Its main tasks, as defined in its Royal Decree of creation are:

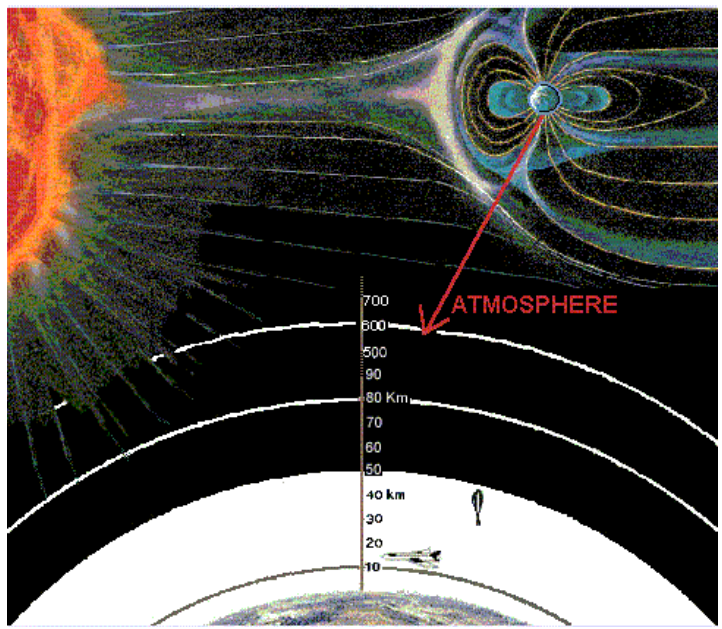
"public service and research in the field of the space aeronomy, i.e. tasks that require data knowledge, gathered using rockets and satellites, within the framework of physics and chemistry of the higher atmosphere and outer space".

Coupling of Atmospheric Layers EU FP5 RTN Project: Engaging Scientists in Training and Outreach Activities

Norma Bock Crosby

Belgian Institute for Space Aeronomy
Ringlaan-3-Avenue Circulaire, 1180 Brussels
Belgium

http://www.aeronomie.be/



EO – EPO

EO - Education and Outreach

EPO - Education and Public Outreach

Outline

1. Defining "Education and Public Outreach (EPO)".

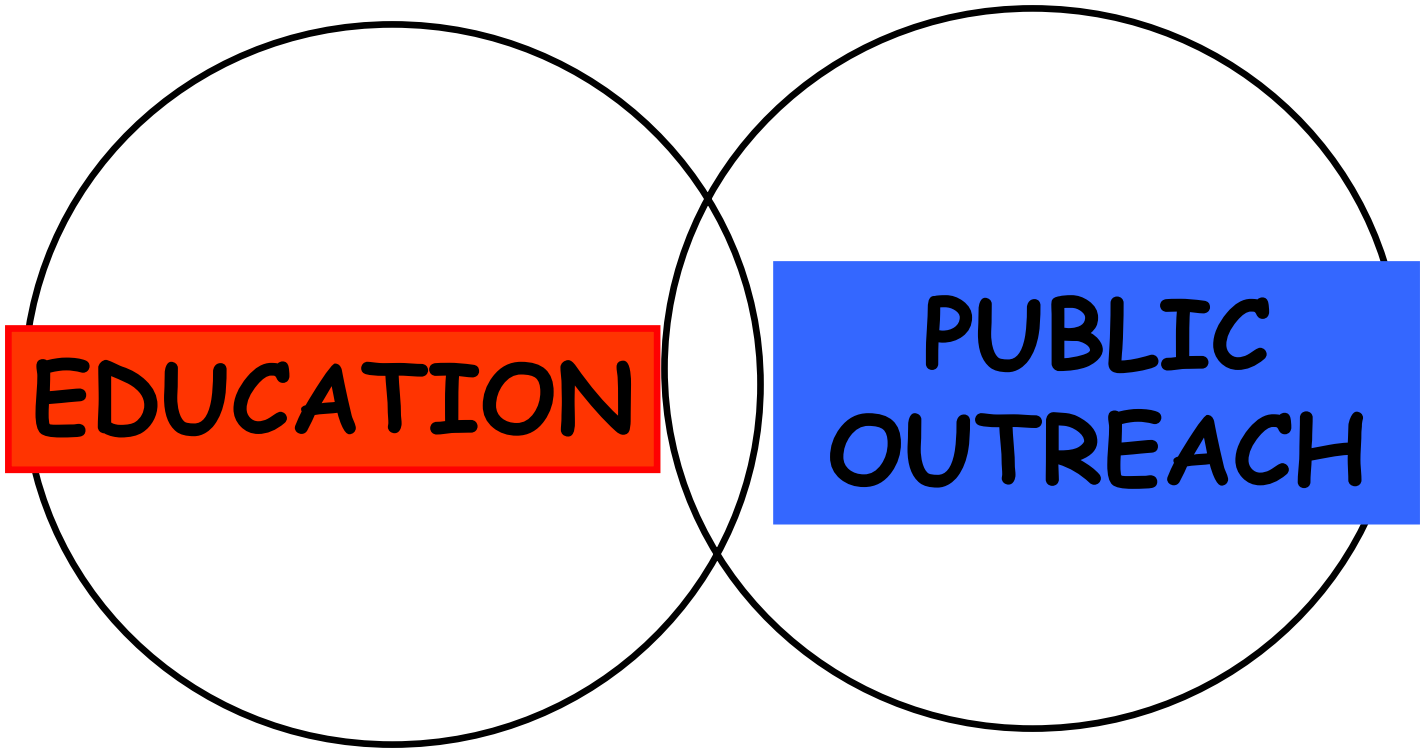
2. Why talk about EPO in connection with satellites and space science?

