

Jicamarca Radio Observatory 2021 Status

Marco A. Milla, Karim Kuyeng, Juan C. Espinoza, and Cesar De la Jara
Radio Observatorio de Jicamarca - Instituto Geofísico del Perú



Introduction

- The Jicamarca Radio Observatory is a research facility of the Geophysical Institute of Peru dedicated to the study of the equatorial ionosphere and upper atmosphere.
- It is located near the city of Lima, Peru.
- Its main instrument is one of the largest Incoherent Scatter radars in the World.
- Antenna 300x300 m².
- Power: 4 TXs (1 Megawatt each)
- In this presentation...
 - Jicamarca radar status
 - News about AMISR14 and SIMONe
 - Radar upgrade progress



JRO is supported by the National Science Foundation through an agreement with Cornell University.



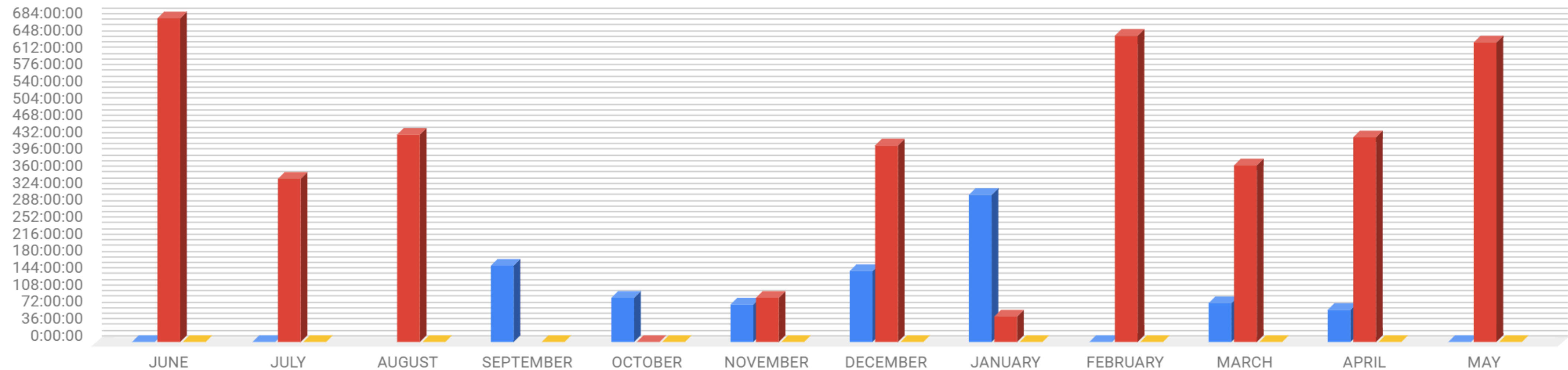
Jicamarca radar and associated instruments status



Jicamarca Radar Operations

OPERATION HOURS 2020 - 2021

■ ISR ■ JULIA ■ OTHERS



- High-power radar operations restarted in Sep 2020.
- Sep-Nov 2020 were mainly dedicated to maintenance.
- JRO closed again in Feb 2021 due to COVID situation in Peru. We returned in March 2021.
- Despite difficulties, we have operated more than 4000h in JULIA mode and about 1000h in ISR modes.

