MINISTÉRIO DA CIÊNCIA E TECNOLOGIA
INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS

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AGÊNCIA ESPACIAL BRASILEIRA

The contribution of the EMBRACE Brazilian Space Weather Monitoring Program to GNSS services

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- Overview
- Website information
- Examples of reports
- Android app
- Other GNSS-related initiatives

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PROGRAMA DE ESTUDO E MONITORAMENTO BRASILEIRO DO CLIMA ESPACIAL

(Brazilian Space Weather Survey and Monitoring Program)

Overview

Program was set up in 2007, operational in 2008

AIMS:

- **Monitor and model space weather phenomena**
- **Raise awareness of space weather effects**
- **Provide real-time information / forecasts**
- **Anticipate and estimate space weather impacts on space- and land-based systems**

- **EMBRACE operates as a Regional Warning and Alert Center for Space Weather**
- **Member of International Space Environment Services (ISES)**

Overview

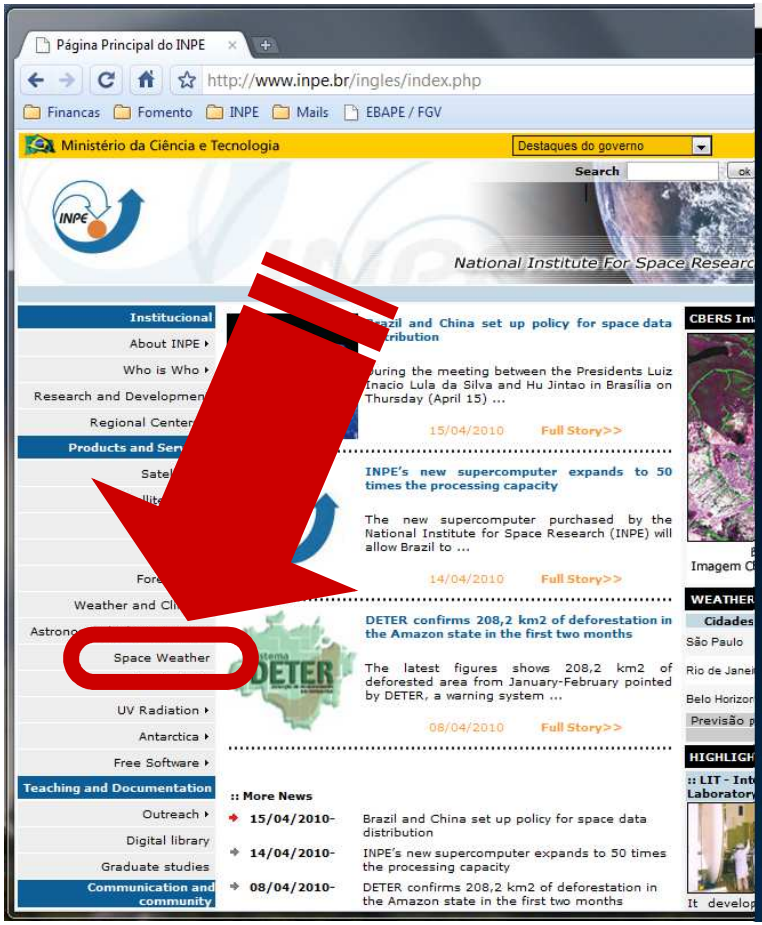
SOLUTIONS FOR

- **GNSS systems**
  - **Precision agriculture**
  - **Flight safety / flight control**
  - **Oil rigs**
- **Defence**
- **Communications / broadcast systems**
- **Power grids / distribution systems**
- **Oil and natural gas pipelines**
- **Satellites**

