

## **4. INTERVIEW OF MR PASSOT** **(MAY 2012)**

### **4.1 Organisation**

**Philippe Ailleris:** *What are the advantages and disadvantages of GEIPAN activities falling under the CNES framework? What other organisation could eventually be in charge of it?*

**Xavier Passot:** To get the trust from the public, an organization has to be public, and civil: public, not to be suspected to make money or to manipulate opinions as sects, and civil not to be suspected to hide the truth. Some scientific institutes (e.g. CNRS in France) could do the job, but the UFO subject has such a bad reputation for scientists, and CNRS is so short of funding that they don't want to cope with the UFO topic. Moreover, because of the frequent link with spacecrafts (satellites passing by, debris re-entries), the CNES knowledge is particularly useful for some investigations.

**PA:** *Does GEIPAN have any working relations with other organisations in charge of collecting UAP information, in France or in foreign countries?*

**XP:** In France, GEIPAN processes the UAP sighting reports collected by the Gendarmerie, Air traffic control, and Air Army. We work with some volunteers who are often active members of some ufologists associations: they investigate some cases on GEIPAN requests. With foreign countries, we have no formal collaboration; I'm sometimes invited by some ufological associations, but I generally declined, because it's not my priority and it would be very time consuming.

**PA:** *Would you consider an European centre for UAP investigations? Is there any interest in doing this work wider in Europe, as opposed to amateurs/voluntary groups or in establishing for example a pan-European institute?*

**XP:** I think that the collection of the sighting reports, the investigations with the witnesses have to be national, because it has a strong socio-cultural aspects. It could be profitable that the investigation methods, the list of frequent misinterpretations, the investigation of the most strange cases could be done at the European level.

**PA:** *What would you propose for further studies? Should it be structured as a large scale government project, international, based on public involvement?*

**XP:** It is mandatory that such an entity be public because the independence is a major issue. When I see the large number of misinterpretations, I believe that it is more important to spend public funds on scientific education than on UAP investigation. It would not be reasonable to have a very large GEIPAN group. The investigation's activity of a group like GEIPAN has to be national, working with the same language and culture. However there would be a great profit to compare and exchange information with similar foreign groups, to check similarities and differences between the sighting reports, and to compare investigation methods and tools.

**PA:** *Does GEIPAN coordinate its activities outside France?*

**XP:** We sometimes exchange information with COBEPS in Belgium about sightings nearby the border.

**PA:** *When an UAP is observed near the French border and investigated by you, do you cooperate with other countries and share information with them in order to find an explanation?*

**XP:** We would like to, but we have no agreement with foreign armies or others air control centers.

**PA:** *Have you ever shared radar information across the border?*

**XP:** Not recently. In fact I don't know if it previously happened, before I joined GEIPAN.

**PA:** *If an European astronaut observes an UAP in low orbit, would GEIPAN be the legitimate interface to collect his testimony?*

**XP:** I think that it is not in the strict mission of GEIPAN, who works only on the French territory. However, nobody is really in charge of the low orbit space, like for the oceans. Should this occur, GEIPAN should be happy to investigate !

**PA:** *An audit of GEIPAN was conducted in the past. Will this report be made available and what were its main conclusions?*

**XP:** This report will be published in a near future (< 1 year). The conclusions are that an entity like GEIPAN is a real need for the society, and that an institute like CNES (i.e. public, civil, scientific, specialized in aerospace) is the best place to host such a group.

**PA:** *Why aren't GEIPAN scientific committee annual's minutes of meetings made available on line? This would show the progression of research activities on the UAP topic since 1977.*

**XP:** There is not any more a scientific committee. There is now a steering committee and an experts panel. They meet twice a year : in the steering committee, we report the GEIPAN activities, the main new cases, the communication events, and validate some decisions on GEIPAN functioning. In the experts group, we report the main new cases, some news in our activity (i.e. the on-going statistical studies), and we work on some current doubtful cases (which will be published some months later).

**PA:** *Mr Patenet had published the 2006-2007 GEIPAN steering committee's report. Has there been any meeting since then and can the more recent minutes of meetings be made available on the website?*

**XP:** This report was more an activity report than minutes of meeting. There has been several meetings since 2007, however the minutes of meetings are frankly quite boring for an ufologist.