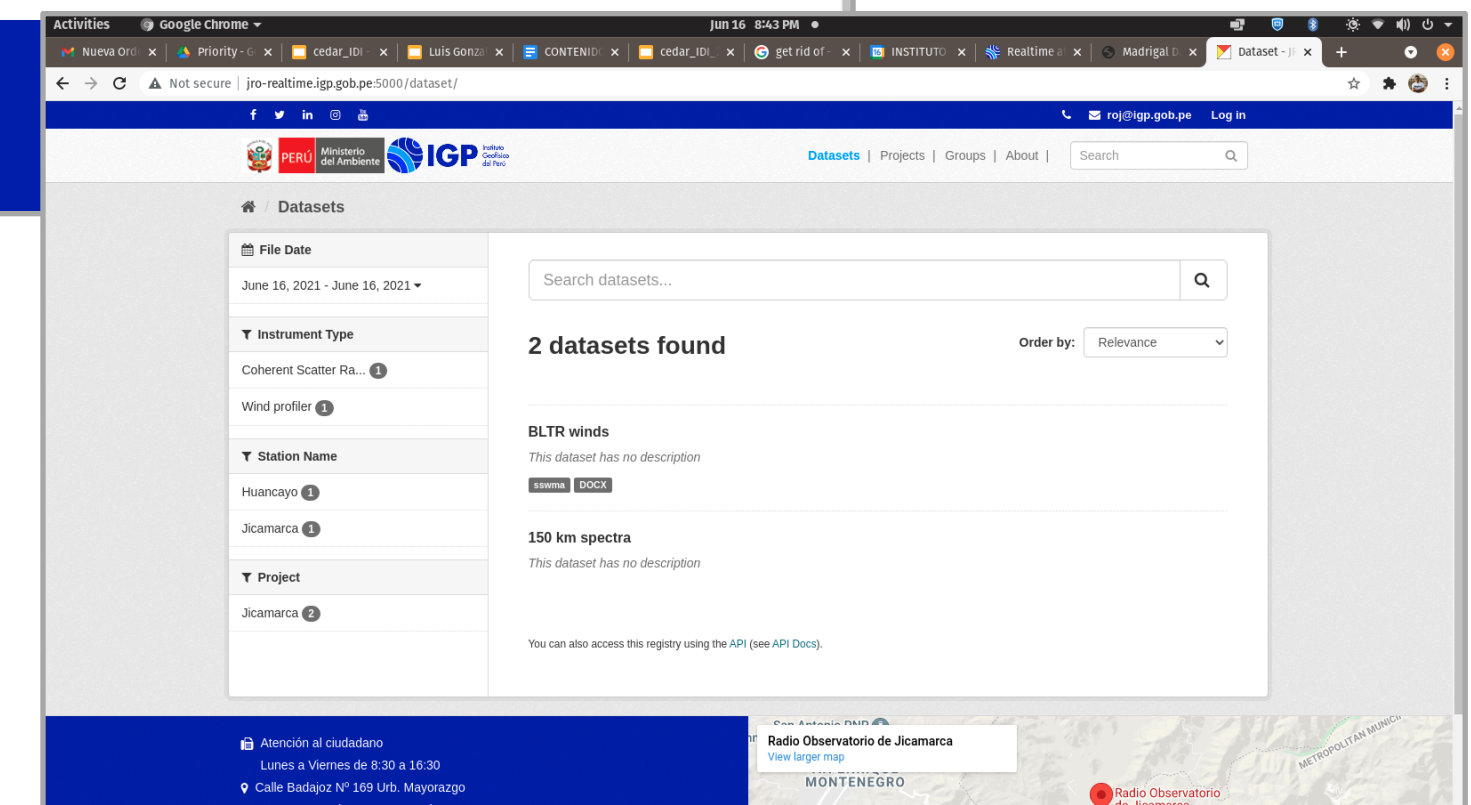
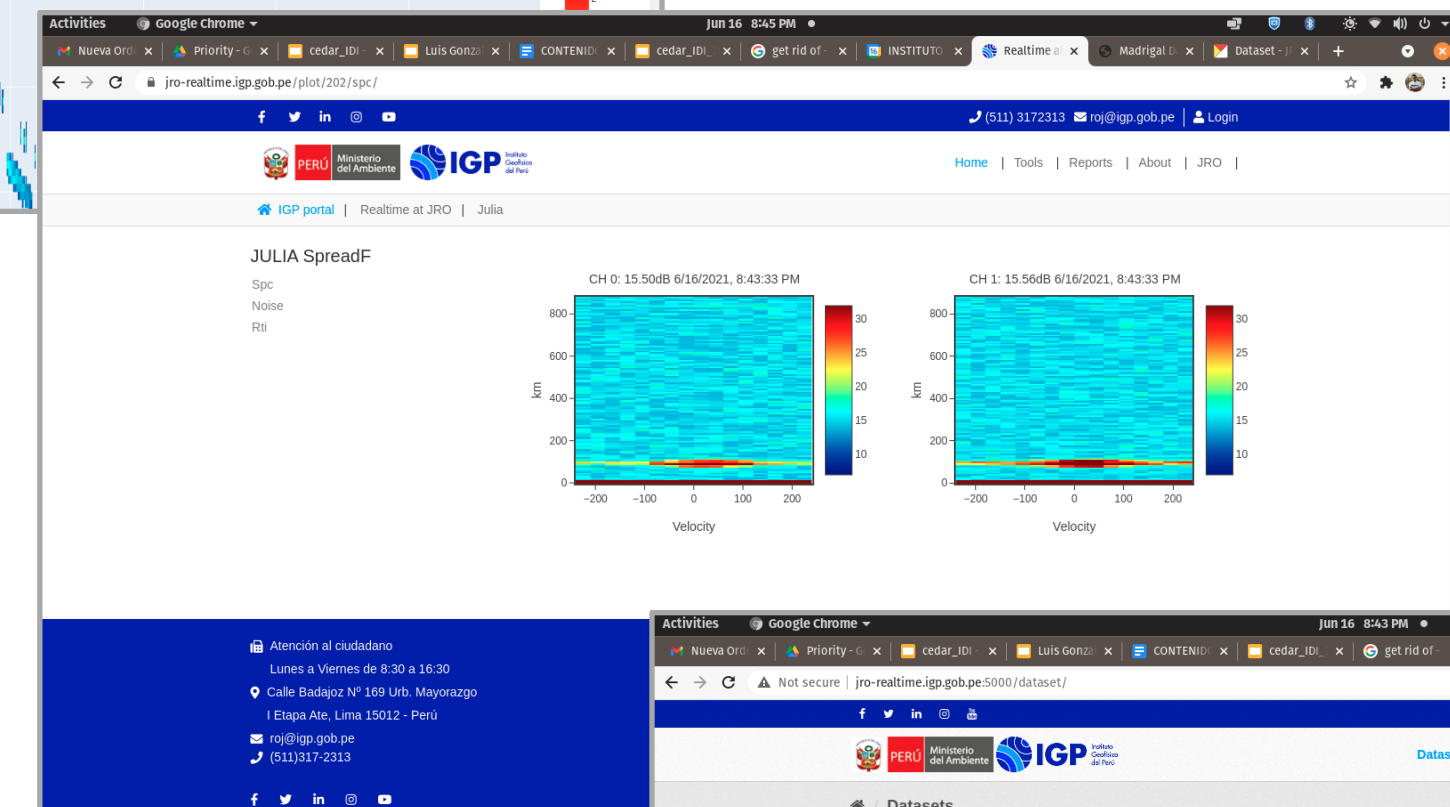
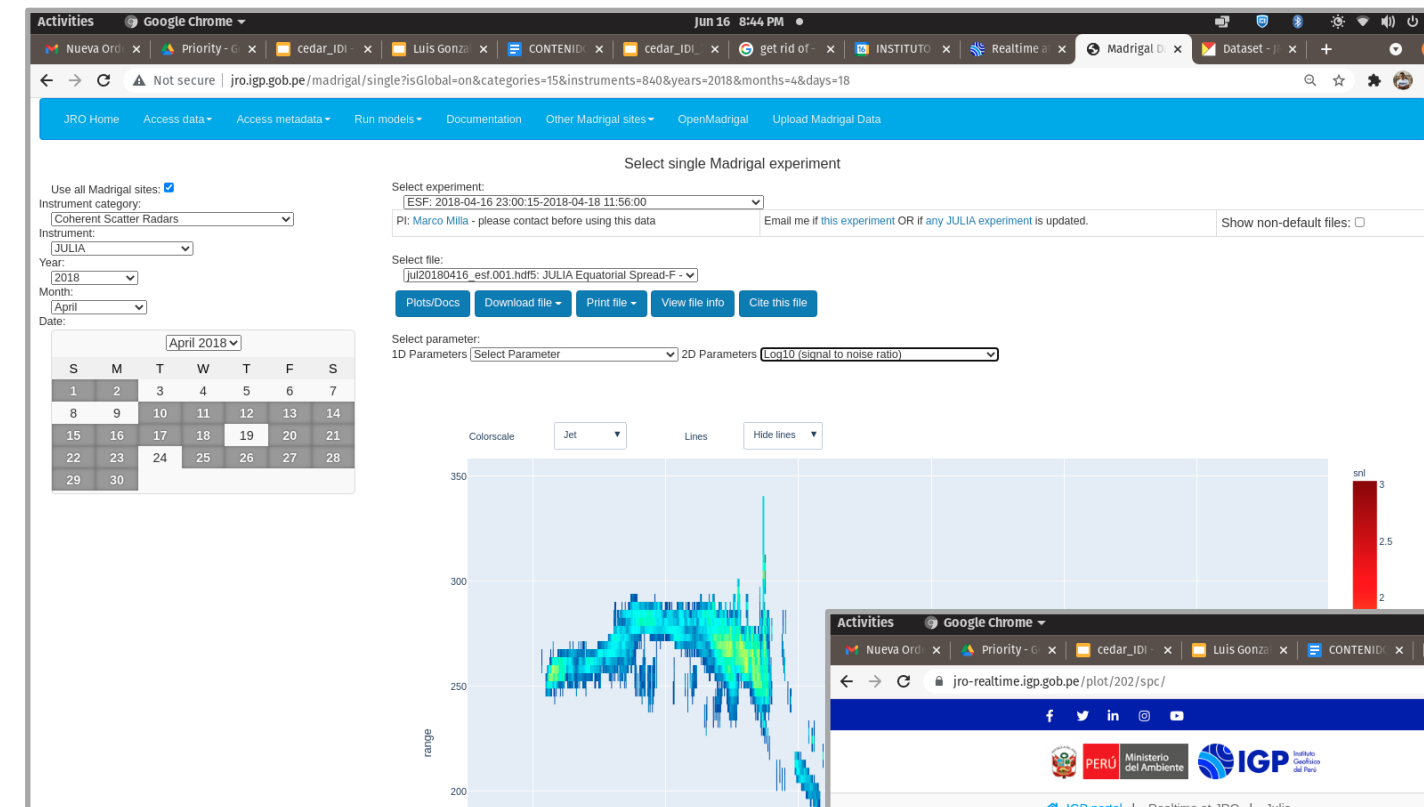
Data available in Madrigal