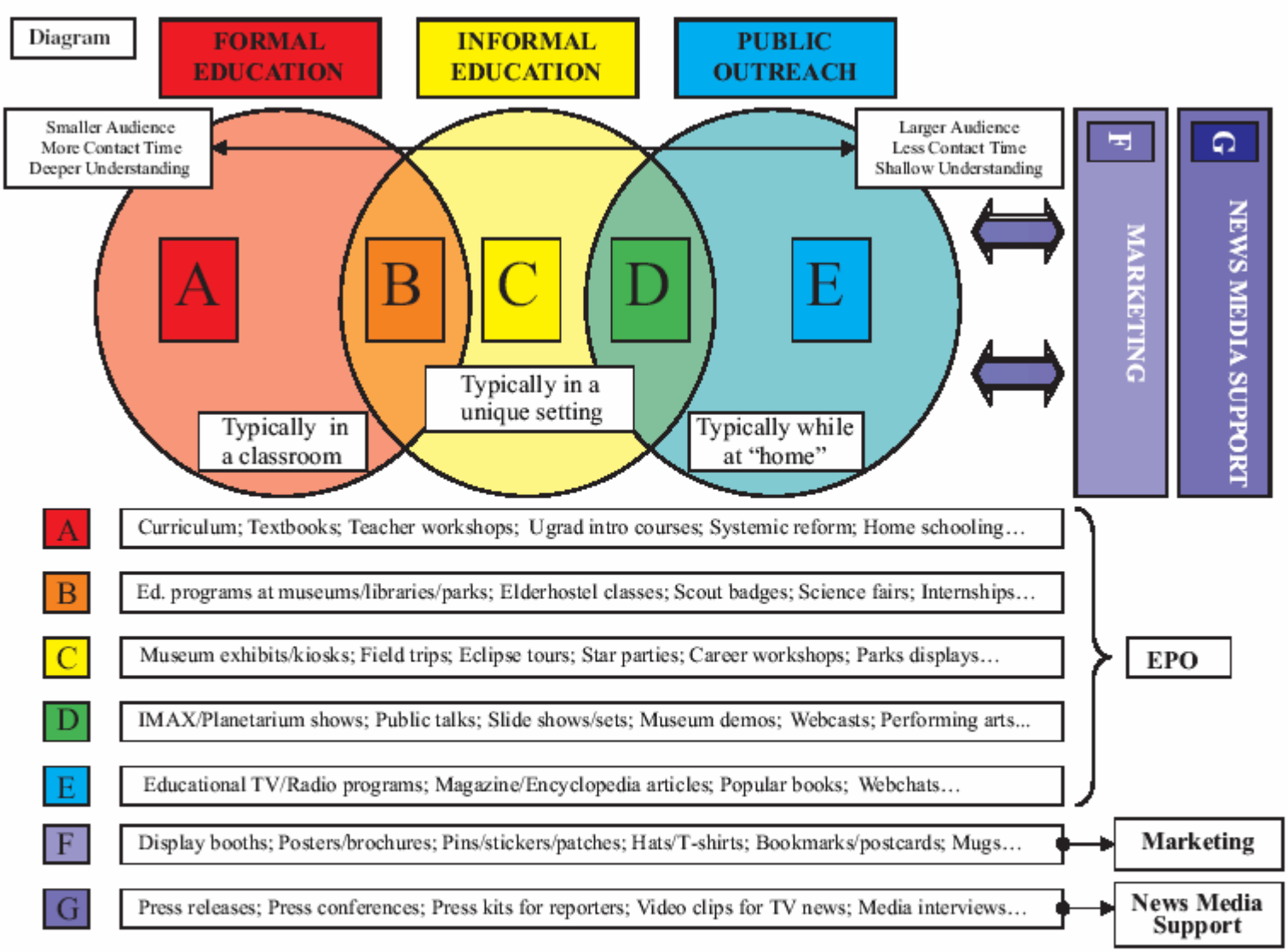
3. Examples of how you can be active in "Education and Public Outreach".

4. Case Study - Coupling of Atmospheric Layers EU FP5 Research Training Network Project.

5. Concluding Remarks.

1. Defining "Education and Public Outreach (EPO)".


EDUCATION
PUBLIC
OUTREACH



This 3-circle Venn diagram offers a conceptual framework for planning education and public outreach programs associated with scientific research programs.

Cherilynn Morrow, Space Science Institute, May, 2000. Email camorrow@colorado.edu.