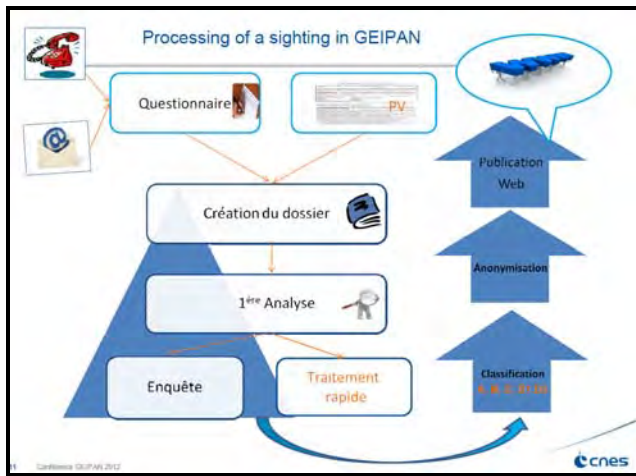


Fig. 1: Testimonies' process

**PA:** *Is Mr Sillard still the GEIPAN steering committee's president and can we know who are its members?*

**XP:** Yes, he is. Other members are representatives of Gendarmerie Nationale, Police, Civil Air Control, Air army, National research center, Météo-France, a psychologist scientist, and some CNES members : the communication director, Mr "Ethics" (J. Arnould), the head of the deputy directorate of the CNES Toulouse space centre, and the head of GEIPAN.

**PA:** *Do you think that GEIPAN answers a general public's need of being reassured?*

**XP:** Some witnesses expect from the GEIPAN a scientific reply to the strange sighting they experienced : those persons are generally very satisfied with our service. Some others hope that GEIPAN confirms their beliefs in extra-terrestrials, and are often disillusioned. I think that the general public need is to have a reliable and scientific point of view on the strange phenomena, more than to be reassured.

## 4.2 UAP and Science

**PA:** *Is GEIPAN interested in participating in any research project, and how important could such involvement be?*

**XP:** GEIPAN is participating or even leading some (modest!) research projects (Hessdalen<sup>1</sup>, statistics, Psychology). These activities have to be done with quite low human and financial resources, and should not slow the main activity of processing of the cases.

**PA:** *How does GEIPAN intend to facilitate and participate to the scientific progress regarding UAP (although it was stated in your presentation that it is not a research institute)?*

**XP:** I believe that the quality of the reports published on the web, from reliable investigation, is the best we have to do.

**PA:** *Do instrumental observational projects fall under potential future activities or will GEIPAN tasks*

*just be limited to the a posteriori collection of testimonies?*

**XP:** We are preparing this year a set of 2 "All-sky"<sup>2</sup> camera to track any strong transient light. It's focused to track the fireballs.

**PA:** *What is the role of GEIPAN in the Hessdalen research project?*

**XP:** We have participated to the funding of the French scientific mission<sup>1</sup>.

**PA:** *Is GEIPAN attempting to use existing scientific databases (e.g., geomagnetic) to search for a signature of a UFO event? If so, what have been the results?*

**XP:** Not yet. good idea !

**PA:** *What has been the impact of publishing on-line the GEIPAN archives? Has there been any interest shown by the scientific community? Any innovative approach? If not, what do you think is missing? How can scientists start any serious critical study of the files?*

**XP:** The impact of putting on line the GEIPAN archives was enormous on the public, and has made less dramatic the UFOs subject. The scientific community is still considering the UFO subject as not serious ; but I believe that our work permits that this opinion is very slowly moving positively. Let's assume that a scientist should be interested in working on UFOs, should he find some funding to do that? However, we have a counter-example: we have a current research study for a PhD in cognitive psychology funded by the Region Midi-Pyrénées and CNES. The results will be published this year, by GEIPAN, and I hope in a scientific publication.

**PA:** *Can any interested scientists obtain information from GEIPAN? Can any outside scientist or researcher visit and use the GEIPAN case archives?*

**XP:** Definitely YES for professional scientists (i.e. working for a scientific lab)! The reply is not the same for private researchers.