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



New web-based applications

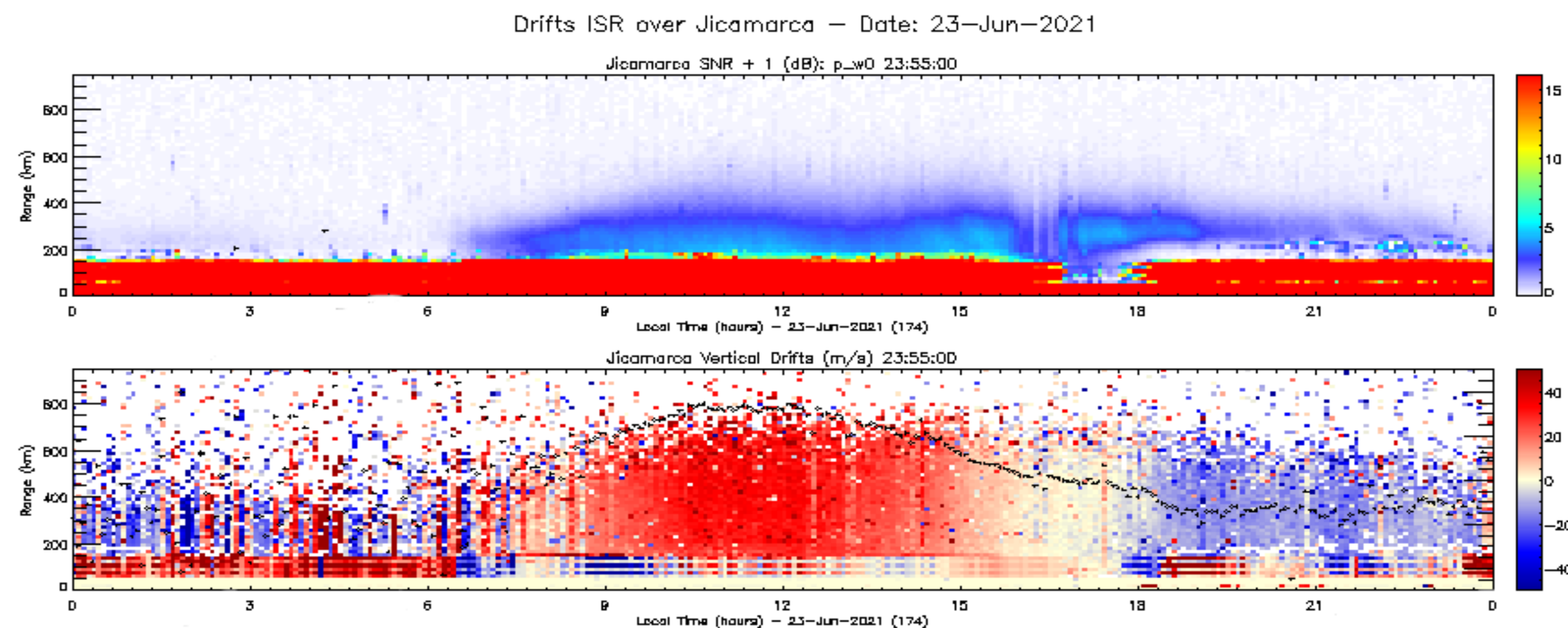
- Madrigal database updated to v3
 - <http://jro.igp.gob.pe/madrigal>
 - New plotting interface included.
 - New web module to upload data.
- Real-time web application
 - <https://jro-realtime.igp.gob.pe>
 - Monitors current operation JRO radar.
 - Interactive graphics (based on javascript).
- New JRO data repository
 - <http://jro-realtime.igp.gob.pe:5000>
 - Prototype based on CKAN framework (open source).
 - Includes multiple data levels (raw and process data).
 - User friendly interface, API user client, data previews.





Radar acquisition system improvements

- JARS 1.2
 - Support Digital RF HDF5 data format (developed by Haystack).
 - Digital filters redesigned to minimize interferences.
- JARS 2.0 is running.
 - Linux OS-based & FPGA-based acquisition radar acquisition system.
 - Firmware running at 180 MHz.
 - Ethernet interface @ 1 Gbps (get rid off NIDAQ board).
 - 8 channels - transfer rate per channel 1.5 MHz.

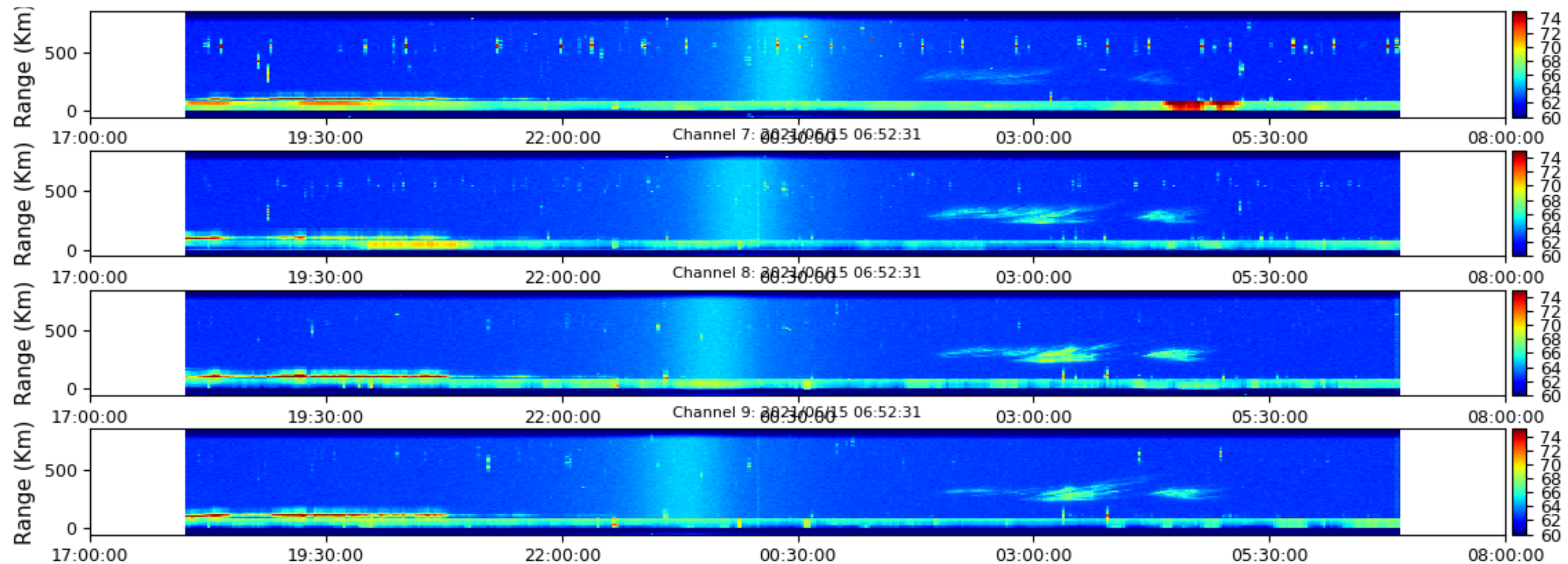
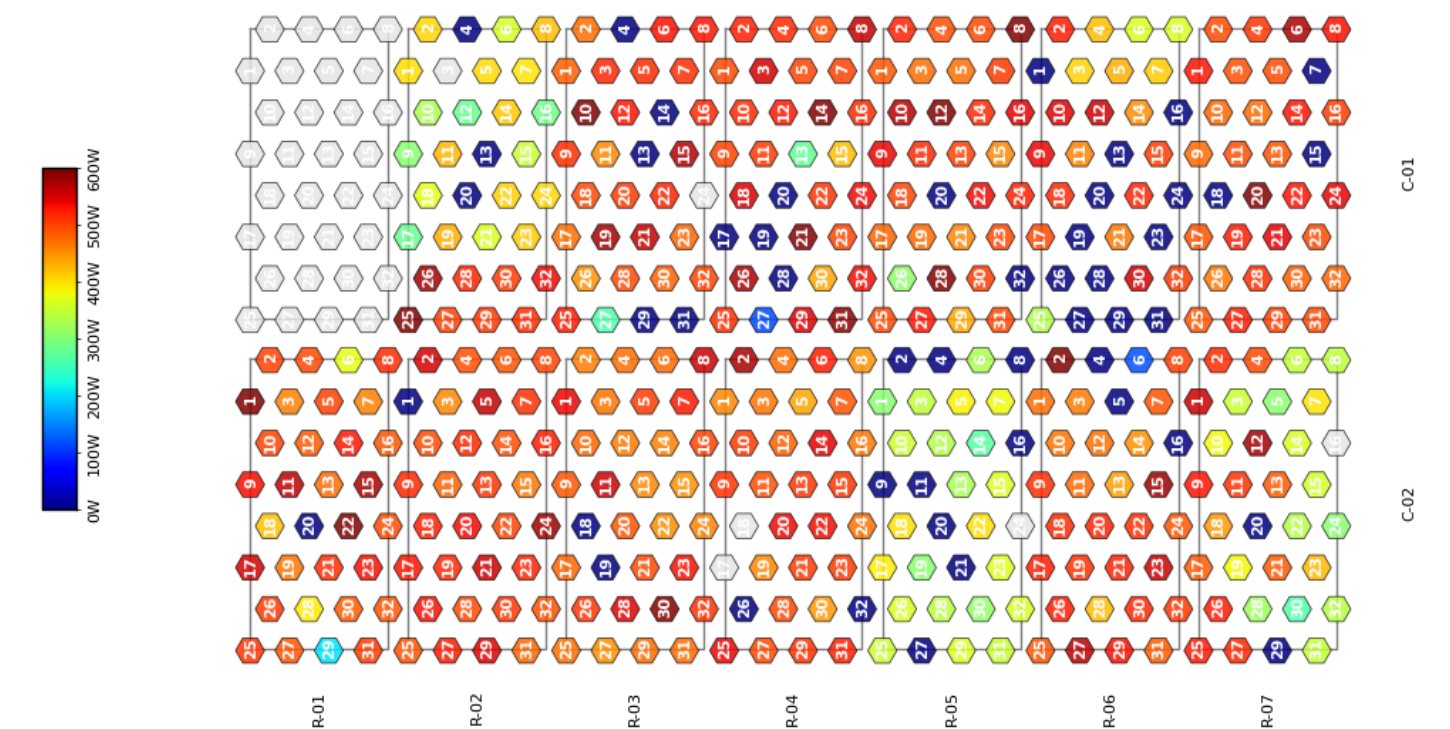




