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Proposal of a BSRN station at the Observatory of Huancayo, Peru

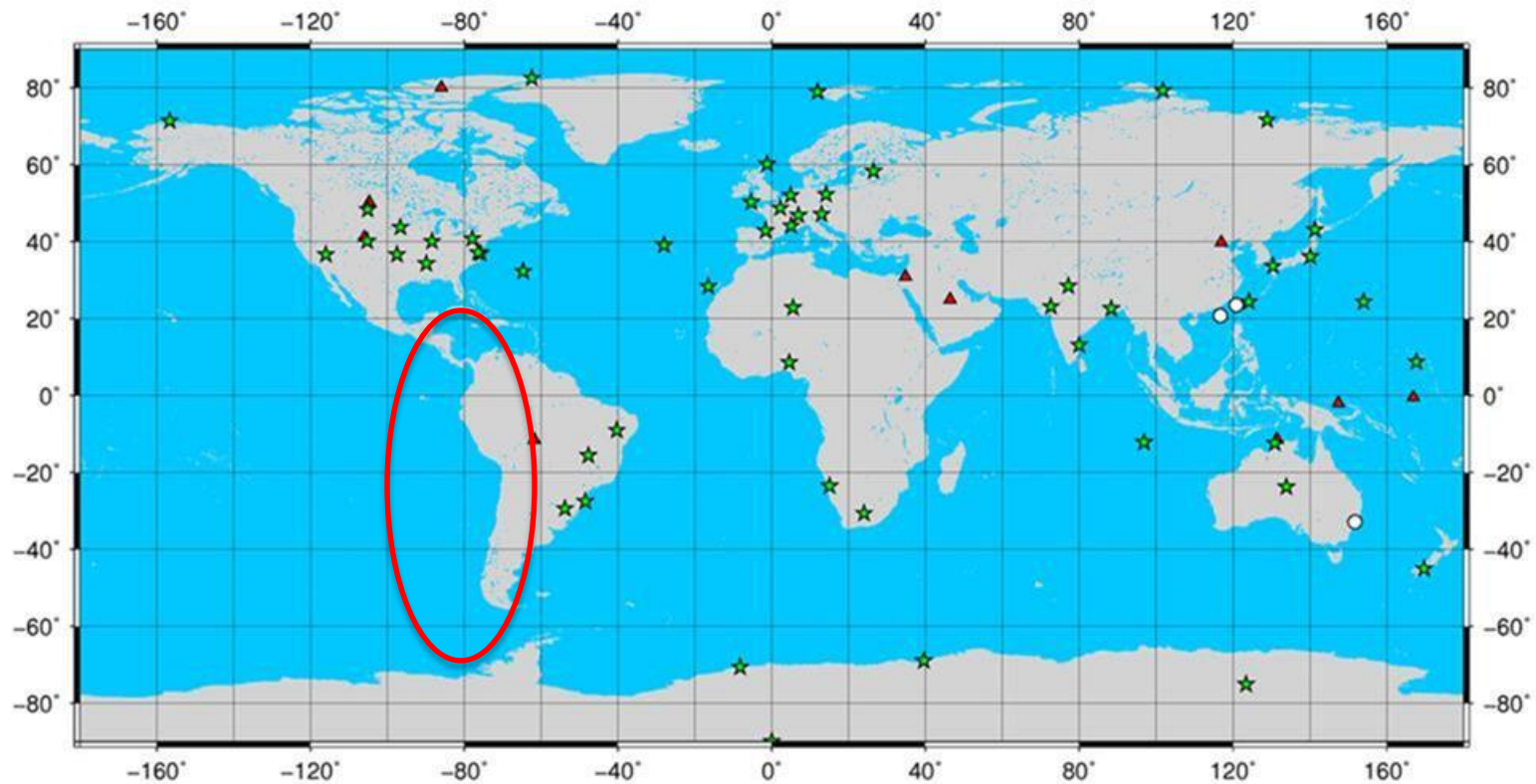
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Geophysical Institute of Peru

