
Archiving and Infrastructure Support at the ILRS Data Centers

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Abstract

Two global data centers have supported the International Laser Ranging Service (ILRS) since its start in 1998. The Crustal Dynamics Data Information System (CDDIS), located at NASA's Goddard Space Flight Center, and the Eurolas Data Center (EDC), located at DGFI, are active archives of laser ranging data and products derived from these data. The laser data sets consist of on-site normal points and full-rate data. The official ILRS products, currently station positions and EOP, are also made available to the user community through these data centers. Infrastructure support for the ILRS include reports of data holdings and quality, satellite predictions, and station configuration information. This presentation will describe this laser ranging archive available at the ILRS data centers and plans for future enhancements.

Data Center Archive Contents

Currently, the ILRS data and product archive consists of normal point and full-rate data, satellite prediction information, and site positions and velocities. Data since mid-1976 are available at the data centers; ILRS products from January 1993 to the present are also available.

Normal point data is the primary ILRS station data product, gradually replacing on-site sampled data and later full-rate data as the primary data product starting in 1991. Normal points are generated on-site very shortly after the satellite pass and transmitted within a few hours to the ILRS operations centers and, from there, to the ILRS data centers.

Full-rate data were the prime SLR product in the 1970's and early to mid 1980's. In the late 1980's, the normal point generation process was refined and normal points were obtained from the full-rate data during post-processing. In the 1990's, on-site normal point production became the accepted process. In the mid 1990's, the SLR/LLR CSTG subcommission agreed that there was no formal requirement for full-rate due to the transition and acceptance of on-site generated normal points as the prime and only station data product. Many stations, however, continue to provide full-rate data to the ILRS data centers since they are sometimes required for specific needs (e.g., center-of-mass analysis, retroreflector experiments, co-location analysis, etc.). Figure 1 summarizes the data holdings (full-rate or on-site normal point) of the CDDIS archive by year versus satellites tracked and network size.

The ILRS currently provides satellite predictions for the network in two formats: Tuned Inter-Range Vectors (TIRVs) and the newer Consolidated Prediction Format (CPF). The CPF is now considered the operational format for prediction providers and

network stations. However, TIRVs continue to be generated by the prediction providers and made available through email and at the data centers to accommodate stations that are continuing efforts to transition to the CPF.

The CPF information accurately predicts positions and ranges for a much wider variety of laser ranging targets than had been previously possible. Rather than using the tuned IRV's with an integrator, the new predictions provide daily tables of X, Y, and Z positions for each target which can then be interpolated for very accurate predictions. CPF provides an expanded format capability and greatly improves tracking on low satellites because the full modeling potential of the orbit computation at the prediction center will be passed on to the stations. Drag files and special maneuver files are no longer necessary. These predictions are available via email or via anonymous ftp from the data centers.

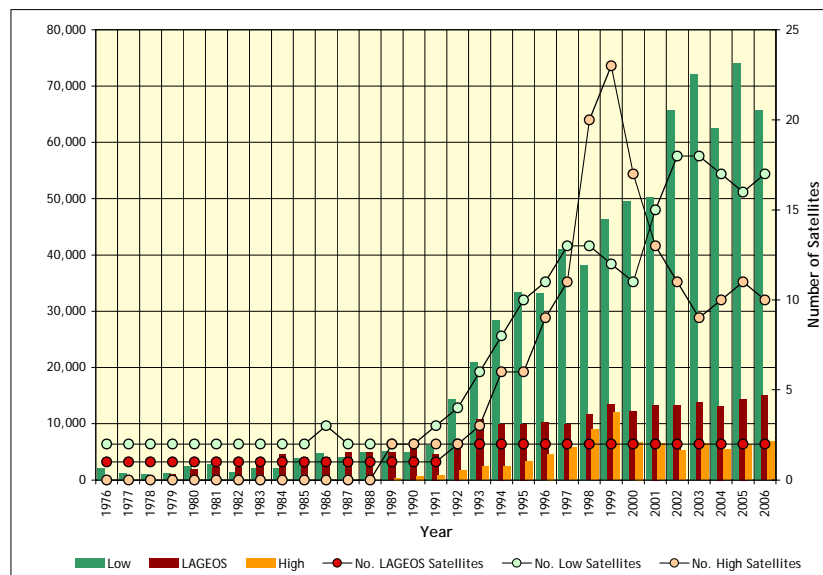


Figure 1. Laser ranging data volume by year

Six ILRS analysis centers (AC), ASI/Italy, BKG/Germany, DGFI/Germany, GFZ/Germany, JCET/USA, and NSGF/UK produce weekly solutions on LAGEOS-1 and -2 for global station coordinates and Earth orientation parameters (EOP). Each week, ASI (primary ILRS Combination Center) and DGFI (backup ILRS Combination Center) merge the individual AC solutions into the official ILRS Combination Product. This combination product is available every Wednesday via anonymous ftp from the data centers. The IERS uses this product for the multi-technique Combination Pilot Project and the Bulletin A EOP.

