

# LARES-2 – initial results from NERC Space Geodesy Facility (SGF), Herstmonceux

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## INTRODUCTION

In this study we present the impact of adding the new target into the observing schedule and evaluate the quality of the predictions. From the analysis point of view, we present the initial impact of adding observations from LARES-2 into our SLR processing by first looking into the RMS of post-fit residuals and second by comparing RMS of 7-day orbital fits with respect to LAGEOS 1/2 and Etalon 1/2 satellites.

## IMPACT ON THE OBSERVING SCHEDULE

One of the questions that arose after the first successful tracking of LARES-2 was if adding such a high-priority target will have any effect on the overall SLR observing, and to what extent. For purpose of this analysis we have grouped SLR targets based on their type (e.g. geodetic, GNSS and LEOs).

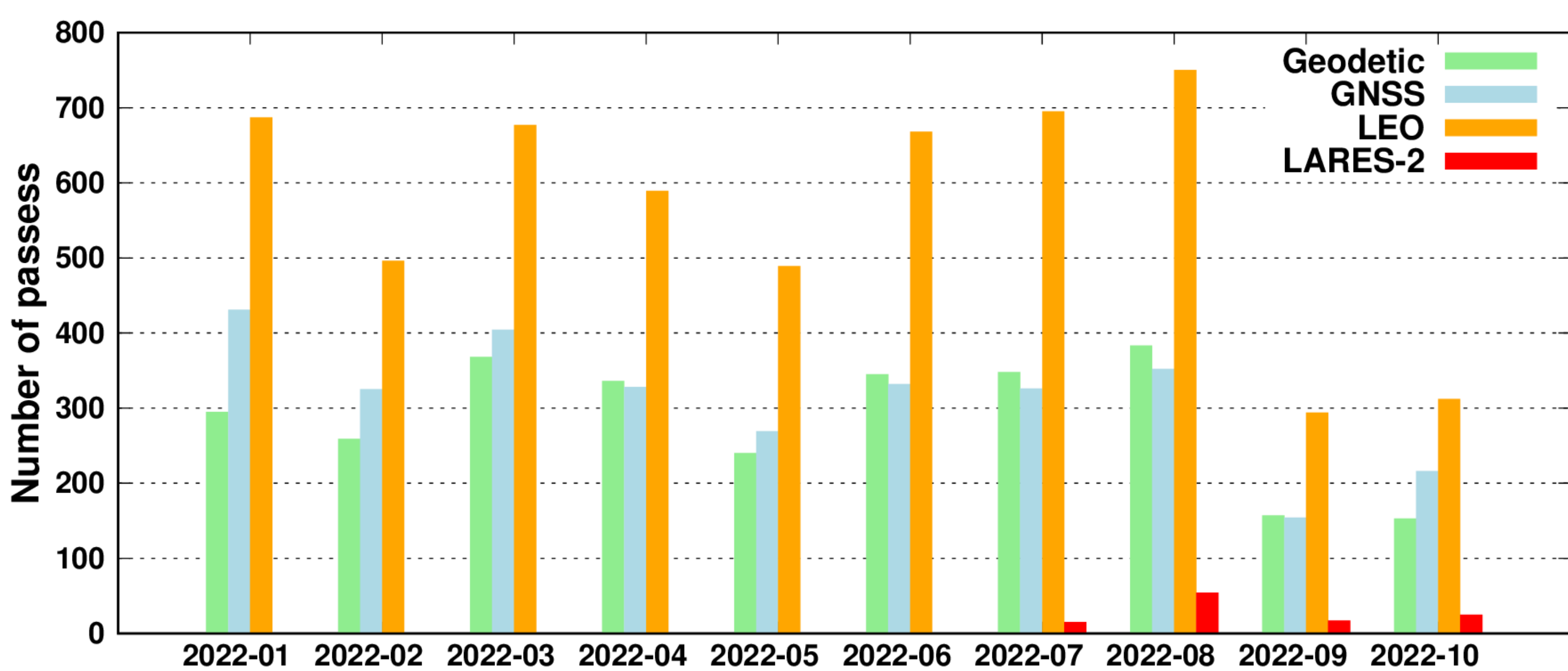


Figure 1: Number of satellite passes tracked at SGF for the period between January – October 2022.

