Space Weather Observatory: Facilities for the Space Navigation

AGENCIA ESPACIAL DEL PERU CONIDA

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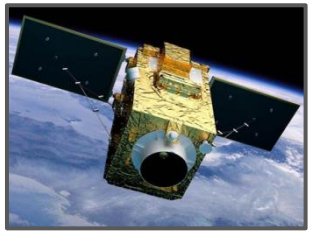
Summary

1.



PRESENTATION

2.

SPACE WEATHER OBSERVATORY

3.

FACILITIES FOR THE SPACE NAVIGATION

4.

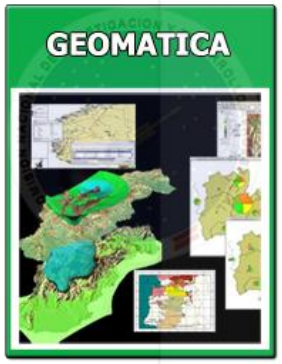
CONCLUSIONS

1. PRESENTATION

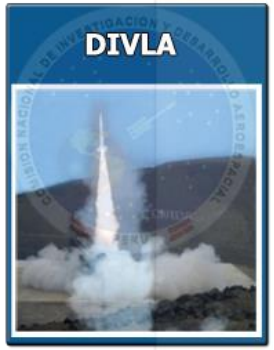
PERÚ Ministerio de Defensa

AGENCIA ESPACIAL DEL PERU CONIDA

NATIONAL CENTER OF SATELLITE IMAGES OPERATIONS - CNOIS



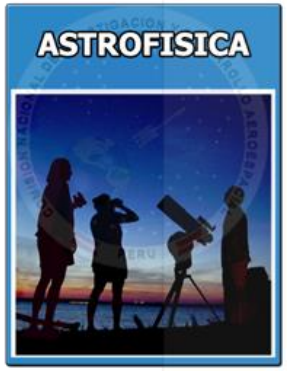
GEOMATICS



LAUNCH VEHICLES

SCIENTIFIC INSTRUMENTATION

ASTROPHYSICS



2. SPACE WEATHER OBSERVATORY

Facilities implemented by CONIDA to perform scientific research in Space Weather and space navigation systems.

Different equipments have been installed since 2006 in order to monitor long-term and transient events from geospace anomalies and solar-terrestrial connections.

CONIDA is operating a telescope (observation of artificial satellite orbits, DEBRIS) as part of projects with APSCO, and TEC monitoring instrument.

SAVNET

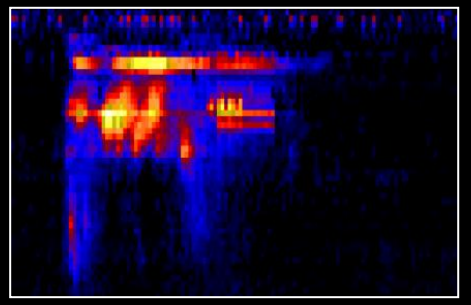
VLF Ionospheric Observations for Solar Flares

