MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

EMBRACE

International Session at the Space Weather Workshop

Extreme Events: Embrace Program View

J. E. R. Costa, C. M. Denardini, R. Gatto
On behalf of
Embrace Space Weather Program (INPE/CEA-LAC-DSS)

Embrace Headquarter

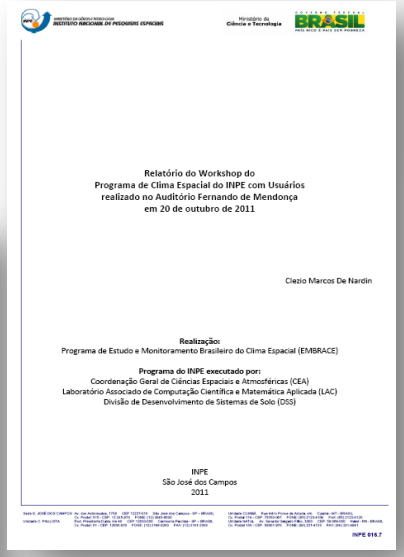
www.inpe.br/spaceweather

Embrace Headquarter

www.inpe.br/spaceweather

Users Workshop 2011

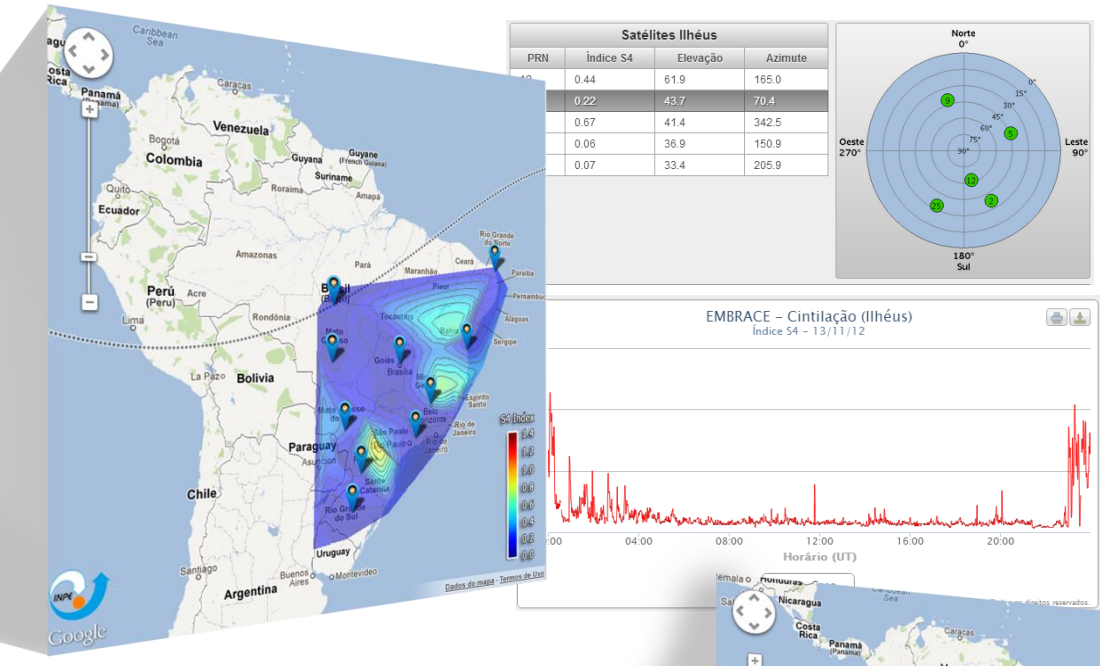
www.inpe.br/spaceweather

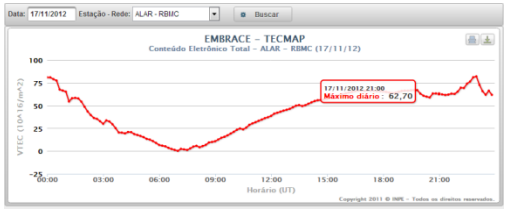


GNSS

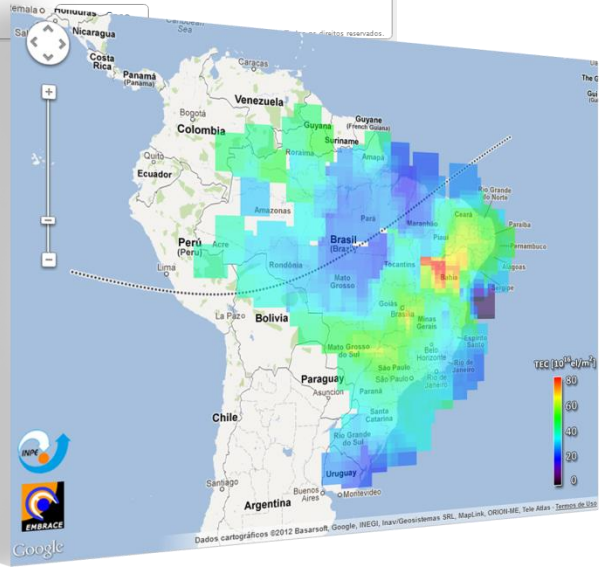
www.inpe.br/spaceweather