Supported by Tim Oakley GCOS/WMO

OPPORTUNITY TO PARTICIPATE IN BSRN AND TO CONTRIBUTE WITH A REGION WHERE SCARCE DATA EXISTS

Running, planned, and closed BSRN Stations, July 2018





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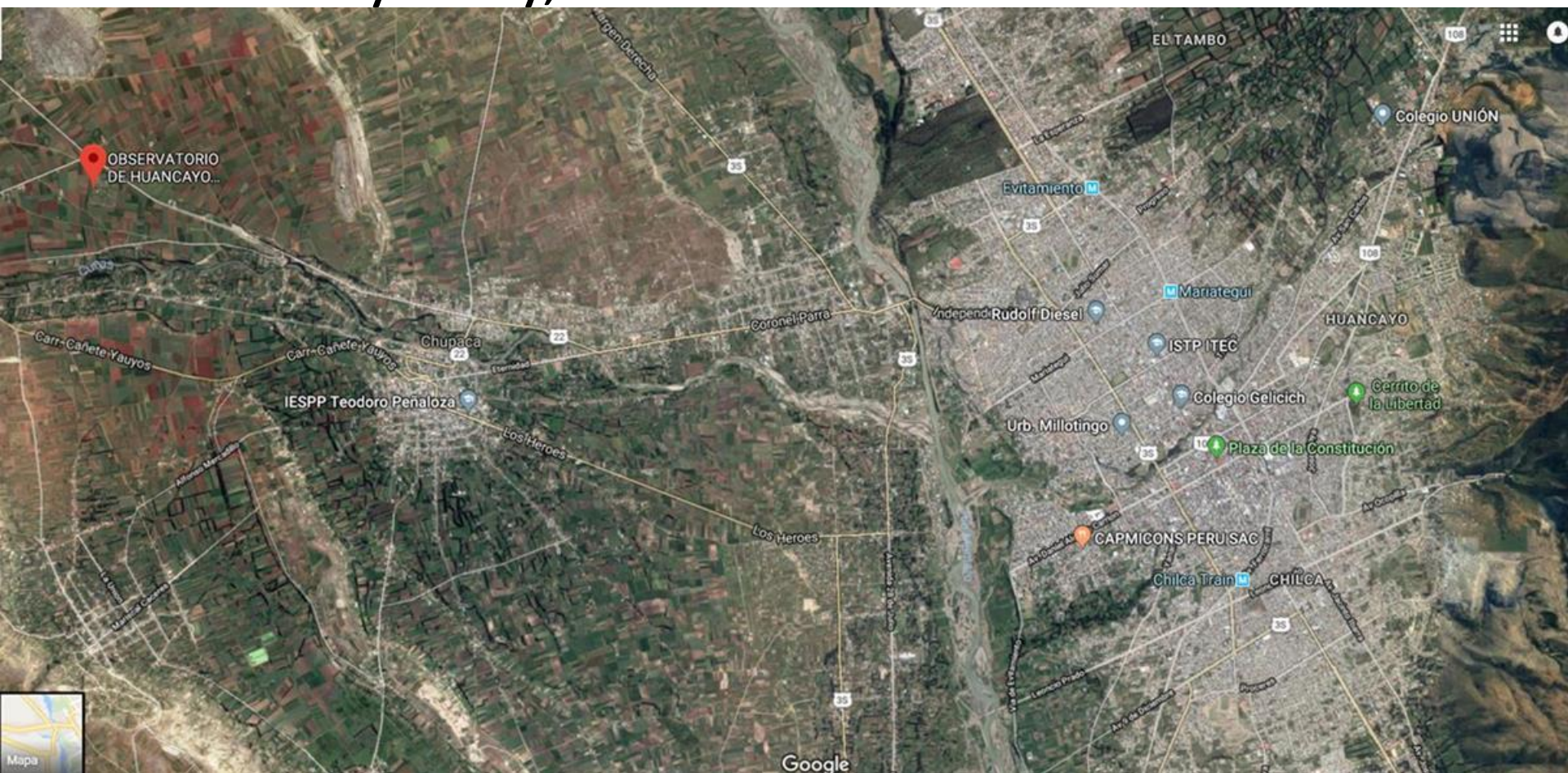
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- The Geophysical Institute of Peru at Observatory of Huancayo, with local partners, have been focused on the implementation of a high quality station for solar radiation that fulfills the requirements of BSRN and assure a continuous maintenance and support by qualified scientists.
- In that sense we present this site as a proposal to be admitted as a BSRN station that can increase representativeness and data validation at the western side of South America.

