Space Science Project and Planning in Brazil

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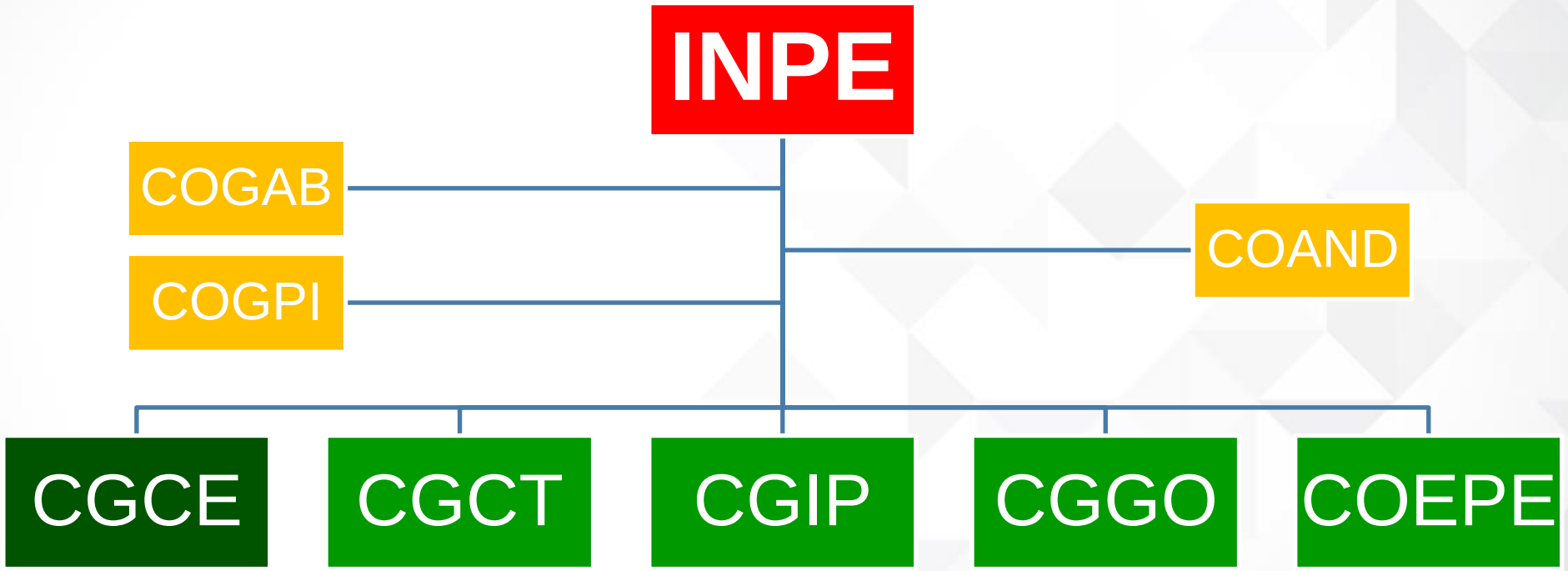
Outline

- About the National Institute for Space Research
- Space Science Projects
  a) Astrophysics
  b) Solar Physics
  c) Magnetosphere & Radiation Belts
  d) Geomagnetic Field & Magnetic Indices
  e) Ionospheric Research
  f) Ionospheric Scales
- Final Remarks

