



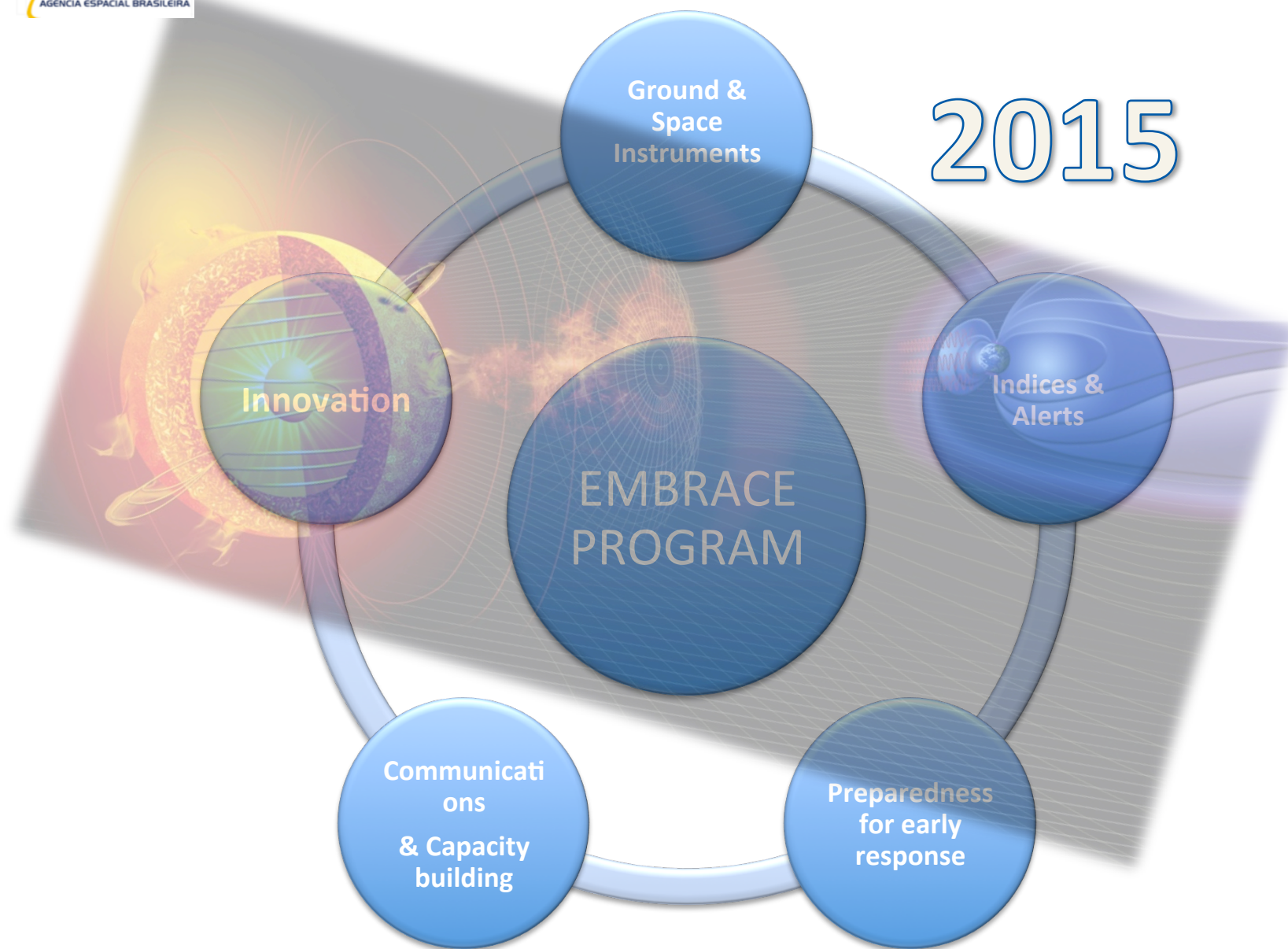
EMBRACE

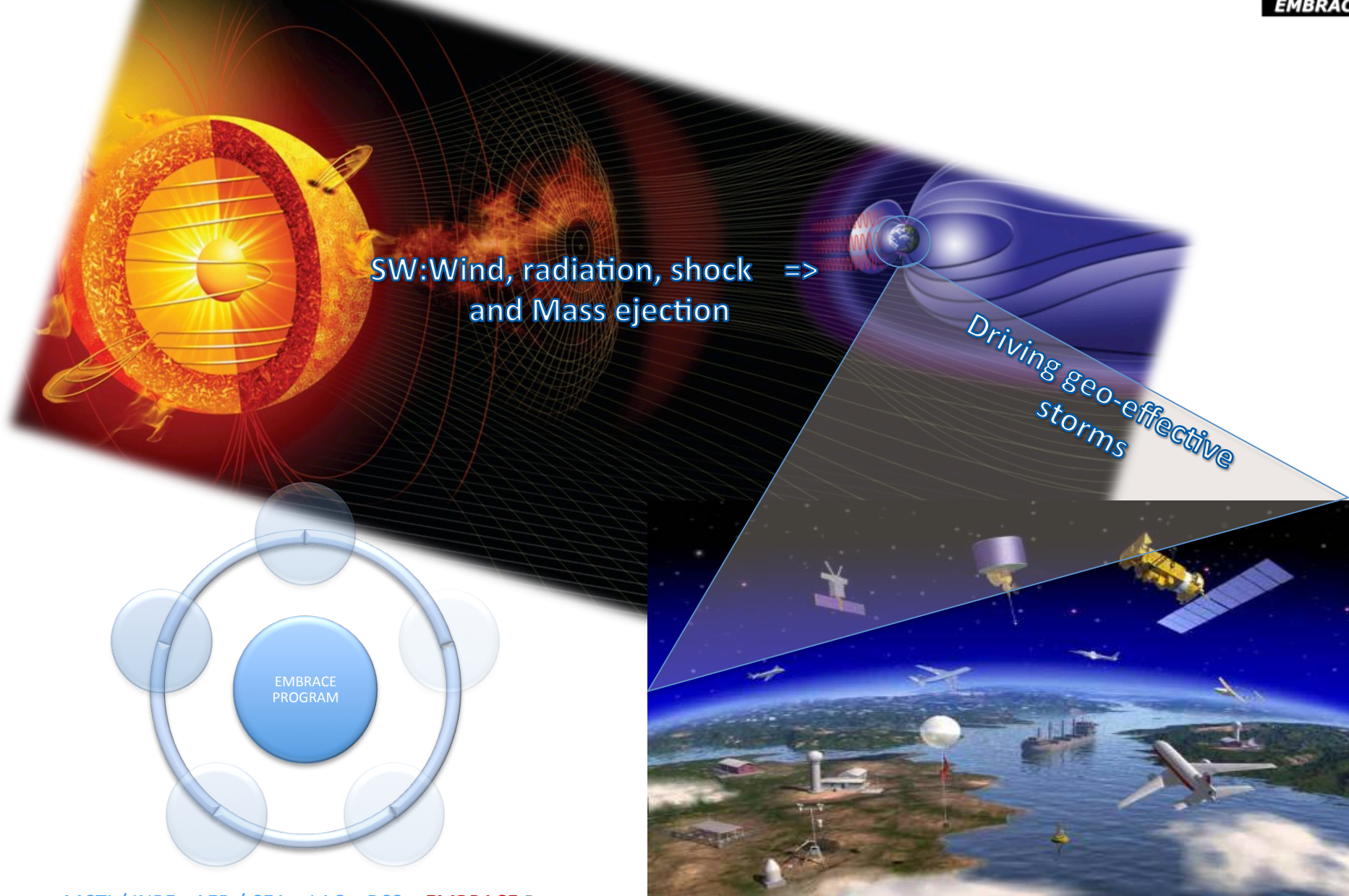
Network and products of the INPE's Space Weather program