Scintillation



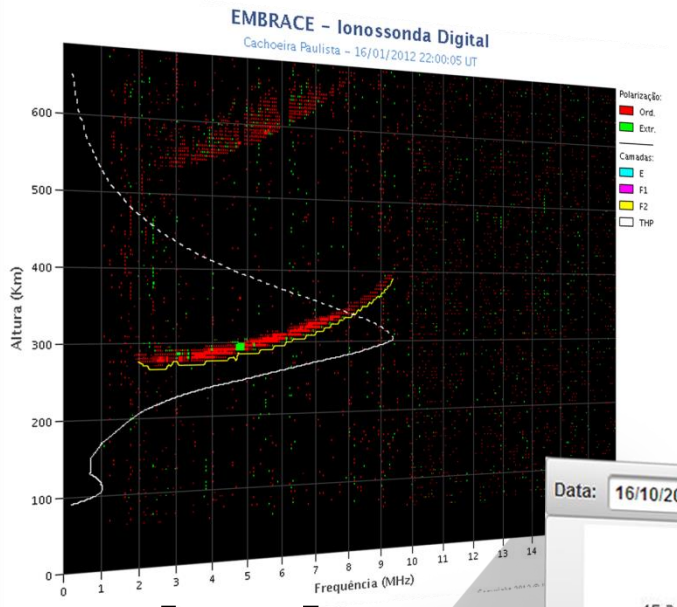


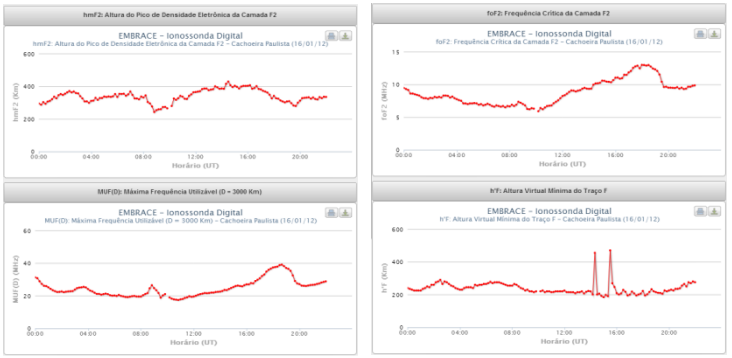
TEC Map



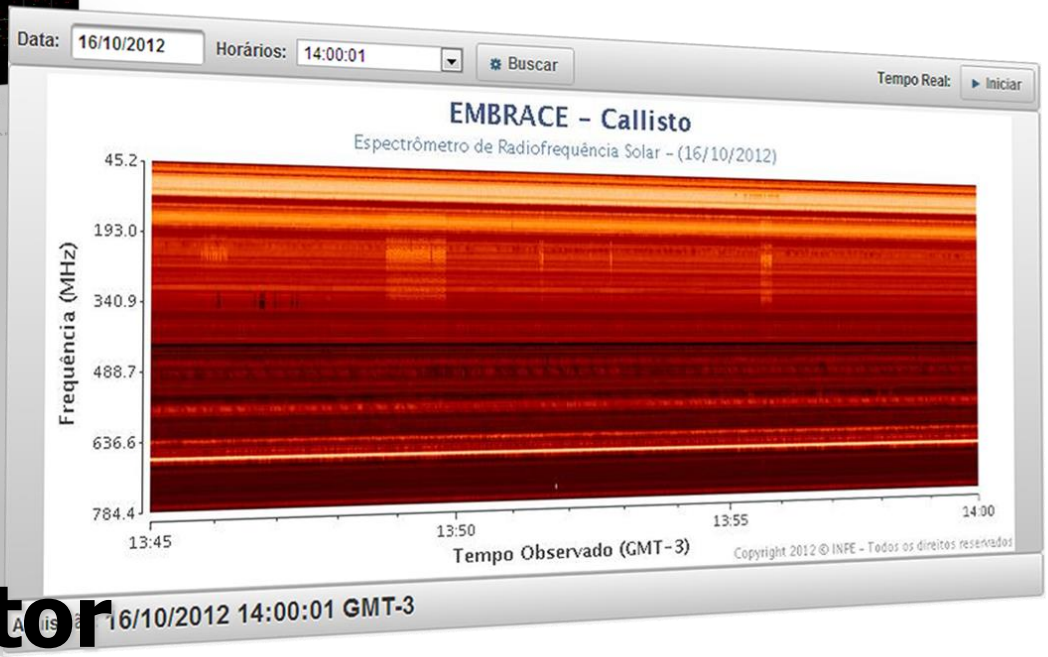
Monitor

www.inpe.br/spaceweather





Ionospheric Monitor



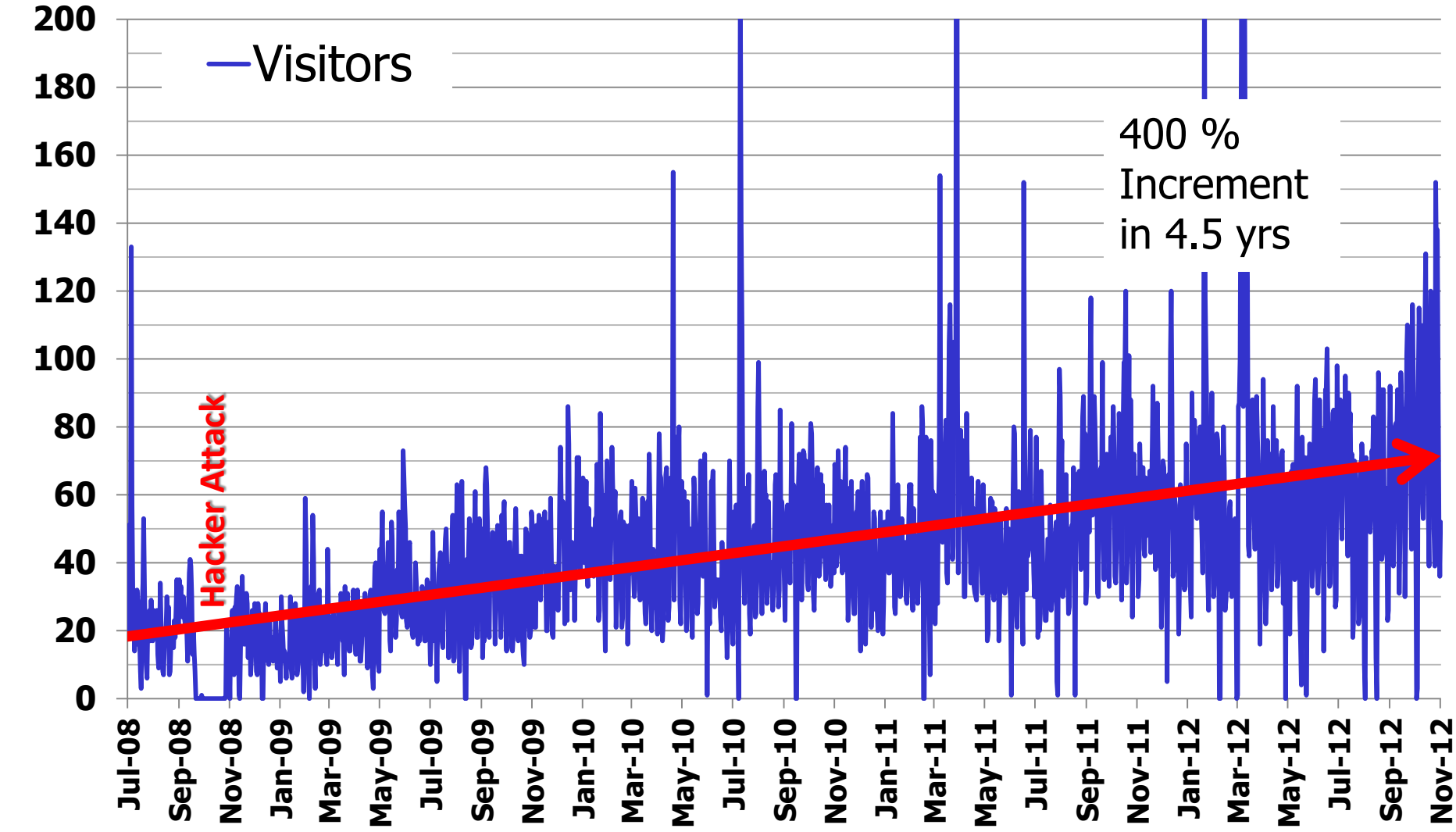
Solar Monitor

Growing Number of Visits

www.inpe.br/spaceweather

Google Analytics

Up to Nov 05, 2012



What do we do ?

www.inpe.br/spaceweather

- How do you forecast or issue an alarm?
- Where do you get information (confirm)?
- To whom communicate?

- What do you know about the consequences and mitigation?