LAGO

Cosmic Rays Observations

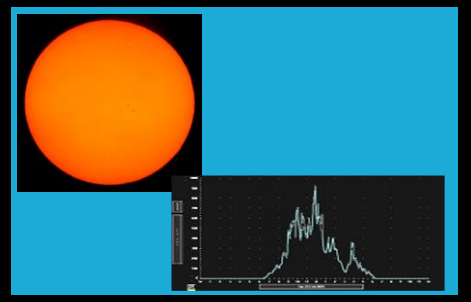
APOSOS

Debris, Satellites and Asteroids Observations



CALLISTO

Solar Flares Observations



SOLAR MONITORING

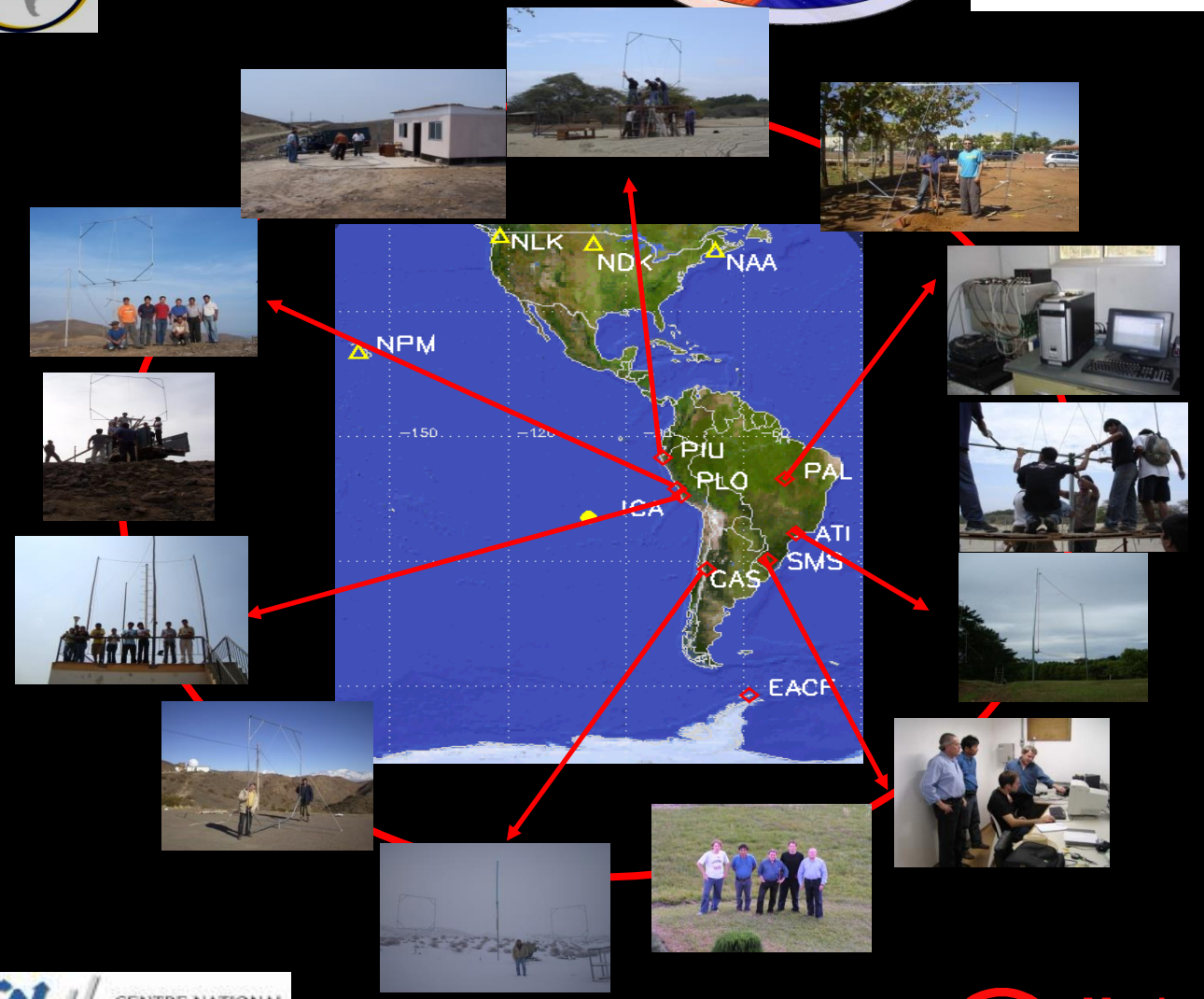
Solar Total Radiation, Hα Filter
UV Index
Sunspots Observation and Prediction Astronomical Ephemerides

CRIRP

Ionospheric ,models and GNSS data analysis

SAVNET
CRAAM/EE

- 8 VLF tracking receiver stations deployed in Brazil, Peru (CONIDA, UP, UNICA) and Argentina.
- 10 years of operation since 2007
- Long-term and transient solar activity (Ly-α ; solar flares)
- Mesospheric disturbances (T, NO, O3)
- Physics of the lower ionospheric (C/D) regions
- Atmos. Physics (TGFs)
- Subionospheric radio propagation modeling
- Search for seismic-EM effects
- Detection of Remote astrophysical objects



Educational, skills, human resources

FAPESP CNPq

CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

Mack Pesquisa

SPACE WEATHER OBSERVATORY - OBJETIVE

Monitor long-term and transient events from geospace anomalies and solar-terrestial connections.

http://www.conida.gob.pe/index.php/SAVNET/savnet.html

The Large Aperture Gamma ray bursts Observatory (LAGO)

A very long baseline "array" of wáter Cherenkov detectors (WCD)

LAGO

- Non-centralized, collaborative network of Institutions
- Developments, expertize and data are shared across the network.
- Sites in eight countries: Argentina, Bolivia, Colombia, Ecuador, Guatemala, México, Perú & Venezuela.