LOCATION OF OBSERVATORY

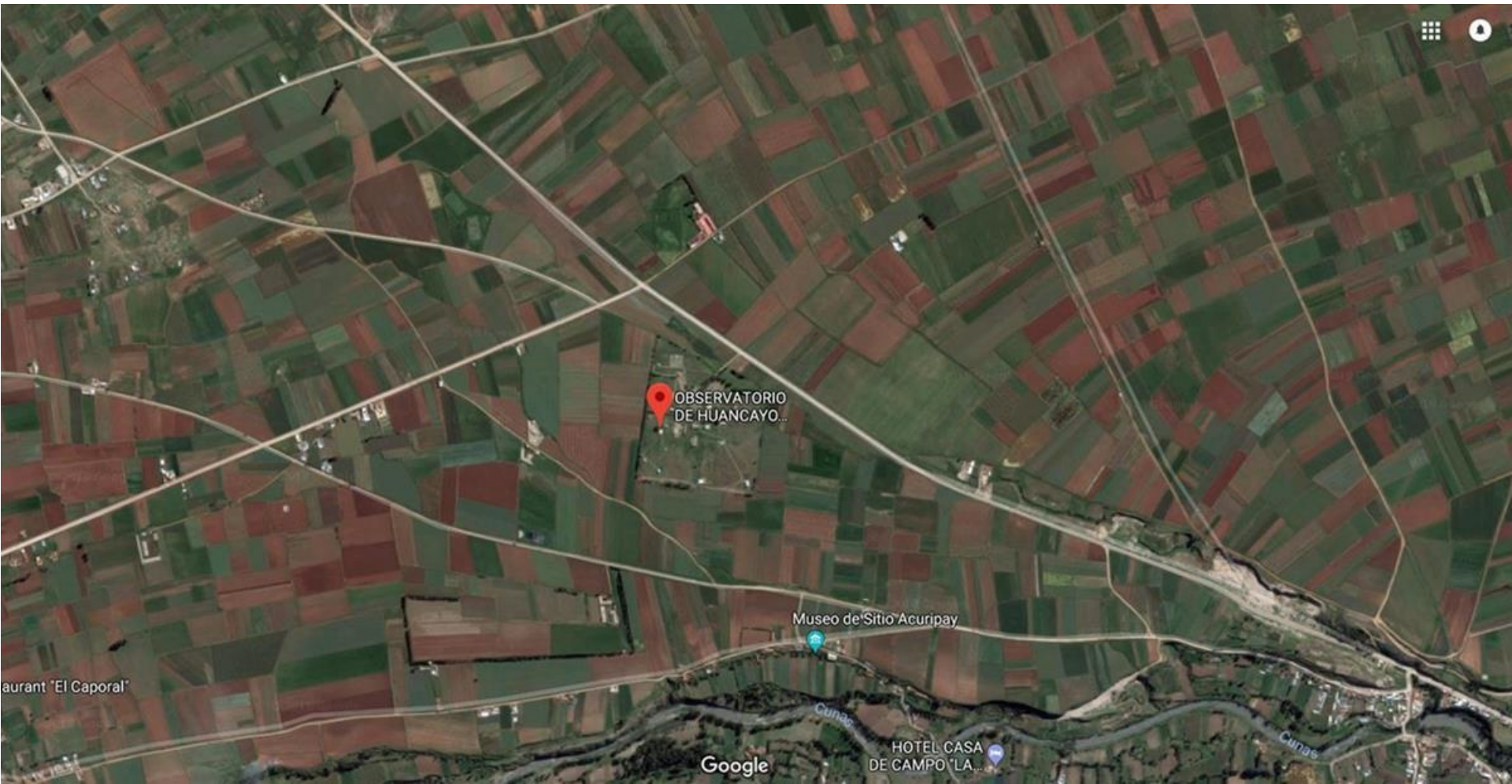
- The proposed site is about 12 km from Huancayo city, the main urban location.