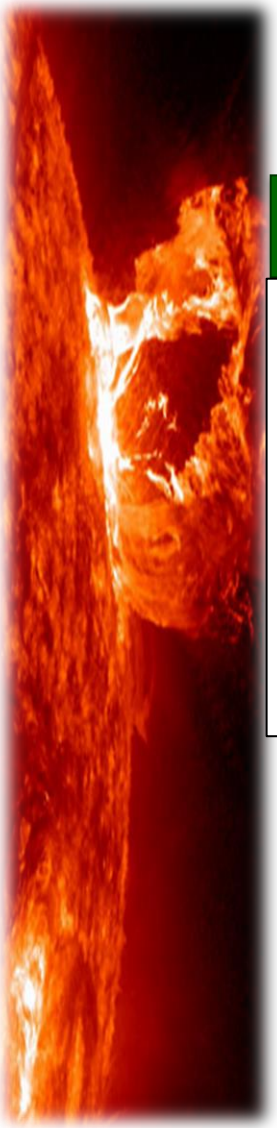
- How do you disseminate the information?

What do our customers do ?

www.inpe.br/spaceweather

A. Aircraft passenger and crew safety
B. Satellites
C. Mobile satellite communications
D. Cellular and emergency communications
E. Ground and avionic device technology
F. Global navigation satellite systems (GNSS)
G. High frequency (HF) communications
H. Terrestrial broadcasting
I. Electricity grid

What issues are there ?



Timeline of an Event

2-3 day WINDOW

IP Shocks

1 hour from ACE

2-3 days from Sun

27 days Solar Rotation

10 – 100's minutes

SEP

