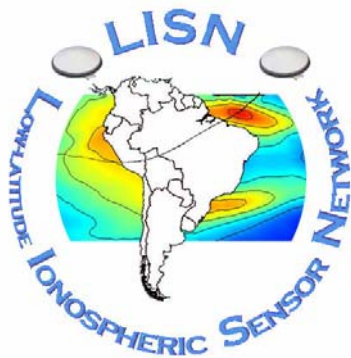




The Low-latitude Ionosphere Sensor Network (LISN)

The First Distributed Observatory in South America

Cesar Valladares and Patricia Doherty
Boston College



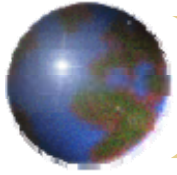
Thanks to our sponsors and many international colleagues!



URSI GA

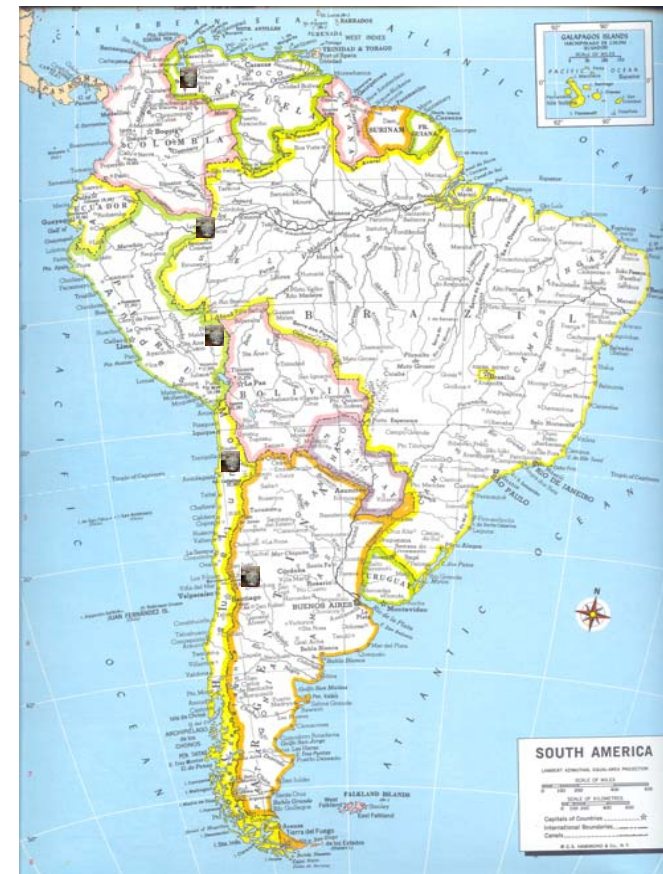
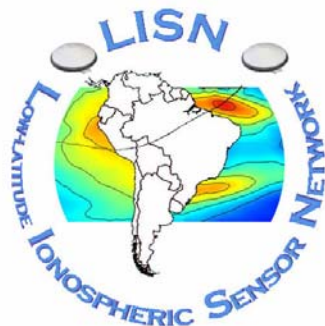
August 12, 2008

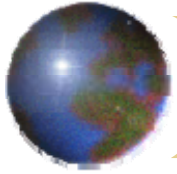
Chicago, IL



Outline

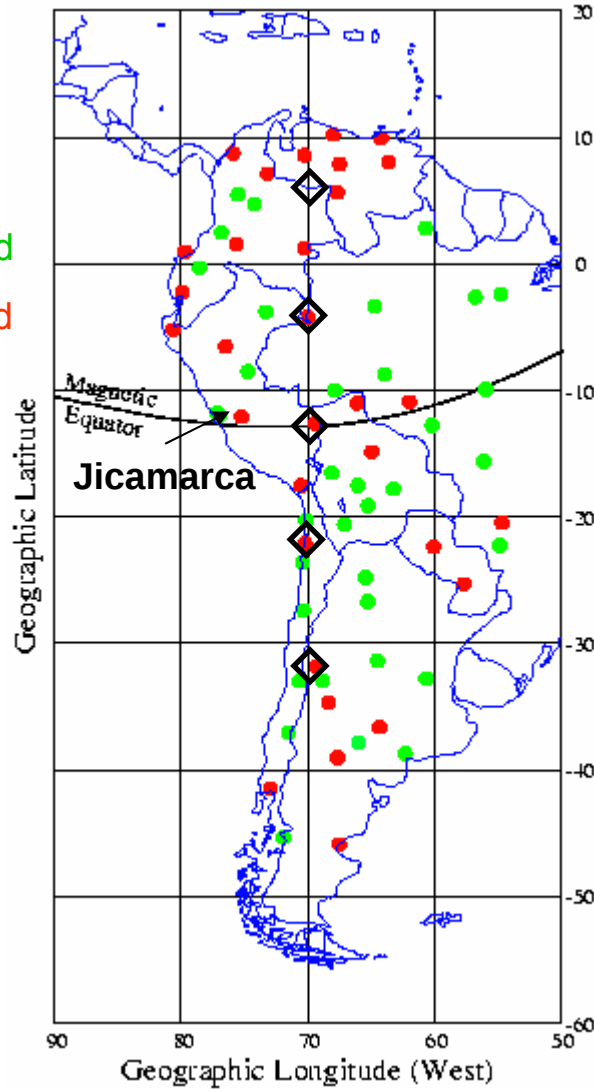
- ✚ Objectives for the LISN Observatory
- ✚ Network Architecture
- ✚ LISN
 - ▣ Instruments
 - ▣ Early Measurements
 - ▣ Science Topics
 - ▣ Status
 - ▣ Benefits
- ✚ Summary



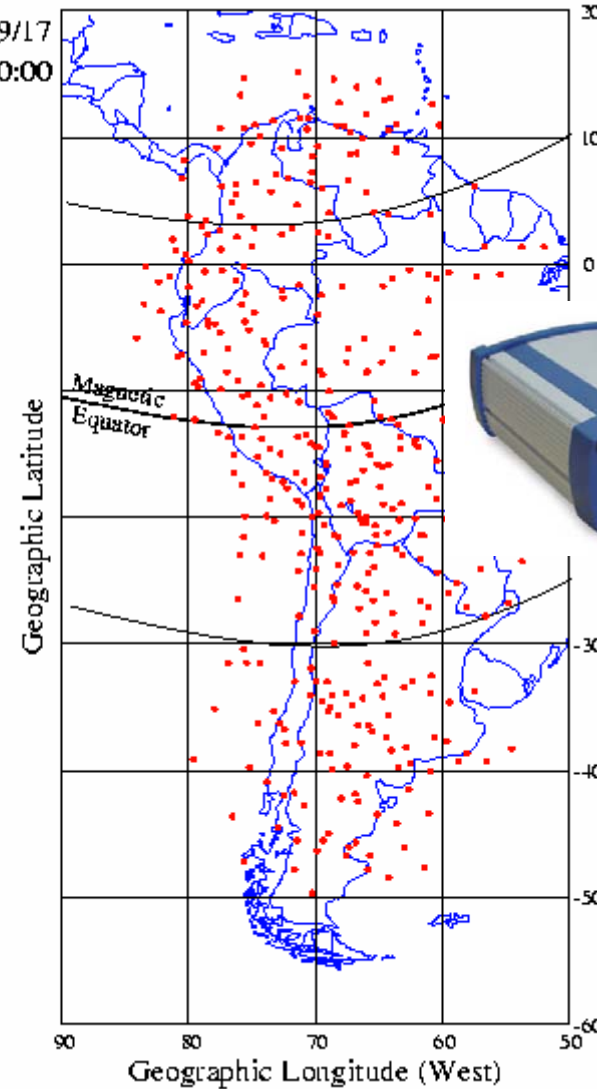


The Low Latitude Ionospheric Sensor Network (LISN)

