-FRIPON camera (Europe NE)
- SPANISH Network (Spain)
- Québec
- GRAVES Radar



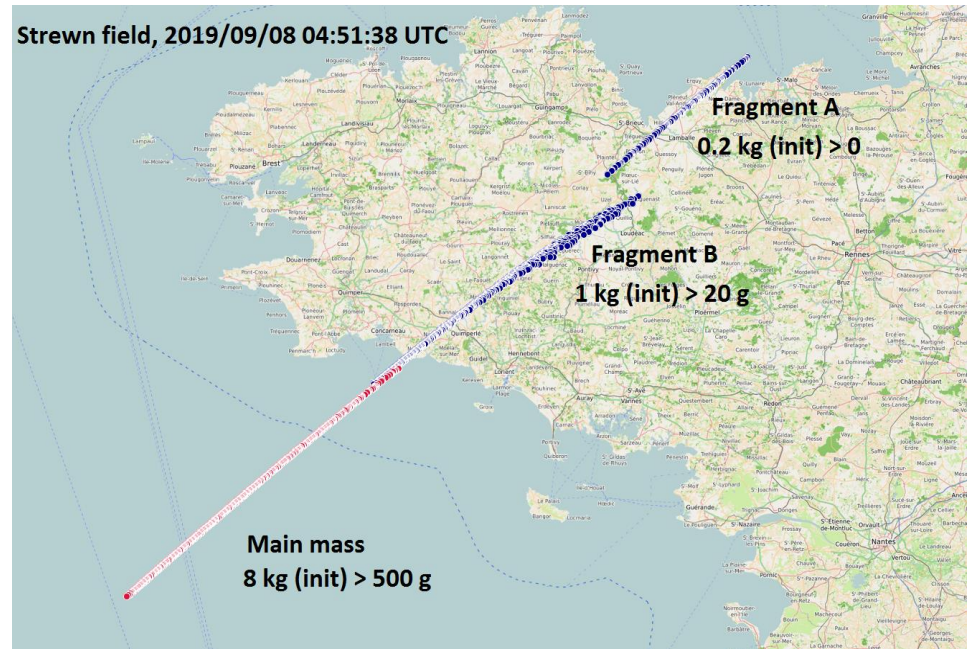
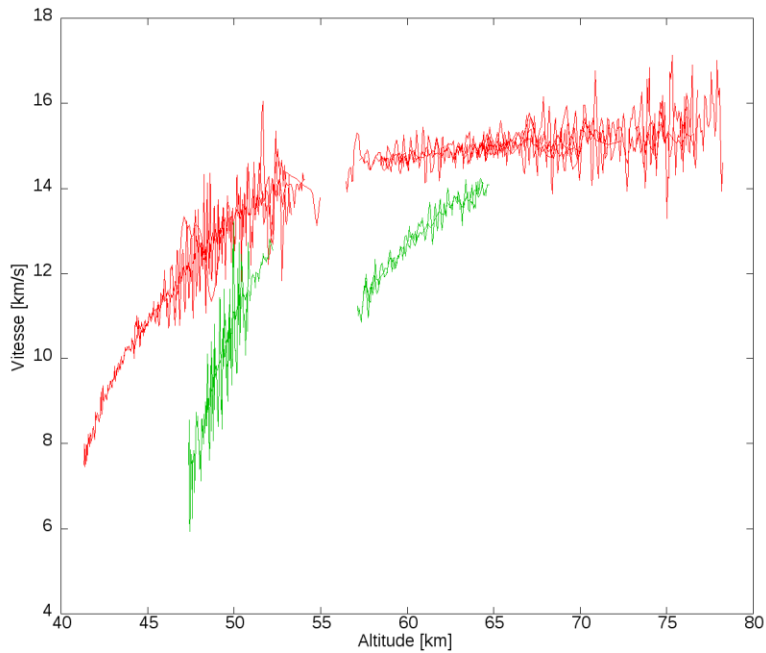
Last big event, september 8th