J.E.R.Costa & EMBRACE team

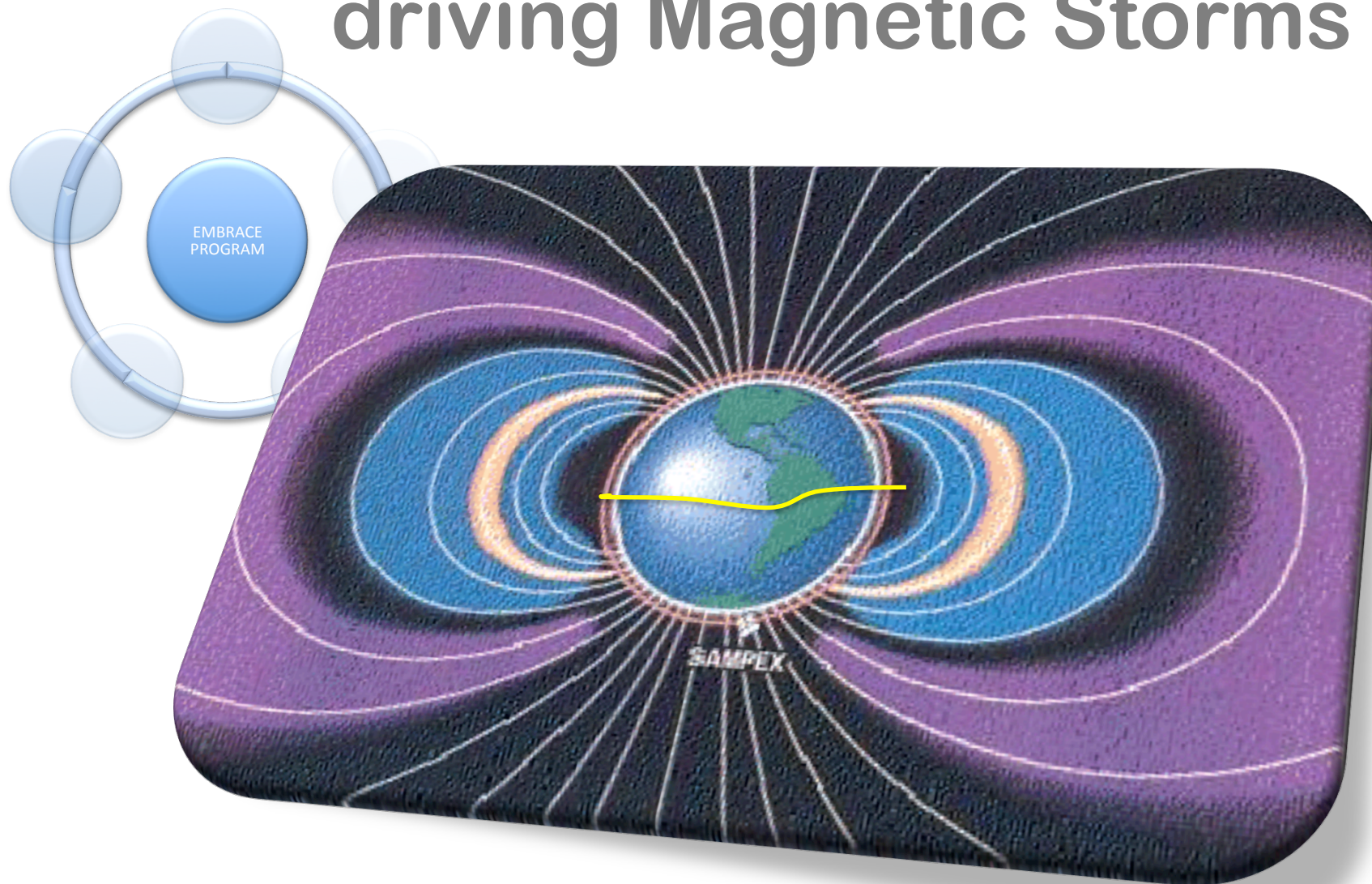


United Nations/Japan Workshop on Space Weather / 2-6 March 2015 - Fukuoka



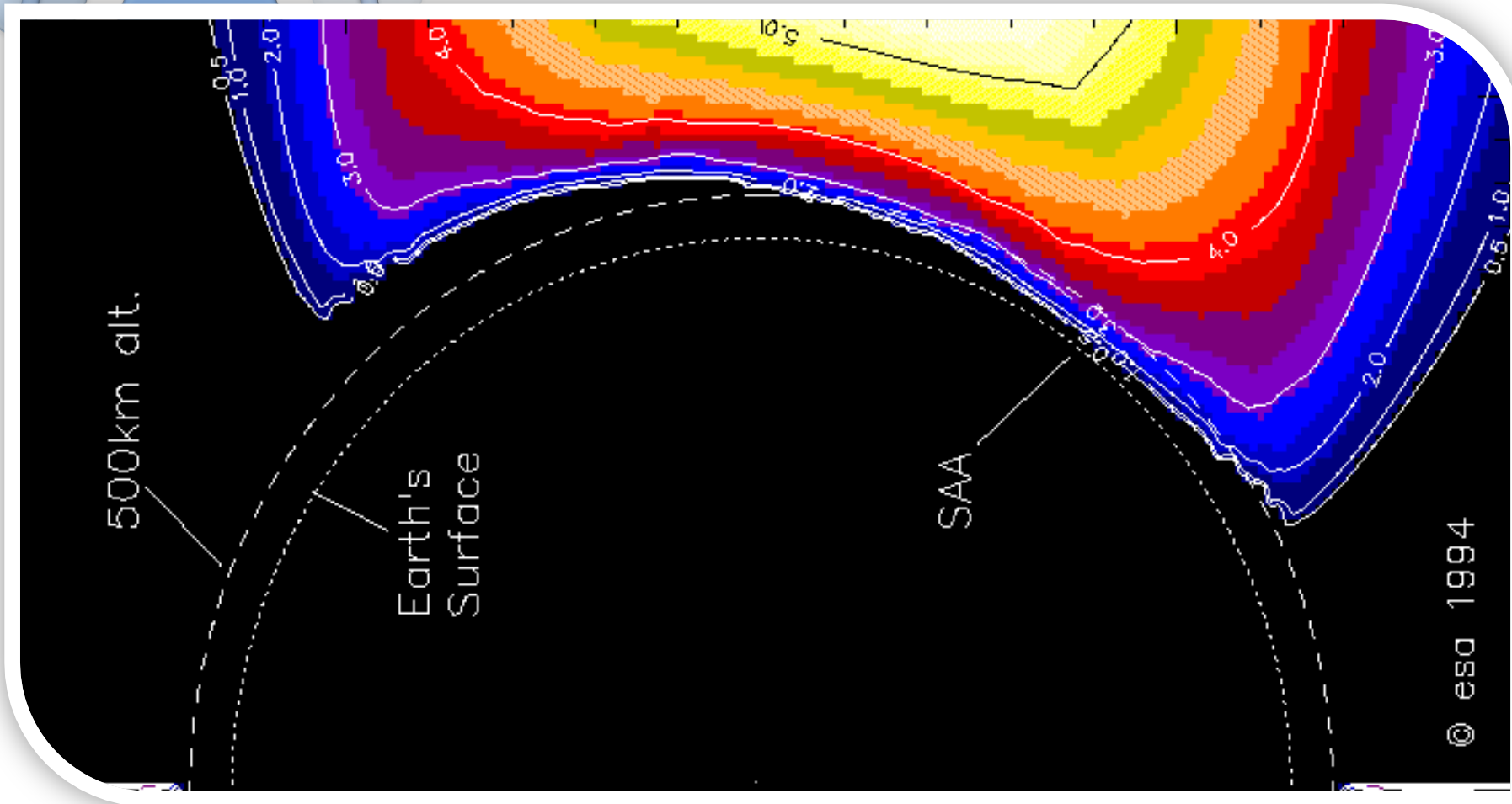


SW: Charges and Fields driving Magnetic Storms





The weakest Magnetic Field is over Brazil - SAMA



Important EMBRACE Sites over Brazil

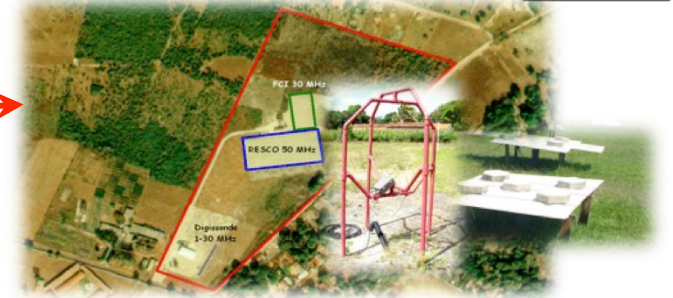
Boa Vista/RR



Belém/PA



São Luís /MA



Atibaia/SP



Itapetinga Radio Telescope

Cuiabá/MT



São João do Cariri/PB



Ground & Space Monitoring

Santa Maria/RS



**EMBRACE
Headquarter**

Cachoeira Paulista/SP



Antarctica