In contrast to that Figure 2 presents the total number of hours spent on observing SLR targets for two selected months in 2022.

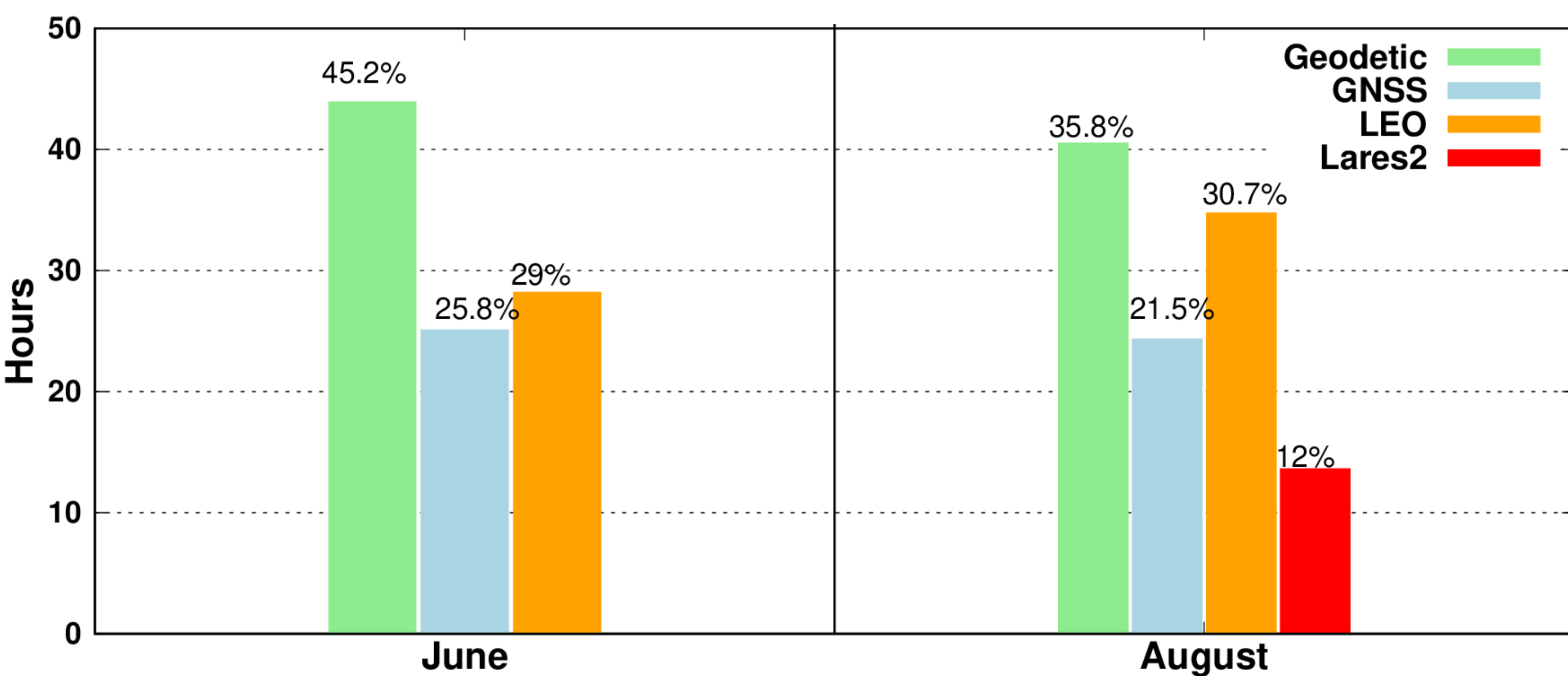


Figure 2: Total number of hours spent observing SLR targets for two selected months; left side June 2022 and one the right side for August 2022.