Last big event, september 8th



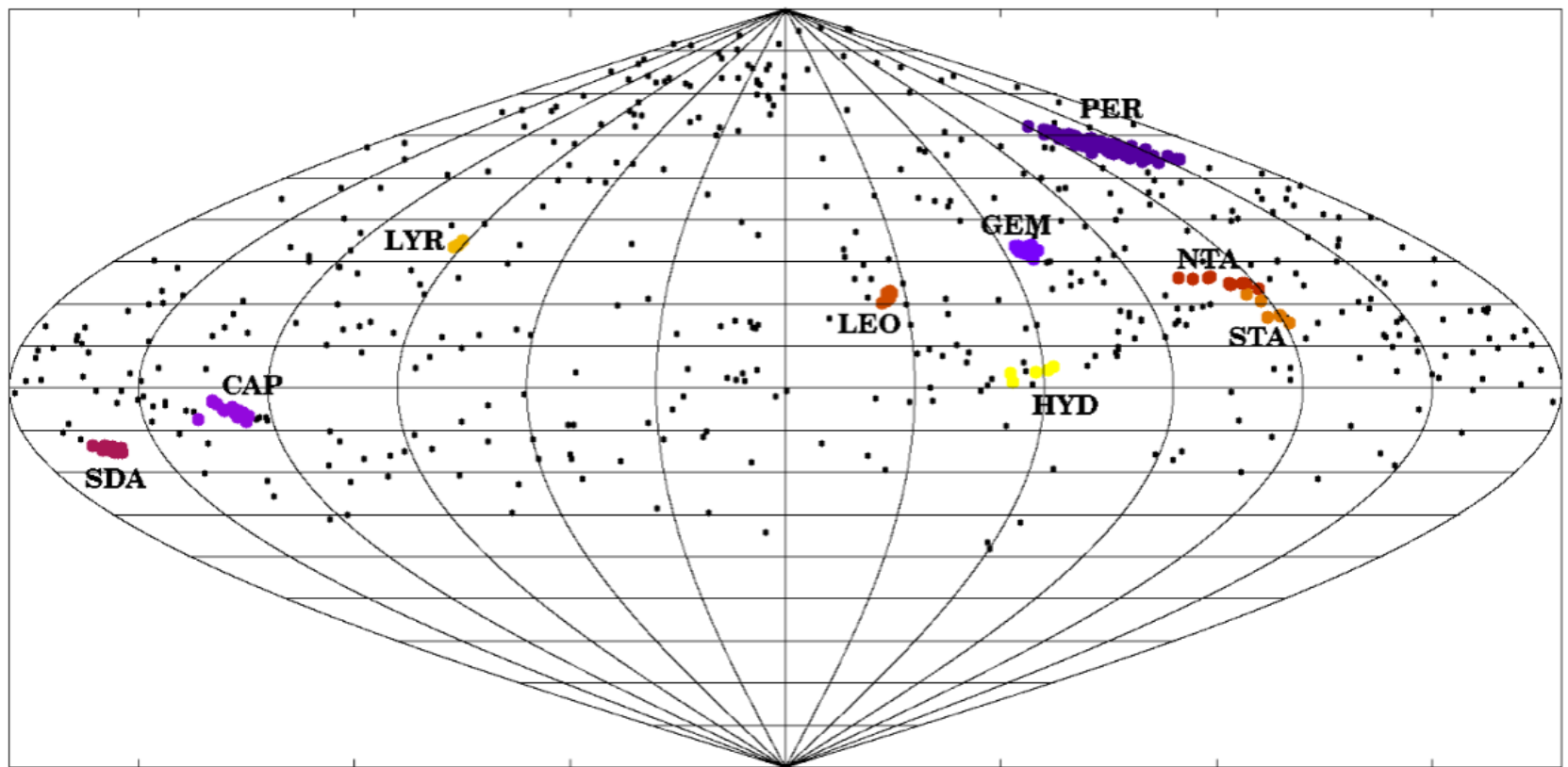
Last big event, september 8th



Fripon => 1000 orbits / year

3 « big » events / year (final mass > 50 g)

Radian map of meteors detected by FRIPON in 2018 :



Recovering météorites

Vigie iel

with

FRIP N!



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l'Observatoire *finace*
de Paris



The goals of VIGIE-CIEL

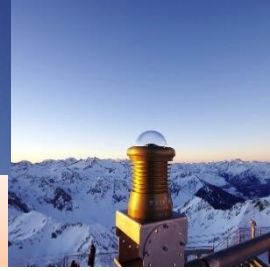
Vigie-Ciel : citizen science program



- ⇒ Recovering freshly fallen meteorites
- ⇒ Replace them as science objects (to keep/study)
- ⇒ Collect data to study the impact flow of extraterrestrial matter on Earth by involving the general public in several citizens programs (meteors, meteorites, impact craters)
- ⇒ Improve knowledge, including:
 - learn to recognize shooting stars, fireballs, meteorites and impact craters and their scientific interest
 - learn to report observations
 - and, for those who will go out in the field, learn to handle meteorites and know the legal aspects of the quest

The goals of VIGIE-CIEL

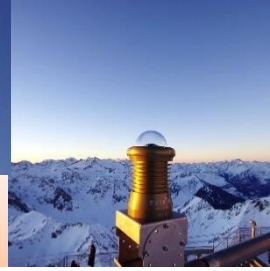
But also ...



- ⇒ Build a strong human network that supports and relays the project
- ⇒ Have a wide diversity of partners
- ⇒ Promoting interdisciplinarity
- ⇒ Involve various audiences in the research project to increase results
- ⇒ Facilitate communication with the general public and promote the network's visibility in the media

VIGIE-CIEL : 3 PROTOCOLS

<https://www.vigie-ciel.org/>



Fireballs

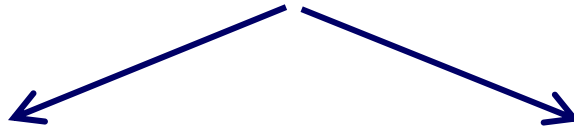


Meteorites



Impact craters

Sporadic phenomena



Transform an observation into a participation work with the AMS (American Meteoritical Society).