São José Campos/SP



Instruments

Ground & Space Monitoring

Radio Monitor Spectrometer
1-40 GHz



CALLISTO



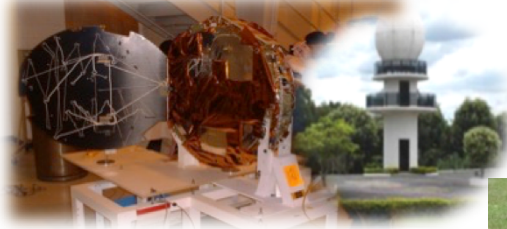
BDA Solar Array

Solar radio imaging
1.2-1.7GHz

Iono sondes



Cosmic 2/NOAA



Photometers



Magnetometers



GPS



Muon Detector
Shinshu University



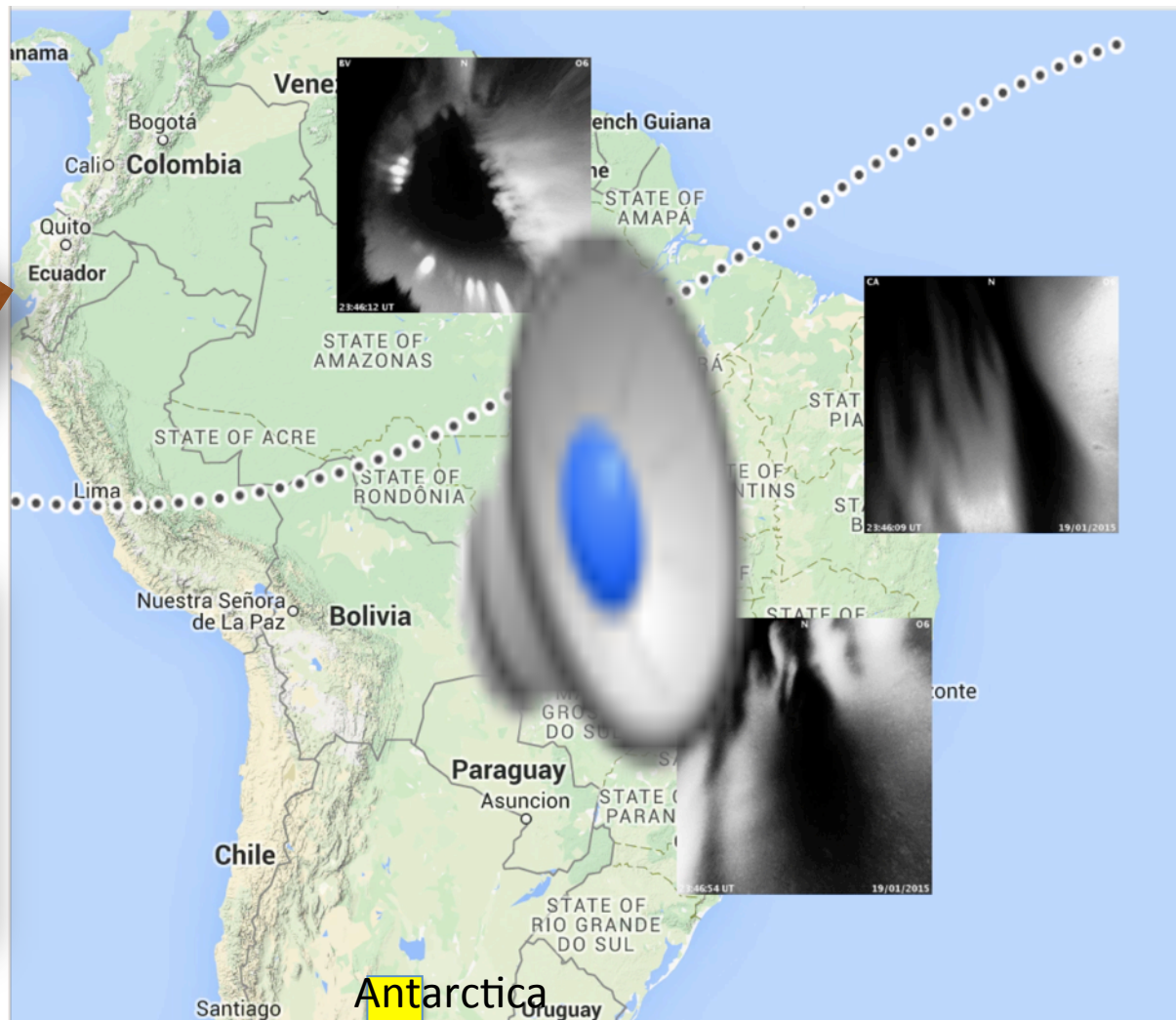
The GNSS Sensor Network



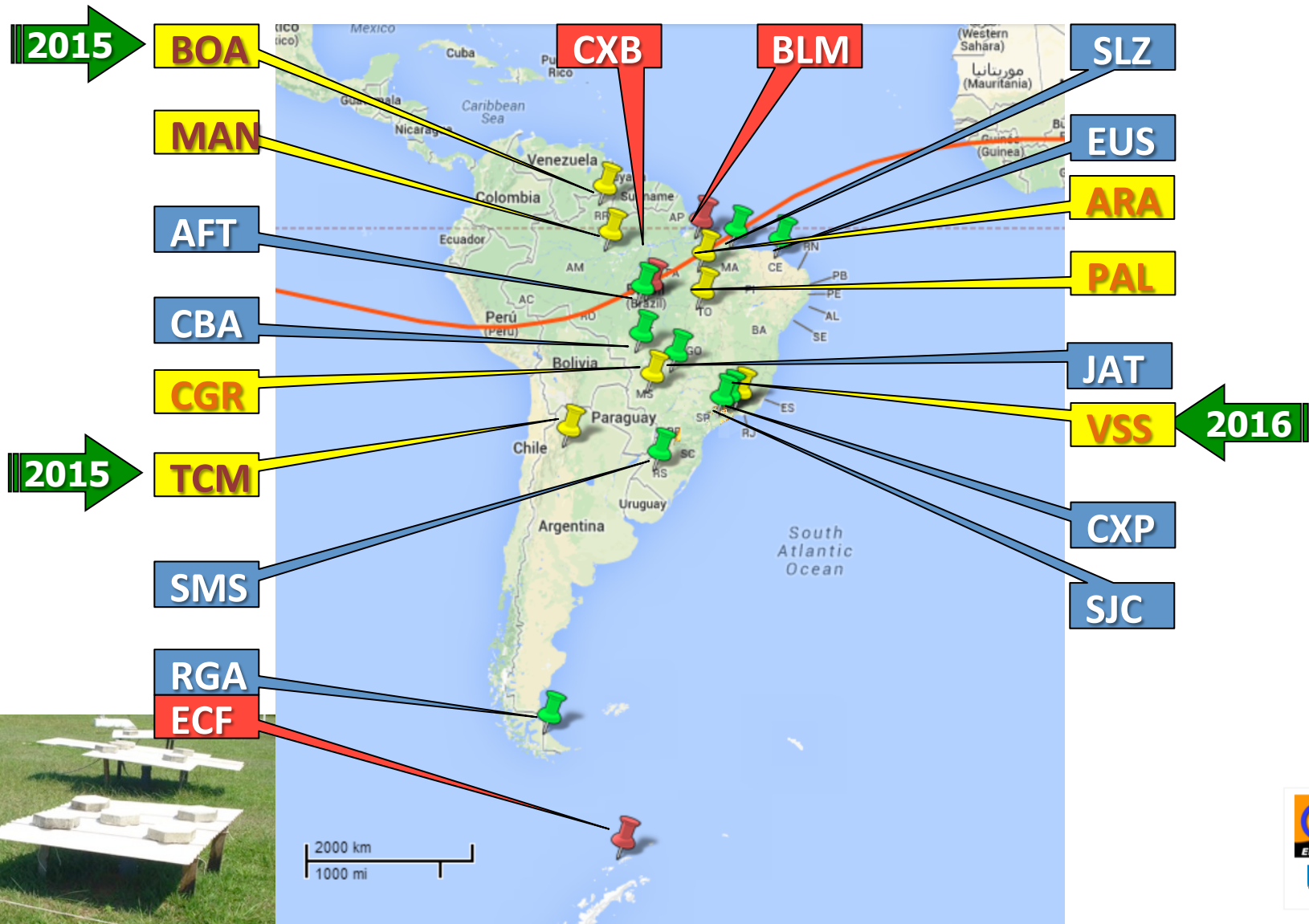
The photometers Network



Installed in Antarctica

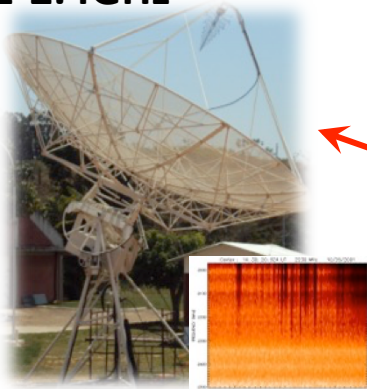


Magnetometers Network

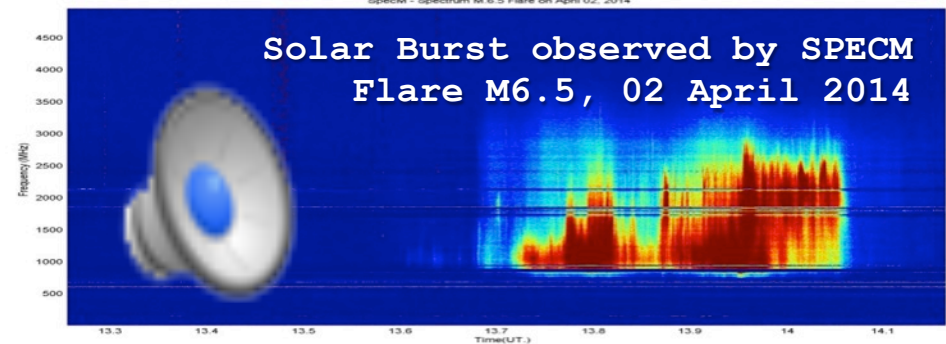
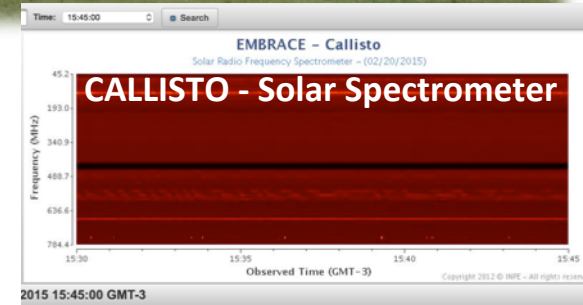