A typical observing schedule with LARES-2 is presented in Figure 3.

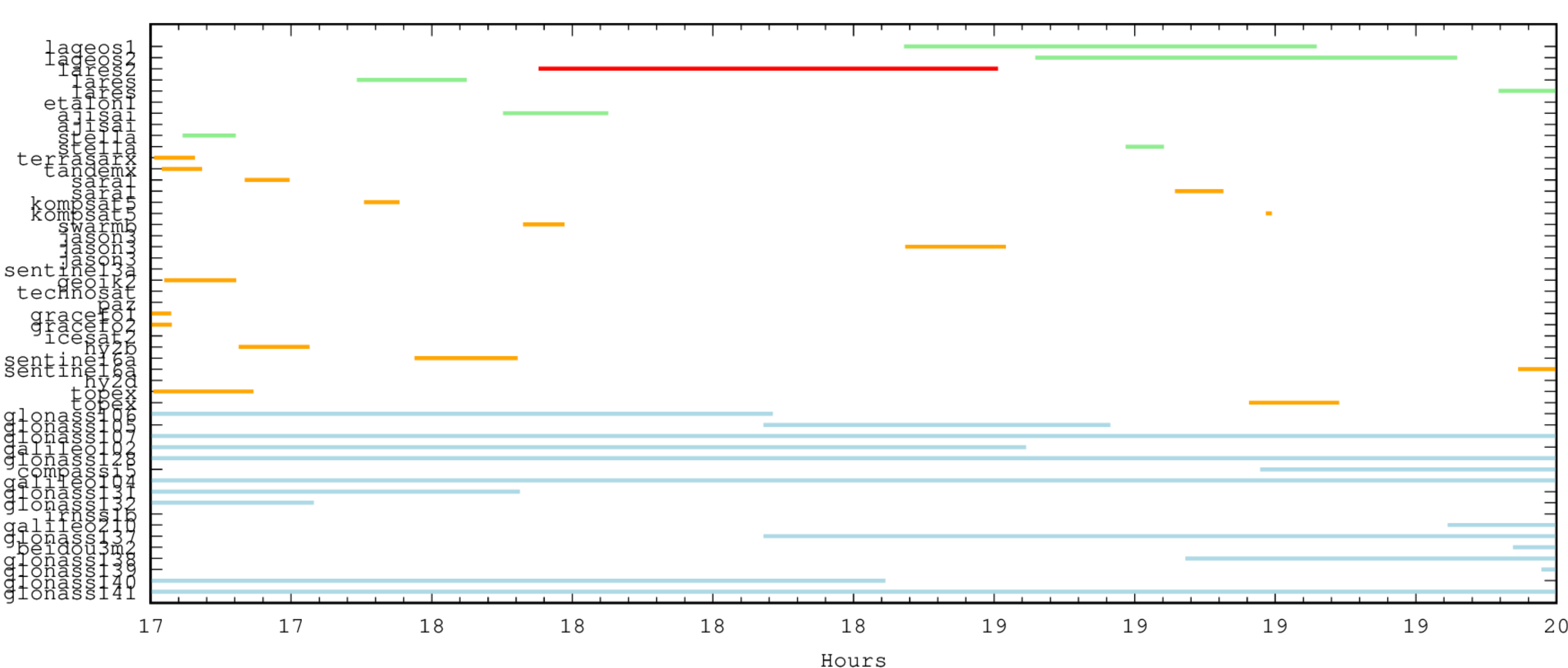


Figure 3: Observing schedule for a 02 August 2022, with LARES-2 shown in red colour.

## QUALITY OF SGF LARES-2 PREDICTIONS

To enable the ILRS global network in making routine observations, especially during daytime, regular and accurate predictions are required, which are based on recent data. The predictions, which are generated automatically every day at Herstmonceux, are based on fits to four days of ILRS network range measurements to determine accurate orbital elements, which are then propagated a few days into the future.