http://www.spacescience.org/

Courtesy of Cherilynn Morrow, Space Science Institute, USA, Boulder, CO

EPO

A. Formal Education
Curriculum; textooks; Teacher Workshops

B. Formal/Informal Education
Educational programs at museums/libraries/parks; Science fairs

C. Informal Education
Museum Exhibits; Eclipse Tours; Star Parties

D. Informal Education/Public Outreach
IMAX/Planetarium Shows; Webcasts

E. Public Outreach
Educational TV/Radio Programs

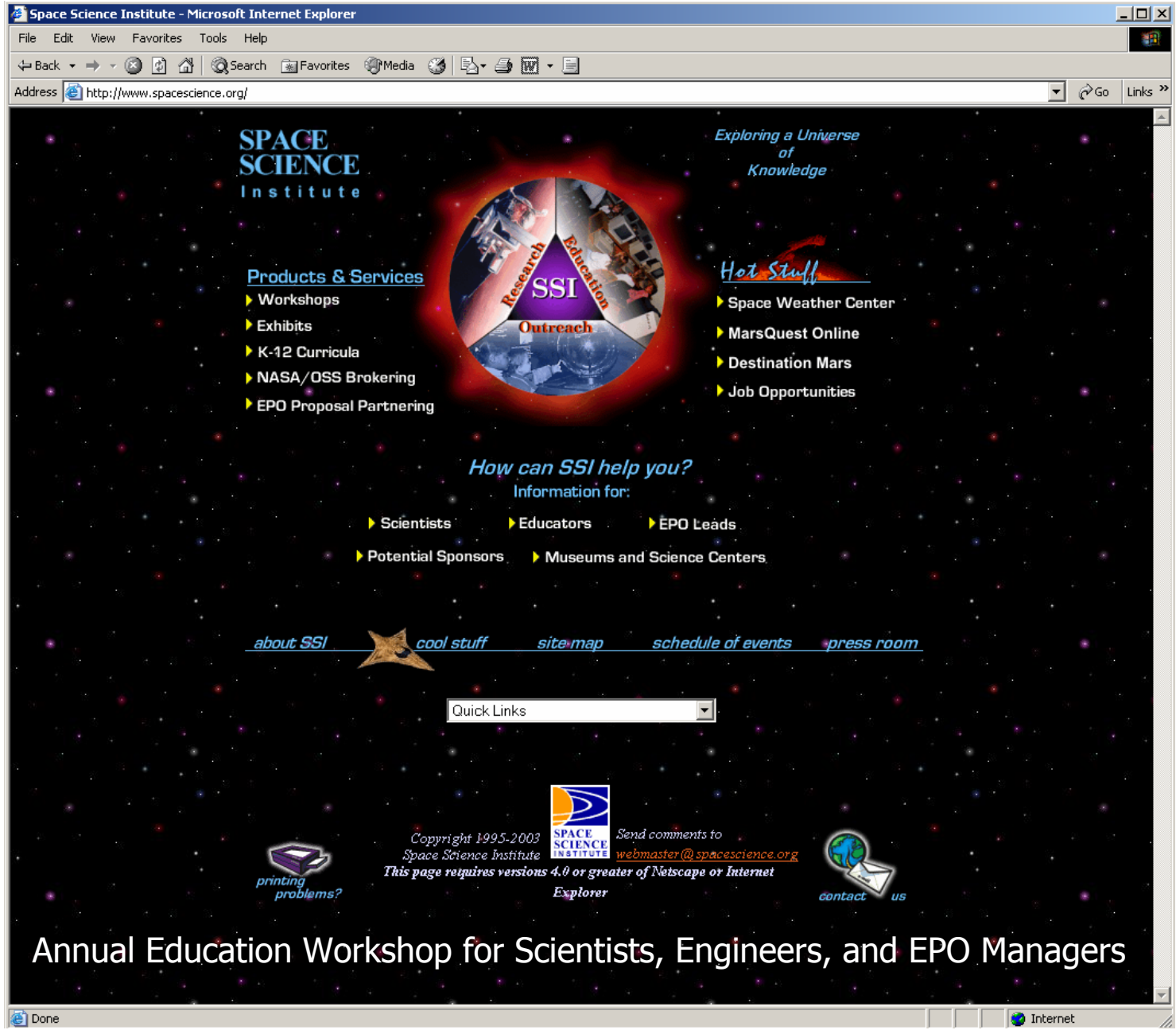
MARKETING

Display Booths; Posters/Brochures;
Pins/Stickers; Hats/T-Shirts

NEWS MEDIA SUPPORT

Press Releases, Press Conferences;
Video Clips for TV News

http://www.spacescience.org/



Annual Education Workshop for Scientists, Engineers, and EPO Managers

2. Why talk about EPO in connection to satellites and space science?

A picture is worth a 1000 words

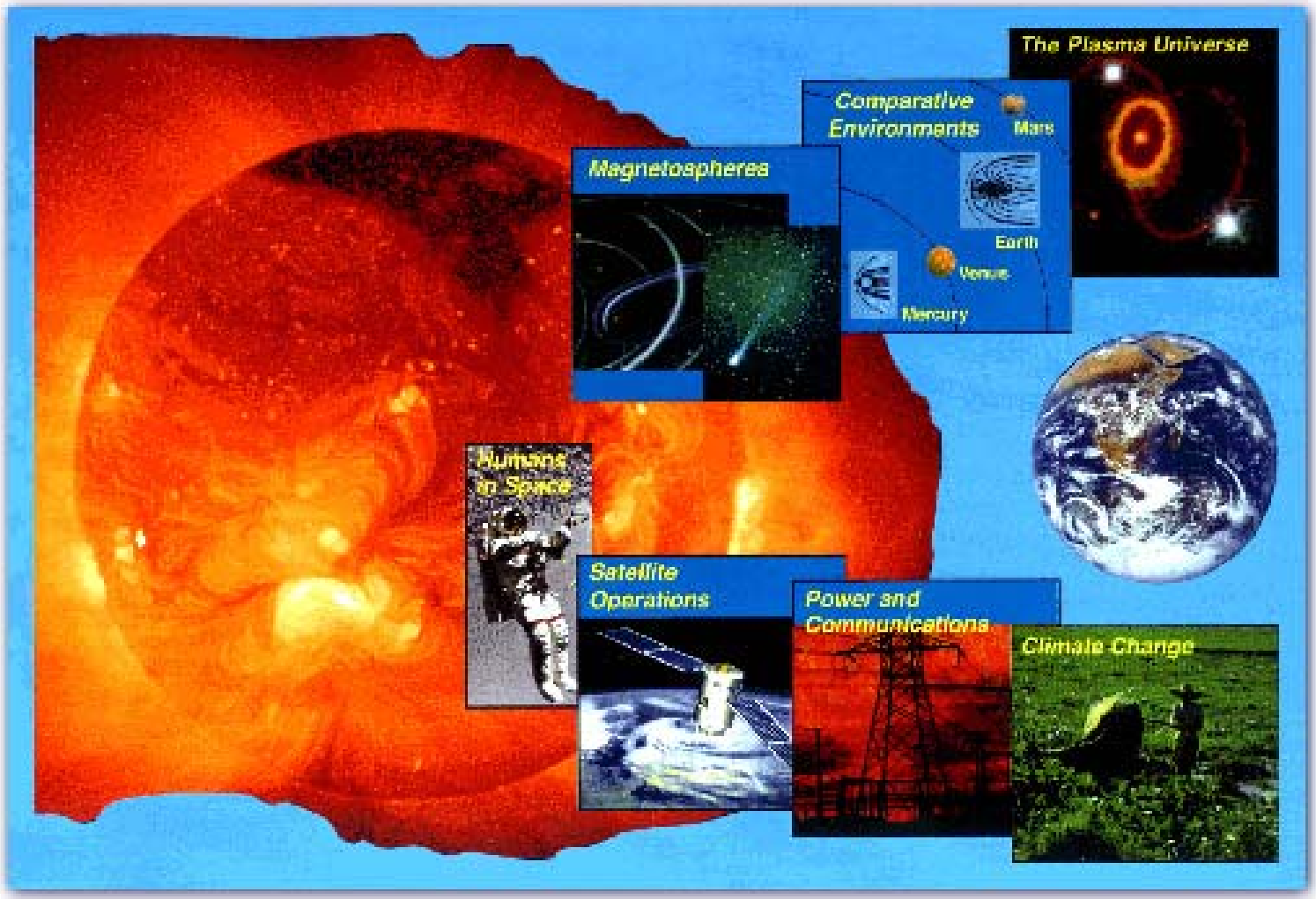
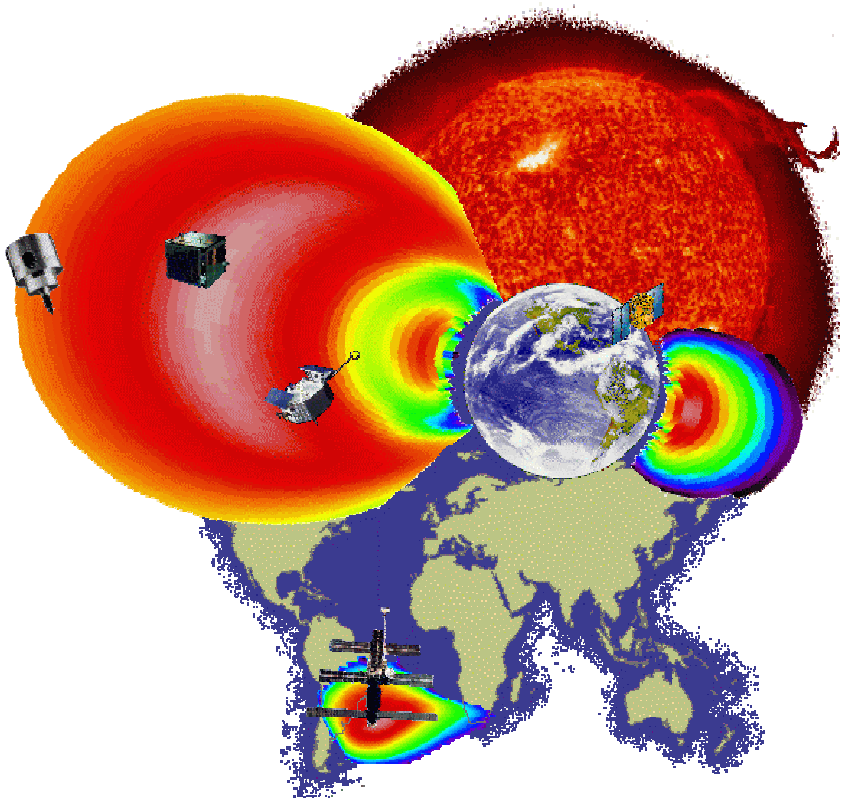