Solar Monitors - Network

BSS – Solar Spectrometer
1-2.4GHz

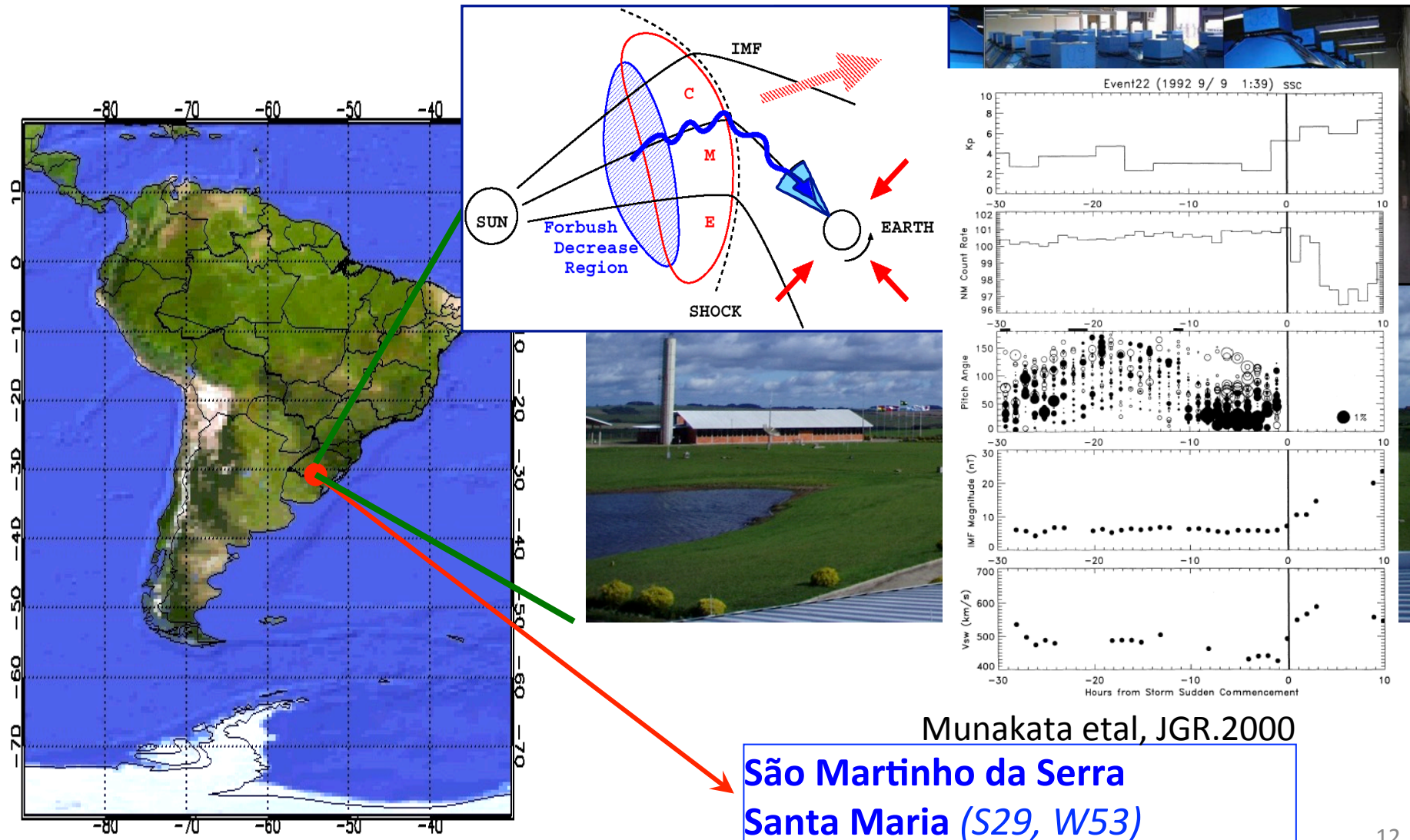


BDA – Solar Interferometer



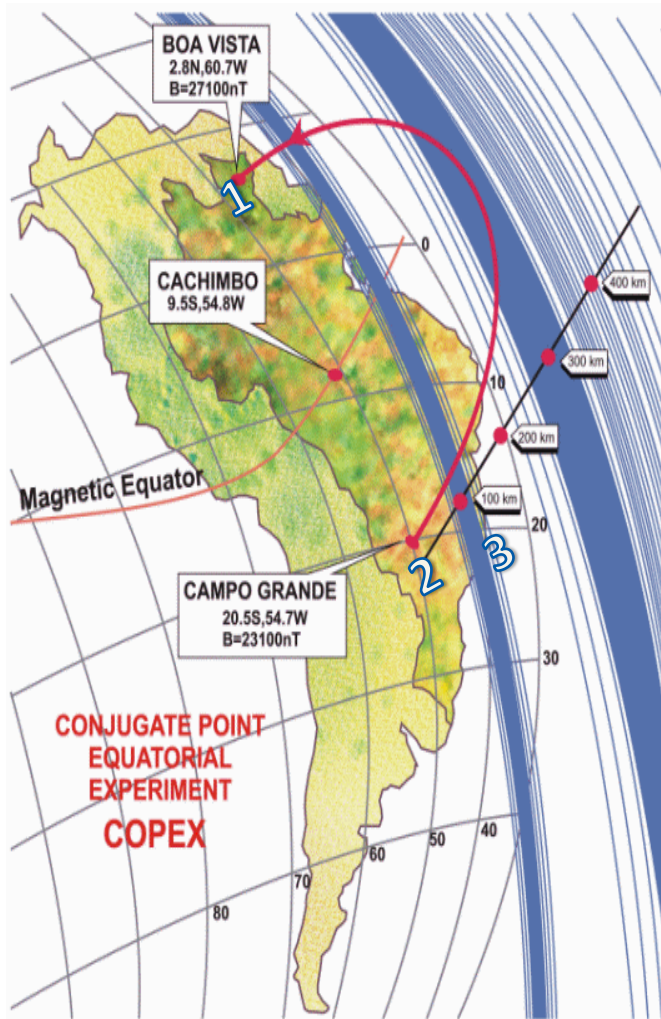
Cosmic ray monitoring by Muon detector

Magnetic storm 6-8 hours ahead



Munakata et al, JGR.2000

São Martinho da Serra
Santa Maria (S29, W53)



Cachoeira Paulista

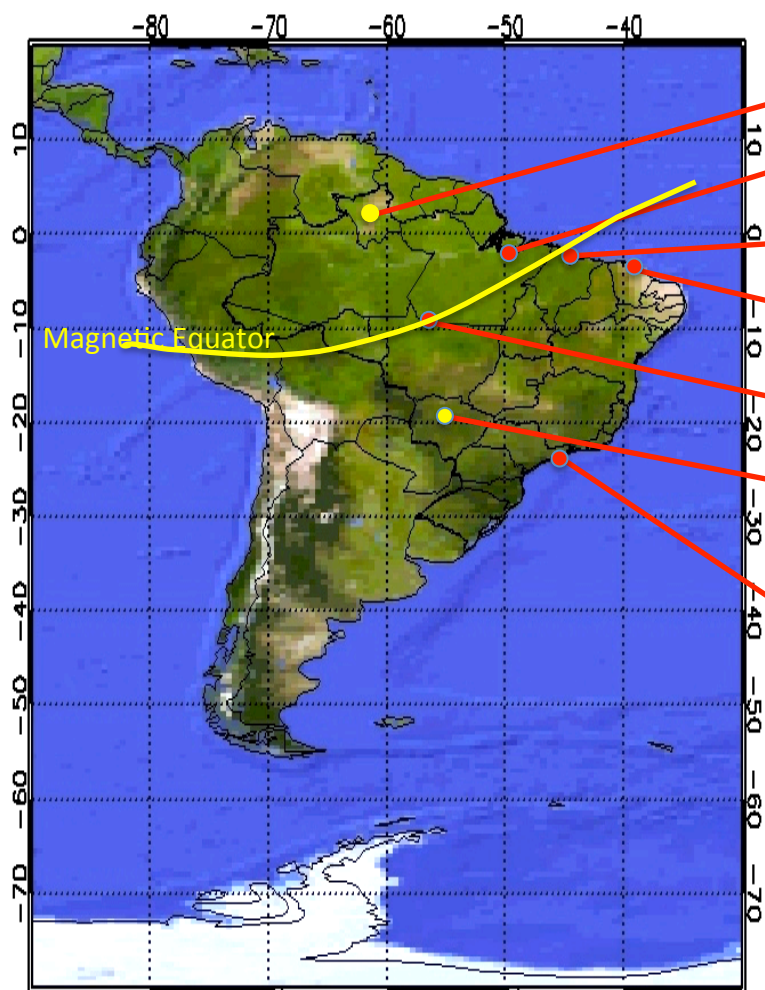
Cortesia: Inez Batista - DAE/CEA

EMBRACE's Digisondes DPS-4D

1. **Boa Vista, RR** – installed and operational since 2013. The data are being transmitted to EMBRACE data center. The transmitting antenna is being replaced. Cooperation with UFRR.
2. **Campo Grande, MS** – Began operation early 2015. The antennas were upgraded with cooperation of aeronautics under the ICEA department.
3. **Cachoeira Paulista, SP** – re-started operations early January 2015. All the antennas were renewed.

Federal financial support from CNPq.

Ionosonde Network



- Boa Vista
- Belém
- São Luiz
- Fortaleza
- Alta Floresta
- Campo Grande
- Cachoeira Paulista
- Installed & Working
- To be installed

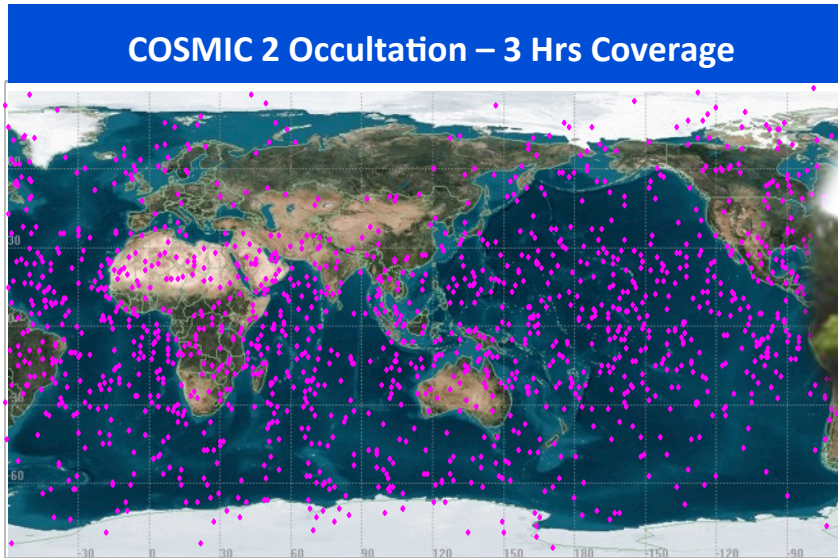
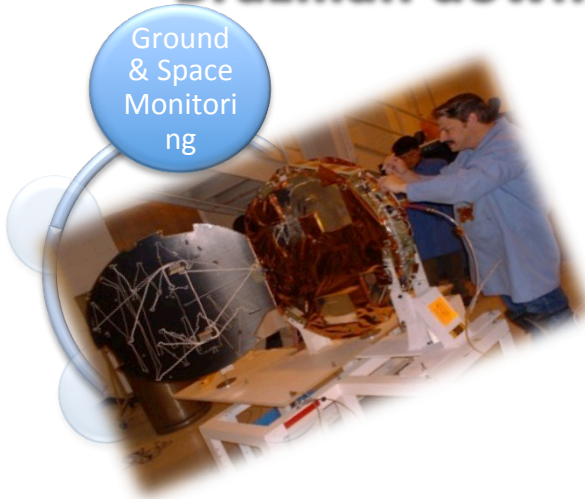


COSMIC 2 Constellation

STATUS – Mission 6 satellites late 2015

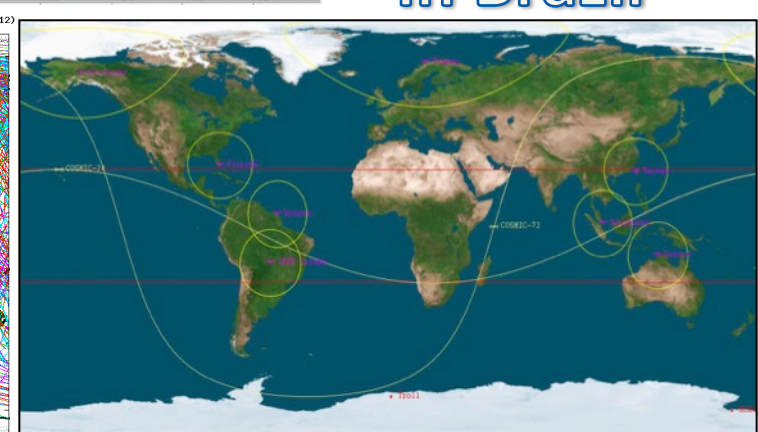
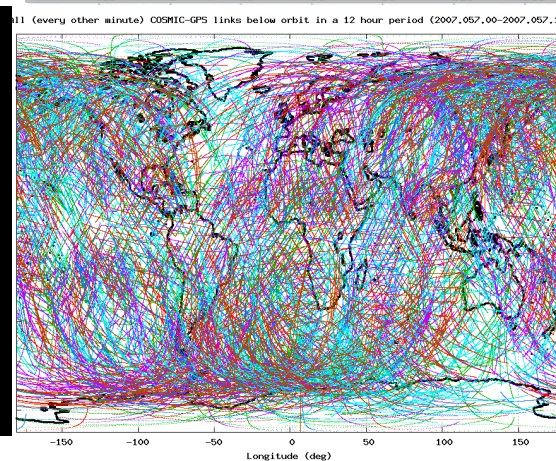
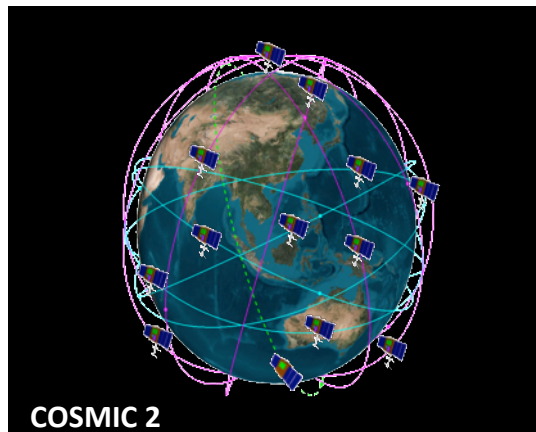
Brazilian downlink in under test with cosmic 1 satellites