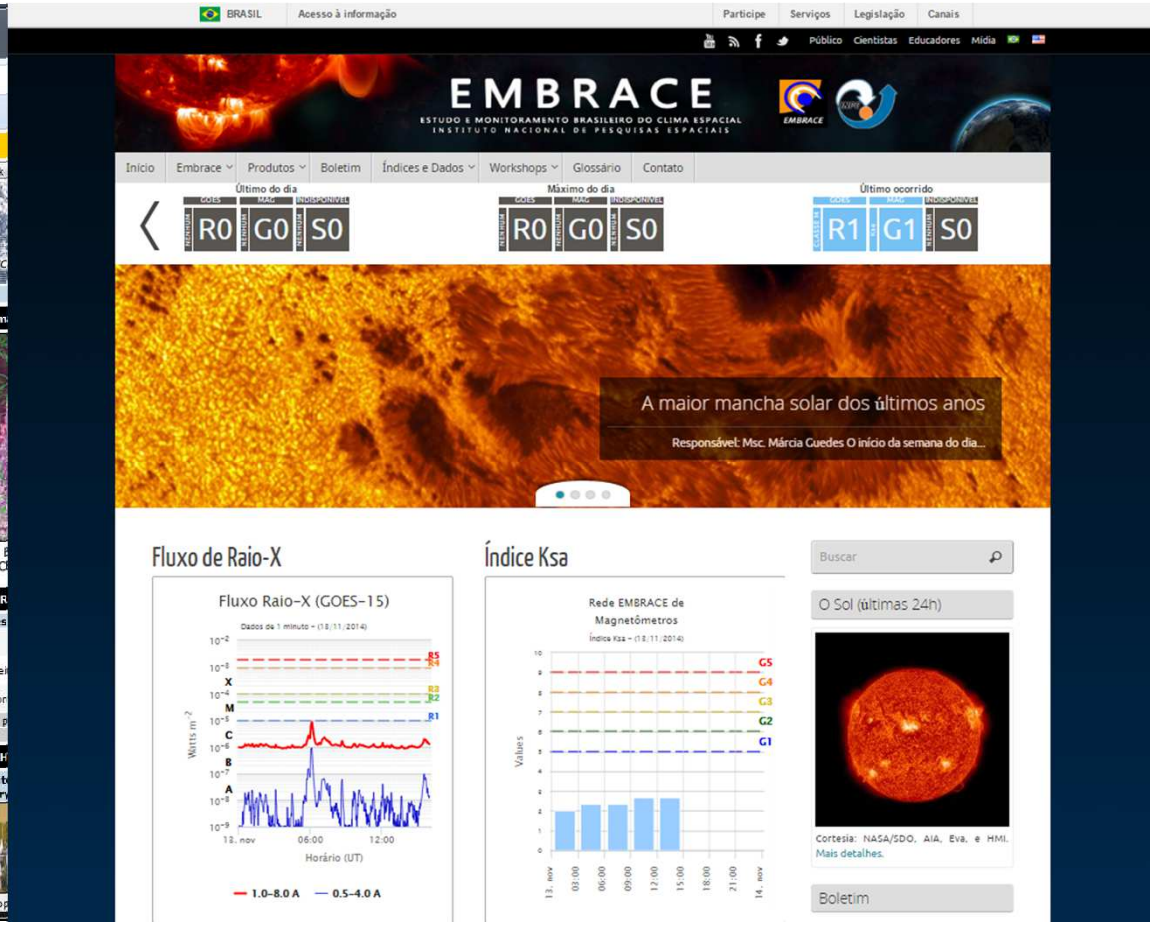
WEBSITE

SINCE JUL 1, 2008

www.inpe.br



www.inpe.br/climaespacial



Website

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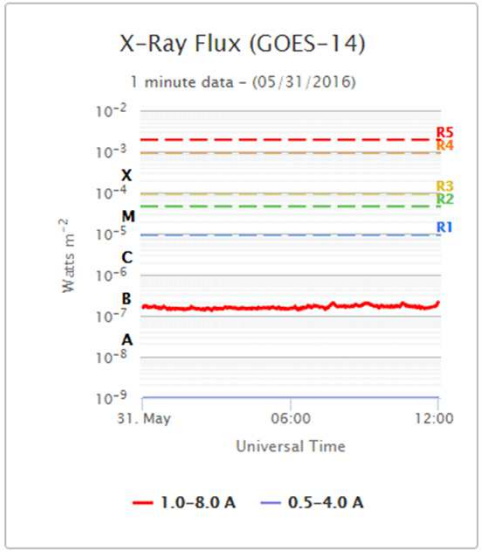
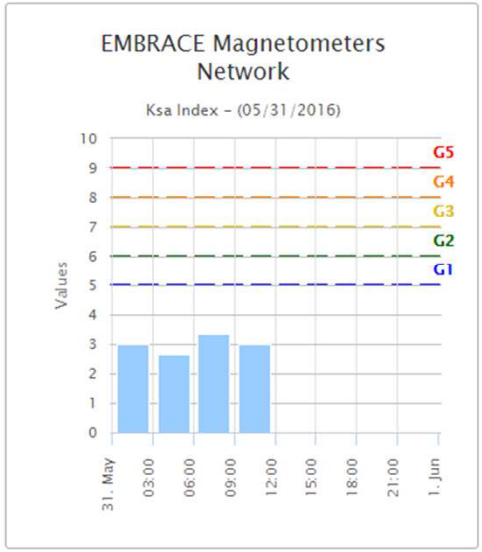
X-Ray Flux

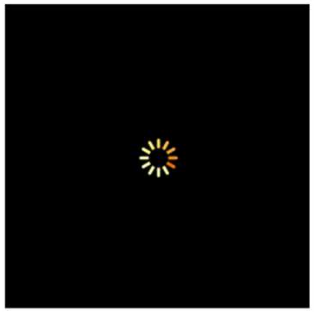


Ksa Index



Search

Daily Sun



Courtesy of NASA/SDO and the AIA, EVE, and HMI science teams. More details.

Bulletin

Sun

Posted in: 30/05/2016

There exist two active regions (NOAA 2548 and 2549) in the visible disk of the Sun. They are located near to the coordinates N14W78 and S14E03. The ac ... Continue...

Interplanetary Medium

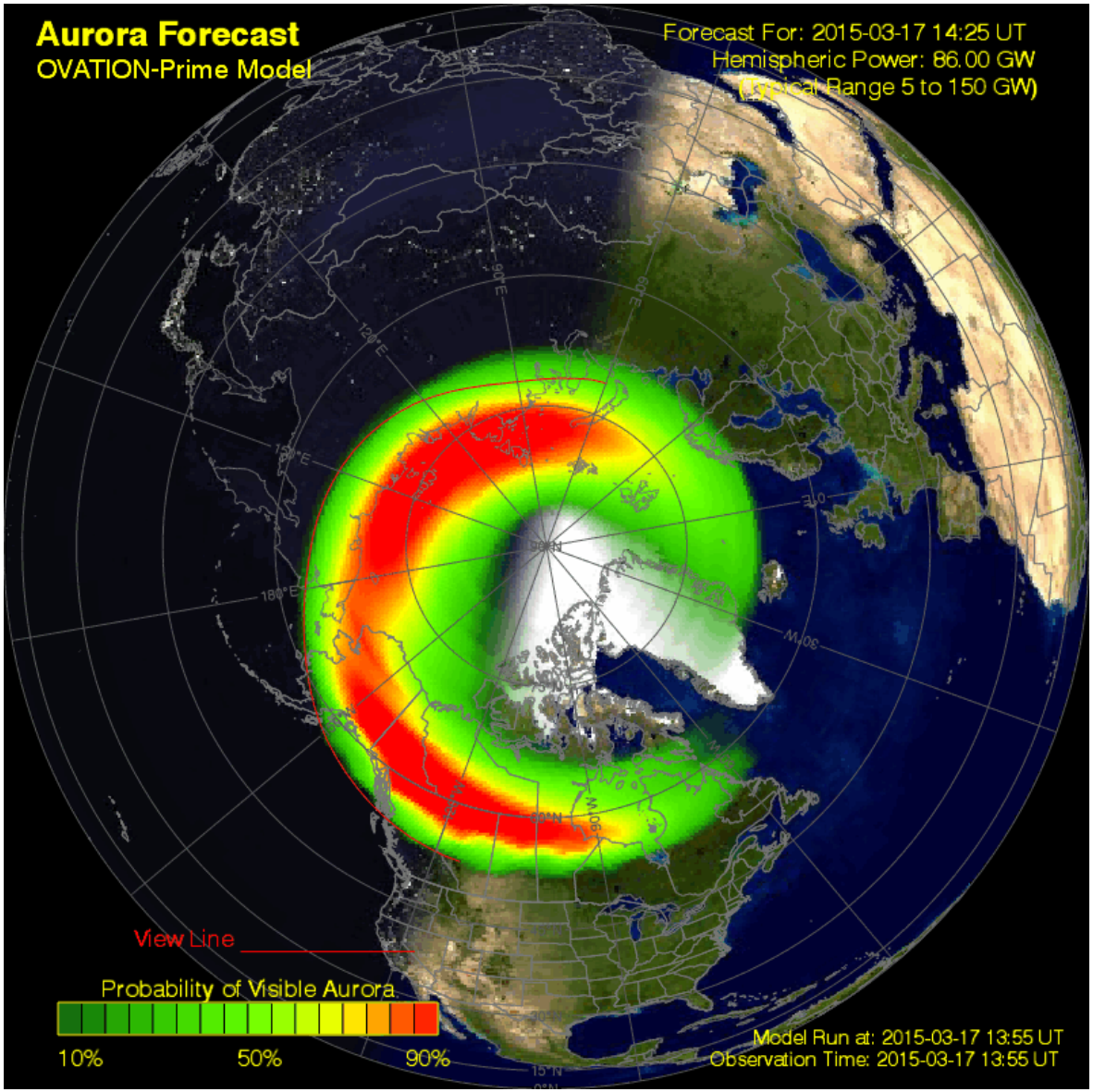
Posted in: 30/05/2016

After being disturbed between days 27 ad 29, the interplanetary medium has been calm on the last

MINUTE 142th BRIEFING: 15/06/2015, 14H30

Information about the interruption of the Embrace / INPE web site services since last Sunday (May, 17)

Storm on March 17 2015



@ 11:14 AM BLT

A G4 (Severe) geomagnetic storm was observed today at 07/1358 UTC (09:58 EDT). This is the response to a pair of CMEs leaving the Sun on 15 March.