**PA:** *Is there a production of scientific/university papers "peer reviewed" foreseen, by GEIPAN or its partners?*

**XP:** yes, and this has already been answered before.

**PA:** *During the last 35 years, has the GEIPAN research in UAP lead to some specific research in some domains? in what fields do you think that it could have some impact?*

**XP:** No clear idea !

**PA:** *What is your advice on making sure that the scientific investigations do not get mixed up with the more crackpot UFO conspiracy type of theories?*

<sup>1</sup> See Annex 1 (Note PA)

<sup>2</sup> GEIPAN will be associated to the French astronomical project "FRIPON" (Fireball Recovery and Inter Planetary Observation Network, <http://www.fripon.org/index.html>), aiming of setting up a network of 100 all-sky cameras across the French territory (Note PA)

**XP:** This is a complex question, that should require a book to reply to.

**PA:** *Is GEIPAN aware of any UAP scientific instrumentation project on going somewhere else in another country?*

**XP:** I know the Hessdalen project, and the rapidly growing network of All-sky cameras. This last devices should definitely solve the problems of fireballs and re-entries debris (this should avoid the famous nov,5 1990 French UAP affair <sup>3</sup>!)

**PA:** *Has there been or is there a thinking in GEIPAN about the extra-terrestrial hypothesis, and in terms of science and technologies how could the manifestation of an ET intelligence be envisaged?*

**XP:** As we consider that there is no physical evidence of alien visit, GEIPAN considers the extra-terrestrial hypothesis in the class of the belief, i.e. it is a personal decision in front of a proof less problem. Within the GEIPAN team, everybody has its own opinion.

**PA:** *How do GEIPAN's activities overlap with other initiatives such as Space Strategic Awareness? and if the whole sky is being radar mapped down to objects of 10 cm in size, can there really be any truly unexplained sightings?*

**XP:** As there are stealth aircrafts, why not stealth spacecrafts?

**PA:** *What role will GEIPAN have in the future? Will it only collect reports, or will it put some effort finding possible solutions? Also how much investigation does GEIPAN want to dedicate to each case ?*

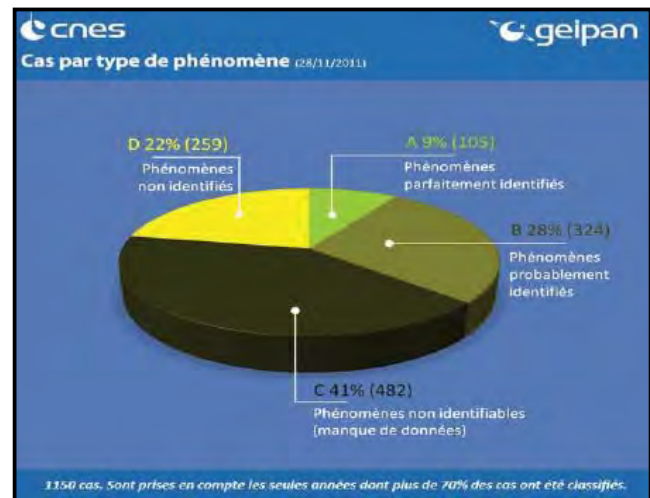
**XP:** The main issue of our activity is that we have not yet solid cases nor measures to start any scientific work. That's why we are mostly collecting reports.

**PA:** *Does GEIPAN systematically collect data on fireballs (meteoroids and re-entering debris) or do they know about such a database (within SSA-NEO it is planned to establish a fireball database)?*

**XP:** I recently created a special simplified questionnaire to report on fireballs<sup>4</sup>. We transmit them to IMCCE, the French astronomy laboratory in charge of studying asteroids, and to the National Museum.

<sup>3</sup> Observation by thousands of persons (including the astronaut J.P. Haignere) of the spectacular space re-entry of the "20925/1990 – 94C/GORIZONT 21 PLATFORM/USSR". Case: <http://www.geipan.fr/index.php?id=202&cas=1990-11-01225> (Note PA)

<sup>4</sup> Available on the GEIPAN website: [http://www.geipan.fr/index.php?id=204&no\\_cache=1&tx\\_da\\_mfrontend\\_pi1\[showUid\]=9622](http://www.geipan.fr/index.php?id=204&no_cache=1&tx_da_mfrontend_pi1[showUid]=9622) (Note PA)



*Fig. 2: GEIPAN statistics (basis:1150 cases published, status 28/11/2011)*

### 4.3 UAP sightings

**PA:** *How many sighting reports are received each year by GEIPAN? How many are investigated in the field? How many cases with physical traces are received?*

**XP:** In 2011, GEIPAN has open 163 folders vs. 191 in 2010. This decrease does not mean that there is a real decrease in sightings : in one hand, we don't open any more folders for "photo only" cases (strange photos, but nothing observed with the eyes), and we have added on the GEIPAN web site many information for the witnesses to make their own investigation (i.e. Chinese lanterns, satellites ..). Moreover, when a witness call and when the explanation seems obvious (stars, planets, ISS, Chinese lanterns), we often propose immediately an explanation ; if it is accepted by the witness, the case is closed, and we don't open a folder. About 10% of the cases (formal ones) lead to investigation in the field. It's a long time since we didn't have any unidentified physical traces. In 2011, we can mention 2 cases with physical traces: a meteorite<sup>5</sup>, and a home-made firework.