- Installed
- Planned

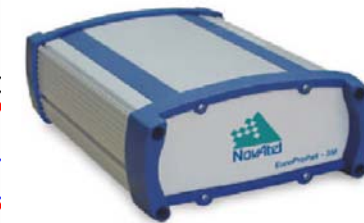


2007/09/17
00:00



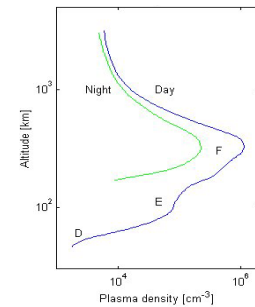
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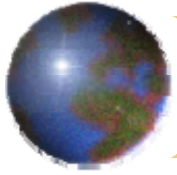
PS



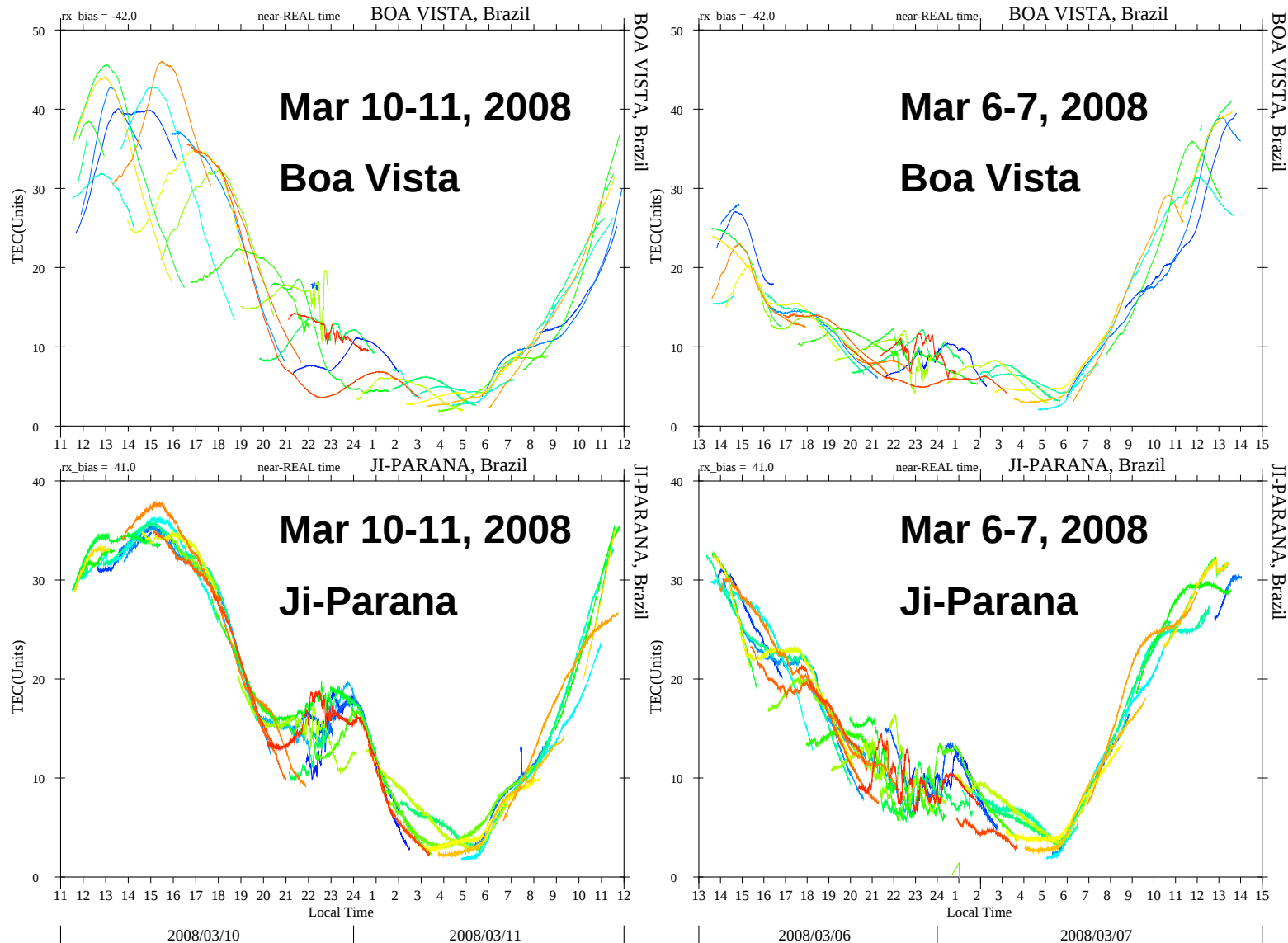
nts

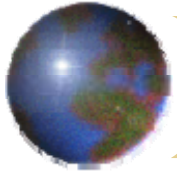
drifts

measure vertical plasma drifts

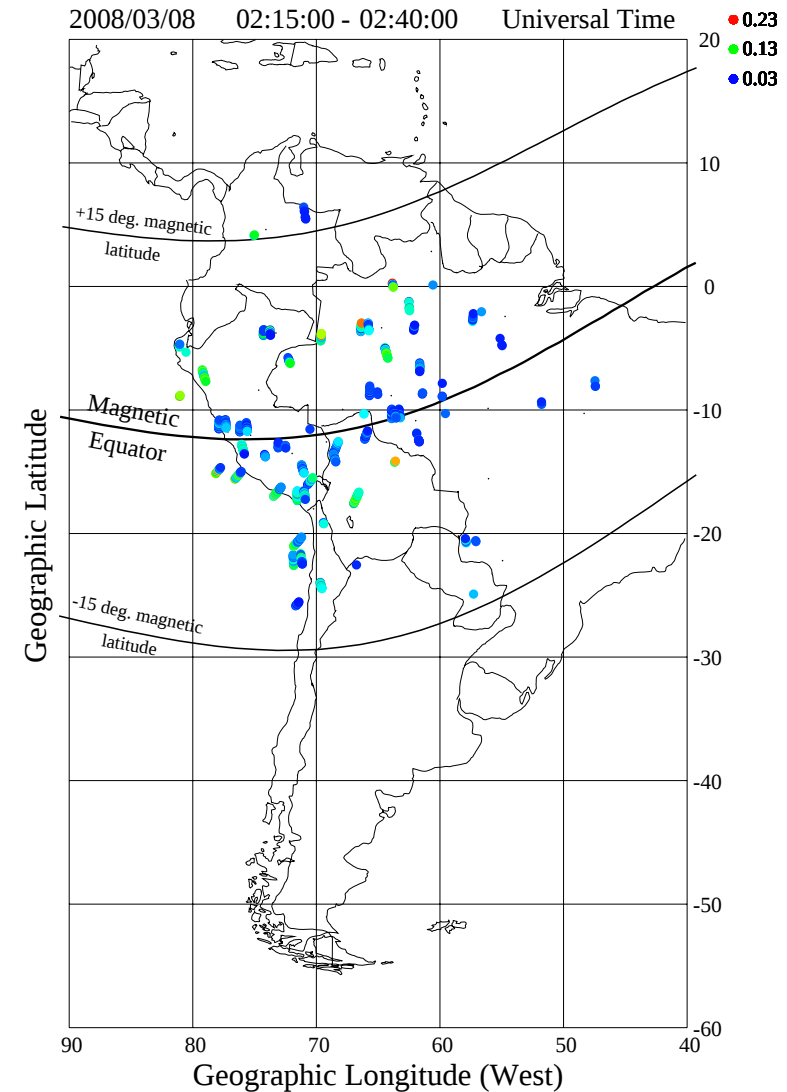