AMISR14 is back to life

- AEU's modules were upgraded and repaired (SRI support).
- Two panels still have some power-supply issues.
- AMISR14 is operational - 80% of nominal power (224kW)
- Operations in parallel with JULIA restarted in June.

UMET Peak Power 154 kW (307/103/6)

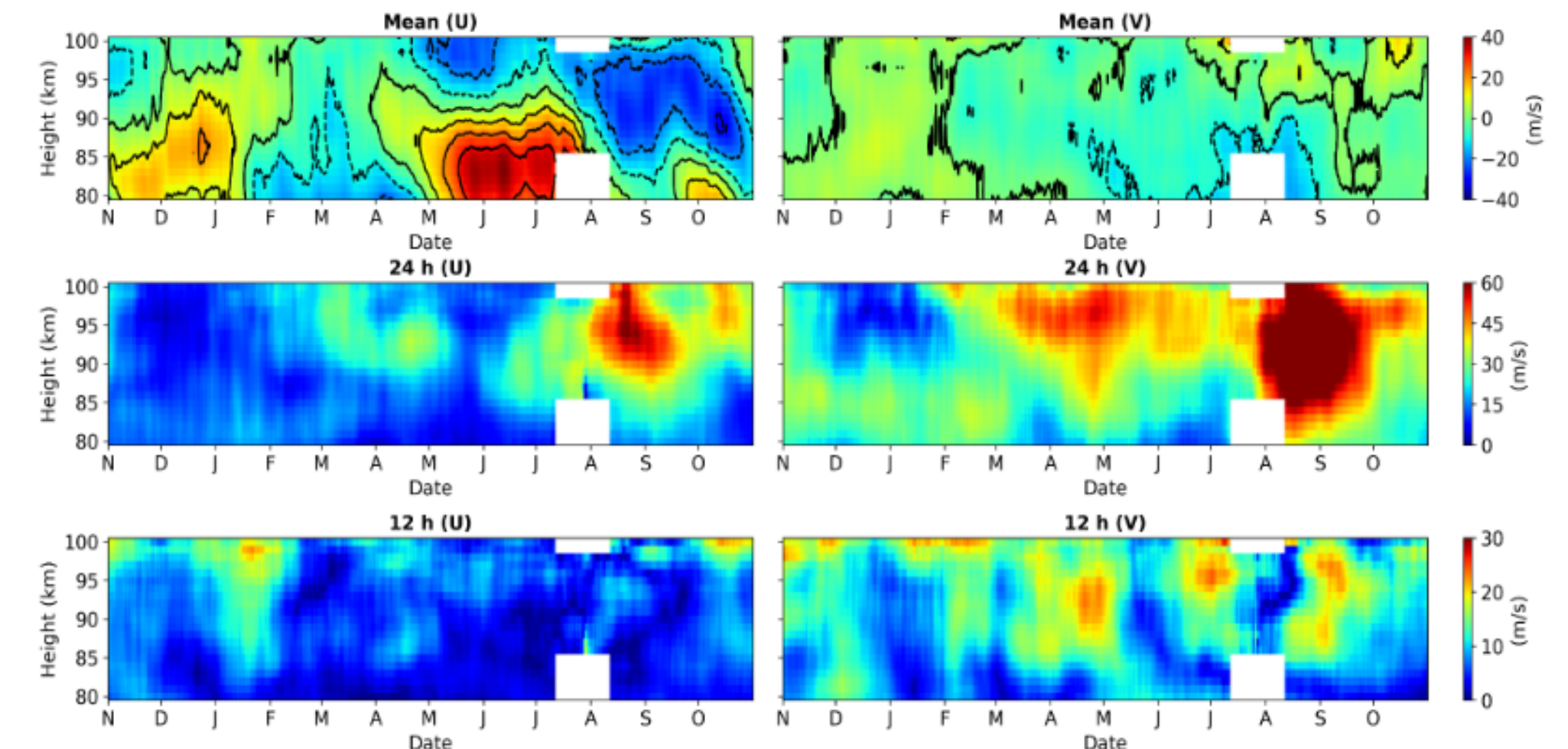


In collaboration with UT Dallas (USA), UAGM (Puerto Rico).