LOCATION OF OBSERVATORY



- It is located over a flat terrain and is surrounded mainly by crop fields.



BSRN STATION AT HUANCAYO

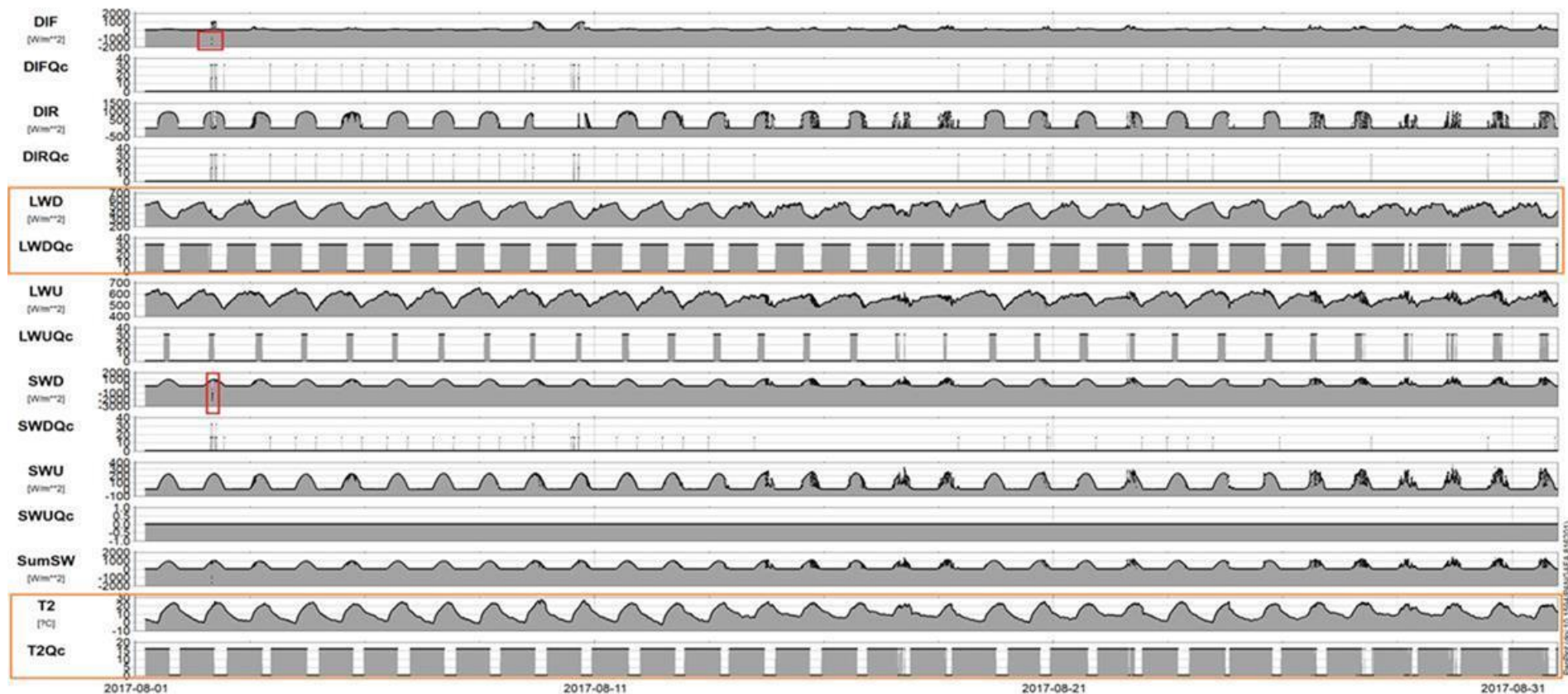


- With support from **GCOS/WMO** programme and Ministry of External Affairs from Peru it was completed the installation of instruments at the end of July 2017.



