Determination and analysis of Herstmonceux geodetic heights 1984-2022

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British Geological Survey

Natural Environment Research Council

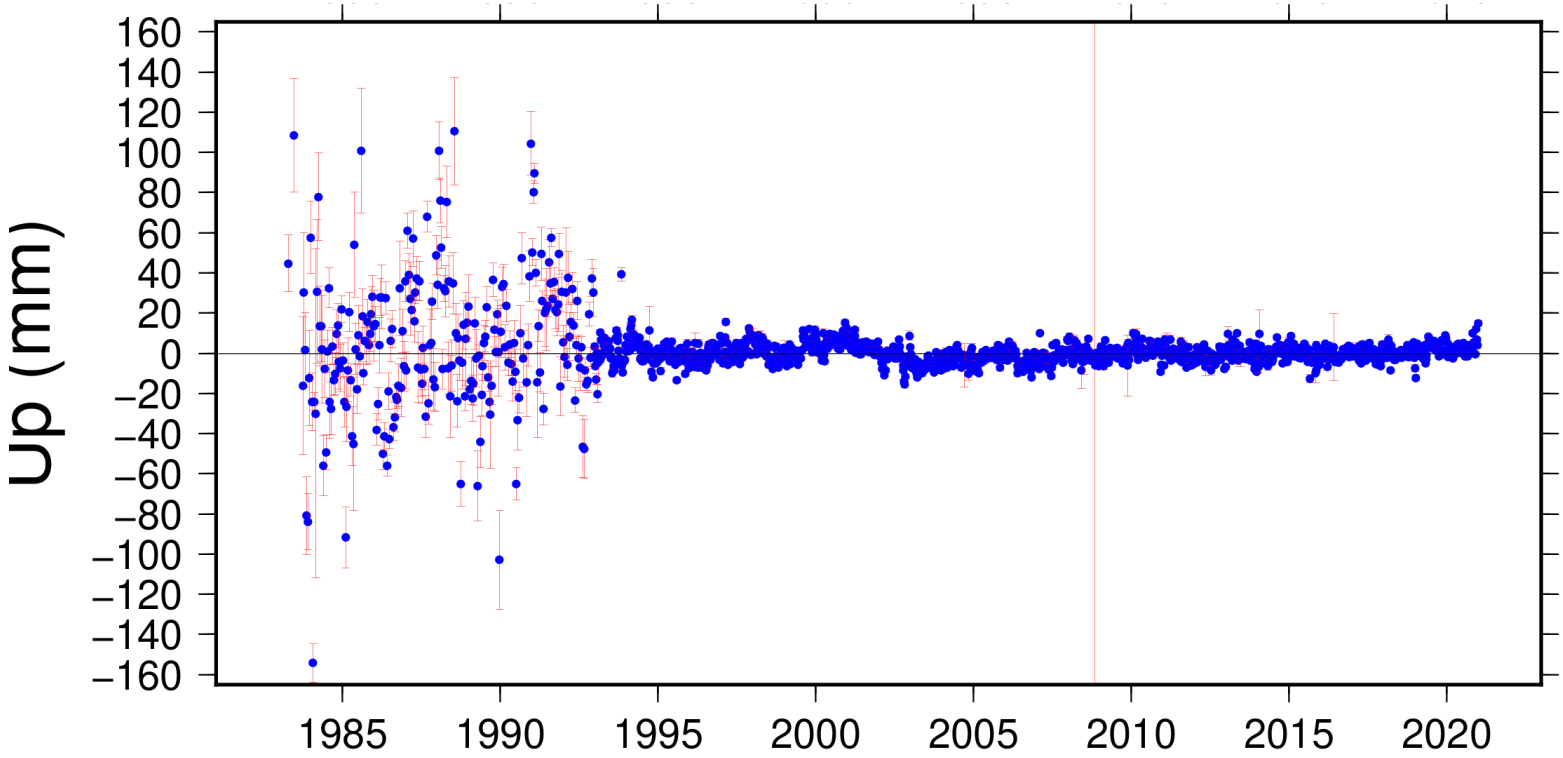
OUTLINE

- The Herstmonceux height time series from ITRF2020.
- Some systematic features remain that are non-geophysical.
- We generate our own time series taking account of known instrumental limitations.