**PA:** *What is the status of photo cases with GEIPAN? Have any recent photos been investigated that seem to show something unexplained?*

**XP:** We often receive "photo only" cases (strange photos, but nothing observed with the eyes) that we investigate generally easily ; when a photo is available, the sighting is mostly identified. In the recent "D" cases, we have no photos.

**PA:** *Why is there such a large number of misidentified natural or man-made phenomena?*

**XP:** Because people are not trained nor used to stare at the sky, and identify planets, satellites, planes, Chinese lanterns, balloons and that some love the idea to see a very strange phenomenon. I believe that humankind has an intrinsic drive to see signs in the sky.

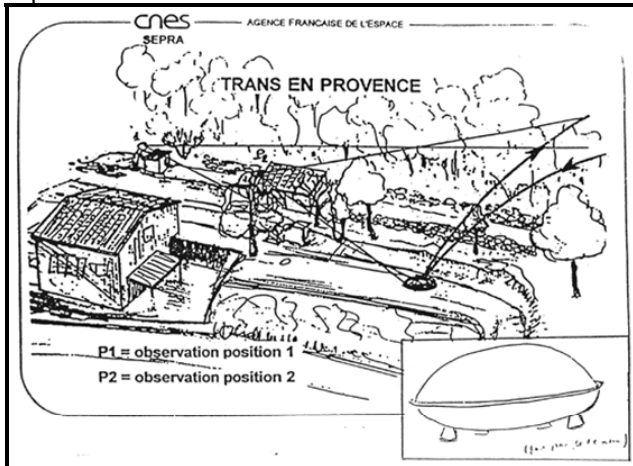
<sup>5</sup> See Annex 2 (Note PA)

**PA: Has there been any increased number of observations after the release of major SCIFI movies or series (ET, X files, MIB, Taken, etc...)?**

**XP:** Some worldwide statistics can be interpreted in this way. About GEIPAN, we always receive a bunch of sighting reports, mostly old ones, after the broadcast of a TV program about UFOs.

**PA: What is the most important tool to identify a UAP reported to you? what kind experts are called in?**

**XP:** The most used tools are geographic maps (Google earth), a sky map, the weather reports (for the wind). The most demanded experts are the aeronautics experts.



*Fig. 3: The Trans en Provence landing case (1981)*

**PA: Have you seen any change in the quality of the reports during the recent years?**

**XP:** As we improved our UAP questionnaires, the sighting reports significantly improved. When we read the old reports, some of them were very poor.

**PA: Do you think that there exists a reticence from plane pilots to report UAP cases?**

**XP:** Sure, there is !

**PA: What physical evidence do you believe is most important to collect about a sighting? How successful has GEIPAN been at collecting such evidence. What plans exist to collect such evidence on new cases?**

**XP:** A good photo should be a very good evidence, if associated to an observation. But in most cases, we have only photo made with a handheld phone ! Some ufologists suggest to use diffraction gratings, and to distribute massively in case of UAP. But the first goal is to have a good photo, which requires at least a SLR camera on a tripod ; should you have it, you don't have it ready in several seconds!

**PA: When a sighting cannot be explained, what is done with it? (archived, discussed with scientists, re-looked a posteriori for finding an explanation ?)**

**XP:** Right ! archived, discussed with scientists, published on the web and re-looked a posteriori for finding an explanation.

**PA: Can some of these cases relate to foreign military activities?**

**XP:** Some sightings were probably related to foreign military aircrafts flying over France, but their behaviours were very common.

**PA: A scope of GEIPAN is the potential analysis of possible risks for the defense. Has there been any case falling into this category, or analysis done?**

**XP:** Not yet !

**PA: Is there any military files (Air force, Navy...) in the GEIPAN archives?**

**XP:** We have several cases of sightings from military pilots, but from conventional cases : fireballs, debris re-entries.

