The SIGMACast Project: A Bridge Between Data and Users

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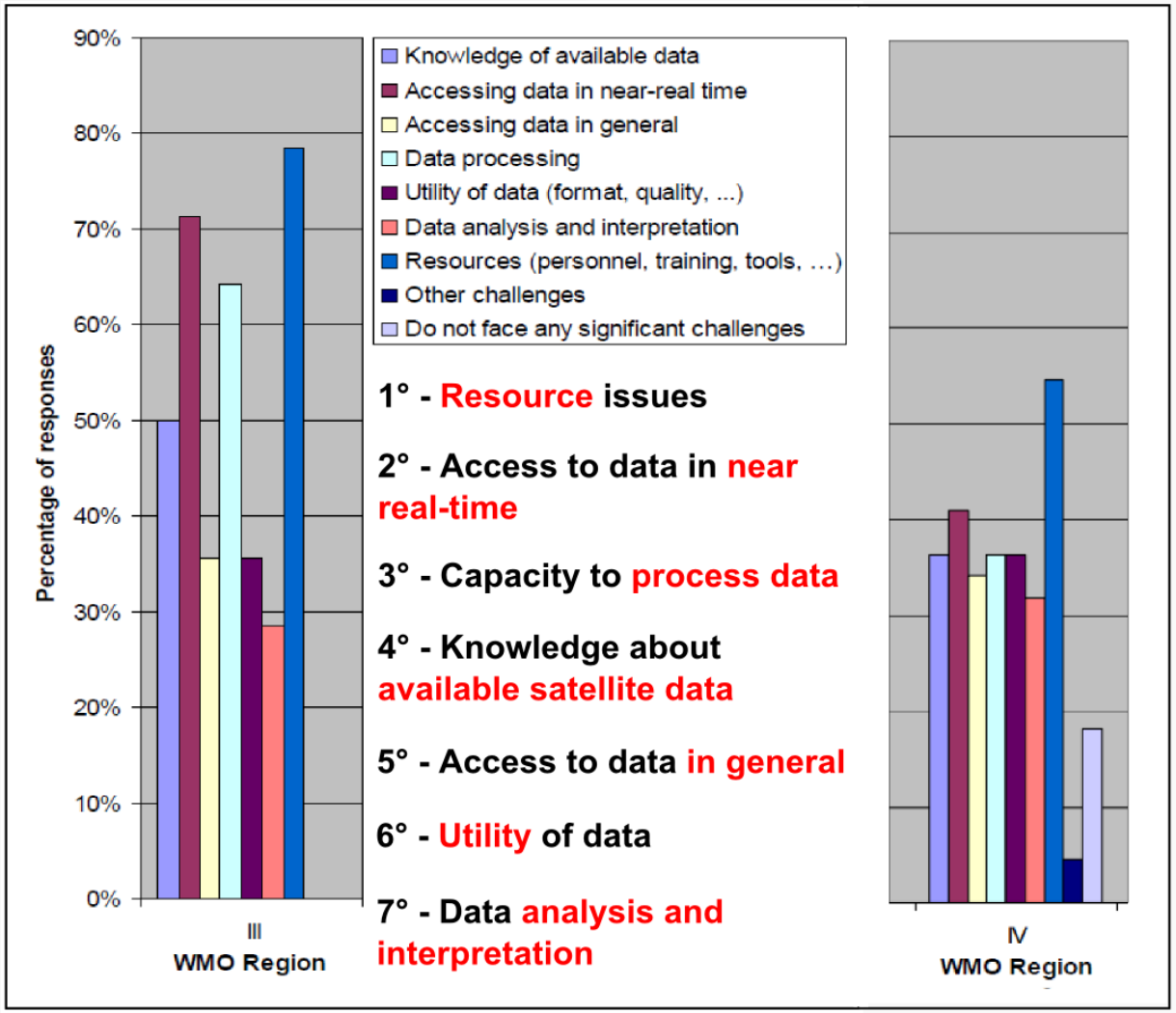
INPE - National Institute for Space Research
CPTEC - Center for Weather Forecasting and Climate Studies
DSA - Satellite and Environmental Systems Division

satelite.cptec.inpe.br

Presentation Outline

- The Challenge
- The Project
  - Low Cost Stations
  - Product Development
  - Training and Support
  - User Friendly Software
- The Future

WMO Survey: Challenges in The Use of Satellite Data



1° - **Resource** issues

2° - Access to data in **near real-time**

3° - Capacity to **process data**

4° - Knowledge about **available satellite data**

5° - Access to data **in general**

6° - **Utility** of data

7° - Data **analysis and interpretation**

Reference: http://www.wmo.int/pages/prog/sat/documents/SAT-PUB_SP-9-Survey-Report-2012.pdf

Presentation Outline

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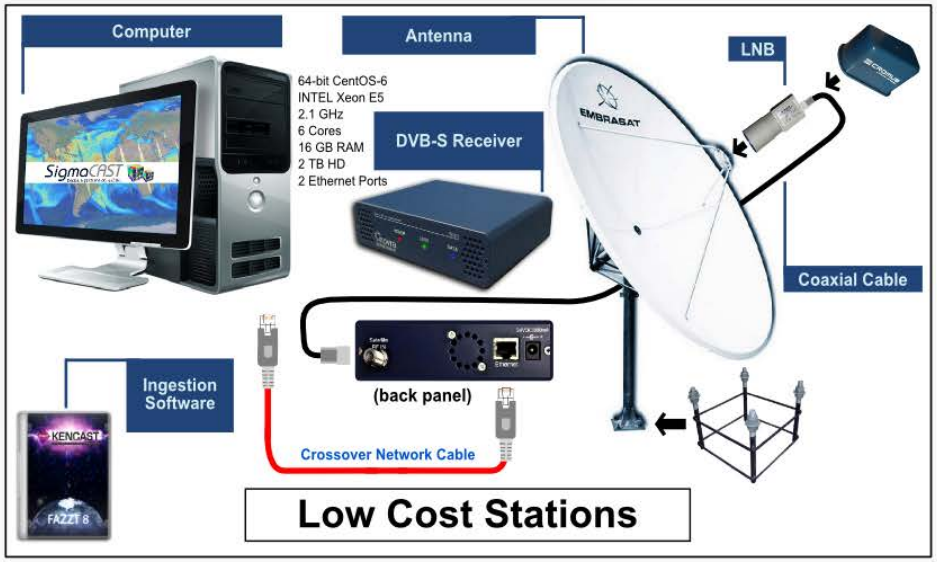
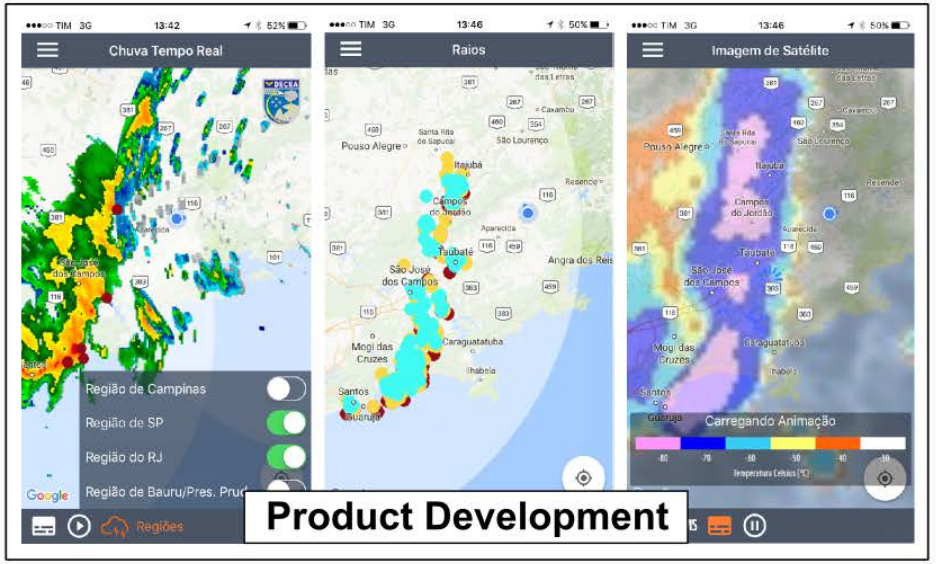
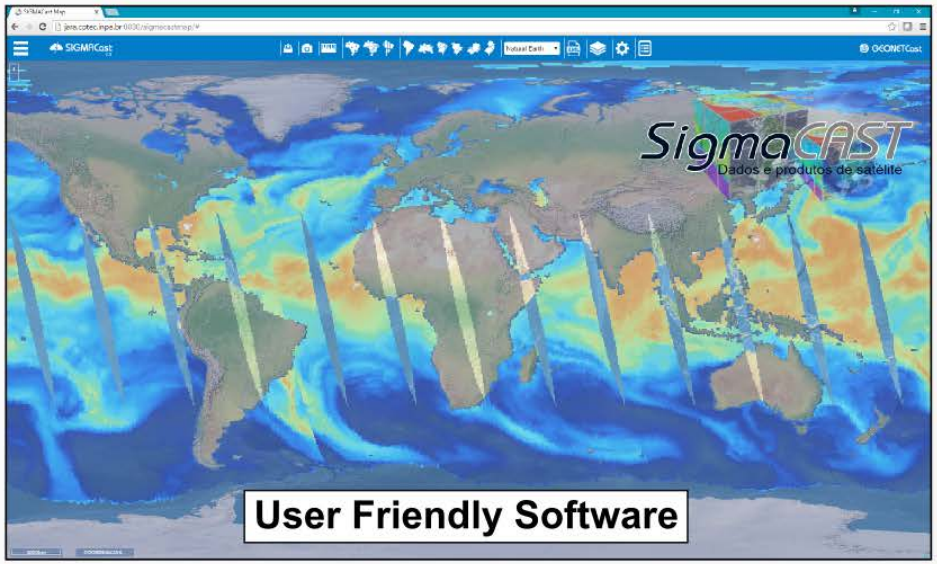
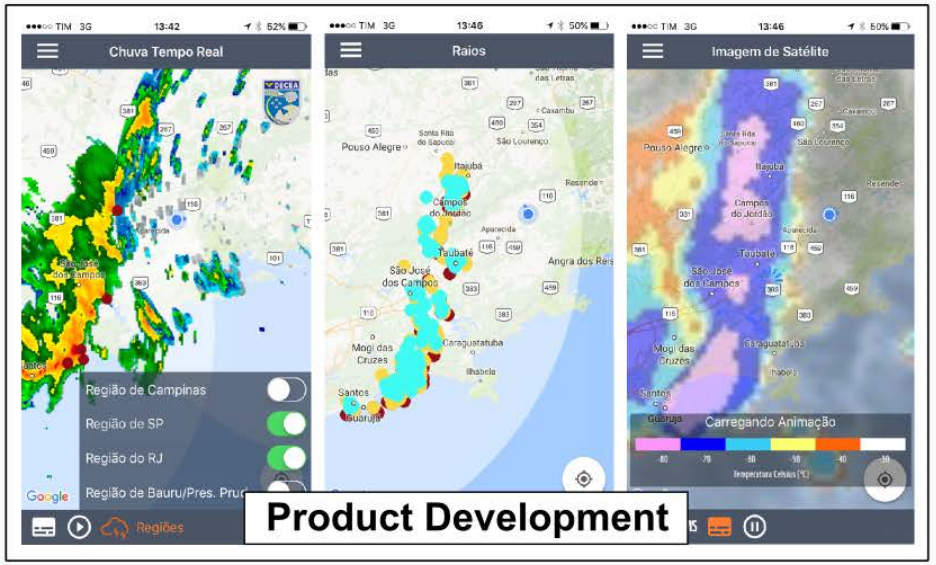
The Four Components of the SIGMACast Project

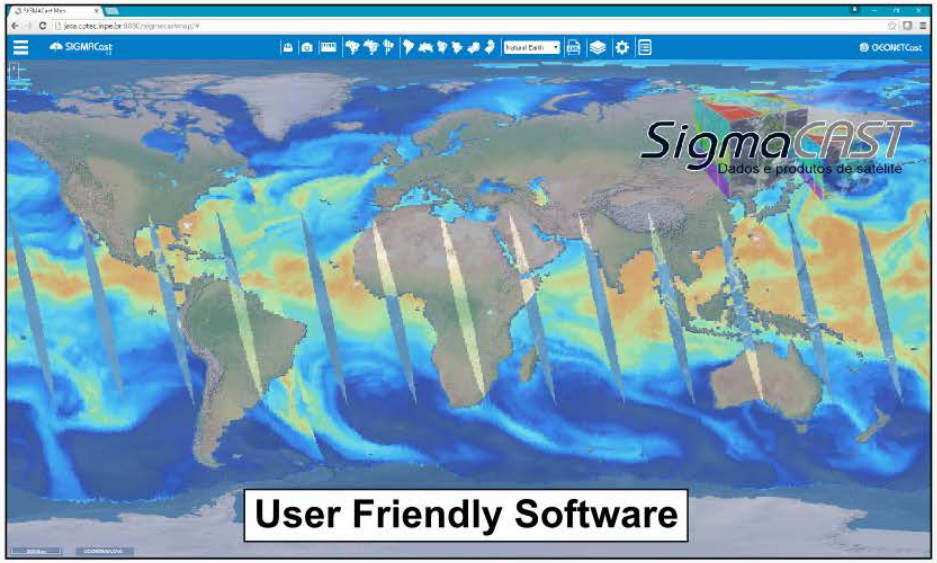






The Four Components of the SIGMACast Project





Low Cost GEONETCast-Americas Stations

Computer

64-bit CentOS-6
INTEL Xeon E5
2.1 GHz
6 Cores
16 GB RAM
2 TB HD
2 Ethernet Ports

Antenna

LNB

DVB-S Receiver

Coaxial Cable

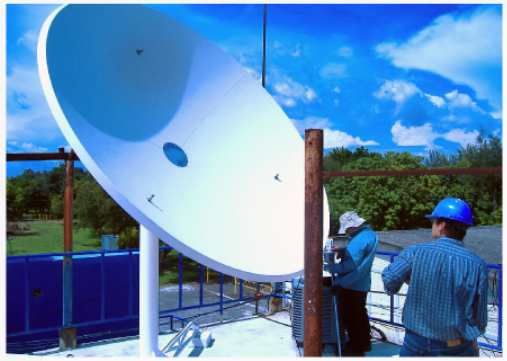
(back panel)

Ingestion Software

Crossover Network Cable

USD 5,000

GEONETCast: A Brief Definition



GEONETCast is a global network of sustained and cost-effective satellite-based dissemination systems. It delivers Earth observation (EO) data and products to the GEO (Group on Earth Observations) community activities, initiatives and flagships on a routine basis.

Group on Earth Observations

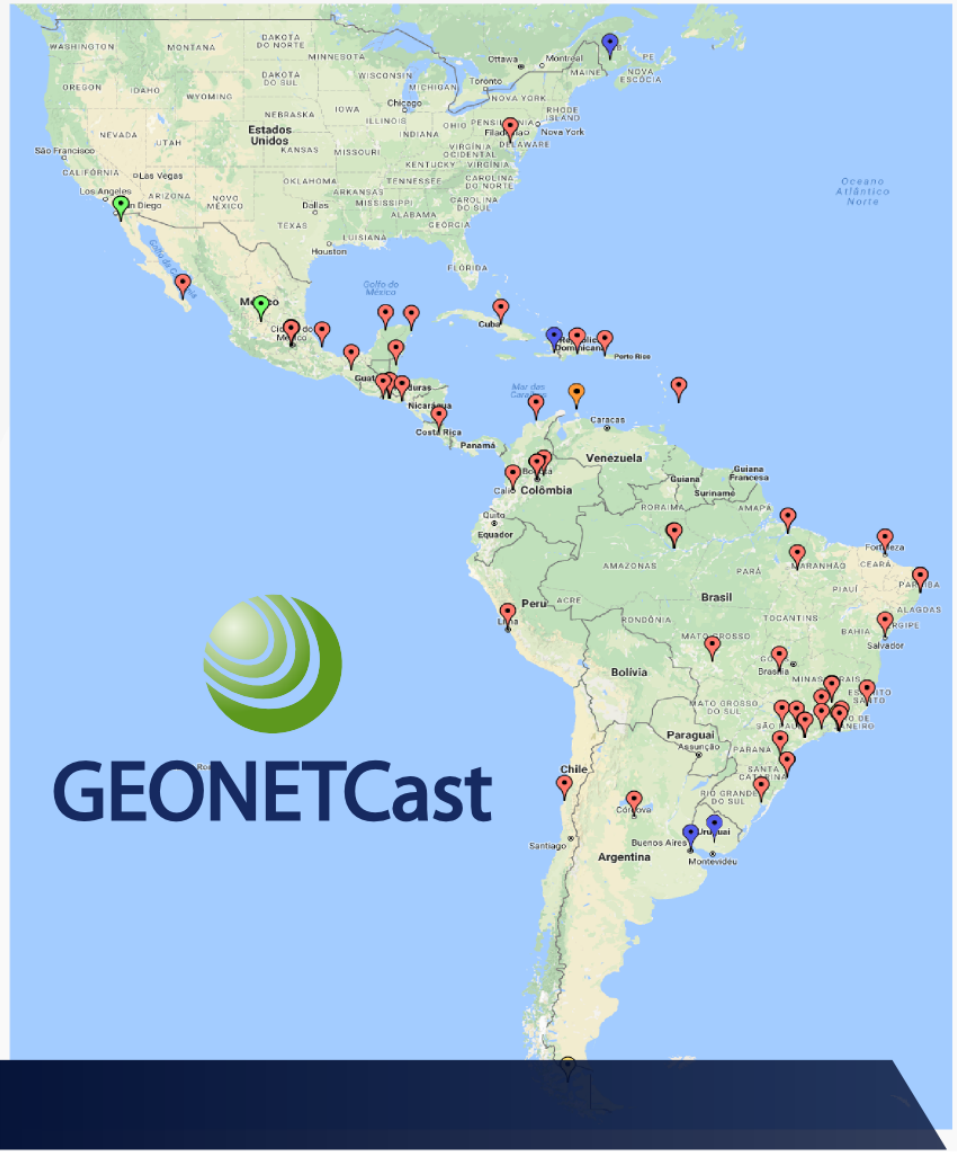
Ameri GEOSS

Implementing GEOSS in the Americas

MISSION: To strengthen international cooperation on global Earth Observation

www.earthobservations.org

GEONETCast-Americas: A Growing Community



Operational:

Argentina (1)
Barbados (1)
Belize (1)
Brazil (29)
Chile (1)
Colombia (5)
Costa Rica (3)
Cuba (1)
Dominican Rep. (1)
El Salvador (5)
Mexico (8)
Puerto Rico (1)
Panamá (1)
Peru (1)
USA (2)

Installing:

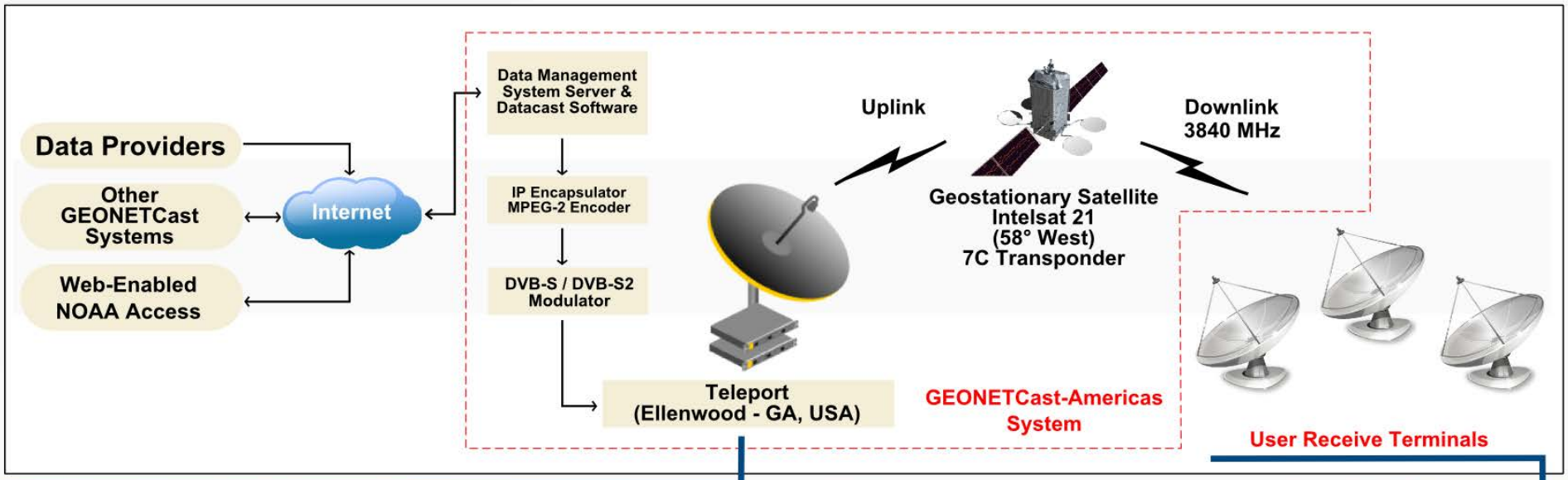
Argentina (2)
Brazil (1)
Canada (1)
Mexico (2)
Uruguay (1)

Planned:

Argentina (1)
Aruba (1)
Chile (1)
Costa Rica (1)
Peru (1)

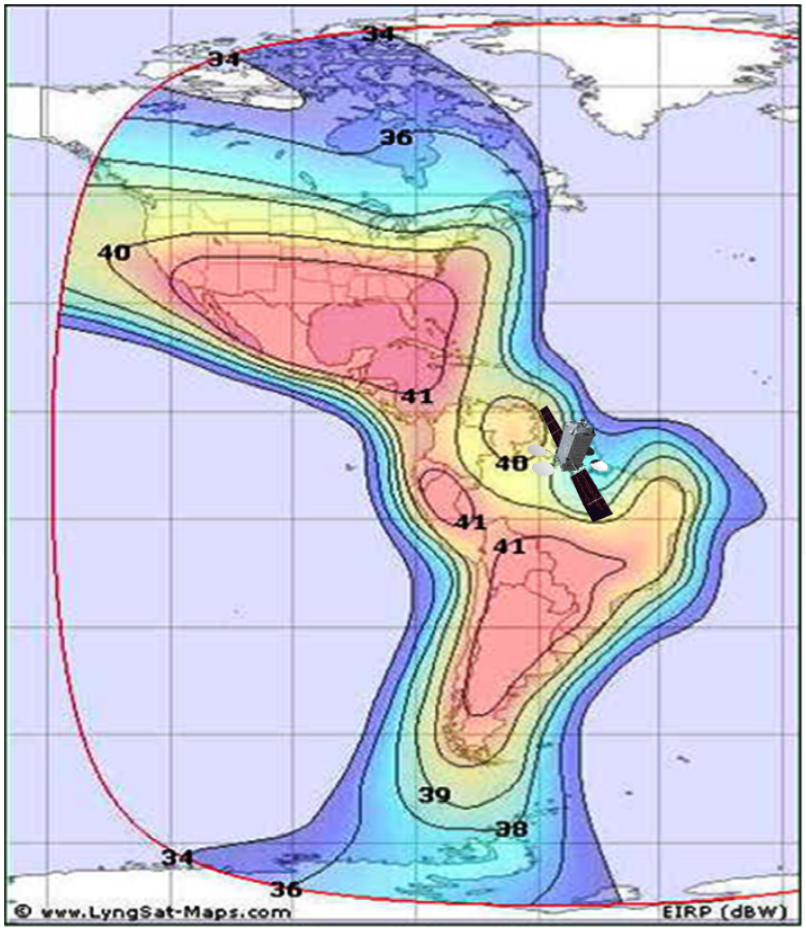
GEONETCast-Americas: A Growing Community

GEONETCast-Americas: System Architecture



GEONETCast-Americas: Coverage

Coverage



- Western Hemisphere component of GEONETCast.
- Provided by USA / NOAA.
- Coverage for North, Central, South Americas and the Caribbean.

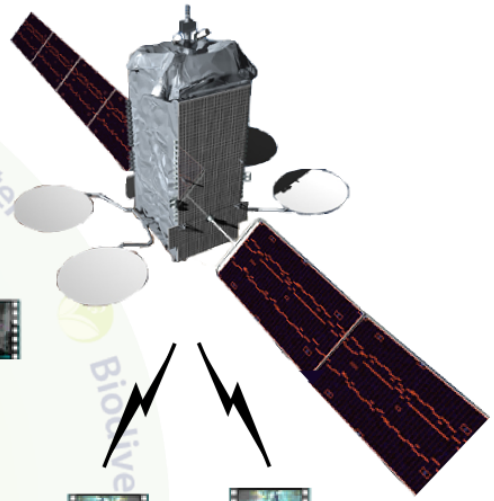
GNC-A
GEONETCast-Americas

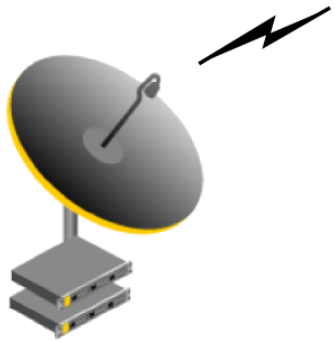
GEOSTATIONARY SATELLITE INTELSAT-21 (IS-21)	
Satellite Name:	INTELSAT-21 (IS-21)
Manufacturer:	Boeing Space Systems
Orbital Position:	58° West
GNC-A Transponder:	7C
West Hemisphere C-Band Beam:	43.3 dBW Peak
Polarization:	Linear - Vertical
Frequência de Downlink:	3.840 GHz
Symbol Rate:	27.69 MS/s
FEC (Forward Error Correction):	7/8
PID (Packet Identification):	4201

The values in red are used in the DVB-S receiver configuration

GEONETCast-Americas: Content

- **Product Broadcast Channels**
  - Separate broadcast channels by data provider
  - Users can choose channels they wish to receive
  - Training Channel included
  - Channel Priorization
- **Product formats**
  - More than 300 products
  - There is no restriction on the format of products

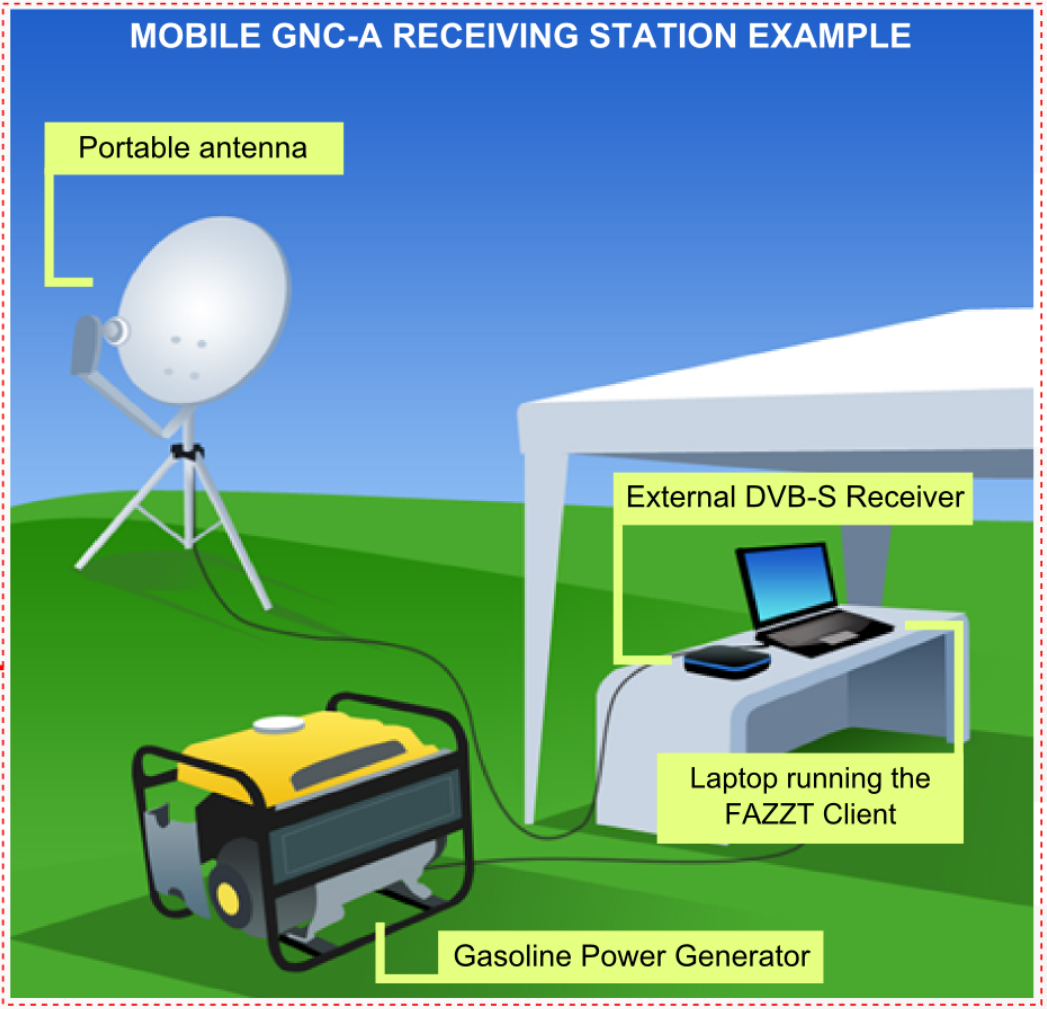




12 Mbps, 47 TB / year

Capabilites for Disaster Response

- Only need power for the computer and DVB-S receiver
- No internet connection needed
- Ability to add data to the GNC-A broadcast on a ad-hoc basis - no format restriction
- Ability to add data prepared within or outside of the region of interest
- GEONETCast-Americas approved for use as auxiliary data distribution systems by the International Charter "Space and Major Disasters"
- GEONETCast-Americas Stations can be portable!

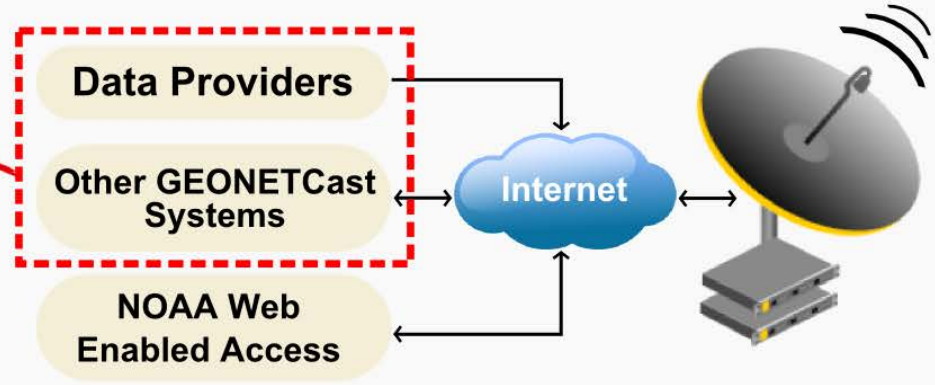


Capabilites for Disaster Response

GEONETCast-Americas: Ingestion Directory

/dados/fazzt

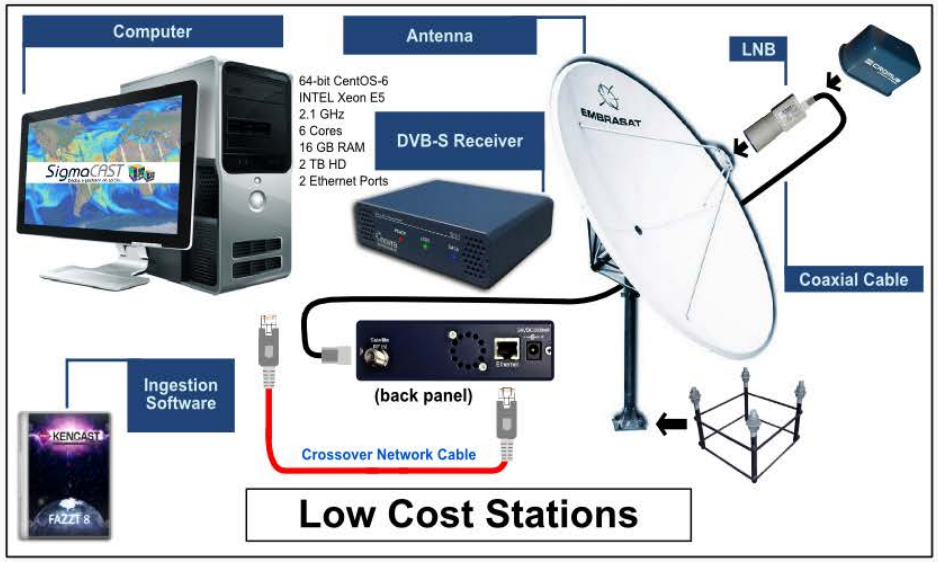
Name	Ext
..	
Alert	
CONAE	
EUMETSAT	
IMN-CostaRica	
INPE	
ISCS-ADMIN	
ISCS-ANLZ-CLIMATE	
ISCS-BUFR	
ISCS-FCAST	
ISCS-GRIB1	
ISCS-GRIB2	
ISCS-PIC	
ISCS-RADAR	
ISCS-SAT	
ISCS-SURFACE	
MARN-El Salvador	
MSG-0degree	
NOAA-NESDIS	
USEPA	
WMO-WMC-Washington	
Heartbeat.txt	

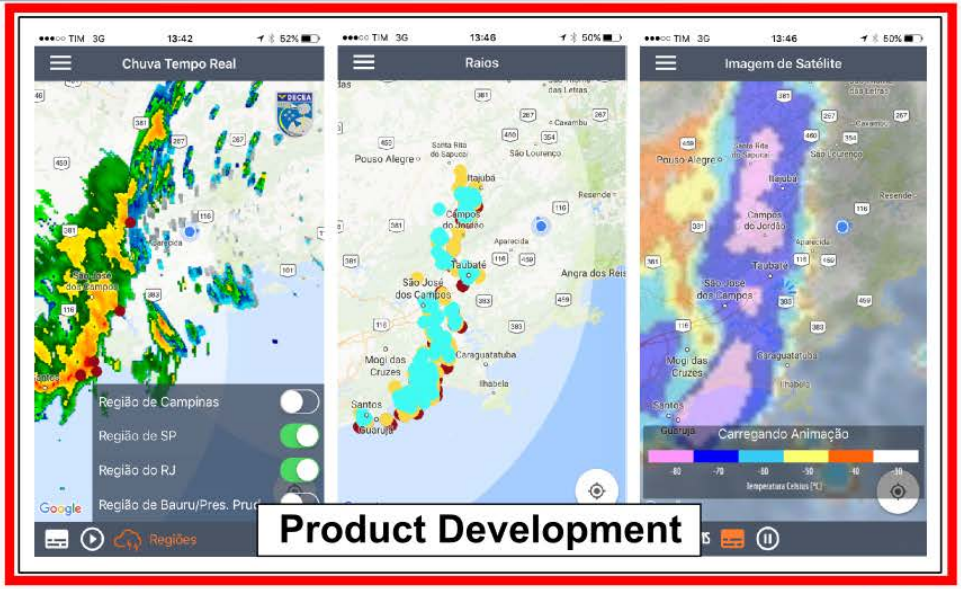


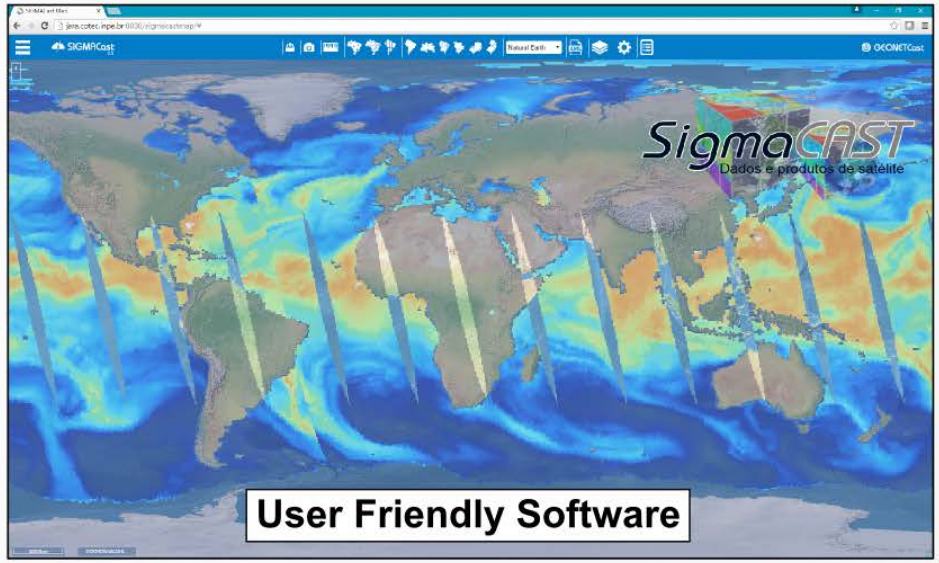
GNC-A
GEONETCast-Americas

MARN
Ministerio de Medio Ambiente y Recursos Naturales

The Four Components of the SIGMACast Project





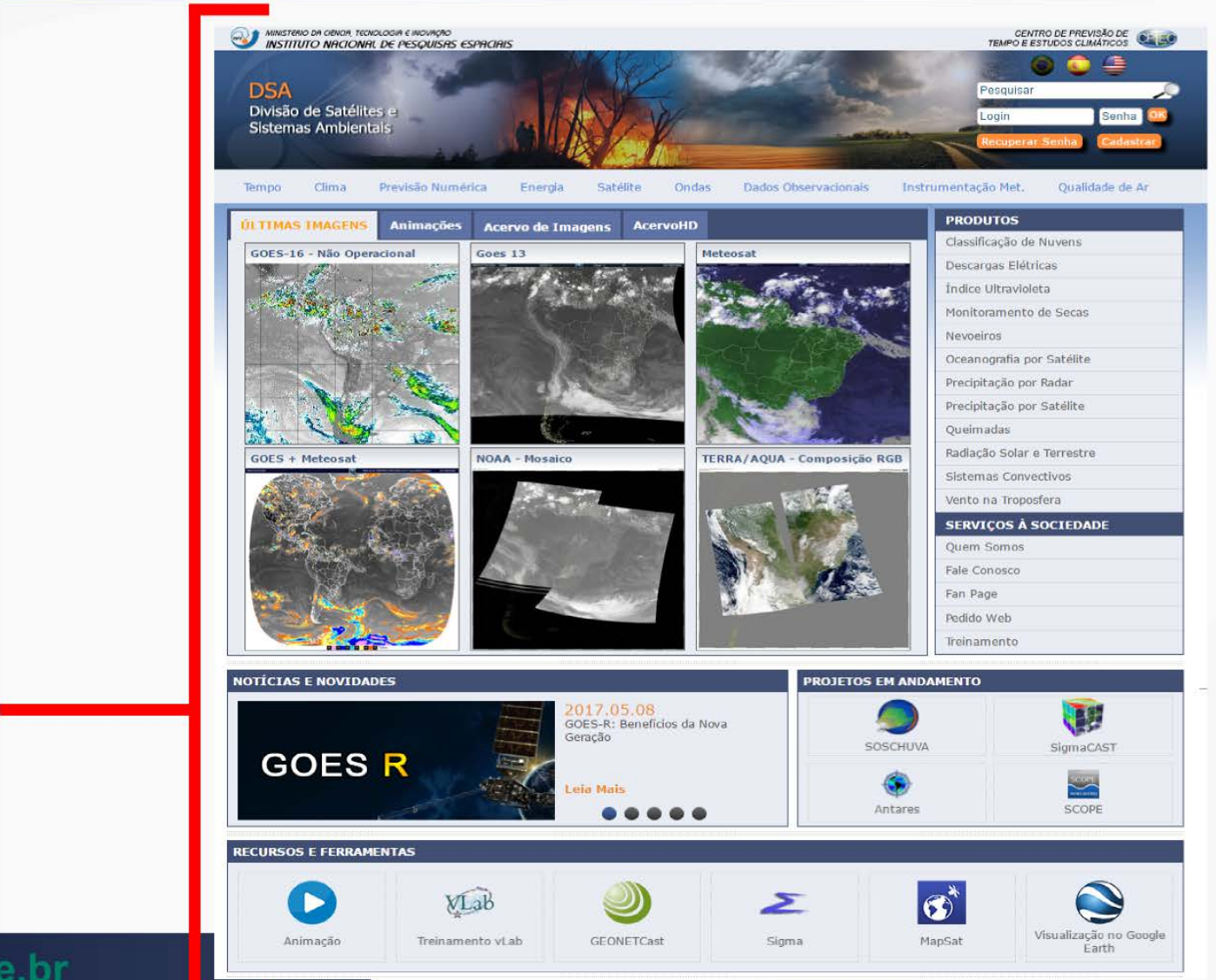


INPE as a Data Provider

- **Receive Stations at INPE**

S-NPP, TERRA, AQUA, MetOp-B, NOAA-18, NOAA-19, Landsat-8, Landsat-7, ResourceSat-2, CBERS-4, FENGYUN-3, GOES-13, MSG-10 (EUM-Terrestrial), GOES-16 (PDA, GNC-A)

INPE as a Data Provider



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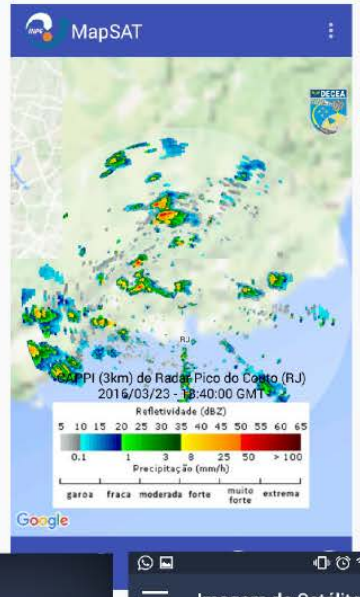
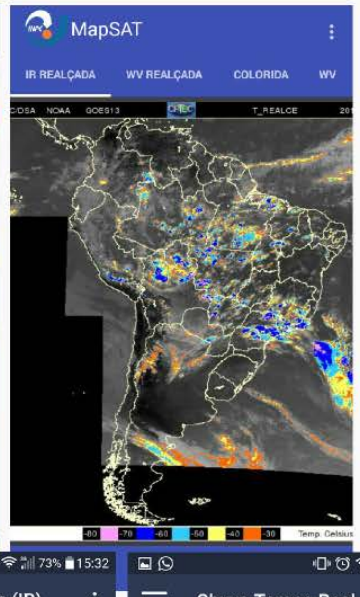
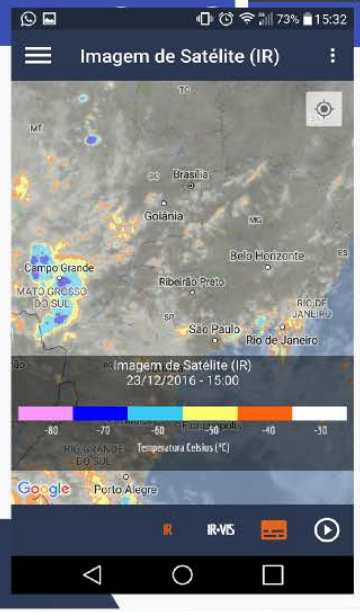
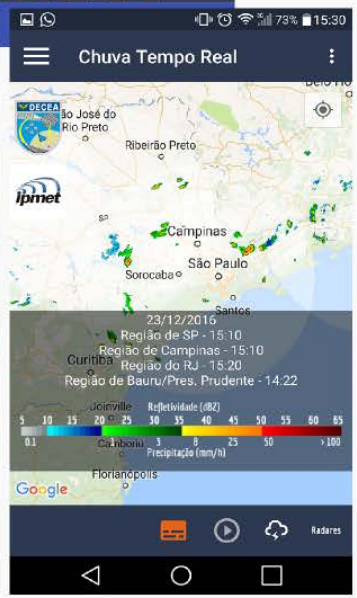
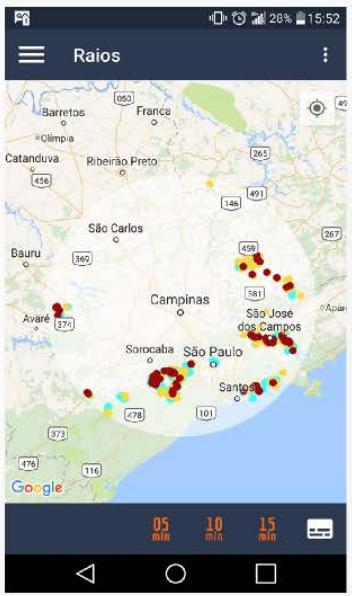
INPE as a Data Provider











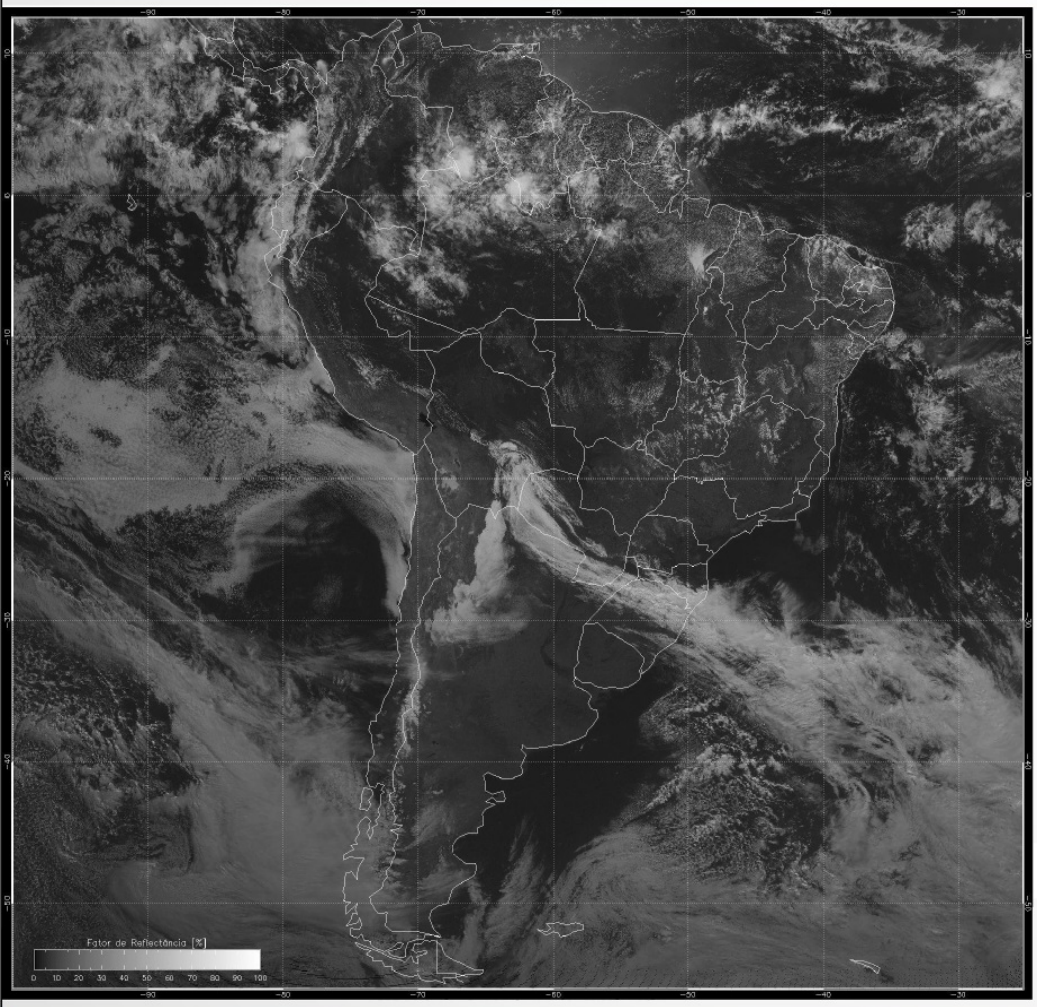
Category: Satellite Images

Product name: GOES-13 - Visible Channel - South America

SDR ID#: 1

Provider: INPE - National Institute for Space Research (Brazil)

Formats: JPEG / GeoTIFF | Average Sizes: 570 KB / 1900 KB | Frequency: 30 minutes | Max nº of received files a day: 48
GeoTIFF Pixel Info.: Albedo * 100 | Satellite: GOES-13 | Inst.: G-13 Imager | Chan.: 1 | WI: 0.52 to 0.71 µm, cent. at 0.63 µm
Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_SAV_YYYYMMDDHHMN



- General Description:

The visible channel is in the region of the electromagnetic spectrum where the sun emits most of it´s energy. That incoming energy is attenuated by molecules, clouds, and aerosols. About 50% of the incoming energy is either reflected or absorbed by the atmosphere and re-emitted to space. The remaining energy reaches the earth´s surface where it is either absorbed or reflected.

