

Status at Ny-Ålesund Geodetic Earth Observatory

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Abstract We present the current status of the Ny-Ålesund Geodetic Earth Observatory. Special focus is placed on the status and future of the VGOS twin telescopes (Ns and Nn) and the legacy 20-meter antenna (Ny).

Keywords Network, stations, VGOS, Ny-Ålesund

1 Introduction

The Geodetic Observatory of the Norwegian Mapping Authority (NMA) is situated at 78.9° N and 11.9° E in Ny-Ålesund, Kings Fjord, on the west side of the island of Spitsbergen. This is the biggest island in the Svalbard archipelago. The Geodetic Observatory features a 20-meter legacy VLBI radio telescope at the Rabben site (see Figure 1), as well as fast-slewing VGOS (VLBI Global Observing System) twin telescopes at the new facility at Brandal (see Figure 2).

In addition to the 20-m VLBI telescope and the 13-m twin telescopes, the geodetic observatory has two GNSS receivers in the IGS system and a Super Conducting Gravimeter which is part of the International Geodynamics and Earth Tide Service. A second SCG is installed at the Brandal site, approximately 1.5 km away. A solar radio burst monitor is set up at Rabben, and a tide gauge is in operation at the harbor.

The observatory also hosts an accelerograph from the Instituto Geográfico Nacional in Spain and a GISTM (GPS Ionospheric Scintillation and TEC

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Fig. 1 The geodetic observatory's Rabben site with the Ny 20-m telescope.



Fig. 2 The geodetic observatory's Brandal site with 13-m twin telescopes (Image: Bjorn-Owe Holmberg).

Monitor) receiver which is operated in the frame of ISACCO, an Italian research project on ionospheric scintillation observations, led by the Italian Institute of Volcanology and Geophysics (INGV). Another Real-Time Ionospheric Scintillation (RTIS) Monitor was set up and has been operated by the NMA since November 2012. A DORIS station is located approx-

imately 350 m from the new geodetic observatory at Brandal and is hosted by the French-German AWIPEV research base.

2 Legacy 20-m VLBI Telescope (Ny)

During the planning works of the new geodetic observatory at the Brandal site, it was agreed together with the airport authorities that due to safety reasons the 20-m radio-telescope (Ny) would be dismantled after a few years of parallel observations between the 20 m and the antennas at the new site in Brandal. The 20-m radio-telescope is close to the airport facilities in Ny-Ålesund and just a few meters from the runway, making landing and take off more challenging in bad weather conditions.

The 20-m antenna began operations in 1994, and it has operated regularly since then. After almost 30 years of operations, the maintenance of the antenna structure is a challenge in the harsh Arctic environment. It is difficult to find spare parts for both the mechanical structure and the S/X receiver. There are also economical reasons, including the budget to run this antenna plus two additional antennas; this triplicates the consumption of electricity, as well as the maintenance and human power needed.

The initial plan was to start the dismantling of the 20-m antenna during autumn 2022, but to make sure that there are enough parallel operations between the Rabben and Brandal sites, it was decided to extend the observing period and delay the dismantling until summer 2023 or whenever a big economical investment would be needed to keep the operations running.



Fig. 3 The 20-m VLBI telescope will be dismantled during summer 2023.

3 Legacy South (Ns) at the New Observatory at Brandal

The south antenna (Ns) at the Brandal site has an installed tri-band S/X/Ka receiver using the S/X bands for observations in the legacy network. Ns has been observing weekly in the IVS network as a regular station since November 2021. It is currently using a DBBC2 backend. An update of its flexbuff was done at the end of 2021. The CDMS (Cable Delay Measurement System) will be installed in the coming weeks.

When the legacy observations are finished, the Ns antenna's VGOS receiver will be upgraded at Yebes Observatory during 2023. The upgrade will consist of changing the LNAs from single-ended to a balanced configuration, resulting in a lower average receiver temperature and lower ripple across the frequency band. A DBBC3 is ready to be installed for when the Ns VGOS observing starts.

4 Parallel Operations of Ny-Ns

As mentioned above, the reason for Ns observing within the legacy S/X network is contributing to the parallel observations with the 20-m antenna before it is dismantled. It is important to have a long enough overlapping time series between the old 20-m antenna and the new antennas at Brandal in order to have a continuation of the Ny times series down at the new site with the Ns and Nn antennas. The Ns antenna was included in the legacy network to link the inter-comparison. Ny and Ns are observing the same sessions in the IVS legacy network (from 2–5 times per week). To run parallel observations with Ns and Ny is a challenge mainly due to the Ny faults. At the end of 2020 there was an elevation encoder fault that lasted four months until the encoder was repaired, and during 2022 the 20-m antenna's maser had a fault that lasted for over a month (see Figure 5).

It is planned that Ny and Ns are observing the NYTIE project (local VLBI sessions) in between official IVS sessions. The idea is to densify the parallel observation time series as much as possible and also to gain experience and learn to perform local VLBI tie sessions. We would like to thank E. Varenus from Onsala Observatory for his big support.