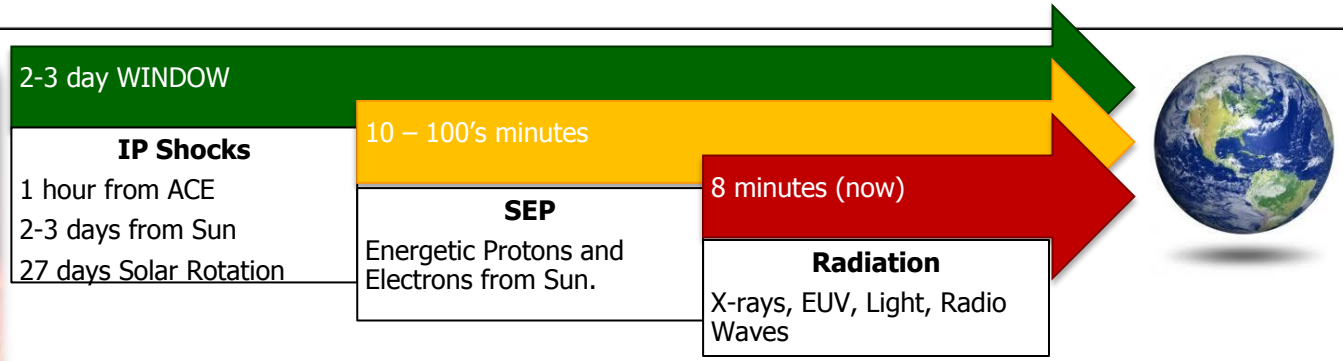
Energetic Protons and Electrons from Sun.

8 minutes (now)

Radiation

X-rays, EUV, Light, Radio Waves

Actions taken during ...



1. A large, complex active region quickly forms on the solar disk.
2. An X20 flare erupts with a large proton event and 2500 km/s halo CME.
3. ACE detects -100 nT Bz, with no solar wind speed information due to the proton contamination.
4. Ground magnetometers show massive disturbances, and calls from power grids start to come in.
5. Post event

MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

Warnings shall be given to ..