About INPE

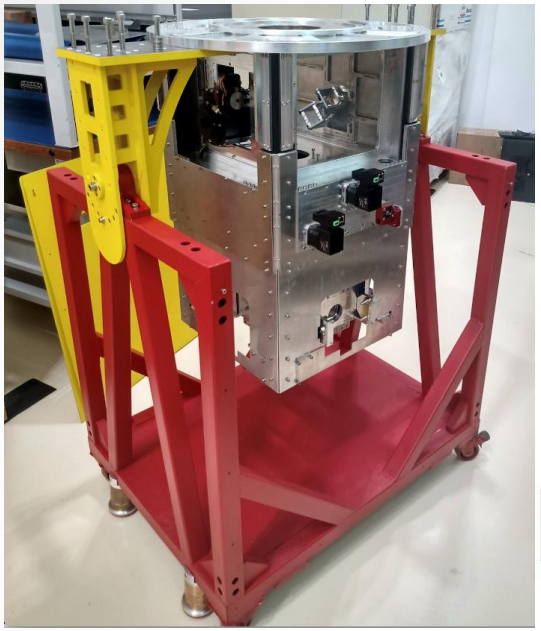


Space Science Projects
Astrophysics

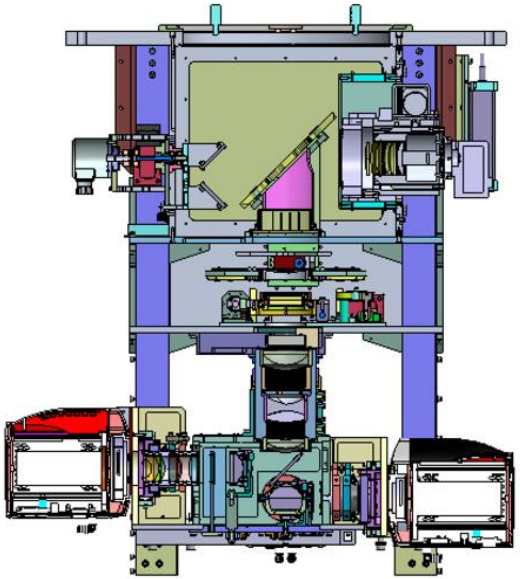
BINGO stands for Baryon Acoustic Oscillations from Integrated Neutral Gas Observations.
It is an international project with collaborators in Brazil, China, United Kingdom, France, South Africa, Germany, and United States. It is the only radio telescope that proposes mapping neutral gas as traced by the 21cm line on large angular scales at redshift z~0.3.

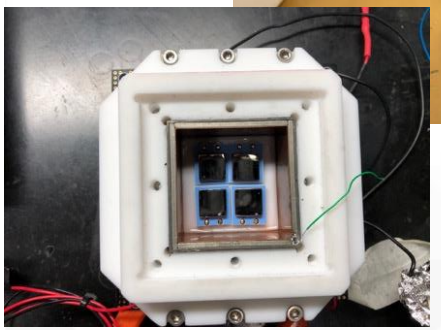
LIGO Scientific Collaboration is a scientific collaboration of international physics institutes and research groups dedicated to the search for gravitational waves. At INPE the Gravitational Mario Schenberg started commissioned operation on September 8, 2006. It involves a collaboration between INPE, USP, ITA, IFSP, UNIFESP, UNESP, UNICAMP, UESC, IAE, UFABC, PUC-Rio, UNIPAMPA, CBPF Leiden Cryogenics, UWA, LSU, and OCA.

Space Science Projects
Astrophysics



SPARC4 – Polarimetric camera





LECX/NanoMIRAX

The SPAC – 4 stands for Simultaneous Polarimeter And Rapid Camera in four (4) bands and it is a project for development and construction of the astronomical instrument to be installed in the 1.6m telescope of the Pico dos Dias Observatory, which is managed by the National Astrophysics Laboratory, another research unit of the MCTI.

The project consists of: acquisition of equipment and subsystems, flight model assembly, integration, testing, launch and in-orbit operation of the nanoMIRAX nano-satellite flight model, which is based on a 2U CubeSat standard platform.