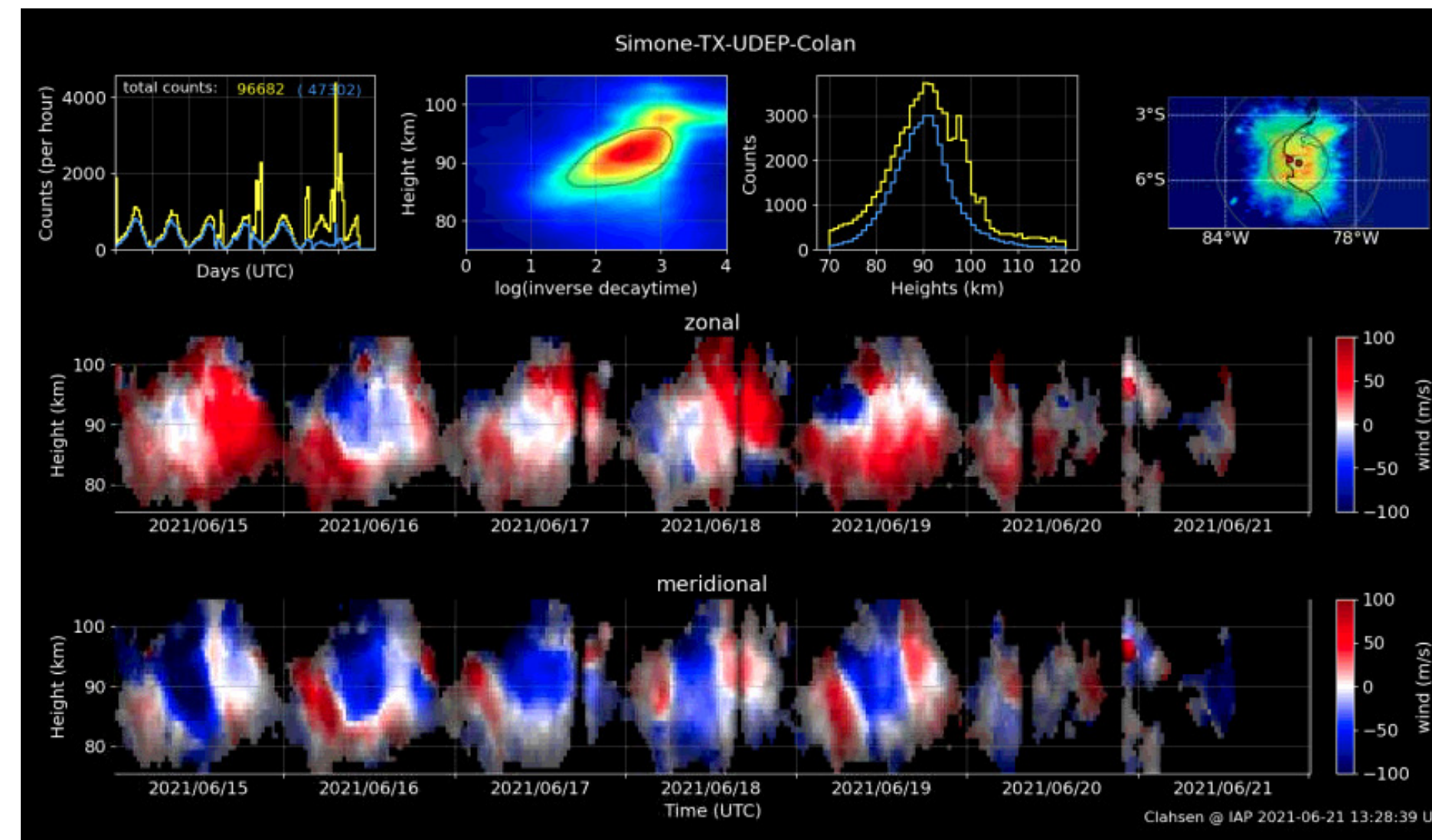


SIMONe at Jicamarca and Piura

- SIMONe at Jicamarca
 - Continuous operation since Sep 2019.
 - 1 TX station at JRO, 4 RX stations (Ancón, Azpitia, Huancayo, Sta. Rosa)
 - Study of MLT wind climatology is in progress (see poster by J. Suclupe).



Mean MLT winds, 24-hour and 12-hour tides above central coast of Peru.



- SIMONe at Piura
 - Radar equipment arrived to Peru in late April.
 - 1 TX station and 1 RX station were deployed in early June
 - Installation of additional RX stations is in progress.

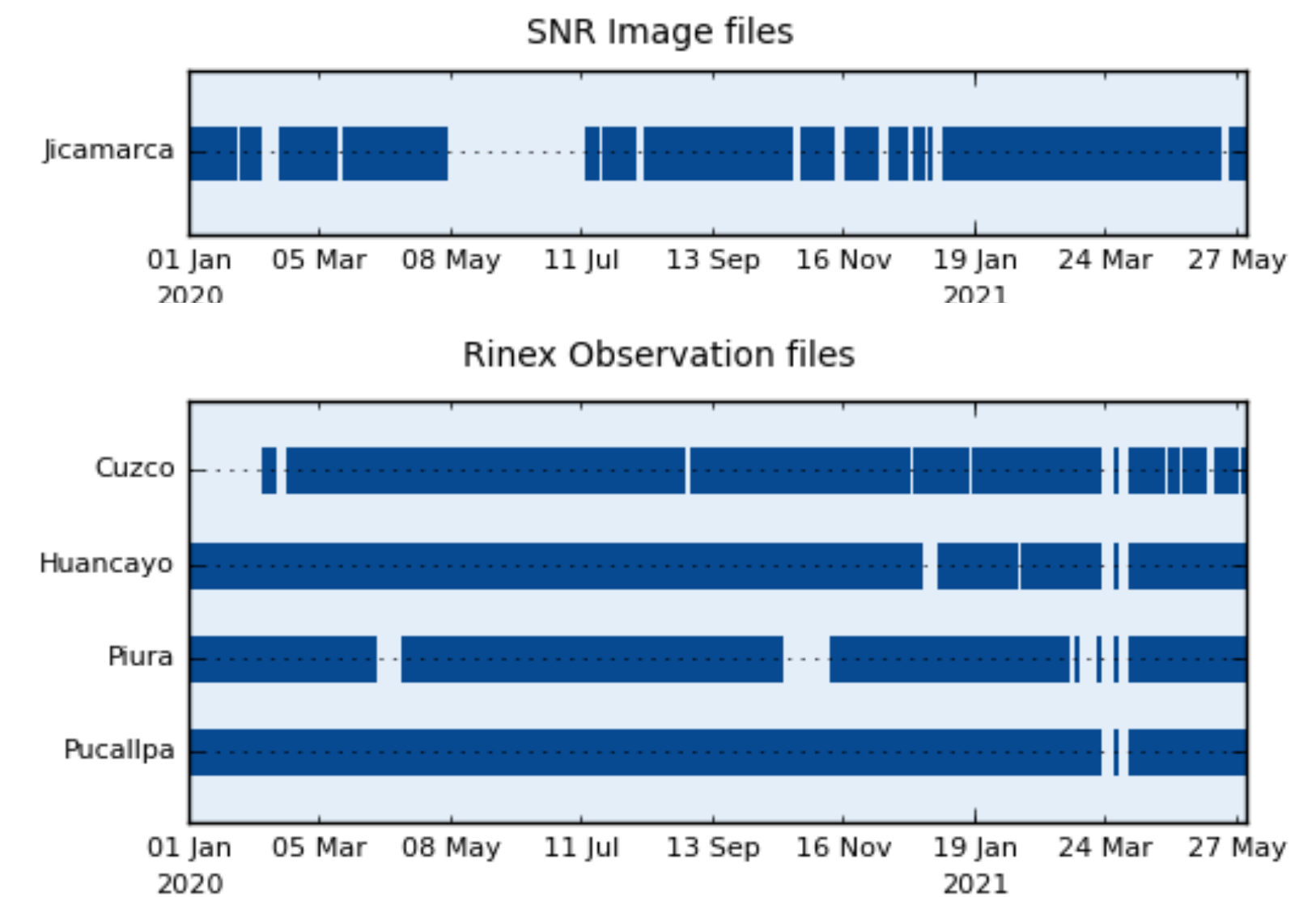
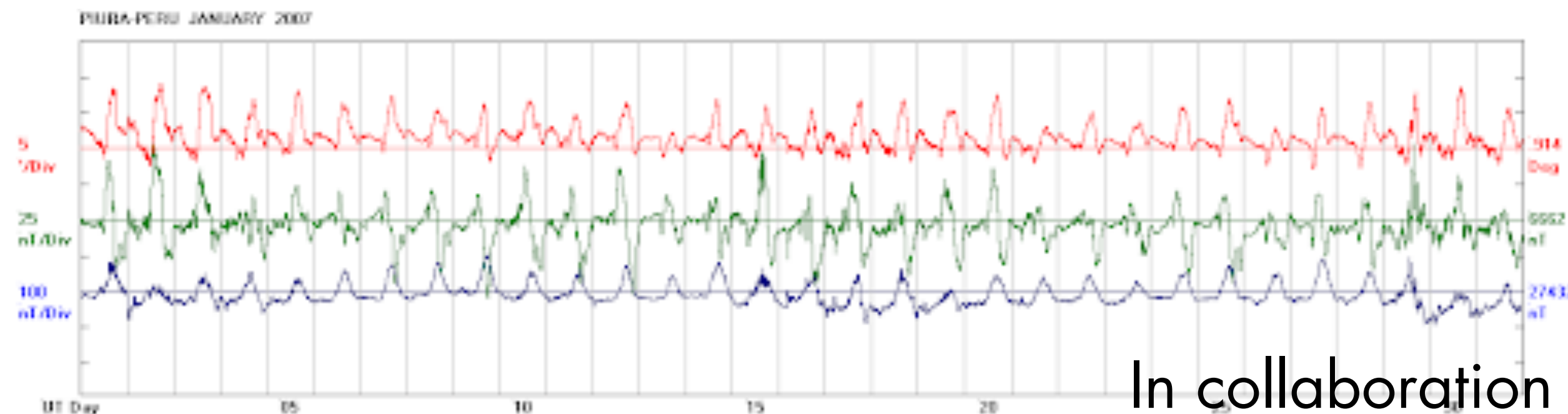
In collaboration with IAP (Germany), UdeP (Peru)