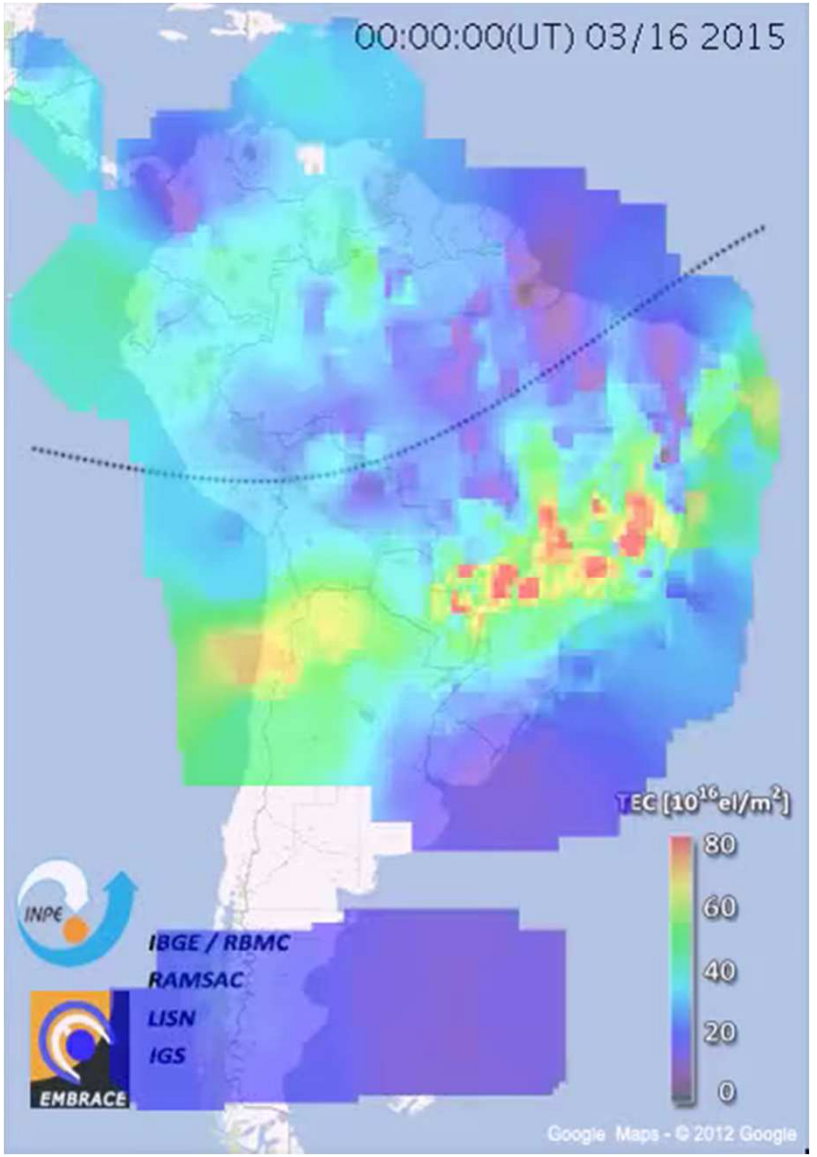
@ 01:09 PM BLT

The Embrace/INPE monitoring system detected a G3 level Magnetic Storm using the South American disturbance index Ksa.