Space Science Projects
Solar Physics

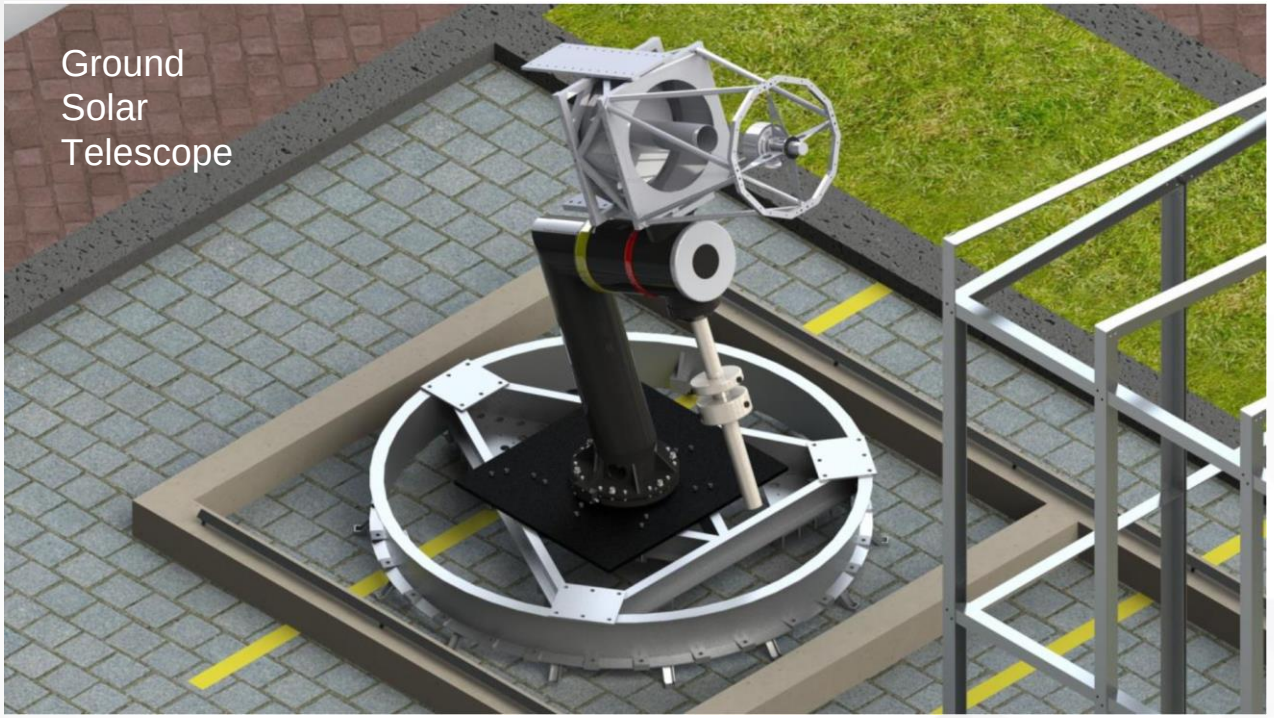
Brazilian Decametric Array

Pierre Kaufmann Radio Observatory

BDA is a Radio interferometer (1-6 GHz) with 26 antennas of 4 m diameter for research mainly on solar, but also galactic and extra-galactic phenomena, mainly from the southern sky. It's an international cooperation, with a strong collaboration from GMRT and NCRA (India)

Pierre Kaufmann is a radio observatory operating in 22, 43 and 90 GHz. It was the first radio observatory used for professional radioastronomy and it is being refurbished, to maintain its capabilities to do mainly solar, but also galactic astrophysics.