In particular, we revisit the impact on data accuracy of the Stanford counters, in use between 1994 and 2007.

- We review our corrected height time series.

HERSTMONCEUX HEIGHT TIME SERIES FROM ITRF2020



(https://itrf.ign.fr/plots/ITRF2020/slr/plot/7840_13212S001.png)

HERSTMONCEUX HEIGHT TIME SERIES FROM ITRF2020

Given the long timespan of observations 1983-2022, and attention to reducing systematics as much as possible (e.g., single-photons, improving hardware, prolific, etc.;), as well as the ASC strategy of accommodating RB in dynamical solutions.

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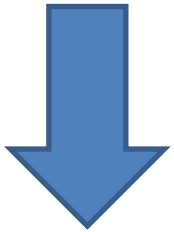
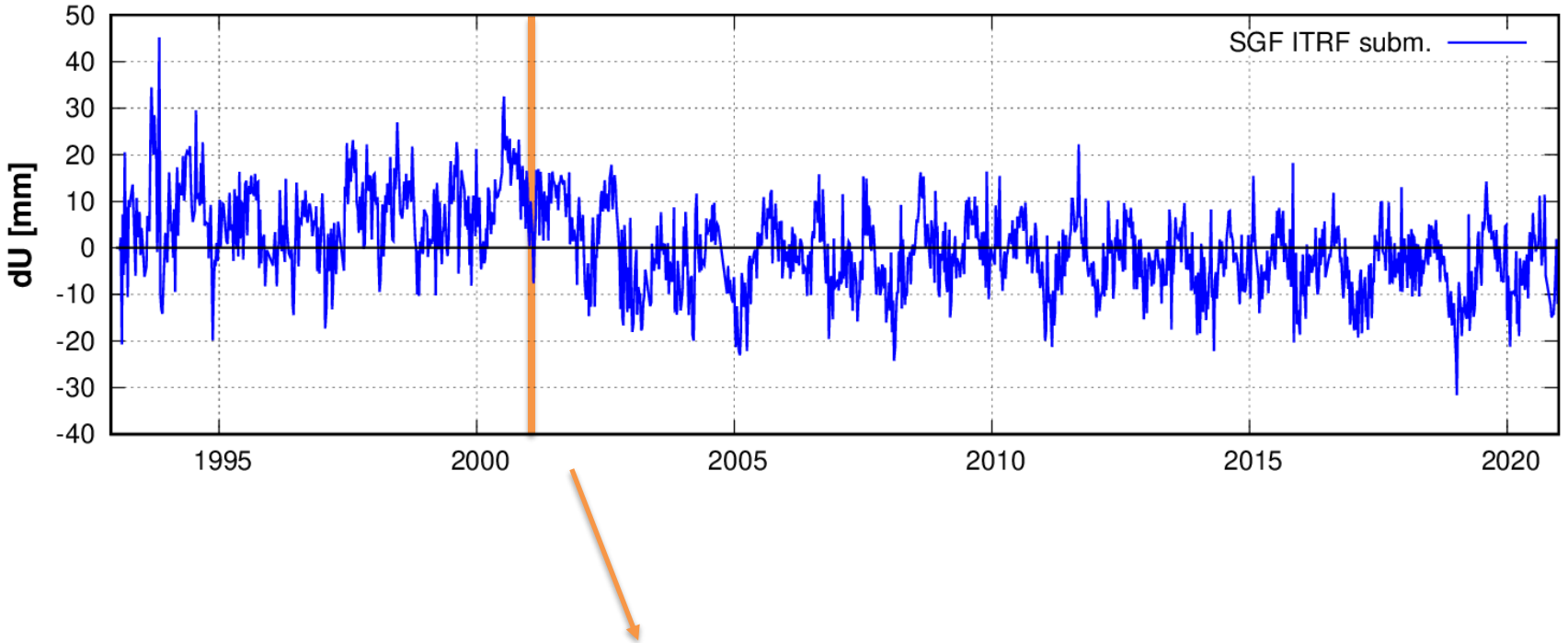


The deduced site coordinates **should be reaching** GGOS goals of mm-accuracy and 0.1mm/y stability. This is clearly not the case for this site, in which we have vested interest.