Image Courtesy of NASA

Present society is deeply dependant on reliable space systems and will be more in the future (cities, rural, isolated) on Earth.

~ EDUCATION OF PRESENT AND FUTURE GENERATIONS.



« Satellites » and « Space Science » are Multi-Disciplinary Subjects !

- Science, engineering, medicine, environment, finance, ...

[In regard to potential EPO activities this offers many unique opportunities.]

Collaborations

And Don't Forget ☺

When writing an application to your funding agency it is important to note the following:

Many national funding agencies

- Like the words "education and outreach"
- In many cases a work-package concerning these words is obligatory in the writing of an application.

This is more and more common and should not be taken with a grain of salt.

3. Examples of how you can be active in "Education and Public Outreach".

PUBLIC OUTREACH ACTIVITIES

- articles (e.g. magazines, etc.)
- press-releases (e.g. new scientific results, etc.)
- interviews (radio, TV, newspaper, etc.)
- talks and presentations for the general public
- CD-roms, web-sites

EDUCATION / TRAINING ACTIVITIES

Examples for both **Old and Young** scientists:

- tutorials at meetings
- specialized workshops, summer-schools, …
- observational/theoretical campaigns when relevant
- writing documentation (e.g. users handbooks)
- network visits, cross-network training,
- etc.

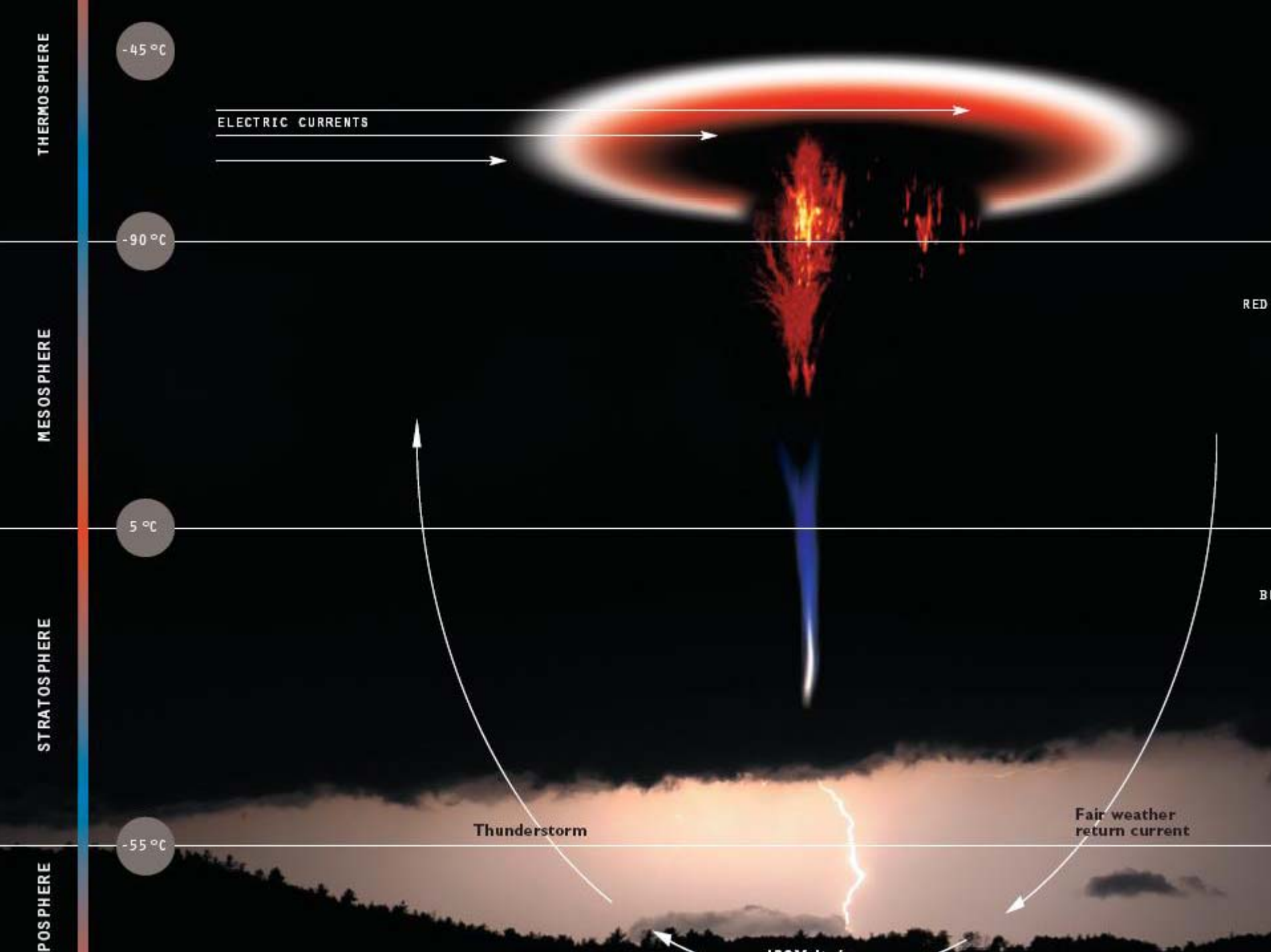
EDUCATION / TRAINING ACTIVITIES cont.