- Applications and Considerations:

- Clouds and earth surface detection
- Soil, water and cloud type sensing
- Haze, smoke, dust and fog monitoring
- Estimation of cloud heights through shadows
- Available daytime only

- GEOSS Societal Benefit Areas:

Agriculture | Biodiversity | Climate | Disasters
Ecosystems | Water | Weather

Category: Satellite Images

Product name: GOES-13 - Water Vapour Channel - South America

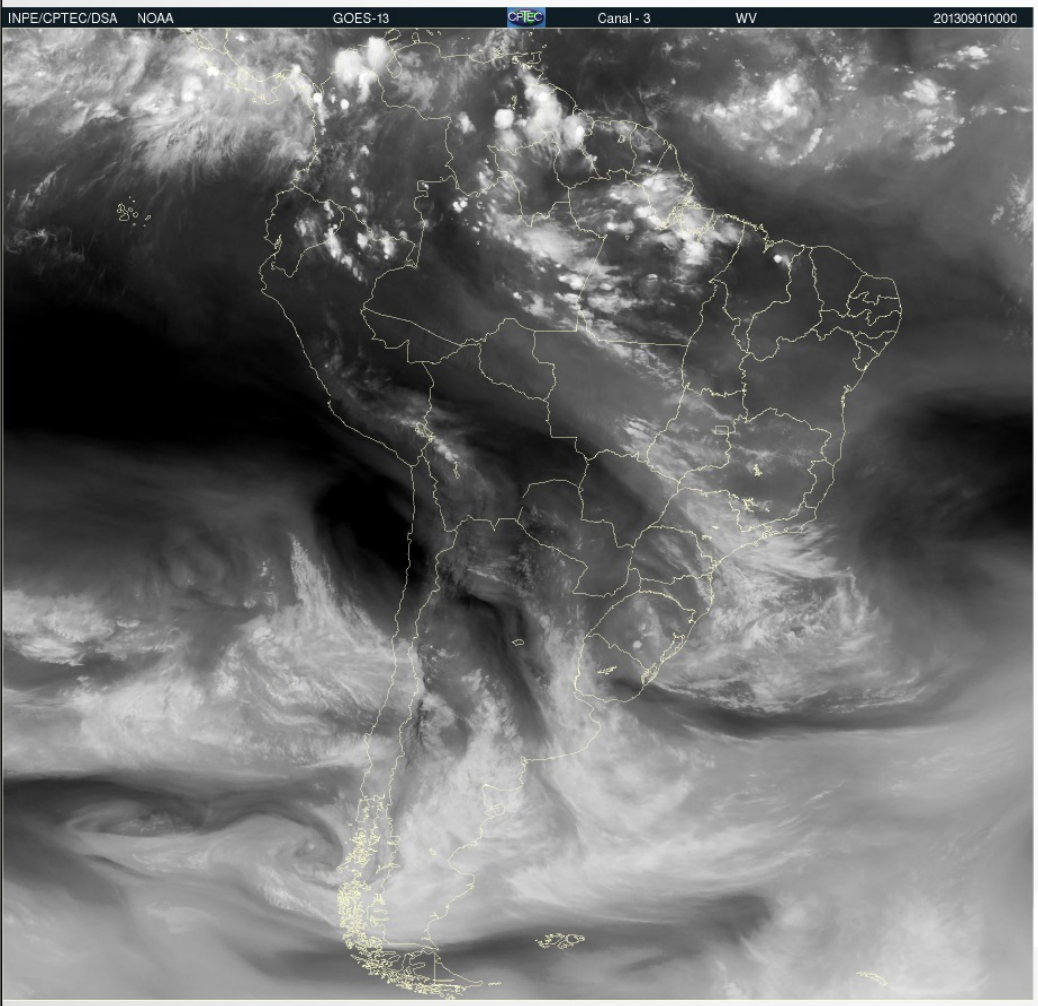
SDR ID#: 1

Provider: INPE - National Institute for Space Research (Brazil)

Formats: JPEG / GeoTIFF | Average Sizes: 570 KB / 1900 KB | Frequency: 30 minutes | Max nº of received files a day: 48

GeoTIFF Info.: B. Temp. (K) * 100 | Satellite: GOES-13 | Inst.: G-13 Imager | Chan.: 3 | WI: 5.77 to 7.33 µm, cent. at 6.5 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_SAW_YYYYMMDDHHMN



• General Description:

The infrared water vapour channel is located at 6.5 microns where the earth´s emitted spectrum is highly attenuated by water molecules. Thus, this channel senses radiation from the mid- and upper-levels of the atmosphere, from both water vapour and clouds. Because water vapour is transported by atmospheric circulations, it allows the detection of features in the mesoscale flow as well as hemispheric patterns.

• Applications and Considerations:

- Very sensitive to atmospheric moisture
- Shows variations in upper tropospheric moisture
- Typically senses upper half of the troposphere
  - Senses higher altitudes in moist regions
  - Senses lower altitudes in dry regions
- Useful for inferring atmospheric motion
- Atmospheric wave structures are very apparent; short waves are readily seen
- Demonstrates limb darkening or cooling effect
- Jet streaks detection
- Ortographically induced waves and associated clear-air turbulence detection
- Finer scale cloud structures detection
- Generation of water vapour motion winds

• GEOSS Societal Benefit Areas:

Agriculture | Climate | Ecosystems | Weather

Category: Satellite Images

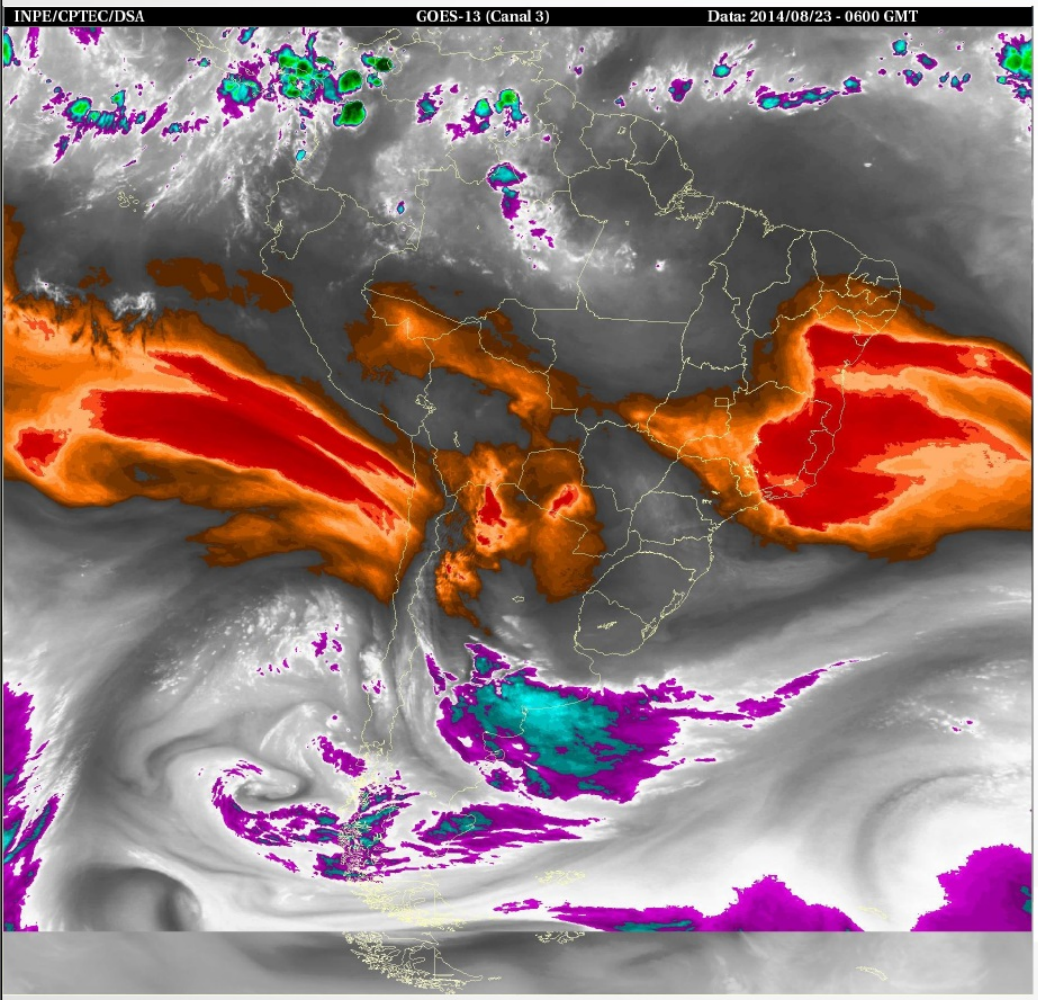
Product name: GOES-13 - Water Vapour Channel Enhanced - South America **SDR ID#: 1**

Provider: INPE - National Institute for Space Research (Brazil)

Formats: JPEG | Average Size: 2400 KB | Frequency: 30 minutes | Max nº of received files a day: 48

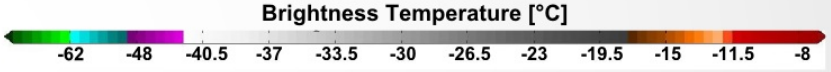
Satellite: GOES-13 | Instrument: GOES-13 Imager | Channel: 3 | Wavelength: 5.77 to 7.33 µm, cent. at 6.5 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_SWE_YYYYMMDDHHMN



• General Description:

While this image has the same information of the SAW product, the distinctive palette allows to indentify the brightness temperature as follows:



• Applications and Considerations:

- Very sensitive to atmospheric moisture
- Shows variations in upper tropospheric moisture
- Typically senses upper half of the troposphere
  - Senses higher altitudes in moist regions
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- Useful for inferring atmospheric motion
- Atmospheric wave structures are very apparent; short waves are readily seen
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• GEOSS Societal Benefit Areas:

Agriculture | Climate | Ecosystems | Weather

Category: Satellite Images

Product name: GOES-13 - Infrared Channel - South America

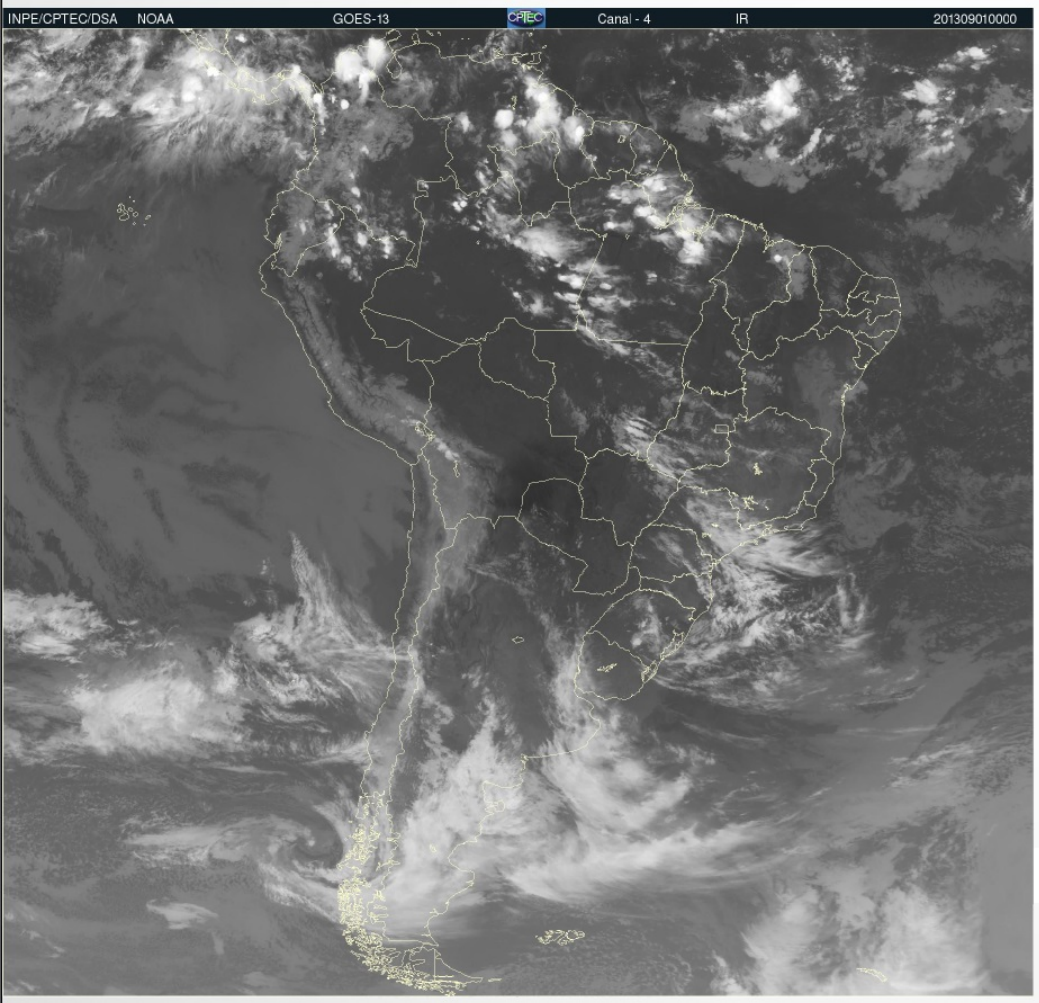
SDR ID#: 1

Provider: INPE - National Institute for Space Research (Brazil)

Formats: JPEG / GeoTIFF | Average Sizes: 570 KB / 1900 KB | Frequency: 30 minutes | Max nº of received files a day: 48

GeoTIFF Info.: B. Temp. (K) * 100 | Satellite: GOES-13 | Inst.: G-13 Imager | Chan.: 4 | WI: 10.2 to 11.2 µm, cent. at 10.7 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_SAI_YYYYMMDDHHMN



• General Description:

The longwave infrared window channel covers a portion of the atmospheric infrared window. At this wavelenght, energy radiated by the earth´s surface and clouds is not significantly attenuated by atmospheric gases. In this channel most surfaces and cloud types have an emissivity close to 1, with a notable exception being thin cirrus. Therefore, the brightness temperature sensed by the satellite is close to actual surface skin or cloud top temperature for scenes other than cirrus.

• Applications and Considerations:

- Surface and cloud top temperature sensing
- Storm intensity and rainfall estimation
- Cloud features tracking over time to estimate atmospheric motion

› Used in combination with the 12 µm channel (GOES 8~11/R):
  - Low-level moisture estimation, sea surface temperature, and volcanic ash detection

› Used in combination with the 3.9 µm shortwave channel:
  - Cloud phase estimation, fog and snow stratus detection and water cloud vs. snow cover detection

• GEOS Societal Benefit Areas:

Agriculture | Climate | Ecosystems | Energy
Water | Weather

Category: Satellite Images

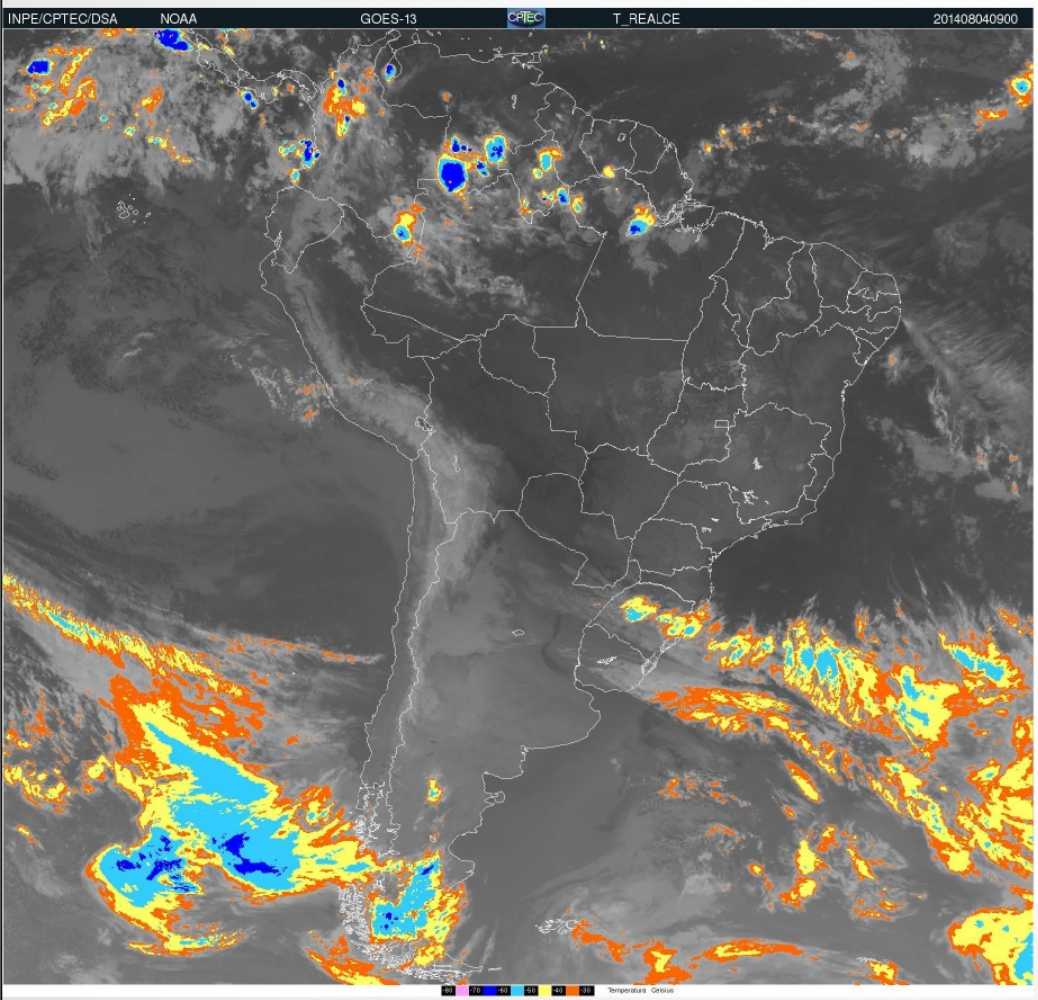
Product name: GOES-13 - Infrared Channel Enhanced - South America **SDR ID#: 1**

Provider: INPE - National Institute for Space Research (Brazil)

Formats: JPEG | Average Sizes: 400 KB | Frequency: 30 minutes | Max nº of received files a day: 48

Satellite: GOES-13 | Instrument: GOES-13 Imager | Channel: 4 | Wavelength: 10.2 to 11.2 µm, centered at 10.7 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_SAE_YYYYMMDDHHMN



• General Description:

While this image has the same information of the SAI product, the distinctive palette allows to indentify clouds with temperature below -30ºC. Blue and light purple represents the lowest temperatures (-70ºC and -80ºC) while orange and yellow the closest to the mentioned threshold (-40ºC and -30ºC), as follows:

• Applications and Considerations:

- Used to enhance convective systems.
- Cloud height estimation: The temperature in the troposphere decreases with height, so high level clouds are colder than low level clouds.
- Cloud type detection.
- Potential precipitation detection.

• GEOSS Societal Benefit Areas:

Agriculture | Climate | Ecosystems | Energy
Water | Weather

Category: Satellite Images

Product name: GOES-13 + METEOSAT-10 - Infrared Channel - South America and Africa **SDR ID#: 1 / 5**

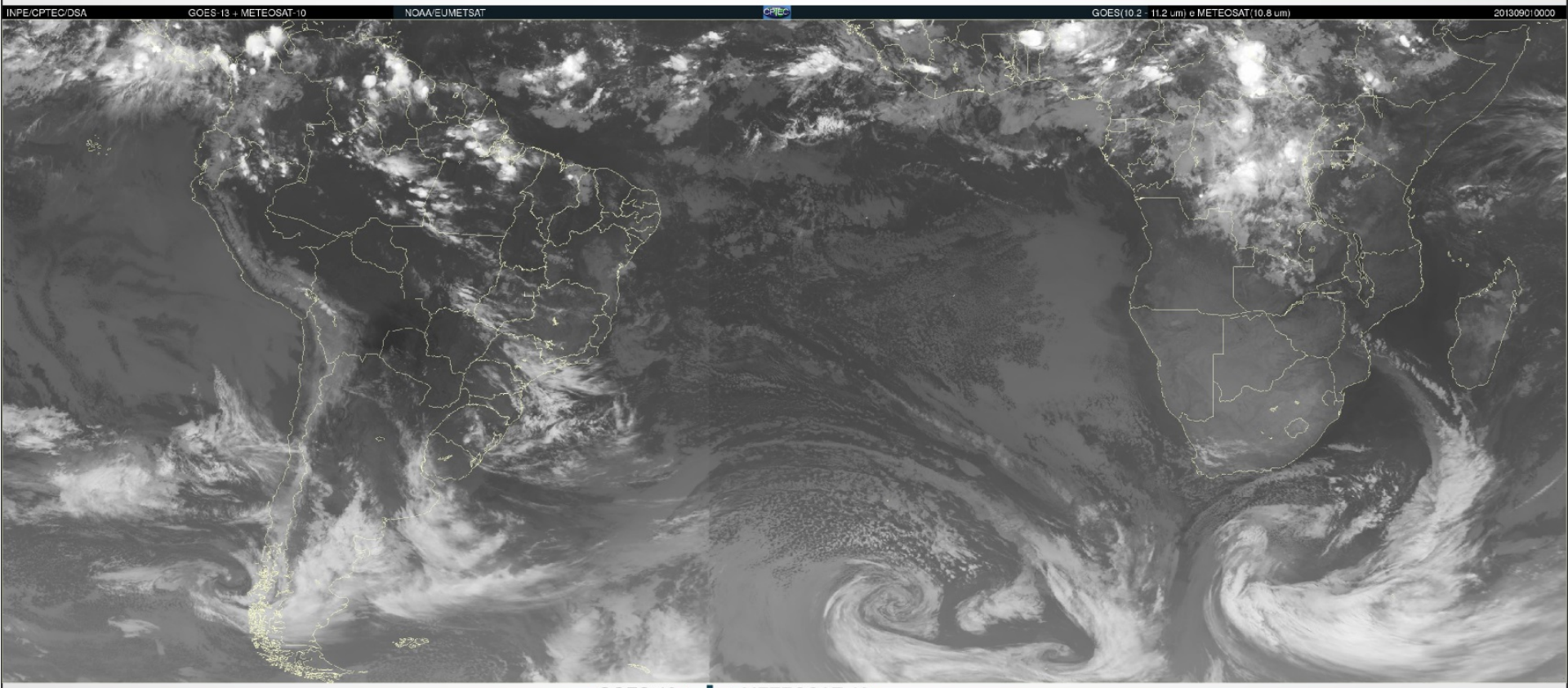
Provider: INPE - National Institute for Space Research (Brazil)

Formats: JPEG / GeoTIFF | GeoTIFF: Temp. (K) * 100 | Av. Sizes: 730 KB / 6.6 MB | Freq.: 30 min | Max nº of files a day: 48

Satellite 1: GOES-13 | Instrument: GOES-13 Imager | Channel: 4 | Wavelength: 10.2 to 11.2 µm, centered at 10.7 µm

Satellite 2: METEOSAT-10 | Instrument: SEVIRI | Channel: 9 | Wavelength: 9.80 to 11.80 µm, centered at 10.8 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_GMC_YYYYMMDDHHMN



GOES-13 ⟷ METEOSAT-10

GOES-13 Spatial Extent
Latitude: 12.52º N to 56º S
Longitude: 100º W to 30º W

• METEOSAT-10 Spatial Extent
Latitude: 12.52º N to 56º S
Longitude: 30º W to 55º E

• Total Spatial Extent
Latitude: 12.52º N to 56º S
Longitude: 100º W to 55º E

• Algorithm Methodology
Both channels are interpolated to a regular grid of 4x4 km spatial resolution using the Nearest Neighbor Algorithm.

GEONETCast *Delivering Environmental Data to Users Worldwide*

Category: Cloud Drift Winds

Product name: Wind Chart - Visible / Near Infrared / Water Vapour / Infrared

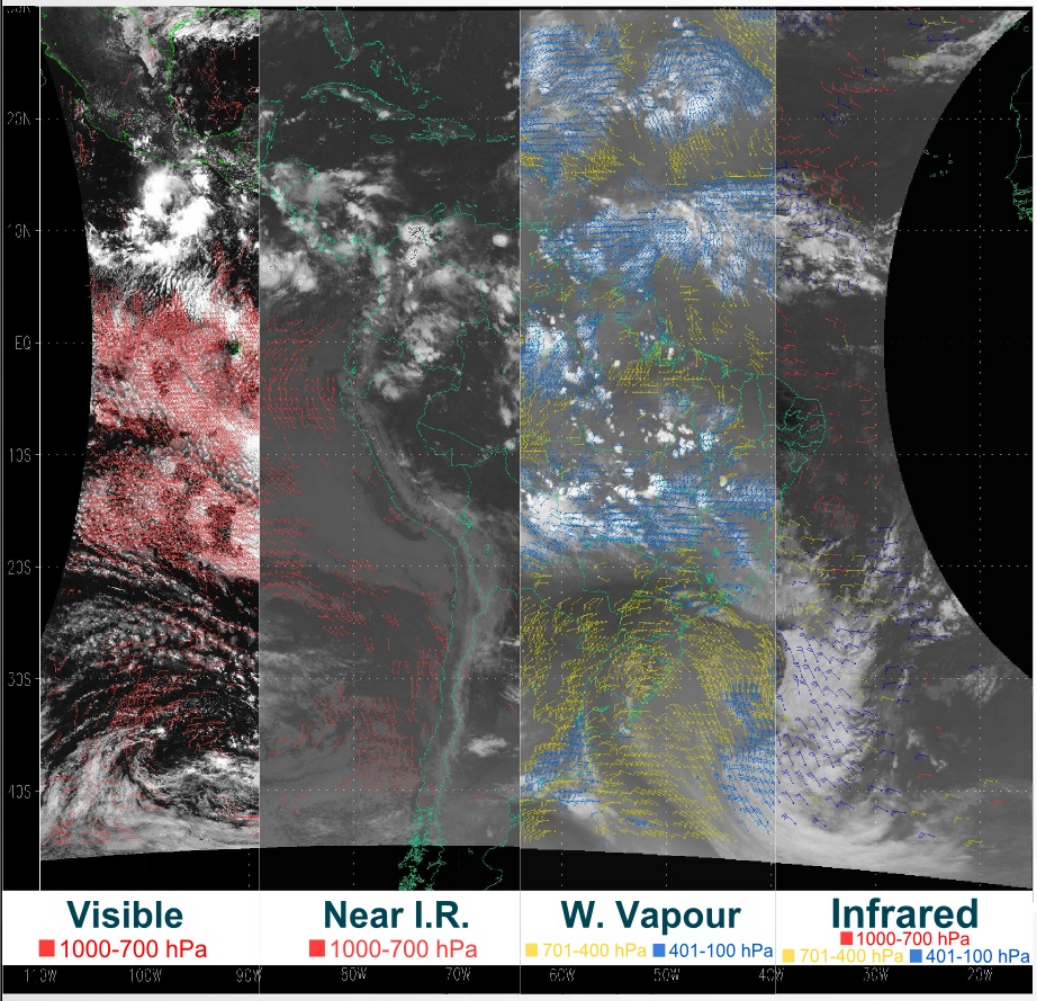
SDR ID#: 8

Provider: INPE - National Institute for Space Research (Brazil)

Format: JPEG | Average Size: 1400 KB / 850 KB / 1200 KB / 1000 KB | Freq. 60 min. | Max nº of files a day, per product: 24

Satellite: GOES-13 | Instrument: GOES-13 Imager | Channels: 1, 2, 3 and 4 | Wavelengths: 0.63 µm / 3.9 µm / 6.5 µm / 10.7 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_GWV / GWN / GWW / GWI



• General Description:

For wind calculation the model estimates the vectors automaticaly, using the Euclidean distance, traversing the calculation field following a spiral pattern. The basic calculation area is a 32x32 pixel region which calculates the smallest Euclidean distance in a 96x96 pixel window. The spiral calculus allows a significantly optimized calculation. By obtaining the best displacement, the correlation between the two segments is calculated in order to analyze the accuracy of the estimation.

- **Visible Channel:**

Estimates winds at low levels (701-1000 hPa) at daytime

- **Near Infrared Channel:**

Estimates winds at low levels (701-1000 hPa) at nighttime

- **Water Vapour:**

Estimates winds at middle and high levels (100-400/401-700 hPa)

- **Infrared Channel:** Estimates winds at all levels (low levels with low precision)

• Applications and Considerations:

Wind fields obtained through clouds displacement observed in geostationary satellite images are an important tool to produce valuable observations for assimilation in atmospheric general circulation models and an important information source for numerical weather prediction models, synoptic analysis of the atmospheric circulation, mass flow estimation and cloud systems evolution monitoring.

• GEOSS Societal Benefit Areas:

Agriculture | Climate | Disasters | Ecosystems
Water | Weather

Category: Weather Forecast

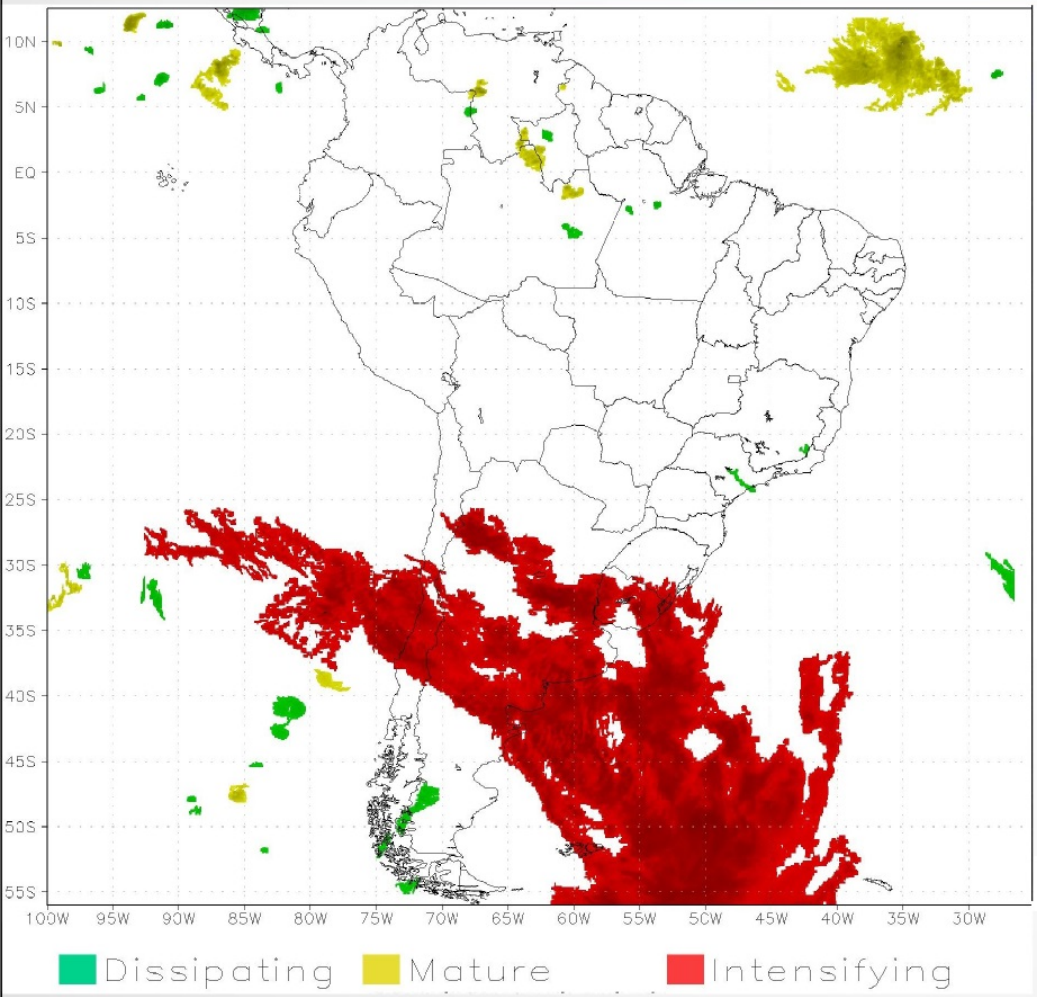
Product name: **Forecast and Tracking the Evolution of Cloud Clusters - ForTraCC** **SDR ID#: 20**

Provider: INPE - National Institute for Space Research (Brazil)

Format: JPEG | Average Size: 430 KB | Frequency: 30 minutes | Max nº of received files a day: 48

Satellite: GOES-13 | Instrument: GOES-13 Imager | Channel: 4 | Wavelength: 10.2 to 11.2 µm, centered at 10.7 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_FTC_YYYYMMDDHHMN



• General Description:

The ForTraCC (Forecast and Tracking the Evolution of Cloud Clusters) is an application software that focuses on the determination of trajectories and life-cycle of the mesoscale convective systems (MCS) with estimates of up to 2 hours (short term predictions) . The application makes use of images from the GOES satellite in the thermal longwave infrared channel. The study of trajectories and life cycle of MCS is based primarily on detection of them, through the threshold of brightness temperature (235 K and 210 K) and an area minimum of overlap between systems found in successive images.

Colours correspond to life stage:
- RED is intensifying
- YELLOW is unchanged
- GREEN is de-intensifying

• Applications and Considerations:

This product is used to obtain the temporal evolution and trajectory of the convective systems, which are generally associated with intense rainfall and gusts of wind. ForTraCC allows tracking of convective systems and forecasts their evolution.

• GEOSS Societal Benefit Areas:

Agriculture | Climate | Disasters | Energy
Water | Weather

Category: Precipitation

Product name: Instantaneous Precipitation - South America

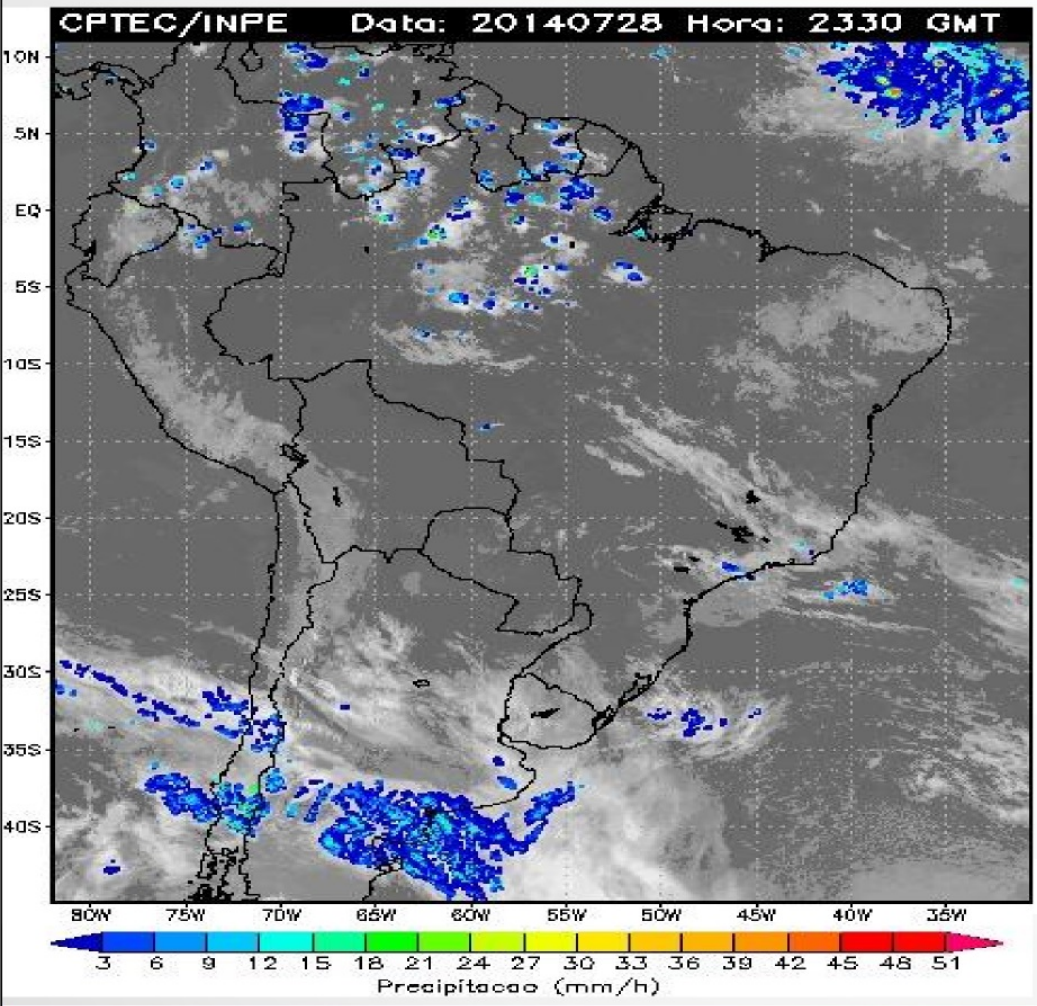
SDR ID#: 21

Provider: INPE - National Institute for Space Research (Brazil)

Formats: JPEG / GeoTIFF | Average Sizes: 110 KB / 30 KB | Frequency: 30 minutes | Max nº of received files a day: 48

GeoTIFF Pixel Information: 0-255 (8 bits) | Data Input: GOES-13 imagery (Cloud top brightness temperature)

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_RFS_YYYYMMDDHHMN



• General Description:

This product comprises the instantaneous convective rainfall estimates, based on GOES infrared images, for the South America region. The estimation is based in the adjusted hydroestimator methodology from South America, using INPE informations about precipitated water, relative humidity and winds (output of the Regional Model for Weather Forecast "ETA Model"). The Hydroestimator is a fully automatic method that uses an empirical exponential relationship between precipitation rate and brightness temperature of the top of the clouds (from the infrared channel of the satellite GOES-13), generating rates of precipitation in real time. The trend of temperature of the cloud (and the texture information) is used to adjust the area covered by precipitation. Variables such as precipitable water, humidity, topography, parallax and a level adjustment of balance for convective events, hot tops (Scofield 2001) are used to automatically adjust the rate of precipitation. The empirical correlation curve between cloud top bright temperatures and the precipitation rate was derived from rain monitoring using surface meteorological radars in the USA.

• Applications and Considerations:

The objective of the RFS product is to estimate the precipitation rate associated to convective clouds. This product provides to forecasters complementary information to other products related to rain and convection monitoring.

• GEOSS Societal Benefit Areas:

Agriculture | Climate | Disasters | Energy
Health | Water | Weather

Category: Oceanography

Product name: Sea Surface Temperature - South America

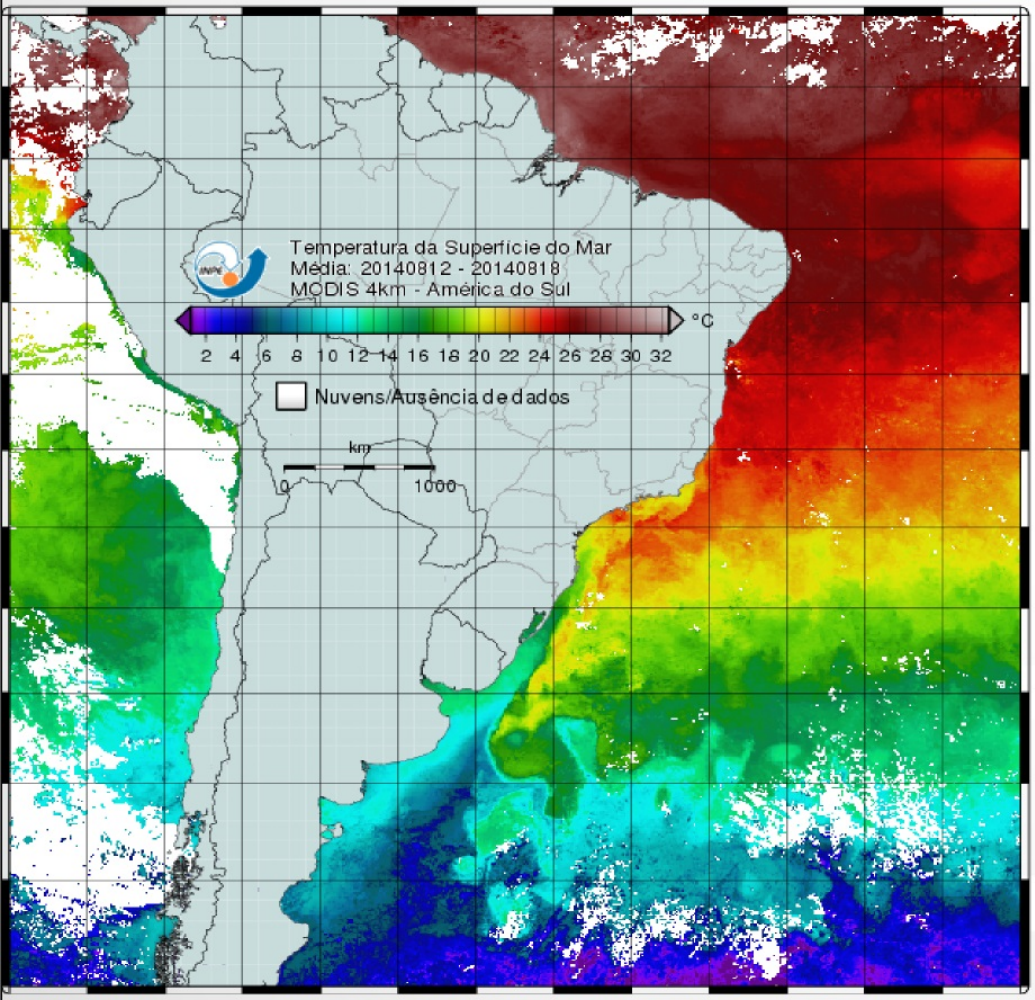
SDR ID#: 28

Provider: INPE - National Institute for Space Research (Brazil)

Format: PNG | Average Size: 650 KB | Frequency: 24 Hours | Max nº of received files a day: 1

Satellite: AQUA | Instrument: MODIS | Channels / Bands used: 31 (10.3-11.3 µm) / 32 (11.5-12.5 µm)

Type: Image | Projection: Rectangular | Resolution: 1x1 km | Naming Convention: INPE_SST_YYYYMMDDHHMN



• General Description:

The general theory of radiative transfer can be used to estimate the surface temperature of nearly any black body given its emmited radiation. In the thermal infrared range of the electromagnetic spectrum, the ocean may be considered a black body and its emmited radiation, or excitance, can be approximated to the Planck's radiator (KAMPEL, 2003), so that the body temperature may be estimated. TSM-AQUA data is estimated by the MODIS sensor aboard the Aqua satellite. The SST is estimated by this sensor similarly to the AVHRR sensor, having the thermal infrared channels in the 11 and 12 µm bands, as in the NOAA satellite. As an advantage over AVHRR, the MODIS sensor has three channels more (3 ~ 4 µm), providing better detection of clouds in nighttime algorithm. The raw data is radiometrically calibrated to generate values of albedo and brightness temperature related to marine surface imaged. Areas with intense cloudiness or low satellite elevation angles (37°) are discarded. Atmospheric correction algorithms are applied to each image before calculating the TSM. The cloud masking is done by the SEADAS software, and the TSM is estimated using a split-window algorithm.

• Applications and Considerations:

This product is used for the detection of mesoscale features, ocean fronts, numerical models input (oceanic and atmospheric), analysis of climate variability and calculation of heat fluxes between the ocean and the atmosphere.