Scientific goals:

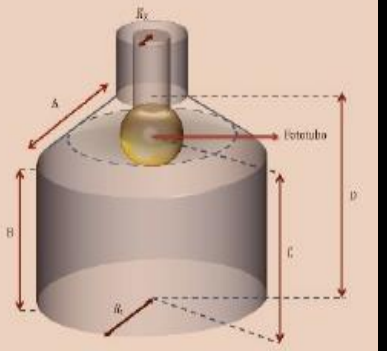
- Search for HE component of GRBs at ground level.
- Study transient and long term Solar modulation (SM) of Cosmic Rays (CR) phenomena.

Academic goals:

- Train latin-american students in H.E. and Astroparticle researchers.
- Build a latin-american grid of Astroparticle researchers.

LAGO "typical" Water Cherenkov Detector

- PMT(s) – Digitizer board (own desing) + GPS +
- Simple WCD detector desing: sensitivity to charged secondar particles and y (mainly trough y e+ e-) →
- Commercial water tanks + internal reflective and diffusive coating
- FPGA based electronics: detector control and data adquisitior top sensor.



http://www.conida.gob.pe/index.php/SAVNET/lago-peru-base-conida-astrofisica

ASIA-PACIFIC GROUND-BASE OPTICAL SATELLITE OBSERVATION SYSTEM (APOSOS)

The project aims to develop a unified space observation network based on optical trackers in APSCO Member States.

The basic objective is to build the network with existing facilities, with the aim of tracking objects and space debris in Low Earth Obit (LEO).

ASIA-PACIFIC GROUND-BASE OPTICAL SATELLITE OBSERVATION SYSTEM (APOSOS)

The optional objective is to bring new facilities, and extends the ability to track objects and space debris in MEO and GEO (peaceful purposes).

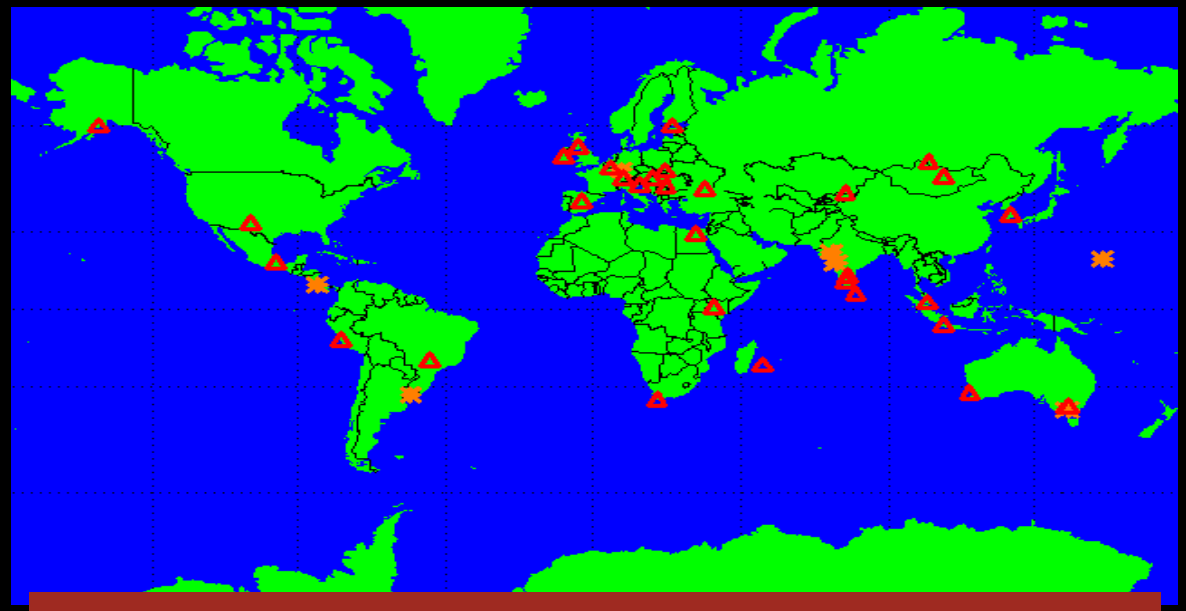
The network is for the purpose of establishing the infrastructure for a collision avoidance early warning service in the future.