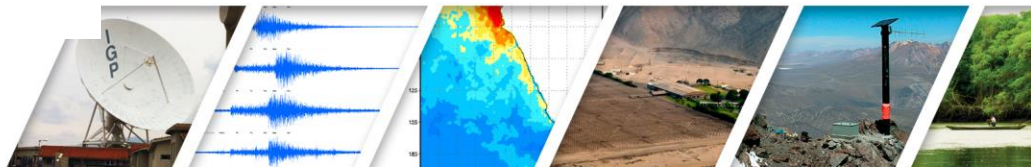
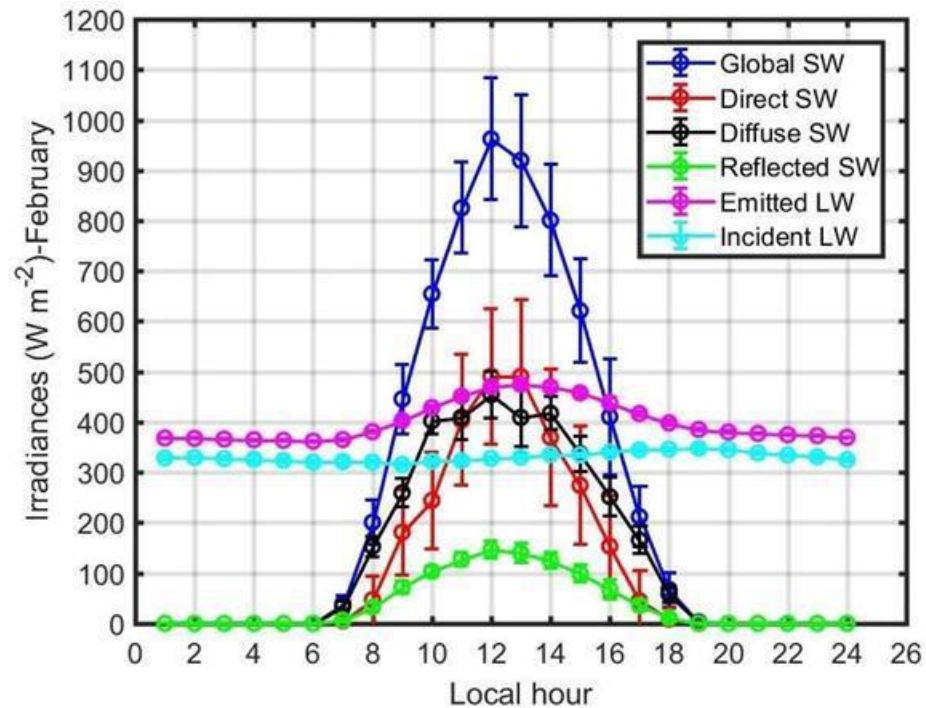
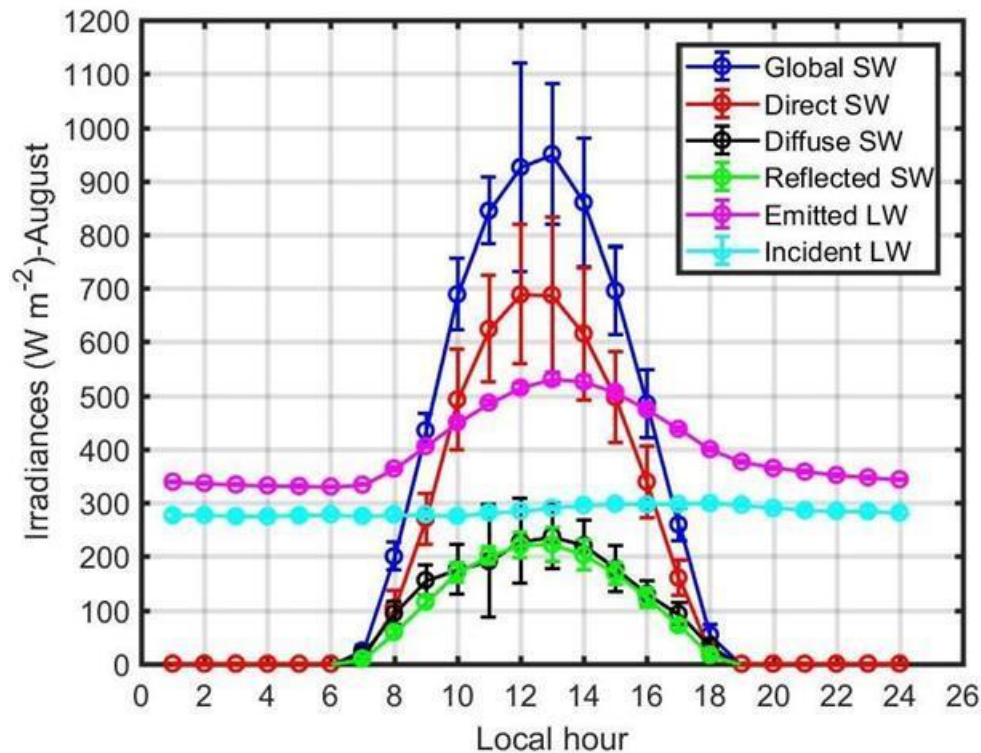
BSRN STATION AT HUANCAYO

