Herstmonceux Space Geodesy Facility

Expanding the SLR space segment with the Galileo constellation?

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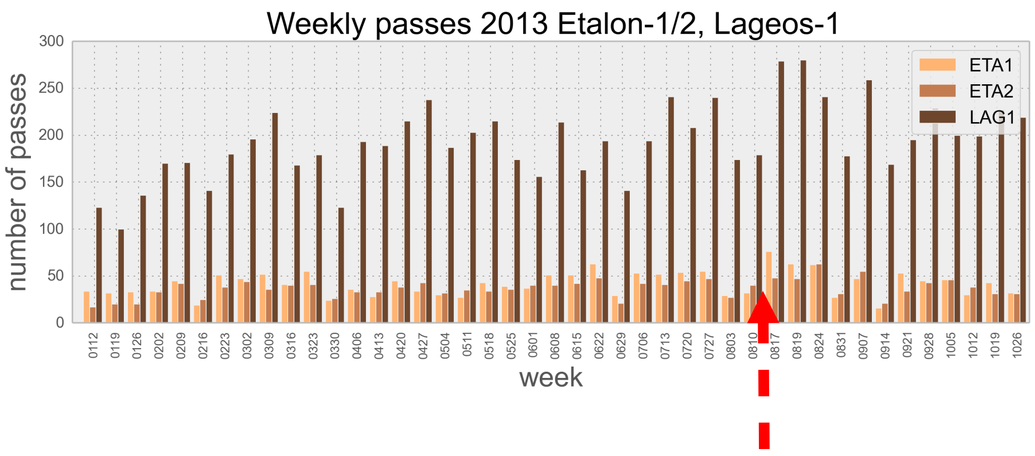
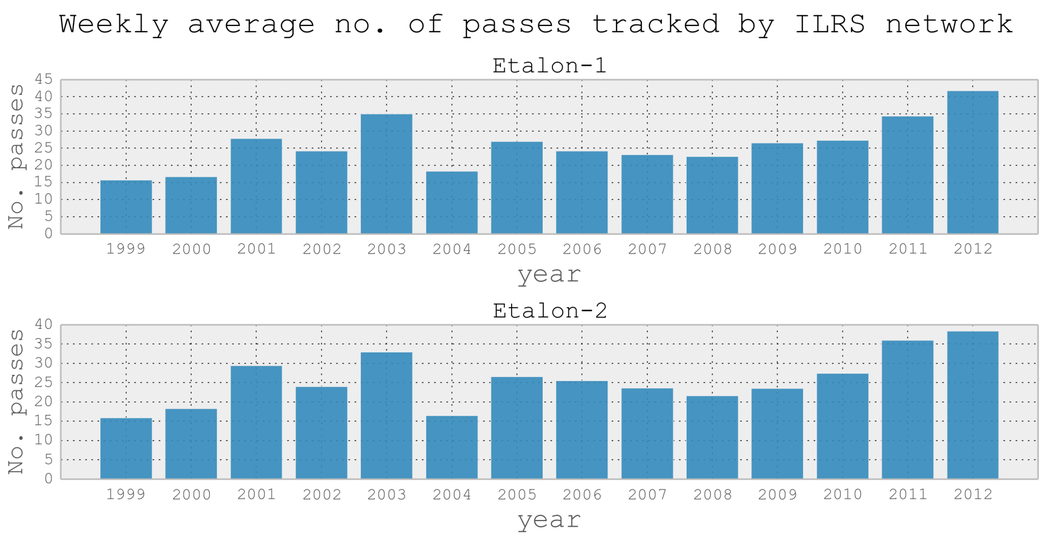
Introduction

Four geodetic satellites, Lageos 1/2 and Etalon 1/2, are currently used by the ILRS analysis centres to produce orbital solutions (station coordinates, geocentre, length of day). Etalon data has been used since 2001 to strengthen the determination of Earth rotation parameters. However, Etalon data is lacking in quantity, which compromises the solutions generated.

The Problem



August 2013: ILRS request for renewed tracking efforts. Despite the upgraded priority, the current network does not seem capable of increasing Etalon tracking substantially.



Significant improvements in Etalon coverage were already made in the last years, suggesting further increases are less likely—and more costly—to be achieved.

Future Glonass launches, the completion of the Galileo constellation, and the upcoming GPSIII will strain the network further and possibly compound the problem.