• GEOSS Societal Benefit Areas:

Biodiversity | Climate | Water | Weather

Category: Oceanography

Product name: Sea Surface chlorophyll - South America

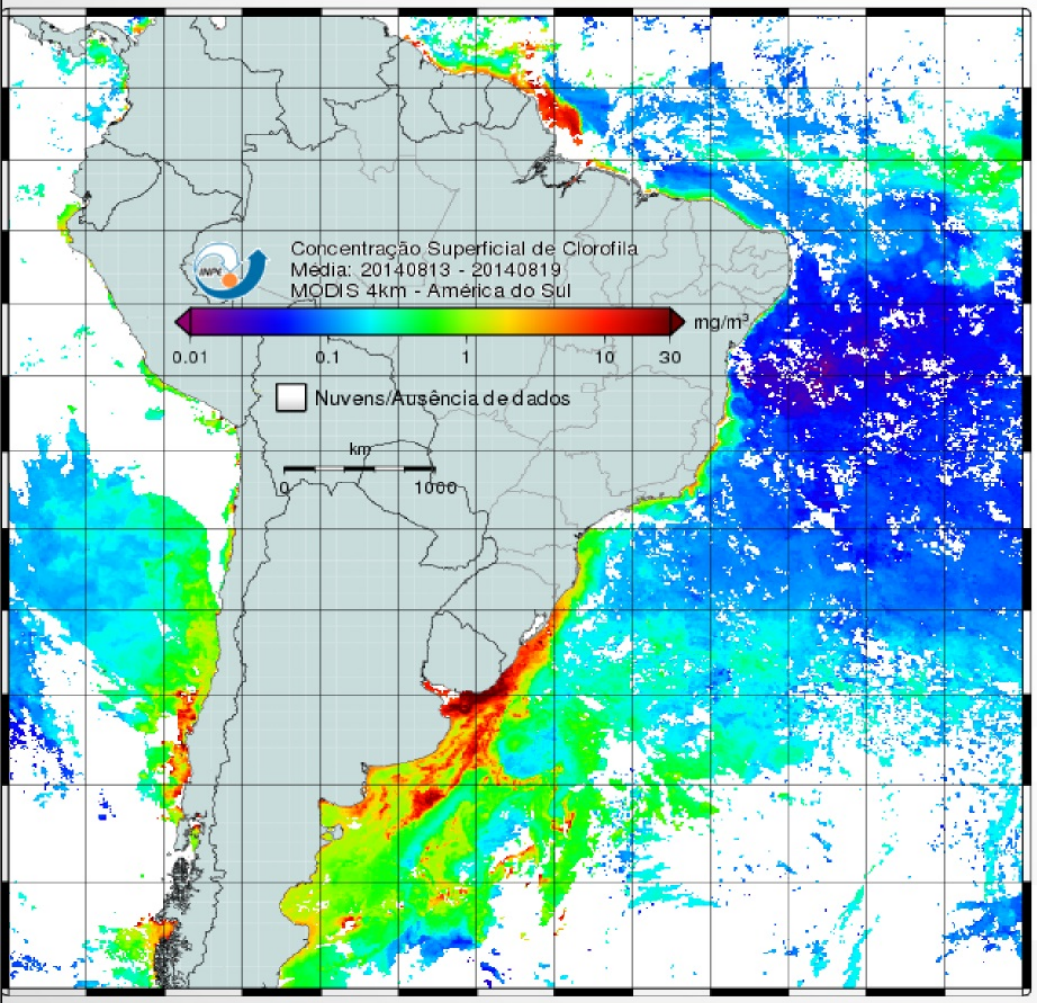
SDR ID#: 45

Provider: INPE - National Institute for Space Research (Brazil)

Format: PNG | Average Size: 500 KB | Frequency: 24 Hours | Max nº of received files a day: 1

Satellite: AQUA | Instrument: MODIS | Channels / Bands used: Channels 8 to 16 (412 nm to 869 nm)

Type: Image | Projection: Rectangular | Resolution: 1x1 km | Naming Convention: INPE_SSC_YYYYMMDDHHMN



• General Description:

According to Kampel (2003), the color of the ocean in natural environments results from solar energy backscattered from the surface and volume of the body of water. The dark blue of the open ocean and oligotrophic waters is the result of selective absorption and scattering of pure water with low concentration (or absence) of phytoplankton and other optically active substances. With a higher entry of nutrients in the aquatic system, usually near the coast, a natural development of higher concentrations of fitoplankton with consequent change from the blue color to green occurs. The greater the amount of sediments or dissolved material in the aquatic environment, ocean color changes to yellow-brown, reaching red in certain circumstances. These colors perceived by the human eye can be quantified by measurements of the spectral distribution of the ascending radiance by sensors placed aboard satellites. This product data is estimated from the MODIS sensor aboard the AQUA satellite. Nine bands of that sensor, in the visible and near infrared range (between 412 nm and 869 nm) have high sensitivity for ocean color studies (Barnes et al., 2003). The raw data from the sensor is calibrated radiometrically to generate normalized radiance values related to sea surface. The SSC is obtained by applying the standard NASA OC3M algorithm (O'Reilly et al. 2000) which relates ratios of bands to the SST through a fourth degree polynomial function.

• Applications and Considerations:

Detection of mesoscale features, ocean fronts, numerical models input (oceanic and atmospheric), analysis of climate variability and quantification of primary productivity (associated with phytoplankton).

• GEOSS Societal Benefit Areas:

Biodiversity | Climate | Water | Weather

Category: Cloud Classification

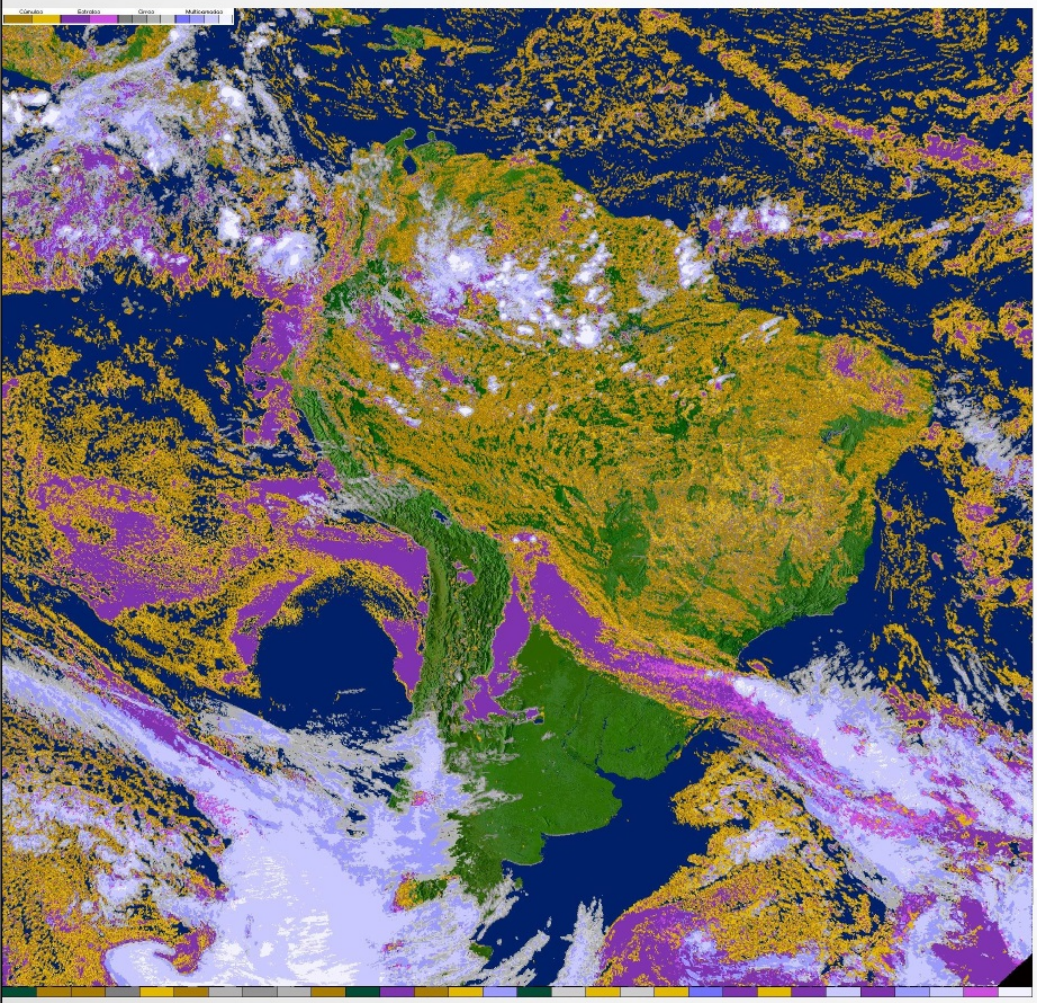
Product name: GOES-13 - Daytime Cloud Classification - South America **SDR ID#: 31**

Provider: INPE - National Institute for Space Research (Brazil)

Format: JPEG | Average Size: 920 KB | Frequency: 30 minutes, from 8:00 to 23:00 UTC | Max nº of received files a day: 28

Satellite: GOES-13 | Instrument: GOES-13 Imager | Channels: 1 and 4 | Wavelength: 0.63 and 10.7 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_CLC_YYYYMMDDHHMN



• General Description:

The basic components of this product are the visible channel reflectance and texture and the infrared channel brightness temperature and texture. A minimum Euclidean distance method allows to classify pixels with respect to a reference set of centroids.

• Applications and Considerations:

The resulting colors classify the image as follows:

Cumulus **Stratus** **Cirrus** **Multilayers**

• GEOSS Societal Benefit Areas:

Agriculture | Biodiversity | Climate | Disasters
Ecosystems | Water | Weather

Category: Cloud Classification

Product name: GOES-13 - Channel Composite - South America

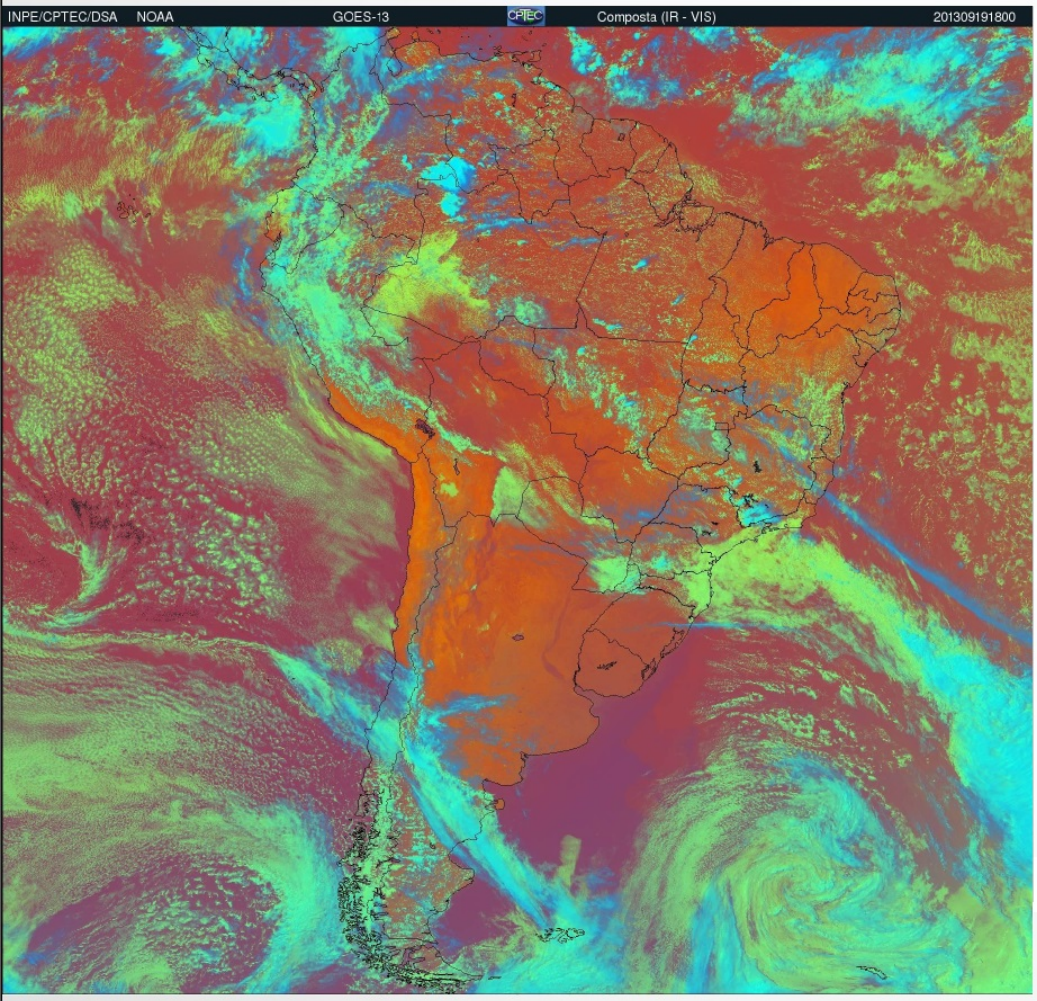
SDR ID#: 32

Provider: INPE - National Institute for Space Research (Brazil)

Format: JPEG | Average Size: 400 KB | Frequency: 30 minutes | Max nº of received files a day: 48

Satellite: GOES-13 | Instrument: GOES-13 Imager | Channels: 1 and 4 | Wavelength: 0.63 and 10.7 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_SAC_YYYYMMDDHHMN



• General Description:

This image is an RGB (Red, Green, Blue) composite, associating both RED and BLUE colors with the infrared channel (temperature relationship), and the GREEN color with the visible channel (reflectance relationship), as follows:

IR Channel:
Max temperature: RED = Rmax, BLUE = Bmin
Min temperature: RED = Rmin, BLUE = Bmax

VIS Channel:
Max reflectance: GREEN = Gmin
Min reflectance: GREEN = Gmax

• Applications and Considerations:

The resulting colors classify the image as follows:

- **Warm and bright clouds:** R + G = Yellowish colors
- **Non-bright cold cirrus clouds:** B = Bluish colors
- **Bright and cold cumuloninbus clouds:** G + B = Magenta
- **Hot and dark surfaces:**R = Reddish colors

• GEOSS Societal Benefit Areas:

Agriculture | Biodiversity | Climate | Disasters
Ecosystems | Water | Weather

Category: Fog

Product name: Fog - South America

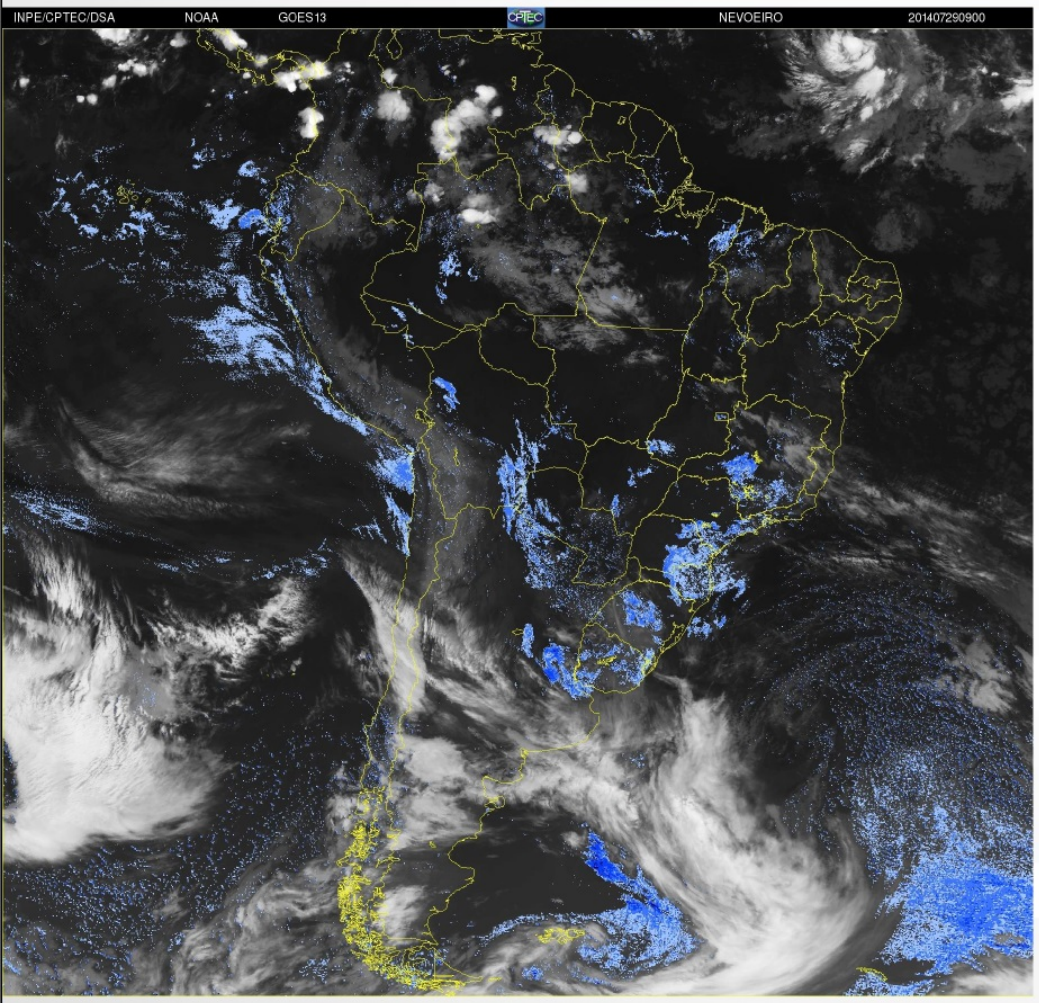
SDR ID#: 50

Provider: INPE - National Institute for Space Research (Brazil)

Format: JPEG | Average Size: 2000 KB | Frequency: 30 minutes, from 21:00 to 09:00 UTC | Max nº of received files a day: 25

Satellite: GOES-13 | Instrument: GOES-13 Imager | Channels: 2 and 4 | Wavelengths: 3.9 µm and 10.7 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_SAF_YYYYMMDDHHMN



• General Description:

Fog occurs when water vapor remaining in the air condenses near the Earth's surface forming a cloud of microscopic droplets of liquid water. Fog may be considered a stratus cloud (low cloud) whose height from its base is located on the floor. Fog and stratus can be identified at night throught the brightness temperature difference obtained from GOES-13 infrared channels 4 and 2, having positive or negative values, which are normalized and scaled. Areas with fog or stratus have positive values and areas with high clouds (Cirrus) have negative values. Fog presents positive temperature differences because the emissivity of the water droplets at 3.9 microns is lower than in 10.7 microns (Ellrod - 1994 / RAMM GOES 3.9 µm Channel Tutorial - 1996).

The image is classified as follows:

• Applications and Considerations:

Fog is a commom obstacle for land, air and sea traffic (the reduction of visibility increases the chances of judgement errors in navigation). It is also important as a factor with an impact on air quality and as a modifier in the climate system.

• GEOSS Societal Benefit Areas:

Climate | Disasters | Weather

Category: Drought Monitoring

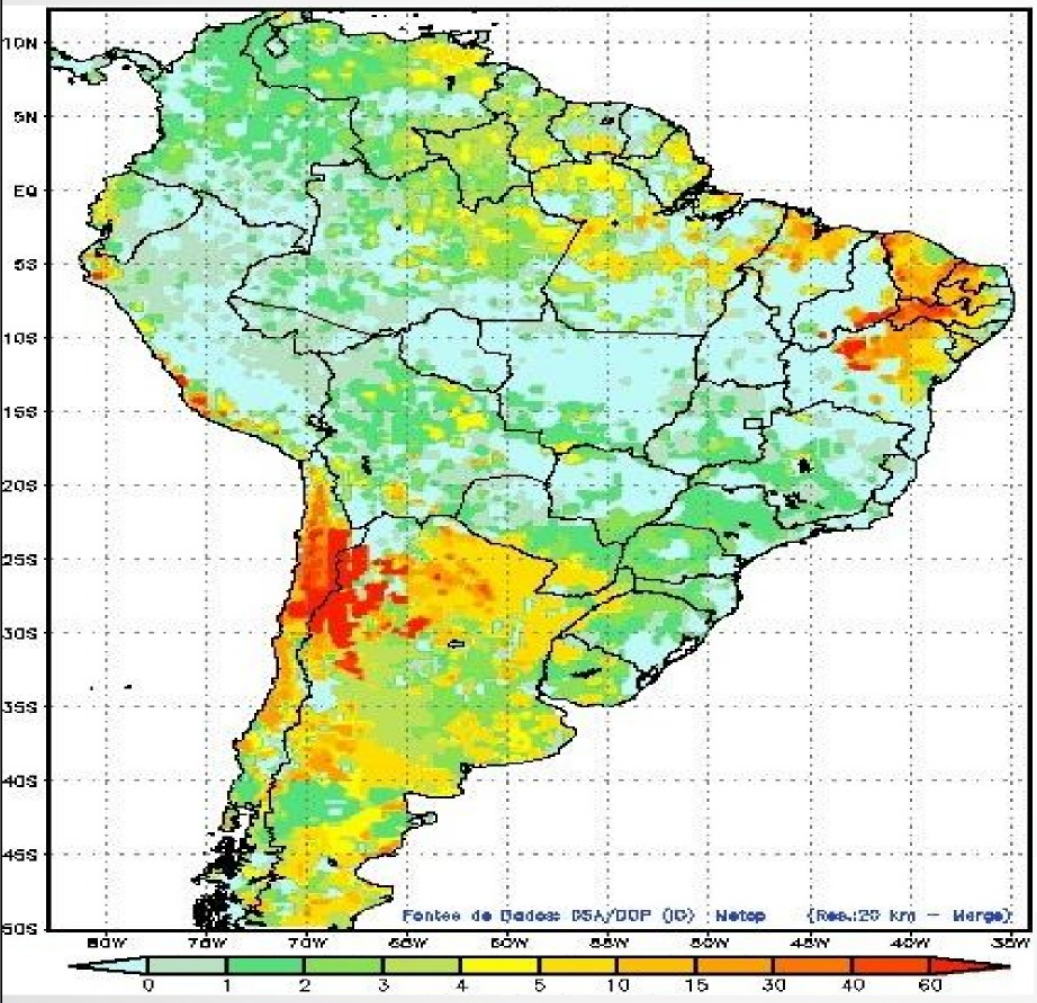
Product name: Number of Days Without Rain - South America

SDR ID#: 39

Provider: INPE - National Institute for Space Research (Brazil)

Format: JPEG | Average Size: 120 KB | Frequency: 24 Hours | Max nº of received files a day: 1

Data Input: TMPA NASA product derived from several satellite inputs (TRMM Radar / GOES-13 / DMSP / Aqua / NOAA) combined with data from Meteororological Surface Stations. | Type: Image | Projection: Rectangular | Resolution: 24x24 km



• General Description:

This product indicates the number of days without rainfall. This information is derived from the use of the NASA TMPA (TRMM Multisatellite Precipitation Analysis) product (which is based on passive / active microwave sensors and infrared data) with the additional contribution of the surface weather stations network, generating as output the number of days without rainfall, once a day. The NDR product is therefore a subproduct of this combined scheme for precipitation estimation using TMPA product and the surface weather stations, entitled CoSch.

• Applications and Considerations:

This product is especially used for dry season monitoring and it is of great interest for decision makers, and farmers. The persistence of the lack of precipitation may result in water stress of vegetation, reduction of agricultural production and to reduce the water level in reservoirs and lakes, affecting also the habitat of various wild animals. When drought hits this stage populations may migrate from one region to another hot the competition for water and may generate conflicts. The phenomenon has drought impact both economic and social and environmental, and is one of the most important natural disasters related to the atmospheric condition can affect large areas for months and years and have great impact on the production of food and economic performance of different countries.

• GEOSS Societal Benefit Areas:

Agriculture | Climate | Disasters | Ecosystems
Energy | Health | Water | Weather

Category: Radiation

Product name: Ultra Violet Index - South America

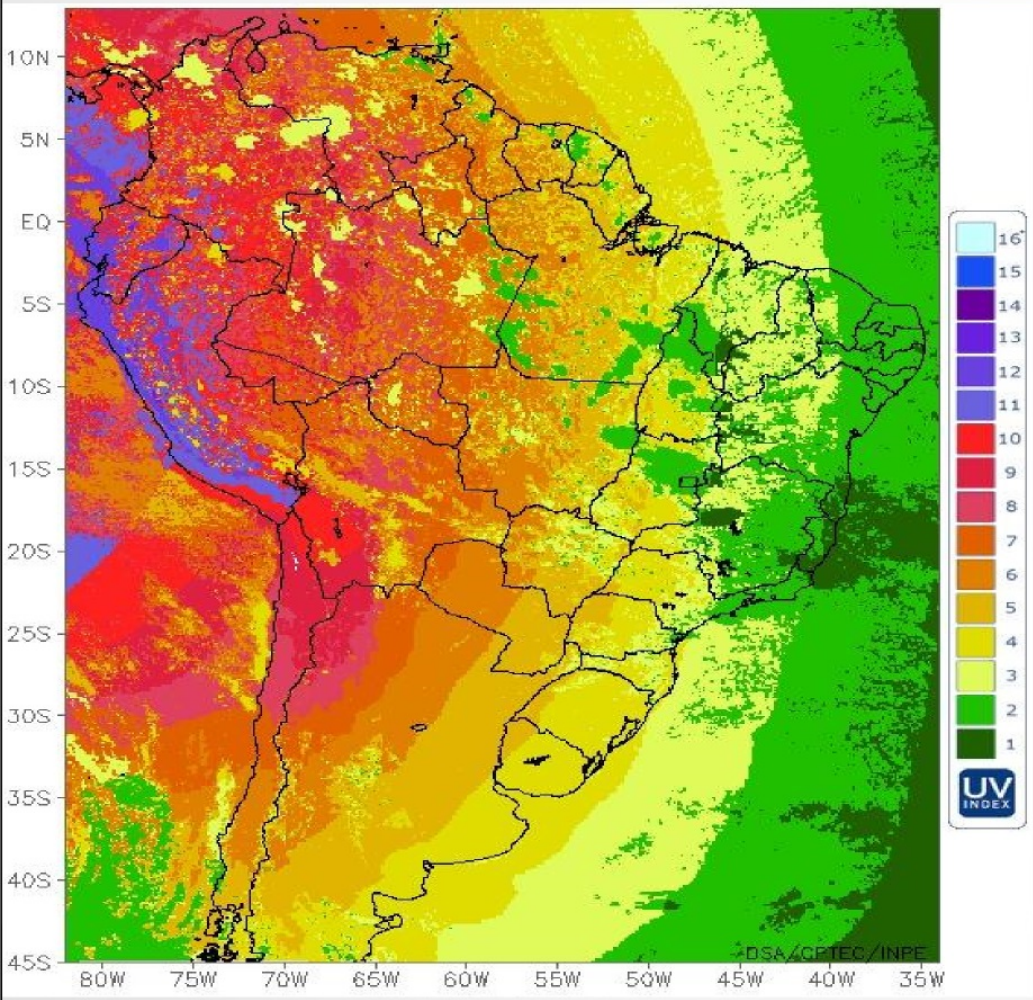
SDR ID#: 40

Provider: INPE - National Institute for Space Research (Brazil)

Format: JPEG | Average Size: 150 KB | Frequency: 30 minutes | Max nº of received files a day: 48

Data Input: Ozone concentration from NCEP/NOAA analysis and GOES-13 imagery (Cloud type estimation)

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_UVI_YYYYMMDDHHMN



• General Description:

This product is associated with the maximum daily value of the ultraviolet radiation. It takes into consideration the ozone concentration based on AURA-OMI and NOAA SBUV/2 sensor measurements provided by NASA and the images of nebulosity derived from GOES data.

The ultraviolet index or UV Index (UVI) is a number linearly related to the strength of the ultraviolet (UV) radiation emitted by the sun that is relevant to effects on the human skin. It represents the strength of UV radiation reaching the Earth's surface at a particular place on a particular day and time. The IUV is an international standard quantity that provides the expected risk of overexposure to the Sun. The UV varies on a scale of 1 to 11+, where 1 indicates a low risk of overexposure and 11+ means an extreme risk.

• Applications and Considerations:

The UV index is aimed to help the general public to take appropriate sun-protective behaviors and avoid overexposure to UV radiation. It helps people to effectively protect themselves from UV sun light, of which excessive exposure causes sunburns, eye damage such as cataracts, skin aging, and skin cancer. Public-health organizations recommend that people protect themselves (for example, by applying sunscreen to the skin and wearing a hat) when the UV index is 3 or higher.

• GEOSS Societal Benefit Areas:

Health

Category: Radiation

Product name: Accumulated Average Insolation - South America

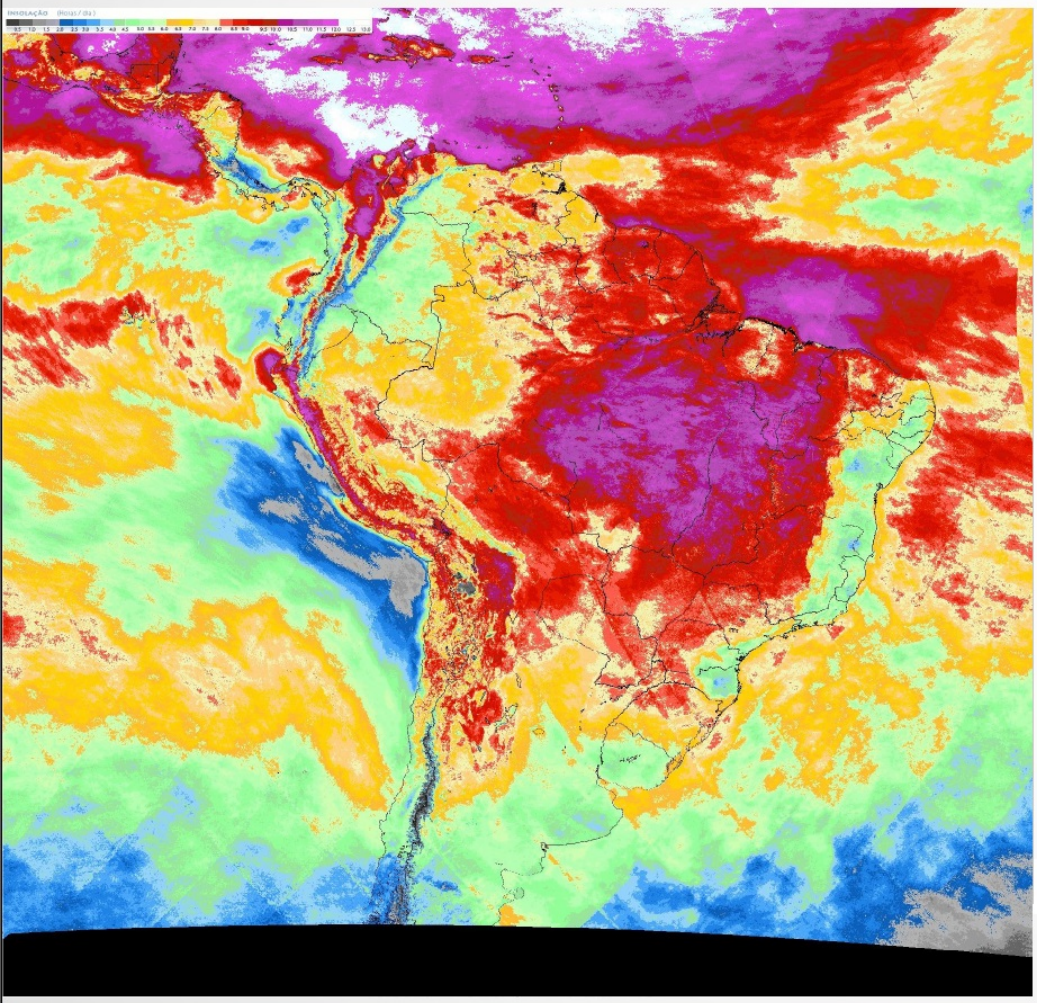
SDR ID#: 47

Provider: INPE - National Institute for Space Research (Brazil)

Format: JPEG | Average Size: 1600 KB | Frequency: 24 Hours | Max nº of received files a day: 1

Satellite: GOES-13 | Instrument: GOES-13 Imager | Channel: 1 | Wavelength: 0.52 to 0.71 µm, centered at 0.63 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_AAI_YYYYMMDDHHMN



• General Description:

Daily sunshine duration can be assessed from VIS channel imagery of geostationary satellites. The algorithm is based on a linear relationship between cloud cover and pixel reflectance in GOES VIS channel. Comparison with ground truth (provided by sunshine recorder) suggests that assessment is accurate within 10% of systematic deviation.

• Applications and Considerations:

The image is classified as follows:

Solar radiation is of fundamental importance for agricultural activities, either from the standpoint of evaporation or mass generation. The duration of sunshine (daily and accumulated on a phenological cycle) can be of great importance, for example, having a close relationship with the Normalized Difference Vegetation Index (NDVI) and therefore highly correlated with crop yield (Klering et al., 2007). The monitoring of insolation is a relevant activity and its estimation by satellite especially recommended, given the large extent, the spatial resolution and the frequency of observations of geostationary satellites such as the GOES series.

• GEOSS Societal Benefit Areas:

Agriculture | Biodiversity | Climate | Ecosystems
Energy | Health

Category: Radiation

Product name: Global Solar Radiation - South America

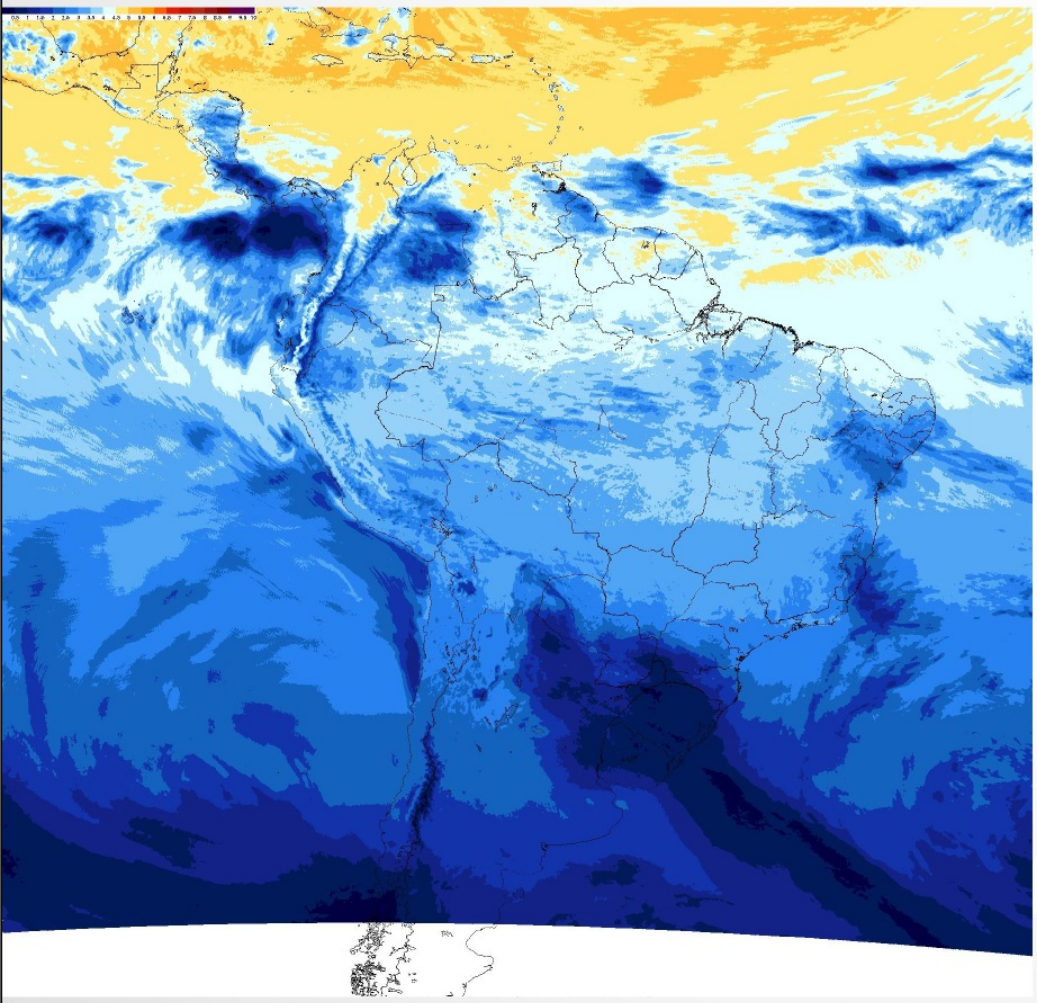
SDR ID#: 47

Provider: INPE - National Institute for Space Research (Brazil)

Formats: JPEG / GeoTIFF | Average Sizes: 900 KB / 1500 KB | Frequency: 24 h / Montly | Max nº of files: 1 daily / 1 montly

GeoTIFF Pixel Info.: (W/m² x 10) | Satellite: GOES-13 | Instr.: G-13 Imager | Ch: 1 | WL: 0.52 to 0.71 µm, cent. at 0.63 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_GSR_YYYYMMDDHHMN



• General Description:

Solar radiation interacts with the atmosphere and the soil, being partially reflected back into space. From the top of the emergent irradiance detected by satellites, it is possible to evaluate the global irradiance on the surface. The global solar radiation model, named GL-model, developed by Ceballos et al. (2004) uses 4-km resolution VIS imagery for assessing solar irradiance in the visible and total solar spectrum.

The image is classified as follows:

• Applications and Considerations:

This product has been used in a broad range of applications, such as atmospheric circulation model evaluation (Tarasova et al. 2006), climatological studies (Costa et al. 2010; Ortega et al. 2010) and agricultural management.

• GEOSS Societal Benefit Areas:

Agriculture | Biodiversity | Climate | Ecosystems
Energy | Health

Category: Radiation

Product name: Long Wave Radiation - South America

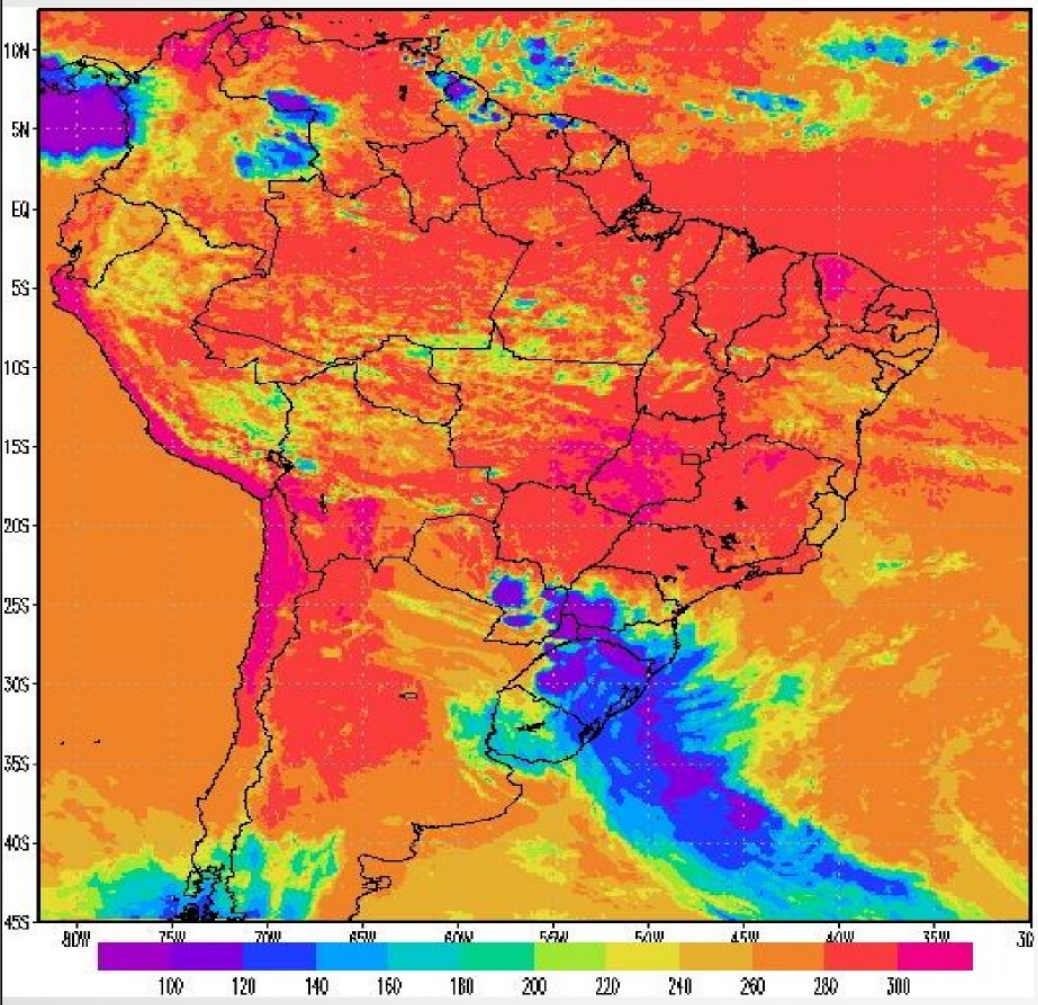
SDR ID#: 47

Provider: INPE - National Institute for Space Research (Brazil)

Format: JPEG | Average Size: 180 KB | Frequency: 3 hours | Max nº of received files a day: 8

Satellite: GOES-13 | Instrument: GOES-13 Imager | Channel: 4 | Wavelength: 10.2 to 11.2 µm, centered at 10.7 µm

Type: Image | Projection: Rectangular | Resolution: 4x4 km | Naming Convention: INPE_LWR_YYYYMMDDHHMN



• General Description:

GOES IR (channel 4) brightness temperature is a key variable for OLR estimation. An algorithm developed by Ceballos et al. (2003) showed excellent fitting with ITPP estimations based on TOVS-NOAA data and NCEP based on AVHRR-NOAA data. OLR fields are produced every 3 hours with 10 km resolution for South American sector. The advantage of using geostationary satellite imagery is that the whole field illustrates a nearly-instantaneous radiation field (each 3 hours), allowing to monitor the daily evolution of OLR and cloud coverage (especially convective systems). This procedure provides a detailed OLR daily cycle.

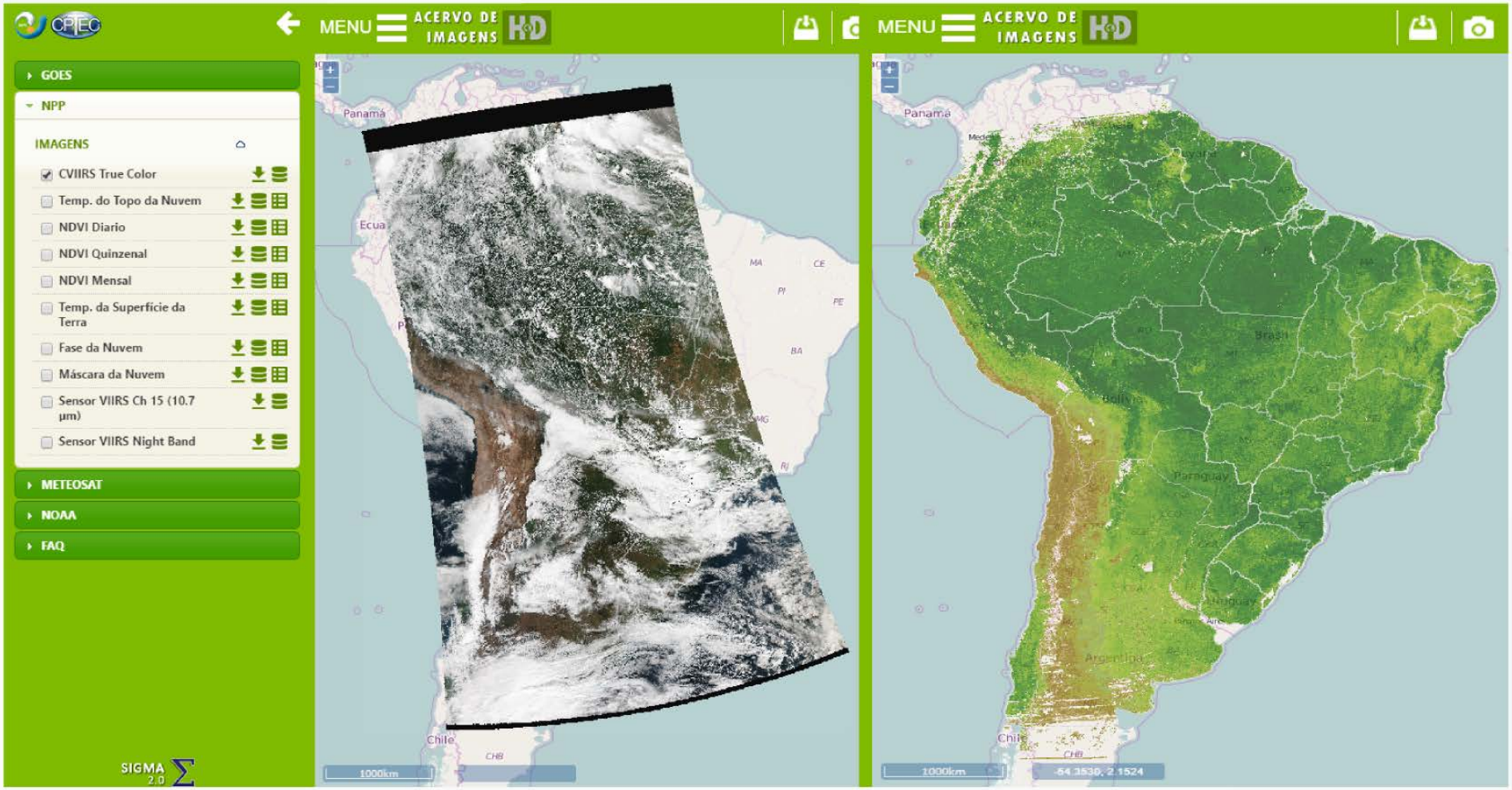
• Applications and Considerations:

This product is used to evaluate the climate, the diurnal cycle of clouds (mainly convective clouds), and the radiative balance of the planet.