**PA: Are there reports of close encounters to be uploaded? Besides the GEIPAN categorization, do you use the Hynek's classification database?**

**XP:** GEIPAN has only several cases of close encounters. The most recent are not very solid cases. We don't use the Hynek classification, because we don't have enough cases.

#### **4.4 GEIPAN website and statistics**

**PA: A Total of 2200 cases are mentioned. Until now and after 5 years of inception of the GEIPAN website, only 1100 cases have been uploaded. Does this mean that it will take another 5-6 years for completing this task?**

**XP:** I'm afraid that it will need several years. However, today, we are able to process more cases than we receive, and I'm preparing a temporary technical assistance to process several hundred of cases within the next year.

**PA: Why doesn't GEIPAN make the category D cases available first on the website, in order to stimulate the curiosity and interest of the scientific community ?**

**XP:** We know that the D cases are more interesting than others. However, we want to show the result of our work and to show that there are many misinterpretations. We process in priority the apparently strange cases, then the very simple ones which are quickly closed ; the latest, i.e. those which are waiting, are "medium" cases which will go probably in class C or B.

**PA: Along the same line: You indicated on one slide that 10% of the 2200 cases originate from pilots or relate to plane observations. However under the statistics, it is mentioned that only 10 cases have been published until now. Why has there been little interest in uploading these files, especially in light of the potential defence, safety dimensions?**

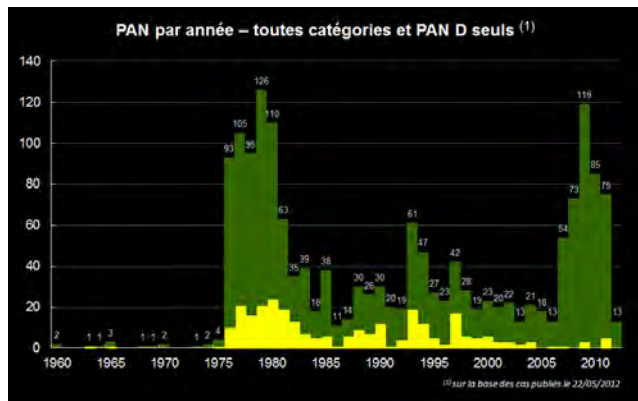
**XP:** I'm surprised of the low figure (10) you refer about the pilot reports. I'll check.

**PA: One of the first analysis of GEPAN was done based on 678 reports, for the period 1974-1978 (5 years). The year 1981 was also high (100 in terms of reports), how do you explain the sudden decrease of sightings? Do you have an annual split of all 2200**



## **cases?**

**XP:** These figures have to be commented, you should not link these figures to the real number of sightings in France. It depends much more on the current reputation of GEIPAN, on the interest of the population about UFOs, than on the real number of sightings. As an extra example of a bias on statistics : actually, I try to lower the number of cases to be processed in GEIPAN by giving to the witnesses the tools and methods to make their own investigation; moreover, we don't process anymore the strange photos without sighting : this decision will impact the statistics, it should lower A and B cases number.



*Fig.4: GEIPAN total cases published 22/05/2012 (green) vs. category D cases (yellow)*

**PA: What tool do you use for the sightings database? How many parameters do you introduce for each case?**

**XP:** We have today an MS-ACCESS database, but we prepare a migration on a web-interface database. Several tens parameters are used, but many are for the internal management of the case.

**PA: Has GEIPAN used its database, which must be quite extensive, to search for any patterns in the UFO data (along the lines of what Poher did in the mid-1970s)? If so, can you discuss any findings? Does GEIPAN observe any pattern in the remaining unidentified sightings (GH D, such as that they are from a certain area, seen by pilots, or with a typical shape, colour...etc...)?**

**XP:** We have not recently made statistics study on patterns. I believe that there are not enough D cases suitable for this kind of studies.

**PA: When other official institutions investigating UAP consider the percentage of the unexplained to be a 3%, how is it possible that GEIPAN still has a percentage of 22%, like in the 1940's in the USA? Is that percentage a reflection of the reality of what is going on, or is it a reflection of the lack of resources (human and financial) to develop a thorough investigation as it should be done?**

**XP:** The main question is "what is really an unidentified sighting"? and what is the border between a "C" case and a "D" case? the border is fuzzy, and depends on the man who sets the classification. E.g. on doubtful cases, my predecessor was preferring "C" class than "D"; I'm personally more ready to class doubtful cases as D1. If

we consider that "unidentified" is equivalent as our new D2 class, I think that the 3% ratio will not be far.