LISN network status

- Ionosondes
 - Continuous operation of VIPIR ionosonde at JRO.
 - VIPIRs at P. Maldonado, Tucuman, and Tupiza need maintenance.
- GNSS receivers
 - Continuous operation at Cuzco, Huancayo, Piura, and Pucallpa.
 - A new station in San Bartolomé, Lima was deployed recently.
- Magnetometers
 - Arequipa, Huancayo, Jicamarca, Nazca, Piura, Leoncito, Cuiabá.
 - Magnetometer database is being processed to remove outliers.
 - 3 fluxgate magnetometers were built for Brazil and Mexico.
- TEC, S4, magnetograms, ionograms and other products are available.

<http://lisn.igp.gob.pe> (New web version soon)



In collaboration with UT Dallas (USA) and other institutions in SA.



JRO upgrade progress

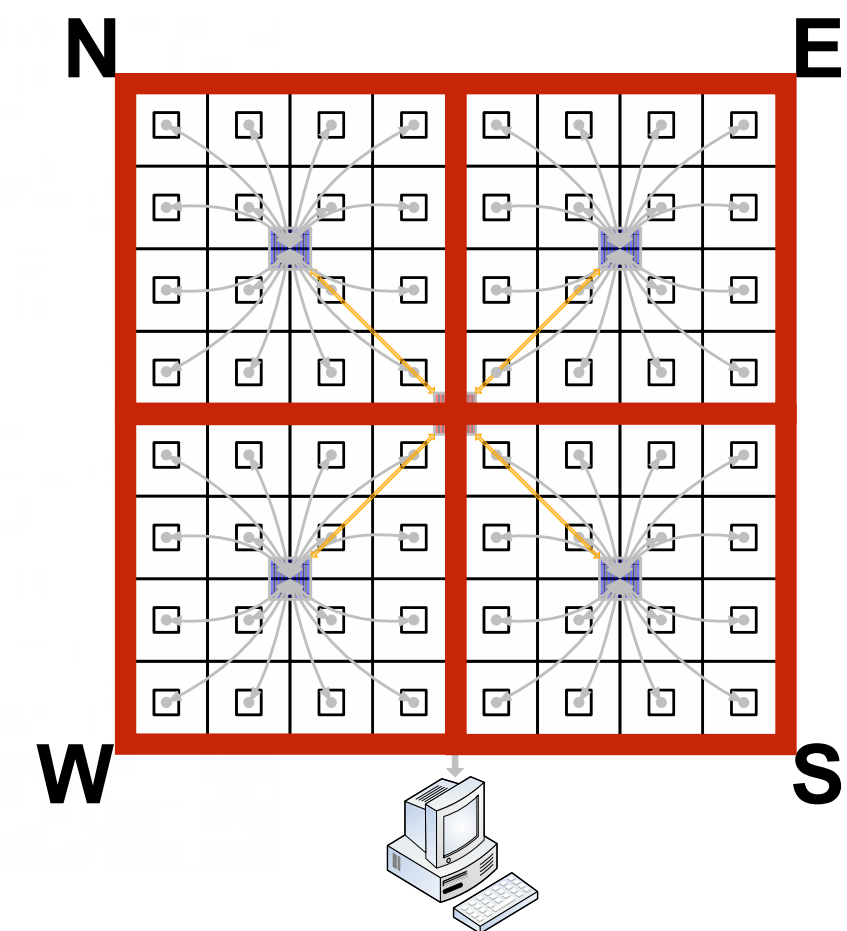
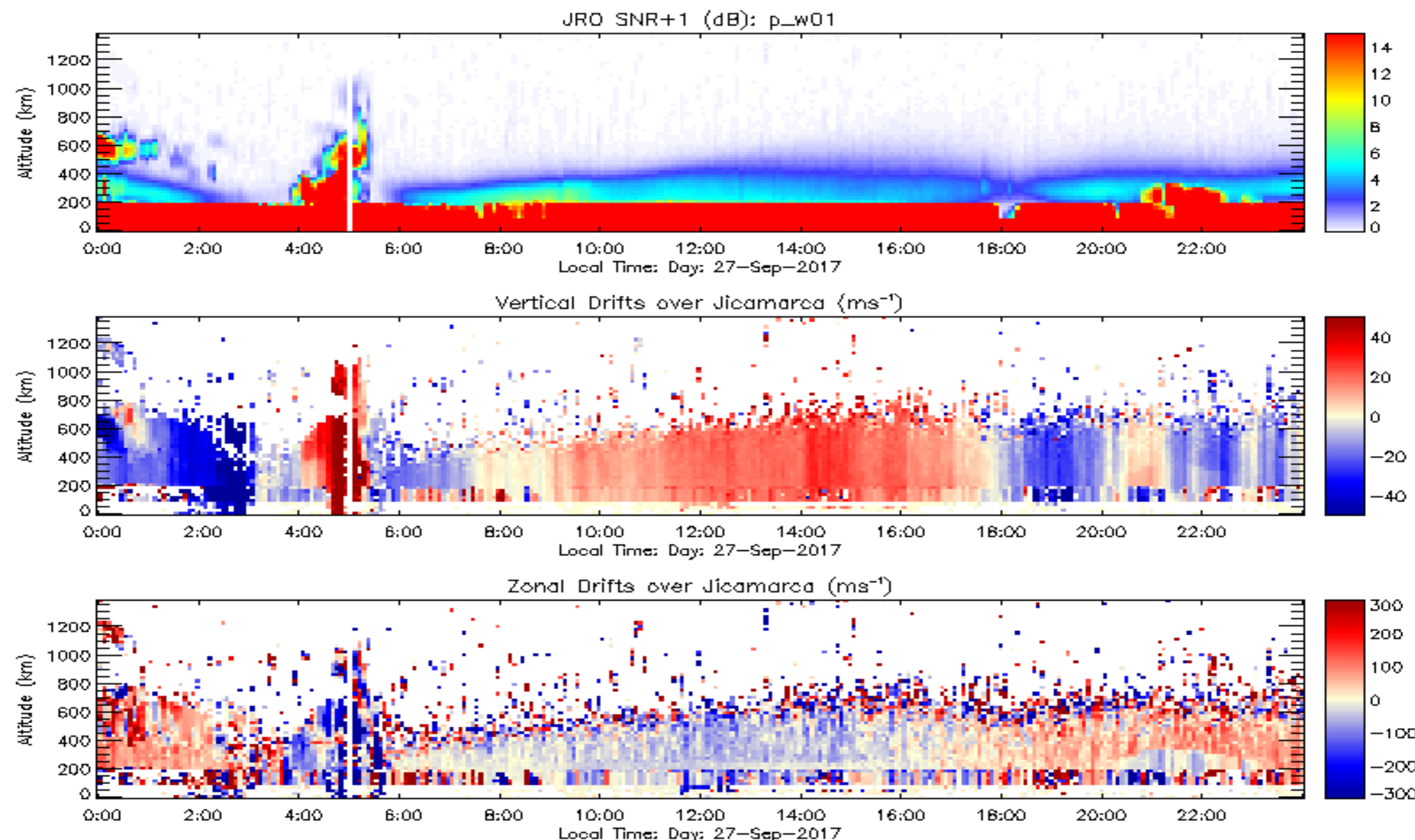


