An Atlantic Network of Geodynamic and Space Stations

RAEGE

Red Atlántica de Estaciones Geodinámicas y Espaciales
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The Spanish-Azorean contribution to VGOS and GGOS

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The *Atlantic Network of Geodynamic and Space Stations* (RAEGE) is a project developed by the National Geographic Institute of Spain (IGN) and the Regional Government of Azores (Portugal). It consists of the deployment of four stations in which coexist several geodetic techniques. Each station is equipped with a 13.2-m diameter radio telescope of VGOS technology (fast switching and broadband receivers), a GNSS receiver, a superconducting gravimeter, with the possibility to also incorporate other systems such as SLR, DORIS, etc.

The IGN Yebes Observatory station (Guadalajara, Spain), which has already achieved VLBI broadband results, is operational since 2013. The station in Santa Maria (Azores, Portugal) was inaugurated in May 2015 and it is fully operational. Construction works have started in the Gran Canaria station (Canary Islands, Spain) during 2018 and it is expected to be operational by 2019. During 2018, the site for the Flores station (Azores, Portugal) has been chosen and construction works are planned to start during 2019.

Global Geodetic Observing System (GGOS) and VLBI Global Observing System (VGOS)

GGOS is a service of the International Union of Geodesy and Geophysics (IUGG), which integrates different geodetic techniques to provide the geodetic infrastructure necessary for monitoring the Earth system and for Global Change research. It provides observations of the three fundamental geodetic observables and their variations: Earth's shape, Earth's gravity field and Earth's rotational motion.

VGOS is a service of the International Association of Geodesy (IAG) to provide high precission measurements of the Earth Orientation Parameters (EOP) and plate tectonics.

Fast-slewing antennas equiped with broadband receivers for Very Long Baseline Interferometry (VLBI) are co-located with other geodetic techniques such as GNSS, SLR, gravimetry, DORIS, being also necessary to provide local ties between them.

GGOS (and within it, VGOS) provides the observational basis to maintain a stable, accurate and global reference frame and in this function is crucial for all Earth observations and many practical applications.

Figure 1: Location of the RAEGE stations.

Fig. 2: The RAEGE station at Santa María (Azores, Portugal).

The VGOS 13.2-m radio telescope

It is an elevation-over-azimuth turning-head antenna with a ring-focus optical design and fast moving capabilities (figure 2,3). At Yebes, it has been recently upgraded with a cladding in the back-up structure to reduce thermal gradients and extend its operating frequency.

Fig. 3: The RAEGE 13.2-m radio telescope at IGN Yebes Observatory (Spain).

The broad-band receiver

The front-end (figure 4a) consists of a dewar with a dual linear polarization quadruple-ridged flared horn (QRFH) feed, directional couplers for noisecal and phasecal injection and two ultra-low noise hybrid amplifiers developed at Yebes laboratories. The RF output signals from the dewar are sent to RF-over-fiber transmitters , allowing signal transportation through single-mode fiber up to the telescope back-ends room. In this place, the optical receivers are installed together with a RF distribution module and 4 up/down converters.

Figure 4a: Dewar internal view

Figure 4b: Up/Down converters integration

Conclusions

The RAEGE project is contributing to GGOS by building four fundamental geodetic stations; two of them are already operational at IGN Yebes Observatory (Spain) and Santa Maria (Azores). Works are on going for Gran Canaria and Flores stations.
Full RAEGE network is expected to be operational in the coming years.

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