Space Science Projects
Solar Physics

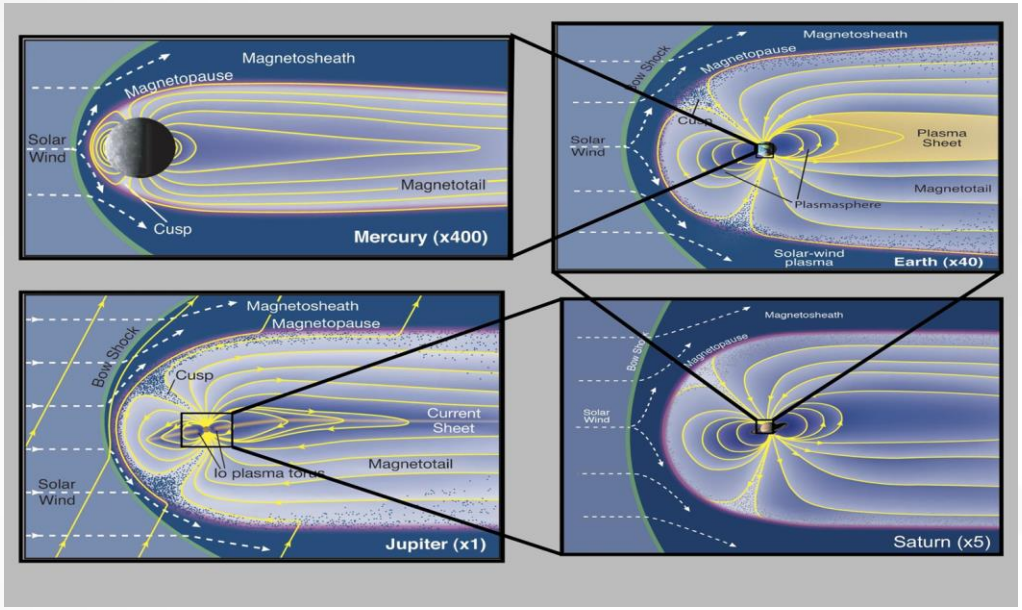


The ground solar telescope is intended to perform observations of the structure of the Sun's magnetic field. In particular, it intends to carry out remote sensing observations of the Sun that provide the estimation of the magnetic structure of the Sun, the modulation of the total and spectral solar irradiance and parameters of plasma and magnetic field in the vicinity of the space platform.