Jicamarca Radar upgrades

The following upgrades are being implemented.

- Electronic antenna beam switching system for all antenna quarters.
- Replacement of the old 100kW “drivers” with solid-state technology.
- Replacement of the antenna ground plane.

Goal: A new JULIA mode to measure F-region drifts and densities in a routine basis.





Automatic Beam Switching

- 64 new control modules (16 for each antenna quarter) were built.
- Network elements (fiber optics switches and housing) have been replaced.
- Two antenna quarters (North and South) fully operational.
- The implementation of the remaining quarters (West and East) is underway.
- Limited access to the observatory has delayed the implementation.
- Expectation: System fully operational by the end of 2021.



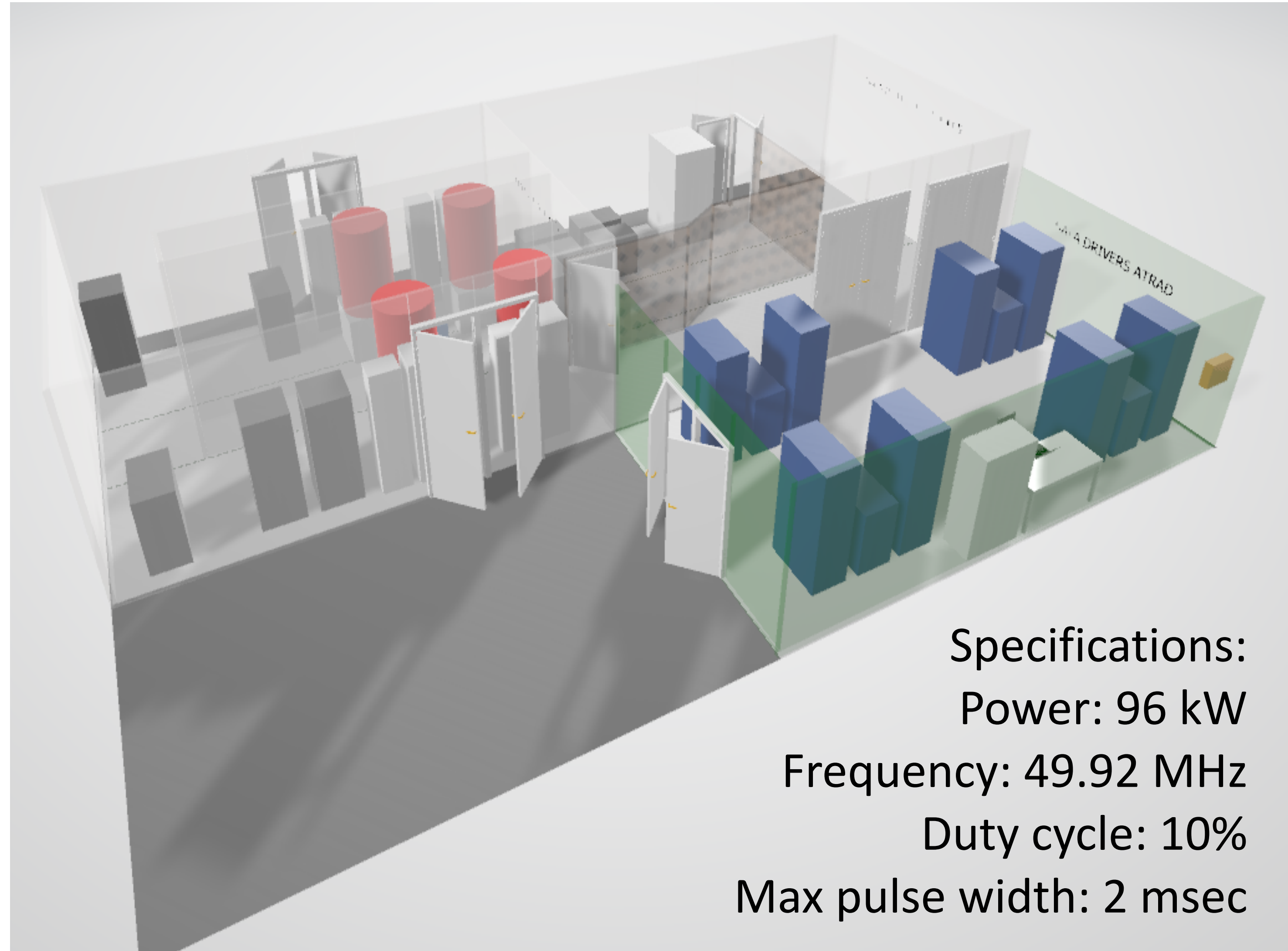
New version of RF and control modules



New solid-state “drivers” have arrived



- Two 96-kW solid-state TXs arrived last week.
- Implementation of a new TX room is going to start in the next weeks.
- TXs should start operations in Sep-Oct 2021.