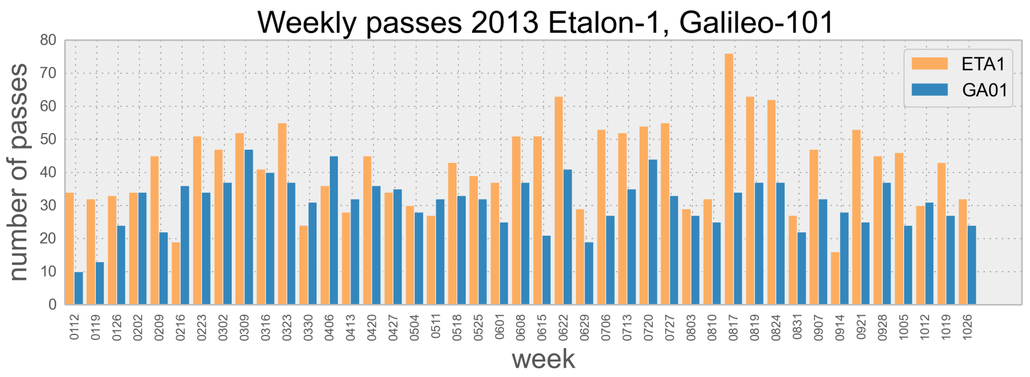
Possible courses of action include:

- Insist on conveying the importance of Etalon tracking to stations
- Do nothing: rely on network expansion and modernisation
- Further explore feasibility of other targets, i.e. GNSS type ones, for geodetic purposes

Galileo as a possible geodetic target

The Galileo constellation may present an opportunity to augment the geodetic ILRS space segment:

- Good return levels: reasonable daytime targets
- Relatively compact LRAs, no fancy shapes, moderate signatures, no eccentricity in Y axis
- Good communication channels to obtain relevant information from (attitude behaviour, manouvers, precise CoM, etc)

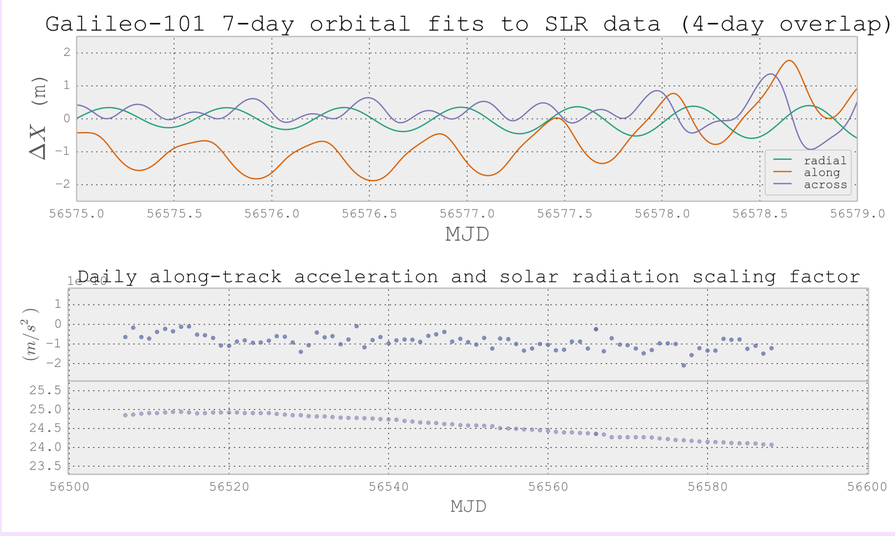


Galileo IOVs tracking

The ILRS network has been very successful at tracking the four IOVs launched in the past two years. Despite their relative low priority, stations are providing NPs at a rate comparable to Etalon, indicating further increases are possible.

Difficulties

Satellite size and continuous yaw-steering are difficulties to deal with to obtain good quality orbital fits for GNSS objects. LRA signature effects may also pose a problem for geodetic requirements.



Preliminary efforts at SGF have met limited success, with RMS orbit overlaps in the radial, along and across track of 30, 100+ and 60 cm. No combination with Lageos data was deemed worth pursuing yet, and we are investigating ways to improve the solutions and examining solar radiation pressure effects.

Conclusions

The multiplication of GNSS targets is calling for the community to explore their scientific potential. In our view, Galileo has some advantages compared to the existing Glonass. Increased tracking and improved modelling hold the key to utilise GNSS objects for SLR products and also improve current combination efforts.