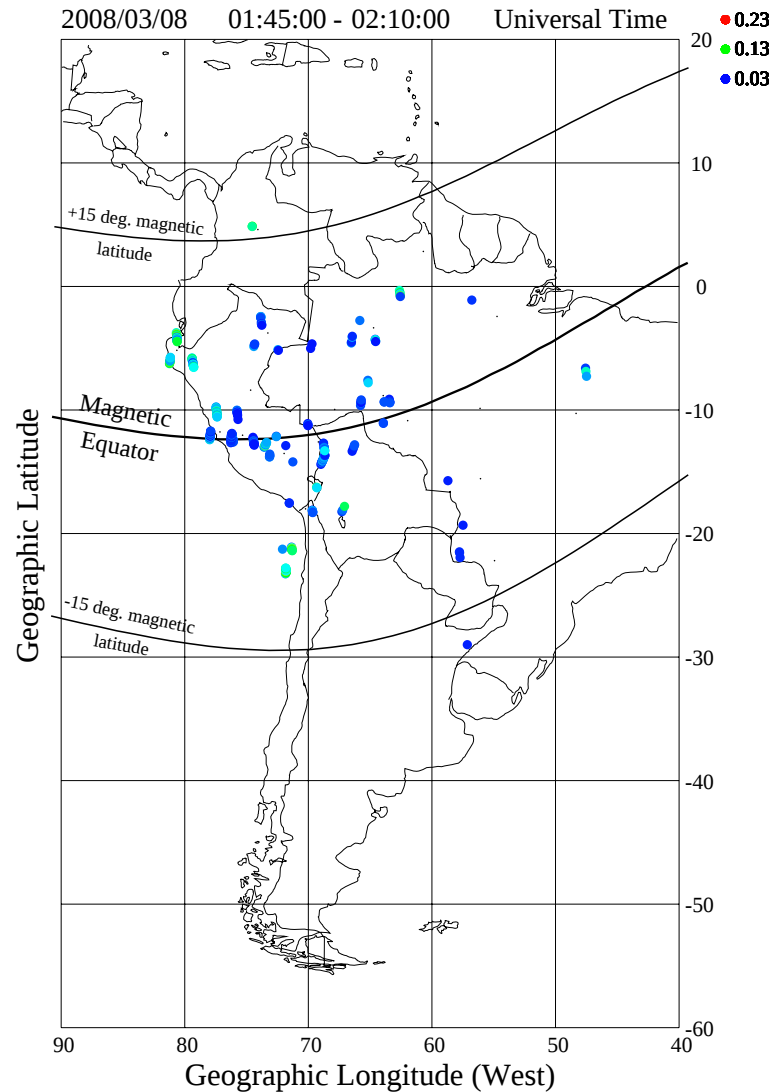


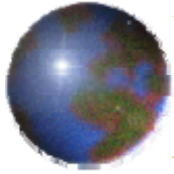
TEC Values Observed near the Crest (Boa Vista) and Magnetic Equator (Ji-Parana)





S4 Scintillation Index observed in SA on March 08, 2008





Ionosondes

(Designed by Terry Bullett and Bob Livingston)

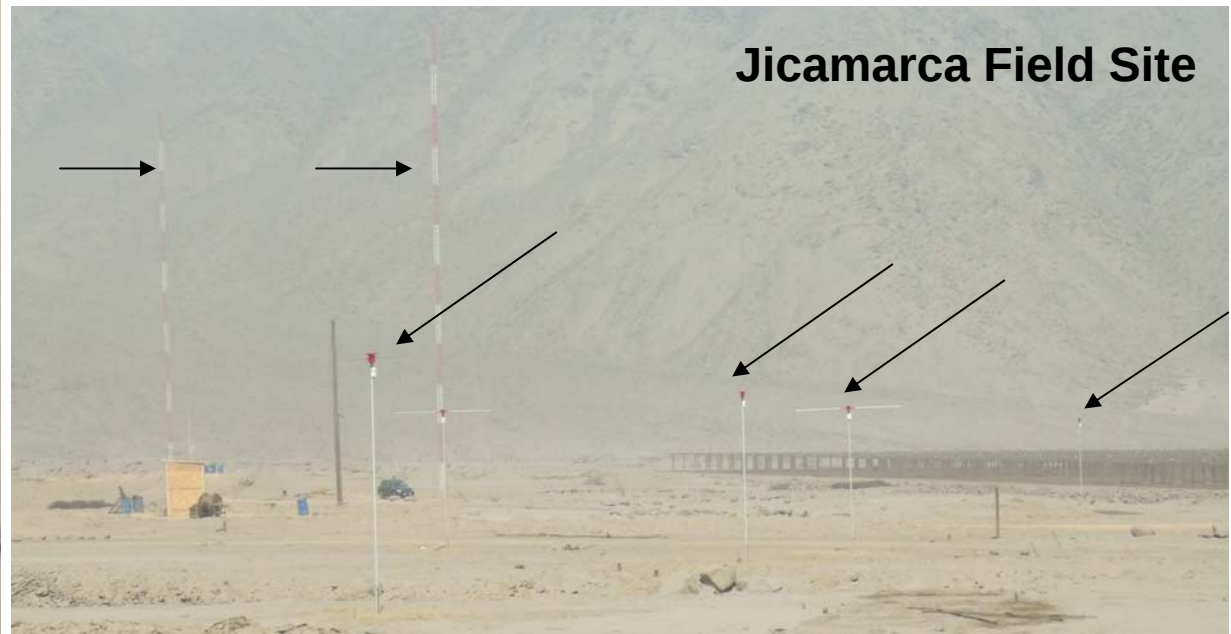


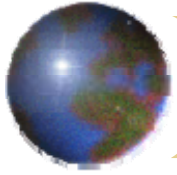
Vertical Incidence Pulsed Ionospheric Radar (VIPIR)