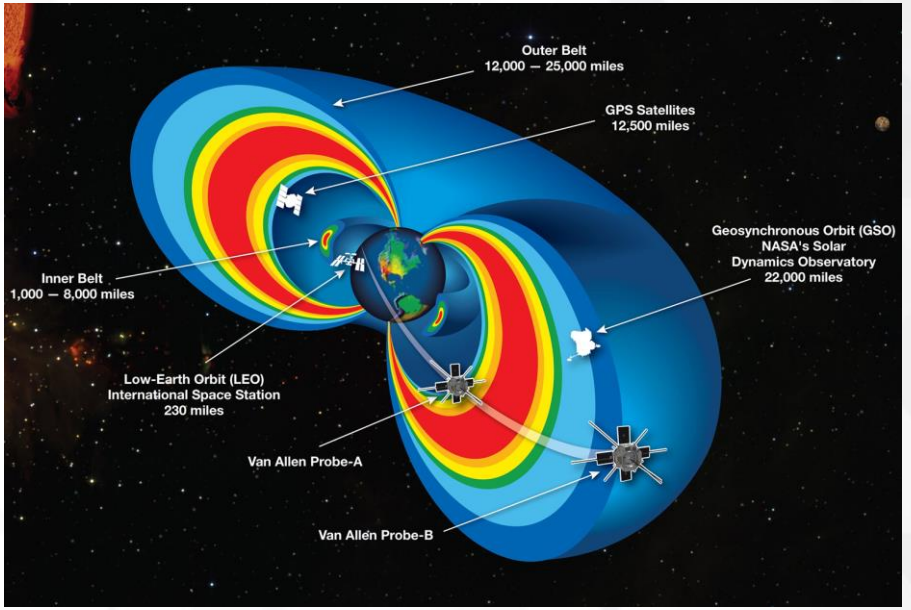
Space Science Projects

Magnetosphere and Radiation Belts

Global Modeling of the Inner Magnetosphere



Van Allen Probes



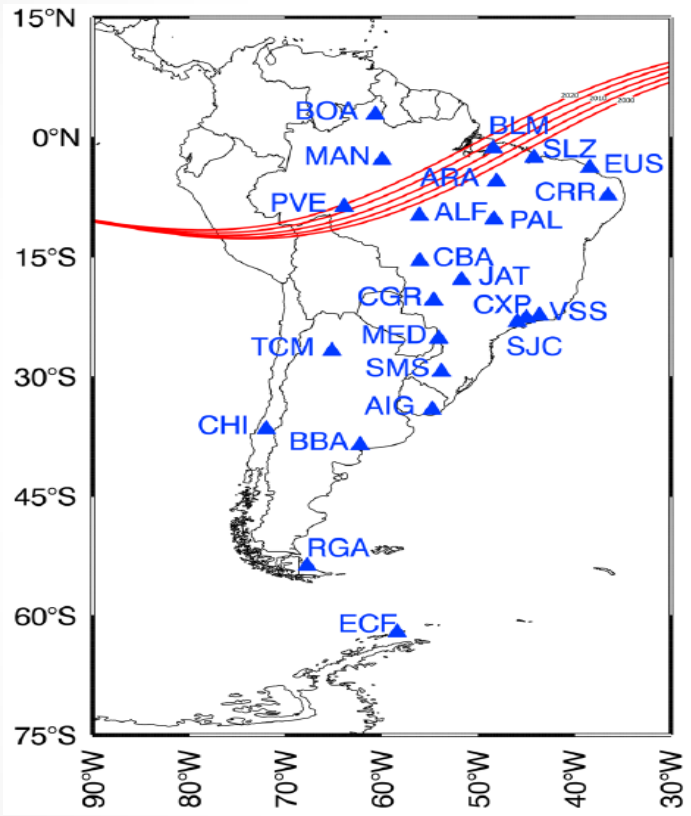
The version of the model SWMF/BATS-R-US global MHD code, which developed at the University of Michigan in the Center for Space Environment Modeling (CSEM) and available at the Community Coordinated Modeling Center (CCMC/NASA) is operational at INPE so it is used to several magnetospheric studies.

As it is well known, the Van Allen Probes or the Radiation Belt Storm Probes were two robotic spacecraft that were part of a Mission conducted by NASA and were used to study the Van Allen radiation belts that surround Earth. INPE has signed an agreement with NASA so we directly downloaded the Van Allen Probes data from the two spacecrafts for researching about the low-energy electrons precipitated over South America Magnetic Anomaly (SAMA) and several other characterizes of the radiation belts.