Mobilize and lead a community of actors likely to mobilize an operational local community in a short period of time.



Collaborative analysis of topographic images of the Earth to identify potential impact structures

1/ Fireballs

<https://vigie-ciel.imo.net/members/imo/>



[Report a Fireball](#)

[Events](#)

[Reports](#)

[Statistics](#)

[English](#) ▾



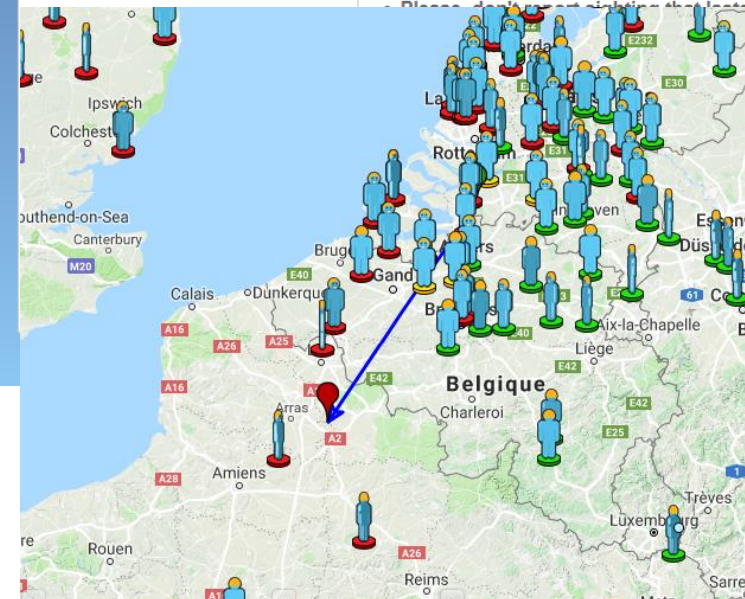
Report a Fireball: it's fun and easy!

You saw something bright and fast? Like a huge shooting star? Report it: it may be a fireball.

We are going to ask you to fill an interactive form that is intended to be easy to fill out for anyone. Please, be as precise as you can. Your report is important, it alerts us to potentially scientifically significant events that occur, and contributes to the general database of knowledge about meteors. You will have the opportunity to give us all the details about your sighting experience at the end of the form.

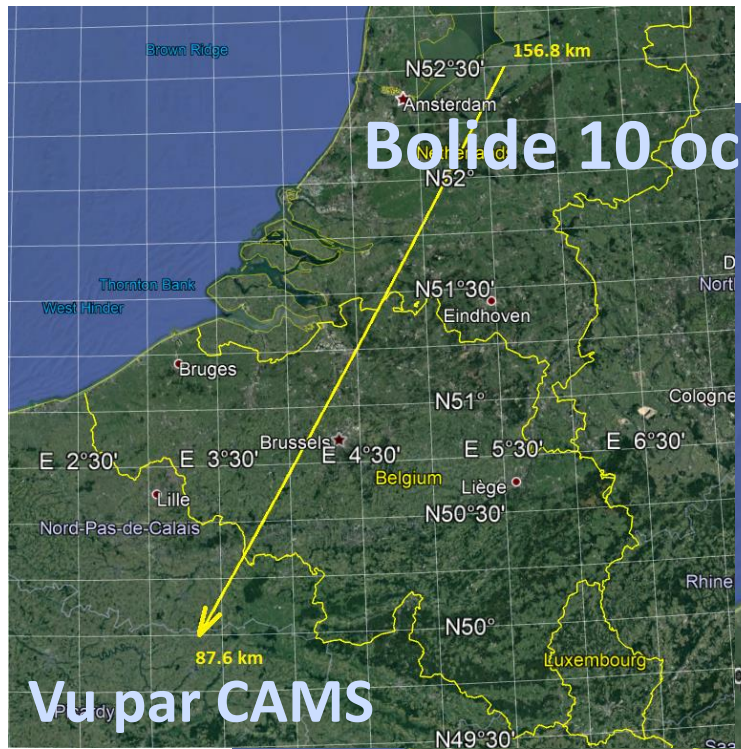
Please do not report sightings that lasted **more than 30 seconds**: the vast majority of fireballs are only visible for few seconds. Seeing a fireball is extremely rare and often an once in a lifetime event. Do not report objects or lights crossing the sky going by 2 or 3: a fireball looks like a big shooting star.

click the Help links or try the [simplified version](#) of the form.