Ns and Ny are also participating in the VSBI (Very Short Baseline Interferometry) project by L. Petrov from NASA to whom we are grateful for his analysis performed so far.

After the parallel observations are finished with the dismantling of the 20-m antenna, it will be decided if the Ns antenna should continue observing a bit longer period in the legacy network or if it should join the VGOS network together with the Nn antenna and others.

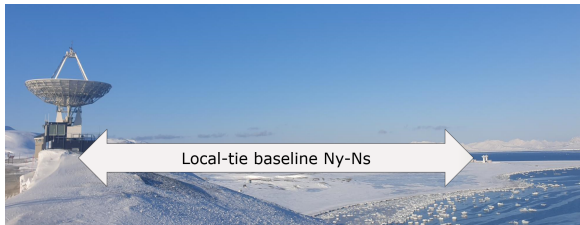


Fig. 4 The distance between the Ny and Ns antennas is about 1.5 km.

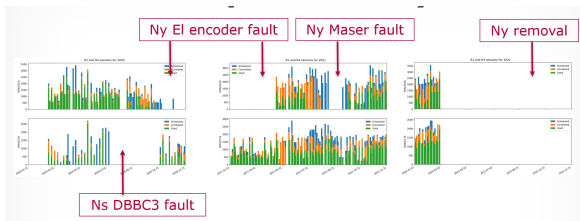


Fig. 5 Sessions observed by the Ny and Ns antennas, to show the periods of parallel observations.

5 VGOS North (Nn) at the New Observatory at Brandal

The new updated VGOS broadband receiver was installed in the north antenna (Nn) at the Brandal site in November 2021. The update in the receiver consisted of the installation of balanced LNAs instead of a single-ended one as mentioned before for the Ns VGOS receiver. The upgrade was performed at Yebees Observatory at the end of September 2021. The Ns VGOS broadband receiver will be sent to Yebees Obser-

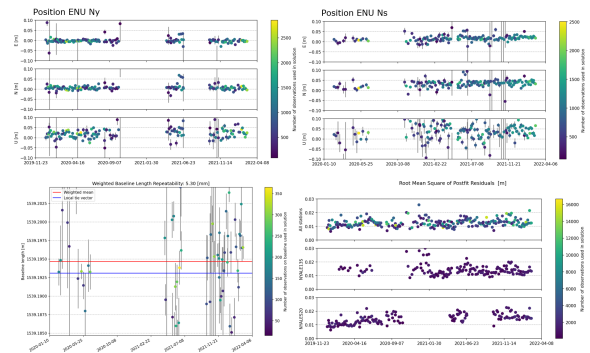


Fig. 6 Time series ENU positions for the Ny and Ns antennas. Weighted Baseline Length Repeatability and Root Mean Square of Postfit Residuals as analyzed by A.-S. Kirkvik using the *where* software.

vatory, and the same upgrade will be performed during 2023, so both VGOS broadband receivers will be equal.

The first fringe test was performed in summer 2022, and results are still to be analyzed at the production of these proceedings.

The aim is to join the IVS VGOS observation schedule by the end of summer 2022. The Nn antenna will join the network of the European EU-VGOS project.



Fig. 7 The Brandal site observatory as seen from the north. The Nn antenna is in the front.

6 RFI Measurement Campaign

Ny-Ålesund and the area 20 km around town is a radio silence area by Norwegian Parliament law (from 1994) to protect the VLBI antenna at the Geodetic Ob-

servatory at the Rabben site, and now it will protect the spectrum from 2–32 GHz for the VLBI antennas at the Geodetic Observatory at the Brandal site.

The use of WiFi and Bluetooth is not allowed in Ny-Ålesund and 20 km around. We have noticed RFI coming from WiFi in town, and during the summer season some tourist cruises use WiFi on board when staying in Ny-Ålesund. We are working on informing and making awareness for tourist cruises and permanent inhabitants in Ny-Ålesund to follow the protection rules. Reporting and advising about radio silence in Ny-Ålesund is a big challenge, as the number of tourist cruises has increased significantly.

7 Satellite Laser Ranging

The SLR installation is an ongoing project. The installation of the dome was delayed due to COVID travelling restrictions from EEUU in 2021. It was finally installed 1 April 2022. The installation of the gimbal telescope assembly is planned for the end of 2022. Laser installation is planned for 2024, and it will be fully operational by 2025.



Fig. 8 The SLR dome was installed in April 2022. The view from the control room. (Image: Bjorn-Owe Holmberg)

8 Other Monitoring Activities: Local Tie, Gravimeters, and GNSS

Local tie measurements are performed yearly using the local GNSS network at Brandal. The next local tie measurement is planned for the end of summer 2022.



Fig. 9 The SC Gravimeter at the gravimeter building at the Brandal site.



Fig. 10 GNSS antennas.