- We also asked to BSRN (Dr. Amelie Driesnen) about checking and quality control of collected data.



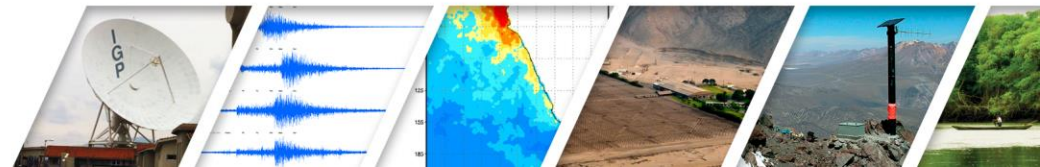
BSRN STATION AT HUANCAYO

- Graphs shows the first 6 months.
- It shows high global and direct solar radiation.



SCIENTIFIC STAFF

- The Observatory of Huancayo of the Geophysical Institute of Peru has a long tradition on atmospheric research having meteorological measurements since 1919:
 - Dr. Yamina Silva, PhD in Physics and Mathematics (done at Russia) with specialization in atmospheric modeling, climate variability & El Niño. She is head of the Department of Atmospheric and Hydrology Sciences.
 - Dr. Rene Estevan, PhD in Meteorology (done at Cuba) with specialization in atmospheric aerosols and radiative forcing.
 - Dr. Jose Flores, PhD in Atmospheric Sciences (done at Brazil), with specialization in high resolution modeling and energy fluxes balance (urban heat island).
 - Eng. Luis Suarez, MSc(c) in Applied Ecology with specialization in solar radiation monitoring and optical properties of aerosols.





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Determination of surface energy fluxes based on meteorological measurements in a gradient tower (30 m)

PI: Dr. José Flores

Convenio No: 010-2017-
FONDECYT

Proyecto MAGNET IGP: Enhancement of the thematic research: Physics and microphysics of the atmosphere



CIENCIAACTIVA

Becas y Co-financiamiento de Concytec

InnovatePerú

Surface energy fluxes

Similarity principle:
Coefficients of diffusion and aerodynamic resistance



$$\frac{LE}{\tau} = \frac{L_v \Delta \bar{\rho}_v}{-\rho \Delta \bar{u}}$$

$$\frac{H}{LE} = \frac{C_a \Delta \bar{T}}{L_v \Delta \bar{\rho}_v}$$

Friction velocity

$$\frac{\partial \bar{u}}{\partial z} = \frac{u_*}{kz} \phi_M$$

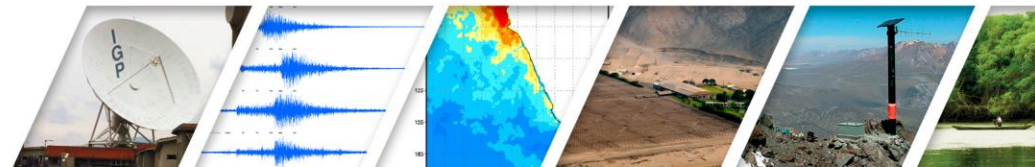
Stability function for momentum

$$\frac{\partial \bar{T}}{\partial z} = -\frac{H}{C_a k u_* z} \phi_H$$

Stability function of sensible heat

$$\frac{\partial \bar{\rho}_v}{\partial z} = -\frac{LE}{L_v k u_* z} \phi_V$$

Stability function of latent heat



Atmospheric Microphysics and Radiation Laboratory – LAMAR

Observatory of Huancayo – Geophysical Institute of Peru

Objective. To understand the physical, microphysics and dynamics of clouds and precipitation in the Andean region and its effect on the radiation and water balance and extreme weather and climate events (frost, heavy rainfall, droughts).

