Argentinean-German Geodetic Observatory
AGGO-VLBI Network Station Report

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Abstract The Argentinean-German Geodetic Observatory (AGGO) contributed to the observation programs of the IVS and of Wettzell. This report summarizes the experiences of the regular provision of VLBI data during 2019–2020.

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 to it 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 approximately 25 km from the center of its capital town of La Plata (and approximately 50 km from the city of Buenos Aires), adjacent to the Pereyra Iraola natural park and next to the Argentinean Institute of Radio Astronomy (IAR) [2].

The project is based on the bilateral scientific-technical cooperation between Argentina and Germany. While Germany via BKG provides the measuring devices and two staff members, CONICET provides the infrastructure and the AGGO staff (currently nine persons) and is responsible for providing operators.

1. Bundesamt für Kartographie und Geodäsie (BKG)
2. Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET)

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

Parameter	Value
DOMES No.	41596S002
CDP No.	7641 (axis intersection)
four-char code	AGGV
IVS two-char id	Ag
approx. longitude	W 58.51398°
approx. latitude	S 34.8739°
approx. height	35.8 m
data acquisition	VLBA5
data recorder	Mk5B+
max. e-transfer bandwidth	400 Mbps
FS-version	9.11.19 (2019), 9.13.2 (2020)
webcam: https://www.aggo-conicet.gob.ar/liveview.php	

2 Activities during the Past Years 2019–2020

2.1 Operators

By the end of 2018 AGGO demonstrated its readiness for regular operations. In order to execute observation programs of the IVS, CONICET decided to start a joint venture with the Argentinean Ministry of Defense in order to receive military staff as operators for the observation shifts. The agreement between both parties was signed on February 5, 2019. The first group consisted of one civil coordinator and six soldiers—three

Fig. 1 The 6-m primary focus offset radio telescope for VLBI observations of AGGO became 25 years old in 2020.

from the army, two from the navy, and one from the air force.

Fig. 2 The first group of operators provided by the Ministry of Defense to the AGGO project. From left to right, top: Rodrigo Duarte, Jorge Gonzalez, David Baldonado, and coordinator Dr. Ánibal Aguirre; bottom: Alejandra Beribei, Luis Correa, and Héctor Huanca. The photo was taken on the occasion of the ceremony of the signature of the agreement between the Ministry of Defense and CONICET. In 2020 Pablo Dario replaced Jorge Gonzalez.

The operators received training on a) geodesy and VLBI, b) the Linux operating system, c) VLBI hardware and monitoring tools, and d) the VLBI Field System, and they were certificated by the end of 2019 after their first year of duty. The training program was elaborated and executed by the AGGO staff. A "VLBI Operator's Manual" was written in order to have a written reference (currently 71 pages) available. This manual is periodically adjusted if changes in the operational procedures require it. It contains a *Checklist* with references to the Operator's Manual, so that a cookbook-like operation of a VLBI session from start to end became possible. The training of the operators continued as training on-the-job, in which the operators were supervised on their shifts during the setup of a session and at the finalization. During the time span while the session was running, the operators monitored the automated processes on their own. A 24-hour session is typically a 27-hour duty for a team of two operators. The operators start two hours before the session with the setup and have one hour after the session to finish their duties. In case of a major technical problem (BBC unlock, receiver temperatures, vacuum, cryo-circuit, power outage), a telephone hotline to AGGO staff is provided for limited remote guidance. The operators are present at AGGO only for the observation sessions.

2.2 AGGO Staff

The AGGO staff is keeping the instruments in operation so that the operators are excluded from maintenance tasks. Recurring duties were to keep the receiver in operational condition, that is to keep it cryogenically cooled and keep a good vacuum, hence keeping a low system temperature. But, frequent power interruptions, high summer temperatures, and aging equipment are causing reoccurring problems. The power supply was modified several times, as the consumption exceeded the limits of the backup batteries. This is being addressed by a new energy backup infrastructure to be installed in 2021/22. The ambient temperature dependence of the receiving system is being addressed by the design of a new receiver box with more cooling elements. This box is currently being installed. Problems with aging equipment, namely with the Baseband Converters, were addressed by adding some resistances in the electronic circuits to compensate for the aging effect. This might be a temporary cure. A further action is on its way: the replacement of analog BBCs by the DBBC2. The number of tasks is larger than the number of staff members, which delays the work on system im-

provements. The programmed sessions of AGGO limit the access time to work on the existing problems, and the supervision of operators is still an issue.