Scientists should all have experience in producing educational material for:

- children (7-9 year olds)
- young adults (10-14 years old)
- first year college/university
- professionals
- the general public

= > better communicators !!!

4. Case Study – Coupling of Atmospheric Layers EU FP5 Research Training Network Project.


THERMOSPHERE
MESOSPHERE
STRATOSPHERE
-45 °C
-90 °C
5 °C
-55 °C
ELECTRIC CURRENTS
RED
Thunderstorm
Fair weather
return current

Sprites, Elves, Jets

OPTICAL PHENOMENA ABOVE THUNDERSTORMS

Sprites, jets and elves are « celestial fireworks », also referred to as « transient luminous events (TLEs) », sprites specifically as « high altitude lightning ». They are observed above the thunder cloud. TLEs occur mainly above large continental thunderstorms, for example over the Great Plains of the United States, where they were first observed about 15 years ago. They have also been observed in South America, Africa and southern Europe, as well as from space.

Sprites and jets are discharges (sudden flow of current through the air that normally acts as an insulator) connected to the electrostatic discharge occurring in the parent lightning strike, whereas elves are a result of atmospheric heating

WHY STUDY THESE PHENOMENA?

The discovery of these phenomena came at a time of controversial discussions of the possible influences of space processes on weather and climate. Is the power supplied by thunderstorms sufficient to maintain an electric field of about 130 Volts/m observed in the distant, fair weather regions? Does the answer lie in TLEs? Do these phenomena affect the atmosphere by :

- altering atmospheric gas concentrations in the stratosphere or mesosphere
- modulating the global atmospheric electric circuit?

Or are they themselves perhaps a result of climate change?

SPRITES

Sprites are flashes of light that last from a few milliseconds to a few hundred milliseconds. Sprites are predominantly red. The brightest region lies in the altitude range 65-75 km, above which there is often a faint red glow or wispy structure that extends to about 90 km. Below the bright red region, blue tendril-like filamentary structures often extend downward to as low as 40 km. Sprites rarely appear singly, usually occurring in clusters of two, three or more. Sprites appear directly above an active thunderstorm system immediately after a positive cloud-to-ground (+CG) lightning stroke.

The optical emissions observed in sprites occur in different colors of the spectrum and are most likely byproducts of the ionization and heating processes of nitrogen and oxygen (the main molecules at these altitudes).

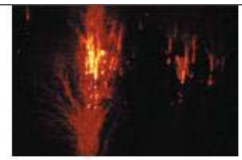
JETS

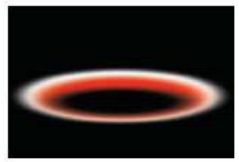
A blue jet is a rare sight, a jet of blue light coming from the top of an electrically active core region of a thunderstorm. Blue jets travel upwards at 100 km/s fanning out into a cone of 15 degrees full width, and disappearing at heights of about 40-50 km.

ELVES

Elves are triggered by a lightning stroke and sometimes appear with sprites. They form as a result of atmospheric heating when large lightning bolts send a strong electromagnetic pulse into the upper atmosphere, shaking up the electrons in nitrogen gas so strongly that they emit light by fluorescence.

Propagating like ripples from a pebble thrown into the still waters of a lake, luminous rings at about 90 km altitude expand outward with the speed of light and last less than 1 millisecond.





The CAL project is an example and inspiration of how an EU Research Training Network project can be a unique opportunity to provide "training and outreach" learning activities.

EU FP5 Research Training Network (RTN) project

Coupling of Atmospheric Layers

WP2 THE TRAINING PROGRAMME

The educational “training” programme is a key ingredient in the CAL project and covers the implementation of the training activities aimed at the ten Young Scientists hired through the CAL project (four of them are following national Ph.D. programmes) as well as participating senior scientists.

Training is highly cross-disciplinary due to the nature of the network study, and covers a variety of scientific methods. Educational activities are based on the following elements:

- National Ph.D. programmes
- Activities at CAL- and other meetings
- Observational campaigns
- A dedicated “summer-school”.

Activities at CAL- and other meetings

1. Education in organisation of research programmes

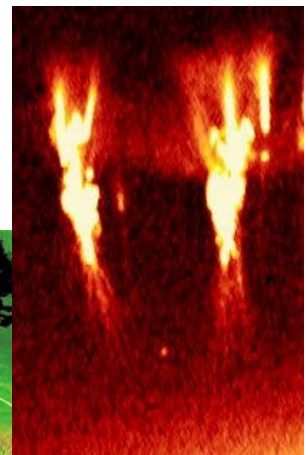
Documentation needed to organise meetings and campaigns have been written with the active involvement of the Young Scientists.

During the CAL third year, activities especially were focussed on the "EuroSprite2005 sprite observational campaign".

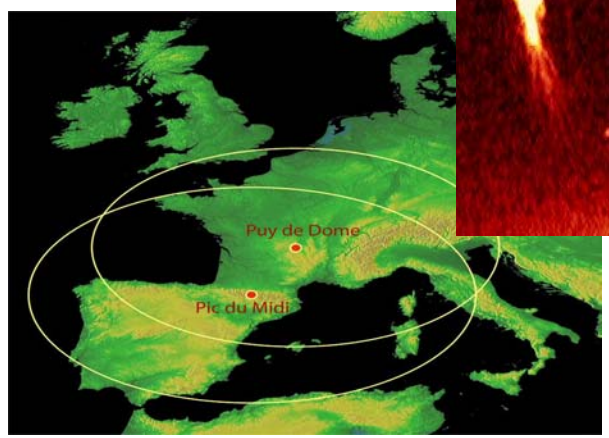
Education in Experimental Work

During the third year, the most important activity of the training programme was the EuroSprite2005 observational campaign.

Between 18 July 2005 to 18 September 2005, cameras installed at the Observatory of Pic du Midi de Bigorre in the French Pyrenees and Puy de Dôme in the Massif Central in central France were remotely operated by the ten Young Scientists funded by the CAL network, from different countries in Europe via the Internet.



The campaign was extended to late autumn due to its success.



During the summer campaign, more than 60 sprites were observed and catalogued.