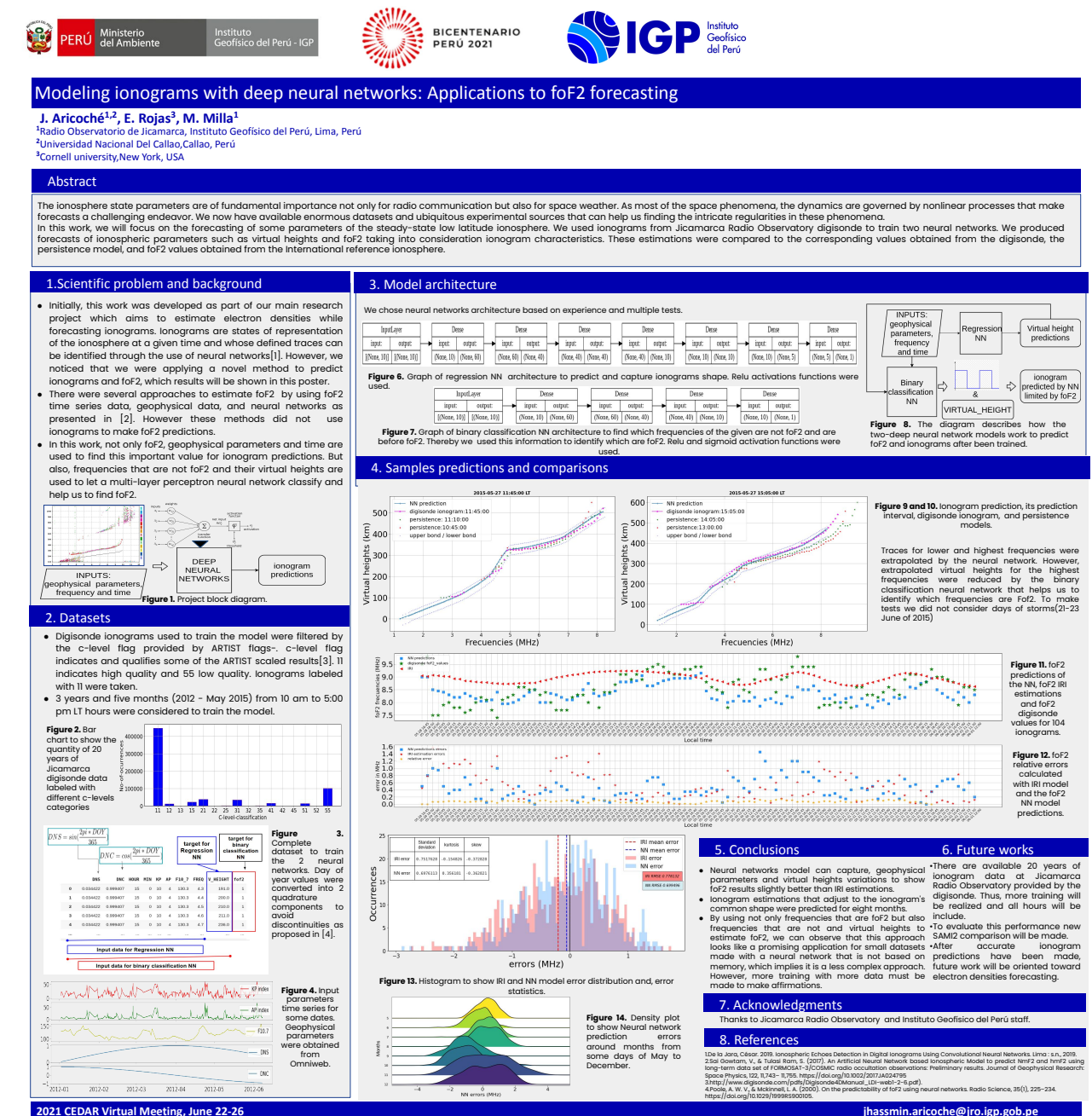
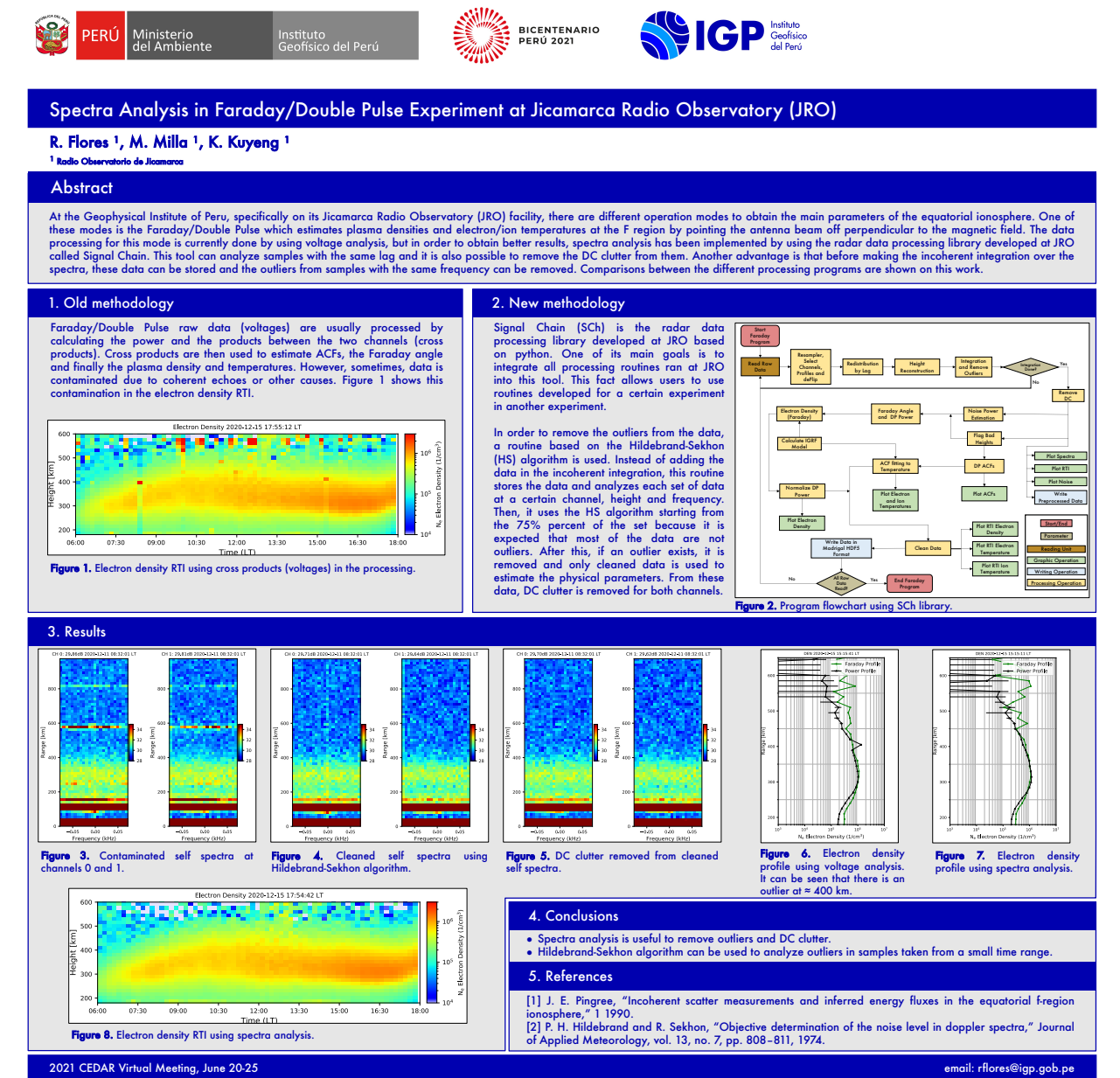
Conclusions

- The Jicamarca radar restarted operations in high power mode in September 2020 and is currently fully operational.
- Some new web-based applications are available for the radar users.
- AMISR14 is back to life and is going to operate in parallel with JULIA.
- SIMONe Piura is being implemented.
- LISN network is operational. Trips for maintenance should be scheduled in the next months.
- Radar upgrades are under implementation.
 - ABS modules should be deployed by the end of the year.
 - Solid-state TXs have arrived and should start operations in Sep-Oct 2021.



Posters this week

- J. Aricoché et al., Neural networks for ionogram forecasting.
- D. Yupanqui et al., Comparison of Radar imaging algorithms.
- R. Rojas & O. Véliz, Development of JROMAG-M103 Magnetometer for geomagnetism studies in Peru.
- J. Verástegui et al., JRO digital receiver modernization using ADCs with high.speed JESD204B data interface and FPGAs.
- J. Suclupe et al., Diurnal and semidiurnal tides in the mesosphere and Lower Thermosphere over the central coast of Peru.
- J. Barbarán et al., Reprocessing of data from Fabry-Perot interferometers (FPI) belonging to the IGP network of optical instruments.
- L. Gonzales et al., Upgrade of Automatic Beam Switching (ABS) at Jicamarca Radio Observatory.
- R. Flores et al., Spectral analysis in Faraday / Double pulse experiment at Jicamarca Radio Observatory.
- G. Fajardo & E. Pacheco. Exploration of machine learning tools developed for the study of space weather and its impact on position approximation in GNSS systems.
- and more...



Thanks for your attention!