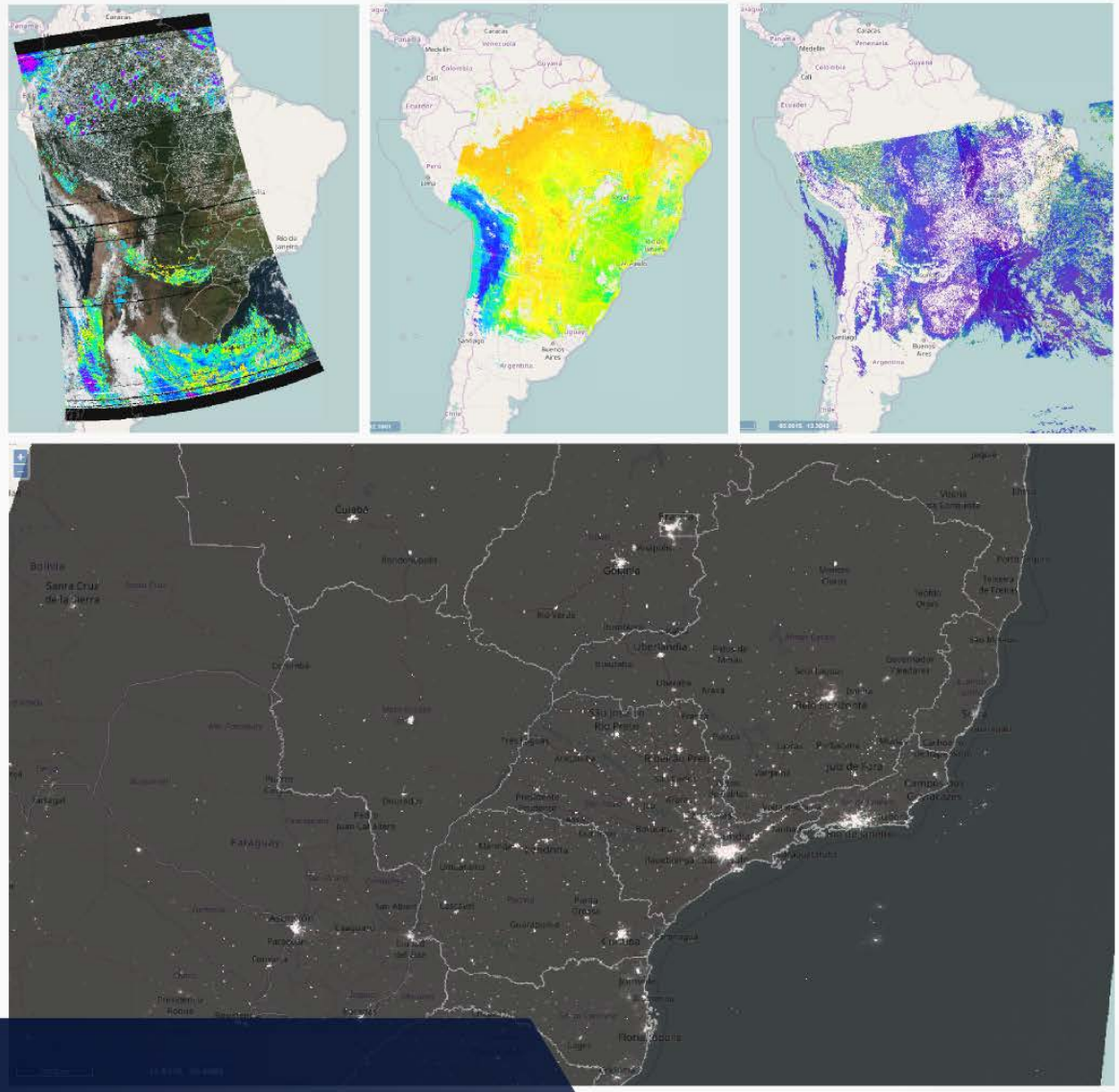
• GEOSS Societal Benefit Areas:

Agriculture | Biodiversity | Climate | Ecosystems
Energy | Health

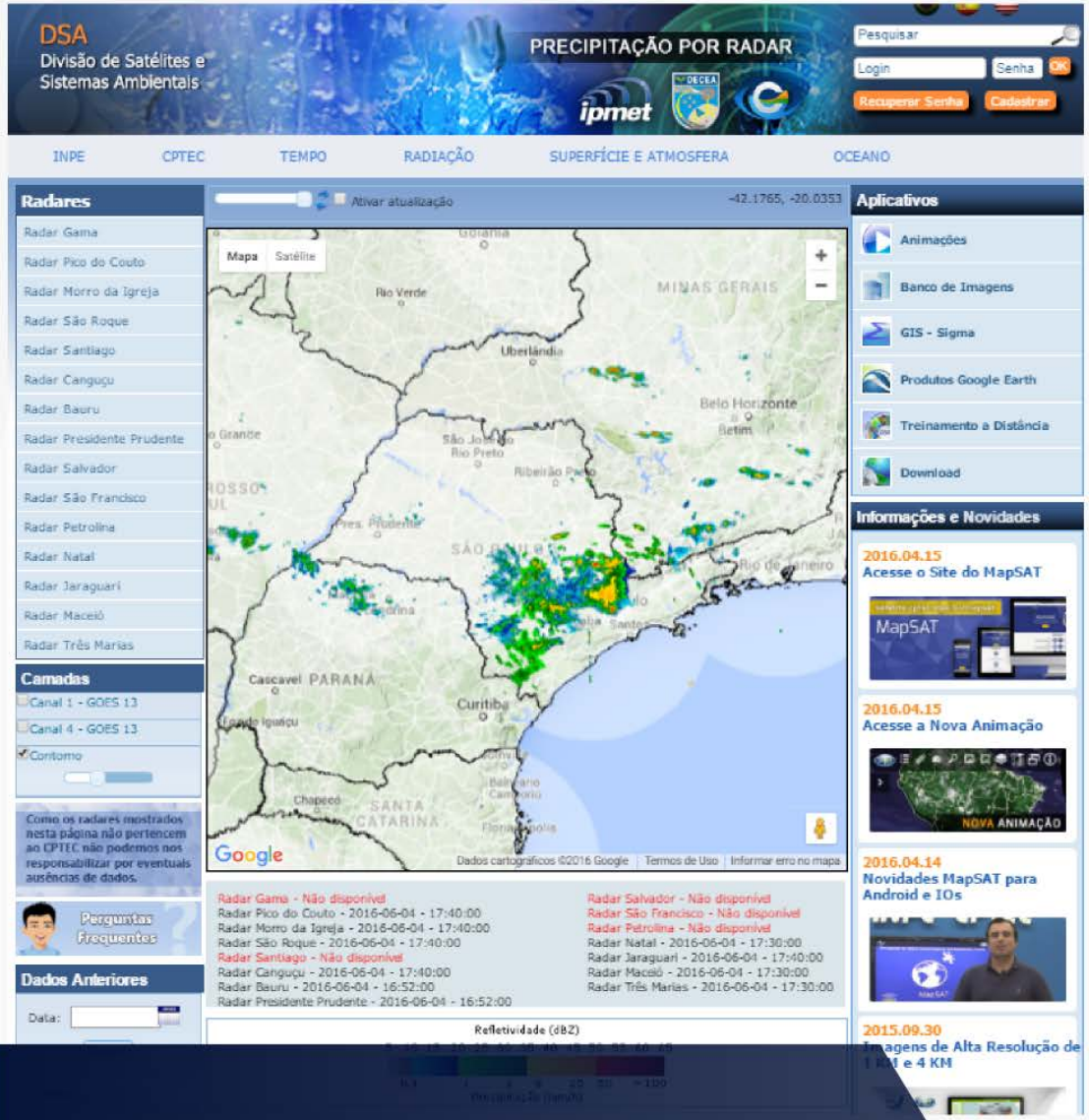
INPE as a Data Provider

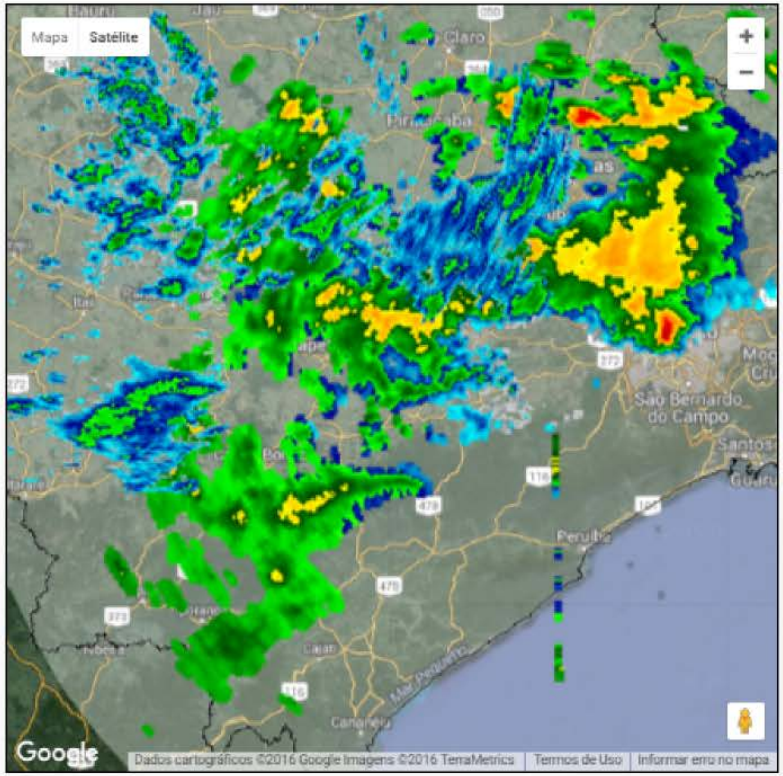


INPE as a Data Provider

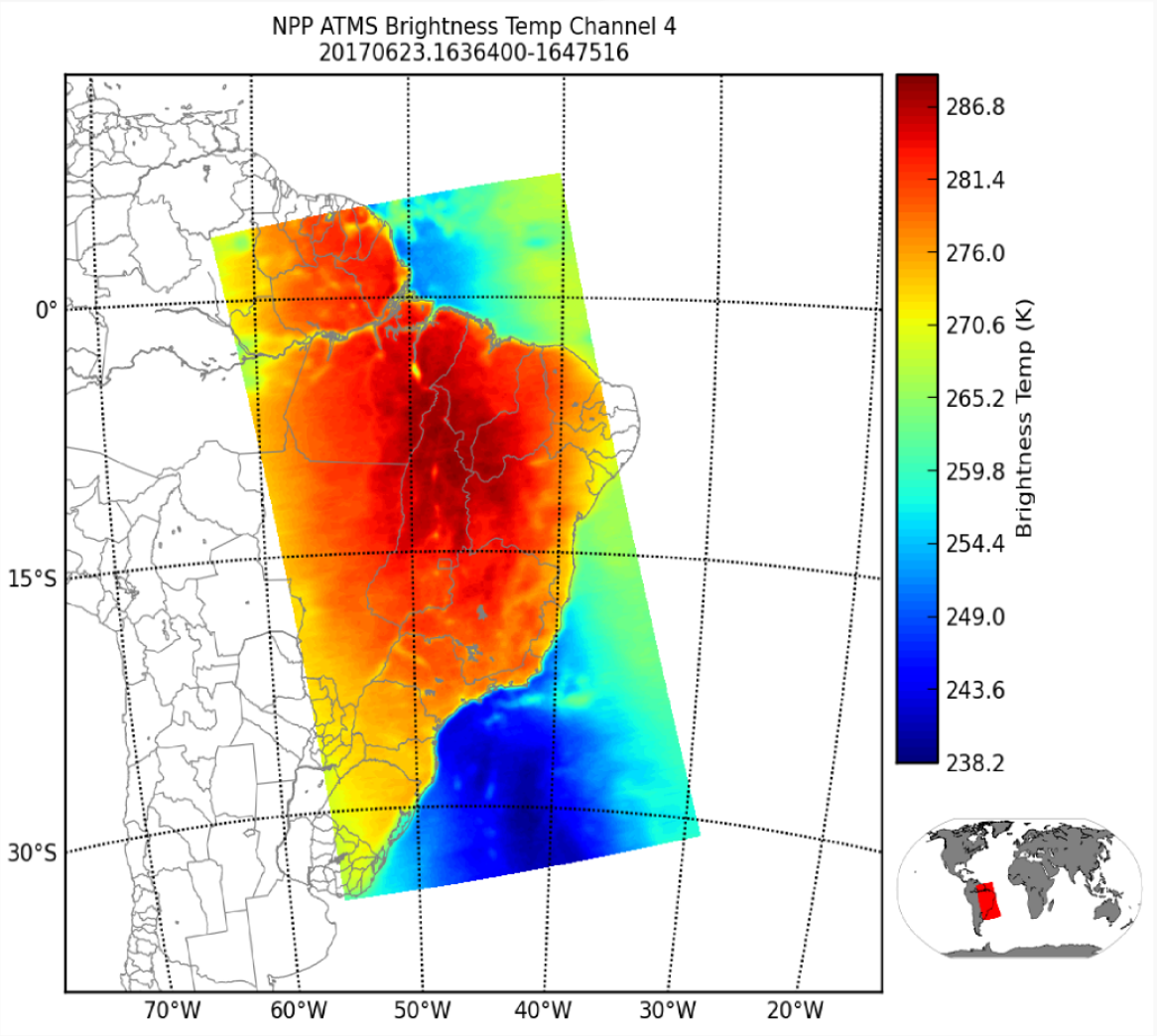


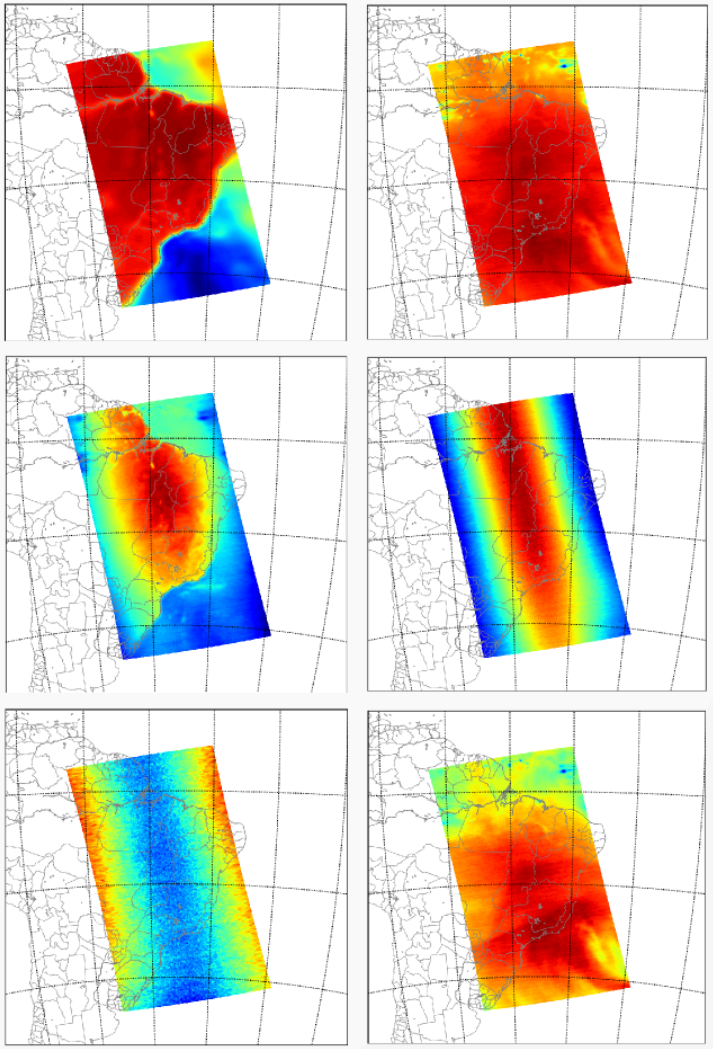
INPE as a Data Provider



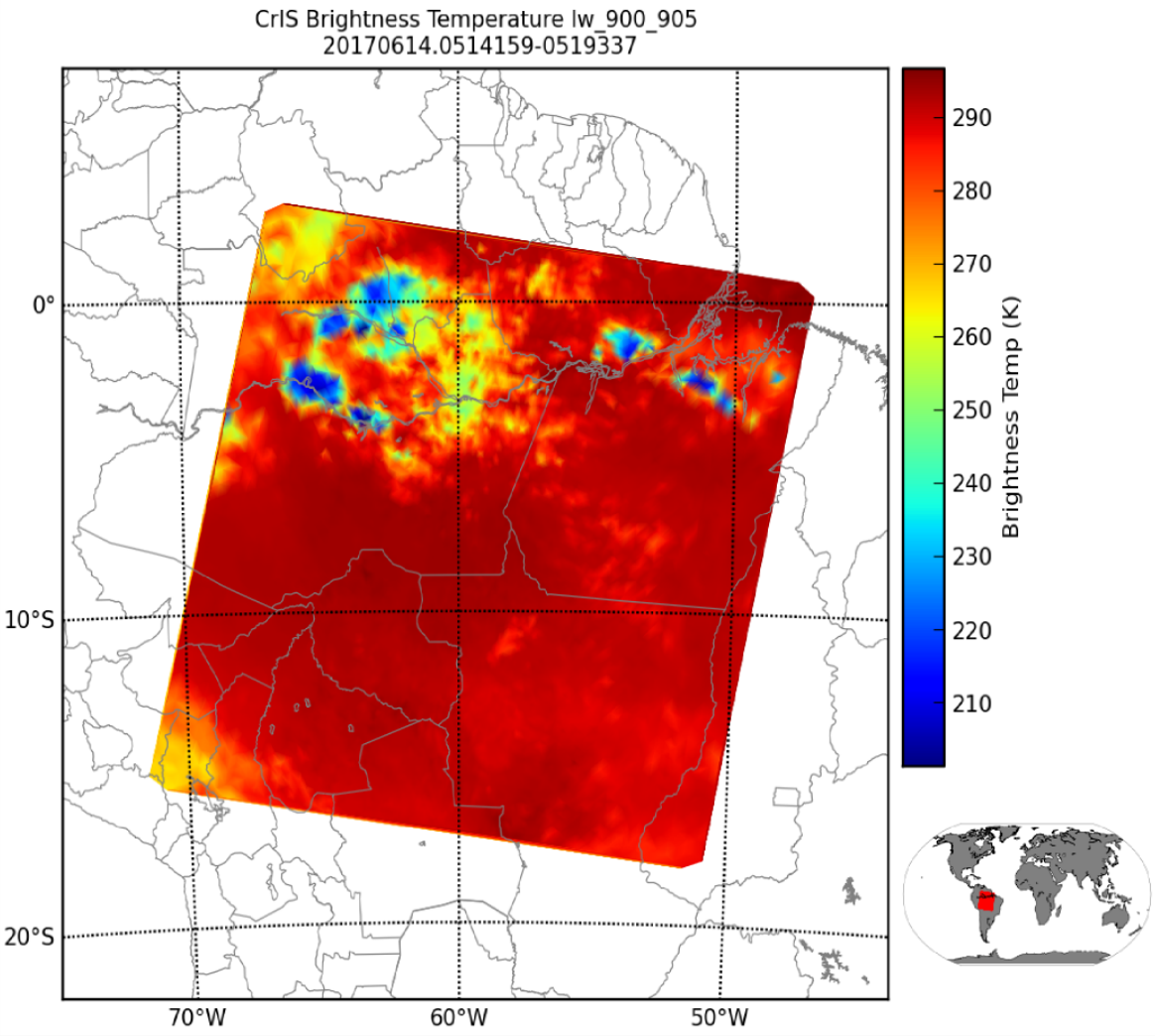


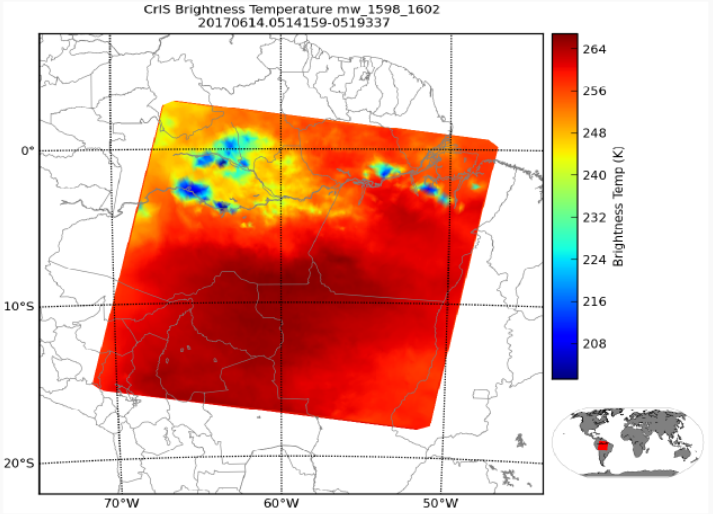
INPE and CSPP

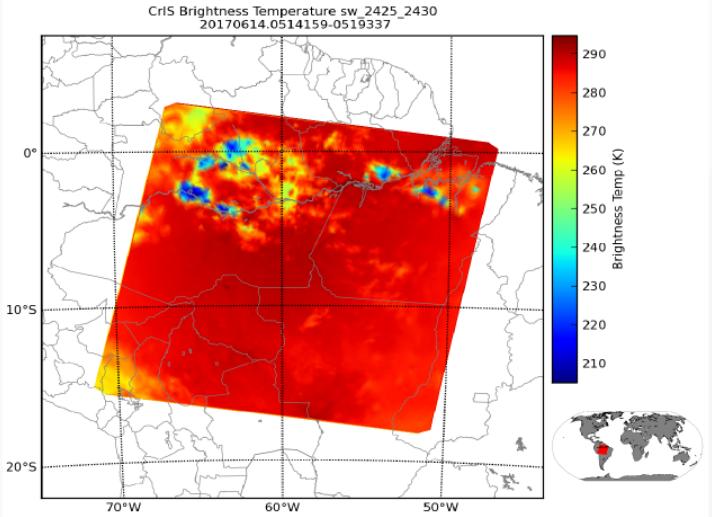




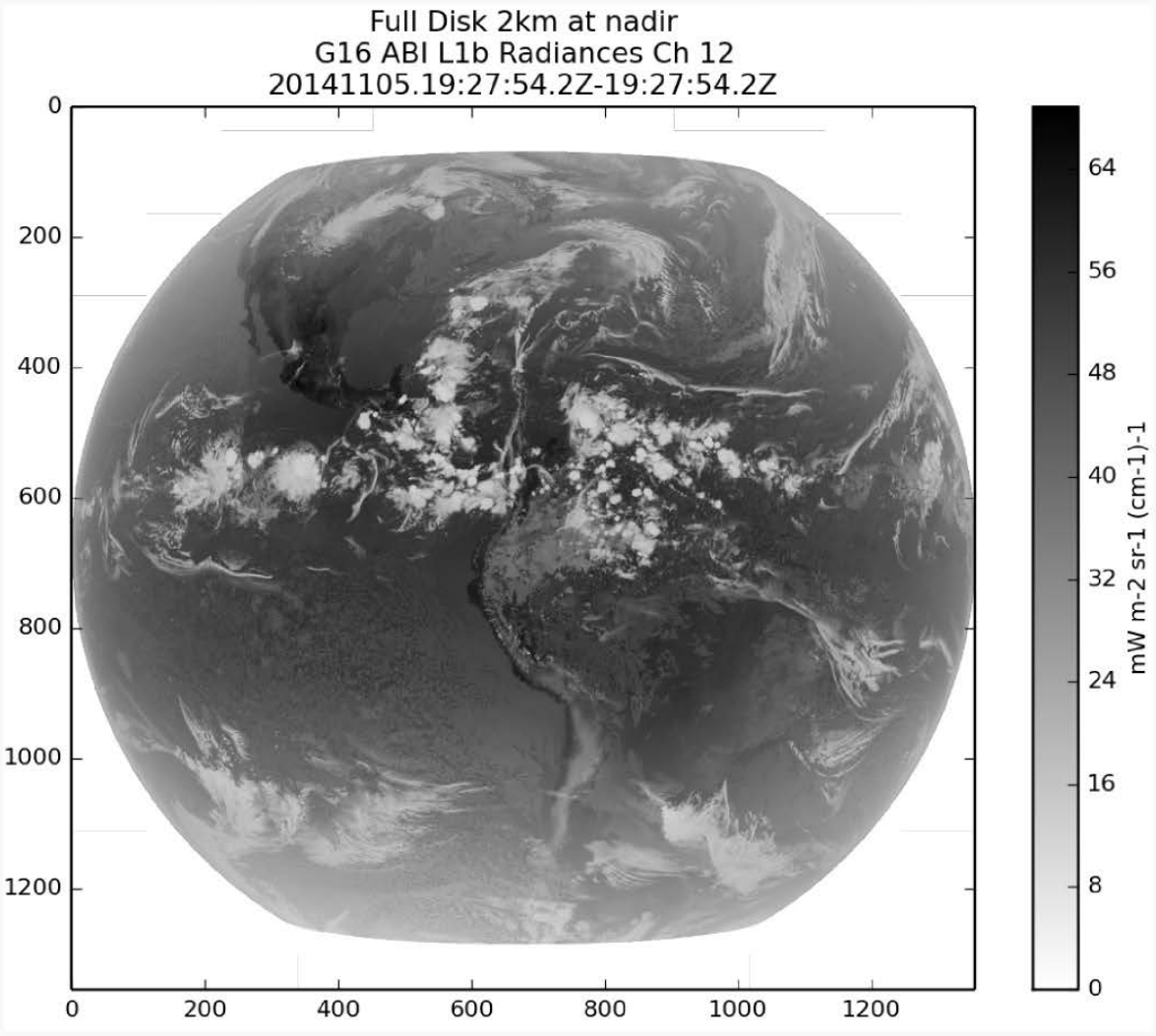
INPE and CSPP

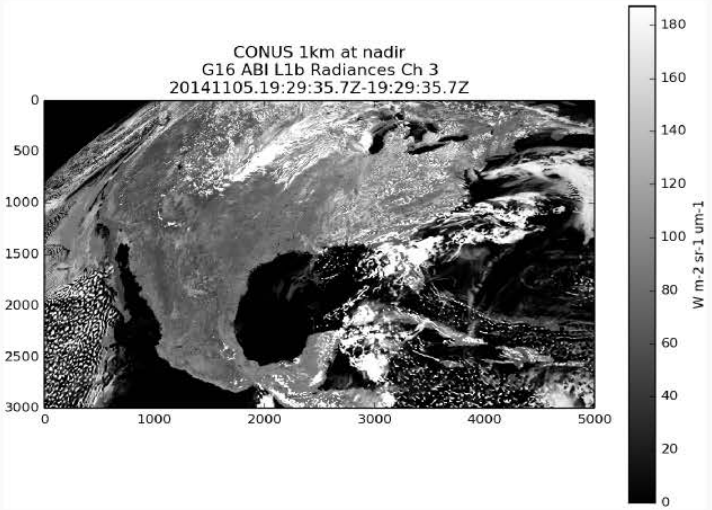


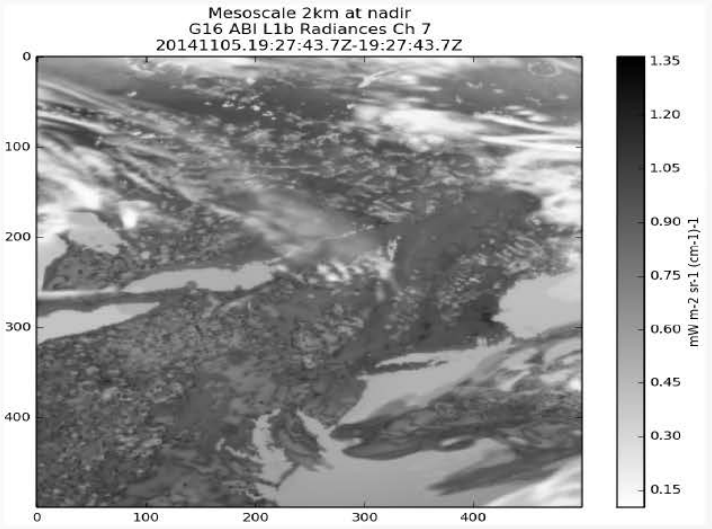




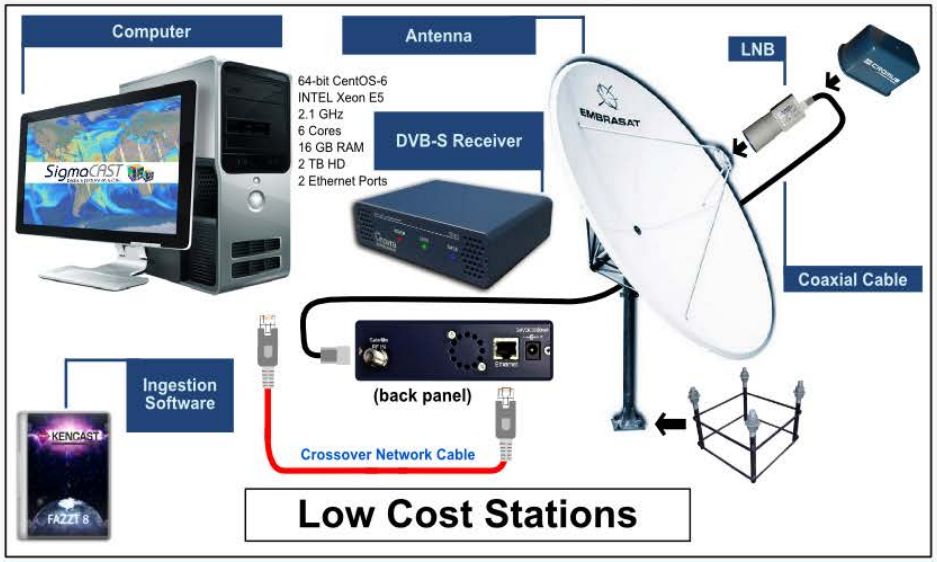
INPE and CSPP

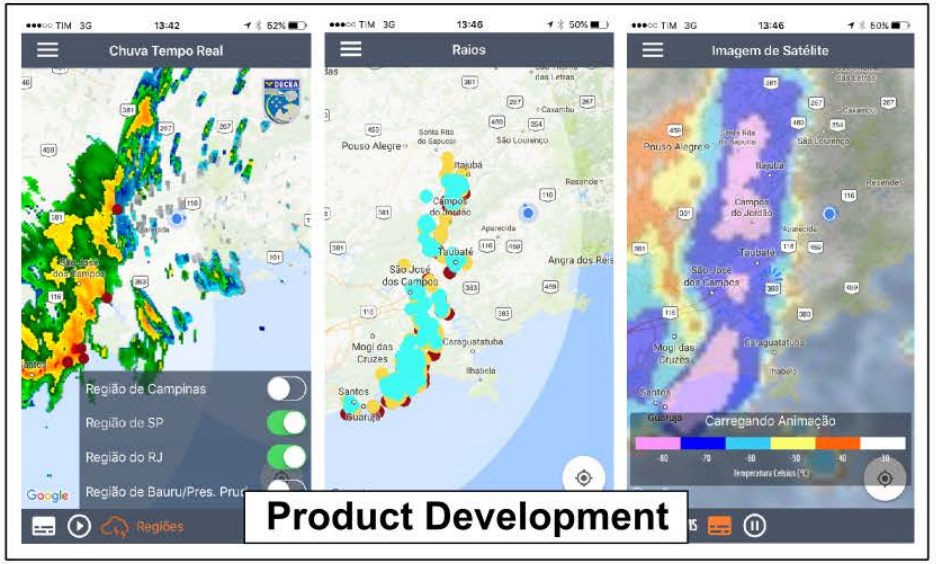


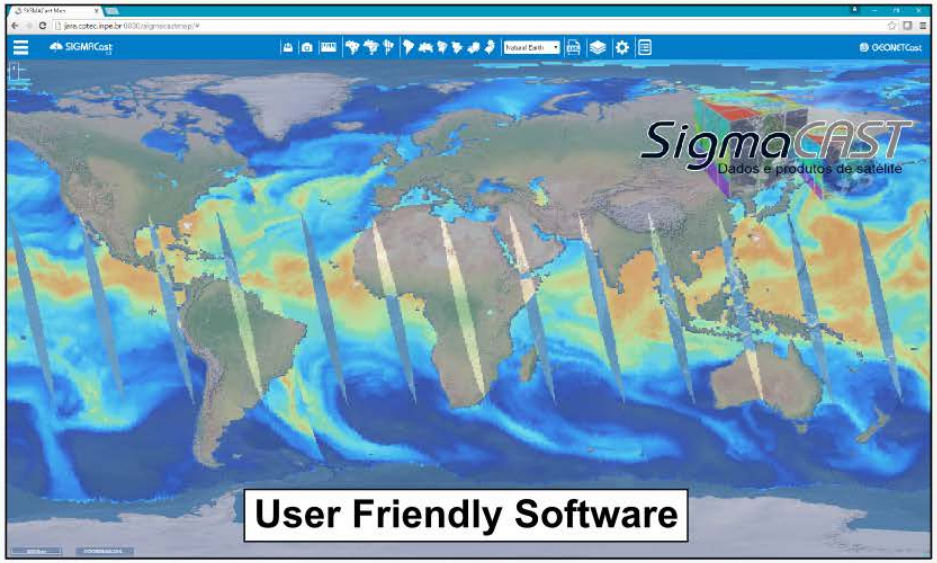




The Four Components of the SIGMACast Project







The SIGMACast Project: Training

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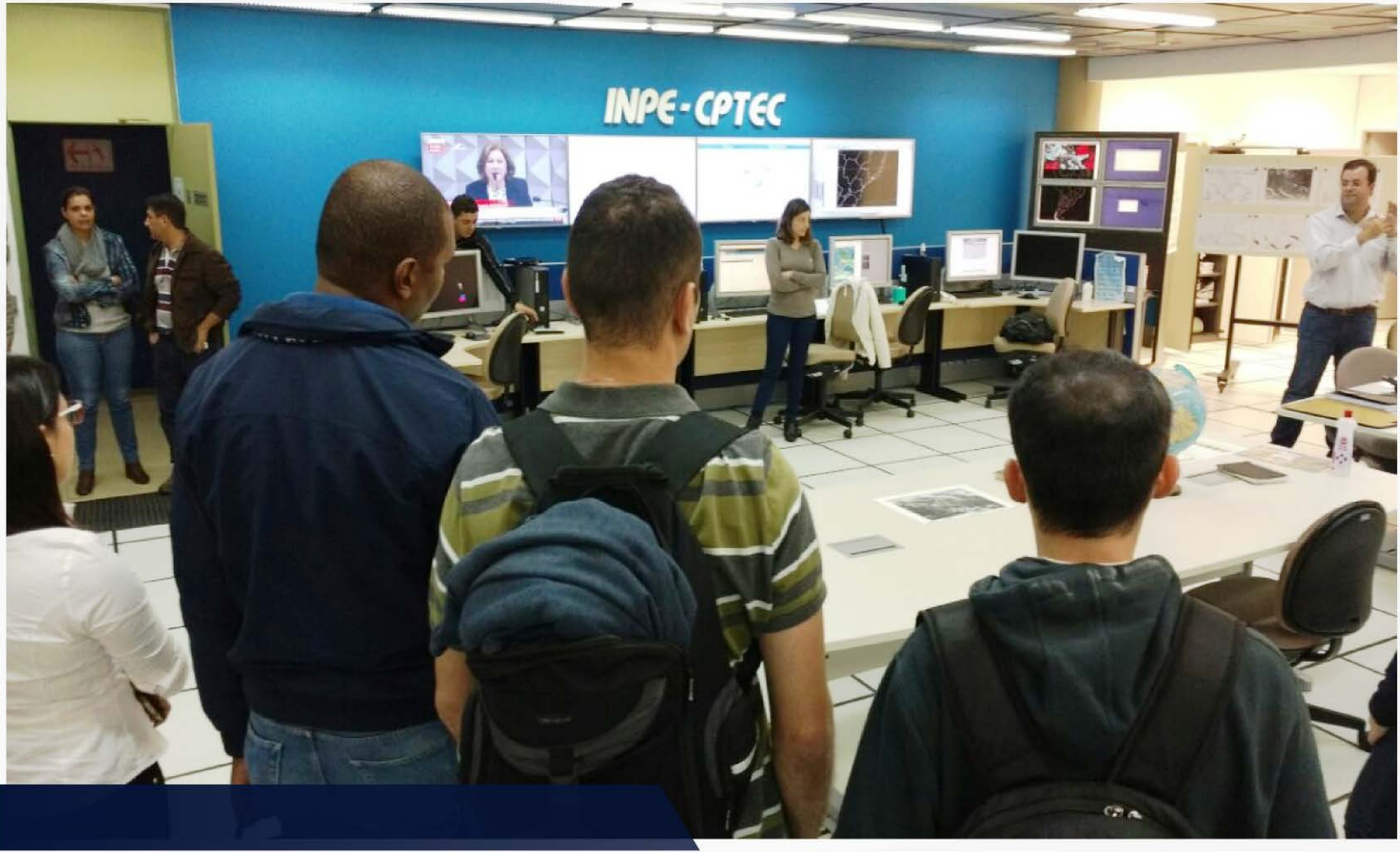
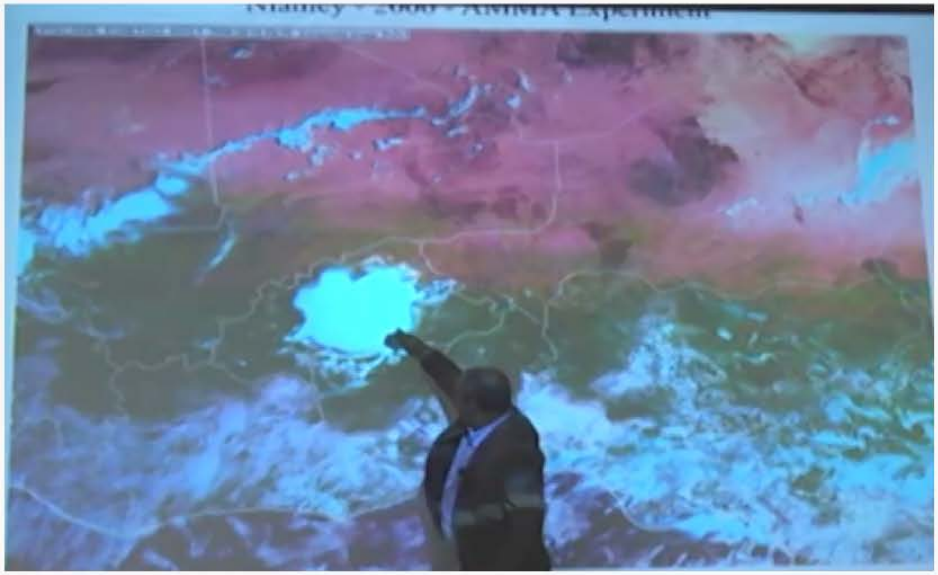
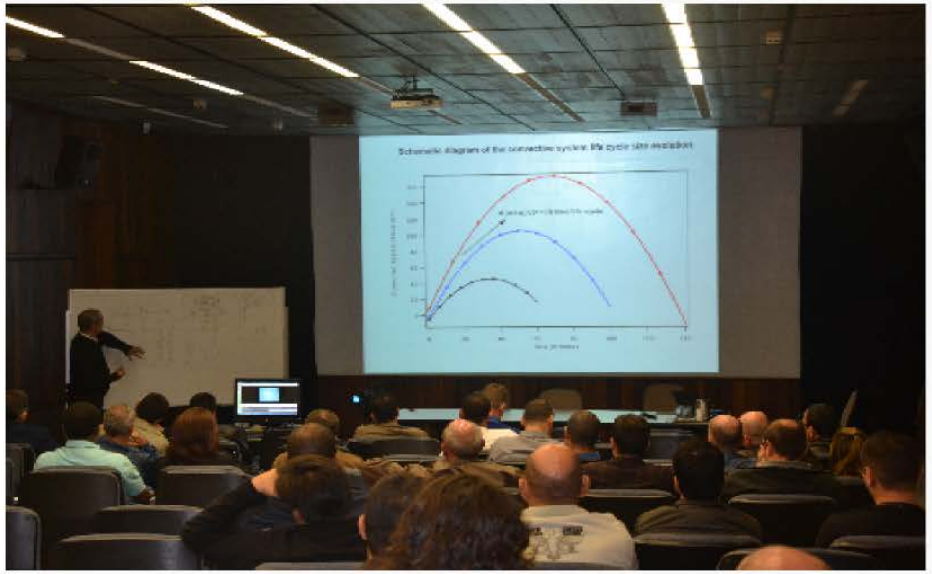
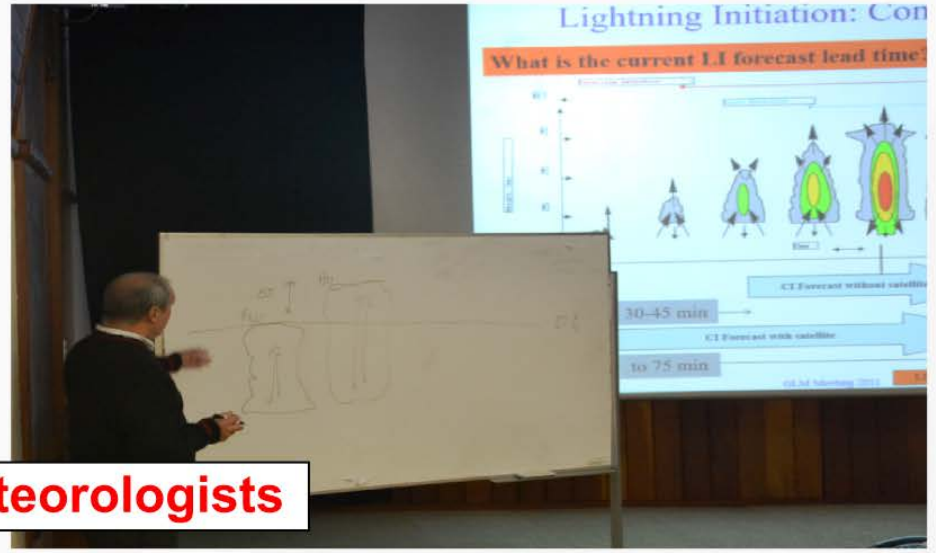
The SIGMACast Project: Training



The SIGMACast Project: Training







Team 1: Meteorologists

The SIGMACast Project: Training

Team 2: Technicians

The SIGMACast Project: Training

The SIGMACast Project: Training

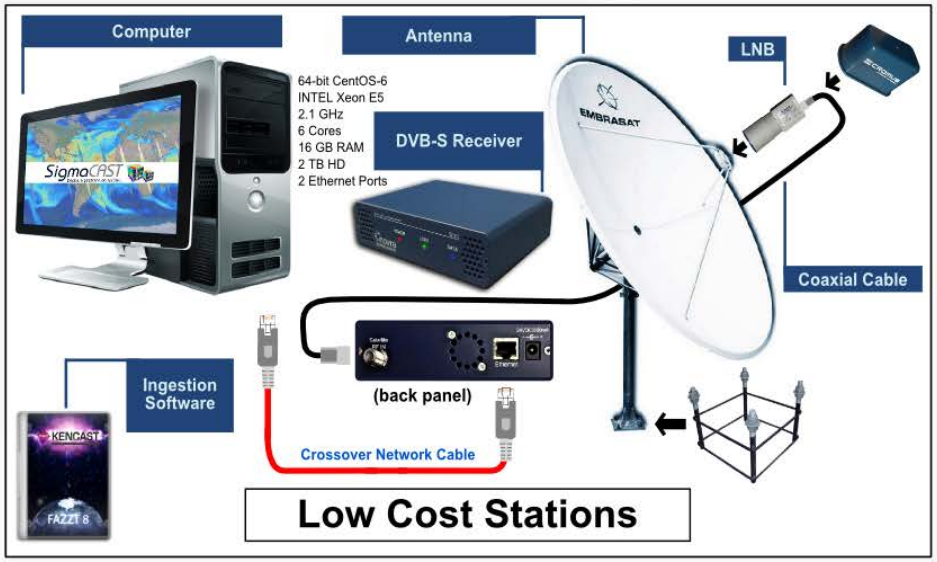
The SIGMACast Project: Training

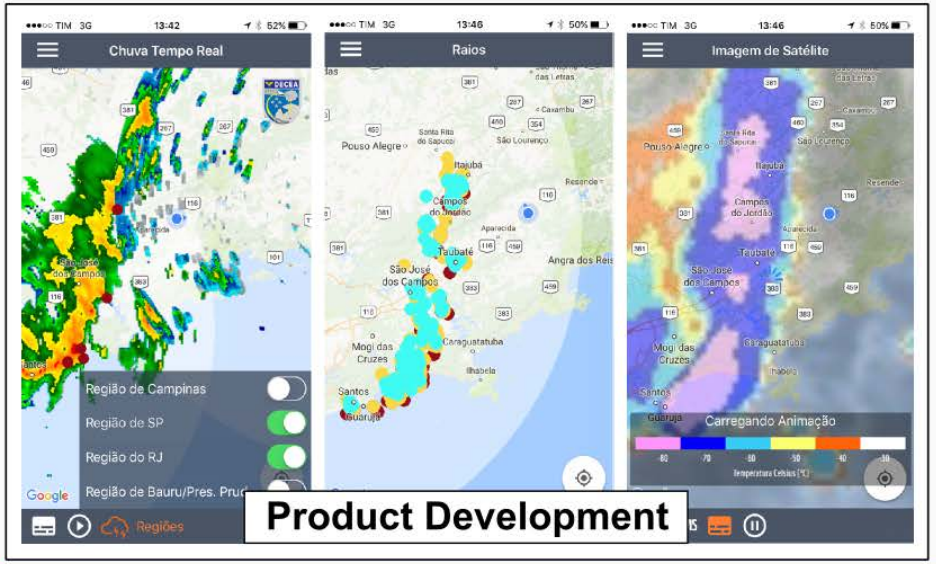
The SIGMACast Project: Training

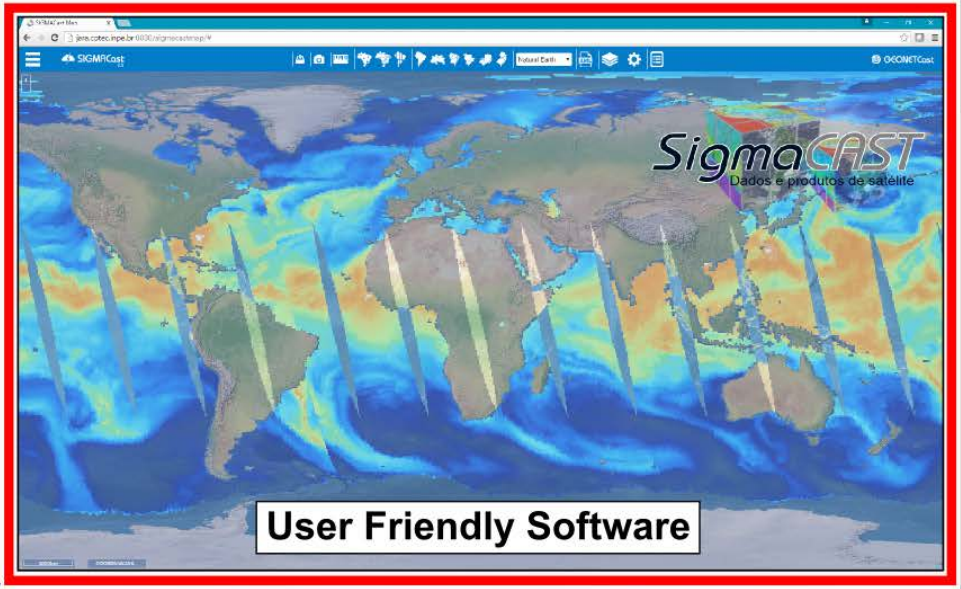
The SIGMACast Project: Training

The SIGMACast Project: Training

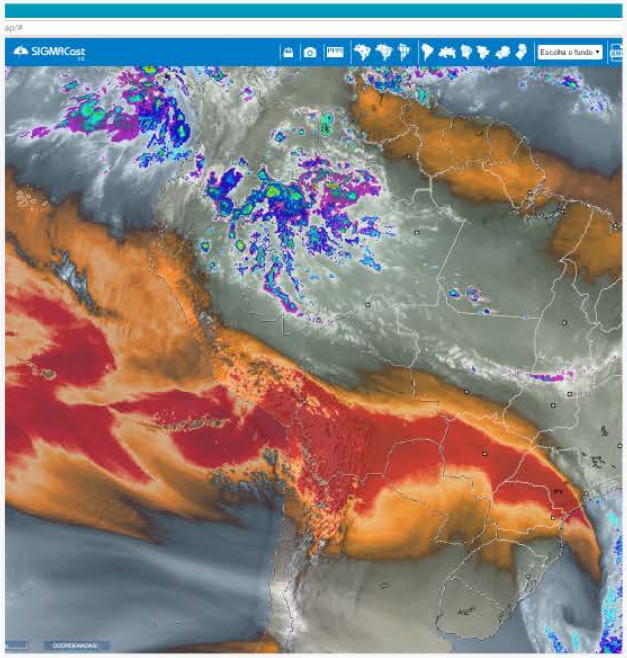
The Four Components of the SIGMACast Project