Ground
& Space
Monitoring



**Downlink
In Brazil**

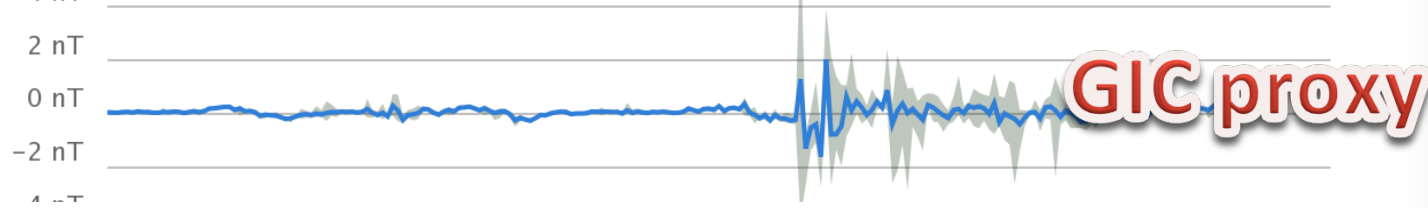
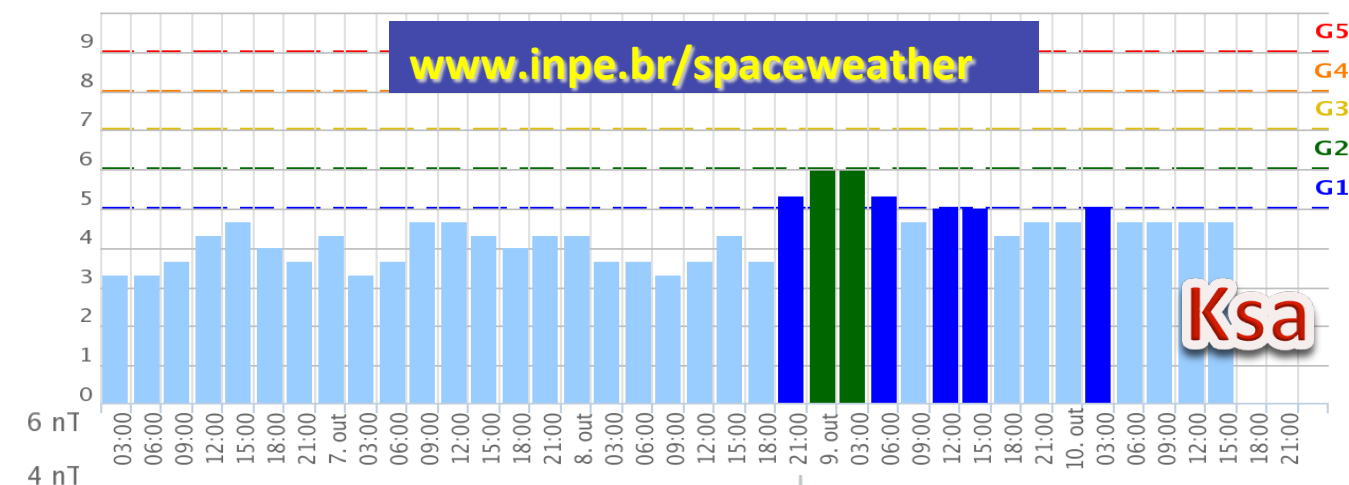
Courtesy: Joaquim Costa - DAS/CEA



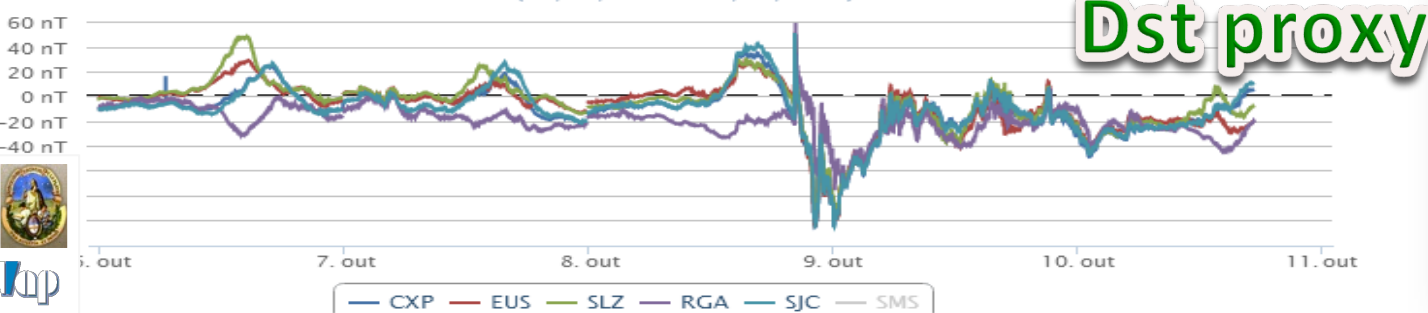
Regional Magnetic Index

06 to 10 OCTOBER 2013

Rede EMBRACE de Magnetômetros
 Índice Ksa - (06/10/2013 - 10/10/2013)



Rede EMBRACE de Magnetômetros
 ΔH - (06/10/2013 - 10/10/2013)



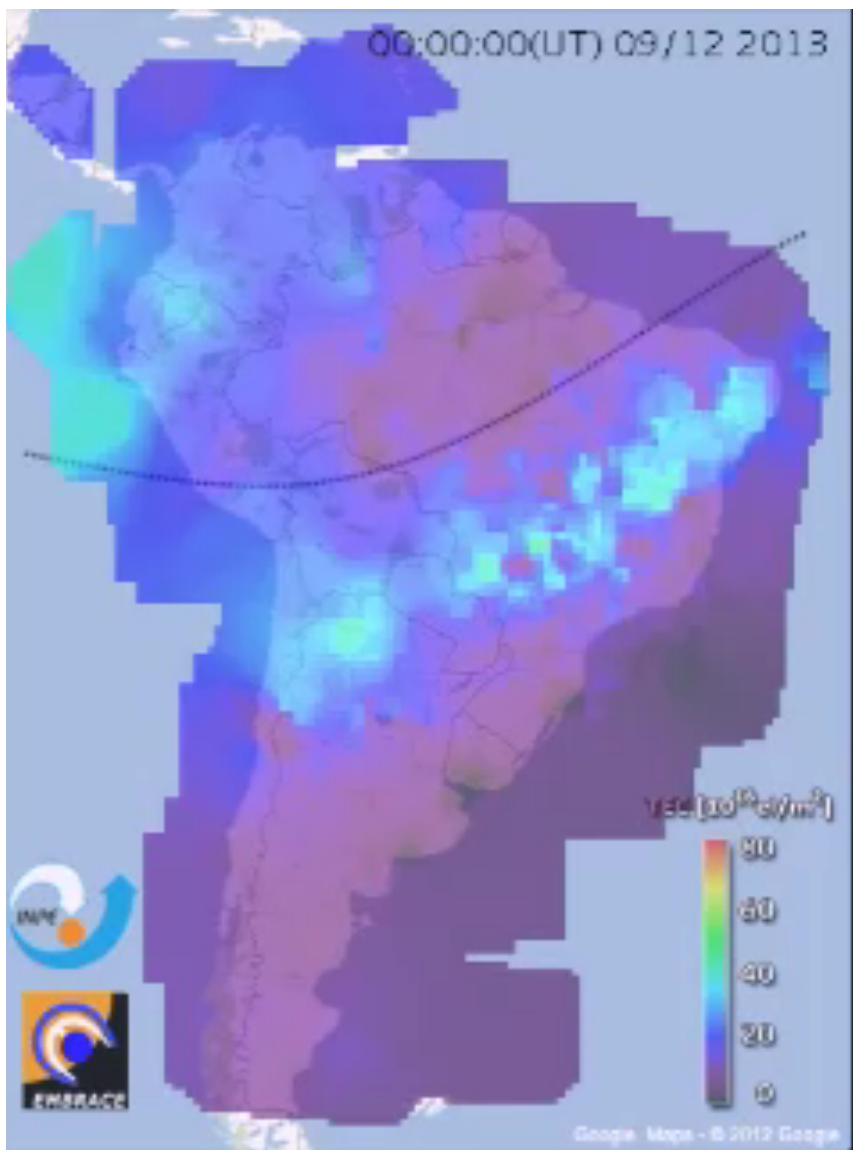
Localização dos Magnetômetros

Listagem

- ▶ Cuiabá, CBA
- ▶ Alta Floresta, AFT
- ▶ Cachoeira Paulista, CXP
- ▶ Eusébio, EUS
- ▶ São Luís, SLZ
- ▶ Rio Grande - Argentina, RGA
- ▶ São José dos Campos, SJC
- ▶ São Martinho da Serra, SMS