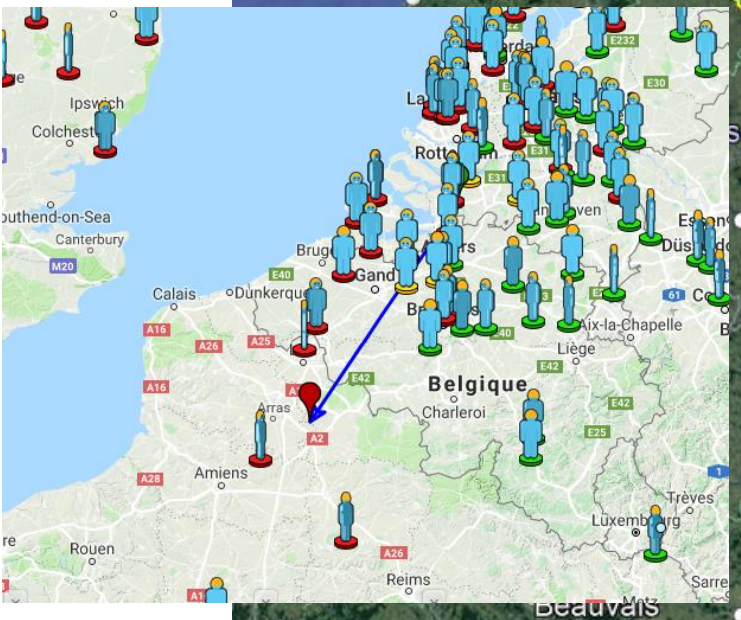


OUVERT

Bolide 10 octobre 2018 à 21h17m TU



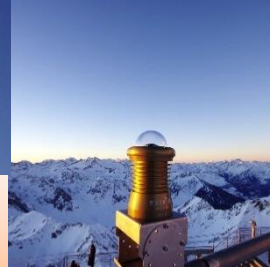
Vu par CAMS



1/ Fireballs

Goals of Vigie-Ciel

- ⇒ Alert in case of an important event
- ⇒ Communicate with witnesses to explain the phenomenon
- ⇒ Characterize the fireball in addition to the cameras (color, sound...)
- ⇒ Mobilize the general public around the event



Plusieurs témoins du côté de l'Italie, n'hésitez ps à témoigner sur vigie-ciel.imo.net pour aider à mieux caractériser le bolide ; on n'a rien du côté des caméras FRIPON, il faisait encore jour.



Vigie-Ciel Signalez un bolide : c'est facile et amu...
Vous avez vu quelque chose de brillant et rapide dans le ciel ? Comme une très grosse étoile filante ? Partagez votre observation avec nous : c'est peut-être vigie-ciel.imo.net

1 4 4

Julien DRUET
@AstroGloomy

En réponse à @AsmaStein @VigieCiel

c'est fait à l'instant

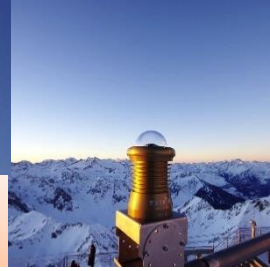
11:56 - 24 oct. 2018

3 J'aime

3

2/ Meteorite search

Fripon and Vigie-Ciel



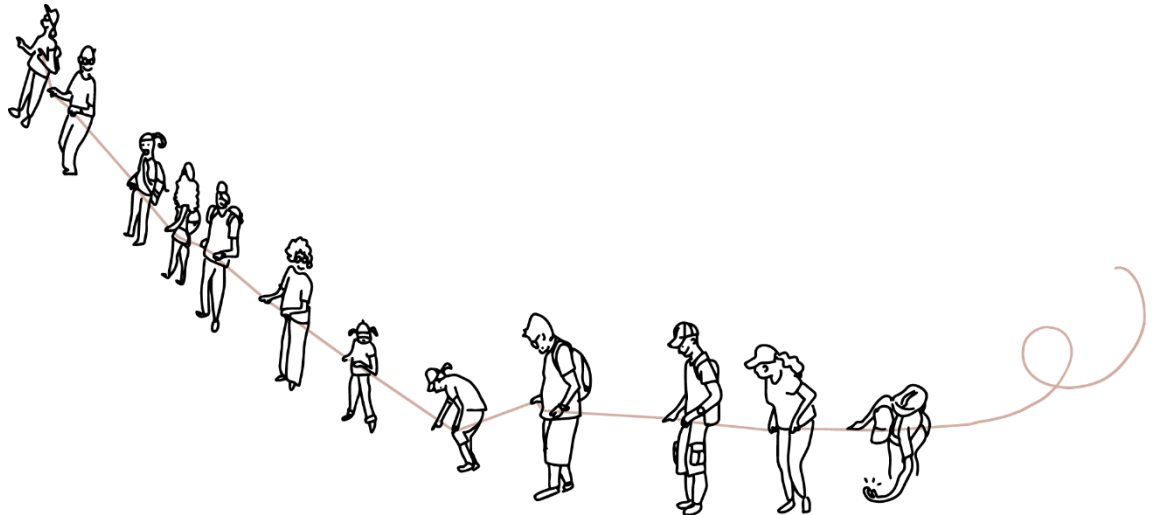
Where are we ?