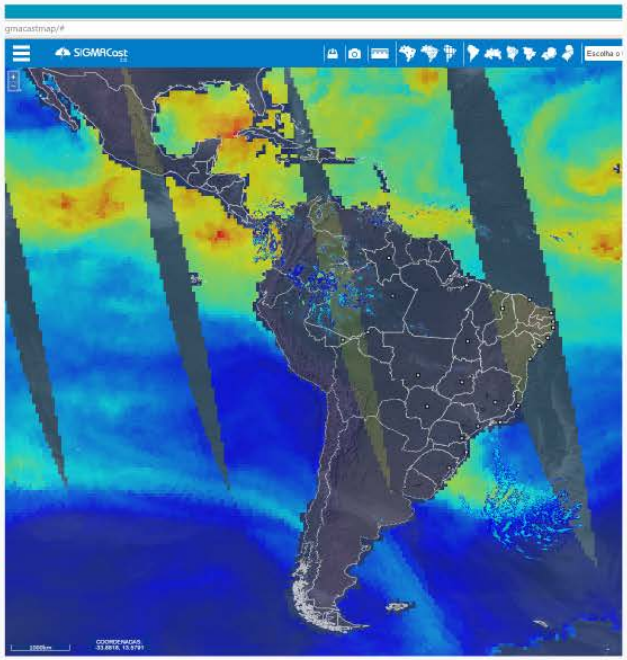






The SIGMACast Software



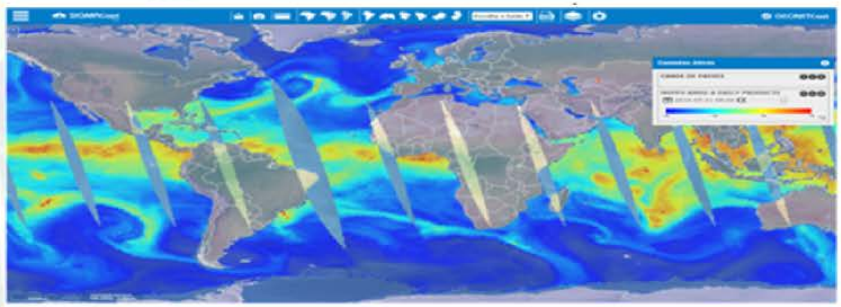


SigmaCAST

Dados e produtos de satélite

The SIGMACast Software: Overview

SigmaCAST



Application Server — Apache Tomcat

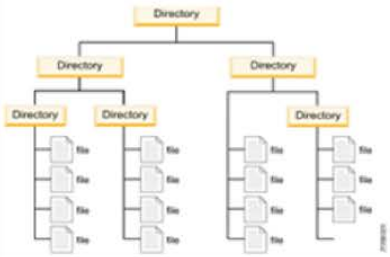
Map Server — GeoServer

Java · python · GDAL

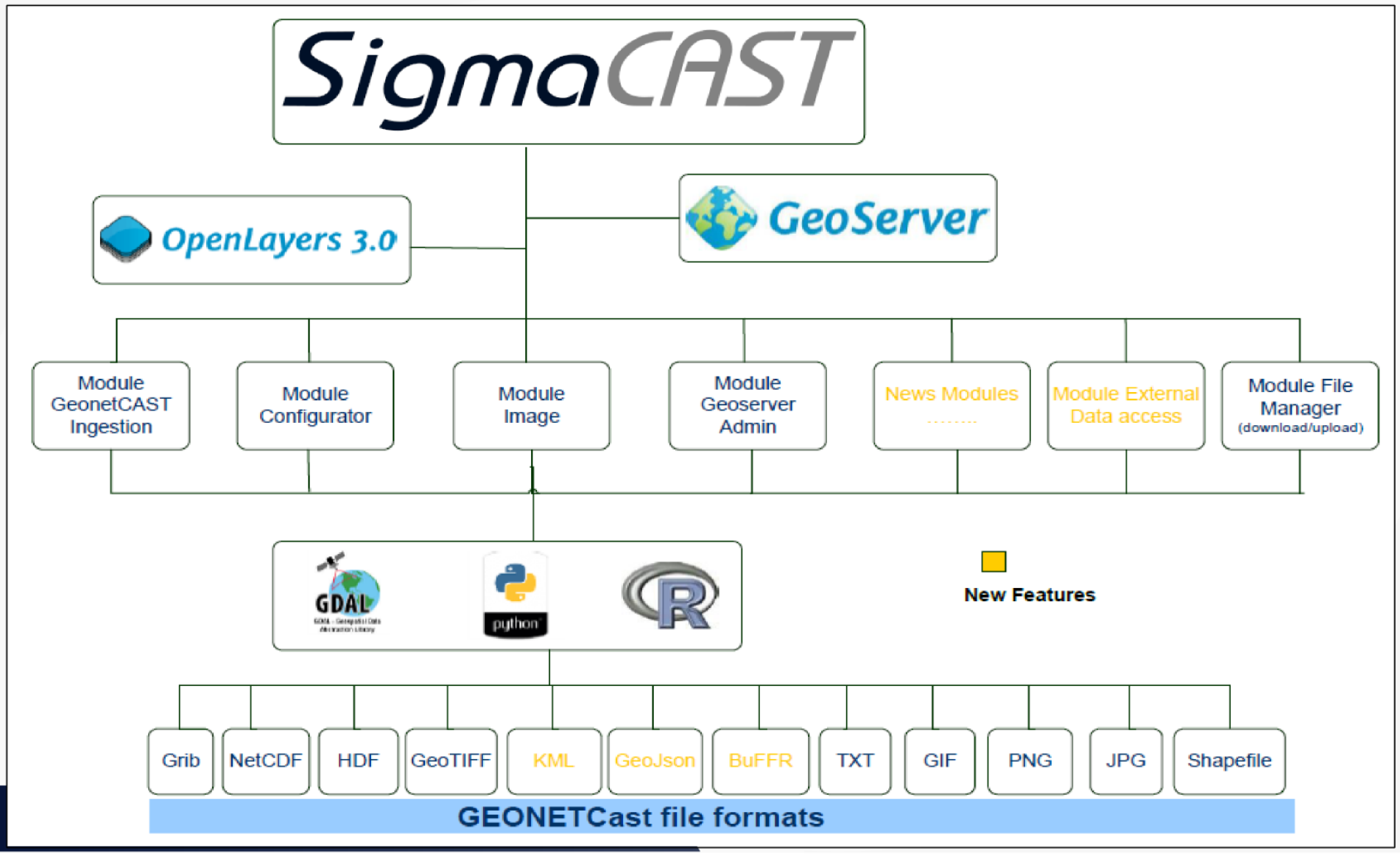
mongoDB

GEONETCast

Delivering Environmental Data to Users Worldwide



The SIGMACast Software: Architecture



The SIGMACast Software: Repository

/dados/fazzt

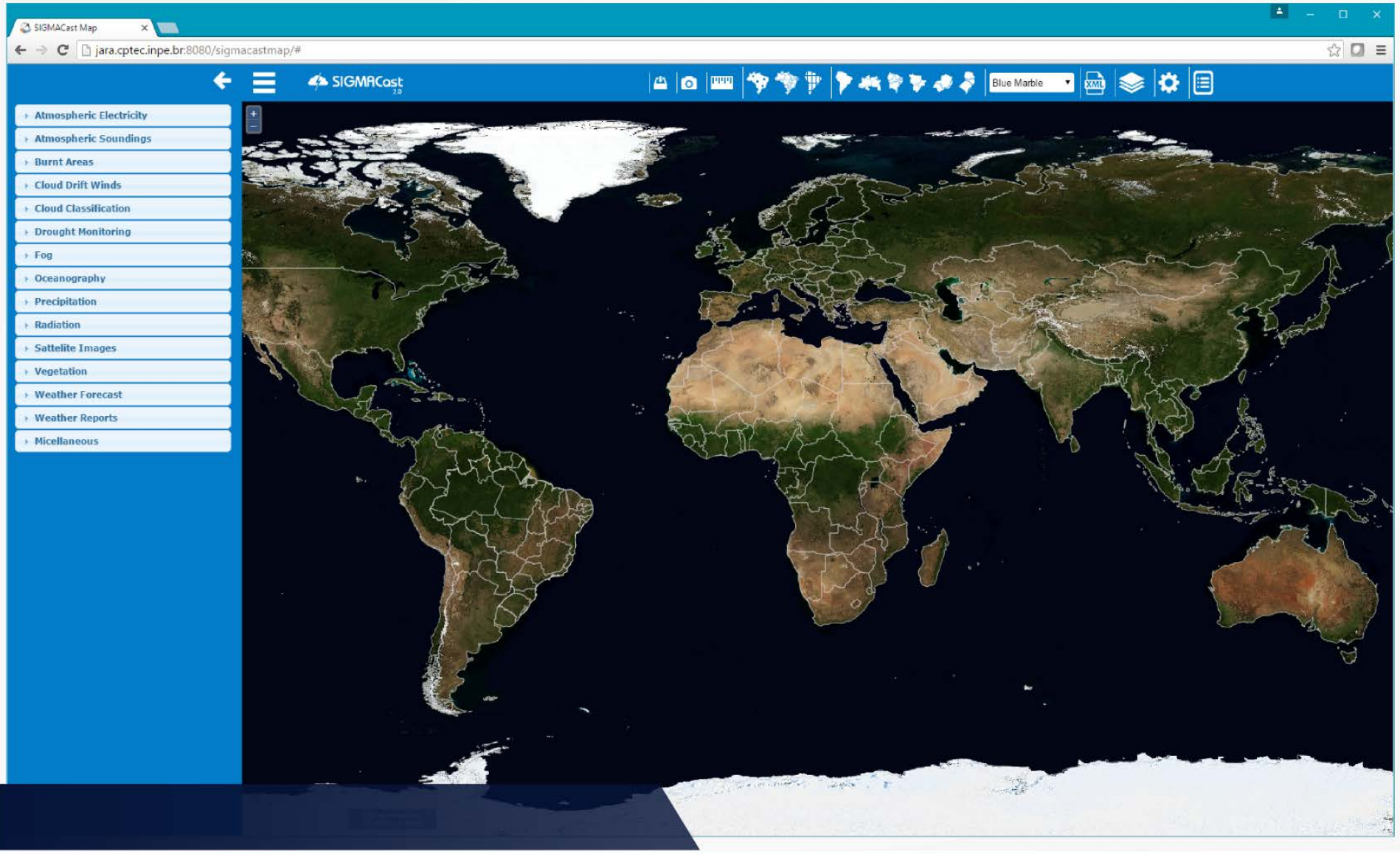
Name	Ext
..	
Alert	
CONAE	
EUMETSAT	
IMN-CostaRica	
INPE	
ISCS-ADMIN	
ISCS-ANLZ-CLIMATE	
ISCS-BUFR	
ISCS-FCAST	
ISCS-GRIB1	
ISCS-GRIB2	
ISCS-PIC	
ISCS-RADAR	
ISCS-SAT	
ISCS-SURFACE	
MARN-El Salvador	
MSG-0degree	
NOAA-NESDIS	
USEPA	
WMO-WMC-Washington	
Heartbeat.txt	

GEONETCast

/dados/web/GEONETCast

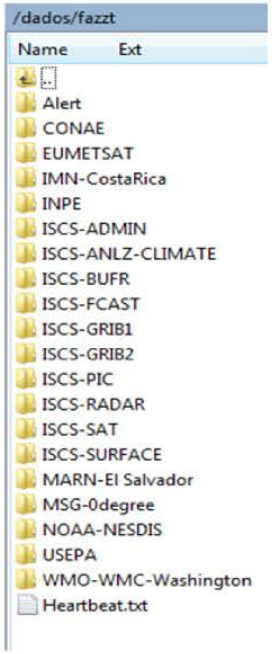
Name	Ext
..	
atmospheric_electricity	
burnt_areas	
cloud_classification	
cloud_drift_winds	
drought_monitoring	
fog	
oceanography	
precipitation	
radiation	
satellite_images	
weather_forecast	
log.txt	

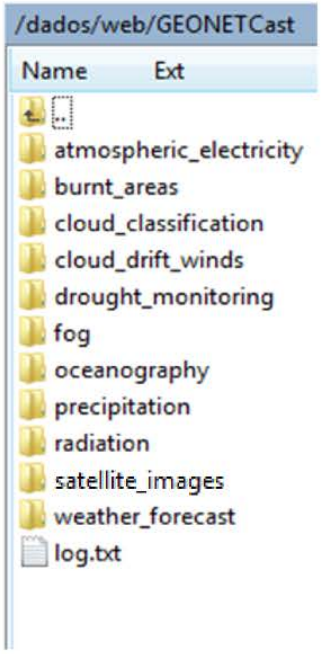
The SIGMACast Software: Main Window



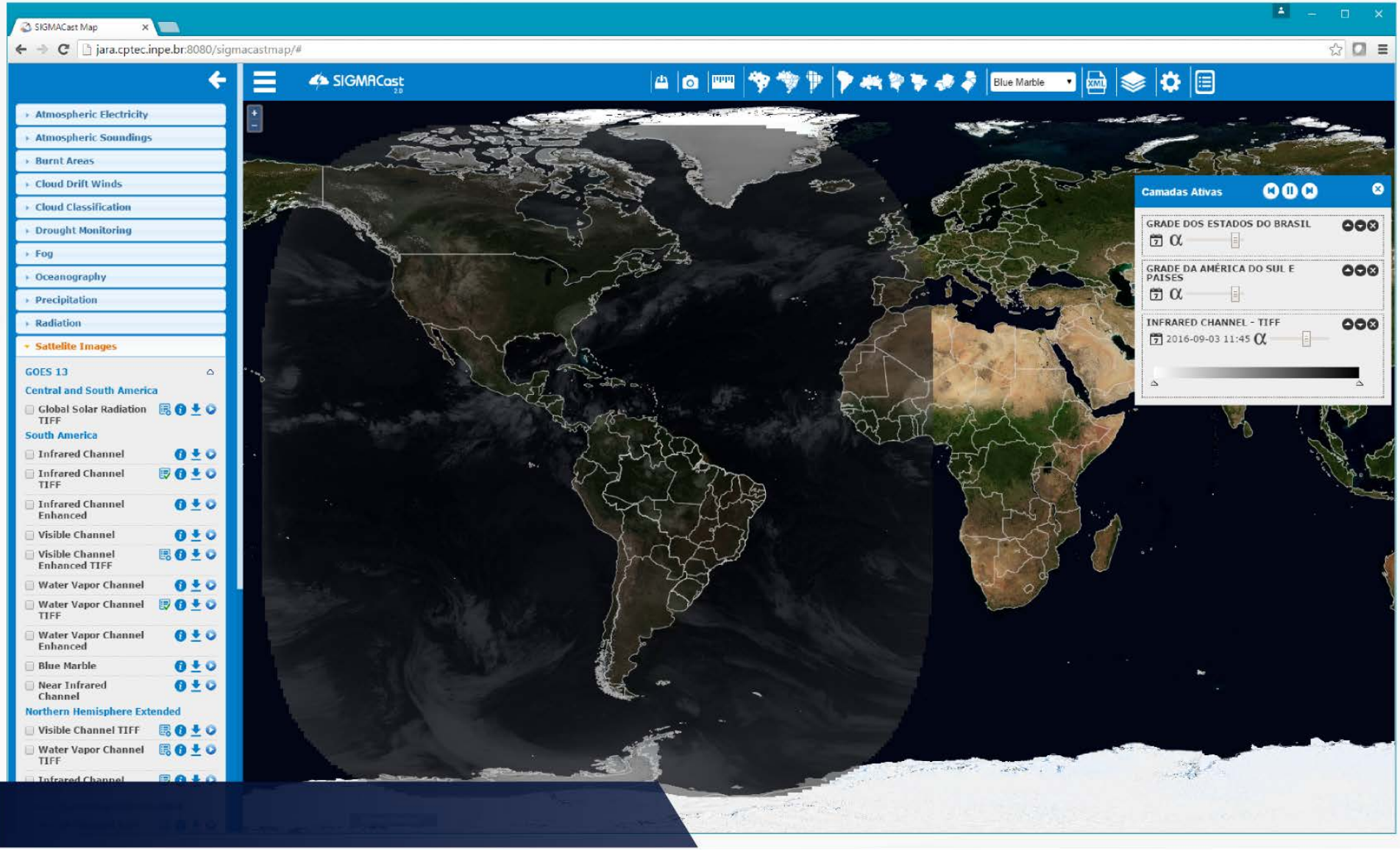
The SIGMACast Software: Custom Menu

- Atmospheric Electricity
- Atmospheric Soundings
- Burnt Areas
- Cloud Drift Winds
- Cloud Classification
- Drought Monitoring
- Fog
- Oceanography
- Precipitation
- Radiation
- Satellite Images
- Vegetation
- Weather Forecast
- Weather Reports
- Micellaneous

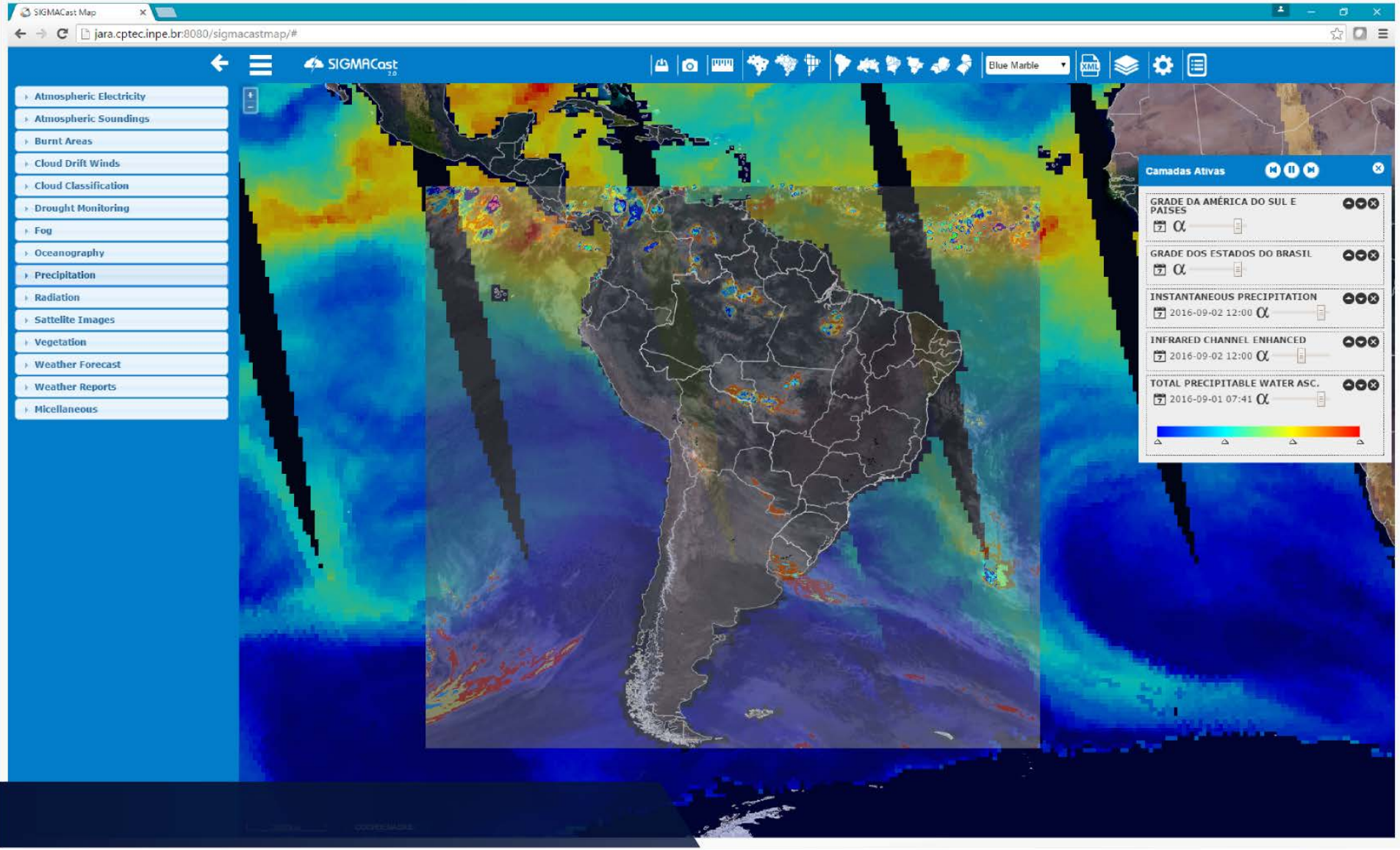




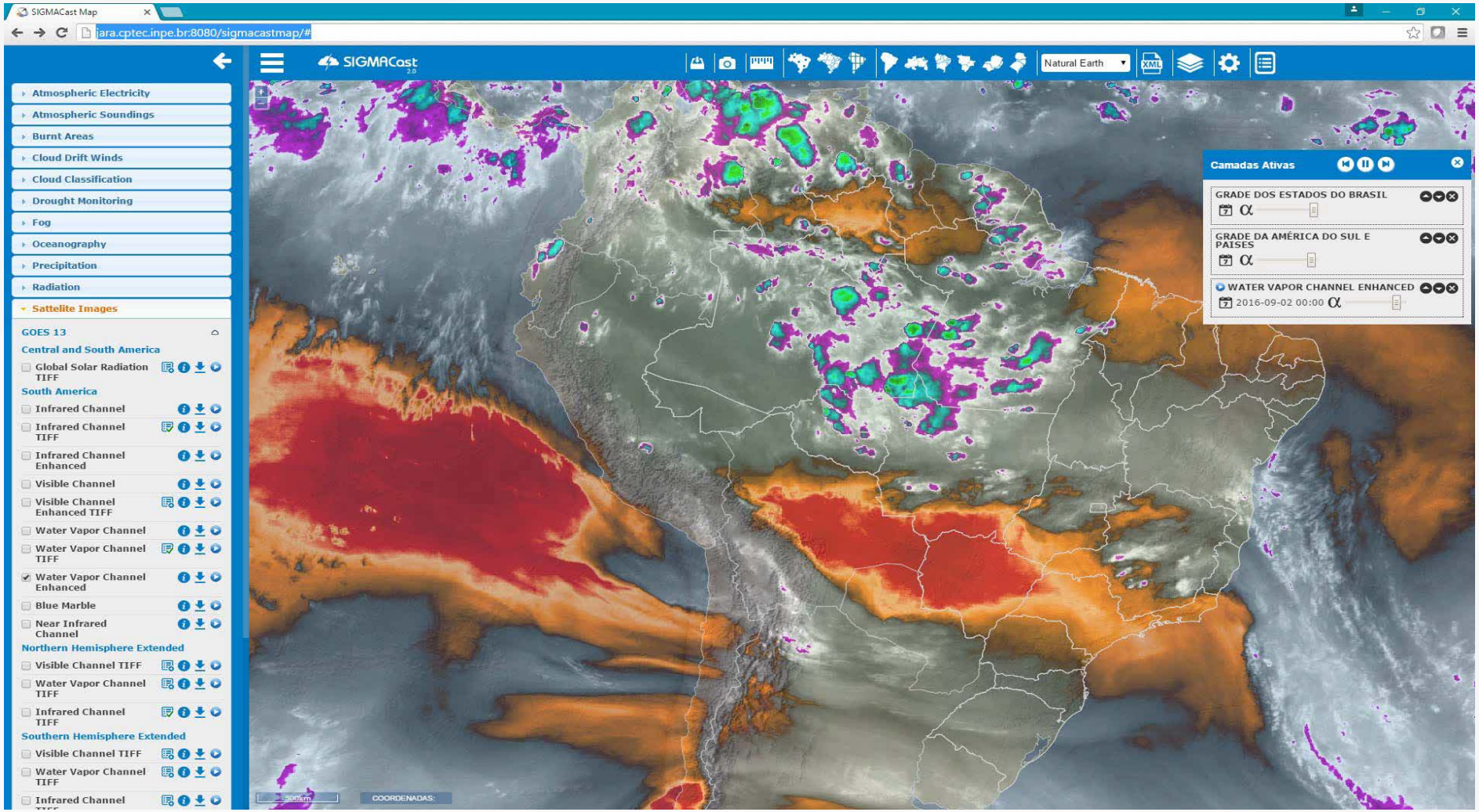
The SIGMACast Software: Product Selection



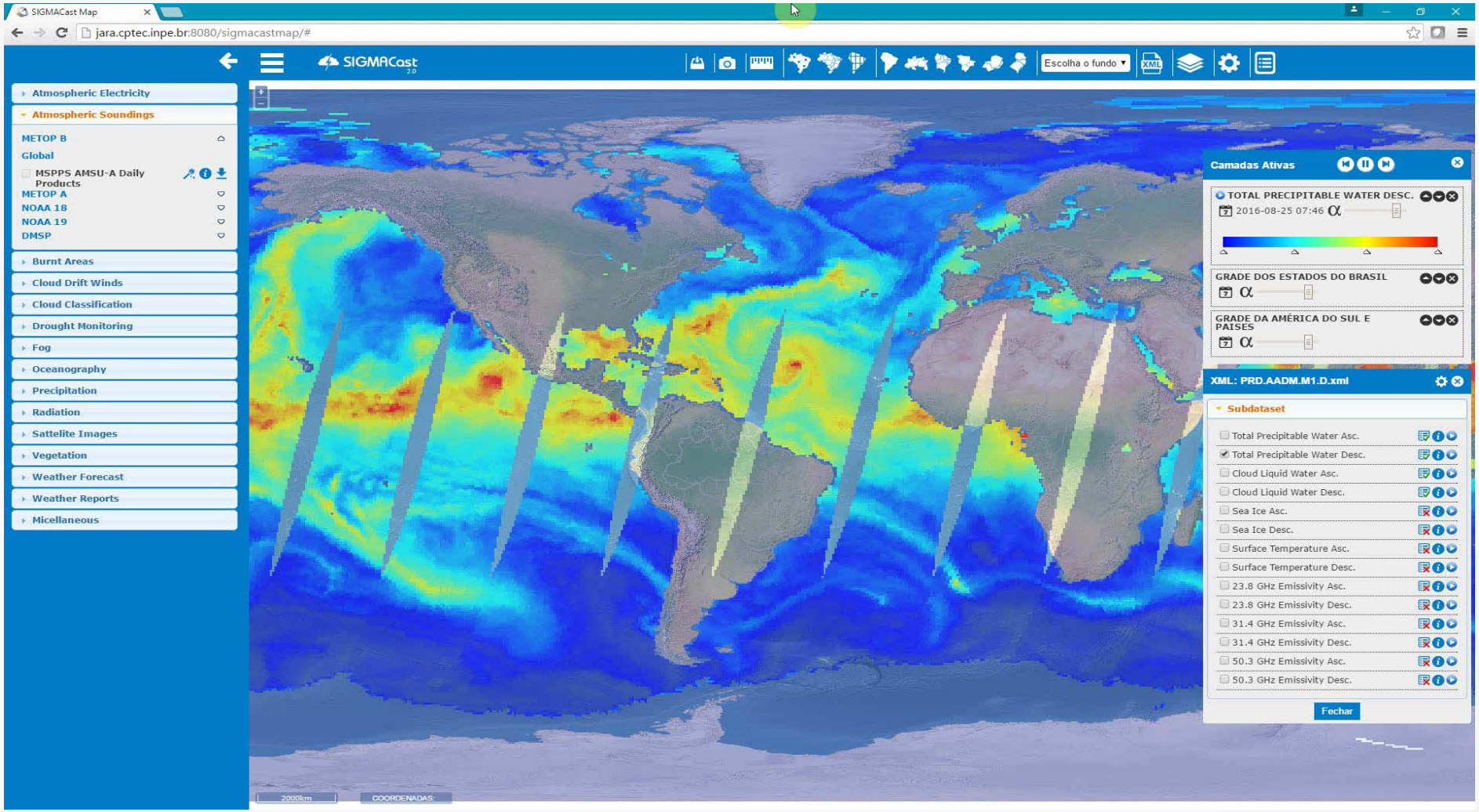
The SIGMACast Software: Layer Overlay



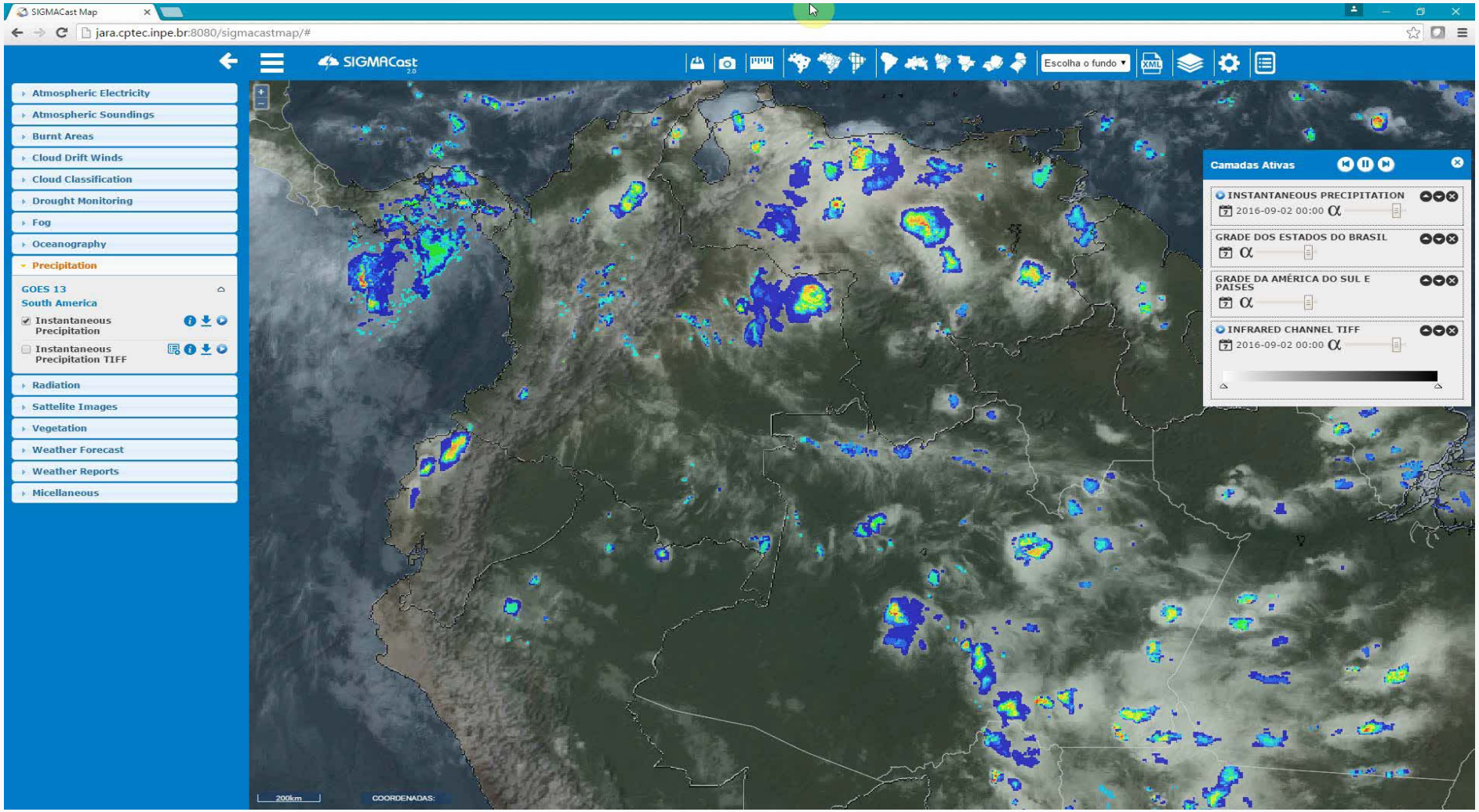
The SIGMACast Software: Animation



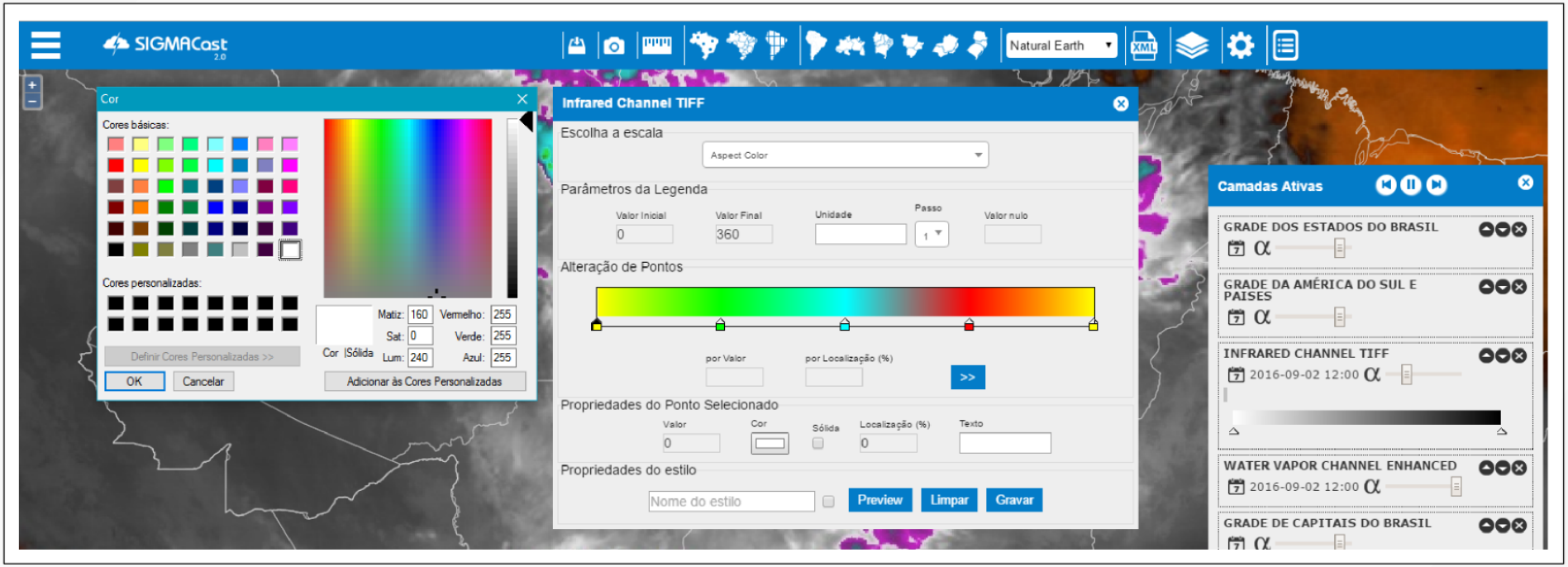
The SIGMACast Software: Animation



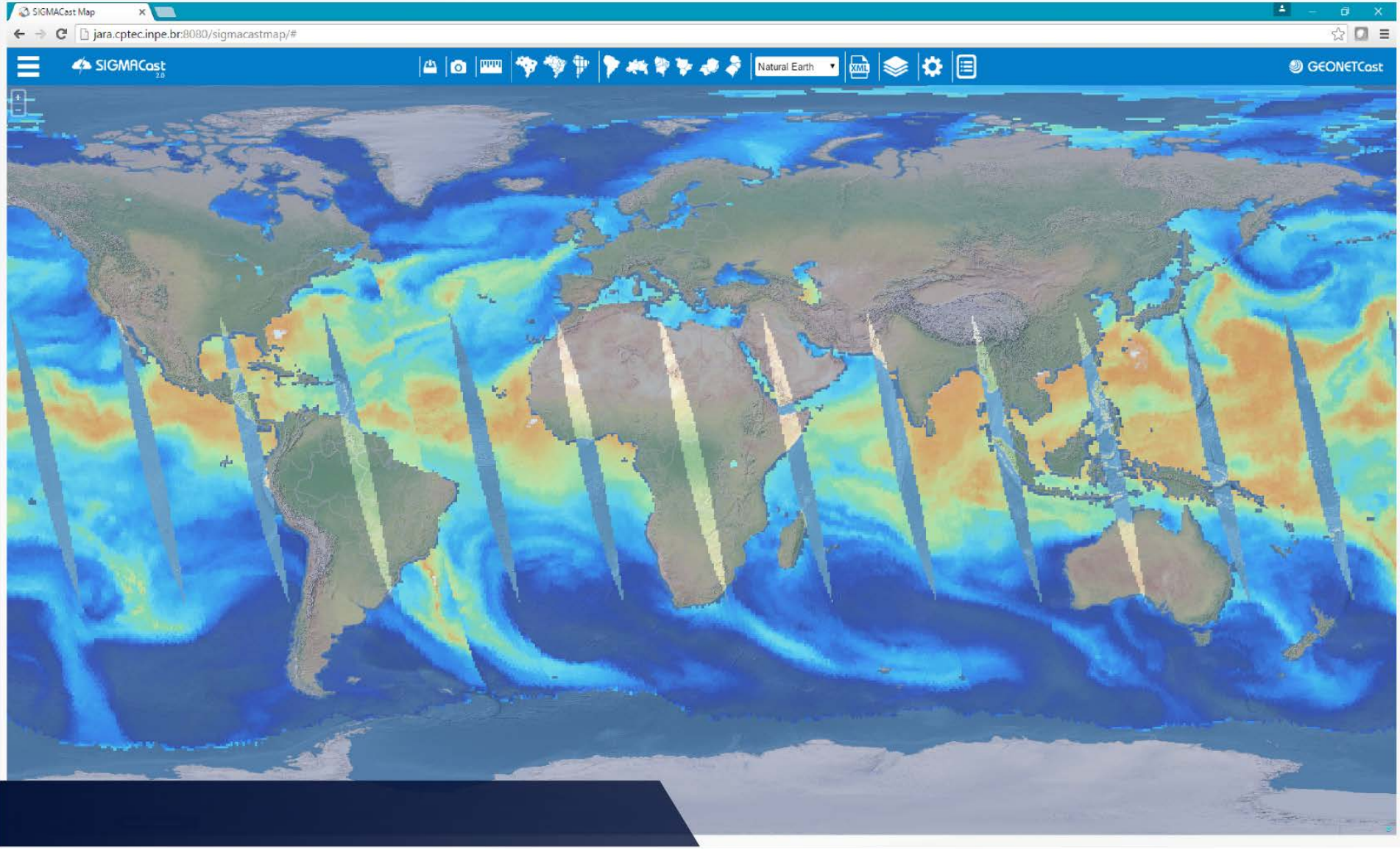
The SIGMACast Software: Animation (Synch. Layers)



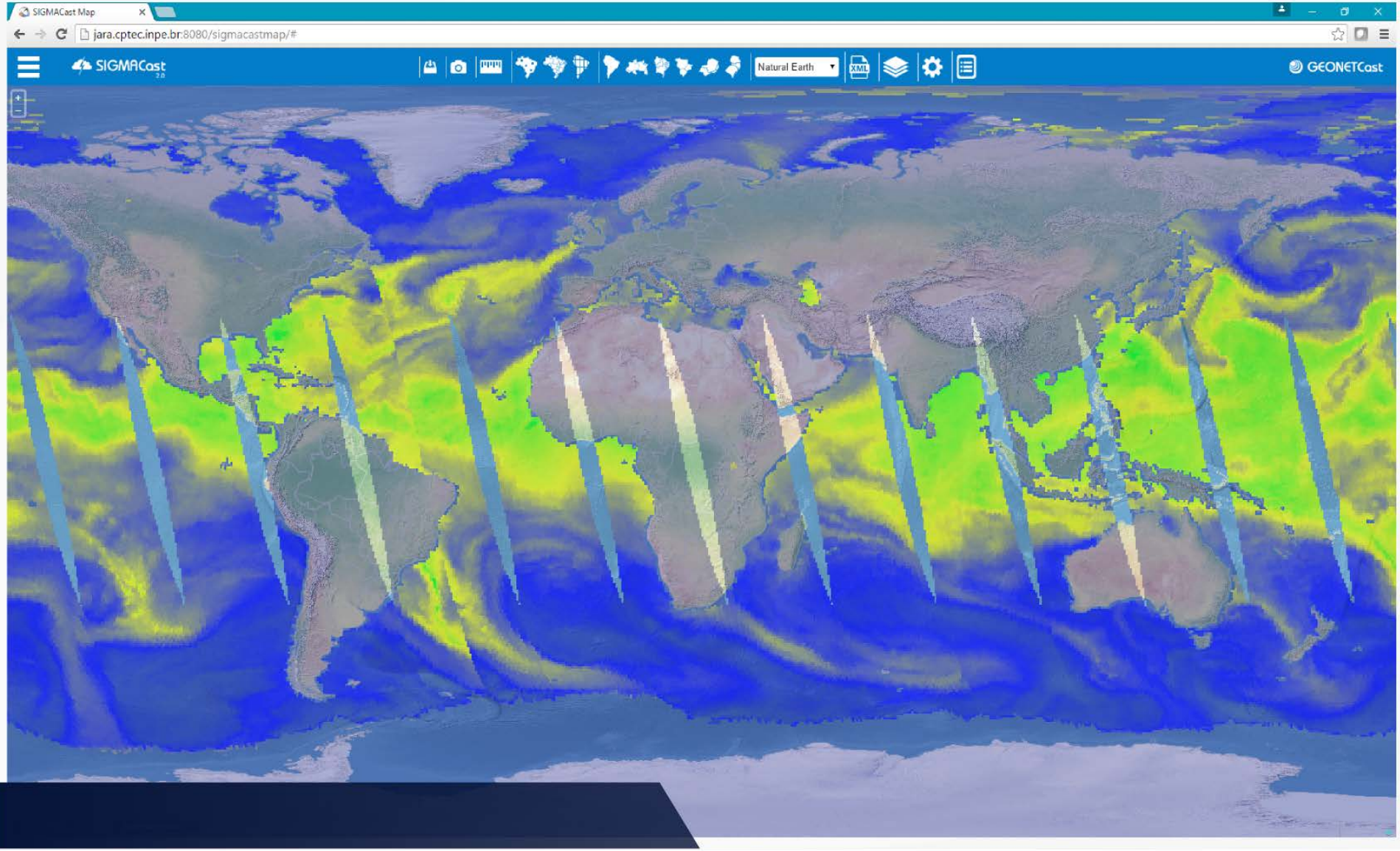
The SIGMACast Software: Custom Color Palette