In order to assess the quality of SGF predictions in SPF3 format, a preliminary comparison with respect to LARES-2 precise orbits for radial, along-track and cross-track components was carried out, see in Fig. 4.

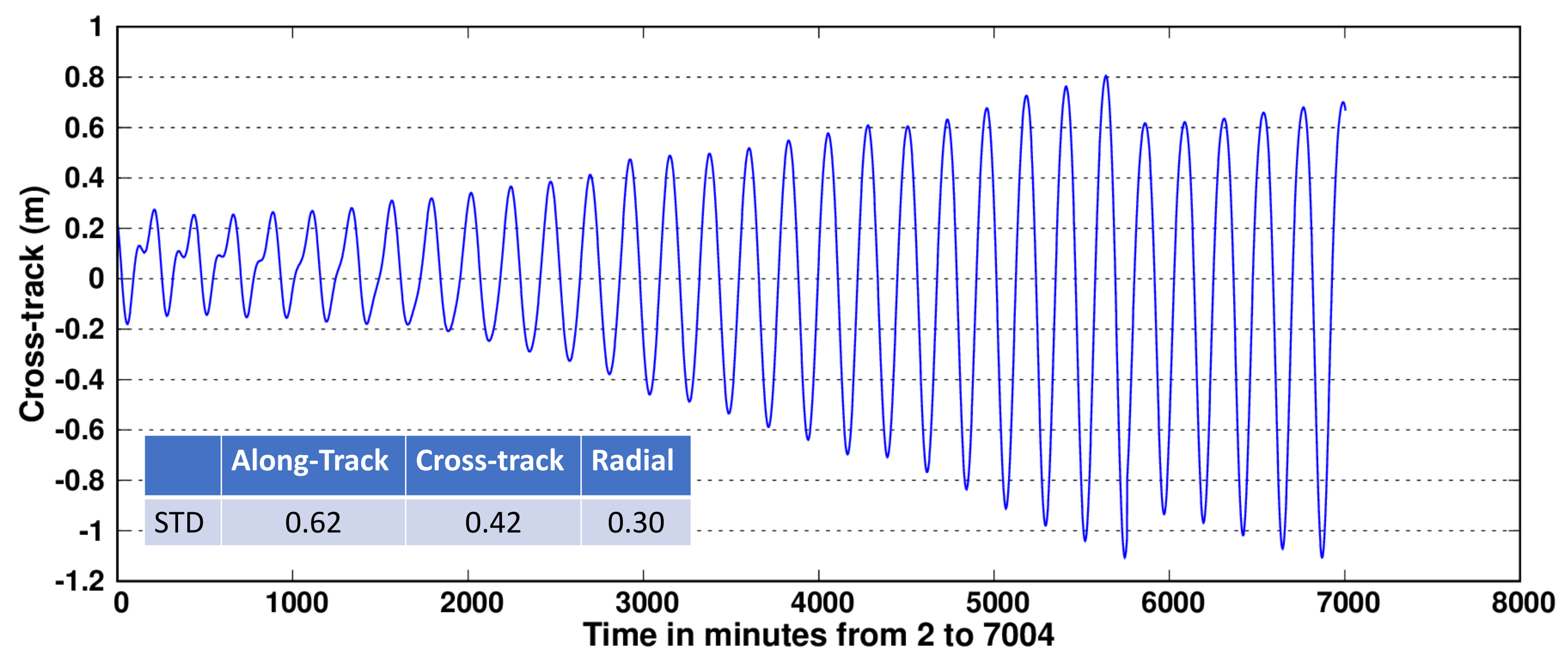


Figure 4: Comparison between LARES-2 predictions in SPF3 format and precise orbits for cross-track component. Additionally, STD values for along-track, cross-track and radial component are also shown.

