

3.4.2 International Laser Ranging Service (ILRS)

Introduction The International Laser Ranging Service (ILRS), established in 1998, is responsible for the coordination of SLR/LLR missions, technique development, operations, analysis and scientific interpretation. Within the organizational structure of the IERS, the ILRS is one of several Technique Centers, having accompanying responsibilities for the generation and quality assurance of Earth Orientation Parameters and related products that are generated within the laser technique. A clear example is the contribution to the implementation of the terrestrial reference system (i.e. the ITRF), where the laser technique provides unique information on the exact location of the earth's geocenter and (shared with VLBI) absolute scale. Another area, where SLR plays an important role, is gravity field development. Although the solutions rely heavily on radiometric observations, the SLR measurements by virtue of their absolute, unbiased character provide a unique tool to validate the orbital and gravity field solutions and independently assess their quality. As an illustration, Figure 1 shows the twin GRACE satellites, launched in March 2002. Although their primary means of navigation is the on-board GPS receiver, the independent and bias-free SLR measurements support the achievement of the science goals of this mission.

Activities in 2003 The ILRS activities cover a broad spectrum, but this IERS-specific overview concentrates on analysis activities. The ILRS Analysis Working Group (AWG) is the entity which is responsible for the coordination of these activities, including the development of quality control procedures as well as official ILRS analysis products. Two AWG workshops were held in 2003, notably in Nice/France (April) and in Koetzting/Germany (October). Here, analysts and program managers met to discuss analysis and data product issues, initiate projects and/or campaigns and evaluate their results.

With the development of (an) official ILRS product(s) and the quality control (QC) issue (of observations and products) in mind, the AWG has initiated a number of pilot projects. They are clearly developing with time. One pilot project concerns the harmonization of semi real-time QC results, the quality assessment of the SLR observations in particular. In 2001 it was recognized that the model for station coordinates plays a major role in the diversity of quality „verdicts“ that are generated and distributed to the stations each week. To bring more uniformity to this, the AWG has strongly recommended that its members use the ITRF2000 solution as a common element in the weekly (or more frequent) analyses. At the time of writing, almost all of the relevant analysis centers have switched to this model. Although no a posteriori evaluation has been made

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yet, it is expected that this will also have consequences for the semi real-time EOP solutions which are generated and submitted to IERS.

The second project is aimed at quality control of the software that is used within the SLR/LLR community. Its purpose is to benchmark the various computer programs and to detect blunders and other possible problems. It focuses on satellite orbits and specific parameter solutions, which may evolve into (the development of) an official ILRS product for satellite orbits. This project has made good progress in 2003, and plays an additional role in acceptance and/or rejection of contributors to a third project.

This third project focuses on two traditional products, i.e. station coordinates and EOPs. The purpose here is to develop an official ILRS solution, currently for EOPs and station coordinates (the former to be included in the IERS Bulletin A). In the future, the analysis system may evolve further to provide other parameters of interest.

Following the release of an official Call for Participation, this project for EOPs and station coordinates has entered a test phase, where the actual data flows and processing schemes are tested, and analysis results evaluated. At this moment (early 2004), 5 analysis groups (using 4 different software packages) provide solutions of station coordinates and EOPs on a weekly, operational basis. These institutes are ASI/Italy, DGF/ Germany, GFZ/ Germany, JCET/ USA and NERC/ UK. The solutions currently cover the period from June 2003 until now. In addition, other research groups (Geosciences Australia, IAA/ Russia) have also expressed their intention to contribute to such operational products. The solutions are based on SLR data to the satellites LAGEOS-1 and -2, and Etalon-1 and -2. This computation is followed by a combination of these individual contributions. This step is currently being tested by ASI/ Italy, DGF/ Germany and NCL/ UK. These results, too, cover the period from mid-2003 until now. In the course of 2003 a change in the analysis scheme was implemented at the request of the client (IERS), i.e. the time-period covered by the weekly analyses was modified from 28 days to 7 days. Having done so, the intervals are consistent with the GPS weeks.

The current test phase of this operational data delivery goes back a number of years in time. Based on the experience gained in preliminary tests, it has been decided to consider solutions for the x-pole and y-pole coordinates and excess Length of Day (LOD) as the prime products of the ILRS analysis activities concerning EOPs. This deviates from the historic situation, where solutions for UT1-UTC were submitted as representative parameters. However, it must be realized that the UT time difference is directly correlated with the right ascension of the ascending node of the satellites(s), so by definition it cannot be observed by any of the satellite techniques.

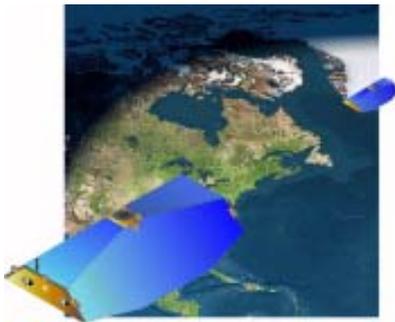


Fig. 1: The GRACE satellites nicely illustrate the characteristic and crucial role that SLR plays in modern space geodesy (courtesy NASA/GFZ).

To improve the quality of the EOP results, the ILRS has given the Etalon satellites (which are analyzed in addition to the (standard) LAGEOS spacecraft) a higher tracking priority than was the case before 2002. Analyses have convincingly shown that the quality of the EOP solutions improves dramatically if even a small amount of Etalon data is included in the data reduction process.

The analysis activities within the ILRS, related to the IERS, are not restricted to just these pilot projects. The ILRS community is providing input to other projects, like the SINEX Campaign, the EOP Alignment Project and the future (IAG) IGGOS Project. Results on these projects can be found elsewhere.

Outlook

The AWG pilot projects, that can be considered as the focal point of the ILRS analysis activities, will proceed with the momentum that they have shown so far. The harmonization project is expected to converge to unambiguous quality assessments soon. The benchmarking/orbits project has embarked upon a strict and ambitious scheme. A first round of results revealed a number of shortcomings, and the current activities will undoubtedly yield a better consistency of the results. The project on station positions and Earth orientation is entering the phase of official product combination. As a first step, by the time that this report officially appears, the ILRS analysis groups and combination centers will have geared up to serve the IERS community with a consistent and high-quality product of EOPs. The EOP/coordinates product is also intended to serve as the ILRS contribution to the IERS Combination Project. The ILRS AWG expects this official product to be available in mid-2004.

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