**PA: Some interested parties might be interested to perform statistical analysis on the GEIPAN database. Could they obtain an Excel file in a simplified format (case, place, year, category, explanation)?**

**XP:** Yes, we forecast to put that available on our web site within the next month. A summary of the GEIPAN's database content under an EXCEL table will soon be published.

**PA: In conclusion, What are GEIPAN views after 35 years of data collection and analysis?**

**XP:** Many misinterpretations and several strange sightings.

**PA: Many thanks Mr Passot for your time and all the best luck for your future GEIPAN activities.**



## **Existence of electric/magnetic signals related to unknown luminous lights observed in Hessdalen valley (Norway)?**

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Hessdalen valley, in Norway, is a north-south elongated basin of about 20 km by 10 km (latitude: 62°50'N, longitude: 11°12'E) in which few inhabitants are permanently living. Since several decades, scarce observations made mainly during night time have point out transient luminous lights, called Hessdalen phenomena ('HP'). Østfold University College was the first pioneer research centre which started to install visual and geophysical monitoring systems able to track the unknown lights (<http://www.hessdalen.org/>). The characteristics of the HP can be summarized as followed. They can appear in the low atmosphere, remain quite fixed and suddenly move up at a speed of several hundreds of km/s, for disappearing on the ground or in one the numerous lakes located in the area. The duration can be of a very seconds to a tens of minutes or more. The HP can be white, blue-white flashing lights, yellows or white lights and have different shapes with sizes up to some cubic metres. From 80 observations per month in the 1980's, the number has sharply decreased to about 20 per year nowadays. In 2010, French Research Centres started cooperation with Østfold University College and the Istituto di Radio Astronomia of Bologna (<http://www.ira.inaf.it/>). The objectives are to study radio emission in the frequency band 1 kHz to 5 MHz (see Farges et al., EGU 2012) and the possible disturbances of the electromagnetic (EM) field recorded at two remote stations located in the valley. The two EM stations are located a tens of kilometres apart along the valley axis. In the northern FIN station, a fluxgate magnetometer (resolution of 1/100 nT), two orthogonal induction coils (frequency band: 7 Hz - 8 kHz, resolution 1/100,000 nT), and two horizontal electric lines (few mV resolution) record the magnetic and electric fields, respectively. In addition, a vertical seismometer is linked to the multi-parameter FIN station. At the south OYU station, two induction coils and horizontal electric lines are set. All data are recorded at 40 Hz.

We present the morphology of the EM field in the area which can define the background noise and the morphological evolution of the EM field along the axis of the valley. Some of the EM variations appear to be phase-delay of several minutes between the two stations which lead to suspect important distortions brought by superficial geological structures (mineral deposits?), some electrical current channelling and the local tectonics. During the last 2010-2011 winter campaign, only few observations by eyes were reported. During these periods, no large magnetic or electric signal was clearly identified.

## Existence of electric/magnetic signals related to unknown luminous lights observed in Hessdalen valley (Norway)?

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### Background

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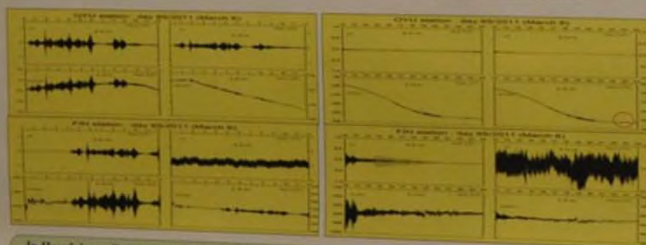
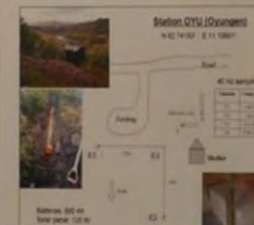
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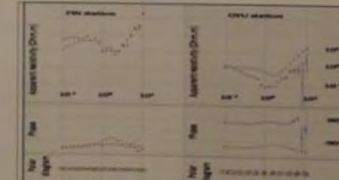
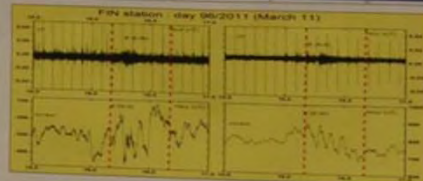
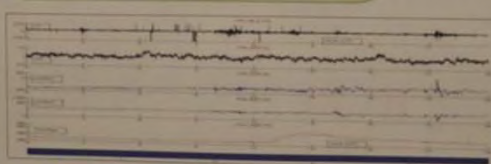