Designed for extreme performance and flexibility

8 Receiving Antennas – dipoles (4 N/S and 4 E/W)

4 Transmitting Antenna towers

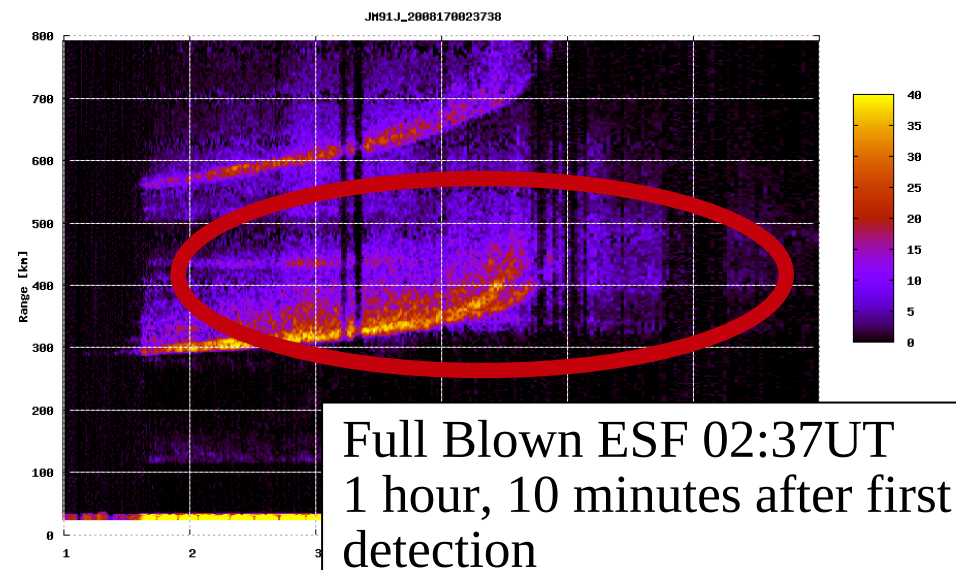
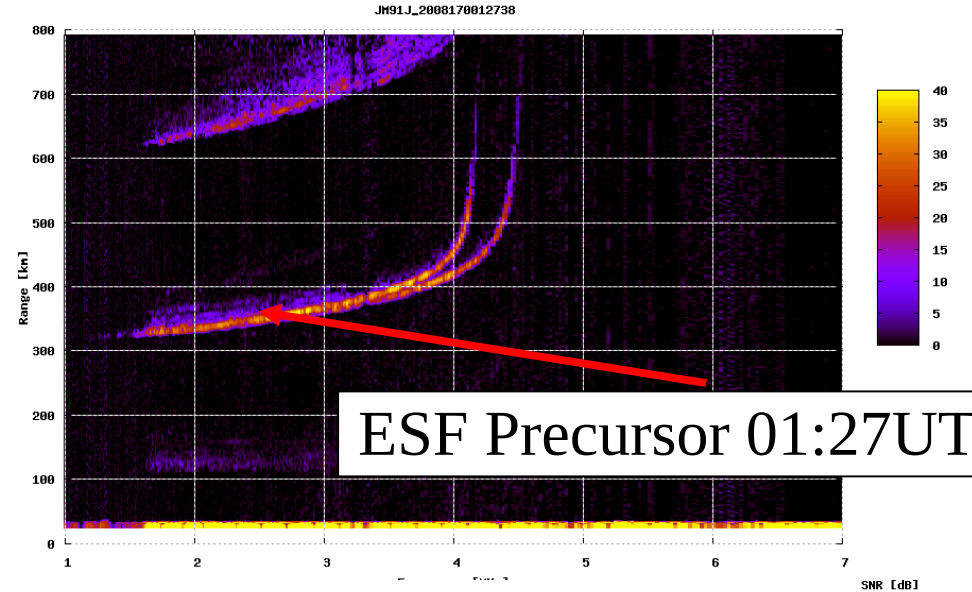




Ionosonde Measurements from Jicamarca

(Designed by Terry Bullett and Bob Livingston)

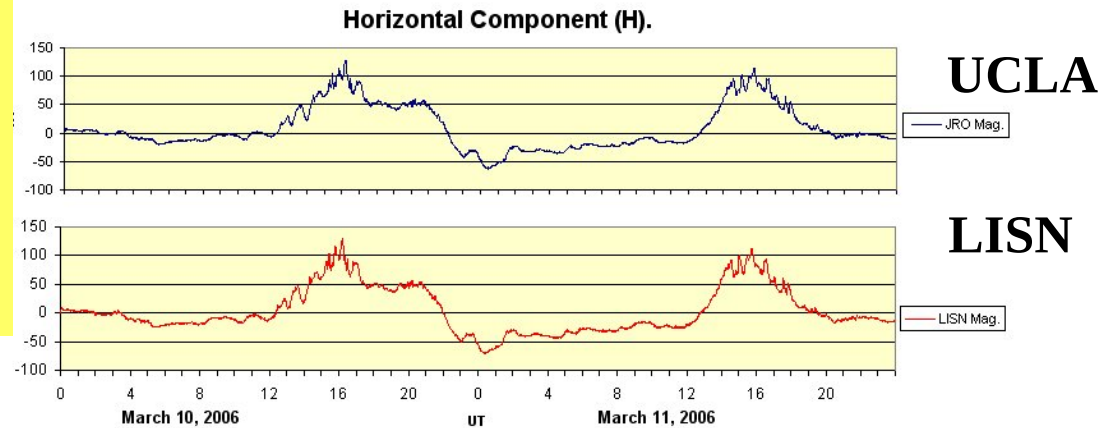
SNR [dB]





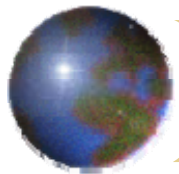
Development of a prototype magnetometer

LISN funded the design of a prototype magnetometer by Oscar Veliz. Right Figure shows a comparison with UCLA magnetometer.

