



Update on EMBRACE, Brazilian Space Weather Program

and

Simultaneous observed ionospheric disturbances and abnormal animal behavior previous to increased seismic activity

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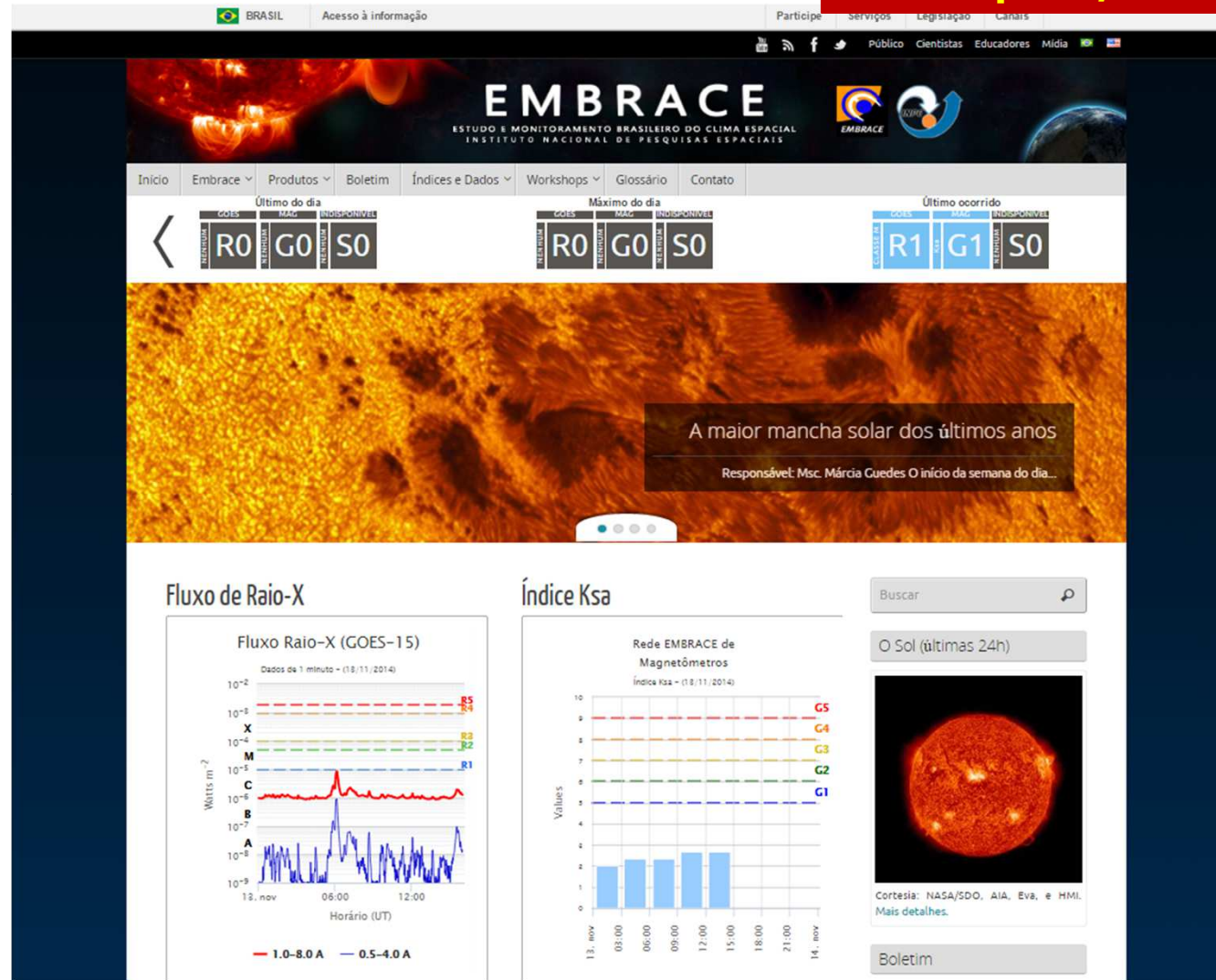
Embrace / INPE