TEC Map over South America

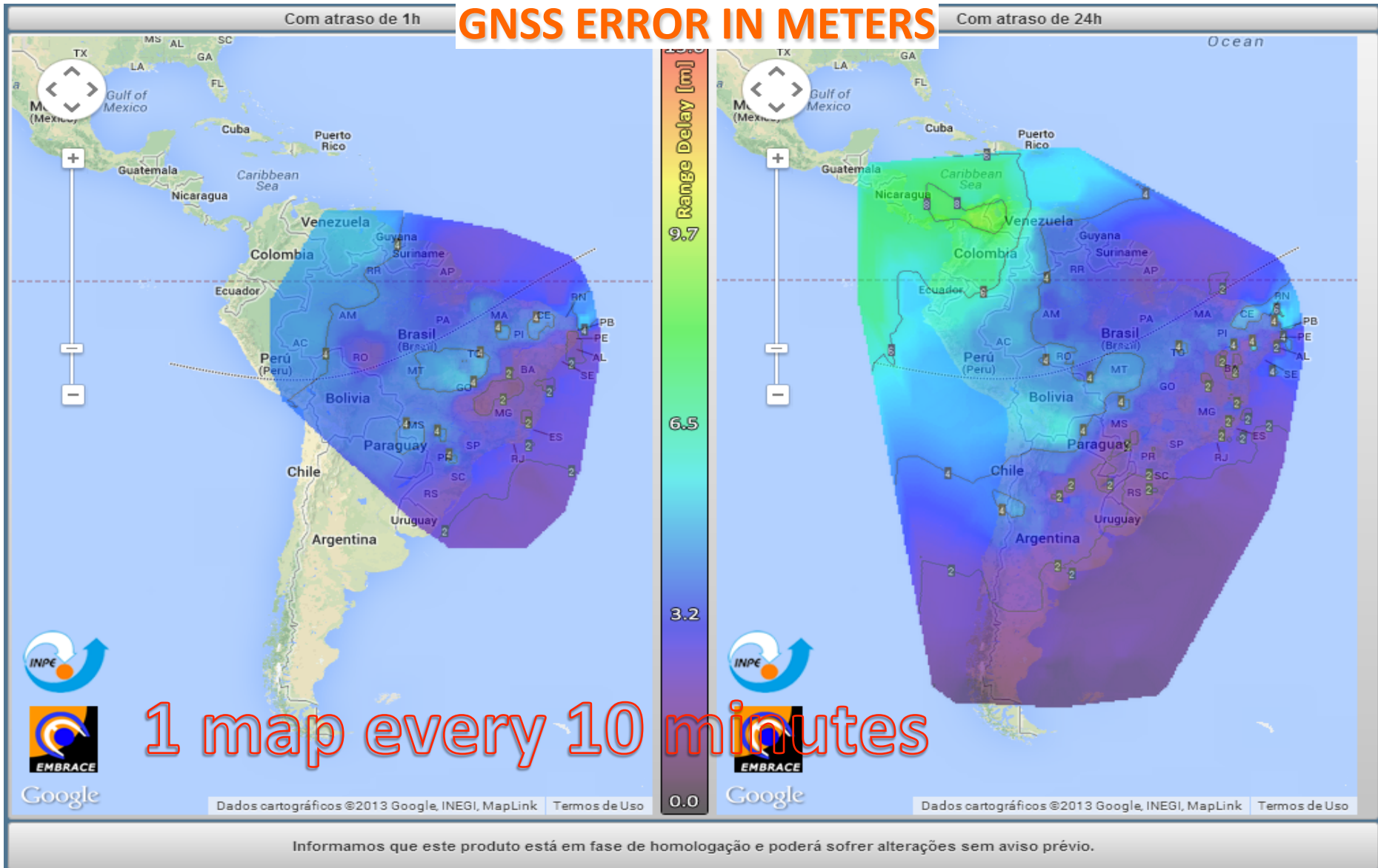




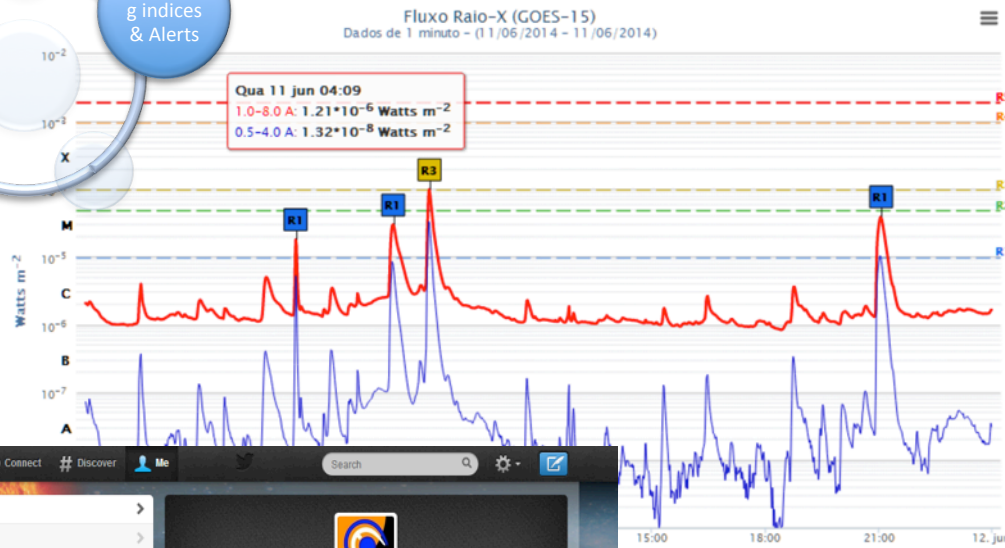
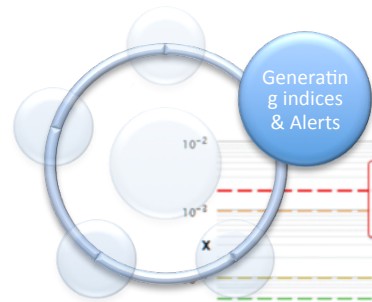
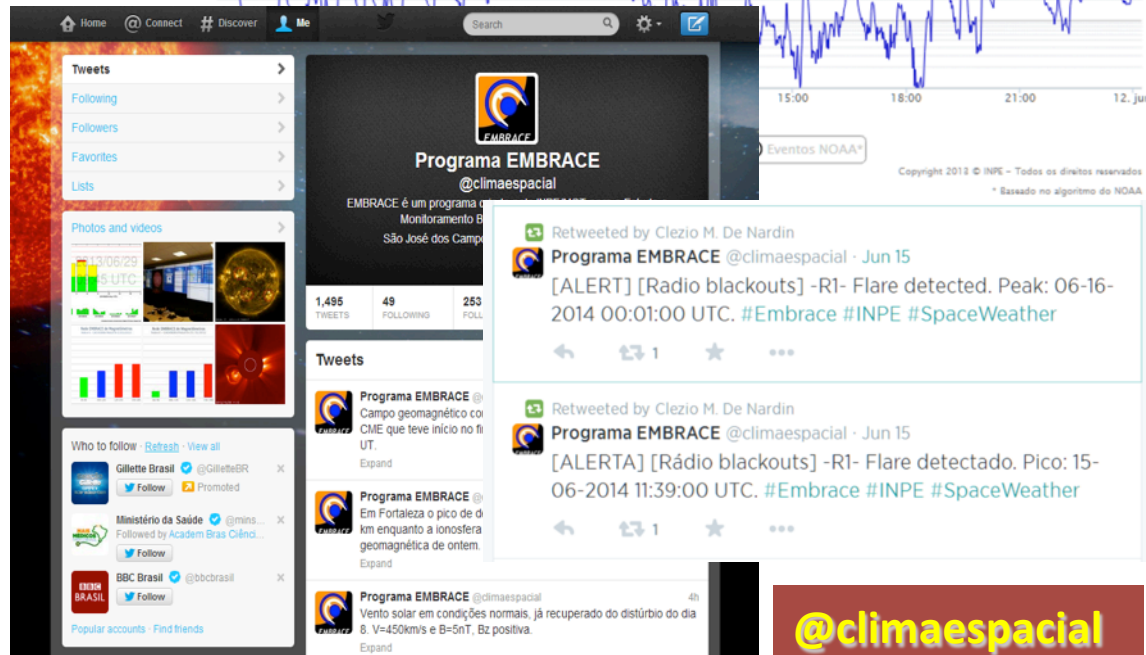
From TEC Map to Error Map



GNSS ERROR IN METERS



Flare Alerts

Home Connect Discover Me

Programa EMBRACE @climaespacial

EMBRACE é um programa de Monitoramento B São José dos Camp

1,495 TWEETS 49 FOLLOWING 253 FOLL

Tweets

Retweeted by Clezio M. De Nardin
Programa EMBRACE @climaespacial · Jun 15
[ALERTA] [Radio blackouts] -R1- Flare detected. Peak: 06-16-2014 00:01:00 UTC. #Embrace #INPE #SpaceWeather

Retweeted by Clezio M. De Nardin
Programa EMBRACE @climaespacial · Jun 15
[ALERTA] [Rádio blackouts] -R1- Flare detectado. Pico: 15-06-2014 11:39:00 UTC. #Embrace #INPE #SpaceWeather

Programa EMBRACE @climaespacial
Em Fortaleza o pico de d km enquanto a ionosfera geomagnética de ontem. Expand

Programa EMBRACE @climaespacial
Vento solar em condições normais, já recuperado do distúrbio do dia 8. V=450km/s e B=5nT. Bz positiva. Expand

@climaespacial

CLASS_X

Clezio Marcos De Nardin,

O sistema de monitoramento do EMBRACE detectou um evento CLASS_X através do instrumento GOES.

The monitoring system EMBRACE detected an CLASS_X event through the instrument GOES.

ALERTA RAIÓ-X GOES



O sistema de detecção de eventos EMBRACE verificou a existência de flare classe X com nível de severidade R3 ocorrido em 11-06-2014 às 09:06:00 UTC.

Efeito de Severidade R3:
HF Radio: Grande área de blackout em comunicação em rádio HF, perda de rádio contatos por aproximadamente uma hora na região iluminada.
Navegação: Navegação em baixa frequência degradada por aproximadamente uma hora.

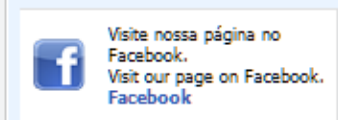
X-RAY GOES ALERT



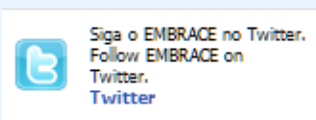
The event detection system EMBRACE verified the existence of flare class X with severity level R3 occurred in 06-11-2014 at 09:06:00 UTC.

Effect Severity R3
HF Radio: Large area blackout in HF radio communication, loss of radio contact for about an hour in the illuminated region.
Navigation: Navigation in low frequency degraded for about an hour.

Esta é uma mensagem automática. Por favor não responda este email. Se precisar contatar-nos envie email para contato.embrace@inpe.br.
This is an automated message. Please do not reply to this email. If you need to contact us please send email to contato.embrace@inpe.br.