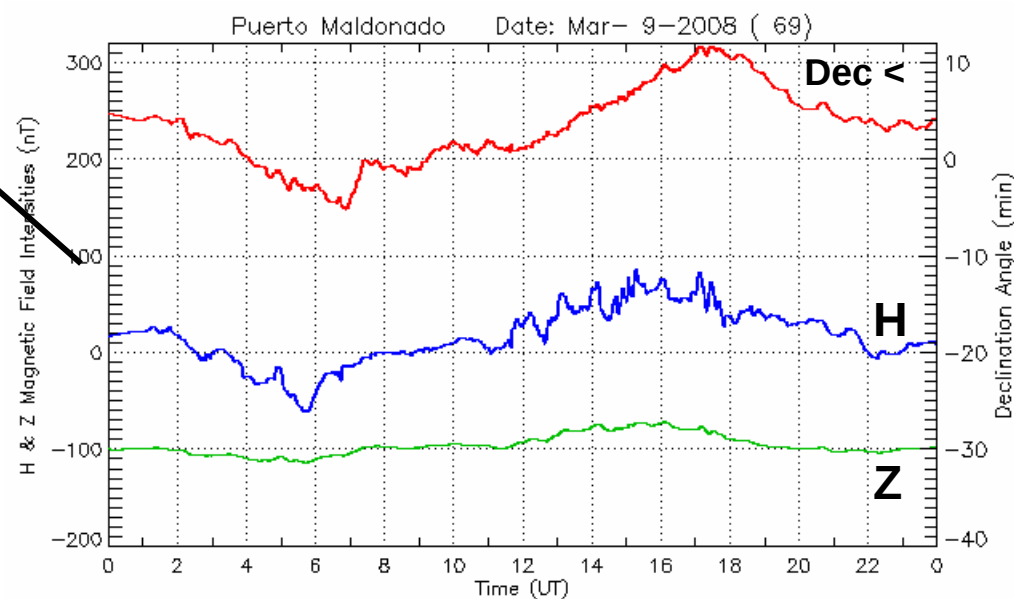
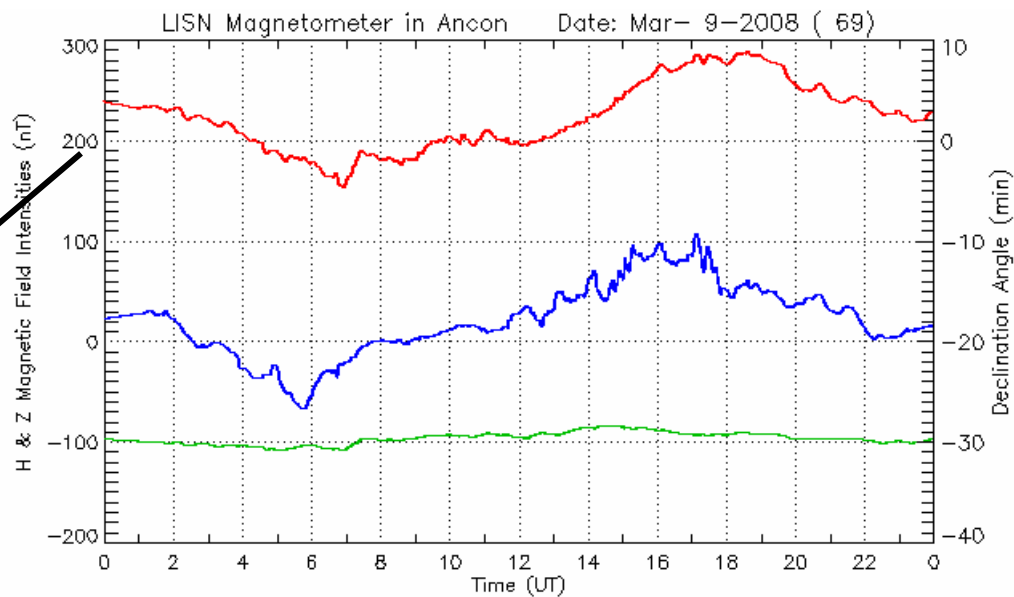


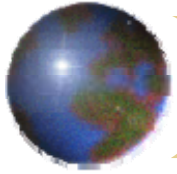
Characteristics of Jicamarca's Triaxial ring core fluxgate magnetometer:

- High Sensitivity and field resolution (0.1nT)
- Long term mechanical and thermal stability
- Highly robust electronics and system reliability (multi-layer circuitry).
- Low power consumption
- Data readily available to Internet uploading (5 min cadence time).

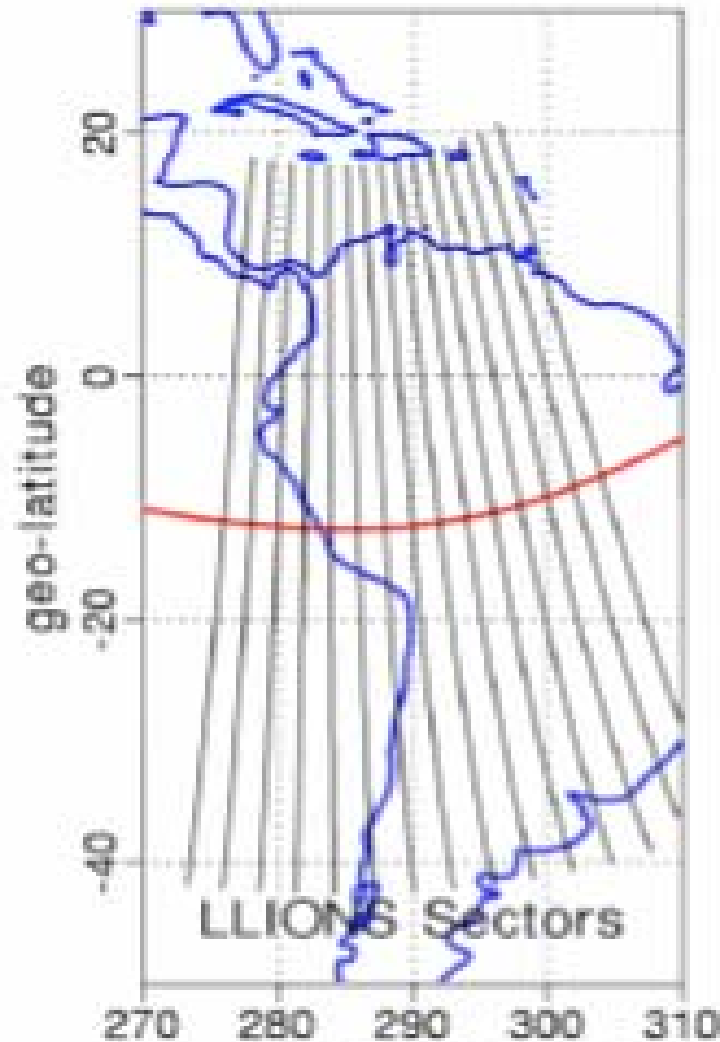


Magnetometer Measurements from Ancon and Puerto Maldonado





Complementary Aspect of LISN

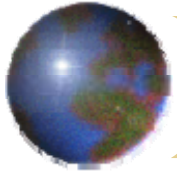


LISN data will be complemented with an assimilative physics-based model designed to “nowcast” the ionosphere above the same geographic region.