www.inpe.br/spaceweather

Novo Portal Web

www.inpe.br/climaespacial



The screenshot shows the EMBRACE website interface. At the top, there are navigation menus for 'Participe', 'Serviços', 'Legislação', and 'Canais'. Below this is a header with the EMBRACE logo and the text 'ESTUDO E MONITORAMENTO BRASILEIRO DO CLIMA ESPACIAL INSTITUTO NACIONAL DE PESQUISAS ESPACIAIS'. The main content area features a large image of a solar flare with the text 'A maior mancha solar dos últimos anos' and 'Responsável: Msc. Márcia Cuedes O início da semana do dia...'. Below this are two graphs: 'Fluxo de Raios-X' (X-ray flux) and 'Índice Ksa' (K_s index). The X-ray flux graph shows data for GOES-15 from 18/11/2014, with a scale from 10⁻⁹ to 10⁻² Watts m⁻². The K_s index graph shows data for the EMBRACE network of magnetometers from 13/11/2014 to 14/11/2014, with a scale from 0 to 10. A search bar and a 'Boletim' button are also visible.

Available
in **JULY 2015**

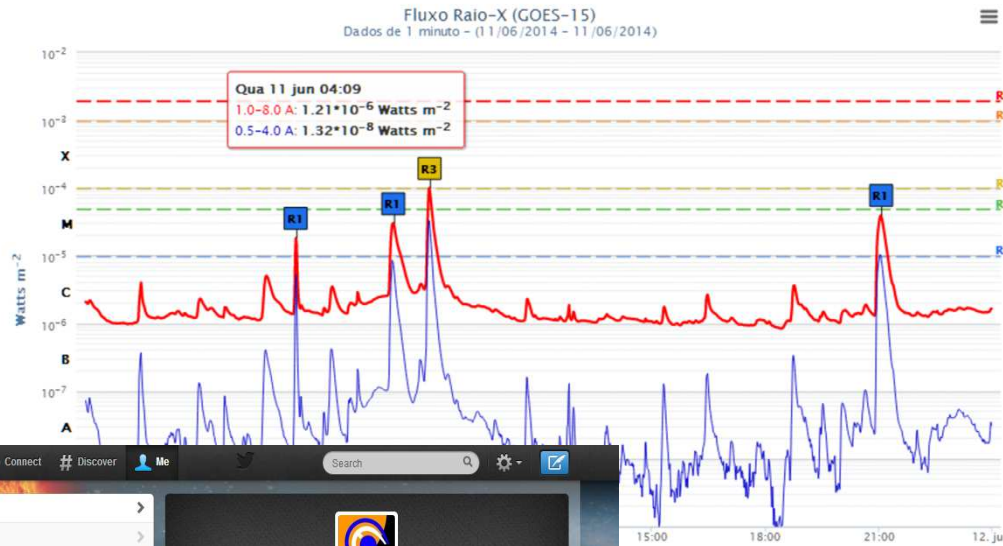


a new APP
at the Google Play

Cortesia: Ande Ivo - Indra



Flare Alerts



@climaespacial



CLASS_X

Clezio Marcos De Nardin,

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

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

ALERTA RAIÓ-X GOES



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

Efeito de Severidade R3:

HF Radio: Grande área de blackout em comunicação em rádio HF, perda de rádio contatos por aproximadamente uma hora na região iluminada.

Navegação: Navegação em baixa frequência degradada por aproximadamente uma hora.

X-RAY GOES ALERT



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

Effect Severity R3

HF Radio: Large area blackout in HF radio communication, loss of radio contact for about an hour in the illuminated region.

Navigation: Navigation in low frequency degraded for about an hour.