2 Profiler radar for clear sky and rain - CLAIRE



2 Solar photometer (AERONET/NASA network)



Aerosol size profiler (8 ranges)

3 Black Carbon (BC) instrument



3 Tropospheric ozone instrument



4 Wind profiler for boundary layer (BLTR)



2 Sky cams



2 Profiler radar of clouds and precipitation



7 Gradient flux tower



5 Flux tower



Piranometers



Higrometer of Krypton



Sonic anemometer



Radiometer

6 Solar station (BSRN)



1 Disdrómeter





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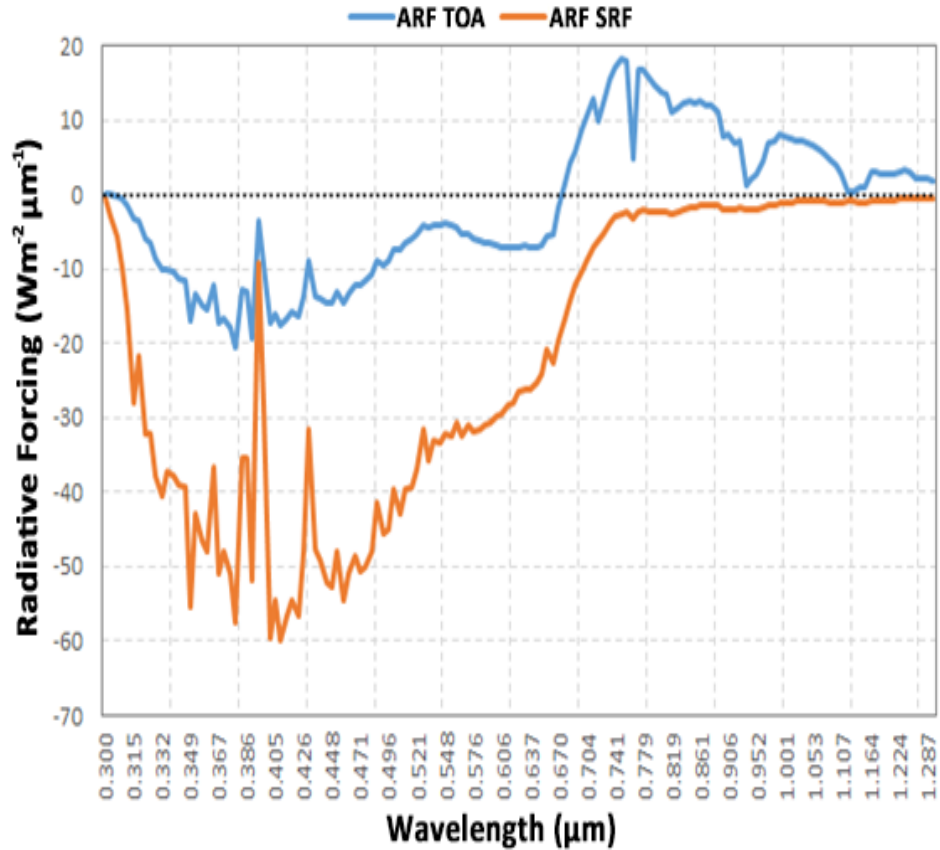


Project: Physics and microphysics of the atmosphere

Research line: Evaluation of the physical, chemical and optical properties of atmospheric aerosols and their relation with solar radiation