=> 3 test searches

=> A guide to good practices being developed based on initial experiences

=>Ongoing legislative work

=>Detection network and functional calculation procedure

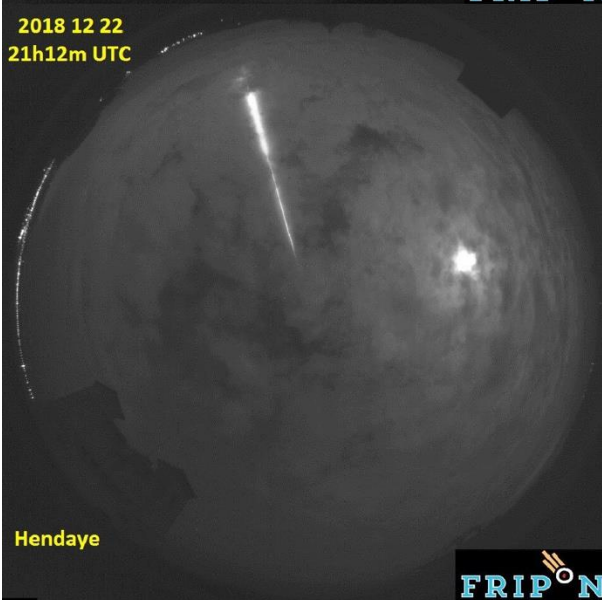
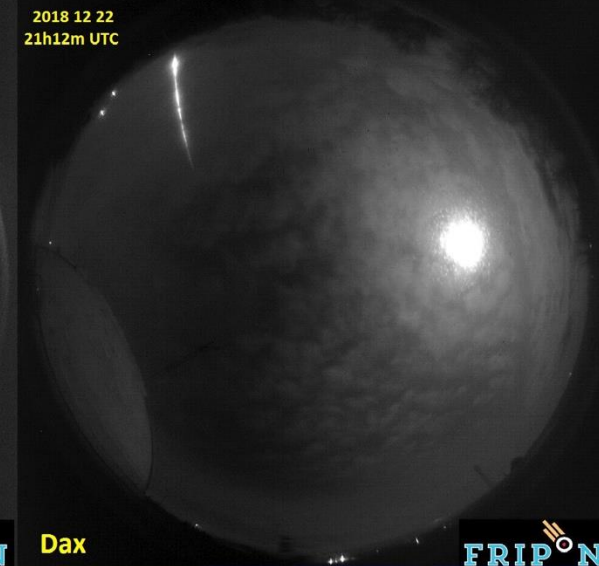
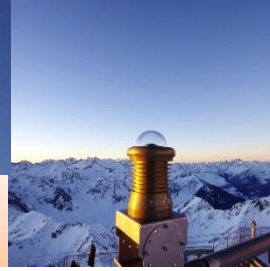


2/ Meteorite search

2018 december 22nd fall

21h12m TU

FRIP  N



2/ Meteorite search

Flyer for public

¿CÓMO SABER
SI HAS
ENCONTRADO
UN METEORITO?



Muchos testigos vieron un bólido (gran estrella fugaz) en el cielo del País Vasco y Navarra el 22 de diciembre de 2018.



El fenómeno luminoso

¿ Piensas que podrías ayudar a encontrar el meteorito que causó este fenómeno luminoso ?
Sí, los cálculos indican que... i habría caído en La Rioja !



Mapa de testimonios



Si se encuentra en esta región, nuestros equipos pueden contactarlo para buscarlo.