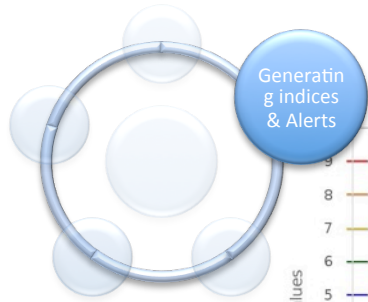
Visite nossa página no Facebook.
Visit our page on Facebook.
Facebook



Siga o EMBRACE no Twitter.
Follow EMBRACE on Twitter.
Twitter

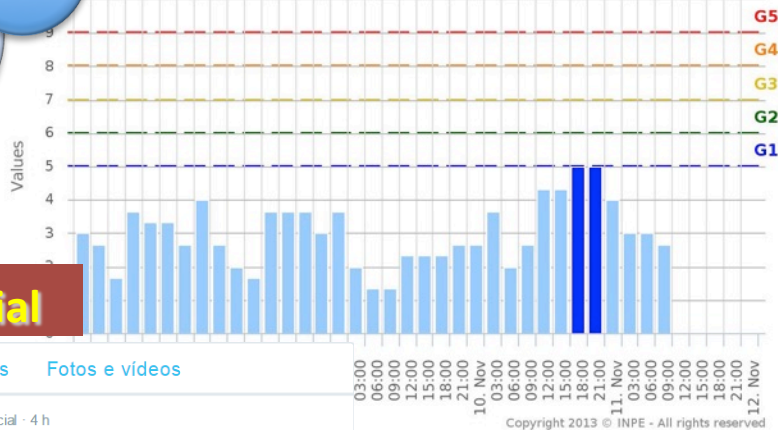


Magnetic Storm Alert



EMBRACE Magnetometers Network

Ksa Index - (11/07/2014 - 11/11/2014)



@climaespacial

Tweets Tweets e respostas Fotos e videos

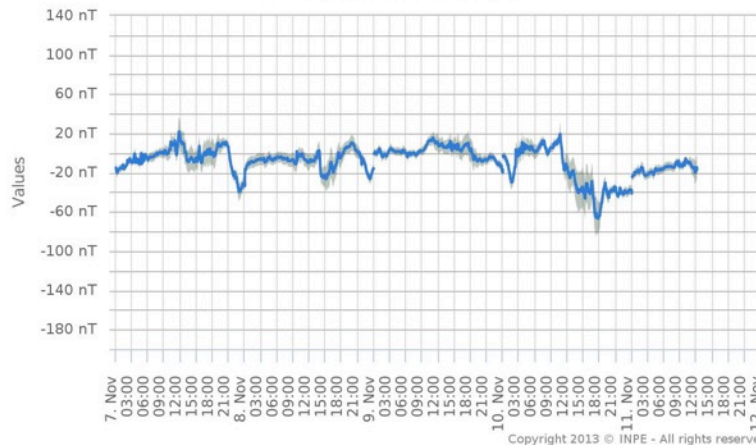
Programa EMBRACE @climaespacial · 4 h
[ALERT] Embrace/INPE detected a G1 level Magnetic Storm using the Ksa index. See details bit.ly/1o2QpUS #INPE #SpaceWeather

Programa EMBRACE @climaespacial · 4 h
[ALERTA] Embrace/INPE detectou tempe índice Ksa. Detalhes em bit.ly/1v6aOcw.

Programa EMBRACE @climaespacial · 22 h
Subtempestade geomagnãhã de hoje eleva os i para 4+ e 1000 nT, respe

EMBRACE Magnetometers Network

ΔH_{sa} - (11/07/2014 - 11/11/2014)



Estudo e Monitoramento Brasileiro do Clima Espacial



Ministério da Ciência, Tecnologia e Inovação

Ksa - 10-11-2014 18:00:00

Clezio Marcos De Nardin,

O sistema de monitoramento do Embrace/INPE detectou uma tempestade magnética nível G1 no índice de perturbação magnético Sul-americano Ksa. Detalhes em <http://bit.ly/1v6aOcw>.

The Embrace/INPE monitoring system detected a G1 level Magnetic Storm using the South American disturbance index Ksa. See details <http://bit.ly/1o2QpUS>.

G1 (Fraco) - 5o



Evento ocorrido no período: 10/11/2014 18:00:00 a 10/11/2014 21:00:00

Efeito: Sistema elétrico: flutuações fracas na voltagem podem acontecer. Operação de satélite: possível impacto pequeno nas operações. Outros sistemas: animais migratórios são afetados neste nível e em níveis mais altos.

Medida: Kp = 5

Frequência Amostral: 1700 por ciclo (900 dias por ciclo)

G1 (Minor) - 5o



Event occurred in the period: 11/10/2014 18:00:00 to 11/10/2014 21:00:00

Effect: Power systems: weak power grid fluctuations can occur. Spacecraft operations: minor impact on satellite operations possible. Other systems: migratory animals are affected at this and higher levels.

Measure: Kp = 5

Average Frequency: 1700 per cycle (900 days per cycle)

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Siga o EMBRACE no Twitter. Follow EMBRACE on Twitter. [Twitter](#)

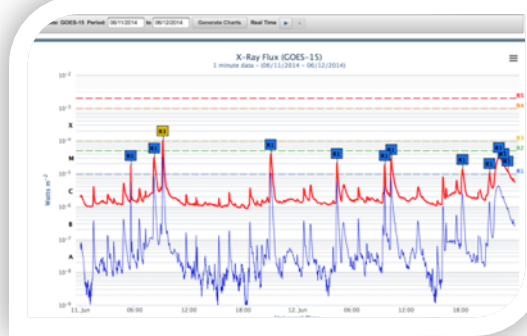
Copyright 2006 - 2014 © INPE - Instituto Nacional de Pesquisas Espaciais. Todos os direitos reservados.

RWC Brazil: Some Highlights

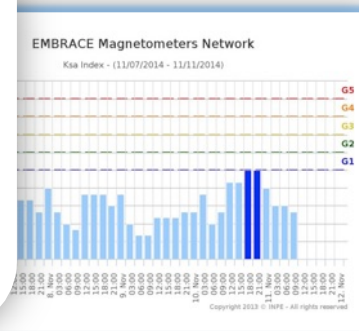
Daily Bulletins



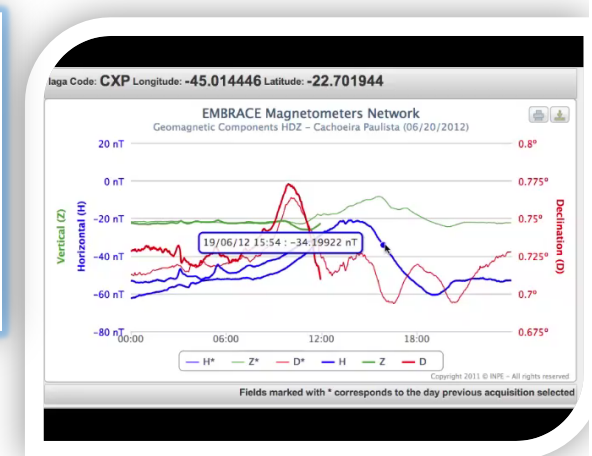
GOES burst alerter



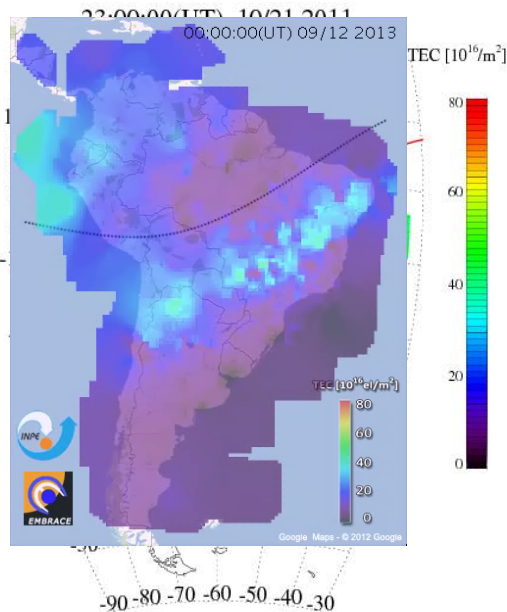
Geomag alerter



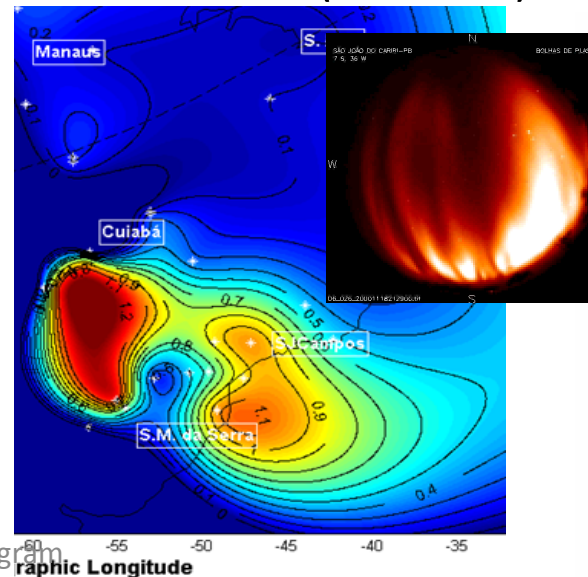
Easy data handling



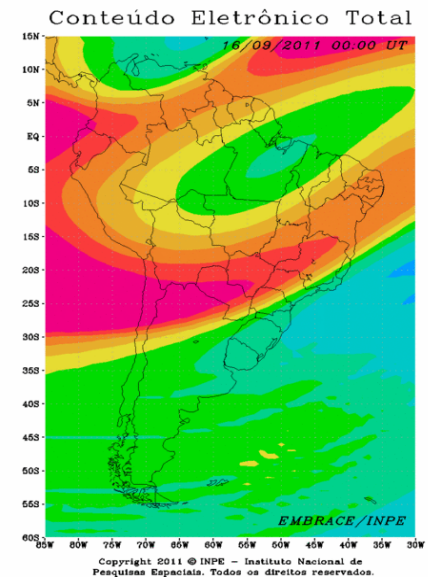
GPS TEC Map over South America (dynamic map – every 10 min)