## ASSESSMENT OF LARES-2 SLR SOLUTIONS

Two analysis approaches for determining the initial impact of adding LARES-2 into our SLR processing were carried out. First, examining the RMS of post-fit residuals (Fig. 5) and second comparing LARES-2 RMS of 7-day orbital fits with respect to LAGEOS 1/2 and Etalon 1/2 satellites (Fig. 6).

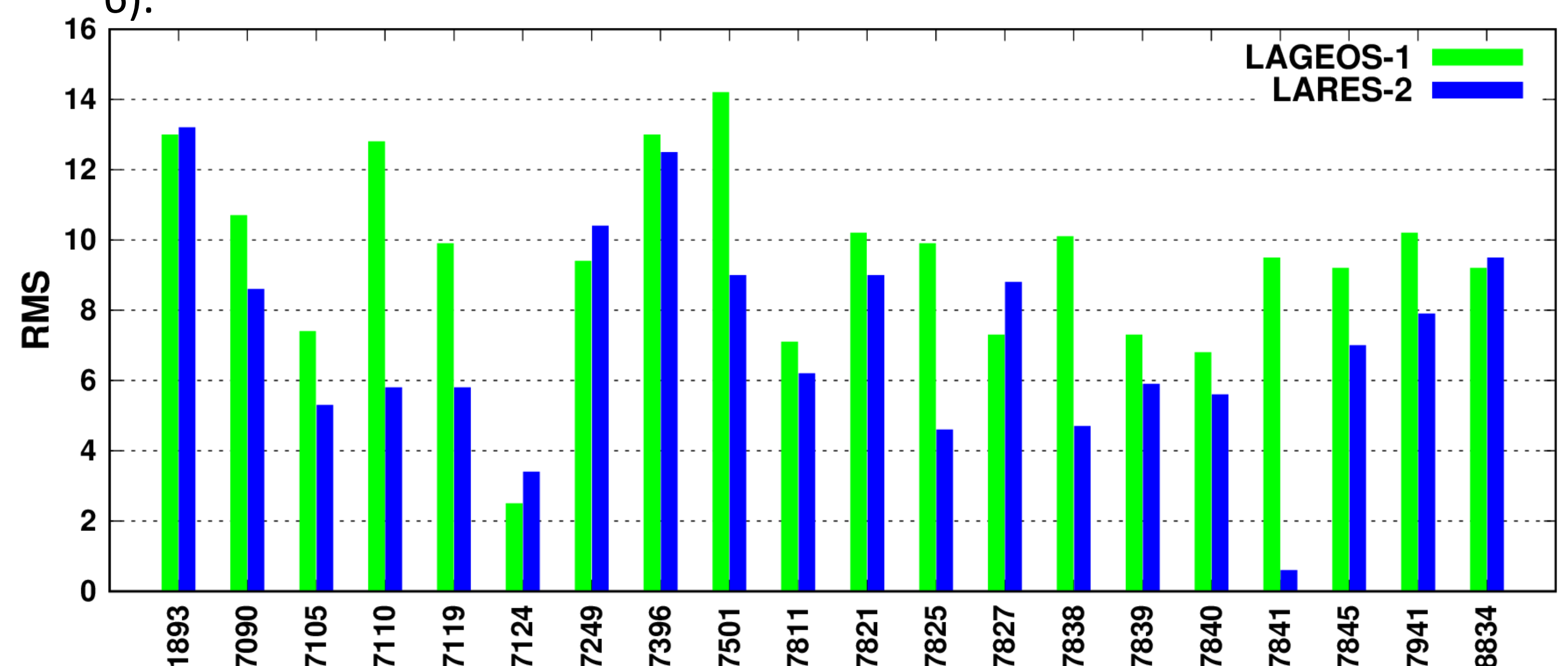


Figure 5: RMS values of post-fit range residuals for selected SLR stations.

