

Institut d'Estudis Espacials de Catalunya (IEEC)

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Abstract

We summarize the tasks and work carried out at the Institut d'Estudis Espacials de Catalunya (IEEC) regarding geodetic VLBI within the frame of the IVS. Main activities are, firstly, geodetic surveillance of the DSS65 VLBI antenna at the Robledo (Madrid) site; and, secondly, investigations pertaining to improvements of the tropospheric correction using GPS, WVR, and local meteorological data as well as meteorological models.

1. General Information

The Institut d'Estudis Espacials de Catalunya (IEEC) is located in Barcelona in the north-east of Spain. It occupies quarters in the Nexus building (Figure 1) of the Universitat Politècnica de Catalunya (UPC) North Campus in the west-end of town (see also Table 1).



Figure 1. Home of the IEEC: the Nexus building of the UPC North Campus.

IEEC is a research unit of the Consejo Superior de Investigaciones Científicas (CSIC), the Spanish research council. In the IVS it fulfills the task of a technology development center. The main study areas lie in the determination of the stability of VLBI sites, i.e. the surveillance of the horizontal and vertical stability of the antenna reference point, and in improving the modelling of atmospheric parameters.

Table 1. Addressing the IEEC using different means.

Address Type	Current Address
geographical address	longitude $\lambda = 2.11^\circ\text{E}$ latitude $\varphi = 41.39^\circ\text{N}$
postal address	Institut d'Estudis Espacials de Catalunya Edif. Nexus-204, Gran Capità 2-4 E-08034 Barcelona, Spain
WEB address	http://www.ieec.fcr.es

2. Technological Developments in Progress

For the DSS65 VLBI antenna at the NASA Madrid Deep Space Communications Complex (MDSCC), Spain, the stability of the antenna site was controlled using geodetic measurements taken at different epochs and covering the time span from 1988 to 1998. A least squares evaluation procedure yielded 3D-coordinates of the antenna reference point with an accuracy of a few mm. Thus, the antenna can be considered stable in position (showing no significant change) over the past decade. This excludes a significant 7 mm change in the north component in March 97. The height, on the other hand, has undergone two significant height changes: an uplift of 17 mm from December 88 to March 97 and an uplift of 6 mm from March 97 to June 97. For more information the reader is referred to the following references: [1], [2], and [3].

In addition to VLBI, the DSN station at Robledo (Madrid) also runs collocated microwave techniques. These comprise a GPS receiver and a water vapour radiometer (WVR). Data from these techniques as well as local meteorological data and, eventually, meteorological models are utilized to improve the modelling of atmospheric parameters. Corresponding investigations are currently underway.

3. Staff Members Working in the VLBI Field

The IEEC staff members who are involved in VLBI work and are contributing to the IVS consists of two people (cf. Table 2).

Table 2. Staff members in IVS related work.

Name	Background	Dedication	Agency
Dirk Behrend	geodesy	100%	IEEC
Antonio Rius	astronomy	50%	IEEC

Antonio Rius had been a member of the technical staff of the MDSCC from 1975 to 1985 being responsible for the radioastronomical activities, before he became head of the Earth Sciences Department of the IEEC. Dirk Behrend is financed by the European Community in the TMR network grant FMRX-CT960071 "Measurement of Vertical Crustal Motion in Europe by VLBI".

4. Current Status of IVS Related Activities

The evaluation of the already performed geodetic observation campaigns is accomplished and the results have been published. It is planned that future campaigns, which should be performed on a yearly basis, be evaluated using the same software and the results be published as soon as possible.

The application of GPS technology to studying the water vapour distribution and evolution in the study area of the MDSCC is underway. Comparisons with results from independent techniques (e.g. WVR) as well as with values retrieved from meteorological models will further the understanding of this crucial variable and are currently in progress. Eventually, the understanding of the water vapour distribution will help to improve the modelling of the atmospheric parameters in the analysis of VLBI data.

5. Future Plans and Outlook

For this spring/summer, it is scheduled the next geodetic observation campaign of the DSS65 antenna. Furthermore, it is planned to investigate additional possibilities of controlling the DSS65 site stability. This stems primarily from the fact that there exists a large time gap of about nine years between the first and the second geodetic control measurements.

Another critical point associated with the geodetic surveillance concerns the stability of the local geodetic network. So far, it was assumed that there was no significant change in the stations of this network. As this might not be completely true, it is vital to also control the coordinates of the local net. Thus, a control survey of this net is planned for later this year.

As the water vapour distribution at the VLBI site is a crucial variable, additional information sources should be exploited to improve the modelling of the atmospheric parameters. This summer a new water vapour radiometer will be installed at the MDSCC: a D2 radiometer from JPL. It is envisaged that data from this WVR be evaluated at the IEEC. The software package to be used shall be an in-house product which is largely based on the "hotrid" package running at Onsala Space Observatory (OSO), Sweden.

References

- [1] Behrend, D. and A. Rius: Reference Point Stability of the DSS65 VLBI Antenna. EOS Transactions, AGU 1998 Fall Meeting, Vol. 79, No. 45, Supplement, p. F208, 1998.
- [2] Behrend, D. and A. Rius: Geodetic Control of the Madrid DSS65 VLBI Antenna. In: W. Schlüter and H. Hase (Ed.): Proceedings of the 13th Working Meeting on European VLBI for Geodesy and Astrometry. Viechtach, February 12-13, 1999, Bundesamt für Kartographie und Geodäsie, Wettzell, 1999.
- [3] Rius, A., A. Alberdi, D. Behrend, C. García-Miró, J.A. Perea: Radioastronomy at the NASA Madrid Deep Space Communications Complex (MDSCC) – Status Report. In: W. Schlüter and H. Hase (Ed.): Proceedings of the 13th Working Meeting on European VLBI for Geodesy and Astrometry. Viechtach, February 12-13, 1999, Bundesamt für Kartographie und Geodäsie, Wettzell, 1999.