CAL Young Scientists activities included:

- EuroSprite2005 output web page:
<http://www.dsri.dk/sprite2005/omp/> or
<http://www.dsri.dk/sprite2005/puy/>
This is the web page where the “sprite observers” could see:
    1.) the images taken by the two cameras,
    2.) the image or list of discharges detected by Meteorage, and
    3.) different log files from the PC cameras.
The web-page is password protected and was
written by Giulio Villa for the previous EuroSprite campaign. It was modified this summer by him, in order to handle the two systems “Pic du Midi” and “Puy de Dôme”.

- EuroSprite2005 / Spritewatch Tutorial:
<http://www.dsri.dk/sprite2005/omp/raw_images/tuto/tuto.html>
was developed by Olivier Chanrion. It explains how to operate the camera system and was written for the Young Scientists.
The web-page is password protected.

- Software to acquire automatic sprite images from the new high-resolution cameras used this year on Pic du Midi was written by Olivier Chanrion. The new software includes for example, taking care if there is enough space on the disk, correcting and installing scripts doing e.g. uploads, calculating the position of camera. etc.. It was developed using the principles of the software written by Thomas Allin that was used during the previous observational campaign (Puy de Dôme). Agnes Mika wrote a program calculating the pan and tilt values from given geographical coordinates.

- Design of daily TLE report documentation was developed by Peter Berg: <http://www.ion.le.ac.uk/~ea59/sprites/eurosprite2005jul25-jul31_report.txt>

- Coordination of observations, support web-page was developed by Enrico Arnone: <http://www.ion.le.ac.uk/~ea59/sprites/campaign2005.html>

- Weather information links web-page was developed by Oscar van der Velde and included weekly weather outlook reports during the campaign that were communicated by email and via the EuroSprite2005 blog (see next item):
<http://www.ion.le.ac.uk/~ea59/sprites/meteodata.html>

- The EuroSprite2005 blog <http://eurosprite.blogspot.com> was created and is being maintained by Enrico Arnone and Oscar van der Velde. The other Young Scientists contributed to its development.

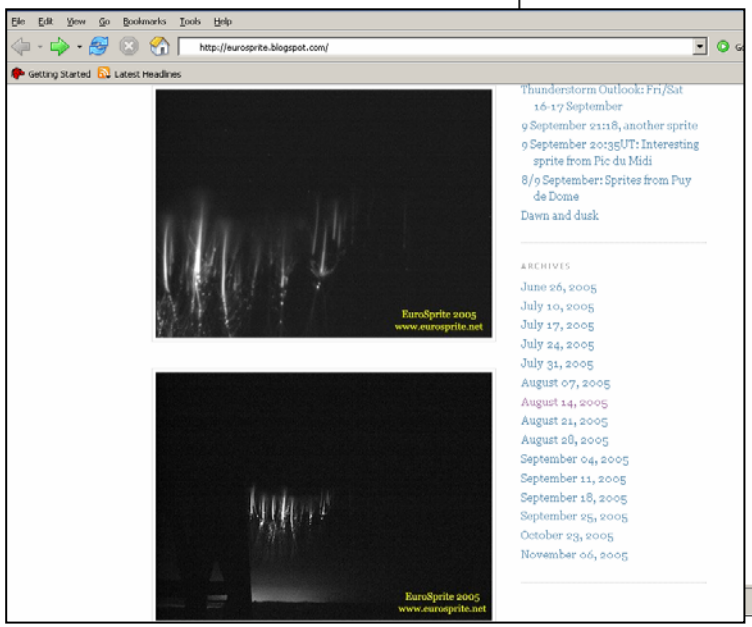
- Fredrik Boberg created the EuroSprite2005 catalogue with the help of Olivier Chanrion:
<http://www.dsri.dk/sprite2005/omp/raw_images/Database/>
The web-page is password protected.

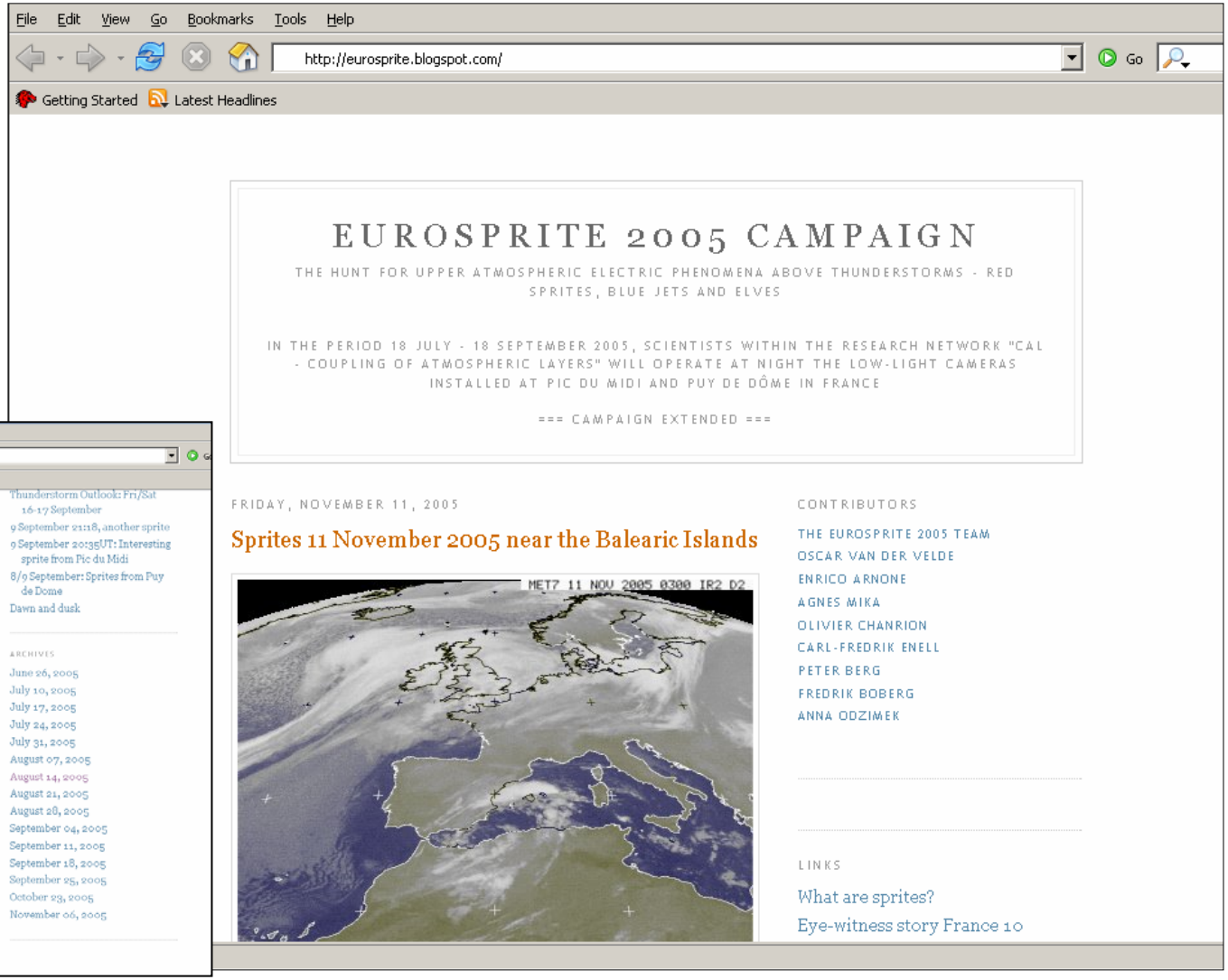
- Anna Odzimek, Enrico Arnone and Oscar van der Velde spent one week during the EuroSprite2005 observational campaign observing directly at the Pic du Midi where they also trained themselves on weather systems and weather phenomena observations. During that week Anna Odzimek and Enrico Arnone put together the structure of the CAL educational sprite web site <www.eurosprite.net> that is built in three levels: "Beginners", "Intermediate" and "Advanced" section. Contributions from Carl-Fredrik Enell and Oscar van der Velde were later added to the advanced section.