2-3 day WINDOW

IP Shocks

1 hour from ACE
2-3 days from Sun
27 days Solar Rotation

10 – 100's minutes

SEP

Energetic Protons and Electrons from Sun.

8 minutes (now)

Radiation

X-rays, EUV, Light, Radio Waves

1. **A large, complex active region quickly forms on the solar disk.**
2. **An X20 flare erupts with a large proton event and 2500 km/s halo CME.**
3. **ACE detects -100 nT Bz, with no solar wind speed information due to the proton contamination.**
4. **Ground magnetometers show massive disturbances, and calls from power grids start to come in.**
5. **Post event**

- **A. Aircraft passenger and crew safety**
- **B. Satellites**
- **C. Mobile satellite communications**
- **D. Cellular and emergency communications**
- **E. Ground and avionic device tech.**
- **F. Global navigation satellite systems**
- **G. High frequency (HF) communications**
- **H. Terrestrial broadcasting**
- **I. Electricity grid**

Training the costumers (before, during and after)

How do we proceed ?

Tracking Tickets Tool

Minute Window

Event Identification

- Active Region growing in complexity
- Filament Eruption
- CME Ejection
- Burst observed
- Coronal Hole moving to center

Ticket # 543
Status New
Priority: Medium
Description: xxxx

Hour Window

Solar Energetic Particles

- Signature at L1
- Signature at LEO
- Signature on Earth

Ticket # 543
Status Assigned
Priority: Low
Descripton: www

Day Window

Near Environment

- CME detection (Muons)
- CME/wind detected (ACE)
- Geomag. Disturbances

Ticket # 543
Status Geoeffective
Priority: **High**
Descripton: www

Timeline from the initial Ticket

Sample of Ticket

Ticket #11 (Enhancement)

Ticket types are good, wiki types are better!

Status: **new**

Reported by:	cboos	Assigned to:	somebody
Priority:	normal	Milestone:	milestone2
Component:	component2	Version:	
Severity:	major	Keywords:	
Cc:		Hardware Version:	

Besides ticket types, one could also think about creating *wiki types*.

Space Weather Ticket (sample)

========== **Communication** ==========

Reporter — The author of the ticket.
Type — The nature of the ticket (for example: Minute Window, Hour Window, Day Window).
Priority — The importance of this issue. Example: warning, critical….
Description — The body of the ticket. A good description should be specific, descriptive and to the point.

========== **Action Taken** ==========

Status — What is the current status? New, Assigned, Closed, Reopened.
Resolution — Reason for why a ticket was closed. One of: event disappears , invalid, duplicate or renewed ticket (geo-effective)
Summary — A brief description summarizing the problem or issue.

Timeline Sample

Apr 5, 2013:

5:46 PM Ticket #11145 (wrap author information for ticket change comments in a span to make them ...) created by dkg@...
It would be nice to be able to to adjust the style of the author of a ...

Apr 4, 2013:

11:09 PM Ticket #11144 (Lightning DEV1 sw using the bound out IO) closed by cboos
invalid: WrongTrac...

11:07 PM Ticket #11144 (Lightning DEV1 sw using the bound out IO) created by henry.tso@...
Many IOs on the top and bottom banks are bounded out. Software is not ...

11:00 PM Ticket #11142 (Add download link in attachment section) reopened by cboos
I've worked a bit on this topic: - [acd0fd76/cboos.git] ticket:11142: ...

10:56 PM Changeset in cboos.git [01c11211] 11142-trac-rawlink-on-the-left by Christian Boos <cboos@...>
1.0.2dev: check modification of an attachment page takes into account ...

Recommendations

- ✓ **Policy** :
  1. Organize agents capable of recognizing geo-effective events and a list of known mitigation processes (RWC-ISES).
  2. Organize local committee able to monitor and disseminate information on all nations (or agencies involved) (Government).

- ✓ **Recognizing the super-storm**:
  RWC shall work with international partners to anticipate, recognize, prevent the effects of Super-Storm.

- ✓ **Failures** :
  Search lines that may be affected, satellites that can fail, discuss the avionics and ground systems that rely on GPS time and HF communication and contingencies, i.e., …
  talk to their clients!

Research: more than just a job ... an adventure ! EMBRACE it !

See you soon ... ☺

See you in Rio in 2016 during the Olympics