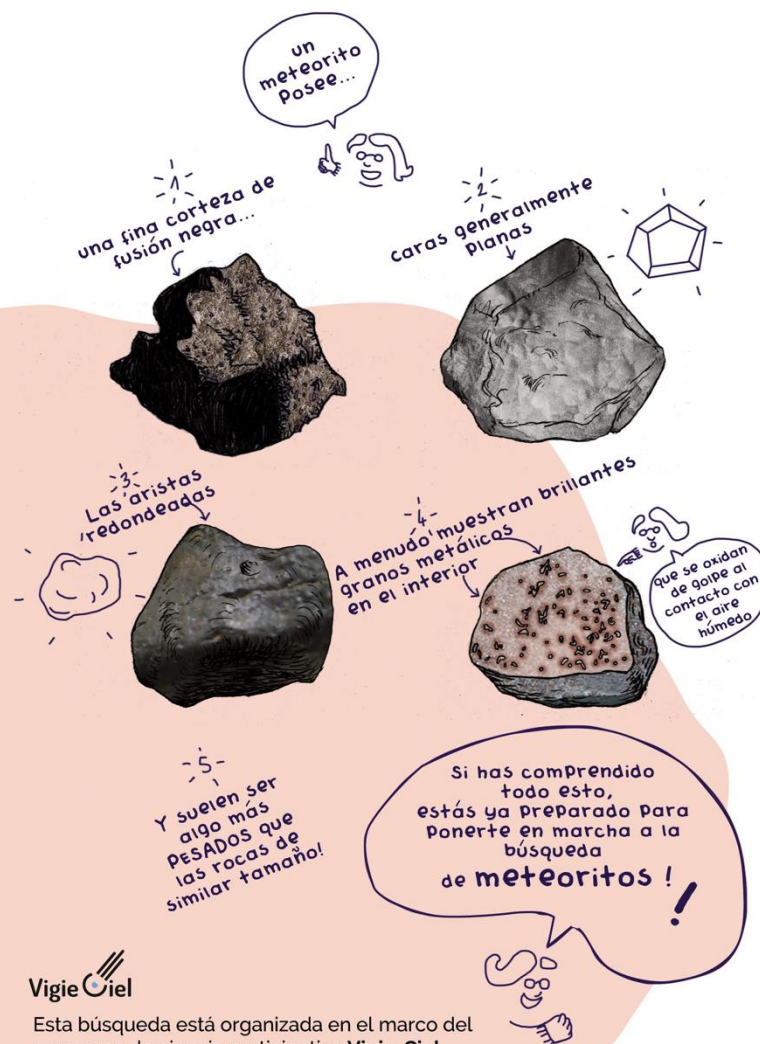
Si ha encontrado una roca que parece un meteorito, contáctenos.

contacto

Instituto de Ciencias del Espacio (CSIC) - Red SPMN,
Josep Trigo Rodríguez : trigo@ice.csic.es / www.spmn.uji.es o
Vigie-Ciel en Facebook /vigie-ciel.org



Vigie Ciel FRIP N

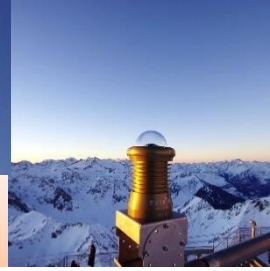


Vigie Ciel

Esta búsqueda está organizada en el marco del programa de ciencia participativa **Vigie-Ciel** con la cooperación de la **Red SPMN**.

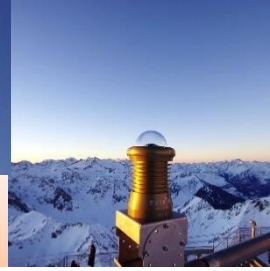
2/ Meteorite search

Search with local people (Logroño and Saragossa universities)