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Simultaneous observed ionospheric disturbances and abnormal animal behavior previous to increased seismic activity

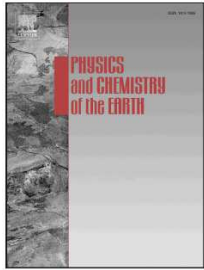
Multidisciplinary research efforts to understand simultaneous non-seismic, and apparently unconnected phenomena prior to major earthquakes:

- Perturbations in the ionosphere
- Thermal infrared anomalies
- Ultra low frequency emissions
- Earthquake lights
- Unusual animal behavior

Involves

- Animal biologists
- Solid state physicists
- Geophysicists

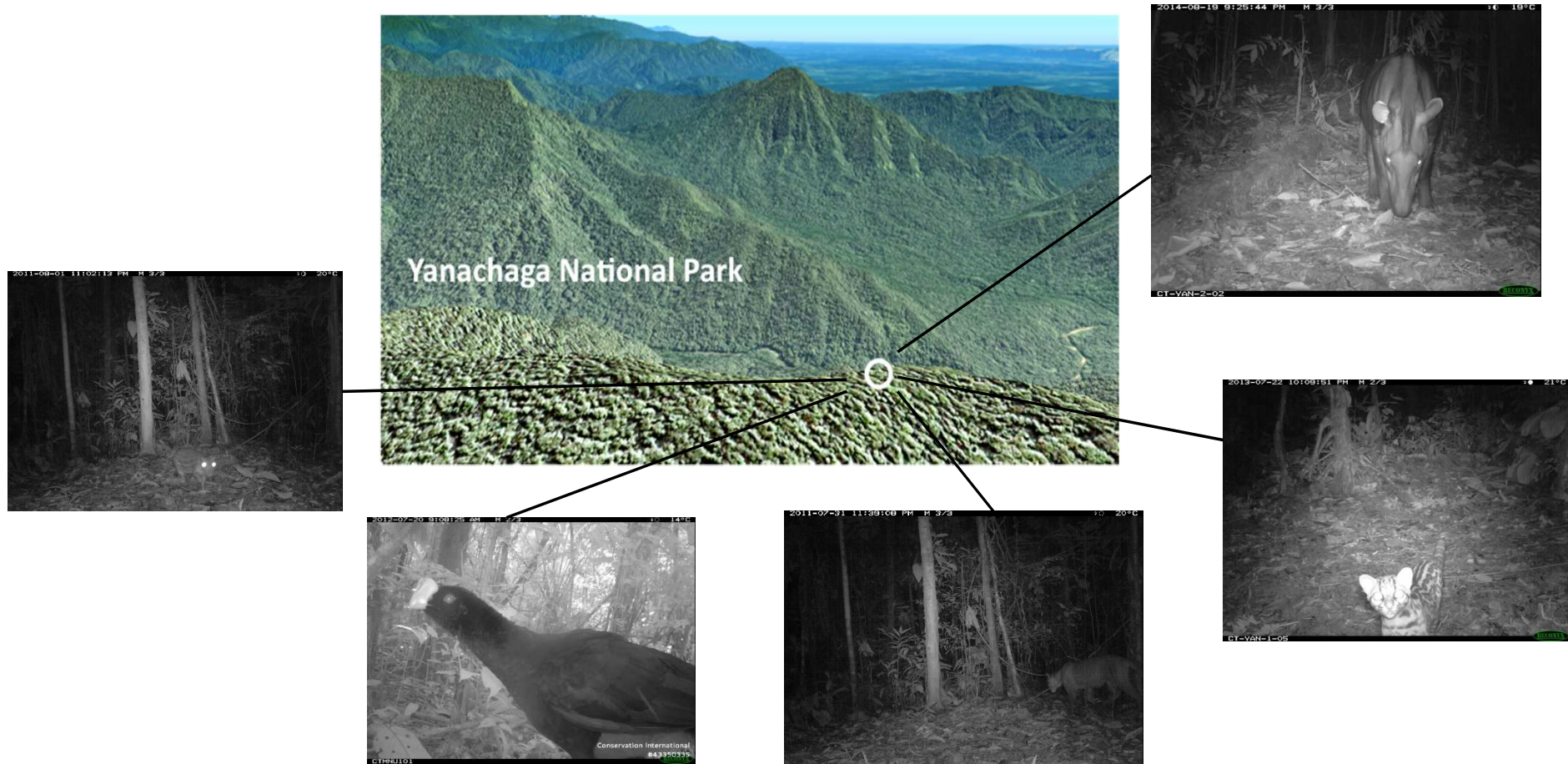
Results obtained so far (mainly with Peruvian and Japanese Institutions) motivated to expand such collaborative programs to other countries, also with the occurrence of high seismic activity, like México and Chile.