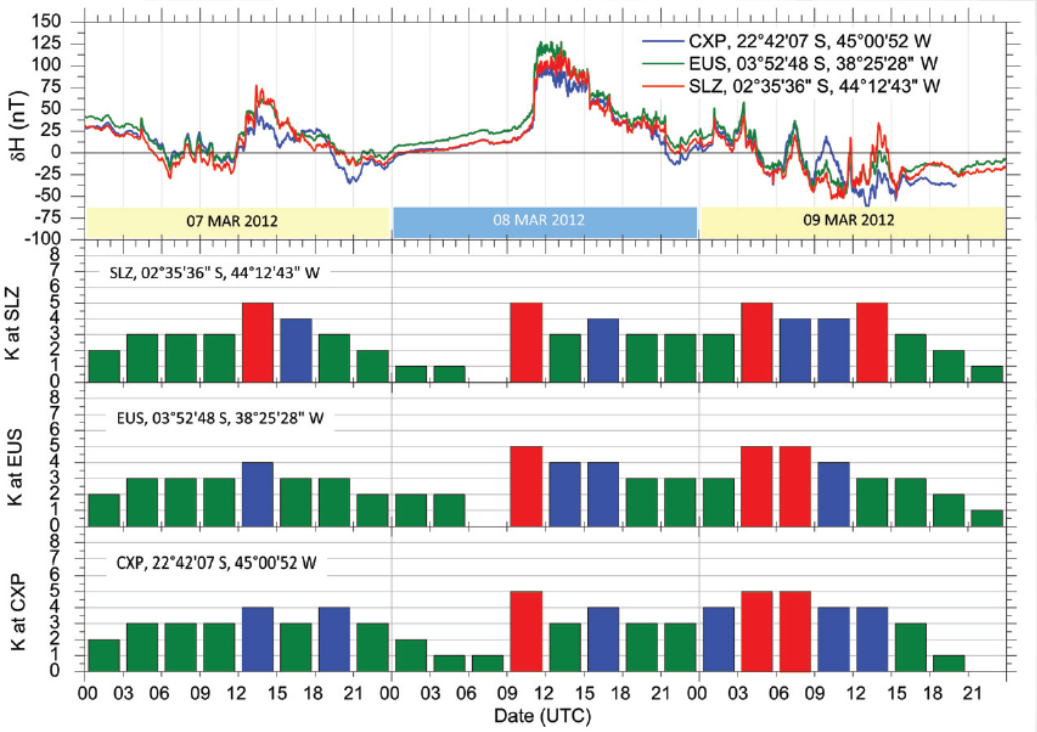
Space Science Projects

Geomagnetic Field and Magnetic Indices

Embrace MagNet



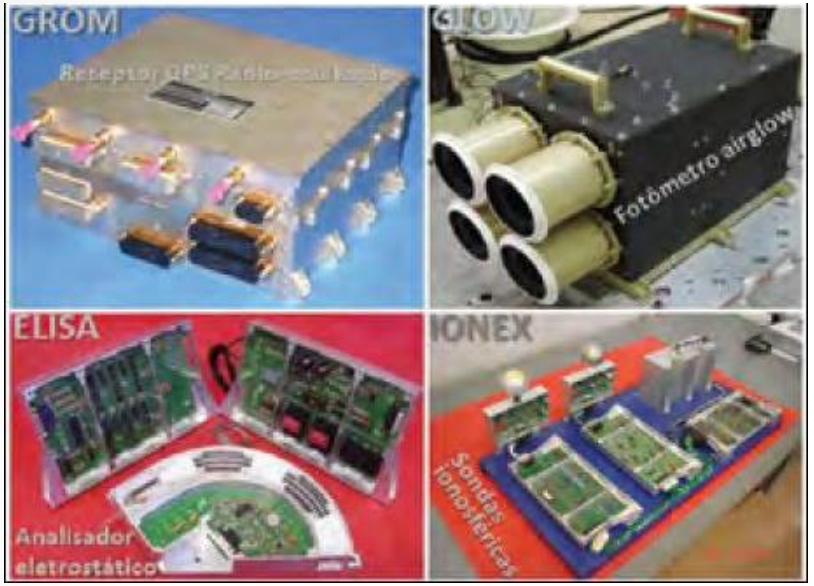
South American K (Ksa) index



The Brazilian Space Weather Program developed the Embrace Magnetometer Network to cover most of the eastern South American longitudinal sector. This network fills the gap of magnetic measurements available online in this sector and aims to provide magnetic data to be used as an estimate of the regional disturbance level caused by the geomagnetic storms driven by the space weather effects, for example, by developing the South American K (Ksa) index presented in the graphs in the right side.