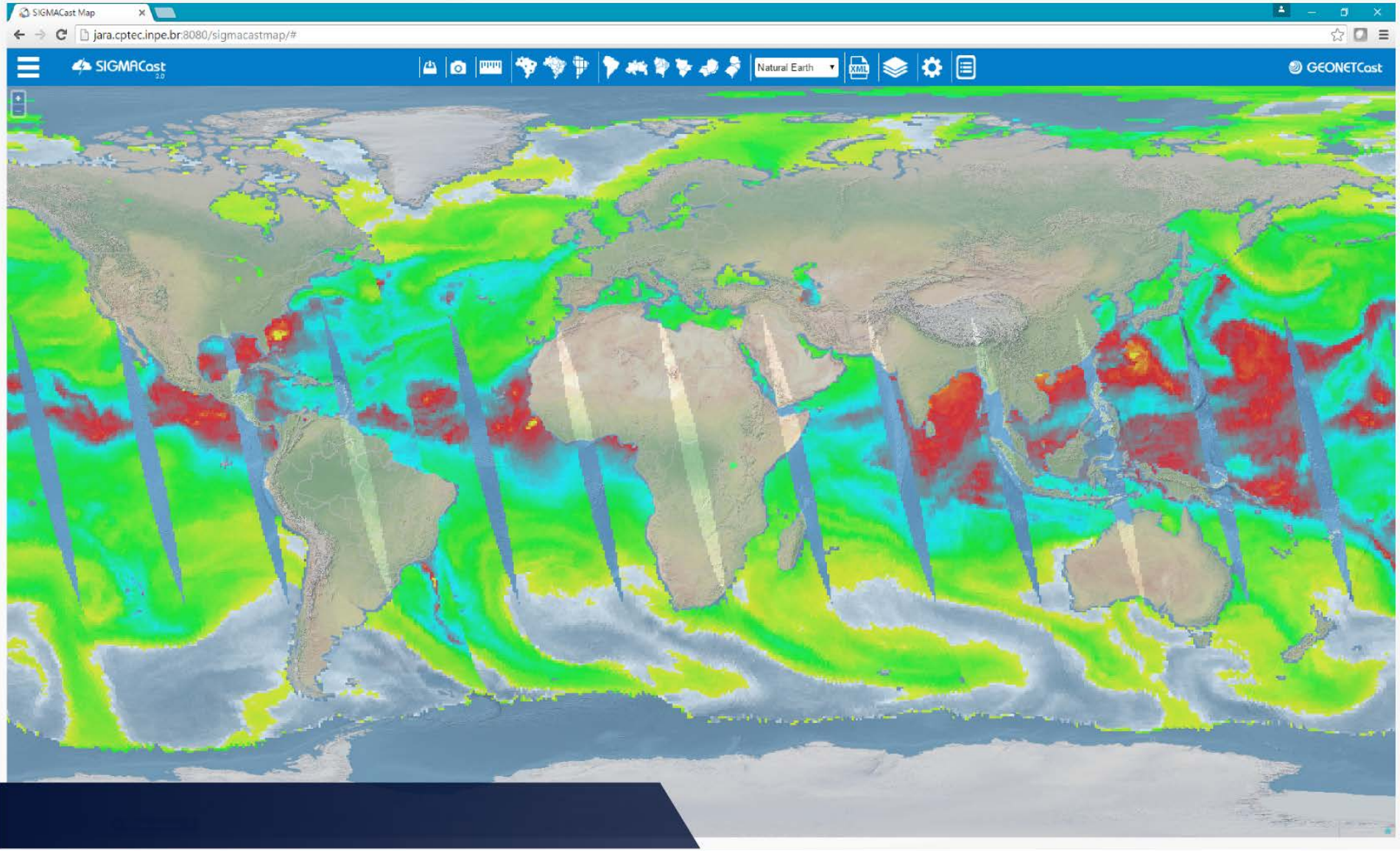
The SIGMACast Software: Custom Color Palette



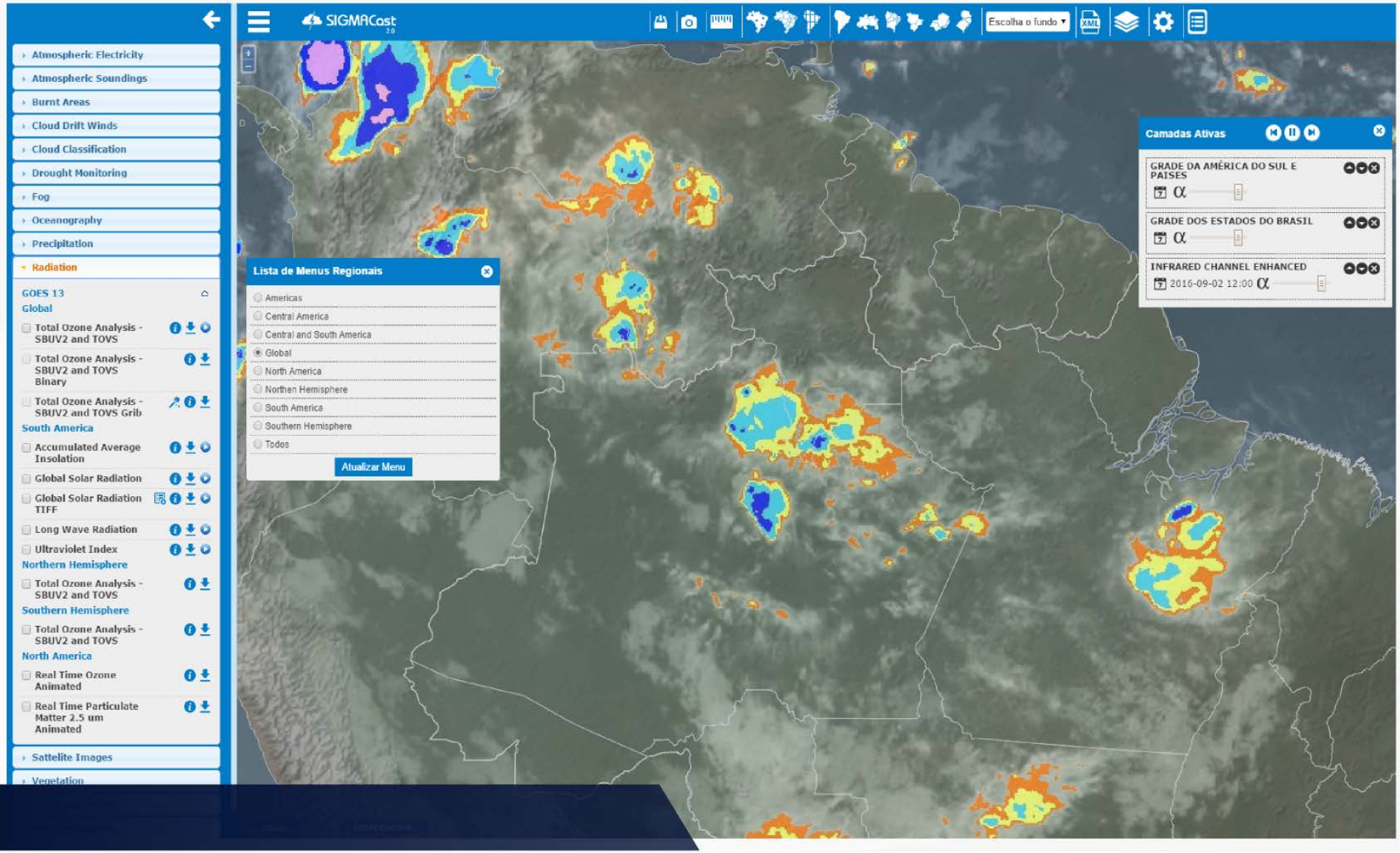
The SIGMACast Software: Custom Color Palette



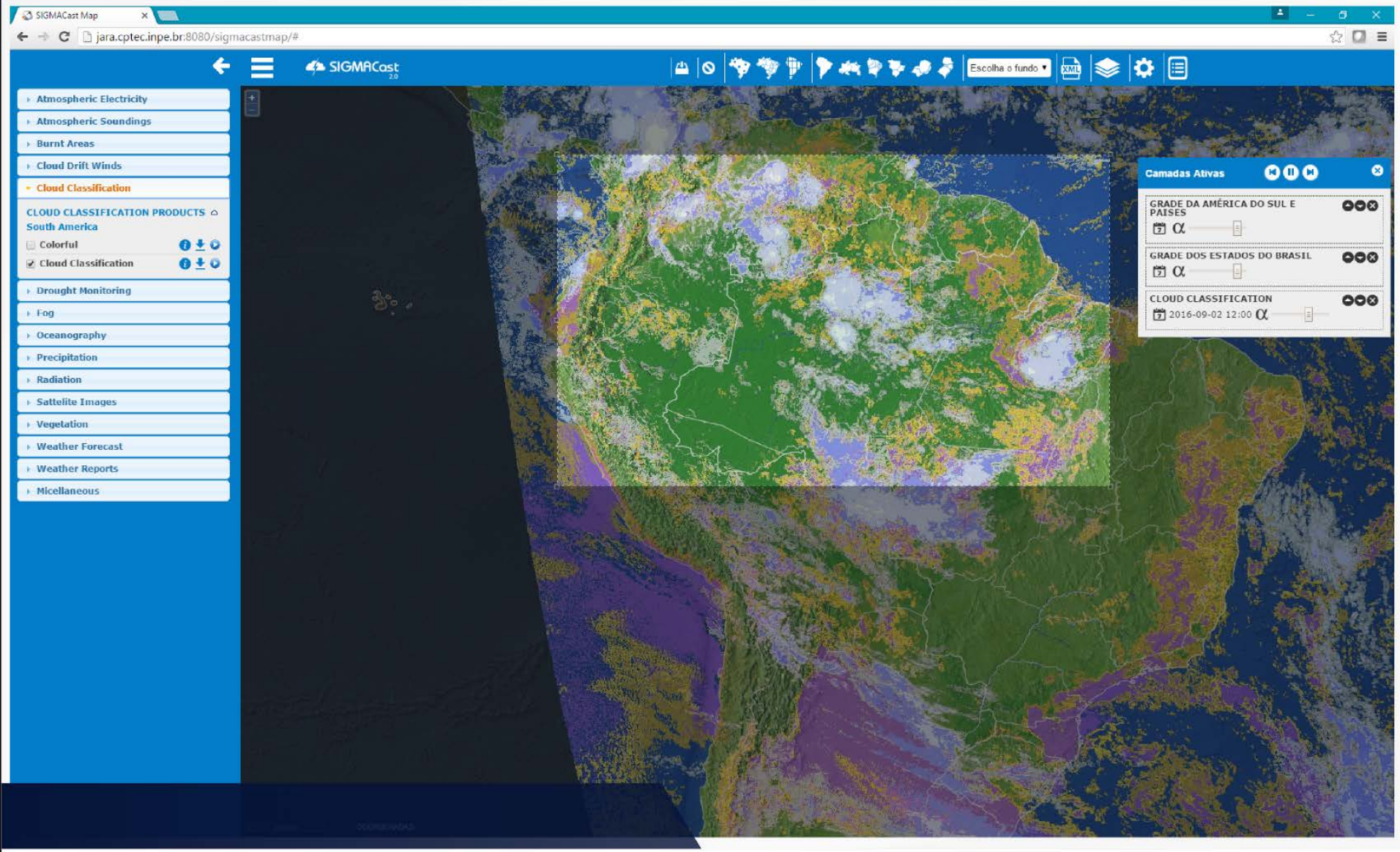
The SIGMACast Software: Custom Color Palette



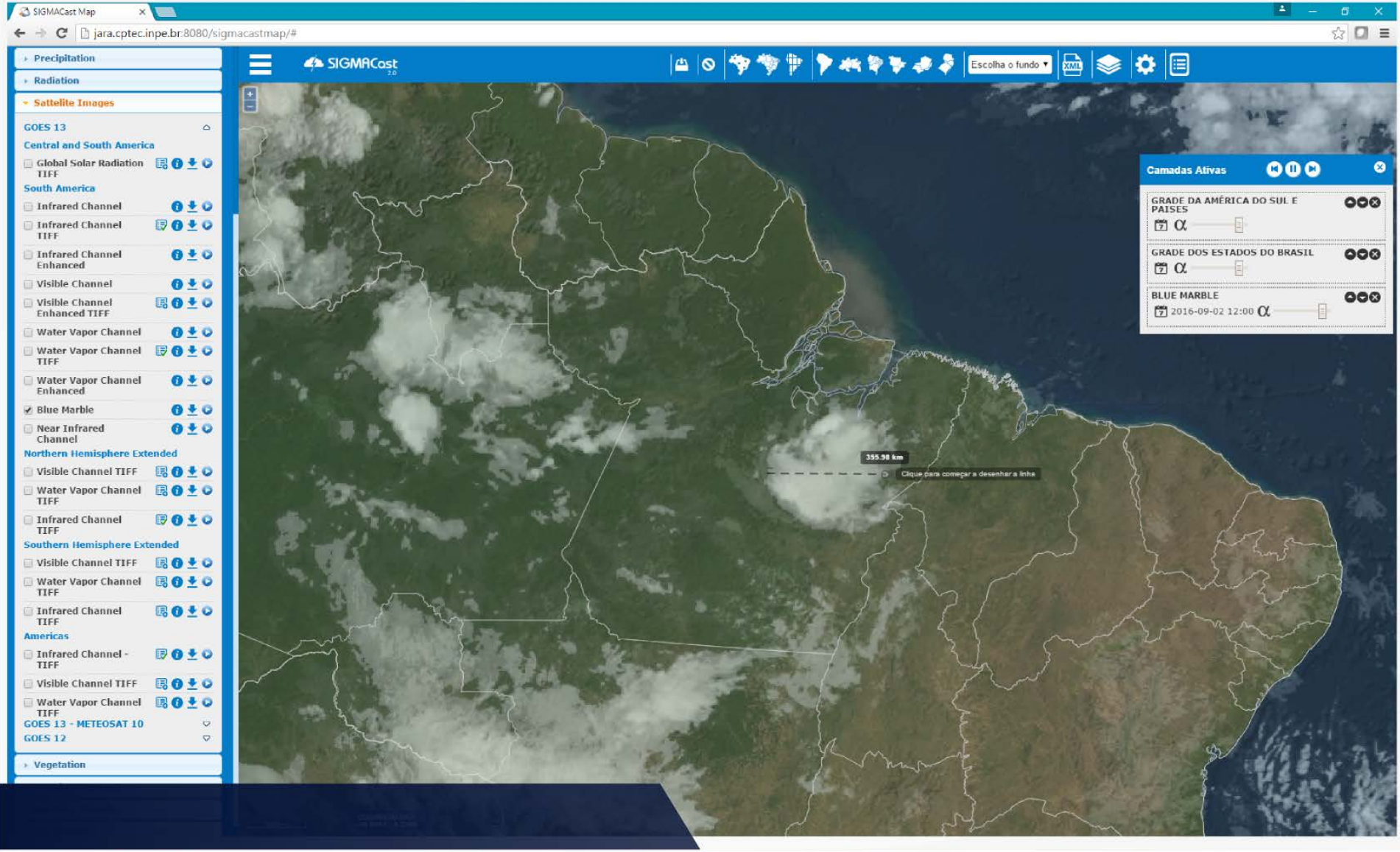
The SIGMACast Software: Regional Menus



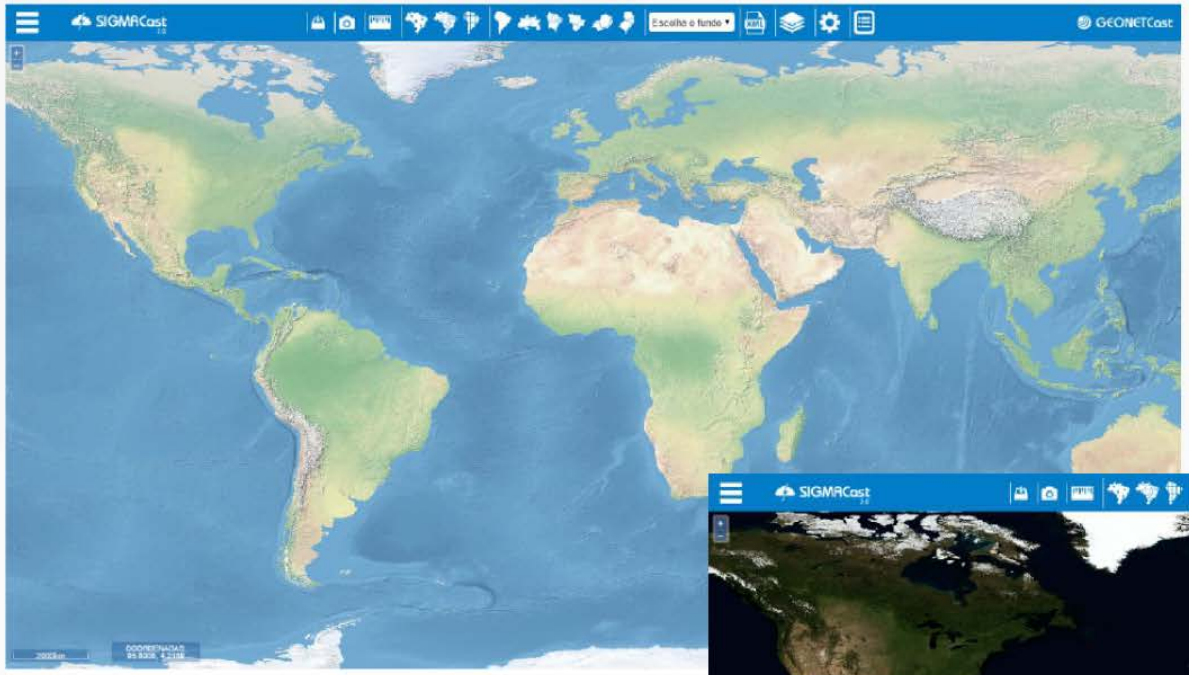
The SIGMACast Software: Subsect and Download



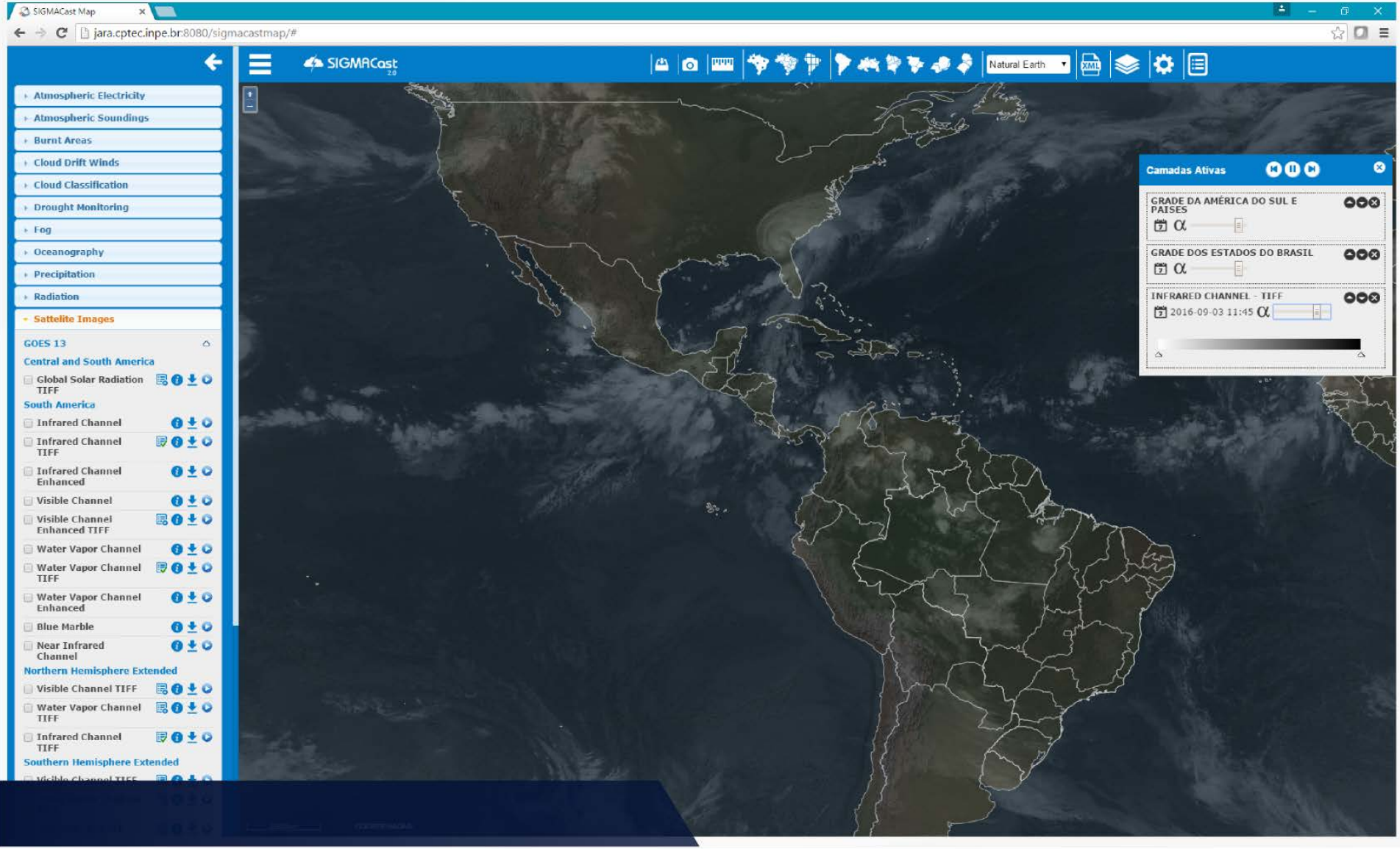
The SIGMACast Software: Distance Measurement



The SIGMACast Software: Background Selection

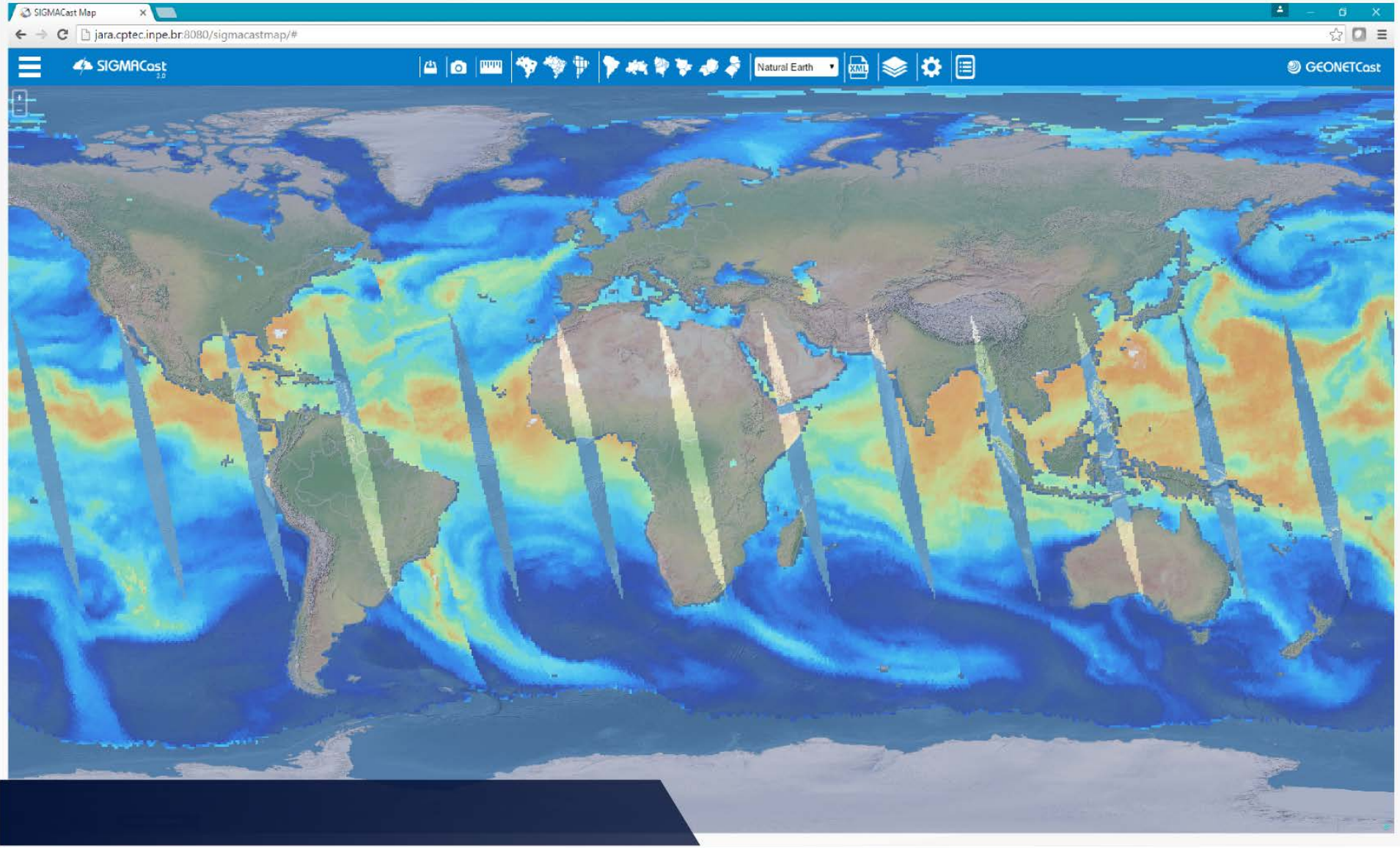


Supported Formats: GeoTIFF

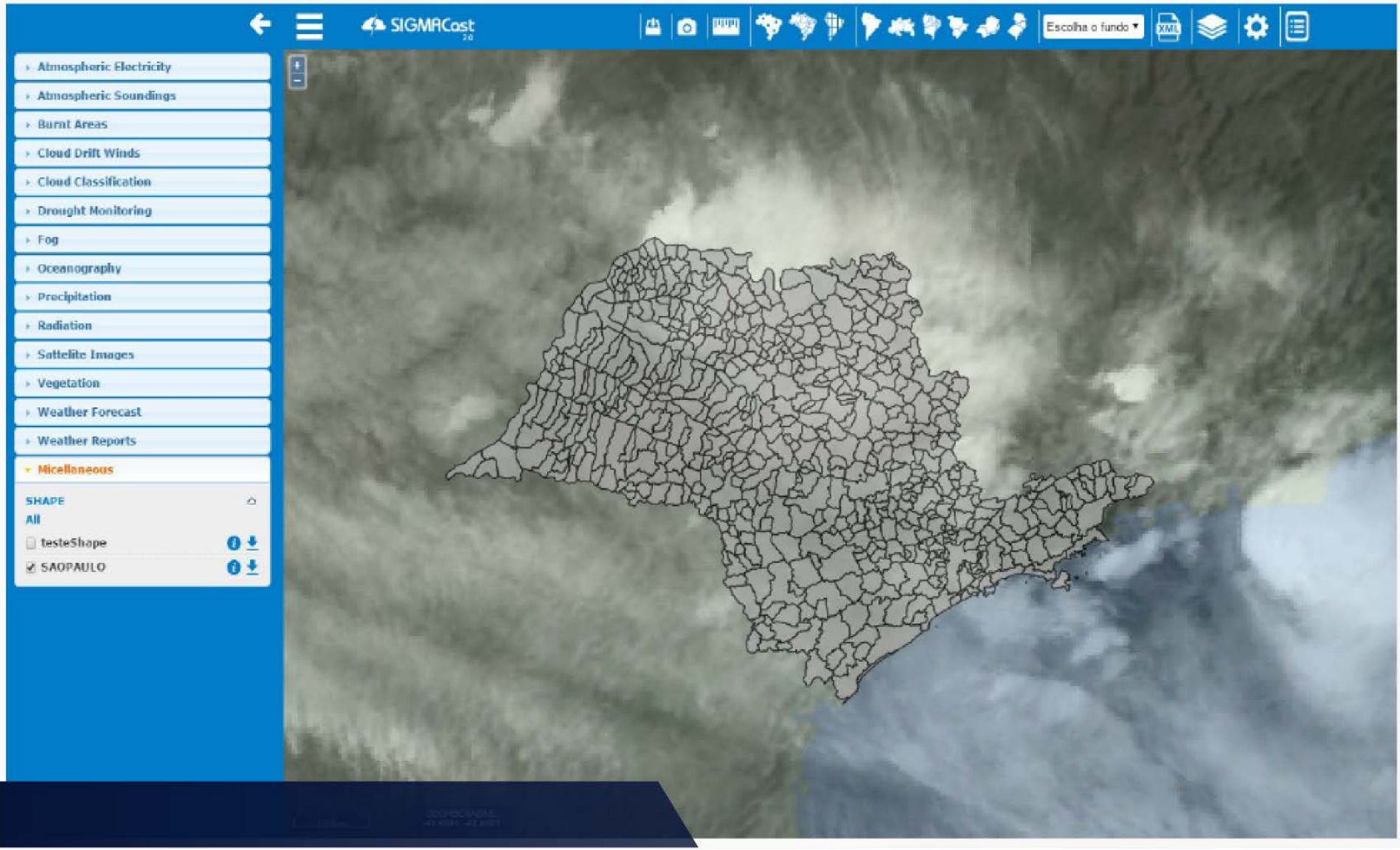


Supported Formats: Color GeoTIFF

Supported Formats: HDF



Supported Formats: Shapefiles



Supported Formats: Shapefiles

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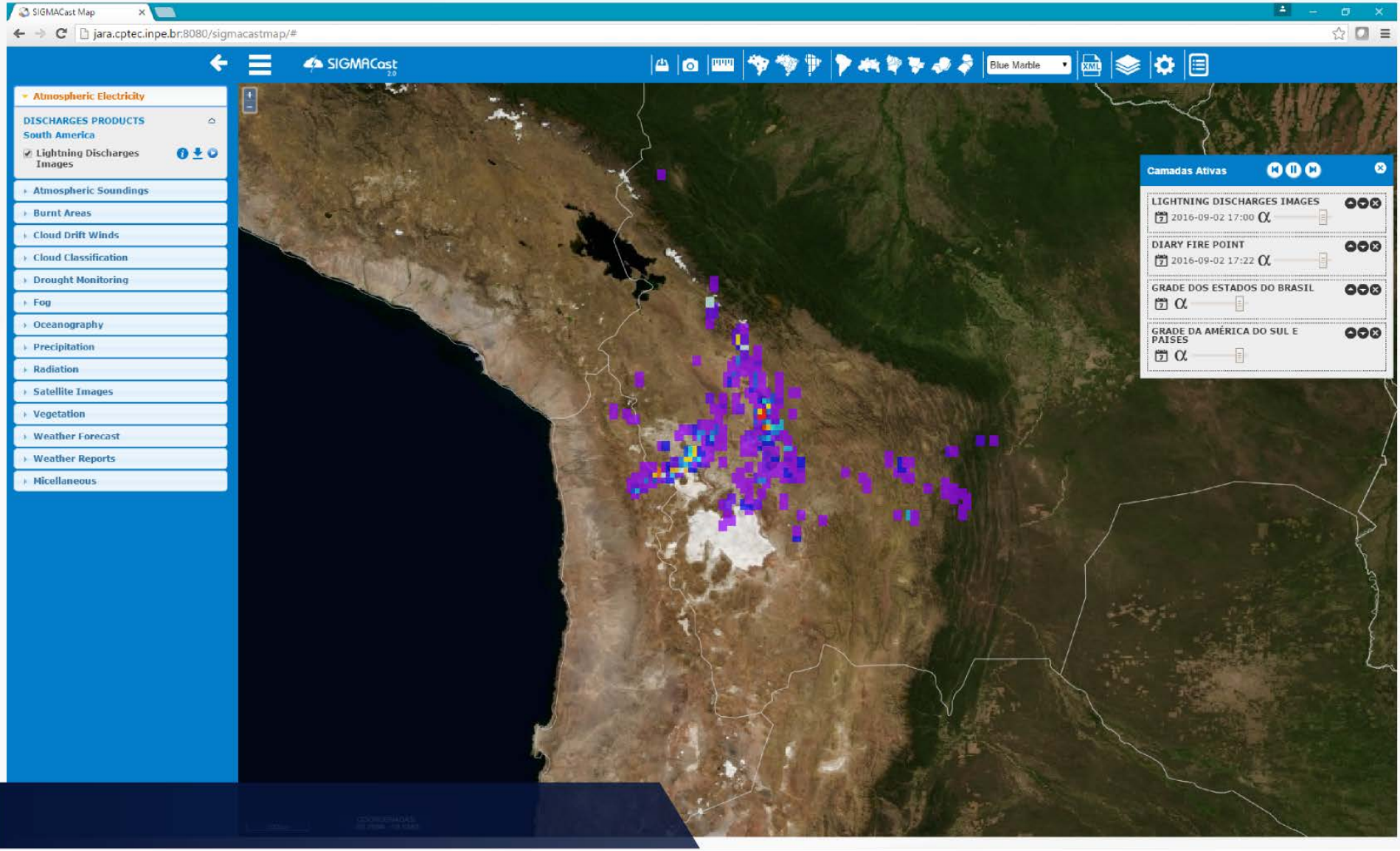
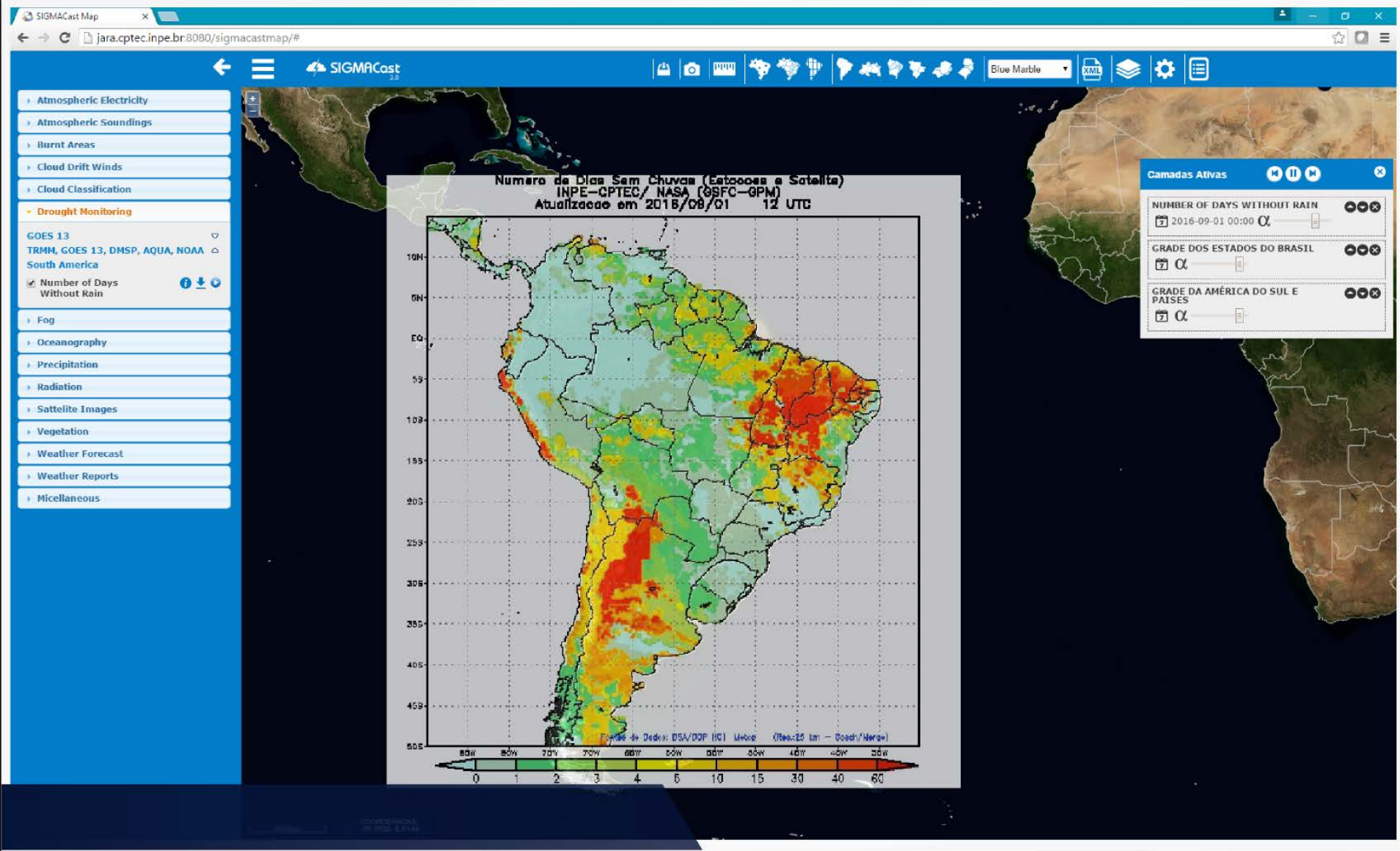


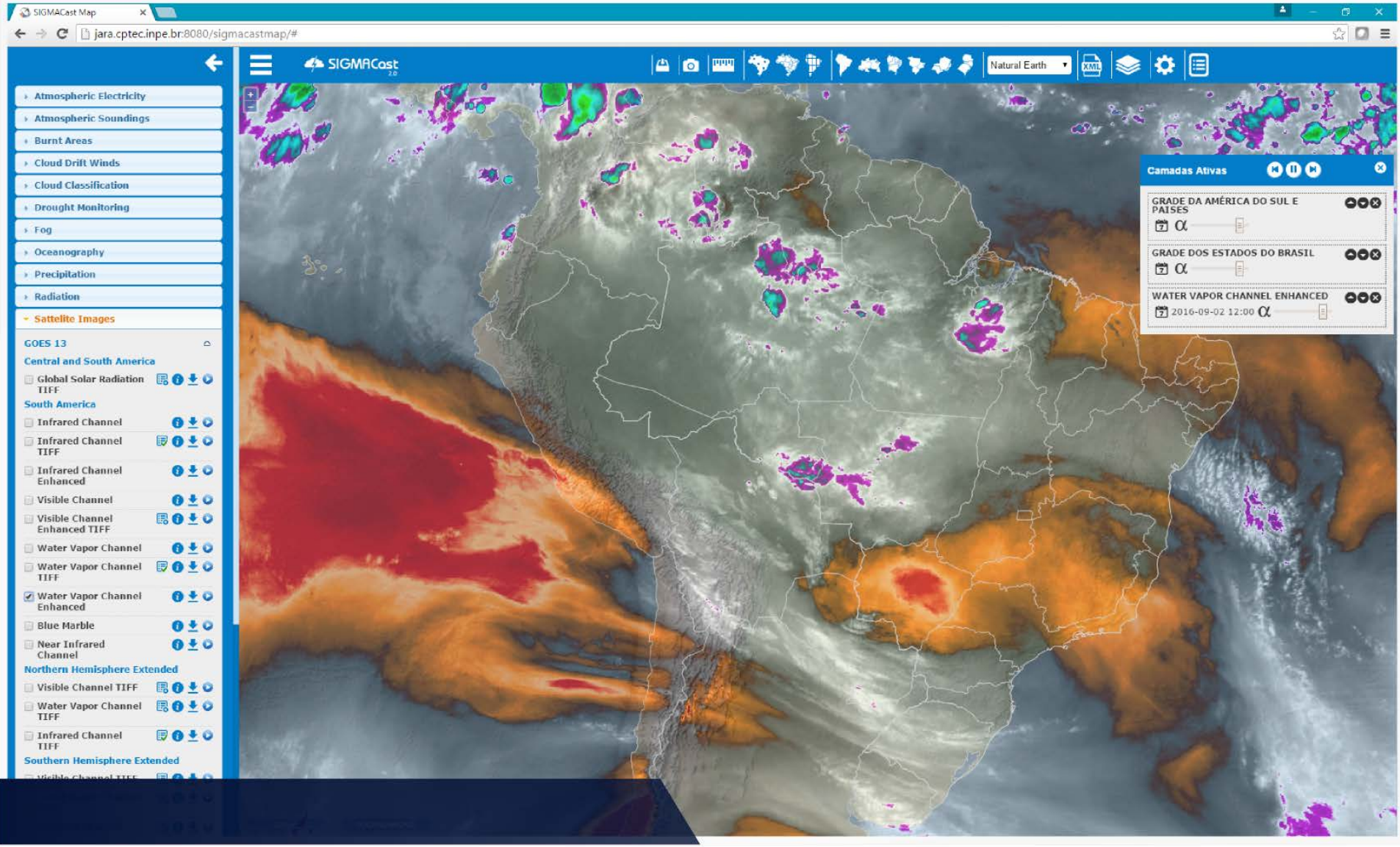
Supported Formats: Georeferenced Imagery



Supported Formats: Georeferenced Imagery

Supported Formats: Georeferenced Imagery

Supported Formats: Georeferenced Imagery



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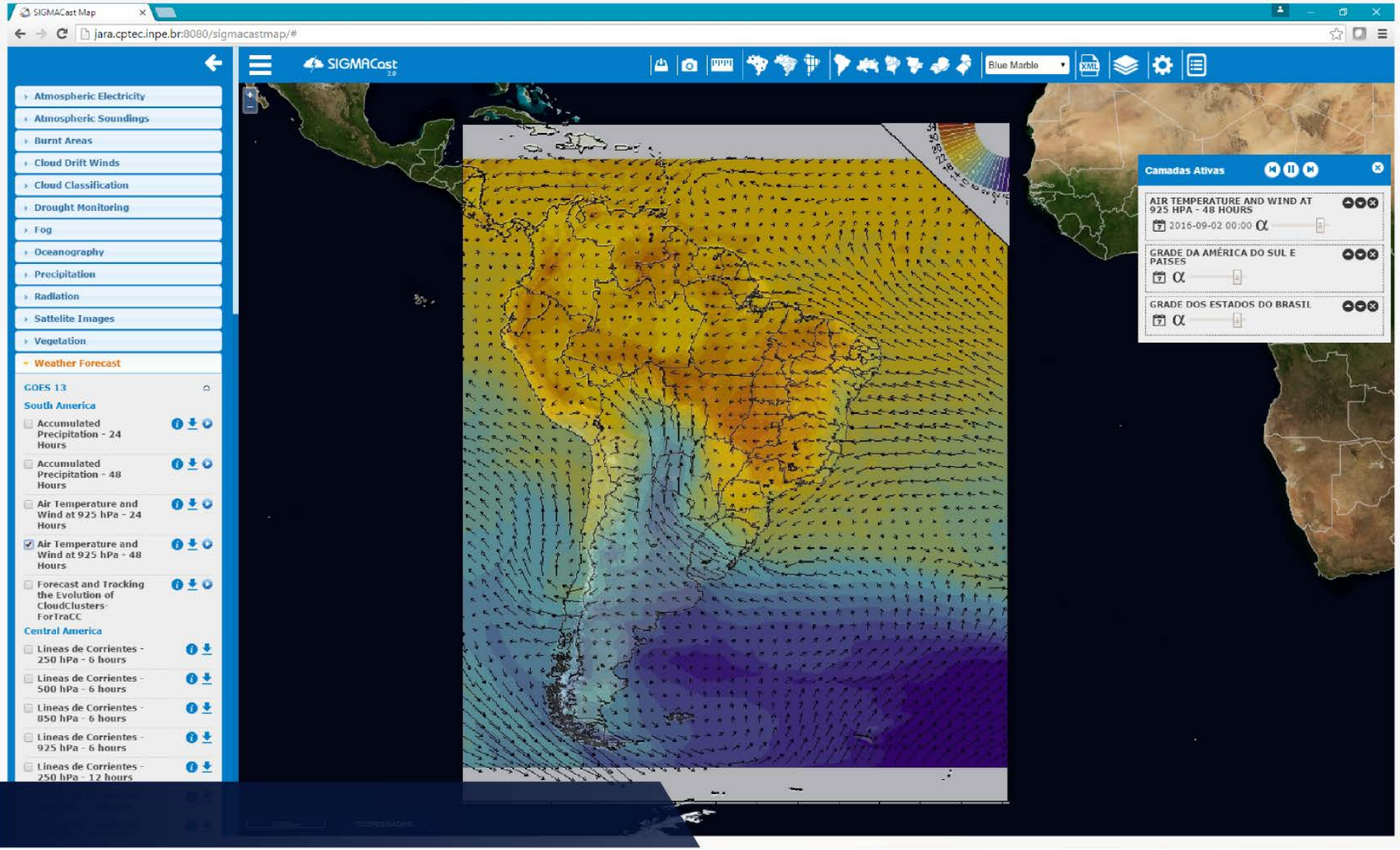

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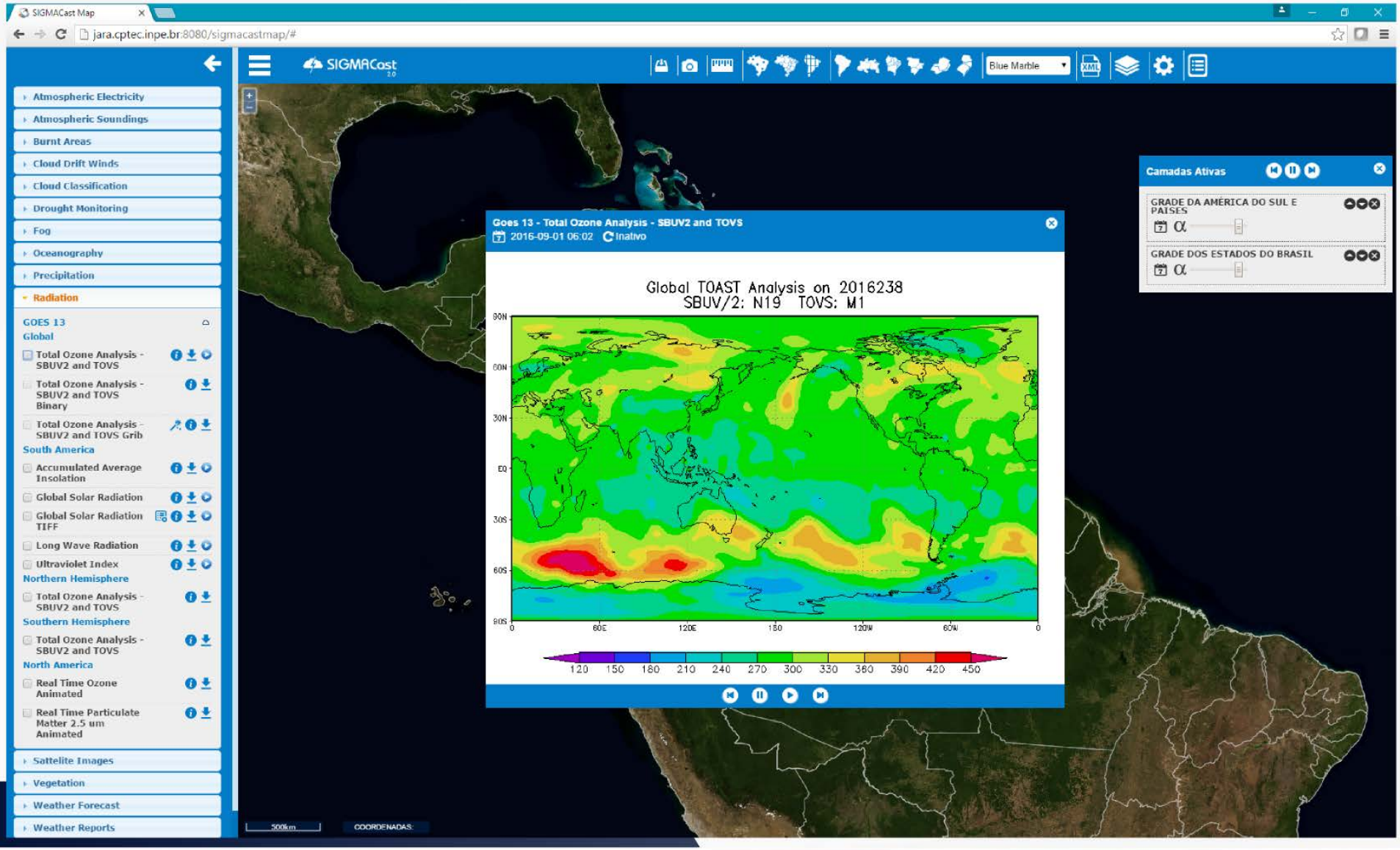