Of course, for 1983-1992, only the LAGEOS and a 30mm-level event timer could be used. The early data nonetheless is valuable (pre-GPS), but not considered further here.

SUBMISSION FROM SGF AC FOR ITRF2020



Clear problem by the end of 2002, but otherwise less problems than in ITRF2014?

SUBMISSION FROM SGF AC FOR ITRF2020

- Seven-day orbital solutions using the two LAGEOS and two Etalon satellites:
  - SATAN code;
  - Updated CoM values from Rodriquez *et al, J Geod,* 2019;
  - ASC Data Handling File for mean range-bias values

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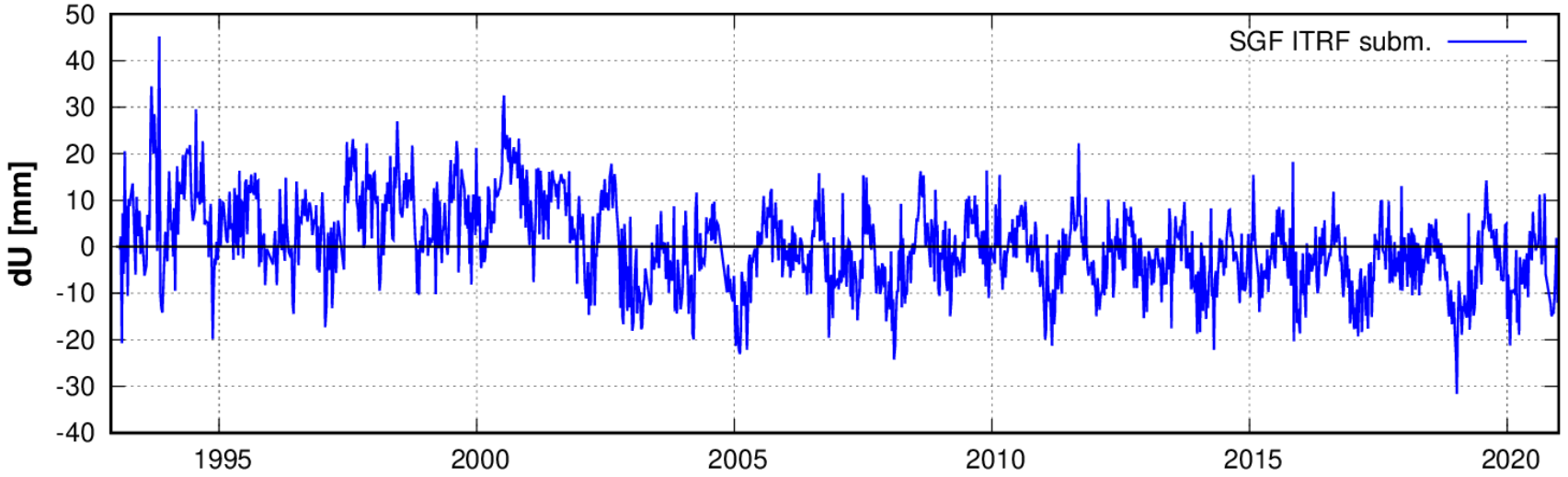
- But the range-dependent errors imposed by the Stanford counters:
  - Were regrettably NOT properly taken into account in these or the previous SSEM solutions;

- Counters were in use 1994-2007 -> Extensive measurements of range-dependent (satellite) plus fixed (calibration) bias.
  - Reported at ILRS Workshop #15 (Gibbs) and in SLRMail 0891, Appleby & Gibbs, Jan 2002.