Changes in animal activity prior to a major (M=7) earthquake in the Peruvian Andes

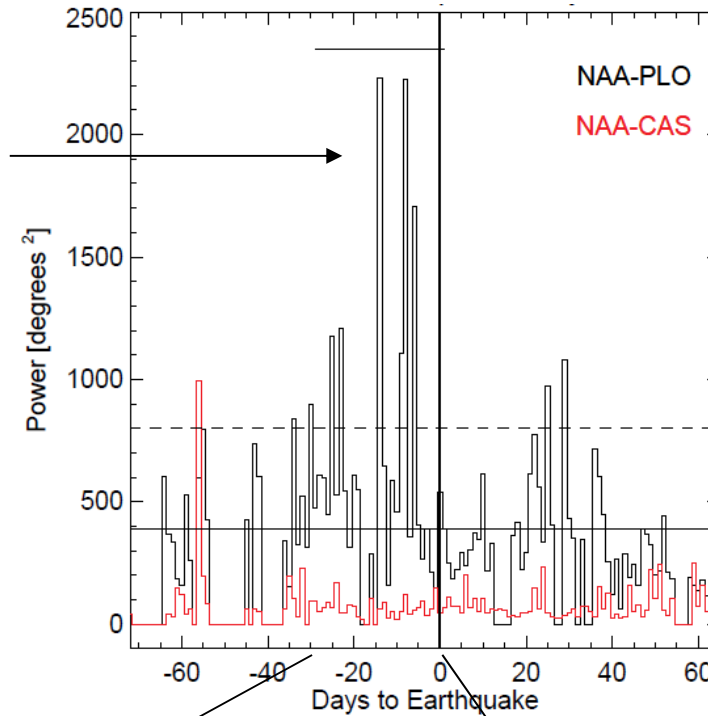
R. A. Grant; J.-P. Raulin; F. T. Freund
<http://dx.doi.org/10.1016/j.pce.2015.02.012>

Use of motion-triggered trapped cameras to monitor animal activity in the Yanachaga National Park in Peru.

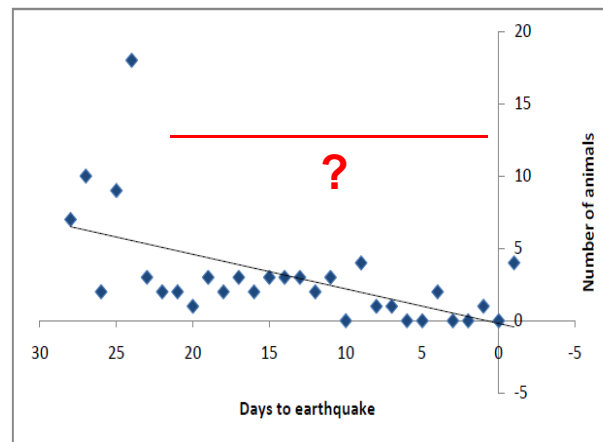
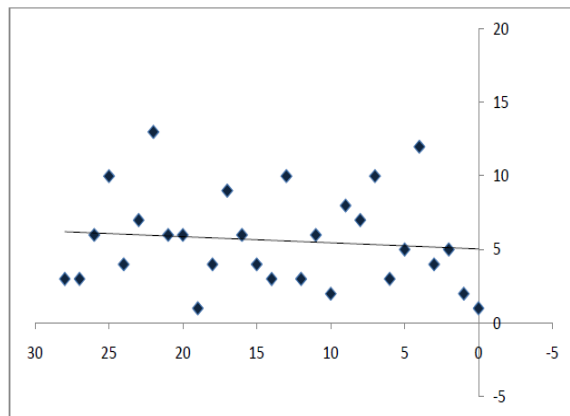


