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PREFACE

Preface

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Since its first application to geodesy in the 1970s, very long baseline interferometry (VLBI) has made considerable progress in terms of accuracy, reliability and resolution. VLBI plays a unique role in the practical realization and maintenance of the International Celestial Reference Frame (ICRF) and contributes significantly to the International Terrestrial Reference Frame (ITRF), particularly for scale.

Very long baseline interferometry also provides geodetic products describing the rotation and orientation of the Earth, which are indispensable for positioning and navigation on Earth and in space, and that give valuable information about interactions within the Earth system. In particular, direct measurements of nutation parameters and the rotation angle UT1-UTC are uniquely provided by VLBI. Furthermore, other geodynamical and atmospheric parameters can be derived from VLBI measurements that are important for geodesy, geodynamics, and studies of the troposphere and ionosphere.

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Briefly, the geodetic VLBI concept uses two or more radio-telescopes (located at $R_1, R_2, \ldots$ in Fig. 1) to observe numerous extragalactic sources, mostly quasars (in directions $\mathbf{k}_i$), and the S- and X-band data are recorded and time-tagged using Hydrogen masers. These time-tagged data are then sent for correlation (X) at particular correlation centres to generate fringes and obtain the delay observable τ relevant for geodetic and astrometric applications. From these delays, the baseline lengths b_i and other geodetic parameters can be deduced to millimetric precision. As such, VLBI provides the most precise measurement of scale over very long (1,000+ km) distances.

In 1999, the International Association of Geodesy (IAG) accepted the International VLBI Service for Geodesy and Astrometry (IVS) as an official IAG service. Since then, the coordination of world-wide VLBI observation and analysis has improved significantly, leading to valuable results for the whole scientific community, both within and outside geodesy.

However, the number of relevant scientific publications on VLBI in peer-reviewed journals remains small, since the scientific discussions and exchanges have taken place largely via the proceedings of international and regional VLBI conferences organized within the IVS (http://ivscc.gsfc.nasa.gov). With the establishment of the IAG's GGOS (Global Geodetic Observing System) project (http://www.ggos.org/), it became an appropriate time for a Special Issue of the *Journal of Geodesy* on VLBI to provide information about the state of the art in VLBI research to a broader geodetic community.

When we issued the call for participation, we were very pleased to see a strong response, not only from IVS analysis groups, but also from various users of VLBI

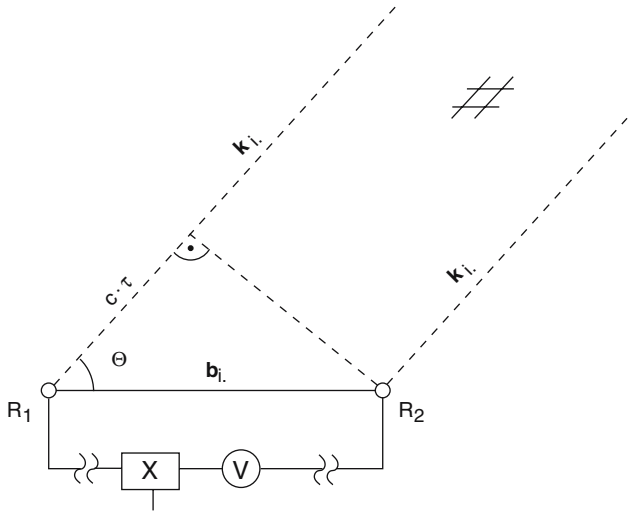

Fig. 1 The geodetic VLBI concept

results. Manuscripts were submitted by institutions all over the world, some including new applications of VLBI, such as combination with other space–geodetic techniques for particular applications.

All submitted manuscripts were subjected to the standard peer-review process for the *Journal of Geodesy*. To maintain impartiality and to preserve the anonymity of the reviewers, all manuscripts on which one of the editors was an author were handled by one of the other Guest Editors. As usual, the final decision about accepting a paper was made by the Editor-in-Chief, Will Featherstone.

The end-result is this Special Issue, which should provide the reader with a better understanding of the current key issues surrounding the VLBI technique for geodesy, the organization of and future plans for the IVS, and a variety of scientific applications such as the celestial and terrestrial reference frames (including effects from the observed radio sources), Earth rotation and orientation, and atmospheric sciences (troposphere and ionosphere). VLBI is one of the space-geodetic techniques participating in the continuous geodetic observation of the Earth system.

We hope that users of the other space-geodetic techniques will find the material in this Special Issue helpful. Finally, we would like to thank all the contributors to this Special Issue as well as the reviewers who made it possible to realize it within a reasonable time-frame.