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The IGGOS viewed from the Space Geodetic Services

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Abstract

The Space Geodetic (Technique) Services of the International Association of Geodesy, in particular the International VLBI Service for Geodesy and Astrometry (IVS), the International Laser Ranging Service (ILRS) and the International GPS Service (IGS) will make major contributions to the proposed Integrated Global Geodetic Observing System (IGGOS) through the provision of time series of parameters which describe the fundamental components of global reference frames, in particular the International Celestial Reference Frame (ICRF) and the International Terrestrial Reference Frame (ITRF), and parameters of the transformation between them (Earth Orientation Parameters (EOP's), nutation, origin and scale). The three techniques VLBI, SLR and GPS are represented by services, which in the last years have taken over the coordination of the supporting components including observation sites, data routing and management, and analysis facilities. Moreover, they have the responsibility for consolidated product delivery by timely provision of high quality time series, with temporal latency in some cases approaching near real time. The results of the different services reflect the distinct characteristics of the technique observables, which are partly similar and partly complementary. Due to the independence and different sensitivity of the techniques, systematic errors between the three techniques can be detected by appropriate combination of the results and to some extent at the level of the observables. Such a procedure will increase the reliability and the consistency of the products in satisfying the requirements of IGGOS.

This paper reviews the different techniques with regard to their advantages and indicates sources of systematic errors. It will focus on requirements which have to be fulfilled for the combination of the service-dependent time series and might provide a basis for discussion on future plans in order to evolve the services themselves towards fulfilling the objectives of IGGOS.

Keywords: Space Geodetic Services; IGS; ILRS; IVS; IGGOS; GGOS

1. Introduction

The Integrated Global Geodetic Observing System (IGGOS) has been conceived over the past few years (Rummel et al., 2000; Beutler et al., 2003) and is planned to become the flagship project of the International Association of Geodesy (IAG). It should bring together the contributions of geodesy to global change studies and provide the focus for the various elements of the new IAG structure.

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IGGOS shall integrate the three "pillars of Geodesy":

- geometry and kinematics;
- Earth orientation and rotation;
- gravity field and its variability.

In particular, it should stimulate close collaboration between the existing (and new) IAG Services. By integrating different models, techniques and approaches, it should achieve better consistency and long-term stability in the products, which can be generated by the services. IGGOS aims at ensuring the availability of uninterrupted time series of state-of-the-art global observations.

The services of the IAG of main concern in this paper are:

- The International VLBI Service (IVS) established in 1999 (IAG, IAU and FAGS) representing VLBI.
- The International Laser Ranging Service (ILRS) established in 1998 (IAG) representing SLR/LLR.
- The International GPS Service (IGS) established in 1994 (IAG and FAGS) representing GNSS (GPS, GLONASS and Galileo).

The International Doris Service (IDS) was formally established by the IAG at the IUGG Assembly in Sapporo, Japan, in July 2003 and is the subject of a separate paper in these proceedings (Willis et al., these proceedings).

The general task of the services is the coordination within the respective techniques of:

- observations (global network);
- data flow;
- data handling and analysis;
- provision of the products;
- technology developments.

Each service has its own specific way of handling these elements (see below).

2. General overview of the products

The combined strength of the IAG Service techniques derives from the fact that all have different sensitivities and are complementary. Table 1 relates the techniques to the principal product groups: Celestial Reference Frame (CFR); Earth Orientation Parameters (EOP's); Terrestrial Reference Frame (TRF); gravity field parameters; orbits; various geophysical parameters.

The special contributions of the techniques to CRF and EOP's can be summarised as follows:

- VLBI is fundamental for realising the Celestial Reference Frame (quasar positions and variations of quasars). In particular, it has a unique capability for determination of the celestial pole position, and for DUT1. It can thus provide the complete set of EOP's.
- SLR/LLR (mainly SLR) provides a major contribution to polar motion and LOD.
- GPS provides high precision and high resolution time series, thanks to the good global distribution of stations and high temporal resolution of the data, and allows determination of changes in the celestial pole, and hence the

Table 1
Contributions of the techniques to different products

	CRF	EOP's	TRF	Gravity	Orbits	Various
VLBI	X	X	X			X
SLR/LLR		X	X	X	X	X
GPS		X	X	X	X	X