Performance

The ILRS Central Bureau staff has developed various reports and plots to monitor network performance. This information is updated on a frequent basis dependent upon the type of report. Station operators, analysts, and other ILRS groups can view these reports and plots to quickly ascertain how individual stations are performing as well as how the overall network is supporting the various missions. All plots and reports can be accessed through the station pages on the ILRS Web site at URL <http://ilrs.gsfc.nasa.gov/stations>.

The ILRS performance "report cards" are generated on a quarterly basis and show data volume, data quality, and ILRS operational compliance information. The

statistics are presented in tabular form by station and sorted by total passes in descending order. Plots of data volume (passes, normal points, minutes of data) and RMS (LAGEOS, Starlette, calibration) are created from this information and available on the report card Web site:

http://ilrs.gsfc.nasa.gov/stations/site_info/global_report_cards/index.html

Example plots from the latest report card are shown in Figure 2.

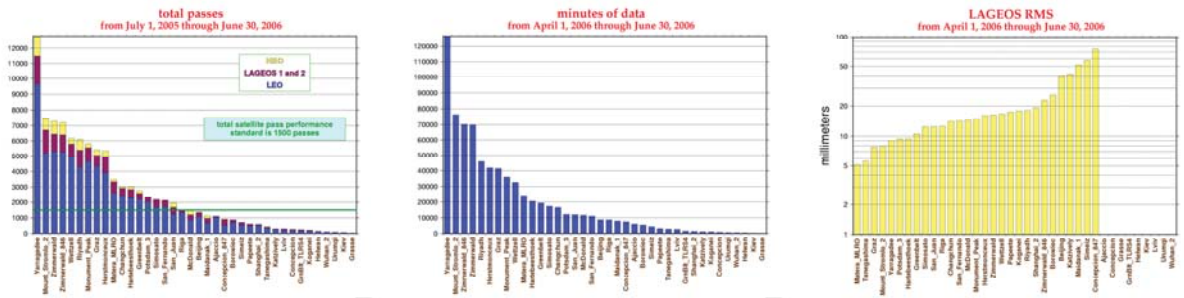


Figure 2a. Total passes for 2006q3 report card.

Figure 2b. Minutes of data for 2006q3 report card.

Figure 2c. LAGEOS RMS for 2006q3 report card.

A plot of the satellite ground tracks of the last seven days of geodetic satellite data is updated daily and available through the ILRS Web site at:

http://ilrs.gsfc.nasa.gov/stations/recent_groundtrack.html.

The plot, shown in Figure 3 for a week in November 2006, graphs the actual network ground tracks of Etalon, LAGEOS, Ajisai, Starlette, and Stella over the previous seven days based upon the archived normal point data.

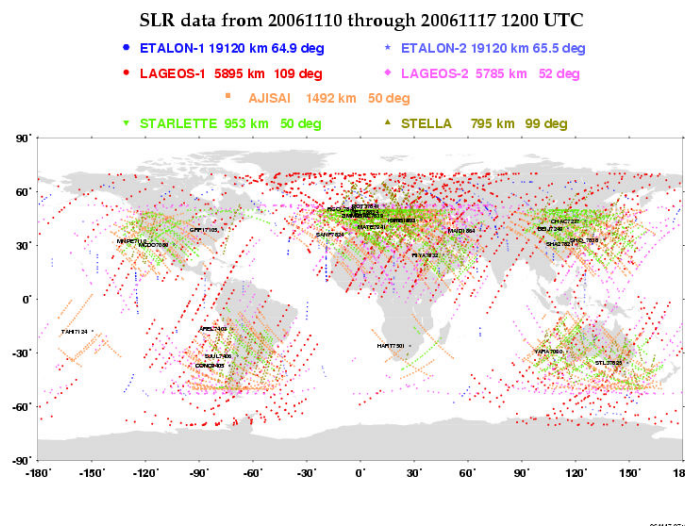


Figure 3. Plot of the satellite ground tracks of the last seven days of geodetic satellite data.