3/ Identification of impact craters

<http://www.vigie-crateres.org/>



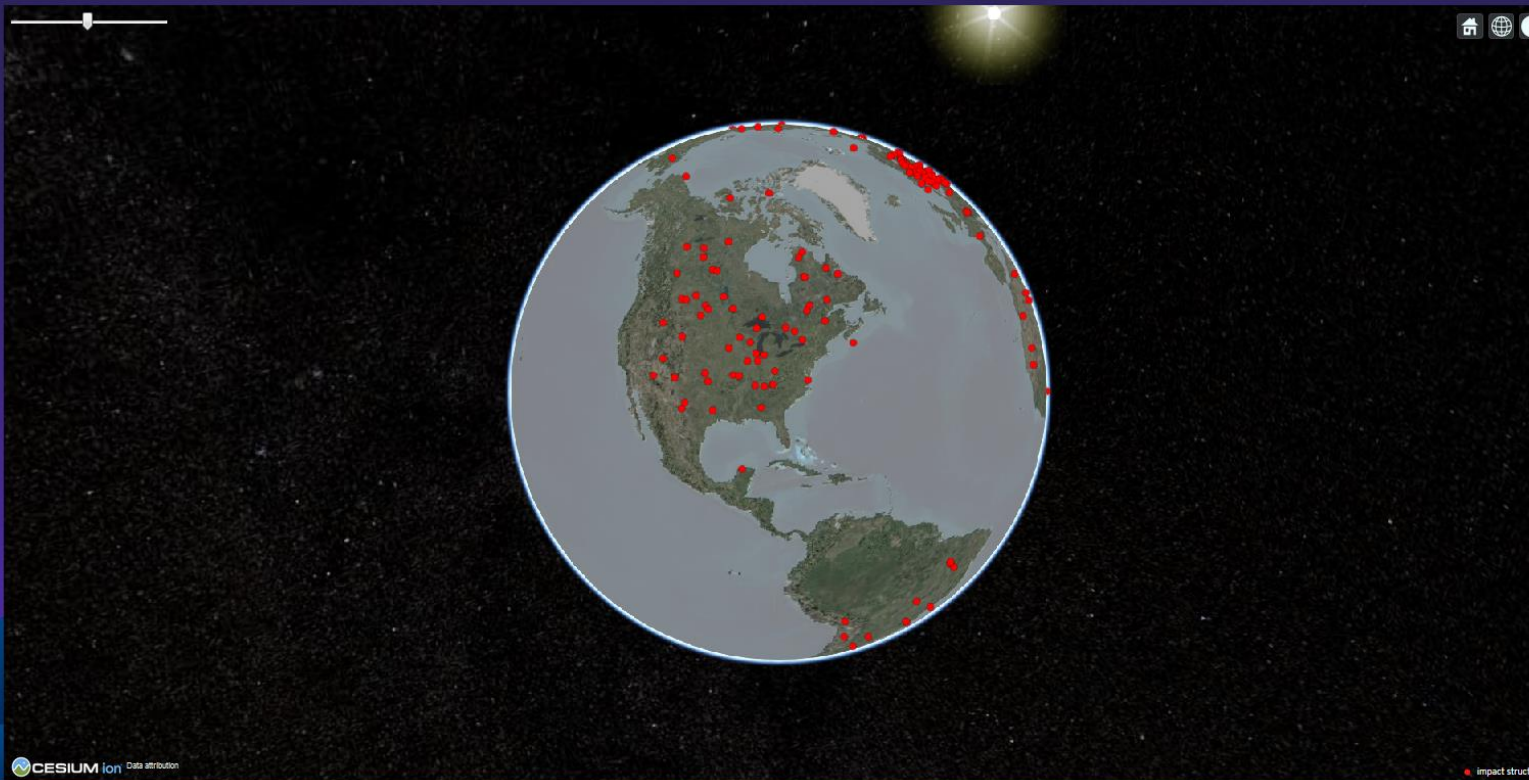
Vigie Cratère

WHAT IS VIGIE-CRATÈRE?

LOOK FOR NEW IMPACT STRUCTURES

LEARN MORE ABOUT CRATERS

CONTACT US



CESIUM Ion Data attribution

Impact structure

Discover potential impact structures by exploring and zooming in on the virtual globe

TODAY

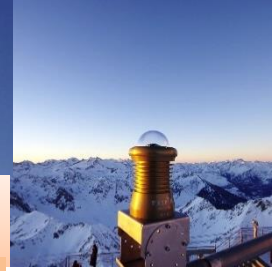
18/11/2019

1323 detected structures
1% explored area

Votes

3/ Identification of impact craters

<http://www.vigie-crateres.org/>



Vigie Cratères

Petit_lapin est connecté

Structure n°128

Détectée par Petit_lapin

Latitude: 5°32'01"N
Longitude: 24°23'03"E
Diamètre: 22.34 km

Votez pour la nature de la structure

(Connectez-vous et zoomez sur la structure)

- Structure d'impact
- Caldeira de volcans
- Effondrements
- Structure anthropique
- Je n'ai rien sur l'imagerie