HISTORY OF STANFORD COUNTERS AT HX



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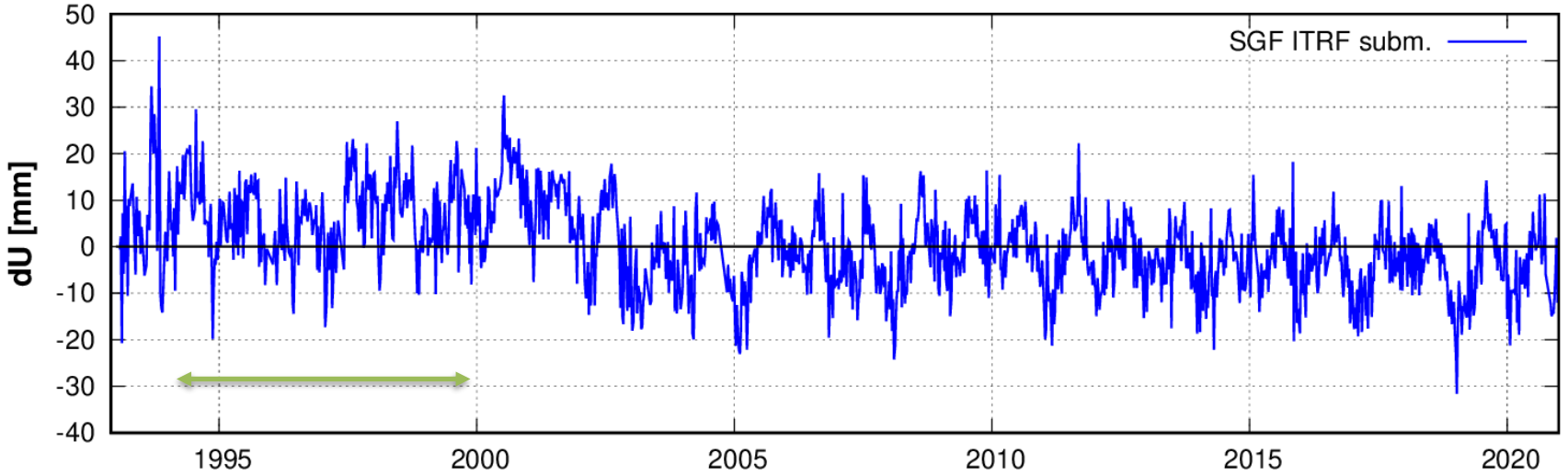

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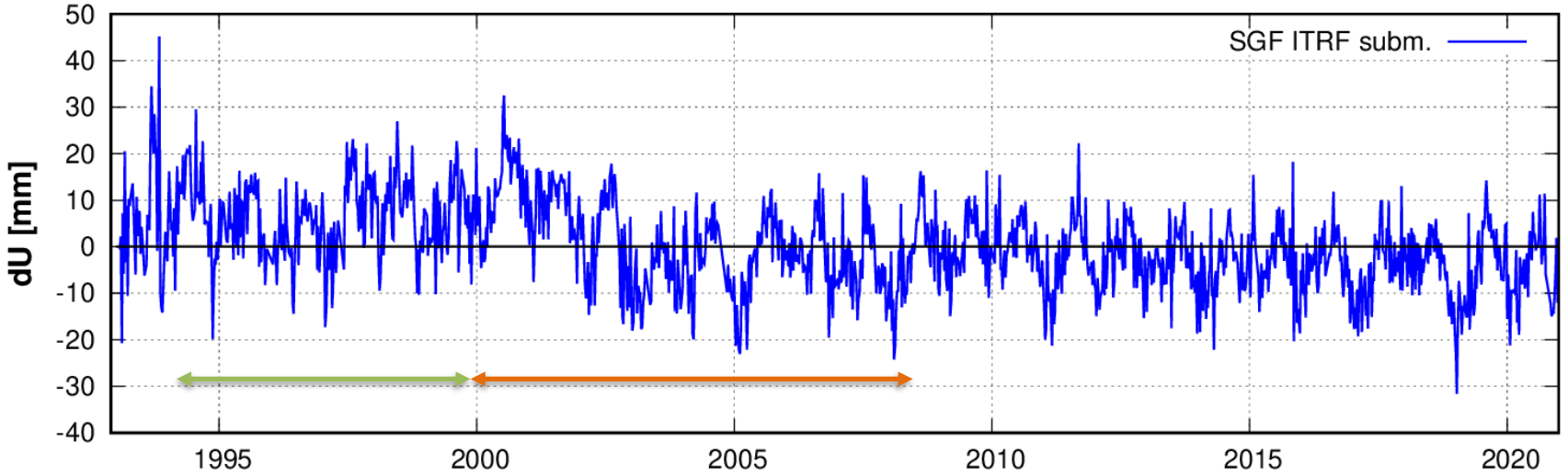