Plots of station performance and meteorological data are regularly generated. The plots are sorted by station and come in two forms: for data from the past year and for data since the year 2000. The information presented in these plots for each station in the ILRS network are: total number of normal points, total number of full-rate points, average number of data points per LAGEOS normal point, LAGEOS normal point rms, calibration rms, and system delay, and station temperature, pressure, and

humidity (as recorded in the normal point data). Examples of these plots for the Yarragadee station are shown in Figure 4. The plots are available through the individual station pages on the ILRS Web site (<http://ilrs.gsfc.nasa.gov/stations>).

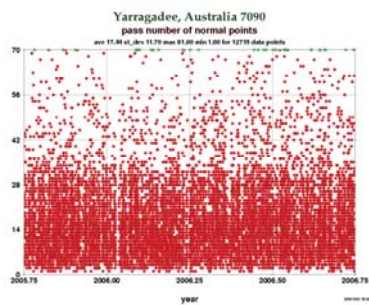


Figure 4a. Total number of normal points from Yarragadee for the past year.

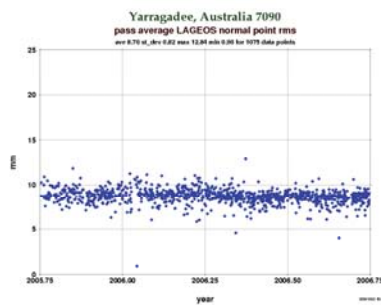


Figure 4b. Pass average LAGEOS normal point RMS from Yarragadee for the past year.

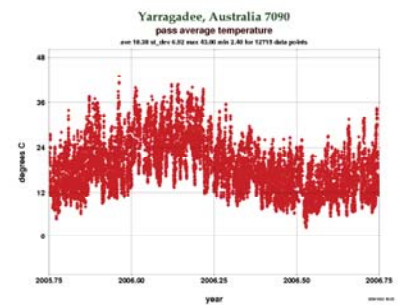


Figure 4c. Average temperature Yarragadee for the past year.

Future Plans

Additional plots of station performance are under development for the ILRS Web site. These plots include statistics for all currently tracked satellites and all operational stations as a function of time; full-rate observations per normal point and normal point rms are also computed as a function of range and time. Examples of the new charts for the Yarragadee station are shown in Figure 5 below.

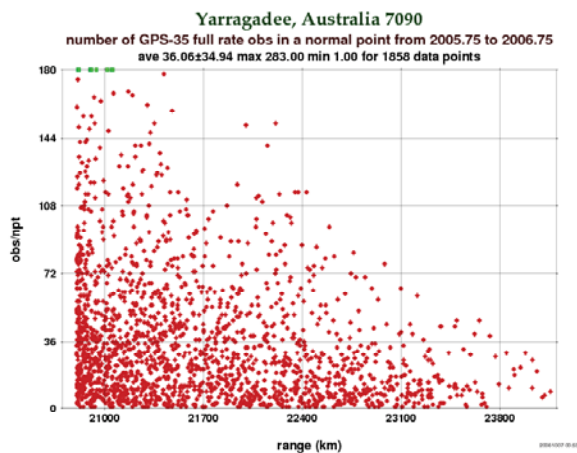


Figure 5a. Number of GPS-35 full-rate observations per normal point from Yarragadee for the past year.

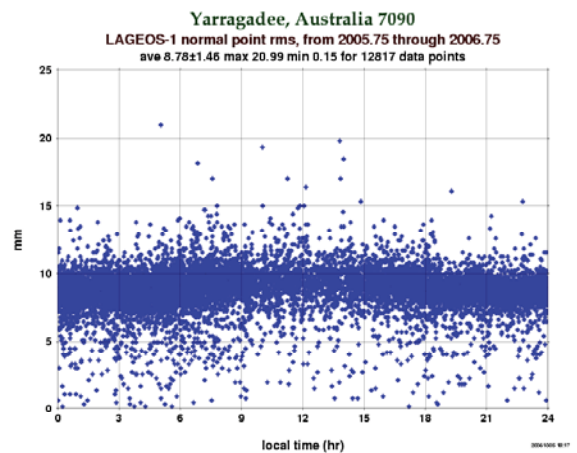


Figure 5b. LAGEOS-1 normal point rms from Yarragadee for the past year.