http://www.conida.gob.pe/index.php/SAVNET/aposos

e-CALLISTO NETWORK

International Network of Solar Radio Spectrometers

Compound
A stronomical
L ow-Cost
L ow-Frequency
I nstrument for
S pectroscopy and
T ransportable
O bservatory



Map of current distribution of Callisto instruments in February 2015

The main applications are observation of solar radio bursts and rfi-monitoring for astronomical science, education and outreach

CALLISTO spectrometer is part of e-CALLISTO network trought implementation program IHY / UNBSSI and ISWI instruments, was financially supported by SNF, SSAA, NASA, Institute for Astronomy and North-South Center of ETH Zurich and a few private sponsors and work bandwidth frequency (45 to 870 MHz).

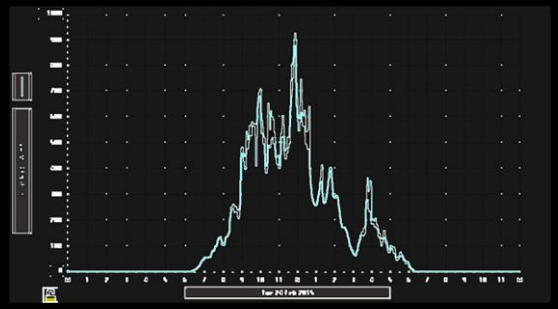
http://www.conida.gob.pe/index.php/SAVNET/red-e-callisto