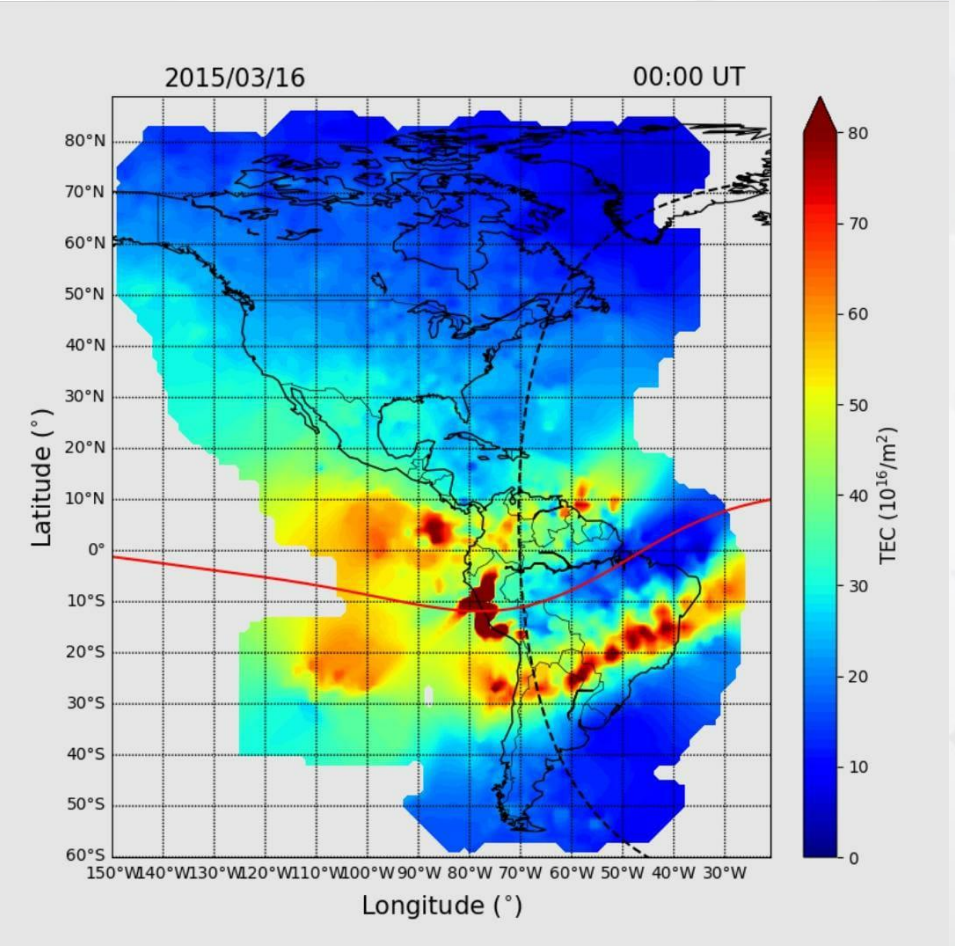
Space Science Projects
Ionospheric Research

Equars Mission



This space system named Equatorial Atmosphere Research Satellite involving a satellite in low Earth orbit, with the objective of promoting the advancement of scientific and technological knowledge in Equatorial Aeronomy.