2.3 COVID-19 Impact

With the occurrence of the COVID-19 pandemic, operations at AGGO had to stop on March 23, 2020, when a lockdown was declared by the Argentinean President. Strict rules were applied, and it was not possible to move around freely, e.g., to the AGGO workplace. Only essential persons, such as military staff, were allowed to follow their duties. The AGGO contingency plan during COVID-19 could not be executed by AGGO staff as they were not considered to be essential. Fortunately, the Operator Coordinator from the Ministry of Defense carried out volunteer daily visits at AGGO and made sure that the minimum infrastructure was kept running (frequency normals, air conditions, cryogenic circuits). Beginning at the end of May 2020, the two-hour VLBI sessions could be observed by one person coming to the station. During the lockdown, the Field System had been upgraded to enable remote control operation, and a new webcam had been installed (Table 1). Later on, operations resumed with less staff possible at the station in accordance with a sanitary protocol and keeping distances among the staff members. The year 2020 ended with a reduced presence of staff at the station and therefore less productivity of the operations because manual intervention was still necessary. But, even under unusual circumstances, a significant number of VLBI sessions could be executed, and AGGO-VLBI data is available for the ITRF2020 calculations. Hence, AGGO may become a new ITRF VLBI network station!

2.4 Sessions

Table 2 gives an overview about the data yield from AGGO and its performance. The loss of sessions is related mainly to technical failures during vacation periods without operators in the summer months in 2019 and due to technical failures and the COVID-19 lockdown restrictions on going to AGGO during 2020.

3 Current Status

The status as of the end of 2020 is that AGGO-VLBI is operational. The availability of operators upon request challenges the AGGO staff to have the VLBI equipment and infrastructure in operational conditions for the scheduled sessions. AGGO is still affected by uncontrolled power outages by the energy provider. The improvement of the horizon mask for the radio telescope by cutting the limiting trees could not be achieved yet. The radio frequency interference situation at S-band became worse, and rare interference of unknown origin (ship radars on the La Plata river?) at X-band could be observed.

As a fundamental station for geodesy, AGGO owns also an SLR station, the overhaul of which suffered further delays due to the COVID-19 crisis. Other instruments are kept working:

- 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 by a 1 Gbps optical fiber.

The power supply is still characterized by frequent interruptions due to the lack of pruning of the vegetation along the route of the line, the 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 and has been delayed by more than two years. Once it has been finished, space in the operation building will be released to move the operations from the containers to the operation building.

The current VLBI staff situation is presented in Table 3.

Table 2 AGGO-VLBI session performance in 2019–2020. The column "Correlated" also contains observed sessions which are still in backlogs at the correlators. "Lost" sessions are those which had to be canceled or were eliminated from the correlation process due to a poor quantity or quality of observations. The "Corona-year" 2020 shows lost sessions due to the lockdown, during which AGGO staff were not allowed to go for work to AGGO for a couple of months. Nevertheless an effort was made to provide as much data as possible.

Year	Session	Duration	Scheduled	Correlated	Lost	Performance
2019	R1	24	45	31	14	0.69
	R4	24	4	3	1	0.75
	T2	24	6	3	3	0.50
	OHIG	24	5	4	1	0.80
	WC	2	32	28	4	0.88
Total			92	69	23	0.72
2020	R1	24	36	22	14	0.61
	R4	24	4	1	3	0.25
	T2	24	5	3	2	0.60
	CRD	24	5	2	3	0.40
	OHIG	24	4	2	2	0.50
	WD	2	48	35	13	0.73
Total			103	65	37	0.63

Table 3 AGGO staff linked with VLBI in 2020.

Name	Background	Tasks	E-mail
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
Augusto Cassino	electrical engineer	head of infrastructure and construction	acassino@aggo-conicet.gob.ar
Hayo Hase	geodesist	head of operations	hayo.hase@bkg.bund.de
six operators	soldiers	VLBI operation	

4 Future Plans

The receiver box is being enlarged to host more cooling peltier elements in order to keep the ambient temperatures of the dewar lower and to better resist high ambient temperatures during the summer season.

The plan to move the operations from the containers to the operation building will coincide with putting into operation a new backend for VLBI: the DBBC and a Flexbuff system to replace the VLBA5 and Mk5B equipment. The new equipment is scheduled to arrive in 2021.

The servo cabinet and the antenna control unit will follow later on. For this operation, a renewal of the cables between the receiver and control room is being considered.

An uninterruptible power supply for the entire observatory has been requested and will be realized. With an enhanced reliability of the power supply, a return to full and reliable operations is envisaged.

Complementary instruments to VLBI such as a water vapor radiometer are being considered for being put into operation during the near future.

Concerning the mid-term future, a new VGOS radio telescope has been specified, and such a desired project is waiting for its execution. But it depends on a renewed agreement on the cooperation between BKG and CONICET. This agreement is under negotiation and targets a time span of more than ten years during which a sustainable operation of AGGO for the Global Geodetic Reference Frame will be assured.

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