SnT 2019
CTBT: SCIENCE AND TECHNOLOGY CONFERENCE

CTBTO
PREPARATORY COMMISSION

Major upgrade at IMS infrasound station IS41 Villa Florida, Paraguay

S.Stefanova, P. Martysevich, N. Mascarenhas, H. Komiyama, N. Meral Ozel

CTBTO, International Monitoring System Division

T4.1-P19

1 Introduction

After 15 years of operation, IMS infrasound station IS41 Villa Florida, Paraguay, had to face several technical issues including lightning damages, unbalanced power supply system, equipment aging and obsolescence In order to mitigate those problems major upgrade of the station took place in June 2018. The project included replacement of old pipe arrays, re-design and installation of new photovoltaic power supply system at the array elements, replacement of old digitizers, sensors and meteorological station. The installation of new MB3a microbarometers and the use of reference infrasound sensors fulfilled the IMS requirements for sensor calibration. Net improvement was observed in the data quality, and continuous, authenticated data are presently received at the IDC. The upgrade allowed also much more reliable maintenance, remote monitoring and efficient troubleshooting of the station.

2 Power Supply System

To improve the existing power supply system new power box with pre-assembled, pre-wired and pre-configured components were installed at each array element. The box includes surge protection, over current / over load disconnect, charge controller and monitoring unit, DC/DC filer for clean 12 VDC supply, Ethernet switch and input/output terminal blocks. The modular design significantly facilitates the installation and replacement of the system components. The use of DC powered Ethernet hub and the IP based power monitoring unit allow remote station control and State-of-Health monitoring. Finally, the generated power is free of electronic noise and does not distort the data in the frequency band of interest (0.02 – 10 Hz).

Two Panasonic solar panels of 330 Wp each, were installed at each array element. The panels were mounted on 40° from vertical plane in order to optimize the output during the winter months.

3 Wind-Noise Reducing System

At each array element the old wind-noise reducing system (WNRS) was removed and new WNRS was installed. Prior to the installation the terrain below the rosettes was levelled and compacted using additional soil, fine gravel and large stones in order to reinforce the supporting banks and to improve the drainage capability of the shallow sub-surface.

The new WNRS at I41PY is comprised of 15-mm diameter stainless steel pipes, valves and 24-way summing manifolds, and 96 non-corrosive metal inlet ports.

Each pipe leading from the 24-way manifold to an inlet port is supported by one or two supports, depending on terrain. Distance spacers of the inlet ports keep the them at 2-3cm distance from the ground. To assure better wind noise reduction all inlet ports were covered with clean pre-washed 19 mm coarse gravel. The newly installed WNRS was pressure tested in order to assure that all connexions of the WNRS are perfectly sealed. The modular, prefabricated WNRS significantly reduced the length of time and the complexity of the on-site installation.

4 Data Acquisition System

Guralp 24-bit CMG-DM24S3AM 3-channel digitizers were installed at each array element. The digitizers collect data from both MB3a (Channel 1) and MB2005 (Channel 3). Channel 2 is used for MB3a calibration. The digitizer is compliant with the IMS technical requirements, including CD1.1 data format, data buffering and authentication, State-of-Health channels, time synchronization, grounding and surge protection.

New digital meteorological set was installed, consisting of Gill GMX-500 digital meteorological station and External Meteorological and Authentication Module EMAM-523. Digital data are sent from the GMX-500 station every second to the EMAM-523 unit, where they are converted to CD1.1 format, signed and sent to the workstation at the CRF. Timing of data is provided by internal GMX-500 GPS receiver.

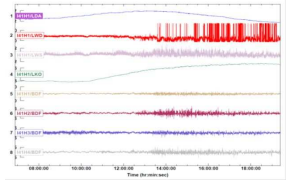
MB2000 sensors were replaced by MB3a microbarometers. At each array element the MB3a infrasonic microbarometers are installed in the equipment and connected to WNRS by four heavy-duty hoses. These instruments provide a pressure output with a flat response between 0.01 and 28 Hz (within +3 dB). In addition, MB2005 microbarometers are deployed in each equipment vault as reference sensors and are connected to a reference inlet port installed next to the vaults.

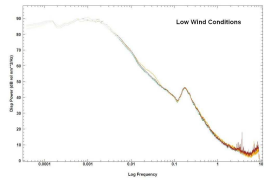
The new data acquisition system allows the station operators to have continous remote access to the sites for data/SOH monitoring, configuration and troubleshooting.

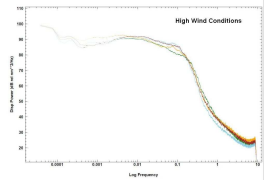
5 Station Performance

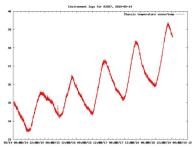
Since the upgrade the availability of authenticated data received at the IDC is 99.96 %. Continuous data are sent from all pressure and weather channels. Power Spectral Densities (PSD) of the 4 pressure fluctuation channels were computed for low wind and high wind conditions. During low wind conditions, the microbarom peak with a central frequency of around 0.2 Hz can be seen on all 4 channels. All four elements have similar noise levels over the entire frequency band, providing same level of detections capability at all elements. Well visible signals are observed at high frequencies around 2.5 Hz and can be attributed to continuous thunder storms around the station.

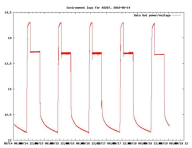
State-of-Health data are continuously monitored by the Station Operators. As example, environmental logs from H2 array element are presented, showing temperature variation inside the equipment vault and power supply voltage over 5 days. The power at the sites is stable and the diurnal charging cycle illustrates the optimal performance of the power system.











6 Conclusions

The major upgrade of IS41 consisted in replacement of the main components of the station equipment and installations – WNRS, power supply and data acquisition systems. The continuity of the data flow and data analysis performed after the upgrade of I41PY show that the Station meets all minimum technical requirements for infrasound stations of the International Monitoring System. The upgrade resulted in stability of the power supply and improved data quality. The possibility to have remote access to the station digitizers and power supply system drastically improved the efficiency of the daily operation and preventive maintenance at IS41.