### Instrumentation

The two EM stations are located a tens of kilometres apart along the valley axis. In the northern FIN station, a fluxgate magnetometer (resolution of 1/100 nT), two orthogonal induction coils (frequency band: 7 Hz - 8 kHz, resolution 1/100,000 nT), and two horizontal electric lines (few mV resolution) record the magnetic and electric fields, respectively. In addition, a vertical seismometer is linked to the multi-parameter FIN station. At the south OYU station, two induction coils and horizontal electric lines are set. All data are recorded at 40 Hz.



In Hessdalen valley the EM field has high amplitude and sharply varies with time. Number of pulses are observed. But the records highlight different amplitudes and morphologies between FIN and OYU stations. Moreover, a time delay between variations exist in spite of the short distance between the 2 stations (~15 km).



On April 11, 2011, 2 Luminous phenomena (LP) have appeared between 1610UT and 1640UT. The large EM field variations are due to external ionospheric sources on which abnormal transient effects are superimposed. No evident signal is correlated with the LP. MT soundings show large changes in the crustal resistivity distribution which could induce abnormal time changes.





## **Possible interaction of meteor explosion with stratospheric aerosols on cloud nucleation based on 2011 observations.**

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The lack of knowledge on the nature and the variability through time of stratospheric aerosols strongly constrains the understanding of precipitation events at local to regional scales. Along other causes, meteoroid ablation is assumed to creating significant disturbances on the upper stratosphere layers, particularly by debris production and flash heating. Due to the lack of observations, the impact on cloud and precipitation processes of cosmic debris that are annually delivered to Earth is not taken into account in climate modeling. Here we report on the data collected from 2011 cosmic events that occurred on the Angles village in Pyrenees Orientales (France). The trajectory of a meteor was traced by the CNES from Toulouse (France) to the Pyrenees boarder with Spain where it exploded at high altitude on August 2. 30 hours later, a detonation with debris pulverization at the ground was recorded at the same location across a restricted area. In the following days, unusual heavy rainstorms and violent fall of hailstones were locally recorded from the Pyrenees to the coastal plain. Meticulous sampling of the 2011 August 3rd debris fall and of the soils affected by the subsequent precipitation events has been performed. A similar assemblage of organic and mineral components of stratospheric origin was revealed. It is formed of aliphatic carbonaceous polymorphs of terrestrial origin, volcanic dust, charred and fresh organic grains, fine grained sandstones with native metals and micrometeorite spherules. Microscopic assemblage, isotopes and geochemical data show composite materials formed of imbricated terrestrial and extra-terrestrial components. Based on their C14 and C13 values the terrestrial carbonaceous polymorphs appear to derive from fossil combustible. The fine imbrication of all the other terrestrial components with the carbonaceous polymorphs indicates a common origin from the upper stratosphere. The mixing of the extraterrestrial debris with the stratosphere aerosols is suggested to resulting from the energy released by the meteor explosion. A direct link between the meteor explosion and the subsequent hailstones and heavy precipitation is clearly established by their similar range of composite debris. The meteor explosion is suggested to have initiated phase transformation of the stratospheric aerosols and their agglutination by complex mechanisms that remain to be further elucidated. The agglutinated particles with carbonaceous components have probably initiated condensation processes thus resulting into cloud formation. This was accomplished within a few days as shown by the time lag between the initial meteor explosion and the following precipitation events. The occurrence of the later across approximately the same region as the one of the debris pulverization from the meteor explosion suggests that the trajectory of the meteor would strongly constrain the agglutination processes. This data reveals the occurrence of solid aerosols with carbonaceous components in the stratosphere, most probably loaded by former volcanic events. In the case of serial meteor explosion the agglutination processes could significantly increase the agglutination process of stratospheric aerosols with resulting cloud formation and thus change of radiative forcing. Further research should reveal the role of meteor explosion on climate through cloud-aerosol precipitation interactions.



# Possible interaction of meteor explosion with stratospheric aerosols on cloud nucleation based on 2011 observations.

## Part 1 - Research Questions

Goal: Role of meteor explosion on atmospheric dust loading and cloud-condensation nuclei effects

How will I answer these:

Data from a present-day situation

What is delivered by meteor explosion ?