- The EuroSprite2005 mailing list was created by DNSC and BIRA.

EuroSprite2005

blog





http://eurosprite.blogspot.com/

CAL Educational Web-site

http://www.eurosprite.net/

Coupling of Atmospheric Layers

Educational Website

www.eurosprite.net

Beginners **Intermediate** **Advanced**

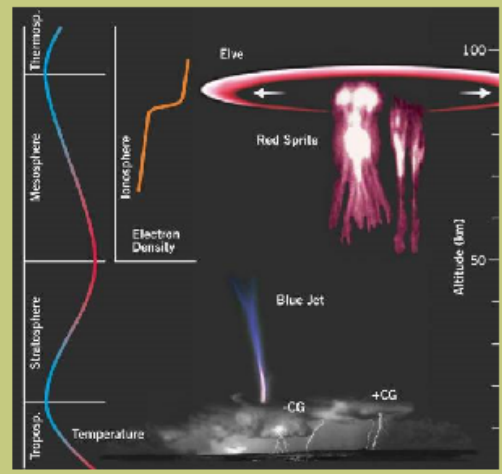
In recent years, scientists have discovered that a whole variety of luminous phenomena occur in the Earth's atmosphere. Not only lightning flashes and aurorae borealis can illuminate our nights, but also sprites, haloes, elves, blue jets, gigantic jets and likely many more to be discovered. These phenomena are collectively called Transient Luminous Events (TLEs).

Sprites are one of the most fascinating of these newly discovered phenomena, first scientifically observed in the early 1990s. They looked like red flashes, the largest reaching from 90 Km altitude almost down to the cloud tops, and extending more than 40 Km. The name sprite was given because of their "attitude" of lasting very shortly (a few milliseconds), leaving only a vague perception in your eyes.

This website is a collection of information that can let you understand and appreciate sprites, while waiting for these exciting new discoveries to make their way to science textbooks. All the material that you can read in these pages is written by scientists of the European Research Network CAL (Coupling of Atmospheric Layers), a group of scientists that work on these phenomena and their relations to the atmosphere and climate.

Start with the beginner level if you wish to have a basic knowledge of these phenomena. This level is designed for young students but can provide all basic information. You can then switch to Intermediate and Advanced once you wish to learn more details. Click on the Gallery at the bottom if you prefer to see some pictures taken during this summer campaign (Eurosprite2005).

Enjoy your hunt for sprites! The CAL team, October 2005.



Pictorial view of elves, sprites and blue jets. (On Sprites and Their Exotic Kin, T. Neubert, Science, Vol 300, 2 May 2003)

EuroSprite2005 Blog

http://www.eurosprite.net/

The CAL mid-term meeting on Crete web-page was developed by Agnes Mika:
<http://cal-crete.physics.uoc.gr/>.

A web-page dedicated to global sprite references “publication list” is being maintained by Carl-Fredrik Enell:
<http://www.sgo.fi/~fredrik/publications/SpritesSearch.html>

Young and Senior Scientists are publishing scientific papers in both scientific and popular journals. The CAL publications list is updated by Thomas Farges every two months and is located at <http://www.dsri.dk/cal/cal-publications.pdf>.

2. Education in giving scientific presentations

"Multiscale nature of spark precursors and high altitude lightning" workshop, Leiden, 9-13 May 2005, EGU2005, EGU2006, ...

3. Education in giving scientific presentations

The young scientists contribute to the development of the CAL-related educational material mentioned in "The CAL Outreach Programme", aimed at both schools and universities. In addition, they present the scientific material of the CAL project in talks both in the country where they are working and in their country of origin. This offers the Young Scientists experience in communication of science to the general public.

4. Cross network training

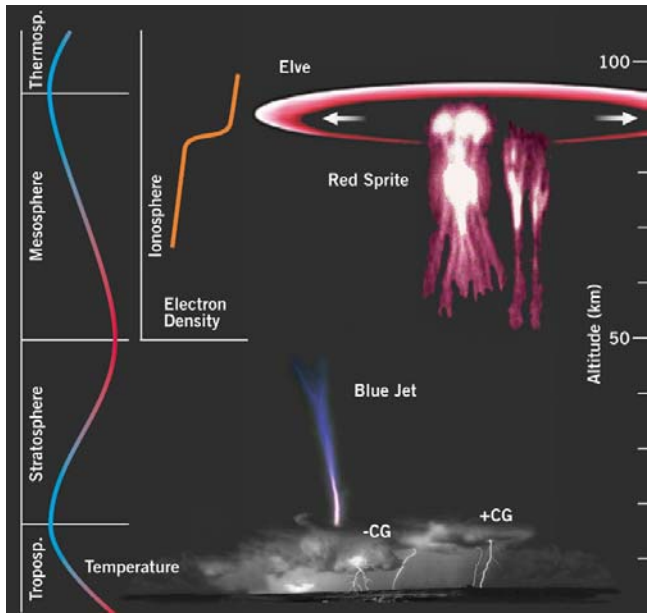
Young scientists that interact on a specific aspect of the network science issues participate in cross-network training from one scientific group to another, and undertake visits for shorter periods of time.