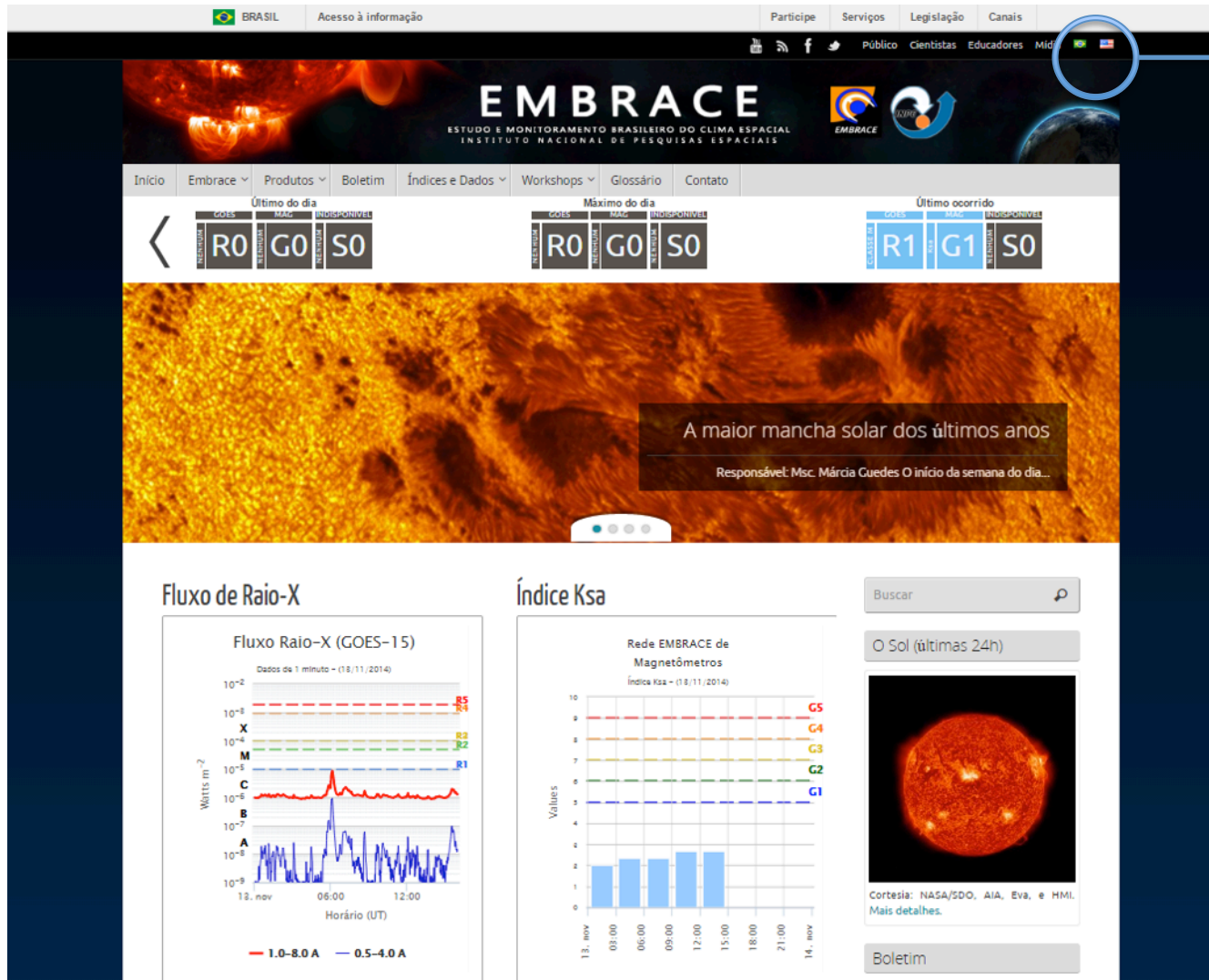
Plasma bubbles and scintillations (realtime)



Ionospheric model (TEC 24 hours ahead)

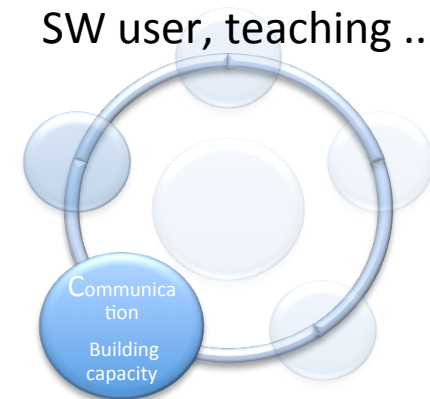


New Web Portal



English and Portuguese

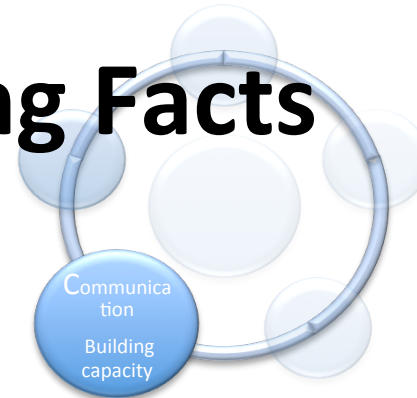
- Activity scale
- Four news letter
- Xray flux monitor
- Ksa monitor
- Last SDO movie
- Web page adjustable for mobiles
- Web page user classified for media, SW user, teaching ..



Cortesy: Ande Ivo - Indra

Briefing Facts

- ✓ Began: April 20, 2012
- ✓ Every Mondays, 14h30
- ✓ Number of meetings: 135 (at 23.Feb.2015)
- ✓ Participants: scientists, technologists, students and fellows from DGE, DAS, DAE, CTA e CRS (via Skype).
- ✓ Result in a report with the discussions.



ATA DA 121ª REUNIÃO DE BRIEFING: 10/11/2014, 14H30

Sala de Exibição do Clima Espacial/INPE-SJC

Presentes: Odem, Márcia, Lívia, Alisson, Marcos (conference call), Lajla, Dalé, Carlos, Rafael, Alisson iniciou a 121ª reunião de briefing.

SOL

Previsão 1: Na semana de 04 a 10 de novembro, a atividade solar observada foi moderada. A região 2205 produziu vários flares classe M e um flare classe X, sendo que a este último houve uma CME associada ocorrida no dia 07/11. Durante este período foram observados ao menos 3 CMEs, no entanto apenas a do dia 07 foi ejetada na direção da Terra. De acordo com as observações do satélite Stereo A, a região ativa que produziu diversos flares classe X na semana passada continua sendo observada e deverá entrar no disco solar ainda durante esta semana, por essa razão há expectativa de novos eventos nos próximos dias.

MEIO INTERPLANETÁRIO E MAGNETOSFERA

Previsão 2: Os dados de campo magnético interplanetário medidos pelo satélite ACE registraram Bz negativo no dia 04, seguido por um aumento da velocidade do vento solar, possivelmente associada a um buraco coronal no polo sul. Os dados de campo magnético total indicam um aumento de intensidade no dia 10, por volta das 01:30 UT que é compatível com a data prevista para chegada da CME do dia 07, no entanto, as informações de velocidade e temperatura não permitem concluir se este aumento foi causado pela chegada da CME. Os dados de medidas de nêutrons também apresentaram queda de 2% no número de contagens no dia 10, que corrobora com o aumento do campo magnético total. Os dados da sonda Van Allen, que monitoram os cinturões de radiação apresentaram queda no fluxo de elétrons relativísticos medidos no dia 4.

TERRA MAGNÉTICA

Previsão 3: Campo geomagnético esteve ativo durante os dias 04 e 10. No dia 04 as alterações do meio interplanetário elevaram o Dst a +47 nT, causando uma diminuição de -30 nT na sequência; foi observada atividade auroral, com índice AE em torno de 3000 nT durante cerca de 6 horas e Kp em torno de 4-. No dia 10, os dados de campo geomagnético apresentaram pequeno aumento na componente H seguido por perturbações de período curto e queda de magnitude, o índice AE esteve acima de 500 nT durante alguns períodos isolados.

TERRA ATMOSFERAS

Previsão 4: Os dados dos diversos instrumentos que monitoram a ionosfera apresentaram valores compatíveis com o de dia calmo para esta época do ano.

Ata elaborada por Lívia Ribeiro Alves

135th Edition



Courtesy: Alisson Dal Lago - DAE/INPE

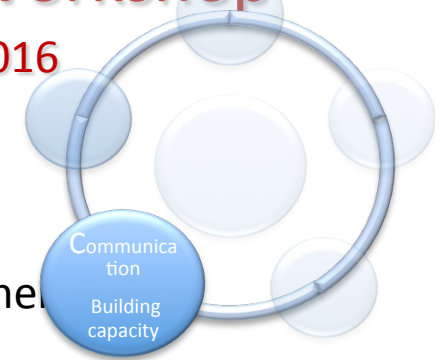
Capacity Building Workshop

COSPAR Space Weather Capacity Building Workshop

TO BE HELD IN SÃO JOSE DOS CAMPOS, ON FEBRUARY 2016

- Duration: from Monday to Monday (8 days – 1 day break)
- Lectures: Leading Scientist Lectures (2 hours)
- Formal Classes*: Solar Physics and Heliosphere
Interplanetary Medium and Magnetosphere
Geomagnetic Field and Magnetism
Ionized Earth's Atmosphere
Neutral Earth's Atmosphere
- Hands on Classes: Students shall have the opportunity to analyze real data and formulate a bulletin for a space weather center in all the topics related to the formal classes.
- Briefing: The student shall attend the daily Embrace/INPE briefing meetings.
At the end of the workshop the students shall lead a briefing meeting assisted by the usual attendees and chaired by Dr. Alisson or Dr. Fabio
- Round Table: Teacher's round table (last event of the meeting/day)
- * The content shall contain a brief/basic concept description of the fields area and turn into an analytical classes of the space weather events.

Proposals
-COSPAR-
Proposals



New Operational Areas

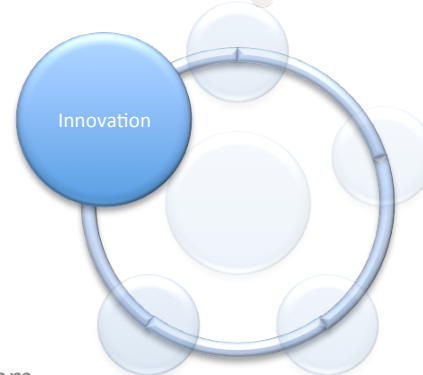
Computer infrastructure for scientists and technologists

Development and tests of new concepts



Powerfull computing center for new developments

EMBRACE LAB
Beta products



Cortesy: Rubens Gatto - DSS/ETE



You can find our staff at EMBRACE page:
<http://www2.inpe.br/climaespacial/portal/staff/>

Thank you