Ionospheric disturbances are detected during a period of 25 days prior to the Earthquake day

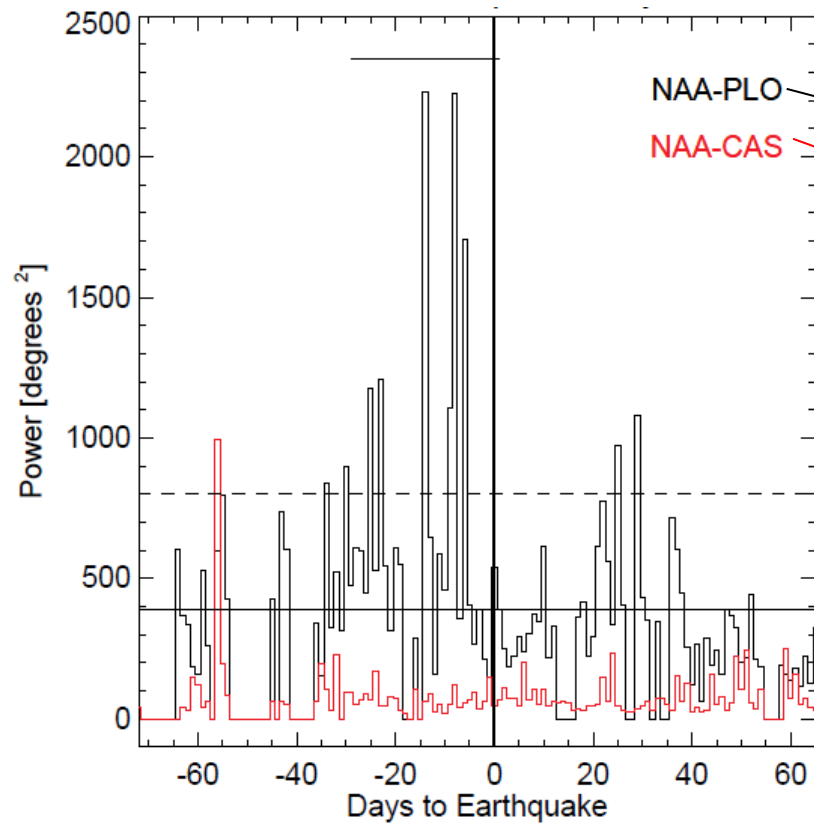
Few minutes periodicity VLF phase and amplitude oscillations