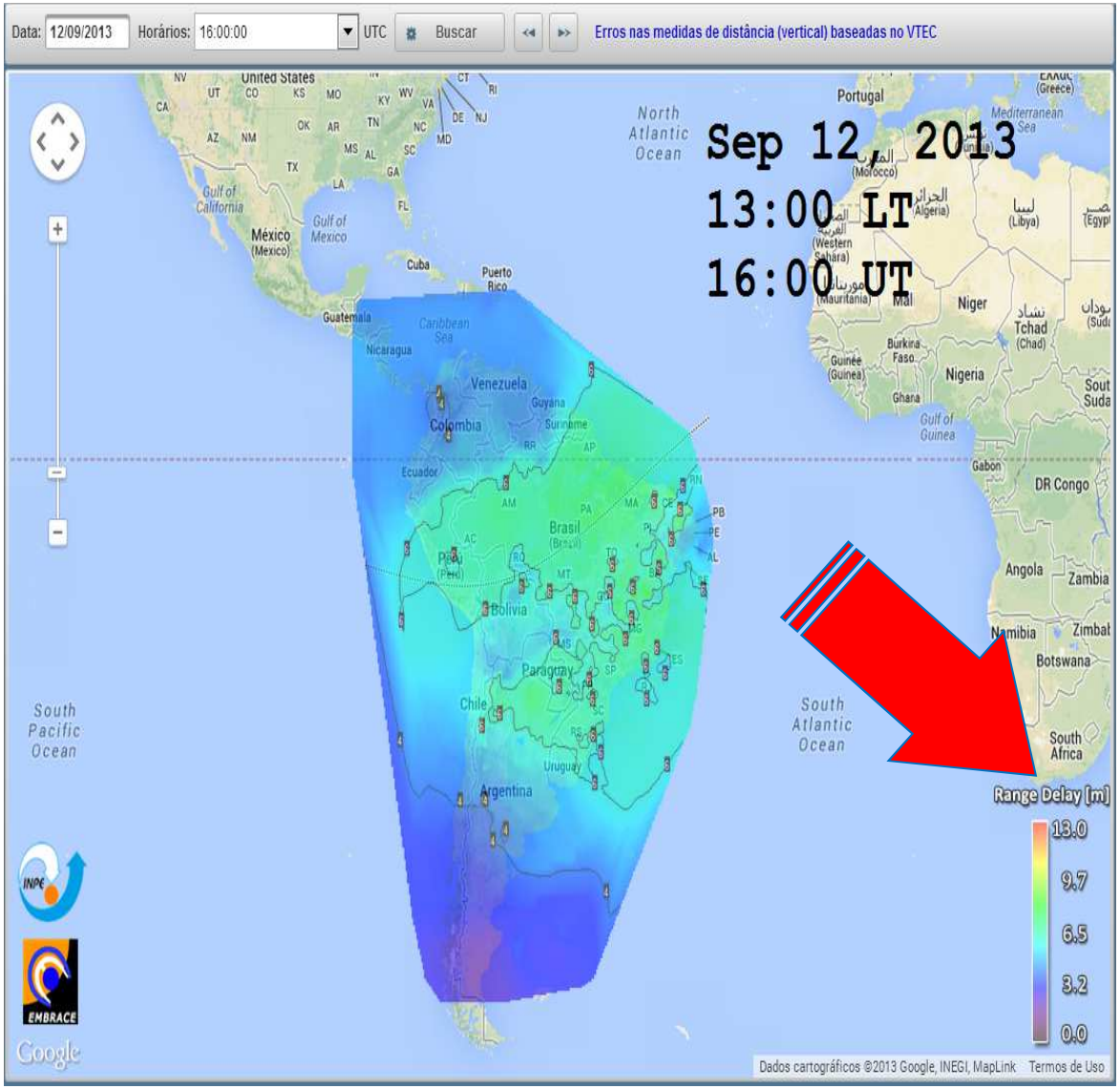
Storm on March 17 2015

Total electron Content 16-18 March 2015

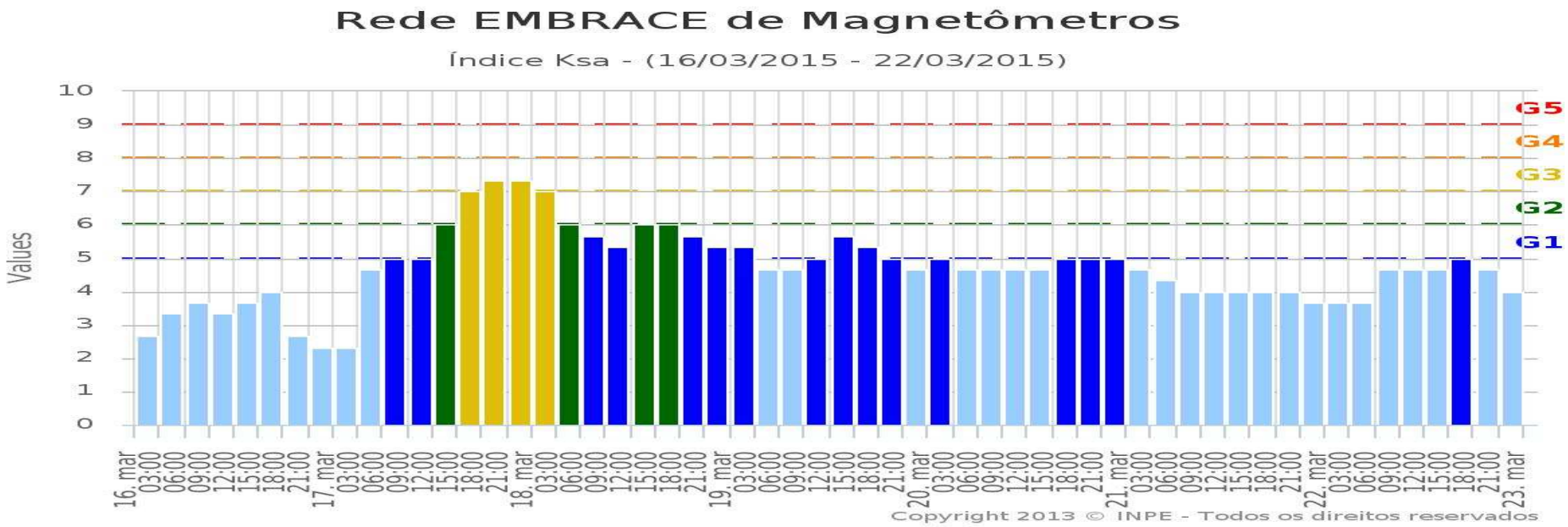
The TEC map is generated at Embrace/INPE every 10 minutes using GNSS signals received from more that 150 receptors over the whole of South America, specially those belonging the following networks: RBMC-IBGE, RAMSAC, LISN, and IGS.