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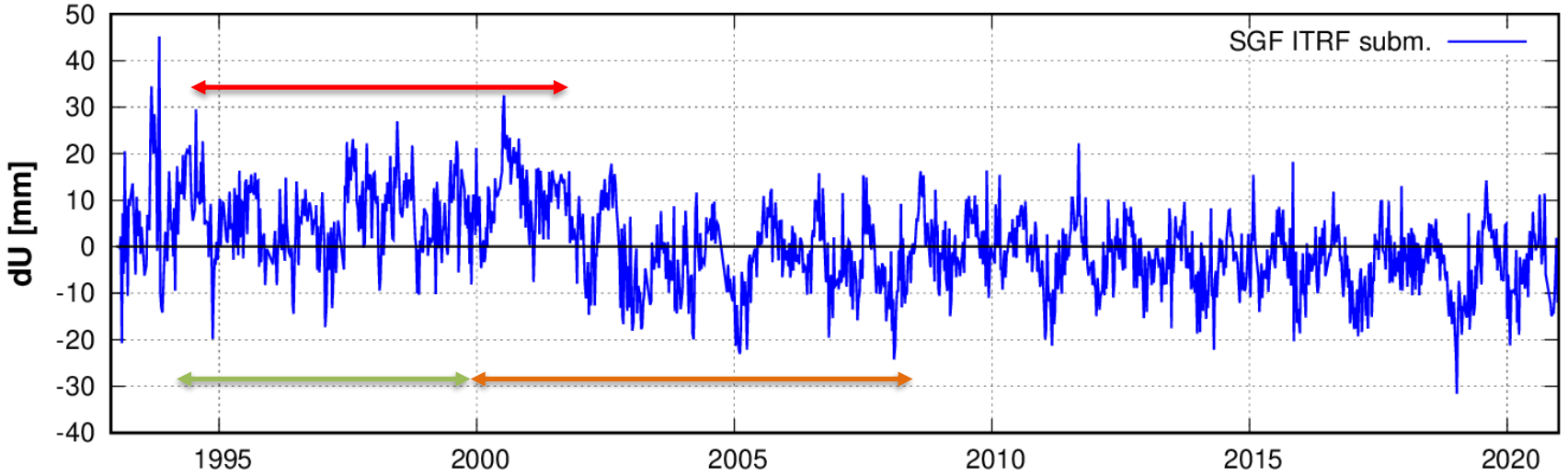