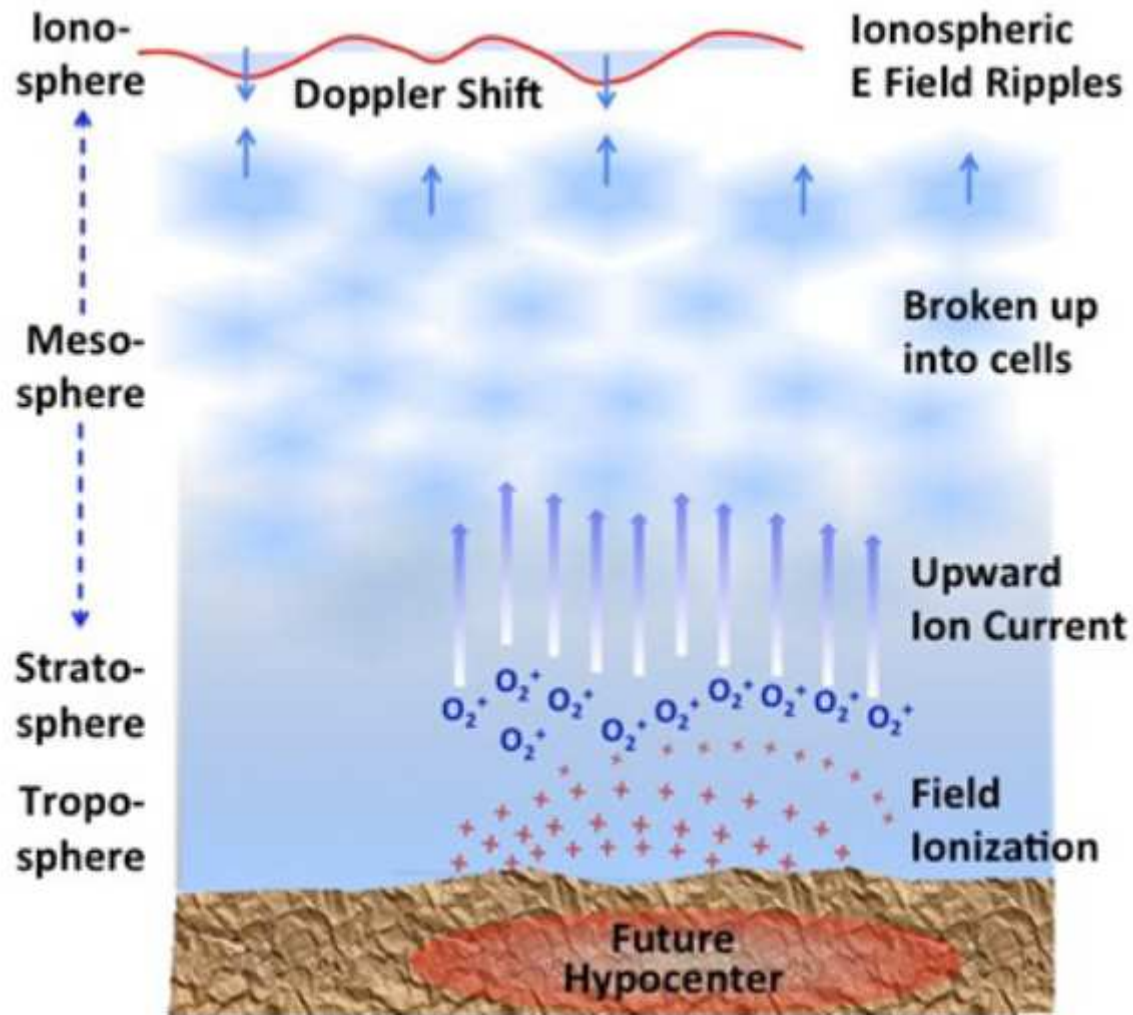
30-days control period of monitoring animal behavior with NO seismic activity



During 25 days before the Contamana Earthquake, animal record numbers are seriously reduced



Ionospheric disturbances are detected in the signal from the VLF propagation path (NAA-PLO) crossing the EQ region, but not in the signal from the propagation path (NAA-CAS) 650 km away from it.



Stress-activation of highly mobile electronic charge carriers in the Earth's crust results in ionization at the ground-to-air interface producing massive positive airborne ions

- Aversive to animals (serotonin blood level)
- Propagate to the lower ionosphere

Final Considerations

The Brazilian EMBRACE Space Weather monitoring program has grown the last 12 months. It provides nowadays on-line alerts for Space Weather clients.

The lower ionosphere plasma is a medium very sensitive to external forcing: radiation, energetic particle fluxes, and magnetic clouds. It is as a large sensor of external disturbances to monitor Space Weather effects.

This is what actually does the VLF technique. However, the latter also shows that the ionosphere can be disturbed from below, associated with natural phenomena.

During earthquake preparation, geophysical processes occur over varying temporal and spatial scales, some leaving their mark on the surface environment, on various biota, and even affecting the ionosphere.

Reports on pre-seismic changes in animal behavior have been greeted with scepticism by the scientific community due to the necessarily anecdotal nature of much of the evidence and a lack of consensus over possible causal mechanisms.

Stress-activation of highly mobile electronic charge carriers in the Earth's crust and their flow to the air surface is a plausible scenario to understand concurrent observations of two widely different and seemingly unconnected precursory phenomena

Further steps: (i) measurements of air ionization; (ii) foster multidisciplinary collaborative efforts.