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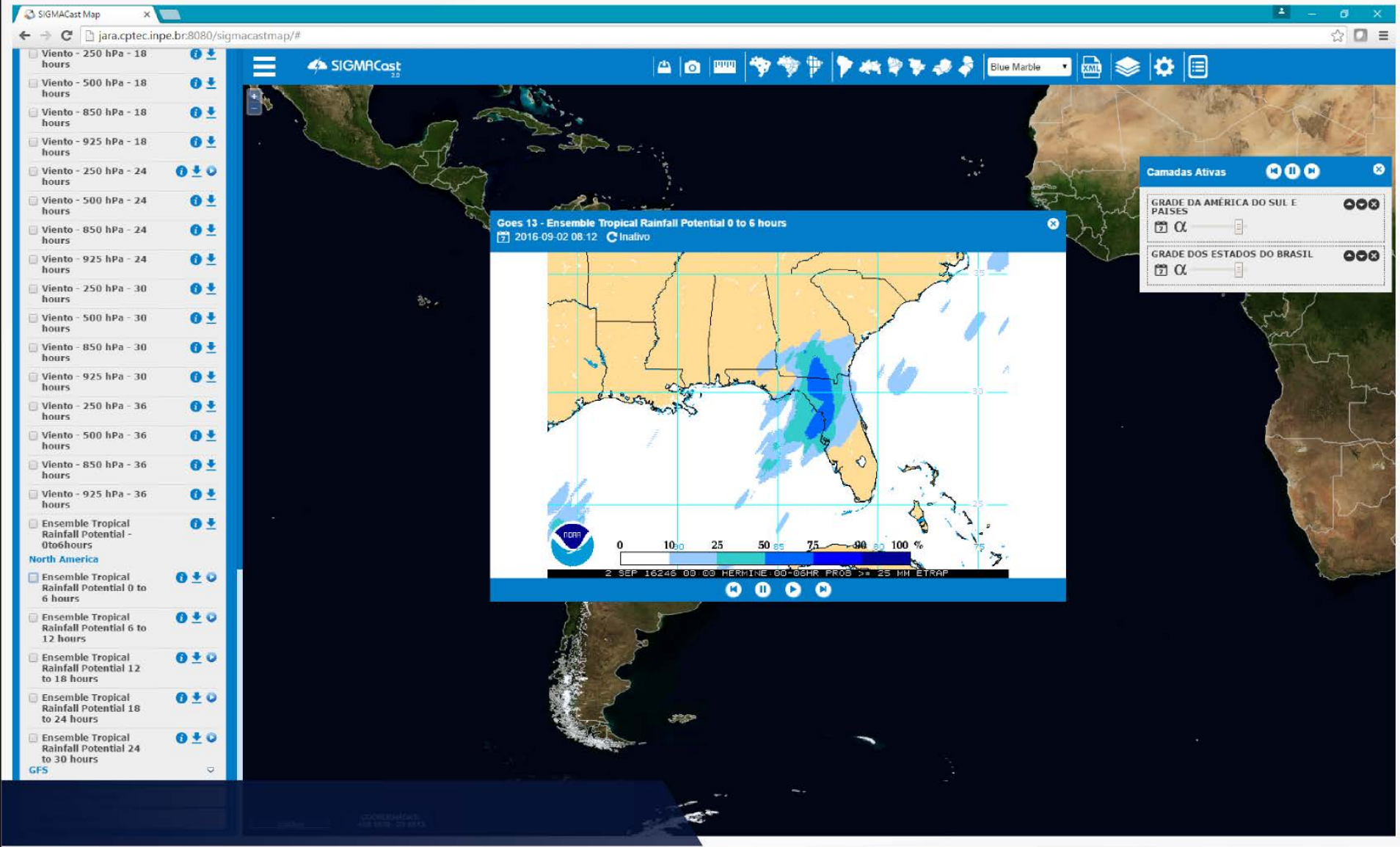

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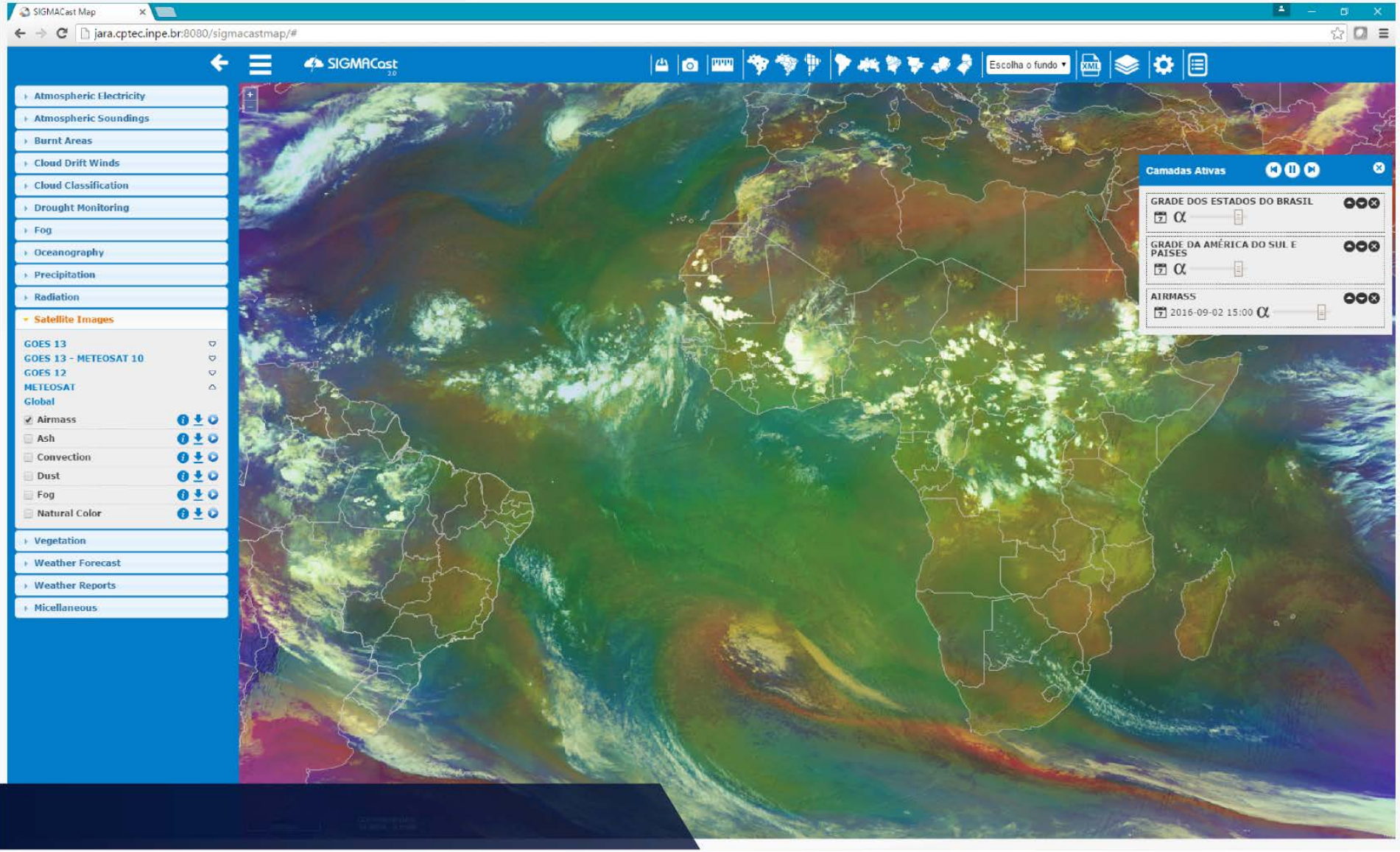

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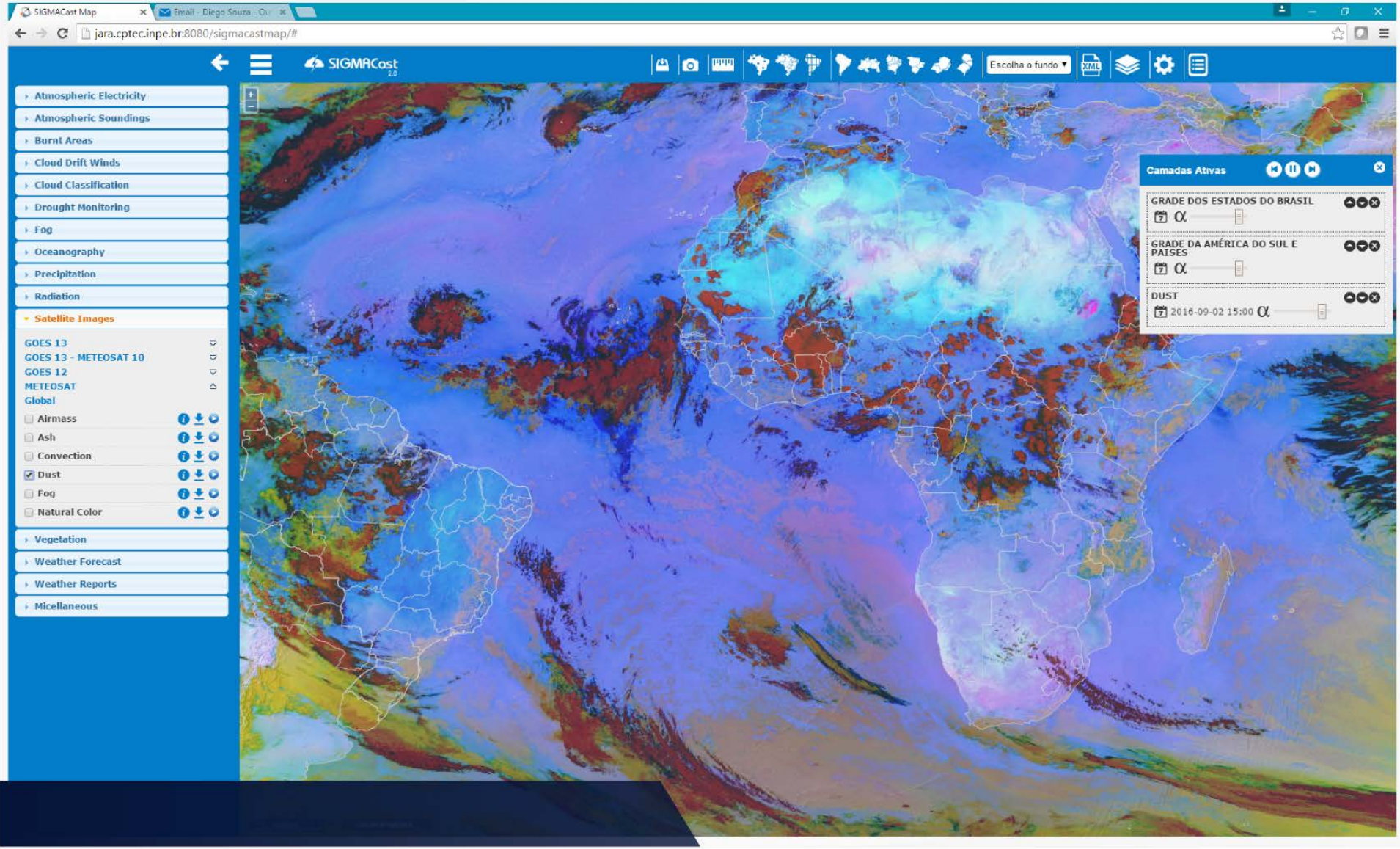

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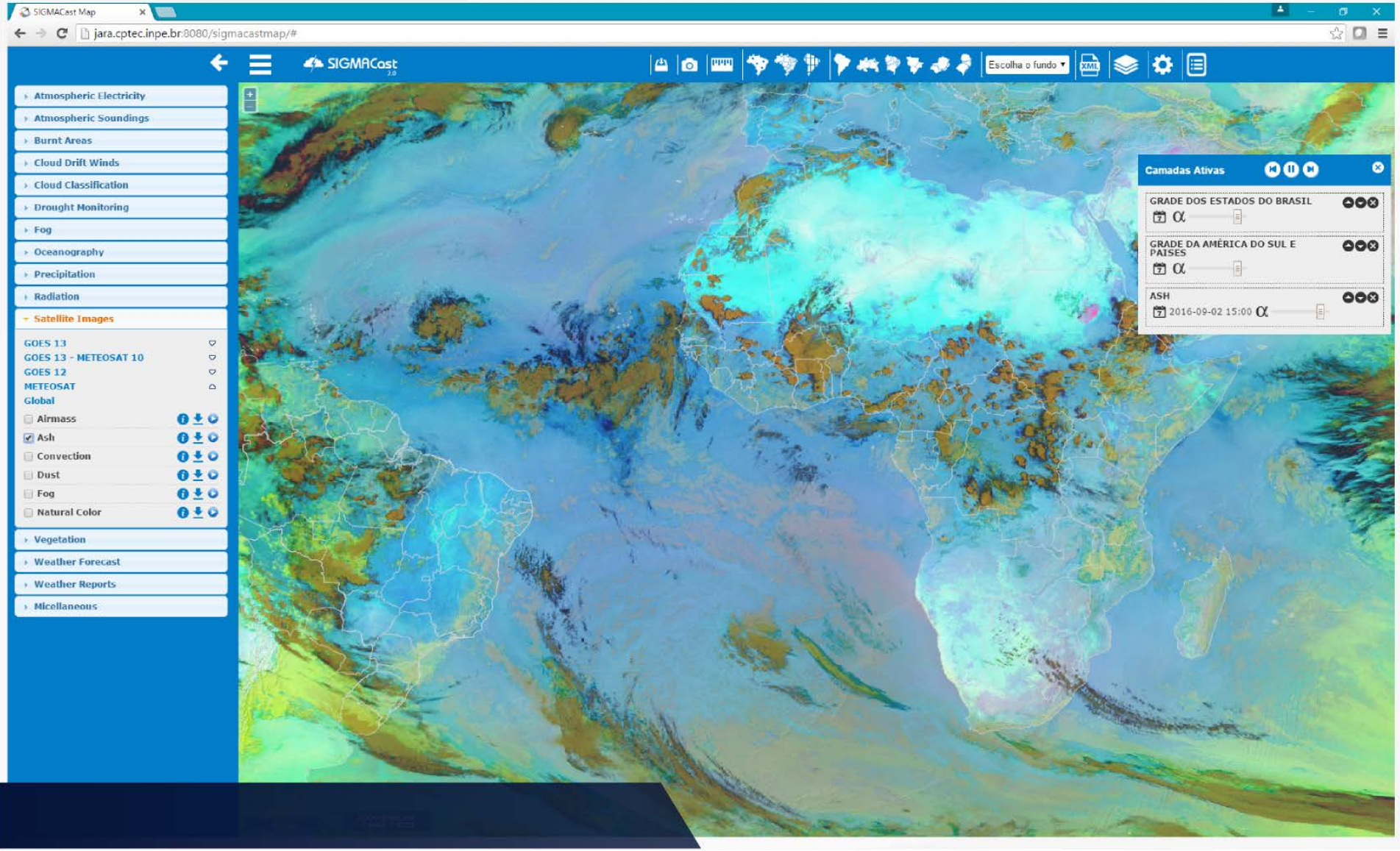

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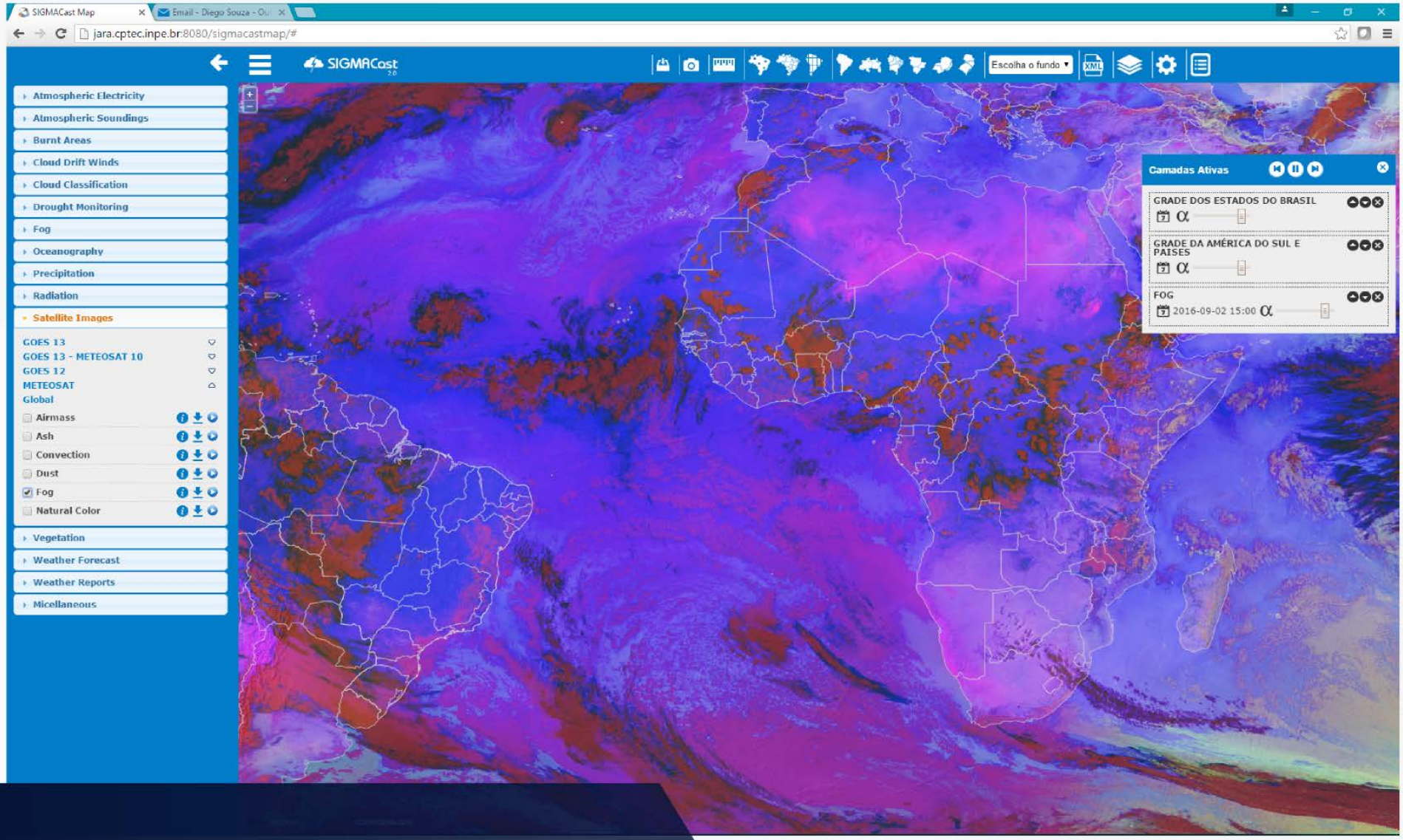

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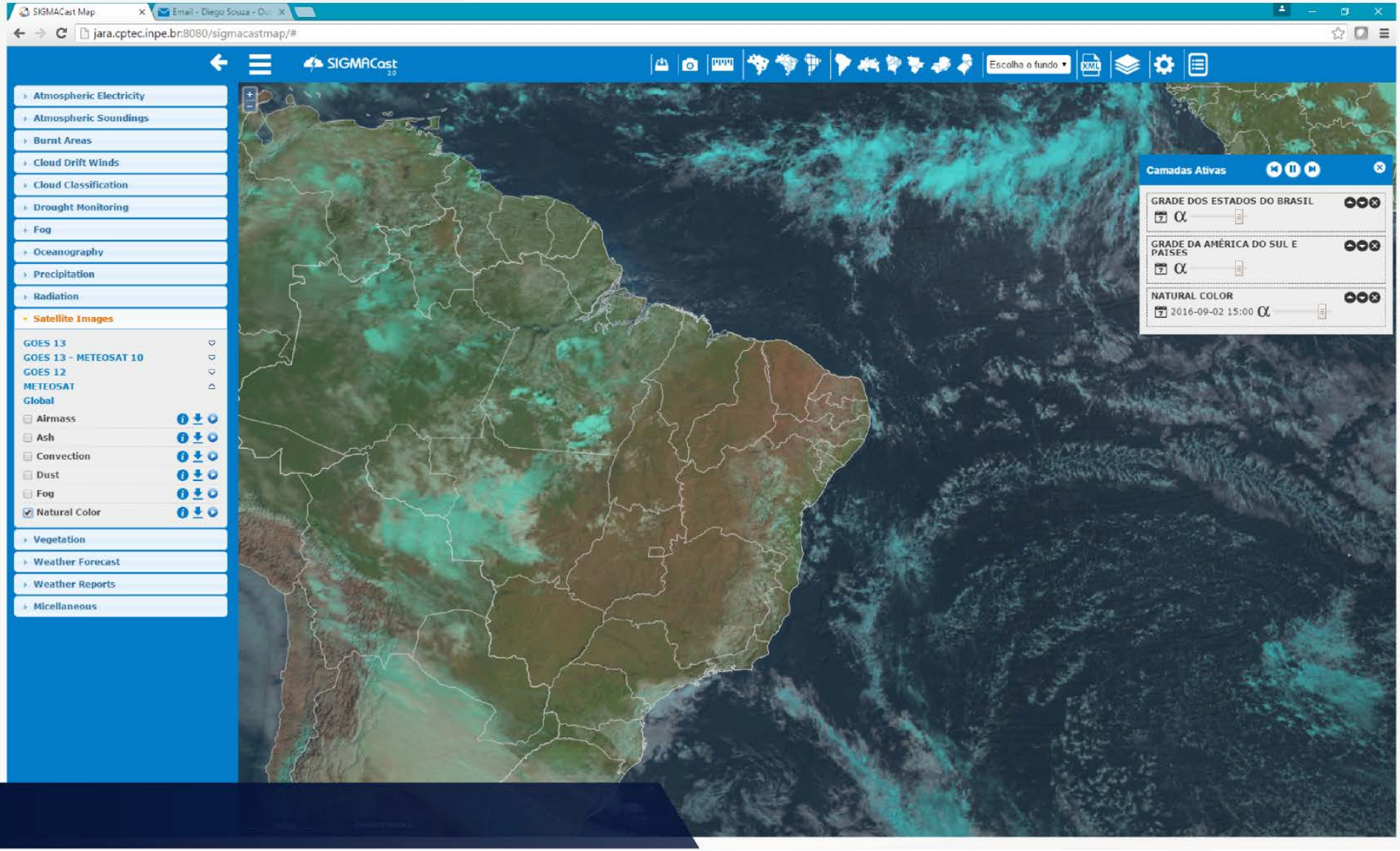

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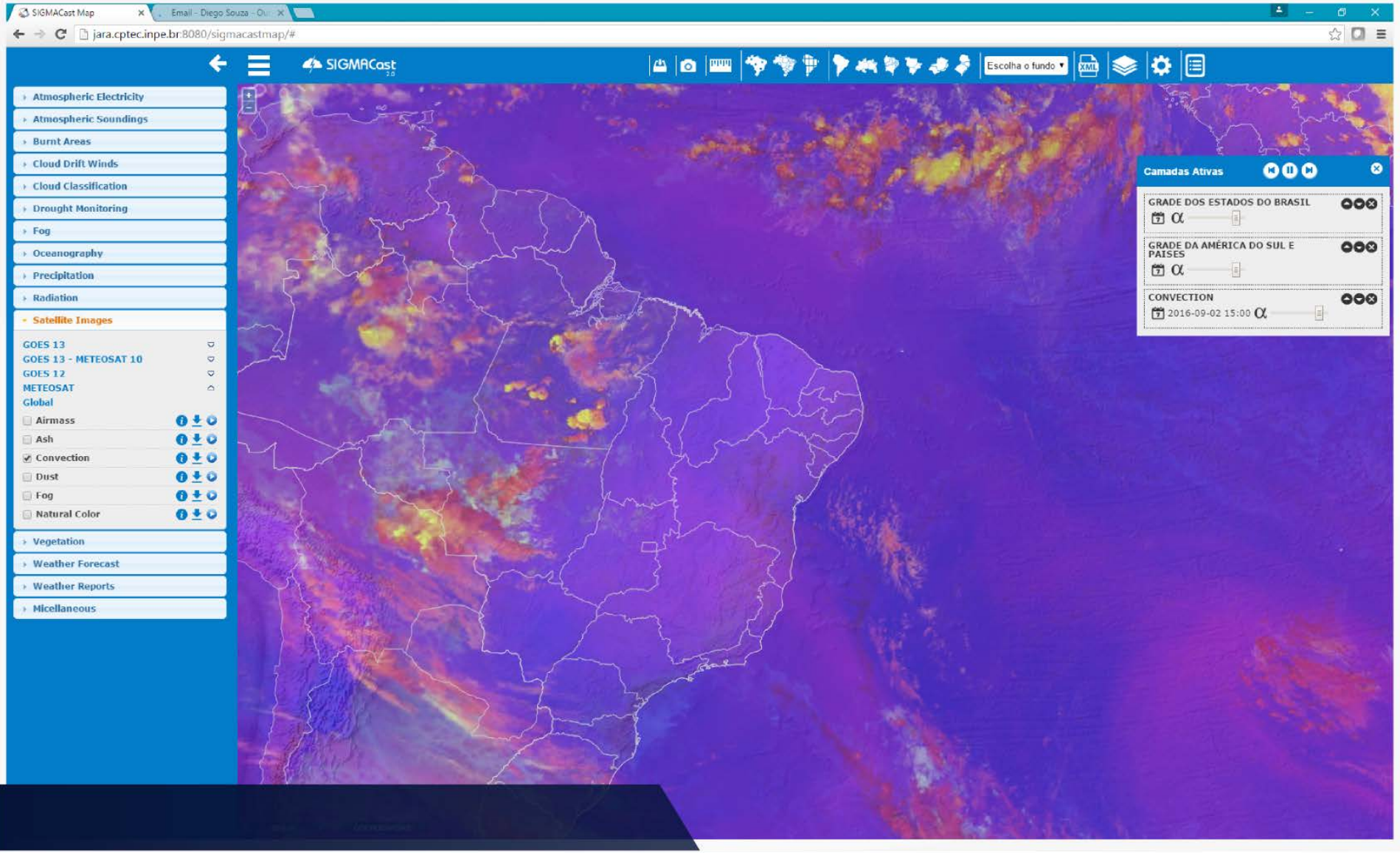
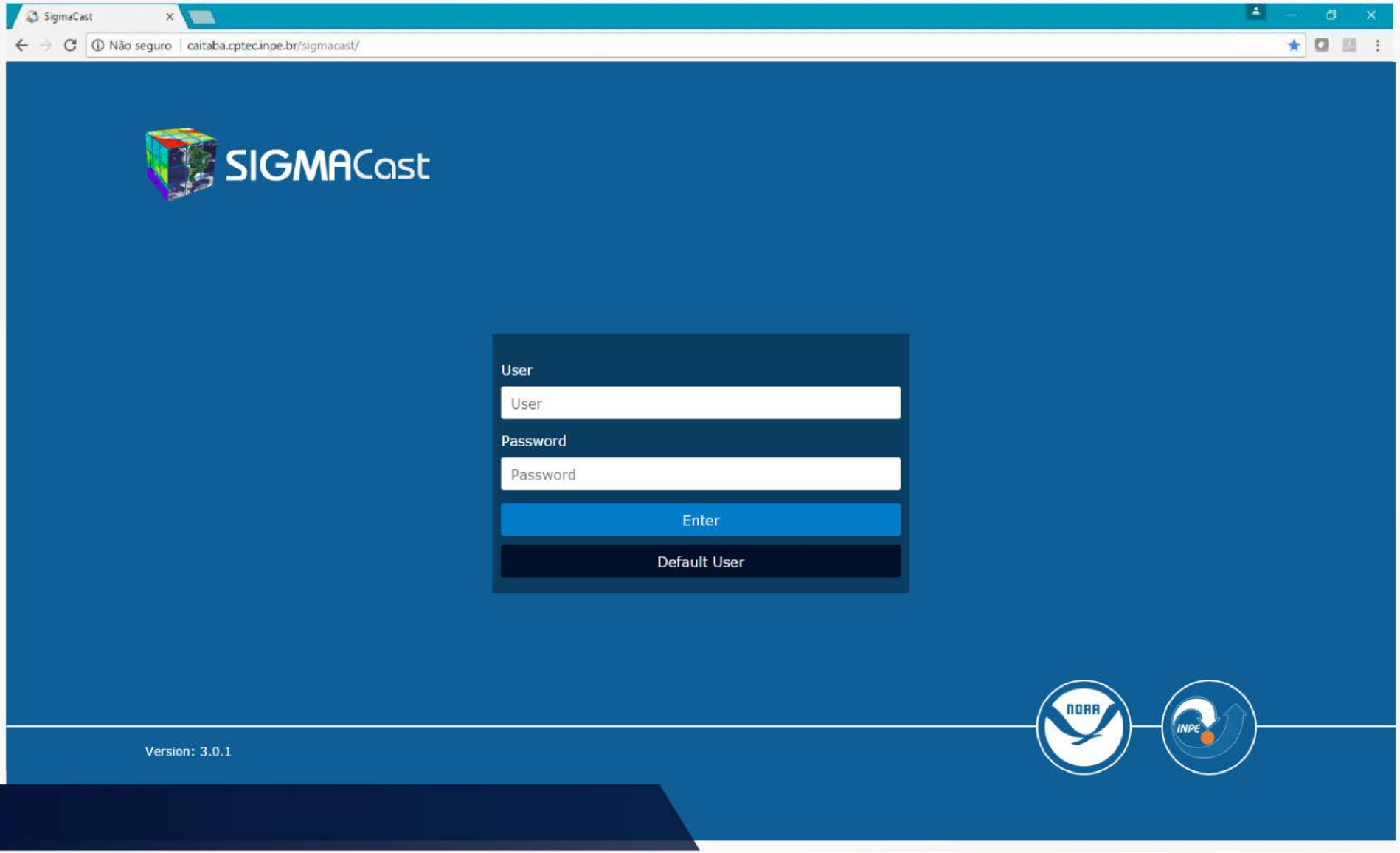
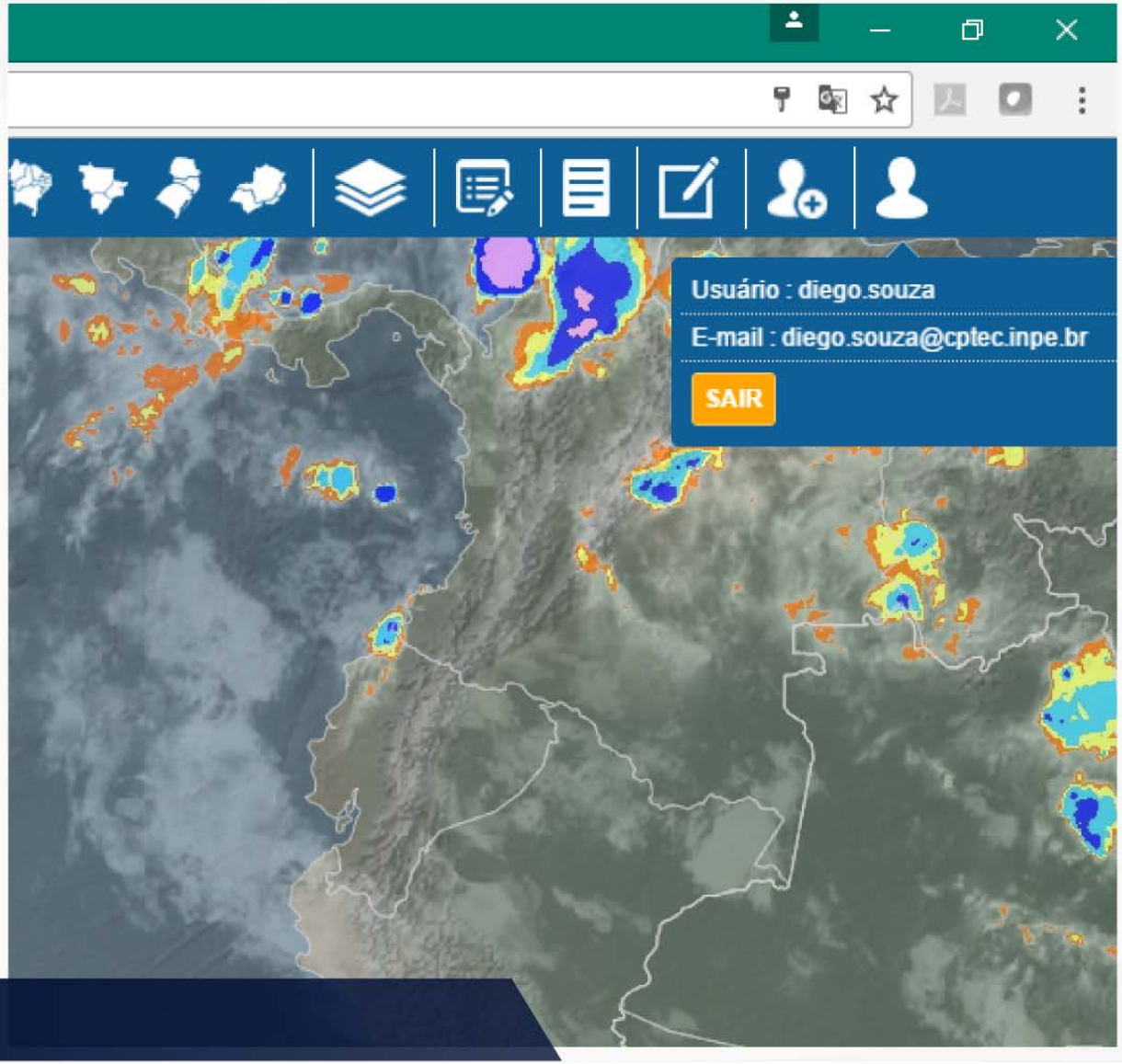