Tout sur la nature des cratères

Apporter des données sur la structure

Calques

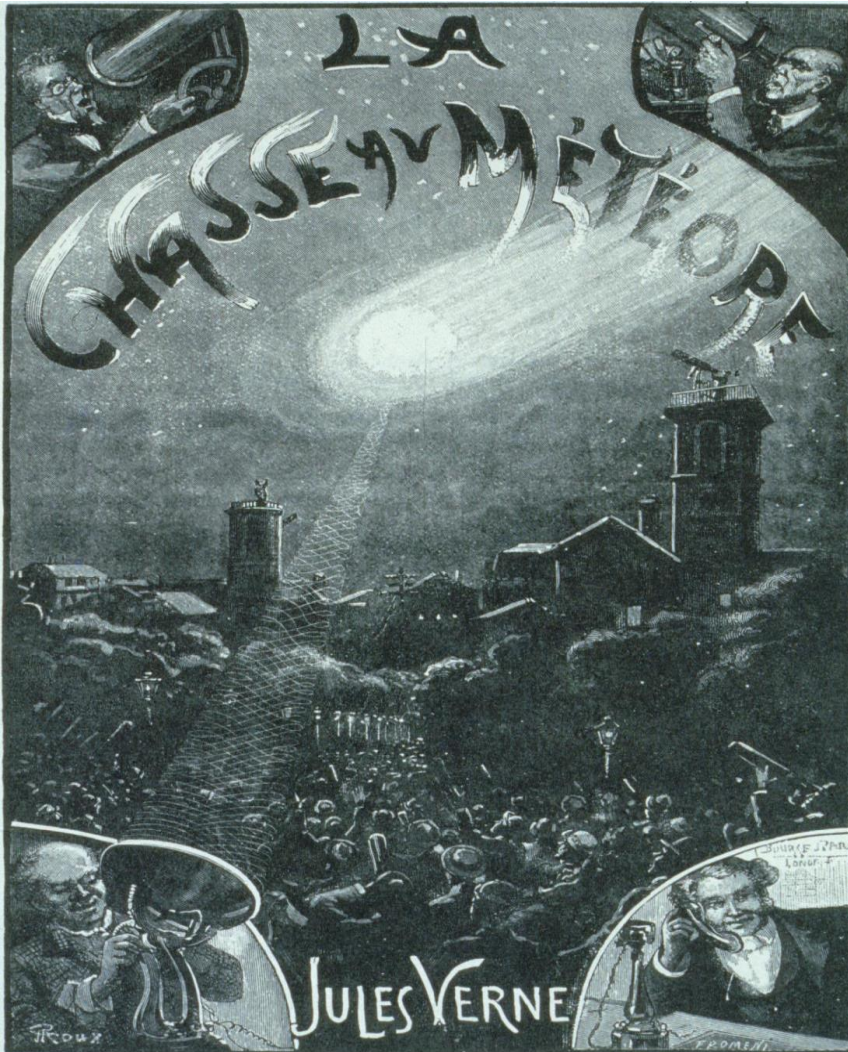
- Relief ombré
- Transparence

Type de structures

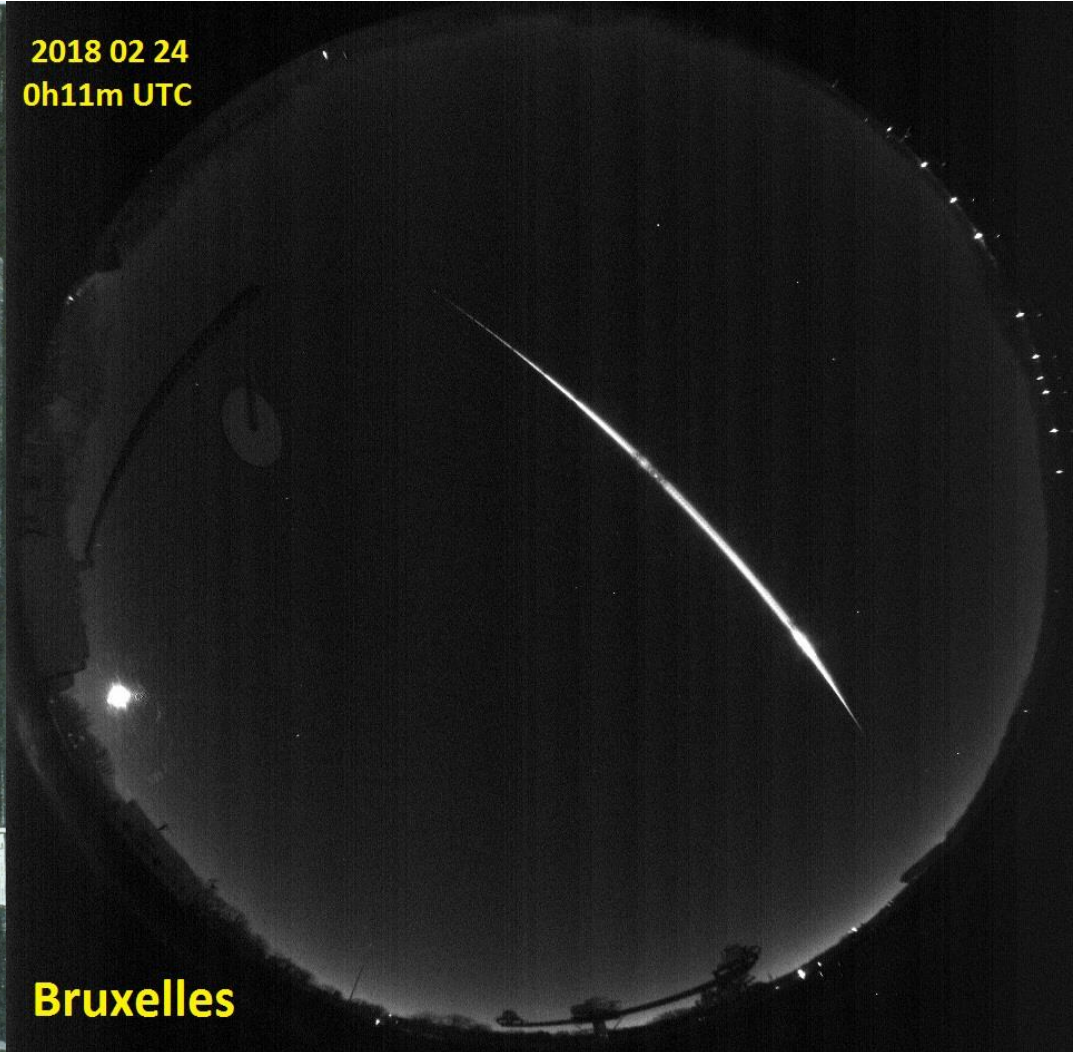
- Toutes structures
- Possibles impacts
- Possibles volcans
- Possibles effondrements
- Contours des structures

L'utilisateur peut sur la structure jouer avec le relief ombré et la transparence

1330 detected structures, 1% of Earth covered



2018 02 24
0h11m UTC



Bruxelles

Vigie  Ciel

FRIP  N