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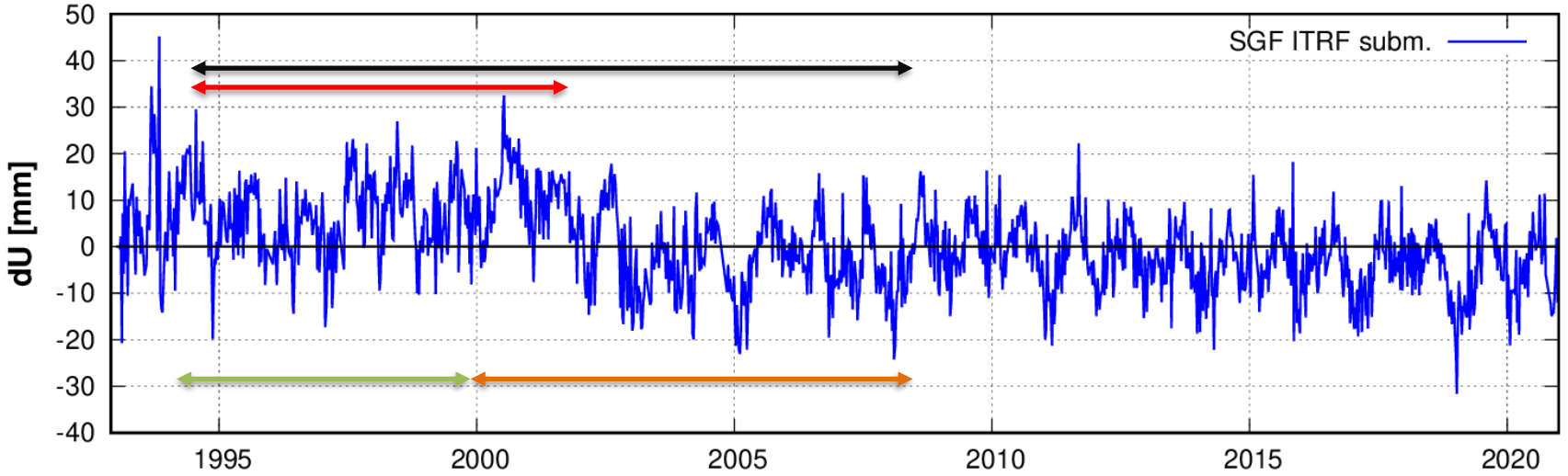

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There is an additional fixed bias of 8.5mm for whole period; from close-range (target board) counter error. Will have been removed by solution for RB in the orbit fits + handling file.

