Roll-out Status of the VGOS Network

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Introduction

The member organizations of the International VLBI Service for Geodesy and Astrometry (IVS) operate an observational network of VLBI telescopes that currently consists of about 40 stations worldwide. This S/X VLBI network was developed mainly in the 1970s and 1980s. Due to the aging infrastructure but also because of demanding new scientific requirements, the larger IVS community planned and started to roll out the next-generation VLBI system called VGOS (VLBI Global Observing System) at existing and new sites over the last few years. The roll-out effort is ongoing and it is anticipated that the VGOS network may become fully operational in the early 2020s. Once VLBI products can be derived from the new system in an operational manner, the VGOS network will replace the legacy S/X network as the production system of the IVS.

How Geodetic VLBI Works

The VLBI observable is the difference in the arrival time of a radio signal (from a quasar) at two different radio telescopes. The measured time delay, using the speed of light, can be interpreted as a distance. The distance is the component of the baseline toward the source (quasar). By observing many sources, all components of the baseline can be determined.

The Current Legacy S/X VLBI Network

The currently used legacy S/X observing network of the IVS consists of about 40 stations. This includes the IVS Network Stations as official member components of the IVS as well as several cooperating sites that contribute to the IVS observing program, in particular the ten stations of the VLBA and the three NASA DSN stations.

Legacy S/X vs. VGOS

When a larger number of legacy S/X antennas started to approach their end-of-life, the IVS conceived a next-generation VLBI system which has come to be known as VGOS (VLBI Global Observing System). Unlike the legacy system, VGOS will be a dedicated instrument that is not intended to share antennas with other applications. In order to be able to satisfy increased scientific requirements, the new system was based on fulfilling three overarching criteria: (1) mm positional accuracy on global scales, (2) continuous measurements for time series of station positions and Earth orientation parameters, and (3) turnaround time to initial geodetic results of less than 24 hours. These criteria determined the definition of the specifications of the VGOS system.

VGOS Roll-out Progress and Some Early Results

After first images with the VGOS broadband system some 1–2 years earlier, first actual geodetic results were determined on the demonstration baseline OAGO to Westford in late 2014. Adding further stations in North America, Europe, and Japan, a six-station network observed continuously for five days in the CONT17 campaign (VGOS CONT17) in December 2017.

Conclusion

The establishment of the VGOS observing network is making steady progress. By December 2018 some seven stations were broadband ready. Initial VGOS results were obtained in the VGOS CONT17 campaign. A focus for the VGOS project for the next several years will be the establishment of the necessary correlation and data transport/storage resources that will be necessary to transition the VGOS from its trial status to the operational system of the IVS.