How was it formed ?

What is the link with atmospheric disturbances?

Meteor explosion on 2011 August 2<sup>nd</sup>, followed by heavy rainfall and hailstorms At the Angles village and on the Roussillon coastal plain , Pyrenees Orientales (France)



Photo of the meteor at 3h 34/2011 August 2nd



Projected trajectory from testimonies



Probability densities of fallen debris



Trajectory of fallen debris based on testimonies and collect



Fall point at Angles village



Dispersion ellipse of the fallen debris



Cottage 34: detonation, explosion, maximum debris



Impact on the wall



Incrustations at the ground



Collected debris: coloured polymers, metals, rock clasts



Polymer

Following events from August 7th to 10th: devastating hailstorms in the Roussillon plain and in the Cerdagne, collect of debris after the rains and from the hailstones



Fine debris collected at the ground



Fine debris collected at the ground



Exotic breccia

Metal ribbon-shaped filaments



Black vesicular carbon



Polymer



Polymer



Polymer



n cloud

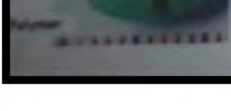
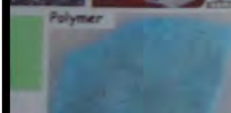
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the link with  
disturbances?

nd hailstorms  
mentales (France)



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## Background in atmospheric science on ablation of meteors

- Leads to the formation of smoke particles
- Smoke and dust particles of meteoric origin have direct effects on atmospheric processes:
- nucleation of noctilucent clouds (NLCs)
  - condensation of stratospheric sulphate aerosols
  - production of nitric acid (HNO<sub>3</sub>) from nitrogen pentoxide (N<sub>2</sub>O<sub>5</sub>) in the upper stratosphere
  - conversion of H<sub>2</sub>SO<sub>4</sub> to SO<sub>2</sub> in the upper stratosphere in the mesosphere and stratosphere:

Insufficient knowledge on the exact composition of meteoric smoke particles

Unique situation on 2011 August 2<sup>nd</sup> :

direct data on what is delivered by meteor explosion

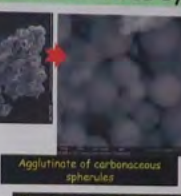
Aliphatic carbonaceous polymorphs :  
filaments, agglutinates, spherules;  
aromatic ones : vitreous char, graphite;  
carbon cenospheres; associated with fine  
grained sandstones and rock clasts : finely  
imbricated with phosphides, phosphates,  
sulphides, sulphates and native metals  
(Fe-Cr-Ni and Fe-Cr alloys, Ni, Al, Cu, Zn,  
Pb, As, Sn, Ag, Au, Bi).



Terrestrial silicate spherules  
with magnetite and iron micro-  
spherules, and graphite



Agglutinate of graphite,  
magnetite and Ag



Agglutinate of carbonaceous  
spherules



Composite nano-agglutinate of crystallized  
carbon, oxides and silicate



Crystallized carbon



Nano-sized carbonaceous  
agglutinates



Cloud condensation nucleation

How was it formed ?

Carbonaceous polymorphs formed from fossil combustible by  
Fisher Tropsh reaction (H<sub>2</sub>O/CH<sub>4</sub>) : dissociation of H<sub>2</sub>O, metals  
and graphite during oceanic impacts  
launched to space million years ago; periodically back to Earth

Vitreous carbon: shock-  
transformation of fossil biochar

C<sup>14</sup>: > 43500 BP  
δC<sup>13</sup>: -30.3 ‰ fossil carbon

## Linking cosmic events and atmospheric disturbances

Production of fine solid aerosols with a carbonaceous  
component derived from fossil combustible

Violent turbulence

Air heating

Concentration of aerosol-loaded air  
masses in the area of meteor explosion

Direct effects of the meteoroid ablation on the  
upper stratosphere layers

Nano-sized carbonaceous agglutinates

Cloud condensation nucleation

Hail and cloud formation

Hailstorms and heavy rainfall in the area  
of meteor explosion

## Working hypothesis

Major cosmic events of the past  
(Tunguska-type air blast to  
large-scale impacts)

Massive production of fine  
aerosols, violent turbulence,  
sudden air heating

Hailstorms, heavy rainfall  
« Deluge-like » situations  
Positive feed-back effect :  
short-term « nuclear-like » winter

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