AGGO Coming Back to Operation

Argentinean-German Geodetic Observatory (AGGO) Report

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Abstract The Argentinean-German Geodetic Observatory (AGGO) has been brought back to an operational status. Several VLBI test sessions were performed successfully.

1 General Information

The Argentinean-German Geodetic Observatory (AGGO) is a joint effort of the Argentinean National Scientific and Technical Research Council (CONICET) and the German Federal Agency of Cartography and Geodesy (BKG) to support the Global Geodetic Observing System (GGOS) by contributing a geodetic fundamental station located in South America [1].

The selected site is a plot of land owned by the science department of the provincial government of the Province of Buenos Aires about 25 km from the center of its capital town of La Plata (and about 50 km from the city of Buenos Aires); it is adjacent to the natural park Pereyra Iraola and next to the Argentinean Institute of Radio Astronomy (IAR).

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Table 1 Useful data about the VLBI reference point at AGGO.

Parameter	Value
DOMES No.	41596S002
CDP No.	7641 (axis intersection)
4-char code	AGGV
IVS 2-char id	Ag
approx. longitude	W 58.51398°
approx. latitude	S 34.8739°
approx. height	35.8 m

Fig. 1 The 6-m primary focus offset radio telescope for VLBI observations of AGGO.

2 Activities During 2017–2018

VLBI became operational when the Dewar of the receiver returned from on overhaul at Yebes Observatory. The displacer of the coldhead needed to be exchanged after about 20 years of use. Several receiver maintenance tasks were carried out: RF window re-

placement, confection and replacement of RF semi-rigid cables at the IF-plate associated with gain chain measurements in S- and X-band in order to corroborate the performance of the amplifiers (including new dewar First Stage amplifiers), replacement of the X-band post-amplifier, replacement of an S-band filter, testing and new connectors for noise diodes.

With a working receiver a number of pointing tests were made in order to verify the Northern direction of the encoder and introducing the corresponding offset to the antenna control unit. A radiometric horizon mask was created based on own procedures for the Field System and a self-made Python program to visualize the result in a plot (Figure 2).

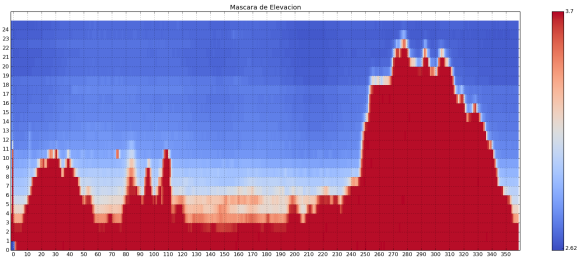

Fig. 2 The radiometric horizon mask at AGGO (azimuth [0°–360°] vs. elevation [0°–24°]; red is radiation, blue is cold sky). The detected radiation is basically due to vegetation. The graph suggests to cut back some eucalyptus trees in order to improve the horizon mask in the North-Northwest direction.

Improvements were made with the monitoring of cryogenic temperatures inside the Dewar by signal conditioning to the Beckhoff I/O modules with modbus connection to the Field System.

A complete overhaul of the Peltier cooling system of the receiver box was carried out. It included: removal of the Peltier units, test and replacement of not working Peltier cells modules, replacement of coolers for forced-air ventilation, power source maintenance and complete some modifications inside the Peltier controller box. The electrical circuit was changed and a new software for PLC control regarding the local ambient conditions was installed. As a result of this, we achieved temperatures inside the box not exceeding 25°C on hot summer days where the ambient temperatures exceeded 35°C. However, box temperatures below 22°C are necessary to keep the ambient temperature cycles independent of the receiver's system temperature.

The observatory was connected to optical fiber supporting technically up to 1-Gbps bandwidth. AGGO is an "e-transfer only" station. During 2018 the implementation of e-VLBI hardware and software took place. This task included: Fiber network cabling, modification of the local area network, installation of new servers, transfer-rate and performance tests covering different e-VLBI protocols, and finally the e-transfer of real VLBI sessions.

Some improvements were applied to five BBCs: The oscillator circuit was modified in order to cope with instabilities related to the temperature variations inside the BBC.

AGGO received two 400-MHz upconverters replacing the VLBA4 upconverter (running at 479.9 MHz). These modules require 100 MHz as reference frequency. Therefore it was necessary to install a 100-MHz reference cable between the H-maser and the upconverter. It is important that both reference frequencies, 5 MHz and 100 MHz, are supplied from the same H-maser.

On January 15, 2018, the "first light" VLBI operation was successfully carried out between AGGO and Wettzell (WB015).

For the commissioning the following test runs were performed with Wettzell and partly with O'Higgins: WB015, WB072, WB087, WB135, WB207, WB221, WB228, WB235, WB242, WB249, WB256, WB263, WB264, WB270, WB277, WB284, WB291, WB298, WB312, WB319, WB333, and WB354.