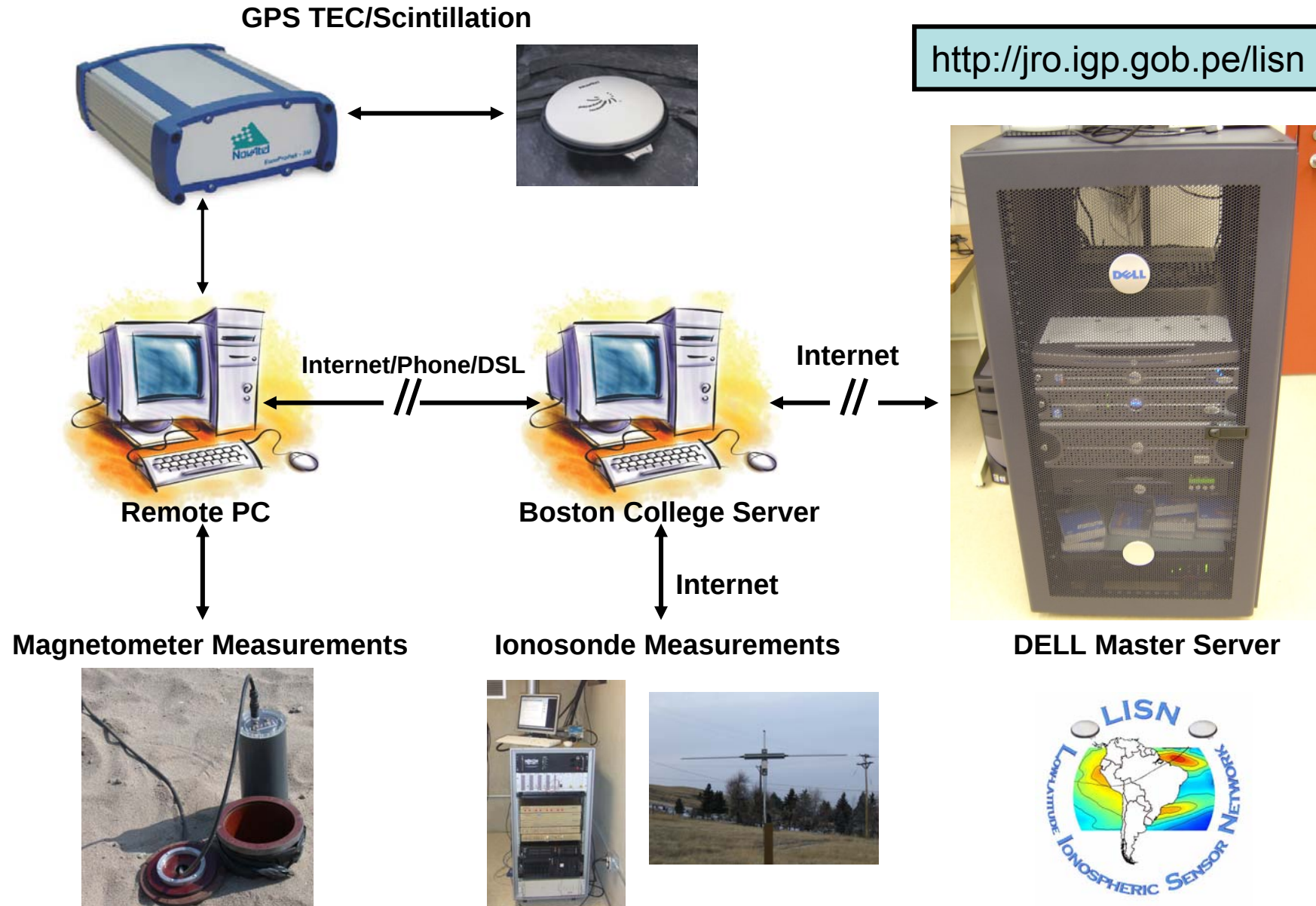
Model based on LLIONS

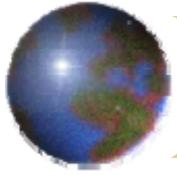
- Solves ionospheric densities (O^+ , NO^+ , O_2^+ , H^+) along magnetic field lines
- Multiple runs to cover longitude range
- Determine low latitude ionospheric drivers
- NeQuick applications in development
- Other modeling/tomographic collaborations welcome...

(Figure Courtesy of V. Eccles, Space Environment Corporation)