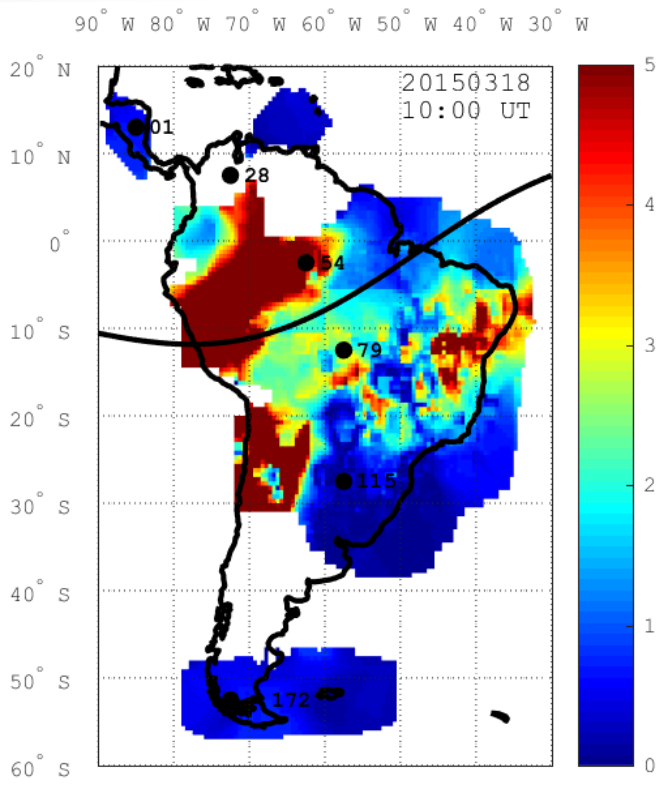
Development of TEC Maps



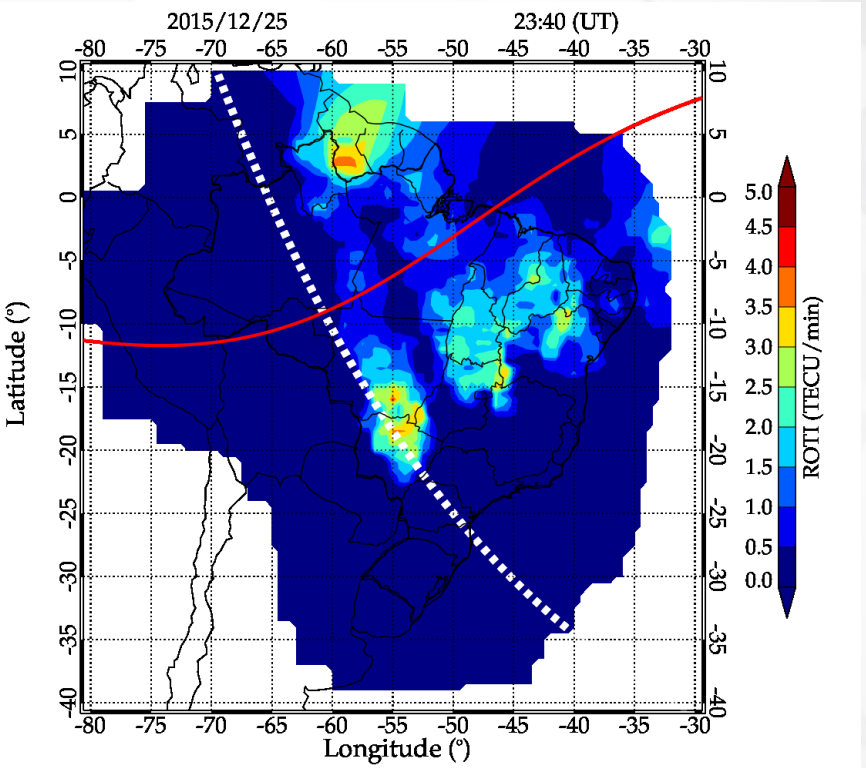
Ionospheric weather maps using the total electron content (TEC) monitored by ground based GNSS receivers over South American continent, TECMAP, have been operationally produced by INPE´s Space Weather Study and Monitoring Program.

Space Science Projects
Ionospheric Scales

DIX Maps for South America



ROTI Maps for Plasma Bubbles



The DIX is a parameter derived from the Total Electron Content Maps and intending to quantify the degree of perturbation of the ionosphere in different geomagnetic conditions. Our contribution is to develop and new approach for calculating the DIX in order to extent its representation of the ionospheric variability to cover the ionospheric response to both external and internal drivers.

This project aims to calculate the Rate Of change of the TEC Index (ROTI) to identify and continuously study the generation and evolution of ionospheric irregularities globally, depending on the availability and coverage of GNSS receptors. It is also possible to construct ROTI maps to estimate the global fluctuation activity and ionospheric irregularities dynamics.

Final Remarks

1) All the projects are currently ongoing
2) Several articles are being published related to these projects
3) Most of the articles, if not all of them, include international cooperations
4) The INPE are open to promote interaction among other scientific team to join our effort

Thank you!

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