In addition, a few IVS test sessions were observed (limited by the lack of operators): R1849, R1871, R1877, and T2126.

In order to increase the operator staff, negotiations between CONICET and the Argentinean Minstery of Defense have started. Once an agreement is reached, operators will be made available, must be trained as operators, and AGGO will become part of the IVS observing programs on a regular base.

3 Current Status

The status reached by the end of 2018 is such that the major instruments of the observatory are working. Only the overhaul and modernization process of the SLR component is ongoing and will be finished during 2019.

Fig. 3 The VLBA5 and Mk5B+ equipment used for VLBI observations of AGGO inside the AGGO-2 container.

Fig. 5 Servo cabinet with antenna control unit inside the AGGO-2 VLBI operation container.

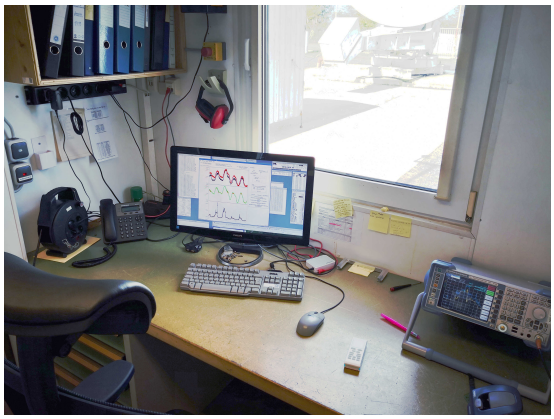

Fig. 4 Operator's desk with view on Field System screen and radio telescope.

Fig. 6 VLBI reference H-maser EFOS-24 and EFOS-20 at the time & frequency laboratory of AGGO.

AGGO operates its:

- time and frequency laboratory with two H-masers, three Cs normals, one GNSS receiver and one NTP-server
- VLBI radio telescope
- GNSS receiver (IGS)
- absolute gravity meter and super conducting gravity meter (IGFS)
- hydrological sensors
- meteorological sensors

Internet provision is available via a 1-Gbps optical fiber.

The power supply is still characterized by frequent interruptions due to the lack of vegetation pruning along the route of the line, adverse weather conditions, and the lack of maintenance of the power line by the supplier.

The construction of a new office building for the staff of AGGO has been initiated. Once finished, space of the operation building will be released to move the operation from the containers to the operation building.

The current staff situation is given in Table 2.

4 Future Plans

With the arrival of operators from the Ministery of Defense a training program will be carried out by the AGGO staff in order to familiarize the operators with VLBI operation and later with SLR operation.

Table 2 AGGO staff as of 2018.

Name	Background	Tasks	Email
Claudio Brunini	astronomer	scientific director	cbrunini@aggo-conicet.gob.ar
Hayo Hase	geodesist	head of operations	hayo.hase@bkg.bund.de
Augusto Cassino	electrical engineer	head of infrastructure and construction	acassino@aggo-conicet.gob.ar
Romina Galvan	geophysicist	local survey, scientist	rgalvan@aggo-conicet.gob.ar
Federico Salguero	electronic engineer	VLBI hardware	fsalguero@aggo-conicet.gob.ar
José Vera	electronic engnieer	VLBI software and system administrator	jvera@aggo-conicet.gob.ar
Alfredo Pasquaré	electronic engineer	time and frequency lab, GNSS	apasquare@aggo-conicet.gob.ar
Michael Häfner	physicist, engineer	SLR system	michael.haefner@bkg.bund.de
Florencia Toledo	optical engineer	SLR hardware	ftoledo@aggo-conicet.gob.ar
Federico Bareilles	electronic engineer	SLR software	fbareilles@aggo-conicet.gob.ar
Pablo Antico	meteorologist, scientist	climate modelling	pantico@aggo-conicet.gob.ar
Romina Ronchi	administrator	administration	rronchi@aggo-conicet.gob.ar

The plan to move the operations from the containers to the operations building will be coincide with putting a new VLBI backend into operation; a DBBC and a Flexbuff system will replace the VLBA5 and Mk5B equipment.

Later on the servo cabinet and the antenna control unit will follow. For this operation, a renewal of the cables between receiver and control room are considered.

An uninterruptable power supply for the entire observatory is requested and is foreseen to be realized. With an enhanced reliability of the power supply, a return to full operations is envisaged.

Concerning the mid-term future, a new VGOS radio telescope is considered to be important.

References

1. H. Hase et al., “Moving from TIGO to AGGO”, In K. D. Baver, D. Behrend, and K. Armstrong, editors, International VLBI Service for Geodesy and Astrometry 2015+2016 Biannual Report, NASA/TP-2017-219021, p. 43-47, 2017.