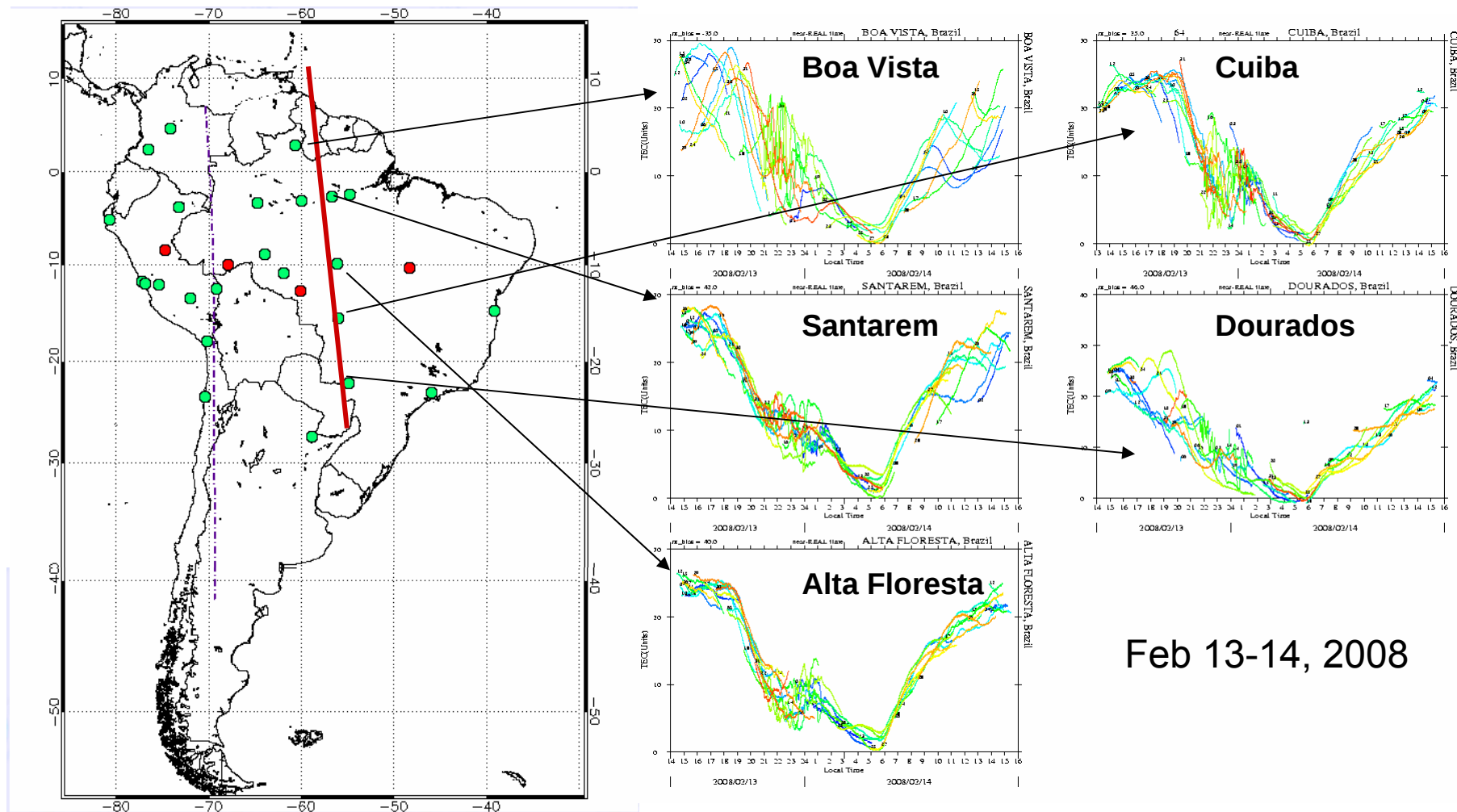
LISN - Data Flow Diagram

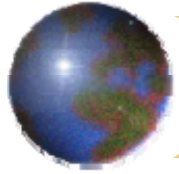




Near Real-time TEC Values

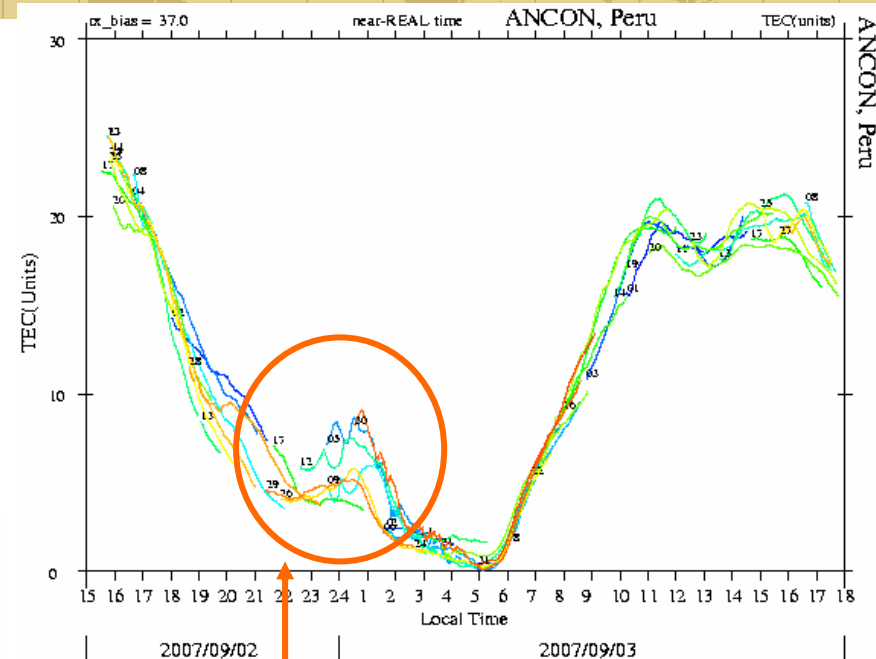
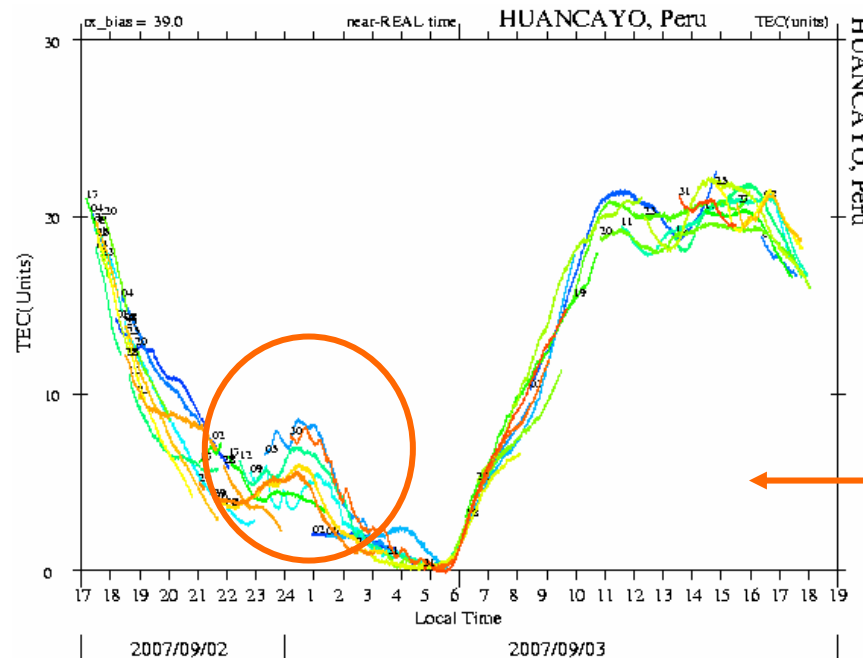
<http://jro.igp.gob.pe/lisn/>





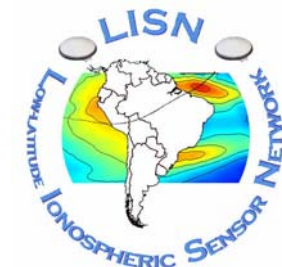
TEC wave Perturbations associated with TIDs

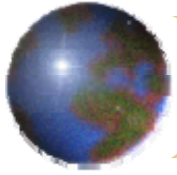
**1 TEC unit fluctuations
seen moving from
Huancayo to Ancon
(westward direction).**



Ancon

Huancayo





Status of LISN



GPS Receivers

- 30 GSV4004 receivers – purchased/prepared/deployed
- More receivers to be added (~15)
- Collaborations with other institutions (~25)
- 30 fully operational – <http://jro.igp.gob.pe/lisn>



Ionosondes

- 1 is working in Jicamarca
- 2 to be installed in June (Peru, Argentina)
- All deployed by mid 2009