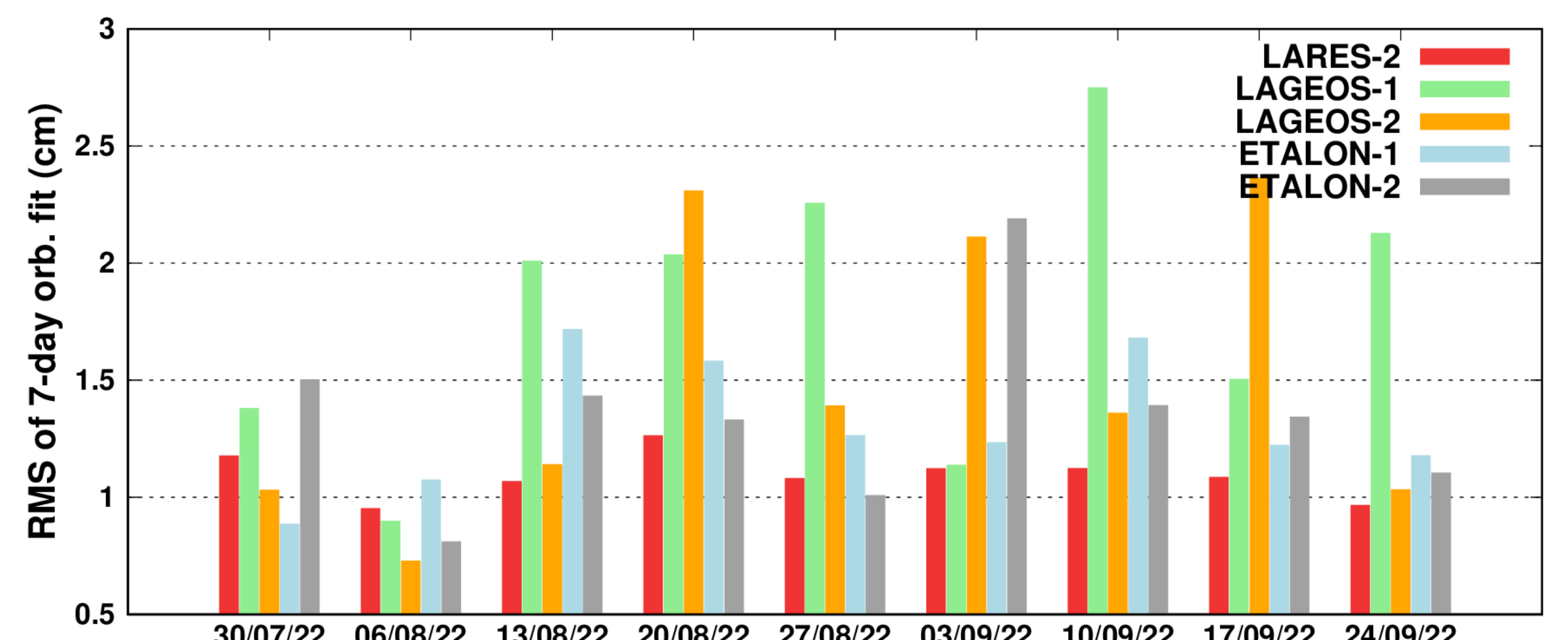


Figure 6: RMS values of 7-day orbital fits for period between 30/07/2022 – 24/09/2022.

## SUMMARY

- Adding LARES-2 into observing schedule does not have major impact on the total number of tracked passes (Fig.1) however it does have an impact on the total hours spent observing (Fig.2). Keeping in mind that monthly analysis does not depend only on observing schedule (Fig. 3) but also highly on the weather conditions.
- We have shown that SGF LARES-2 predictions accuracy does not deteriorate significantly over time and is on the level of  $\sim 0.5$  m for standard deviation for all three components (Fig. 4).
- In terms of quality of LARES-2 solutions, initial results, based on RMS values of post-fit range residuals (Fig.5) and orbital fits (Fig. 6) show that they are on the same level as for LAGEOS-1 or in even better (Fig. 5, Fig. 6) in some cases.