SOLAR MONITORING AND PREDICTION CENTER

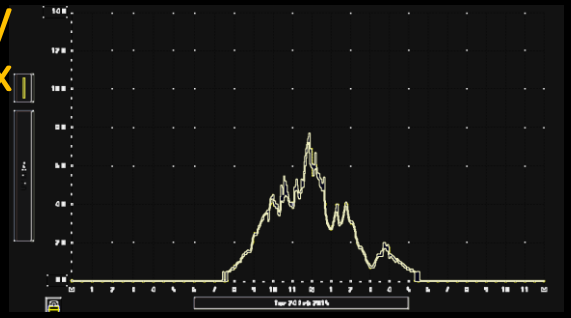
Daily observation and Early Alerts

Solar Photosphere Sunspots

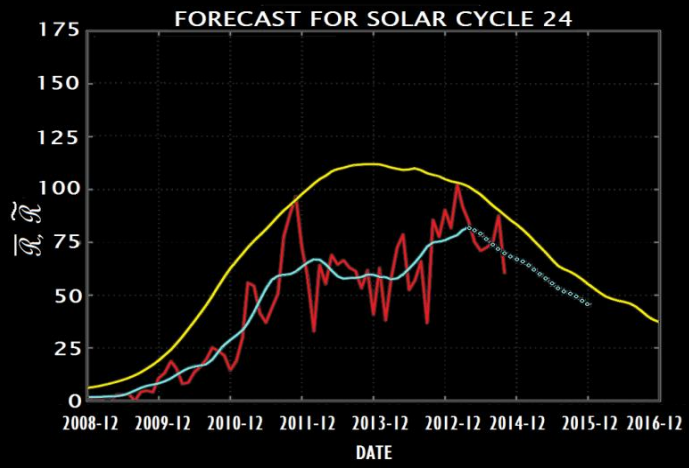
Solar radiation



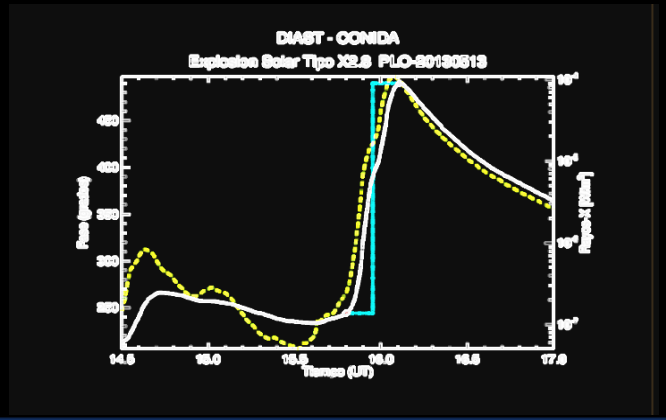
UV Index



Prediction



Solar Flares and Geomagnetics Disturbances



3. FACILITIES FOR THE SPACE NAVIGATION

CRIRP PROJECT

Research on Atmospheric Effects on Ionospheric Modeling through Study of Radio Wave Propagation and Solar Activity. The leading institute is China Research Institute of Radio wave Propagation (CRIRP).

The implementation of this project rise in to try to provide more accurate and suitable ionospheric models for the Asia Pacific region, with this it can be used in communication systems and satellite navigation systems by making use of data available in this area.

TEC/scintillation monitor - Antenna for GNSS signal receiving

CRIRP PROJECT

Main specification of the monitor:

- Signal receiving: GNSS carrier phase and amplitude variation
- Dynamic range: better than 30dB
- Sampling rate of original data: 20 Hz
- Resolution of output: no more than 1dB

TEC/scintillation monitor

SPACE WEATHER – APOSOS/CRIRP

APOSOS

COE
(Space Observation Center)

CRIRP

International GNSS Monitoring and Assessment
iGMA Project

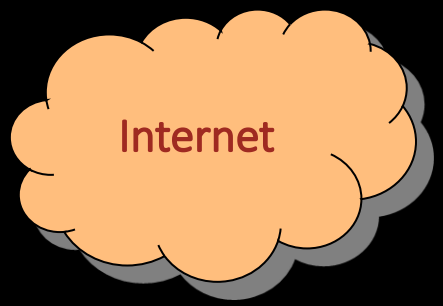
OVERALL OBJECTIVE:
Introduce and promote GNSS research and applications to achieve GNSS technical collaboration among the APSCO Member States.

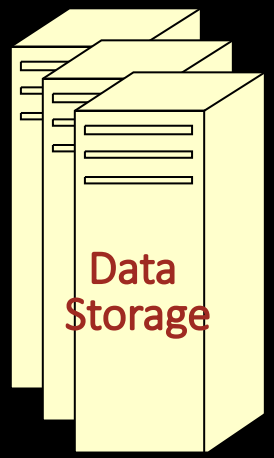
This project is designed to:

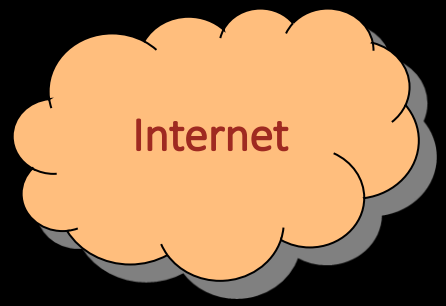
- build GNSS data collection points among member states of APSCO
- set up a data analysis system and carry on monitoring
- assessment of GNSS service performance and modeling of ionosphere delay, etc.

International GNSS Monitoring and Assessment
iGMA Project

GNSS Device for
Data Collection







GPAK
Software

Data Analysis

International GNSS Monitoring and Assessment
iGMA Project

2018 Working Plan

1. Complete the site investigation of Peru (March-April)
2. Prepare the software training materials (March-April)
3. Software training and application extension (March-April, organized by APSCO)
4. Prepare the manual of receiver installation, operation and maintenance in May
5. Site construction, site operation and on-site maintenance training: April-June - Peru
6. Site commissioning (at least one month after site installation) (finish in November)
7. Data analysis (finish in November)
8. Project acceptance (end of February-March, 2019).

4. CONCLUSIONS

CONCLUSIONS

- CONIDA has been developing the space observation center in the city of Huancayo, which will later be moved to the south of the country, in the city of Moquegua.
- CONIDA has been participating in different projects related to space navigation, such as CRIRP and iGMA.

AGENCIA ESPACIAL
DEL PERU CONIDA

Ciencia y Tecnología espacial para el desarrollo

THANKS