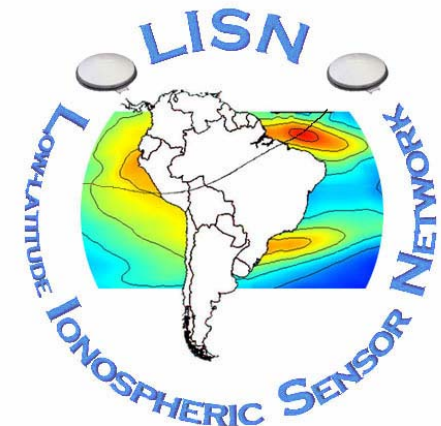
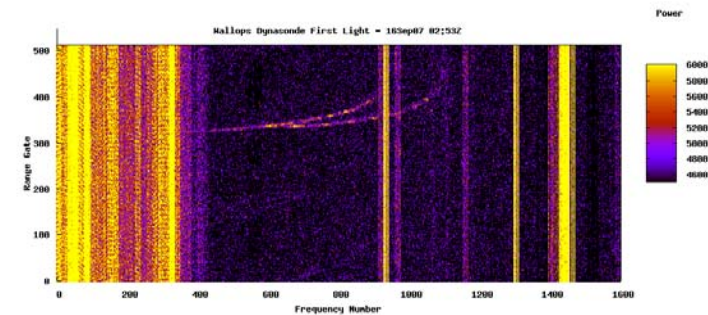


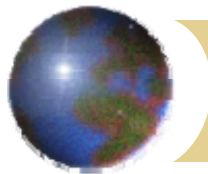
Magnetometers

- All 5 constructed
- 1 Installed
- 4 by early 2009

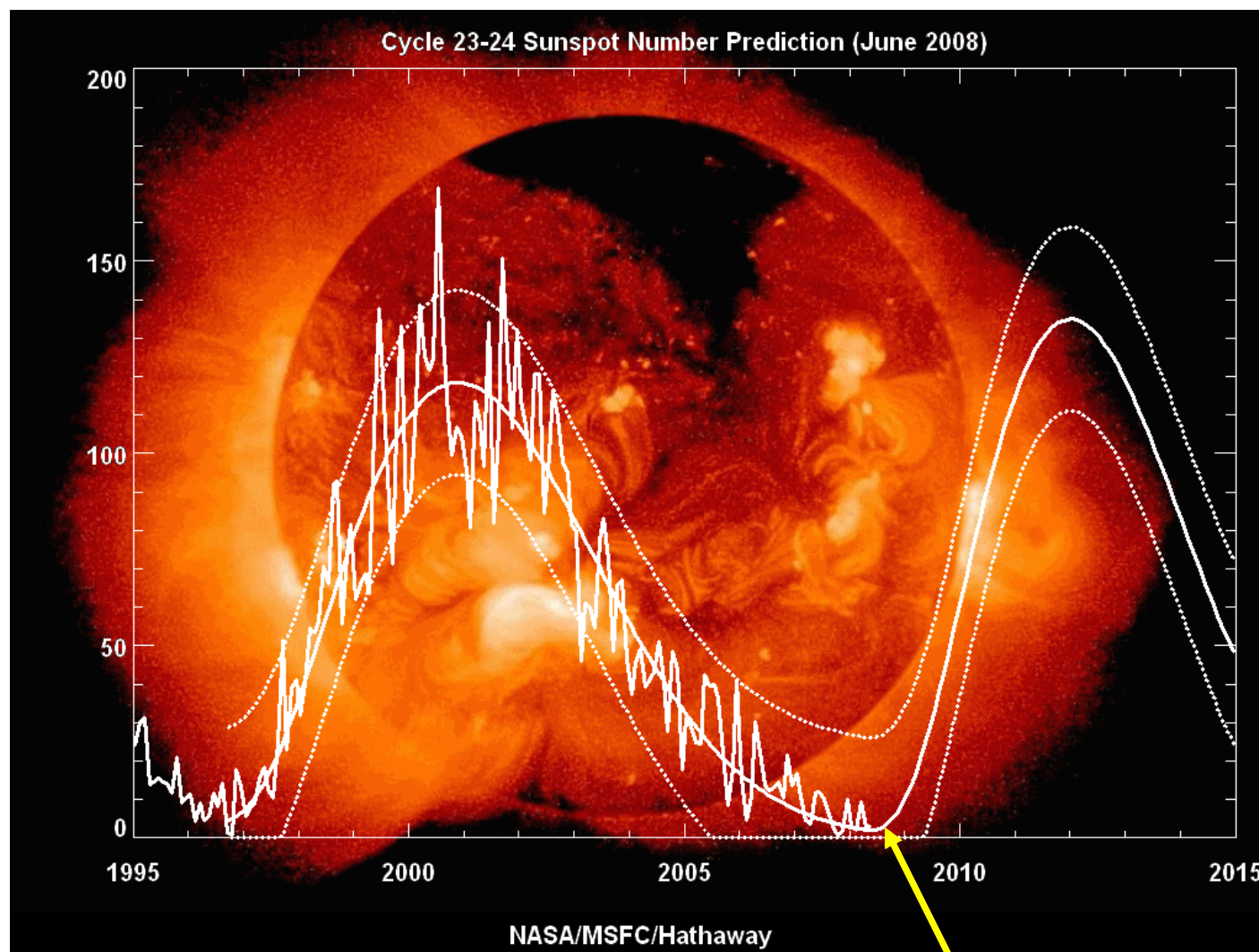


System installation complete July 2009





Just in time for Solar Cycle 24!

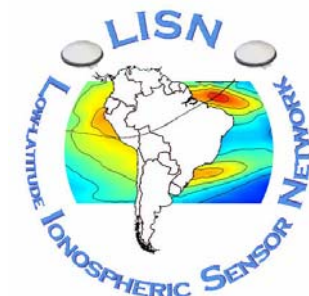


Operational Phase of LISN



SUMMARY

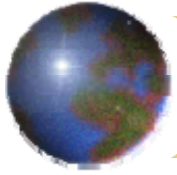
- ✚ LISN Motivation – Low Latitude Features
- ✚ LISN Architecture
- ✚ LISN Goals
 - ✚ Coordinated Measurements
 - ✚ Study electrodynamics of the low-latitude region
 - ✚ Develop tools to nowcast/forecast initiation of Spread F
- ✚ Examples of measurement techniques
- ✚ Current Status





Lessons Learned

- **The successful operation of the LISN instruments depends upon two important factors: (1) local persons willing to provide proper logistic and maintenance support and (2) Internet connectivity.**
- **LISN has motivated the following new projects:**
- **Brazil – Eurico dePaula – Scintillation measurements using different sensors. Maps of scintillation in SA.**
- **Argentina – Claudio Brunini – New methods for calculations of TEC.**
- **Peru – Oscar Veliz – Development of magnetometer prototype.**
- **Colombia – Jaime Villalobos – Space Physics School at the Universidad Nacional.**



1st LISN Team Meeting – Jicamarca, Peru - August 07
31 Participants – 7 Countries



Thanks for LISTeNing!