SIMONe Peru: Deployment and Operations

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Abstract

SIMONe Peru is a modern multistatic specular meteor radar which allows measuring winds in the mesosphere and lower thermosphere (MLT) between 70 and 110 km in altitude. Its main objective is to study the atmospheric dynamic in this region. Moreover, the system provides a higher number of detections compared to other systems and gives good statistics from detections in this region. This system started operations on september 2019 in the central coast of Peru. This work presents a general outline of the SIMONe Peru system, as well as the some preliminary results that allow us to operate and monitor it.

1. Introduction

A new Spread Spectrum Interferometric Multistatic meteor radar Observing Network (SIMONe) started operations on september 2019 in the central coast of Peru, with its transmitters located at the Jicamarca Radio Observatory (JRO), where the largest antenna for equatorial ionospheric studies resides. The system consists of 5 folded-dipole antennas on transmission fed by one transmitter each, forming a Pentagon interferometer located at JRO, and 5 dual-polarized single antennas located between 40 and 180 km from Jicamarca. The location of the operating receiving sites (green circles) are indicated in the Figure 1. The SIMONe concept was introduced and described by Chau et al. (2019) [1] and later used on a special seven-day campaign in northern Germany (Vierinen et al., 2019 [2]). The system, developed by Leibniz-Institute of Atmospheric Physics (IAP), was installed in collaboration between IAP and JRO personnel, and it is continuously monitored.

Figure 1. Location of transmitter (Tx) and current receivers (Rxs):

- ➔ Tx:
  - JRO (11.95° S, 76.87° W, 540.55 m)
- ➔ Operating Rxs:
  - ANCON (11.77° S, 77.15° W, 72.00 m)
  - AZPITIA (12.59° S, 76.62° W, 69.92 m)
  - HUANCAYO (12.04° S, 75.32° W, 3335.20m)
  - SANTA ROSA (11.66° S, 76.79° W, 1160.75 m)

2. Description

- ➔ Operating frequency: 32.55MHz (CW)
- ➔ GPS synchronized systems
- ➔ Software Design Radio (USRP) equipment for both Tx and RX, making the radar versatile and easy to change configurations
- ➔ Tx power: 500W each
- ➔ Systems are designed for continuous and automated (acquisition, data processing, data transmission) operation

Detailed information of the system can be found in Chau et al. (2020) [3].

Figure 2. Transmitter system.

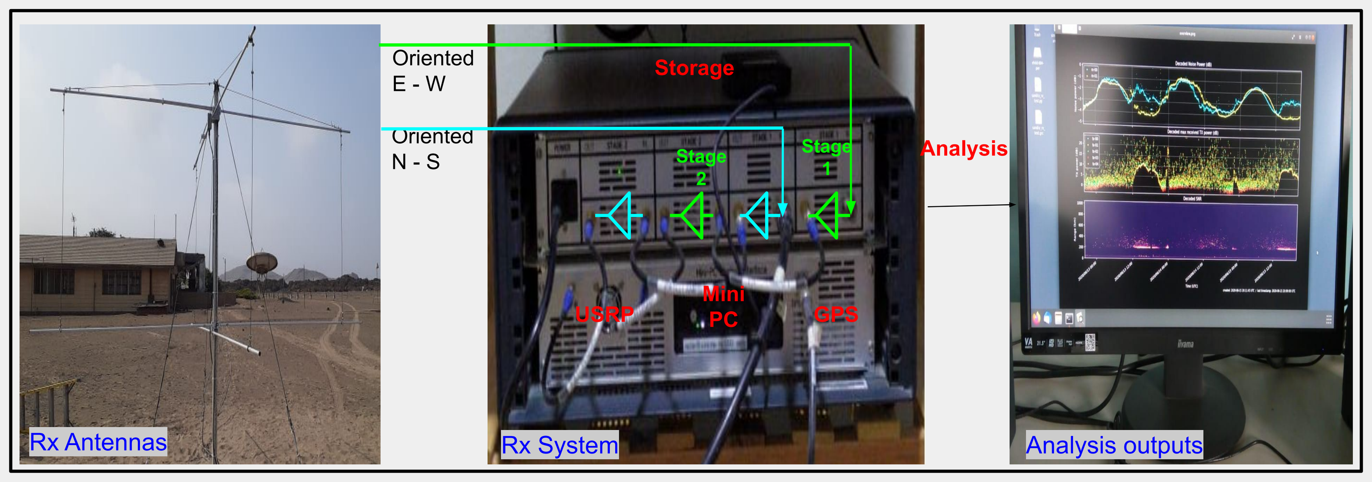

Figure 3. Receiver system.

3. Measurements and Operation of SIMONe Peru

Wind measurements:

The system measures the winds in the mesosphere and lower thermosphere (between 70 and 110 km in altitude). Detailed and novel results of SIMONe Peru can be found in Chau et al. (2020) [3].