TEC Map → Error Map



Magnetic Storm Alert

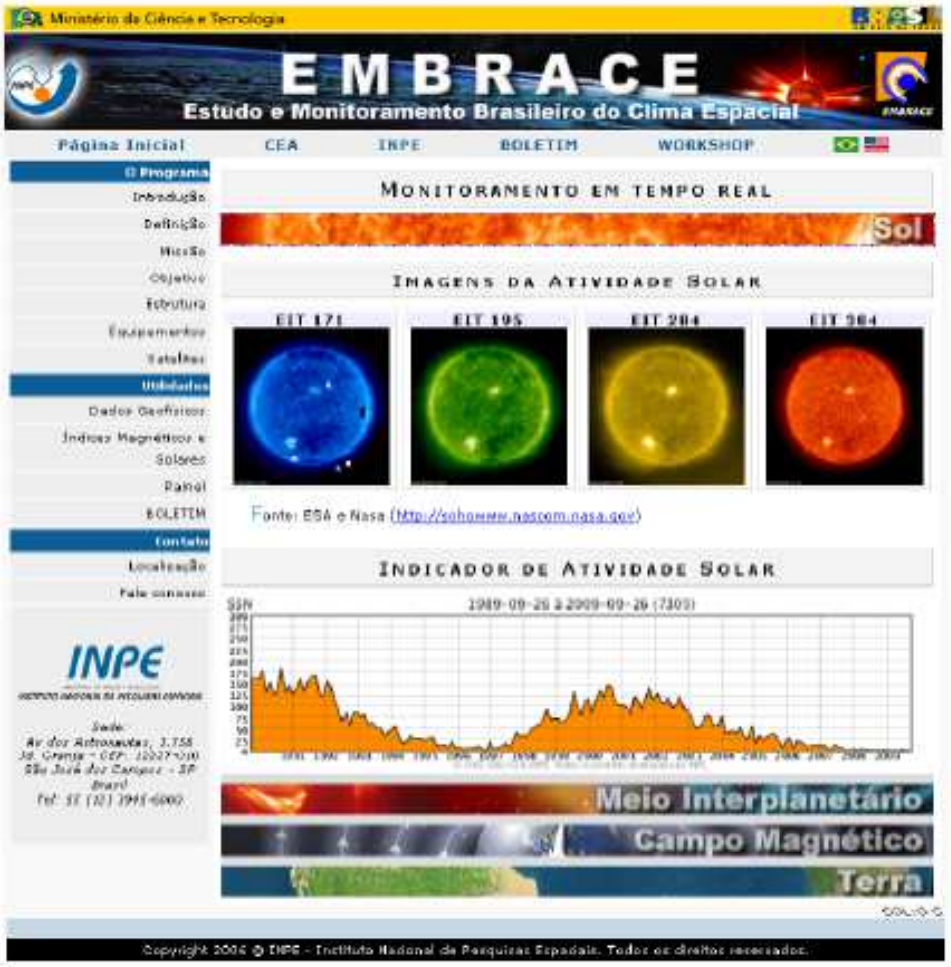


G3 (Forte) - 7+

Evento ocorrido no período: 17/03/2015 18:00:00 a 17/03/2015 21:00:00

Efeito: Sistema elétrico: correções de voltagens podem ser necessárias, alarmes falsos iniciando algum equipamento de proteção. Operação de satélite: sobrecarga estática de superfície nos componentes podem ocorrer, pode ocorrer aumento do arrasto sobre os de baixa órbita, e correções podem ser necessárias para os problemas de orientação. Outros sistemas: podem ocorrer problemas intermitentes na navegação do satélite e navegação em baixa-frequência, comunicação em rádio HF pode ficar intermitente.
Medida: Ksa = 7
Frequência Amostral: 200 por ciclo (130 dias por ciclo)