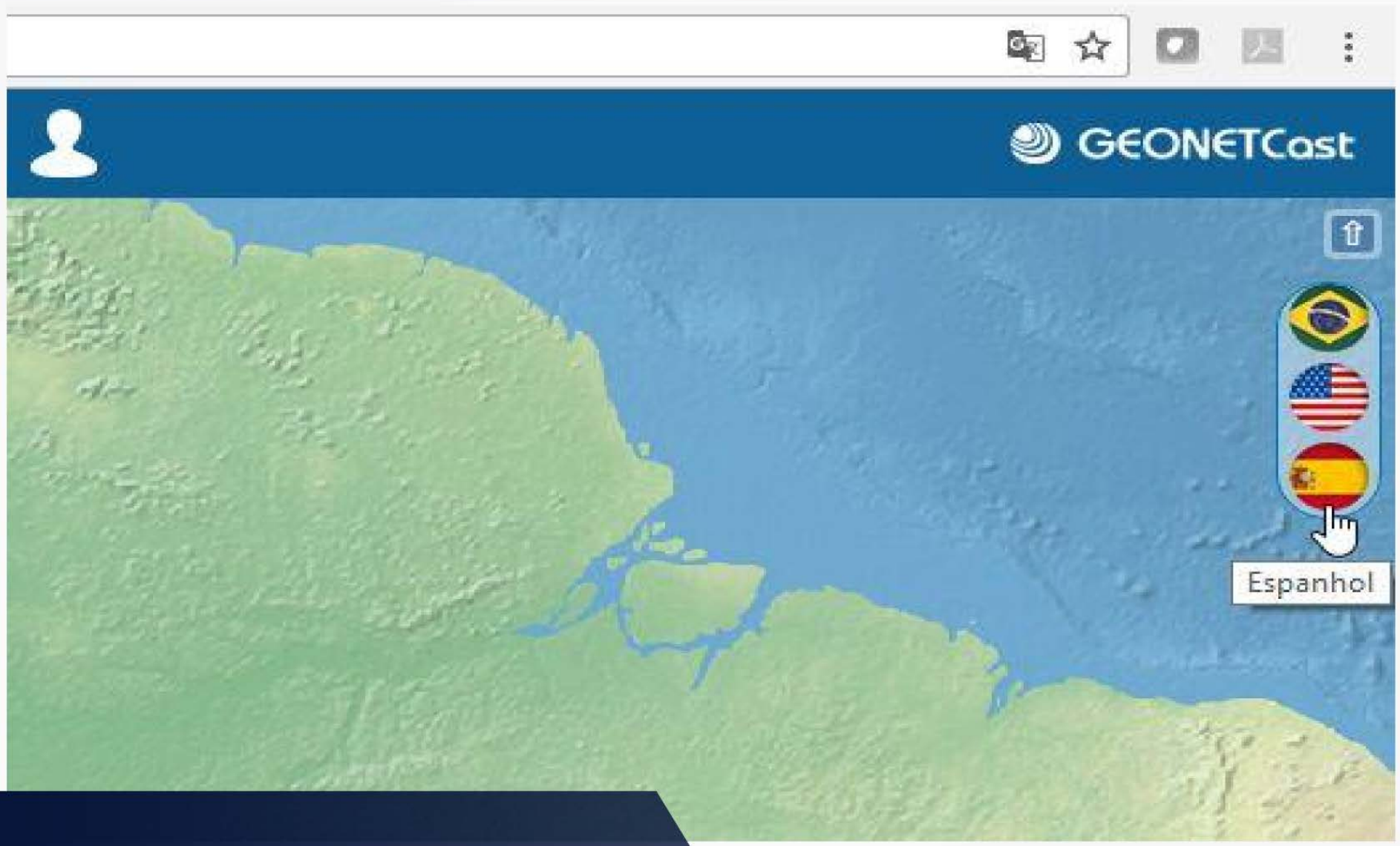
SIGMACast v3.0: User Profiles



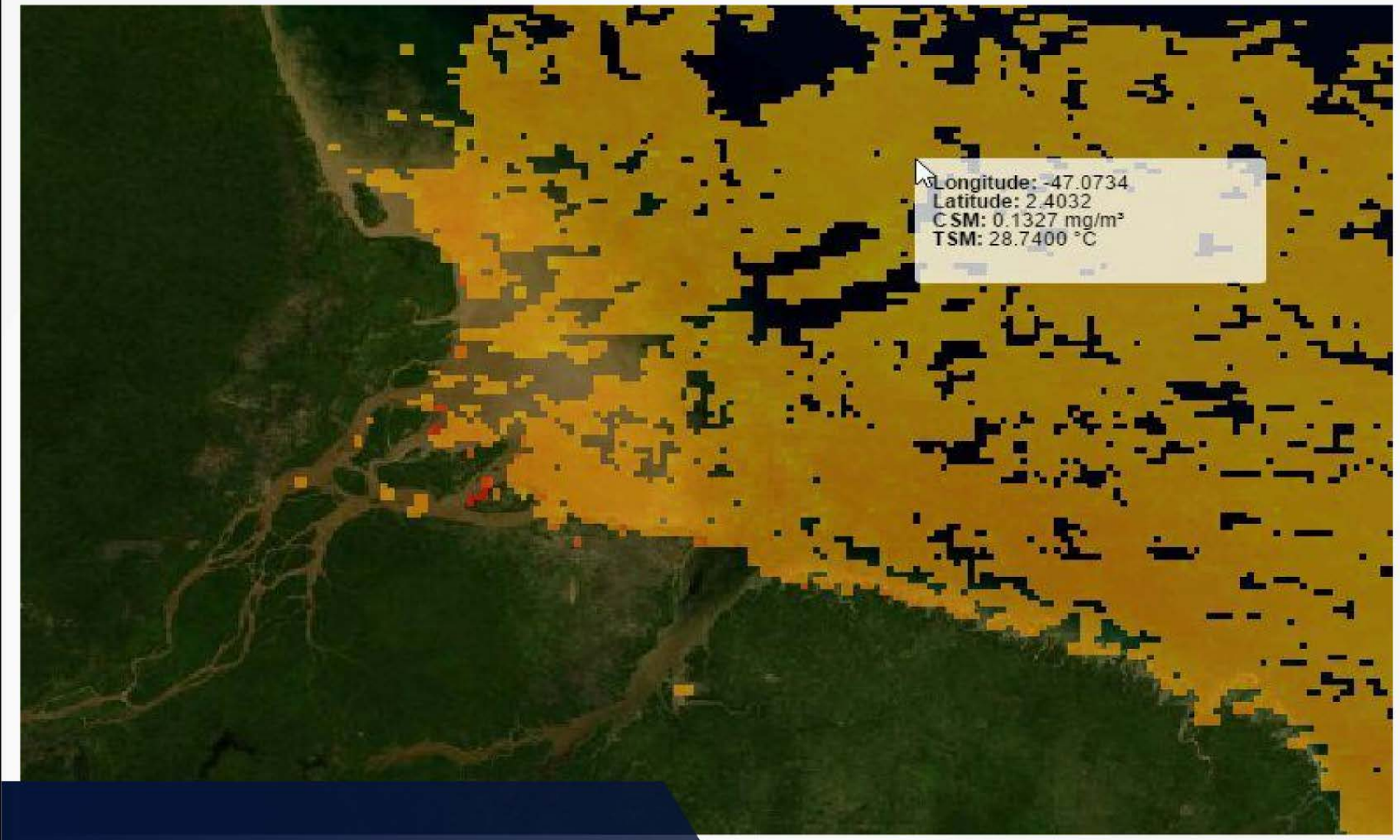
SIGMACast v3.0: User Profiles



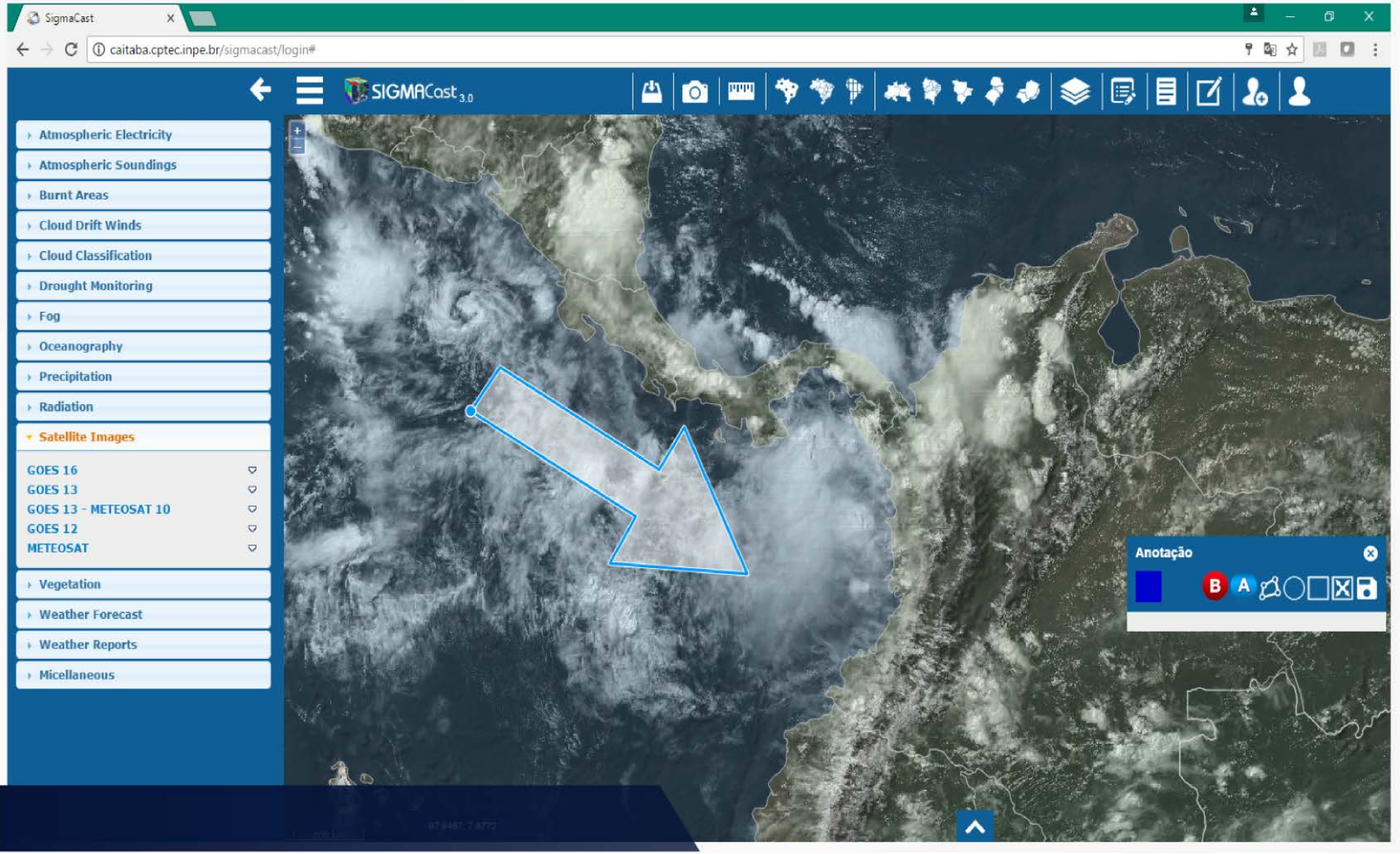
SIGMACast v3.0: Multi Language Support



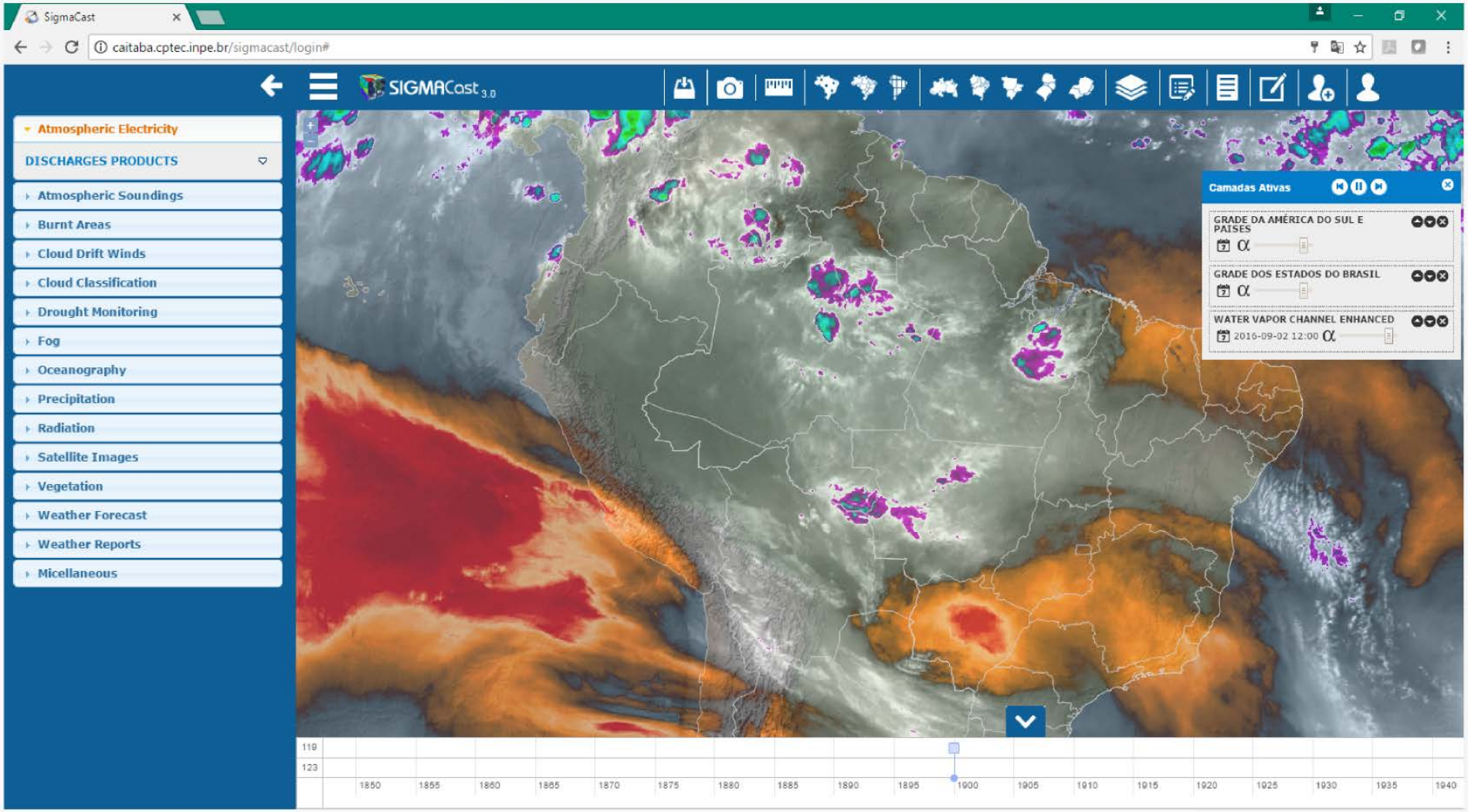
SIGMACast v3.0: Pixel Values Extraction



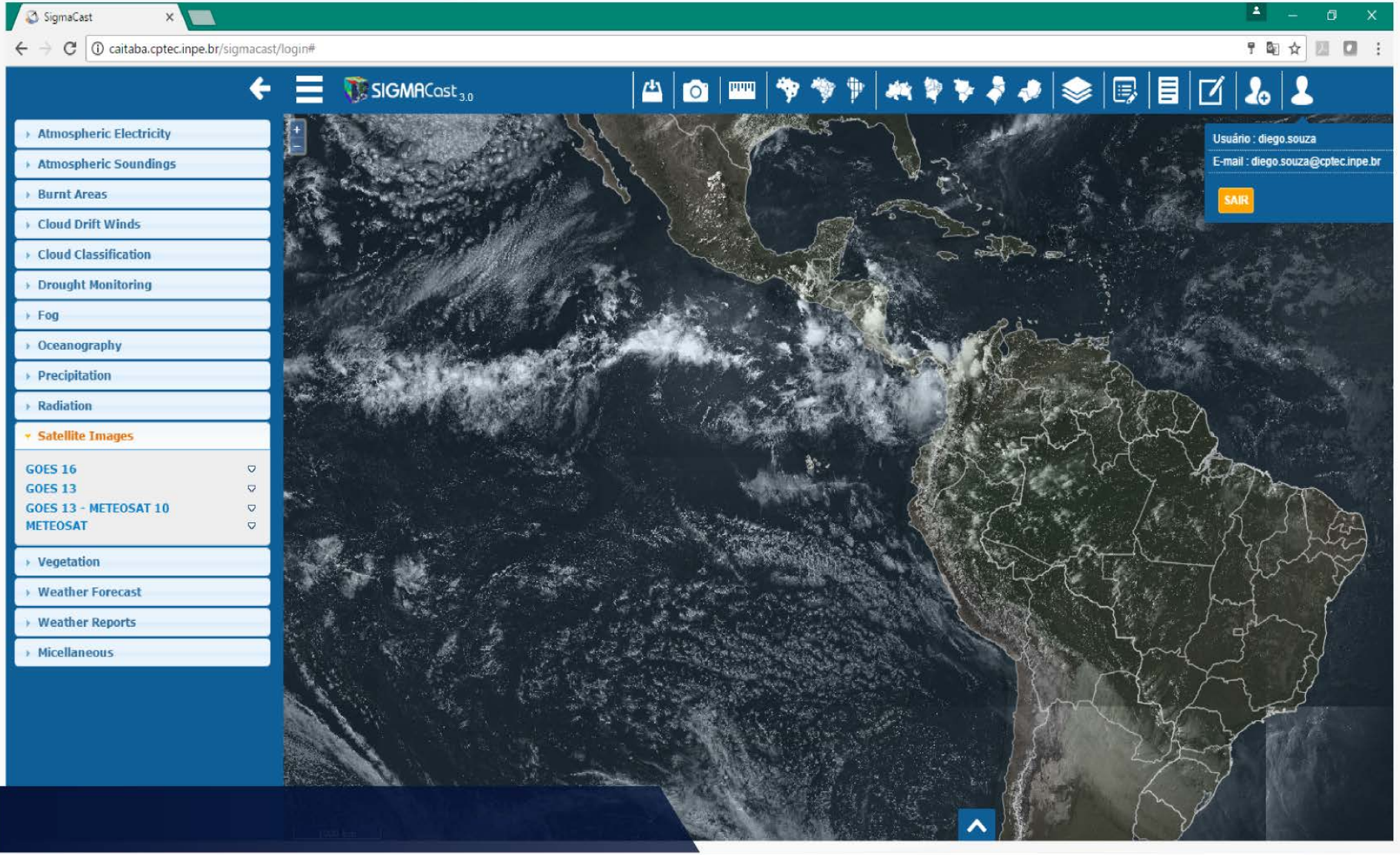
SIGMACast v3.0: Image Annotation



SIGMACast v3.0: Time Bar

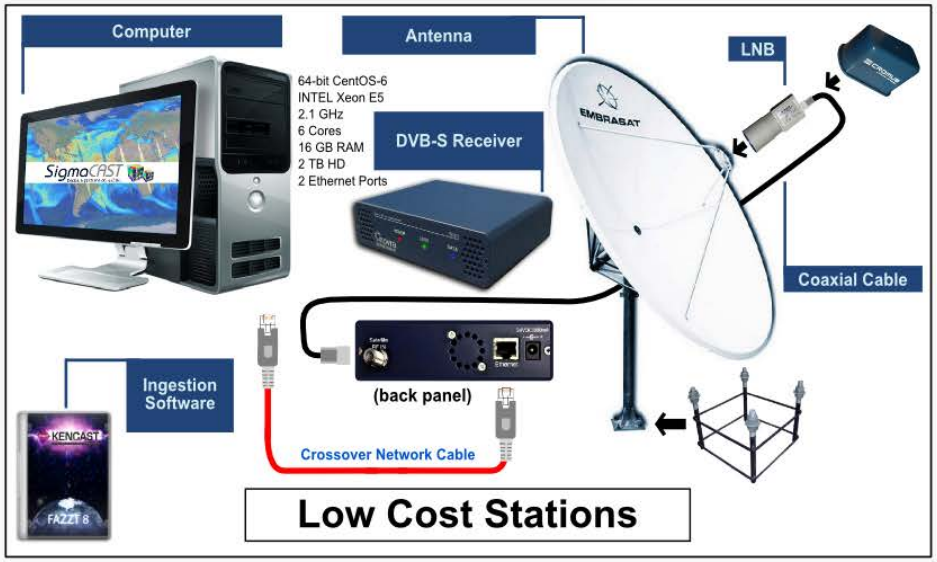


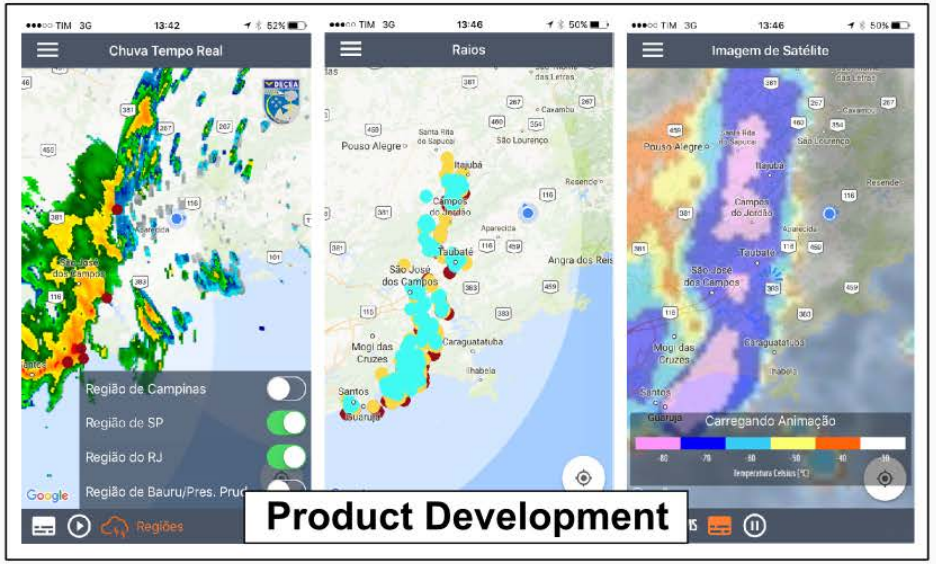
SIGMACast v3.0: GOES-16 Support

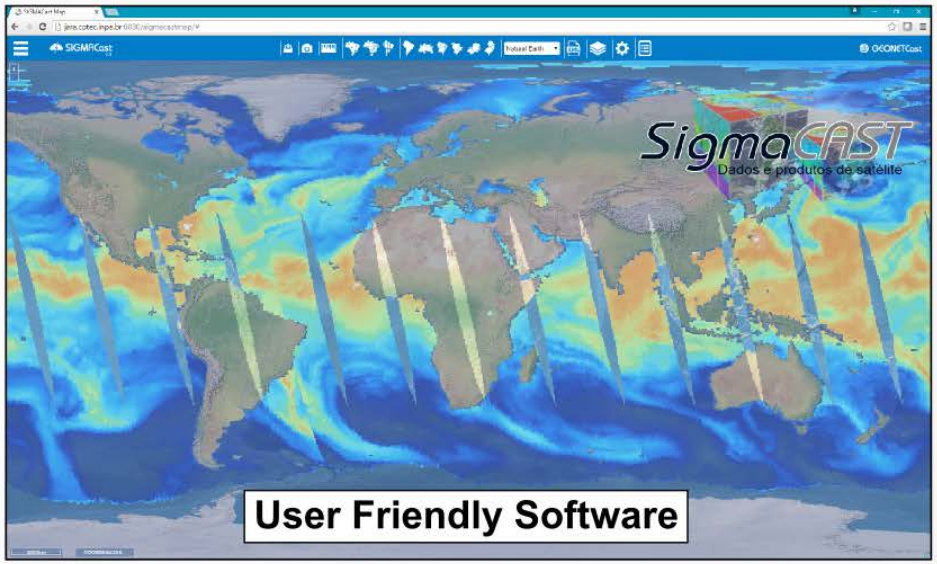


The SIGMACast Software: Network Enabled Access

The Four Components of the SIGMACast Project







Presentation Outline

- The Challenge
- The Project
  - Low Cost Stations
  - Product Development
  - Training and Support
  - User Friendly Software
- The Future

Capacity Building Workshops

"Train the Trainer" Workshop - NOAA Satellite Conference 2015 (VLAB/CIRA)- Greenbelt, USA

Capacity Building Workshops

"AmeriGEOSS Week" - GEONETCast and GOES-R - Bogotá - 07 - 10 June 2016

Capacity Building Workshops

"Taller de Capacitación de GEONETCast-Americas" - Mexico City - 04 - 06 May 2016

Capacity Building Workshops

GNC-A Imagery Processing and Interpretation - 11 Sep 2014

GEONETCast-Americas: Blog

GNC-A Blog | All about

https://geonetcast.wordpress.com

GNC-A

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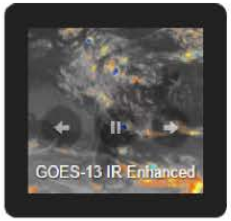
GNC-A PRODUCTS EXAMPLES



GNC-A STATIONS EXAMPLES

Three New GNC-A Stations Being Installed and a New Operational One

Posted on 2017-05-19

We have three new GNC-A stations being installed! Two in Mexico and one in Uruguay.

The GNC-A station from Uruguay in being installed at CENUR (University of the Republic of Uruguay – Regional University Center, Salto North Coast). The antenna is shown at the picture below:

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GEONETCast-Americas Blog: News

GNC-A Blog | All about G

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SOON IN GNC-A:

GOING FURTHER

- MetEd Satellite Meteorology Lessons
- RAMMB Satellite Foundational Course for GOES-R
- RAMMB General Training Sessions
- CIMSS Satellite Blog
- WMO Satellite User Readiness Navigator (SATURN)
- WMO Observing Systems Capability Analisys and Review Tool (OSCAR)

BLOG VISITORS MAP (AFTER MAY 04TH 2017)

This is the setup they are using:

Antenna:

- **Manufacturer:** DICÑO y Construcción de Tequisquiapan S.A.
- **Model:** Antena Parabólica 2.4 metros DICÑO
- **Manual:** Link

LNB:

- **Manufacturer:** Chaparral
- **Model:** C-Band LNB
- **Webpage:** http://www.chaparral.net/c-band-lnb/

DVB-S Receiver:

- **Manufacturer:** NOVRA
- **Model:** S75+
- **Supported technology:** DVB-S
- **Webpage:** http://novra.com/products-page/ip-satellite-data-receiver/s75/

The new operational stations is from the CEPAGRI/UNICAMP (Center for Meteorological and Climatic Research Applied to Agriculture – University of Campinas) in Brazil.

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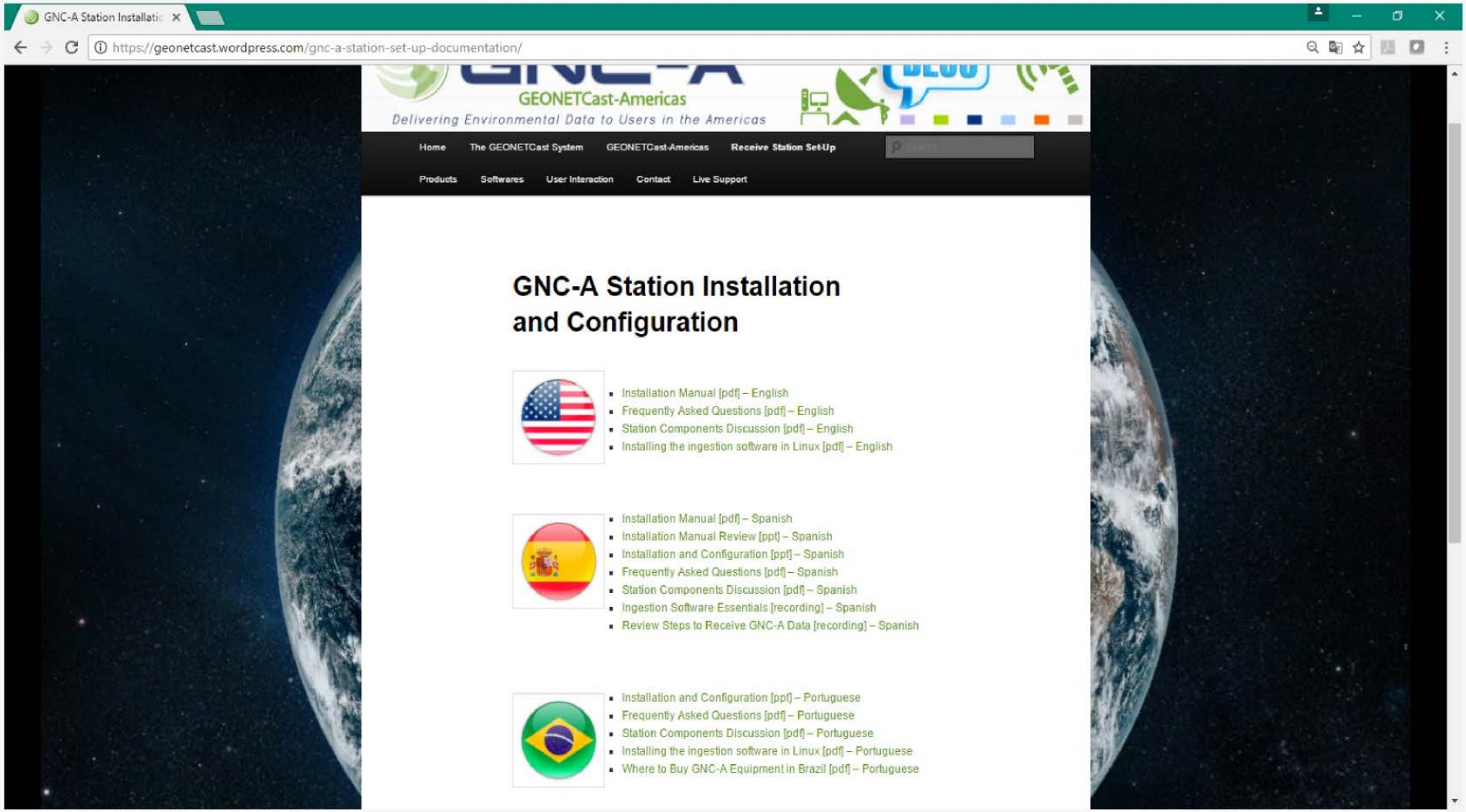
GEONETCast-Americas Blog: Documentation



www.geonetcast.wordpress.com

GEONETCast-Americas Blog: Product List

GNC-A Product List | GN

https://geonetcast.wordpress.com/gnc-a-product-catalog/

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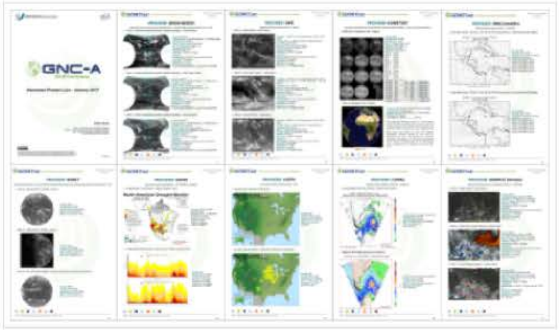
GNC-A Product List

Please find at the link below an illustrated list of products being disseminated through GEONETCast-Americas:

Up-to-Date GEONETCast-Americas Illustrated Product List (January 2017):

- GEONETCast-Americas Illustrated Product List – 24 January 2017 [pdf]



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GEONETCast-Americas Blog: Product Samples

Product Samples Downlc

https://geonetcast.wordpress.com/gnc-a-product-samples-download/

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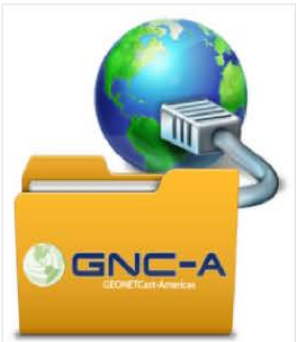
Product Samples Download

Do you want to know the files you're going to receive in near real time when installing a GNC-A Station?



By clicking at the link below you will have access to a sample ingestion directory, received via GNC-A in **January 18th 2017**.

It has the same structure of a real GNC-A station ingestion directory, including folder and file names.

You may download any file you want.

- GEONETCast-Americas Ingestion Directory Sample

Note: The files consist of a period of **24 hours** for smaller file sizes directories and **6 hours** for larger file sizes directories.

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GEONETCast-Americas Blog: Stations Examples

GNC-A Stations Example

https://geonetcast.wordpress.com/stations-gallery/

GNC-A

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GNC-A Stations Examples

Last Update: *01/10/2017 18:00 UTC* (Click on any image to enlarge)

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GEONETCast-Americas Blog: Where to Buy

Where to Buy GNC-A Eq

https://geonetcast.wordpress.com/where-to-buy-gnc-a-equipment/

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Where to Buy GNC-A Equipment

As seen in other pages from this blog, in order to assembly a GEONETCast-Americas station you need basically five components:

- Ingestion Software
- DVB-S/S2 Receiver
- Antenna
- LNB
- Computer

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GEONETCast-Americas Blog: Tutorials

GNC-A Product Manipul

https://geonetcast.wordpress.com/gnc-a-product-manipulation-tutorials/

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GNC-A Product Manipulation Tutorials

In this page, you will find tutorials developed by the community related to GEONETCast-Americas and the usage of its content. Click on the images to download.

- GEONETCast-Americas Product Manipulation using GDAL and GMT [pdf, Spanish]

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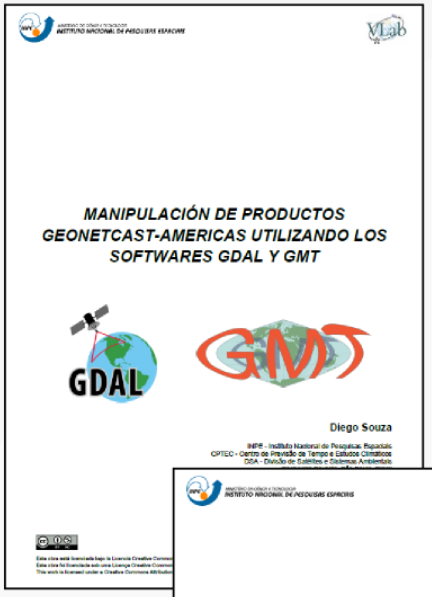
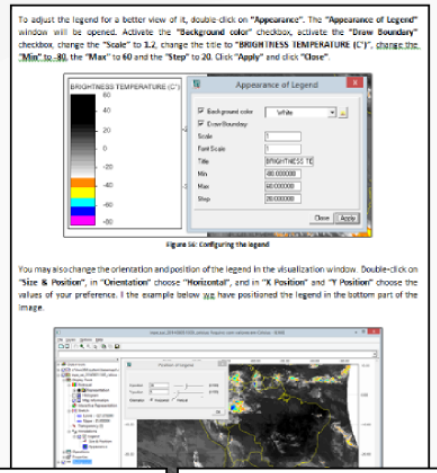
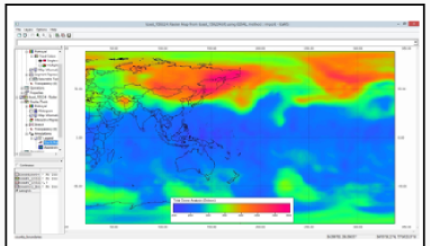
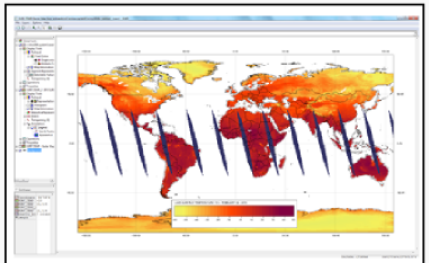
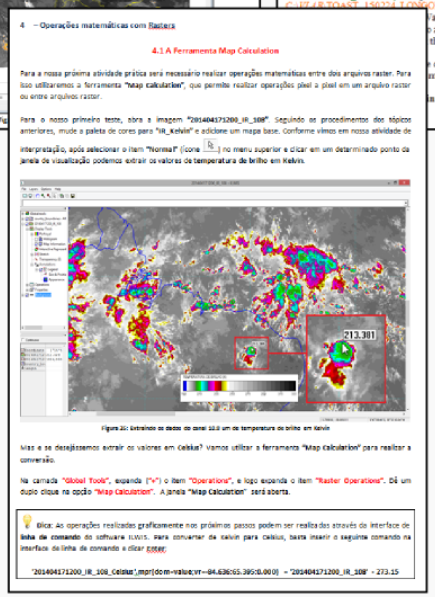
GEONETCast-Americas Blog: Tutorials

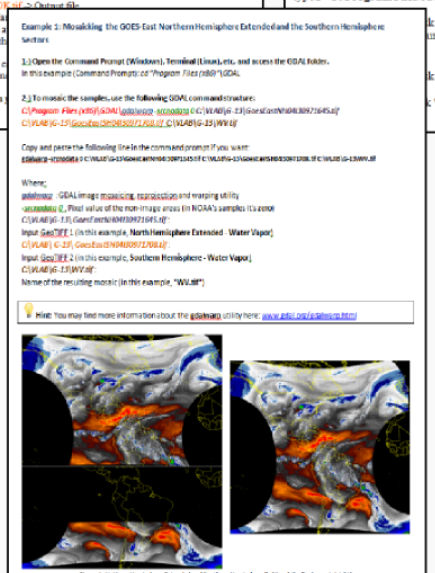


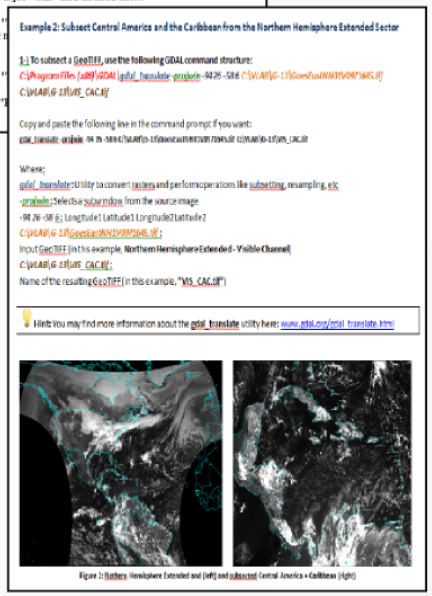












GEONETCast-Americas Blog: Tutorials

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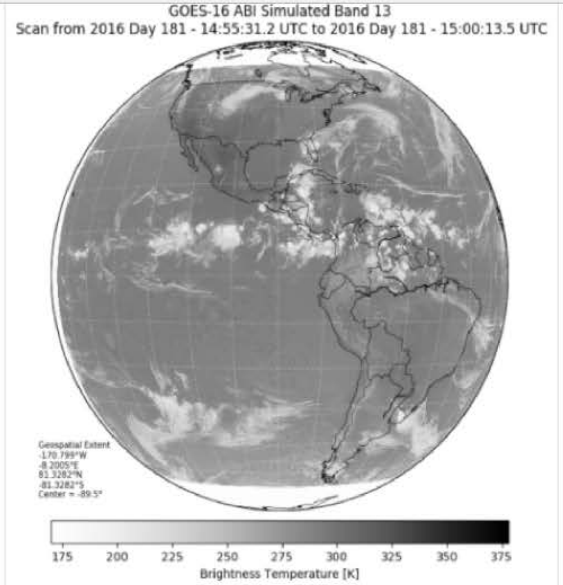
GEONETCast-Americas Blog: Tutorials

GEONETClass: Manipulat

https://geonetcast.wordpress.com/2017/05/15/geonetclass-manipulating-goes-16-data-with-python-part-iii/



And this is the end of Part III!

For you're reference, this is the complete script we have used in this part:

```
# GNC-A Blog Python Tutorial: Part III

# Required libraries
import matplotlib.pyplot as plt # Import the Matplotlib package
from netCDF4 import Dataset # Import the NetCDF Python interface
from mpl_toolkits.basemap import Basemap # Import the Basemap to
import numpy as np # Import the Numpy package

# Path to the GOES-R simulated image file
path = 'C:\VLAB\OR_ABI-L2-CMIPF-M4C13_G16_s20161811455312_e20161
# Search for the GOES-R channel in the file name
Band = (path[path.find("M4C")+3:path.find("_G16")])
# Search for the Scan start in the file name
Start = (path[path.find("s")+1:path.find("_e")])
Start_Formatted = Start[0:4] + " Day " + Start[4:7] + " - " + St
# Search for the Scan end in the file name
```

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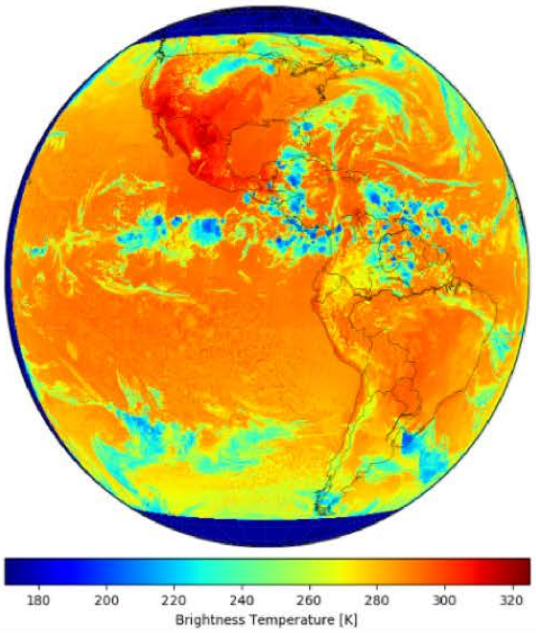
GEONETClass: Manipulat

https://geonetcast.wordpress.com/2017/05/11/geonetclass-manipulating-goes-16-data-with-python-part-ii/

option from this link.

In the example below, the "**jet**" colormap and the **170 ~ 325 K** thresholds are used.



The next lines configure the basemap, parallels and meridians appearance:

```
bmap.drawcoastlines(linewidth=0.3, linestyle='solid', color='blac
bmap.drawcountries(linewidth=0.3, linestyle='solid', color='black
bmap.drawparallels(np.arange(-90.0, 90.0, 10.0), linewidth=0.1, c
bmap.drawmeridians(np.arange(0.0, 360.0, 10.0), linewidth=0.1, co
```

You may test different line widths and colors. Here's an example with the "**hsv**" colormap, a threshold between **170** and **360**, countries and coastlines with a line

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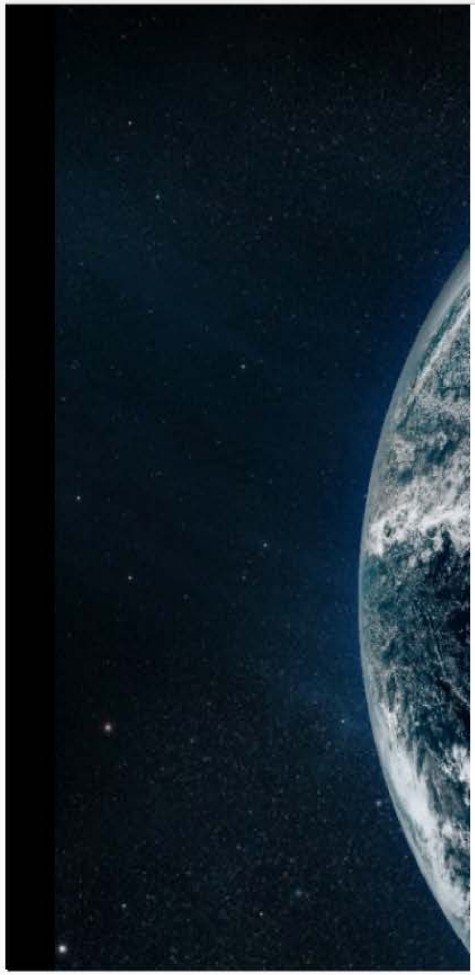


https://geonetcast.wordpress.com/2017/05/15/geonetclass-manipulating-goes-16-data-with-python-part-iv/

- Land-Sea Mask

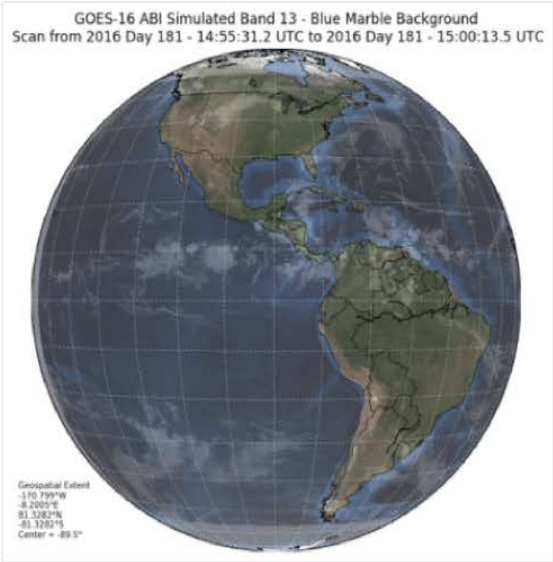
Let's begin adding a Blue Marble background.

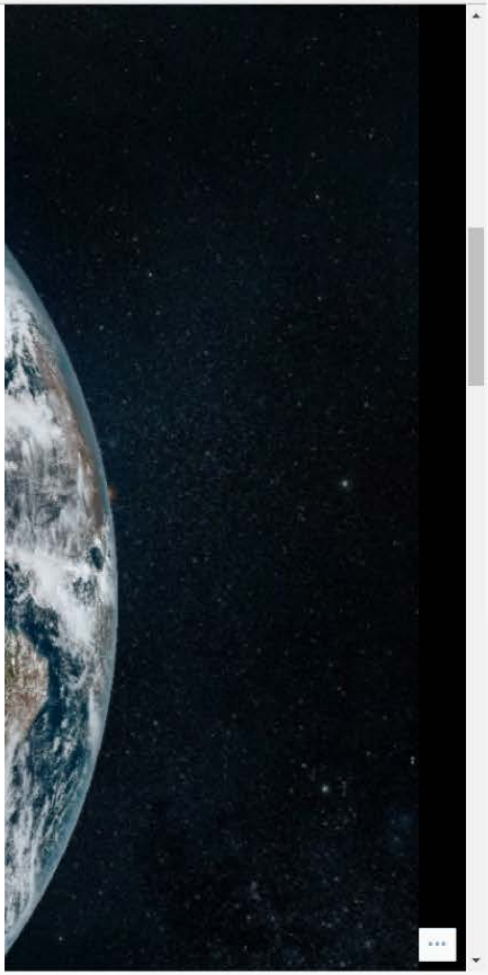
In order to do this, add the "*bmap.bluemarble()*" command **before** the "*bmap.imshow*" command. Also, on the "*bmap.imshow*" command, add the "*alpha=0.5*" parameter. The code below show the changes:

```
# Add a Blue Marble background
bmap.bluemarble()
# Plot GOES-16 channel with transparency
bmap.imshow(data, origin='upper', vmin=170, vmax=378, cmap='Greys
```

Also, remove the legend from the code and add "Blue Marble Background" to the title.

By doing this, you should get this result:





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GOES-16 Product Manip

https://geonetcast.wordpress.com/2017/02/08/goes-16-product-manipulation-using-free-software-tools/

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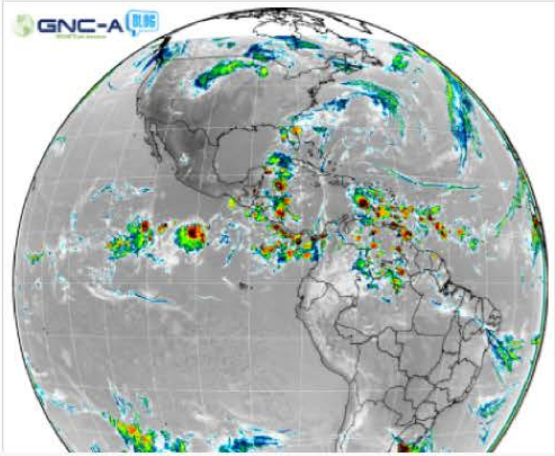
Posted on 2017-02-08 ← Previous Next →

GOES-16 Product Manipulation using Free Software Tools



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GOES-16 Product Manip

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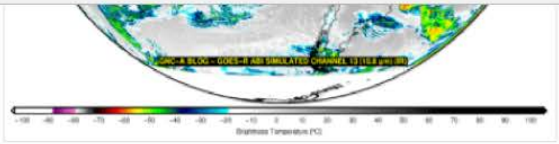

The image above was generated using a GOES-16 simulated image sample downloaded from the GOES-R official webpage. To generate this plot, three freely available software were used: GDAL, GMT and IMAGEMAGICK. In the Tutorials section of this Blog, you will find a 114 page tutorial on the usage of these tools (using GNC-A data).

In this particular GOES-16 case, this simulated sample from the Channel 13 (10.35 um) was used. It is in NetCDF4, and has the same structure of the files that will be broadcasted through GNC-A.

The script below shows all the instructions used to generate the image above.

Basically, these are the functions performed by each software:

- **GDAL:** Format conversion and image georeferencing.
- **GMT:** Math, Color Palette, Projection, Shapefiles, Borders, Text and Legend
- **IMAGEMAGICK:** Logo

```
# [GDAL] Converts the GOES-16 Channel 13 subdatased to NetCDF (f
gdal_translate -of netCDF -a_srs "+proj=geos +a=6378137. +b=6356

# [GDAL] Assigns a georeference to the image
gdalwarp -s_srs "+proj=geos +a=6378137. +b=6356752.31414 +lon_0=

# [GMT] Multiply the pixels by 0.039071999, sums 173.14999 and s
grdmath Channel_13r.nc 0.039071999 MUL 173.14999 ADD -273.15 ADD

# [GMT] Creates a color palette using the McIDAS-X IR4AVHRR6 col
# the lower limit as -103, the upper limit as 105, and intervals
makecpt -CIR4AVHRR6 -T-103/105/1 > C:\VLAB\CMI\palette.cpt

# [GMT] Chooses the plot size
gmtset PS_MEDIA A0

# [GMT] Projects the image, making the plot (post script format)
```

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GNC-A Live Support (Sky

https://geonetcast.wordpress.com/gnc-a-live-support/

GNC-A

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GNC-A Live Support (Skype)

Search for **gnc.americas** in your Skype and send a new contact request. Feel free to ask any questions about hardware (antenna, LNB, computer) and software (ingestion software, visualization) required to run a GEONETCast-Americas Station.

Available Monday through Friday from **11:00** to **18:00** UTC.

Support in **English**, **Spanish** and **Portuguese**!

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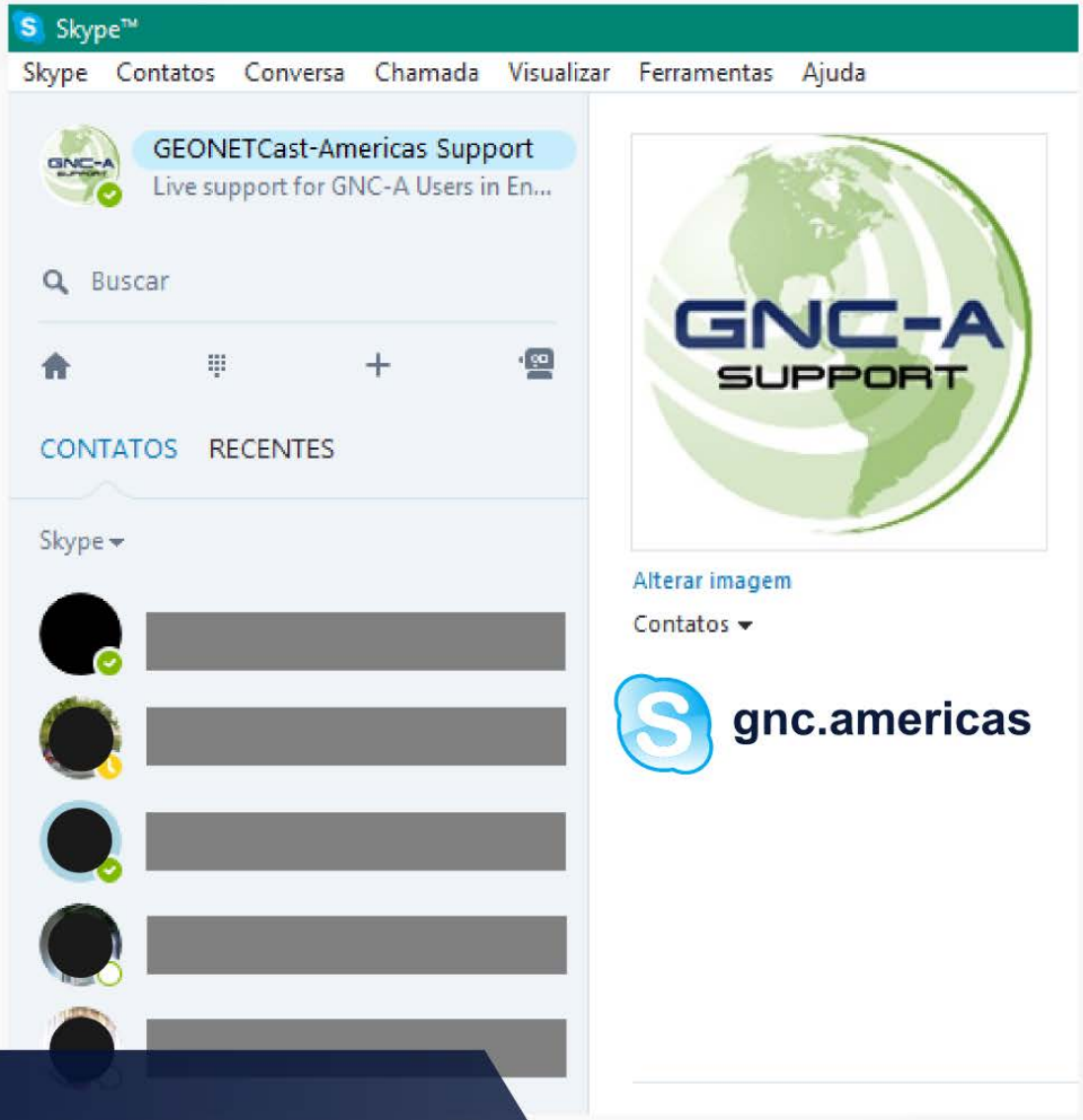
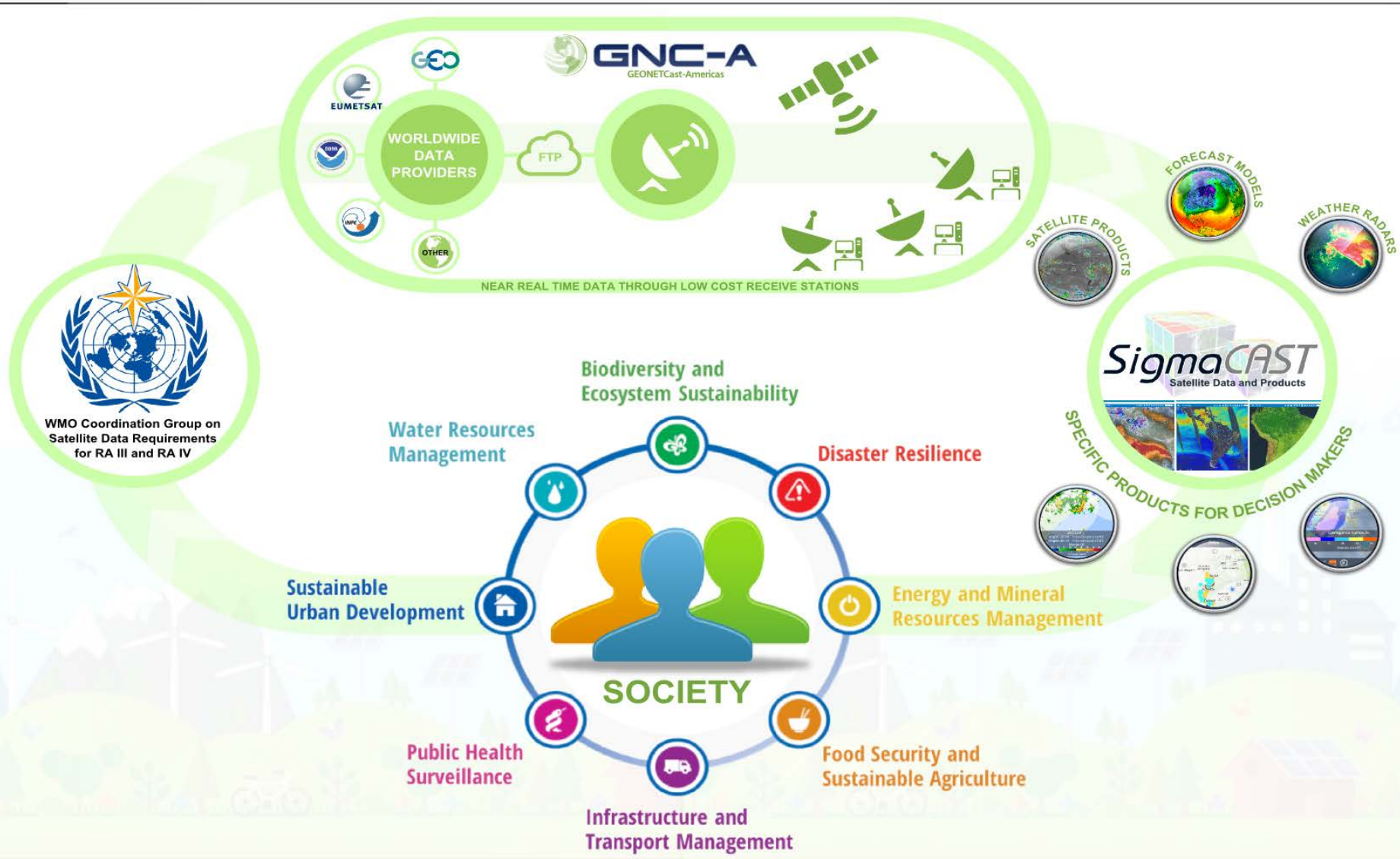


A Bridge Between Data and Users



The SIGMACast Project: A Bridge Between Data and Users

THANK YOU FOR YOUR ATTENTION

Diego Souza

diego.souza@cptec.inpe.br

INPE - National Institute for Space Research
CPTEC - Center for Weather Forecasting and Climate Studies
DSA - Satellite and Environmental Systems Division

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