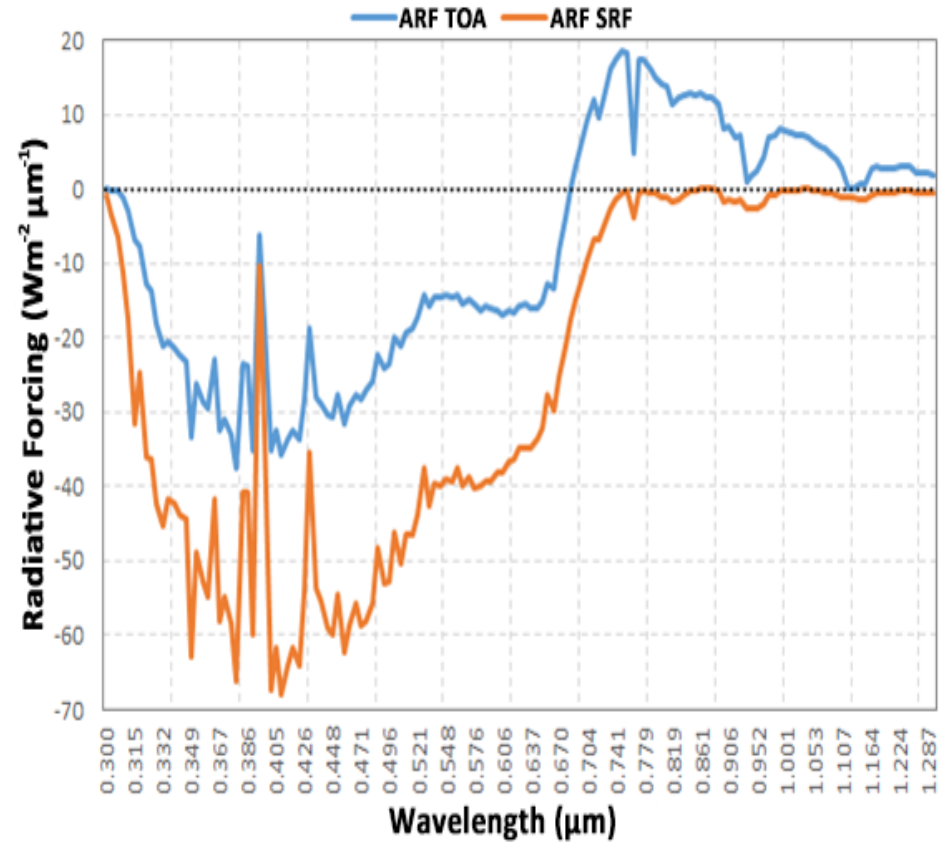
- **Evaluation of aerosols radiative forcing employing radiative transfer models.**
- **Comparison of models results with surface solar radiation measurements (BSRN station).**

Aerosol Radiative Forcing



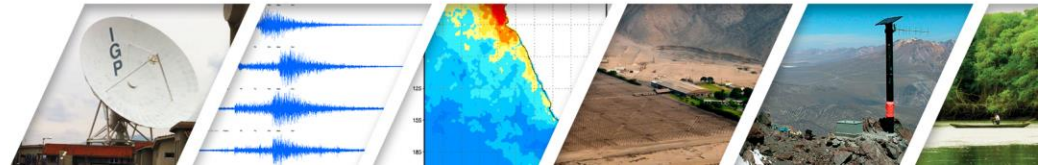
September 17, 2015

Surface ARF: -15.11 Wm^{-2}



September 19, 2015

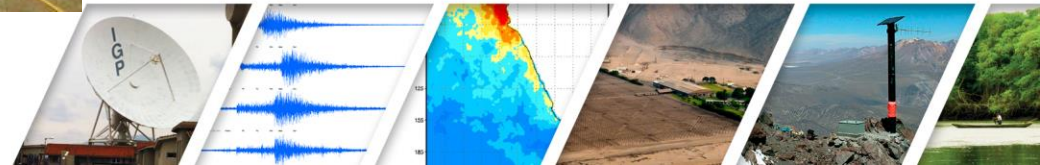
Surface ARF: -17.39 Wm^{-2}



ADDITIONAL BSRN STATION AT URBAN SITE



- Local public university also interested in increasing research in solar radiation and renewable energy (Faculty of Mechanical Engineering of the **Universidad Nacional del Centro del Peru**).
- It started with two CMP21 and one CHP1 and solar tracker SOLYS2 with a datalogger CR1000X.
- Main idea is to evaluate changes between rural/urban sites.
- **Complete implementation of BSRN requirements for a next BSRN workshop in the near future, 2022?**



Thanks!