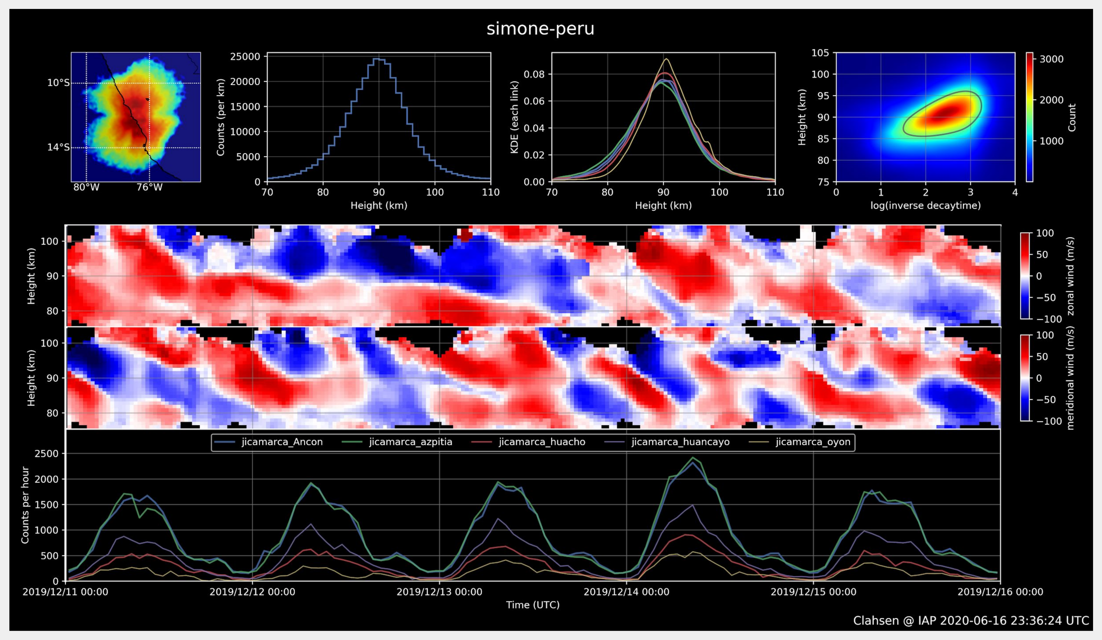

Figure 4. Example of parameters obtained after combining five SIMONe Peru links: (a) 2D histogram of detections latitude vs longitude, (b) altitude distributions of all links, (c) altitude distribution of each link, (d) 2D histogram altitude vs inverse decay time, mean (e) zonal and (f) meridional winds, and (g) counts per hour for each bistatic link. Figure belongs to Chau et al. (2020) [3].

Operations and monitoring:

- ➔SIMONe Peru stations operate 24x7
- ➔All programs run in the background
- ➔Remote control software is used for stations monitoring
- ➔ At the end of the day the parameter data and plots of statistics of meteors and estimated wind are sent to the JRO server
- ➔ These daily plots can be seen in the website of JRO http://jro.igp.gob.pe/english/ (in real time section)

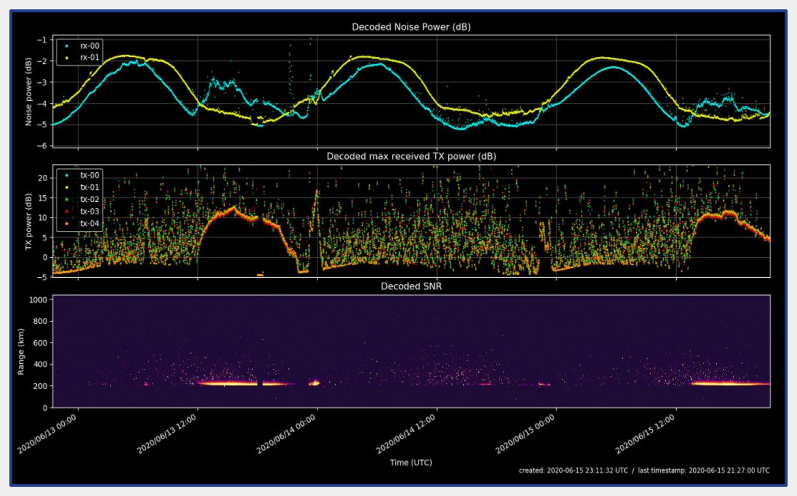

Figure 5. Example of (a) noise power in dB, (b) transmitter power in dB, and (c) RTI from Azpitia link.

This figure is very useful for monitoring. It allows us to see if the acquisition and transmission are working.

4. Future Work

- ➔ Design of new low-cost tx and rx hardware in order to expand the network and increase coverage
- ➔ Implementation of database for data accessibility

5. Acknowledgements

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6. References

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