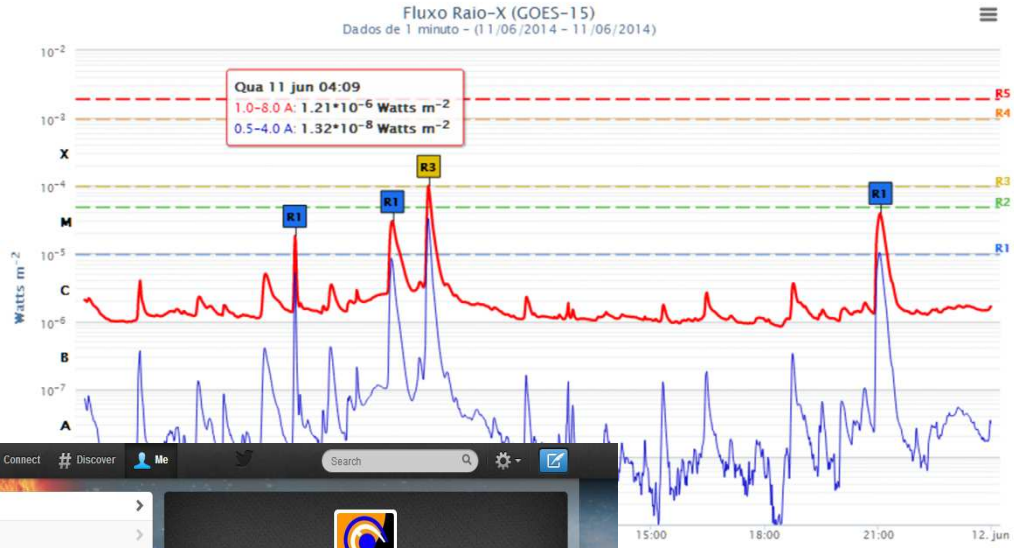
Solar Activity

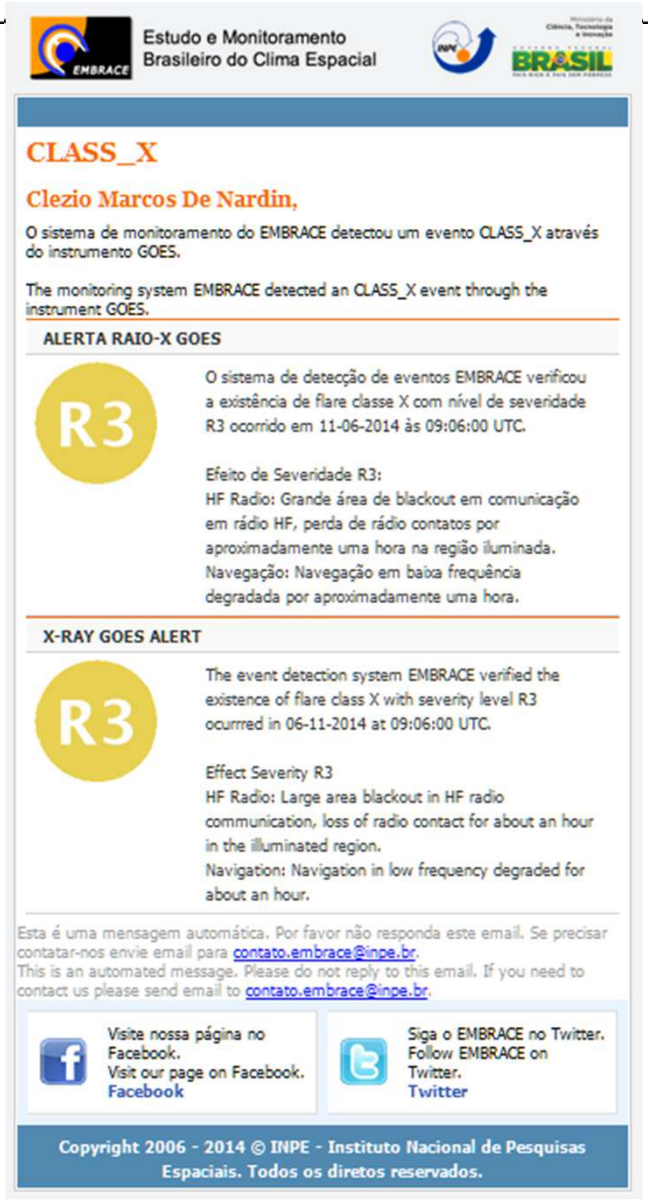


Solar Images

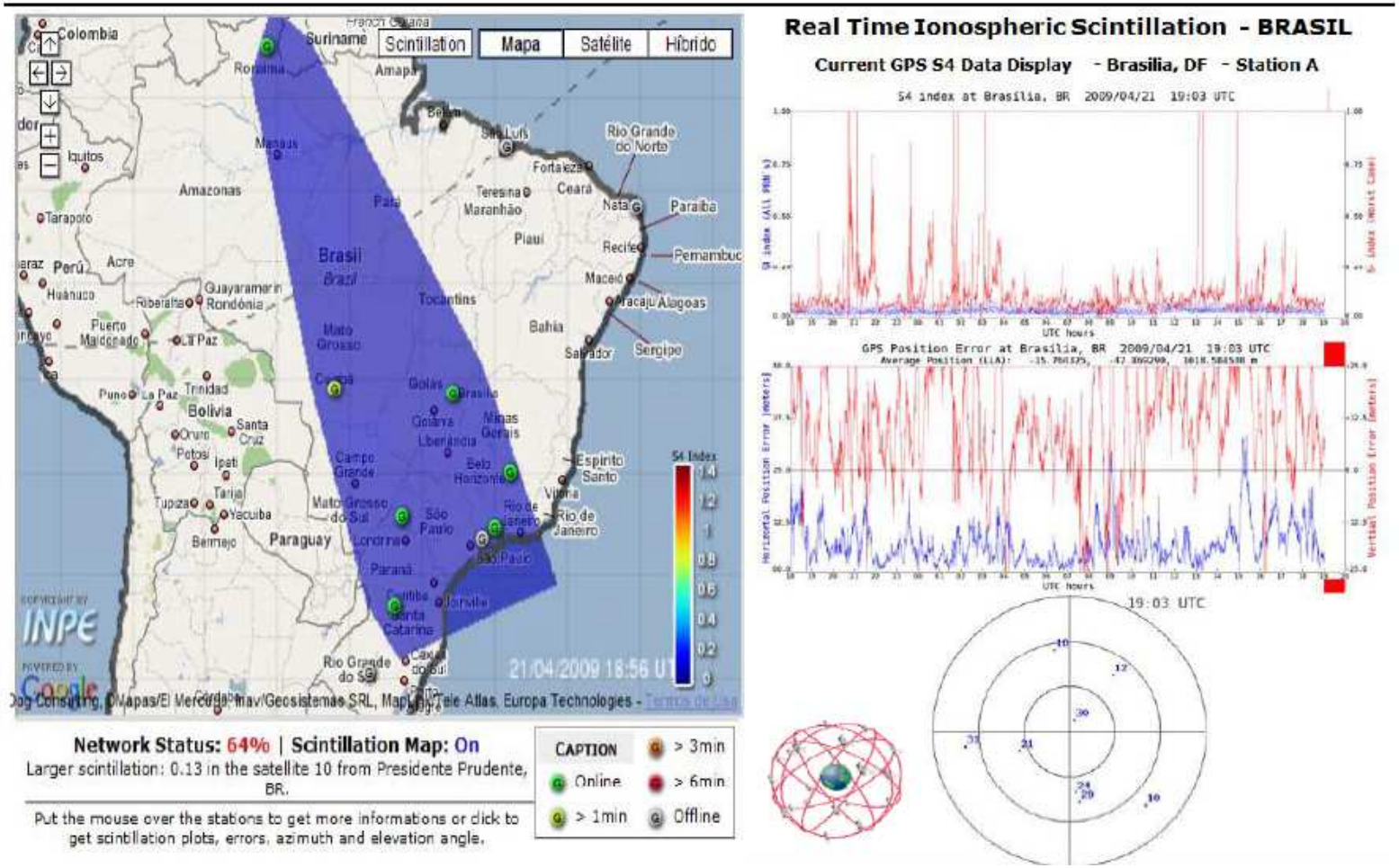
Solar Index

Solar activity alerts



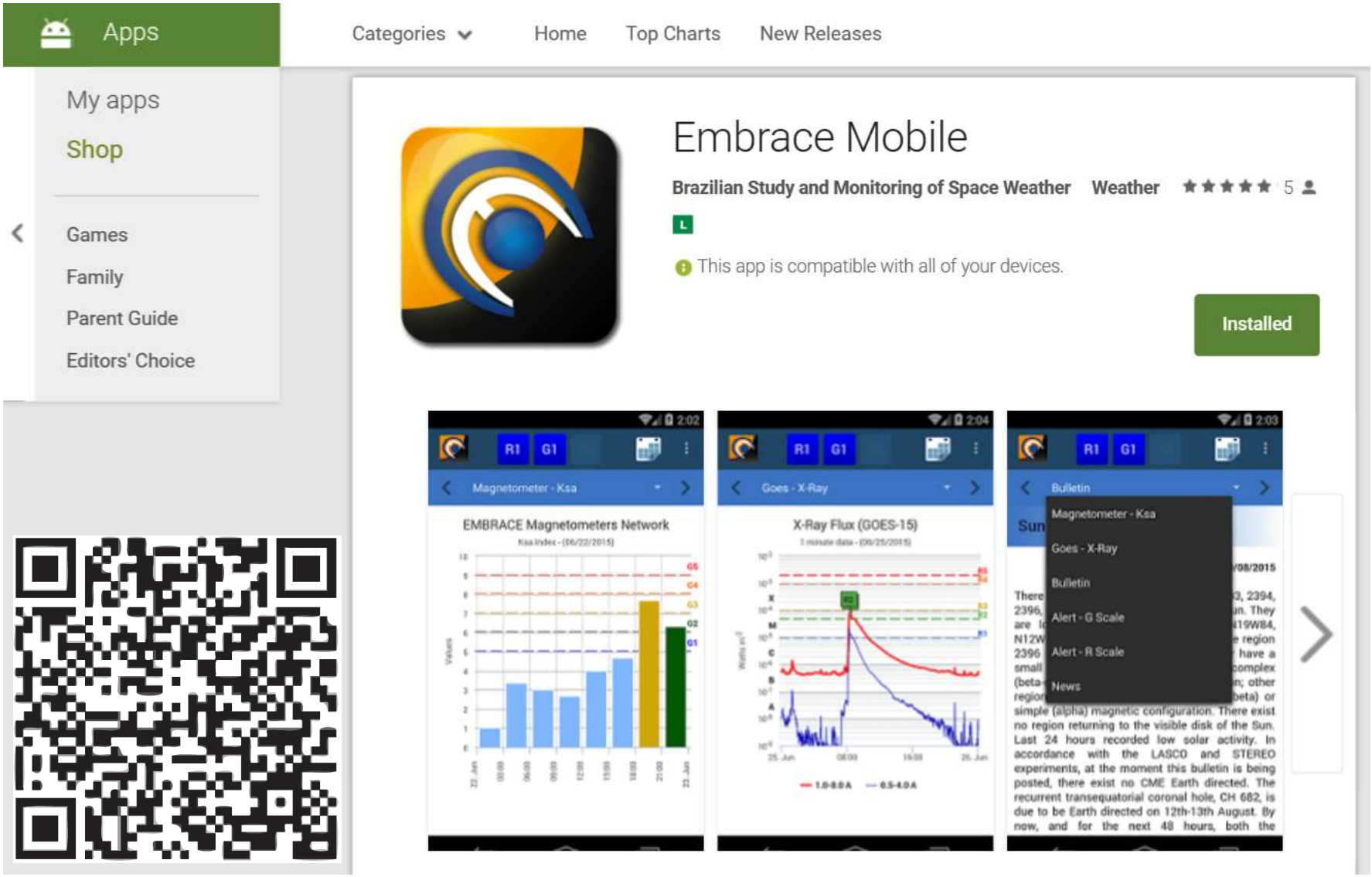


GPS Error – Ionospheric Scintillation



Android App

https://play.google.com/store/apps/details?id=br.inpe.climaespacial.mobile

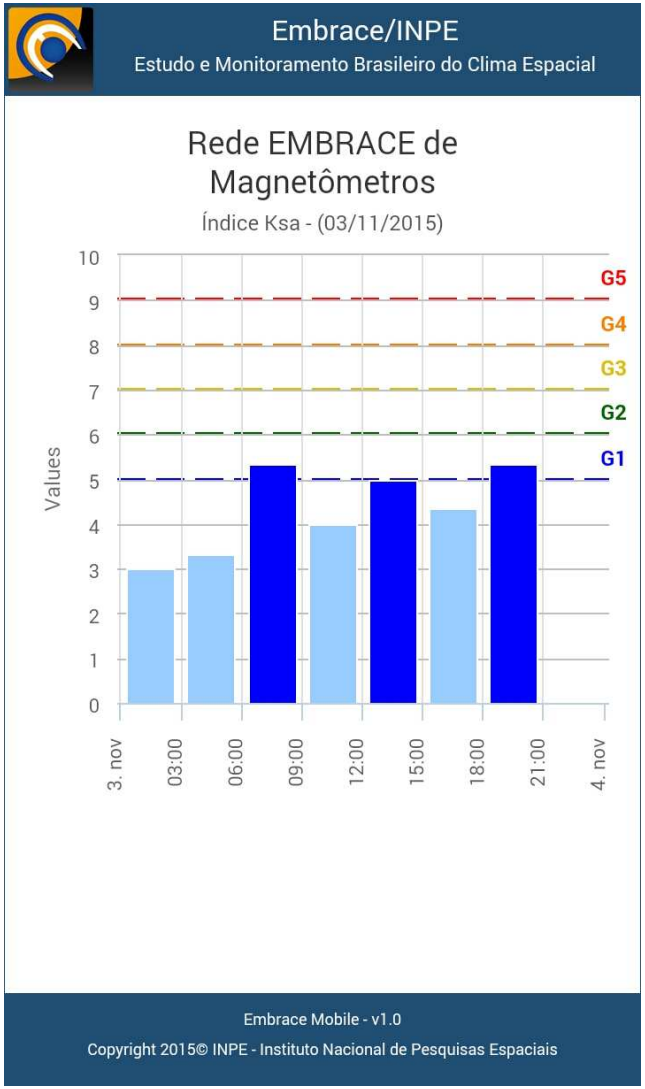


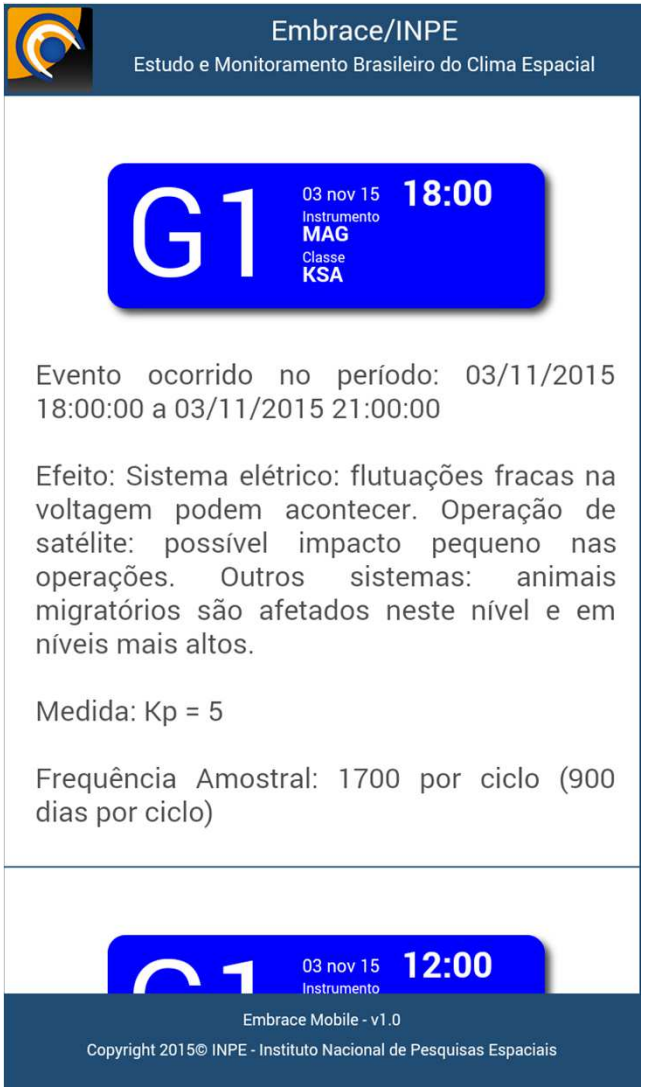
Android App

Embrace Mobile

New APP Embrace Mobile Google Play

SINCE JULY 2015





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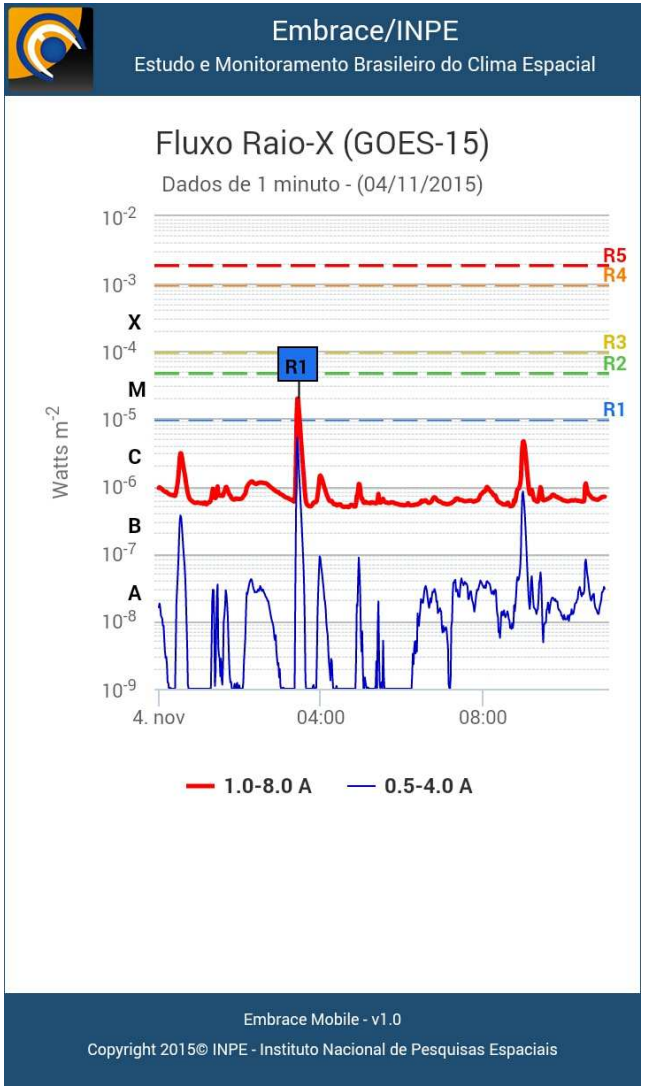


Other GNSS Initiatives

CIGALA (GALILEO)

Concept for Ionospheric Scintillation Mitigation