5. Tutorials

At the CAL yearly meetings, tutorials are given by invited speakers specialized in topics of interest to the CAL RTN.

WP3 THE OUTREACH PROGRAMME

The subject matter of the network, with the spectacular images of high-altitude discharges, is ideal as outreach material for the general public.



"On Sprites and Their Exotic Kin" by Torsten Neubert, Science, Vol 300, 2 May 2003 (see http://www.dsri.dk/cal/science-sprites.pdf)

Activities of this work-package include:

- “popular/semi-popular” articles
- press releases
- interviews
- educational web site http <http://www.eurosprite.net/>
- a public CAL web site (services both the network teams and the public).

Articles, press releases, interviews, and a public web-site

1. "Introduction to sprites" article for airline magazine

Based on the EuroSprite2005/2006 sprite observational campaigns, an article is being written.

2. Press releases for upcoming sprite campaigns

Announcements advertising the EuroSprite2005 sprite observational campaign and inviting people to join the event (e.g. observations that could be correlated with the sprite observations) were sent to the:

- Eggs – Electronic Newsletter and information service of the EGU <http://www.the-eggs.org/>
- AGU SPA Section Electronic Newsletter <http://www-ssc.igpp.ucla.edu/spa/spanews.html>

3. Interview a couple of the young CAL scientists

The interview is being written into an article to be published in an appropriate magazine. Topics cover various aspects of the Young Scientists training experience (e.g. living and working in another EU country, what made them choose the sprite field?, what they imagine their career future will be like?, etc.…).

4. Creation of CAL public web-site

The CAL web-site <http://www.dsri.dk/cal/> was created in December 2002 after the CAL kick-off meeting and has both a members only part and a public part. Both parts are continuously updated and the development of the web site is an on-going activity.

The public part offers information about the CAL project, introduces the member teams, and lists references (including introduction material) relevant to the subject.

CAL

Public

Web-site

CAL

Coupling of Atmospheric Layers

http://www.dsri.dk/cal/index.html

Presentations and educational material for the public

1. Presentations

All Young Scientists must get experience in giving presentations for the general public.

A proposal entitled “Coupling of Atmospheric Layers – EU FP5 RTN Project: Training and Outreach Programme” to the “Communicating European Research (CER) 2005” International Conference-Exhibition, Brussels Exhibition Center (Heysel), 14-15 November 2005, was submitted.
The objective of the exhibit was to show how CAL’s training and outreach activities have been implemented into the CAL project and was intended to be an example and inspiration of how an EU RTN project can be a unique opportunity to provide such types of learning activities. Especially the EuroSprite2005 campaign was highlighted.

For this and future events a brochure emphasizing the CAL “training and outreach” learning activities was prepared.

COMMUNICATING EUROPEAN RESEARCH 2005

http://europa.eu.int/comm/research/conferences/2005/cer2005/index_en.html

2. Educational material for schools/universities

As part of their CAL work all Young Scientists are producing educational material concerning their research for middle school levels and above in both English and in their native language:

-The educational sprite web site <http://www.eurosprite.net>.

- Olivier Chanrion
<http://www.dsri.dk/~chanrion/>

- Oscar Van der Velde
<http://www.lightningwizard.com/CAL/>

- Carl-Fredrik Enell
<http://www.sgo.fi/~fredrik/publications/CAL/CFEedu.pdf>

- Massimiliano Ignaccolo
<http://staff.bath.ac.uk/eexmi/mywebpage/home/mywebpage.htm>

- Enrico Arnone
<http://www.ion.le.ac.uk/~ea59/modelling/modelling.html>

5. Concluding remarks.

Training and Outreach are important tools for:

- Educational purposes (satellites & space science)

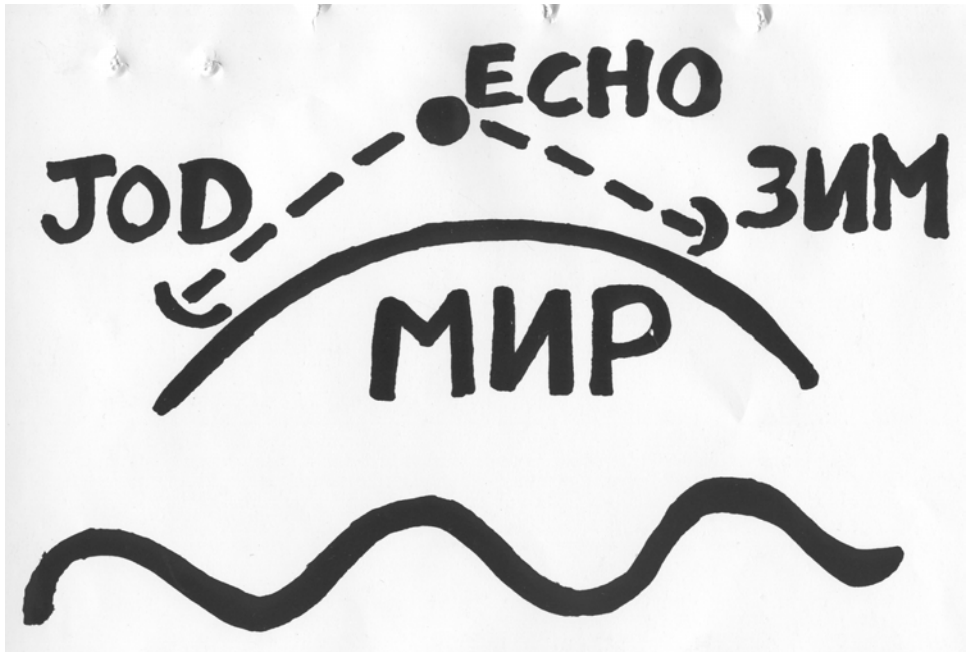
- Communication (national & international level)

- Connecting people (scientific world as well as in general).

EO – EPO

!!! INTERESTING AND FUN !!!

Combining scientific work with pedagogical activites



Radiophysical Research Institute (NIRFI), Nizhny Novgorod, Russia

NIRFI carried out the reception of the signal, which was radiated from Jodrel Bank (UK) to the passive communications relay, reflected by the communication satellite of USA.