for Professional GNSS in Latin America (ended in 2012, but network is still active)

CALIBRA

COUNTERING GNSS HIGH ACCURACY
APPLICATIONS LIMITATIONS DUE TO IONOSPHERIC DISTURBANCES IN BRAZIL

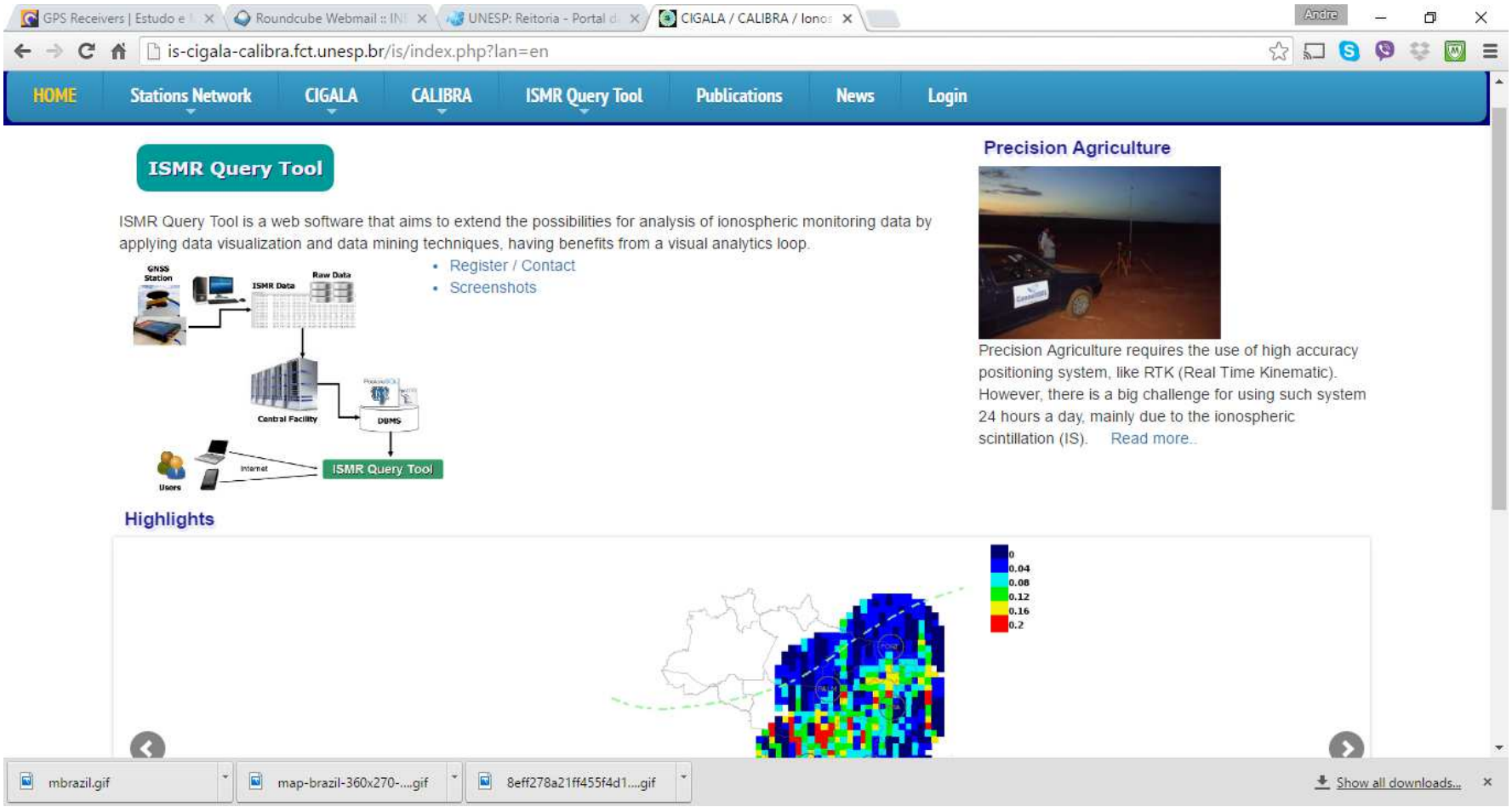
New: GBAS aircraft landing system –
modelling to adapt US parameters to Brazil

ISMR QUERY TOOL

ISMR Query Tool allows users to perform queries and analysis
on the CIGALA/CALIBRA ionospheric monitoring database

Other GNSS initiatives

CIGALA/CALIBRA website



http://is-cigala-calibra.fct.unesp.br/is/index.php?lan=en

Other GNSS initiatives

GLONASS and Space Weather

4 GLONASS CORRECTION STATIONS:

- **Recife (NE)**
- **Brasília (center)**
- **Santa Maria (South)**

Precise point positioning studies

Other GNSS initiatives

GLONASS at UnB – PPP Studies

The overall objective of the proposed research on Precise Point Positioning (PPP) is to assess the **impact of multi-constellations** instead of stand-alone (GPS or GLONASS) PPP solution around Brasilia. Data are extracted from the GNSS receiver of the One-Way Station (OWS) MSGLONAS, «Sazhen-TM-BIS» installed at University of Brasilia.

Future perspectives include:

- Practical applications on HASP (high altitude student platform;
- Onboard attitude determination;
- Impact point prediction;
- High precision applications with UAVs and mobile robots.

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