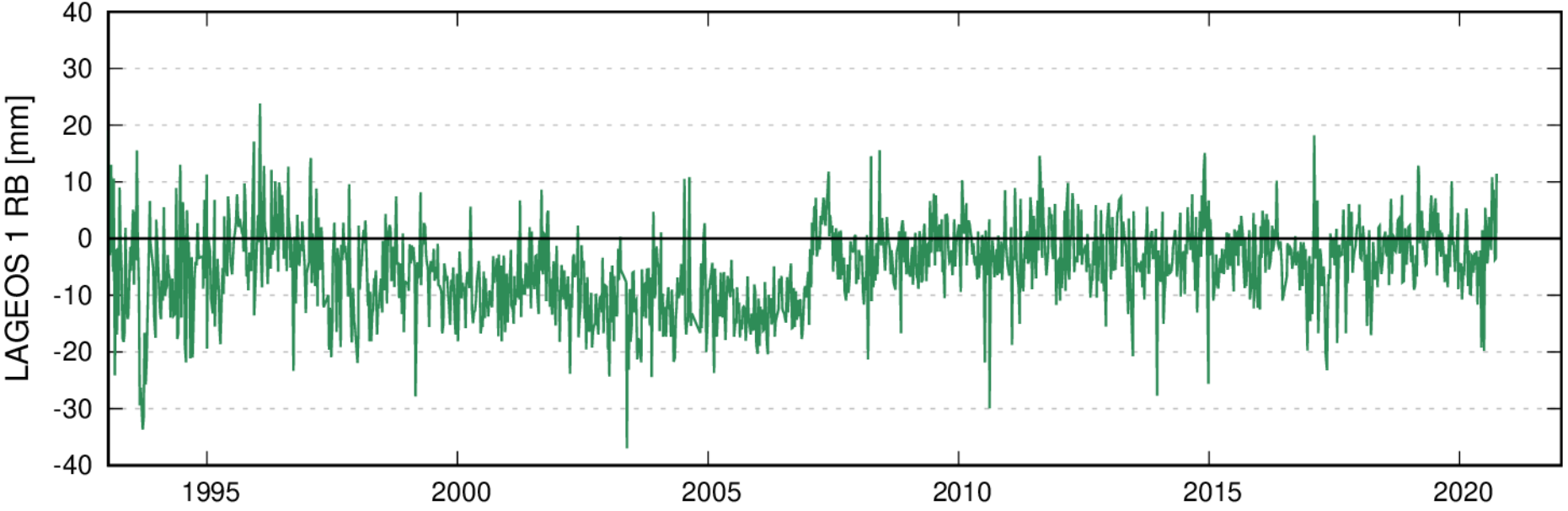
INTERNAL REPROCESSING

To accommodate Stanford systematics:

- SSEM PP type of processing.
- Estimating range-biases for every 7-day arc for Herstmonceux along with station coordinates and Earth Rotation Parameters.
- Application of range-dependent and fixed-value error to normal-point as appropriate.
- Investigating impact on estimated range-biases,
- and on the station height time series.

RANGE BIASES (LAGEOS 1)

It is interesting to look at the RB results:



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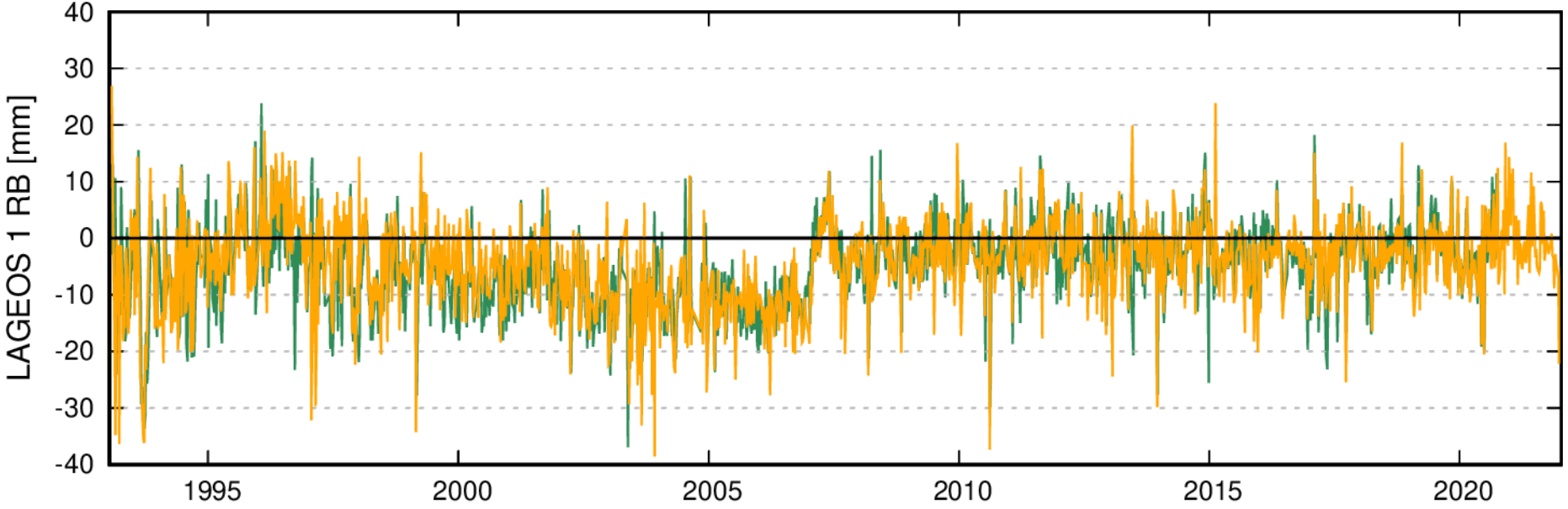

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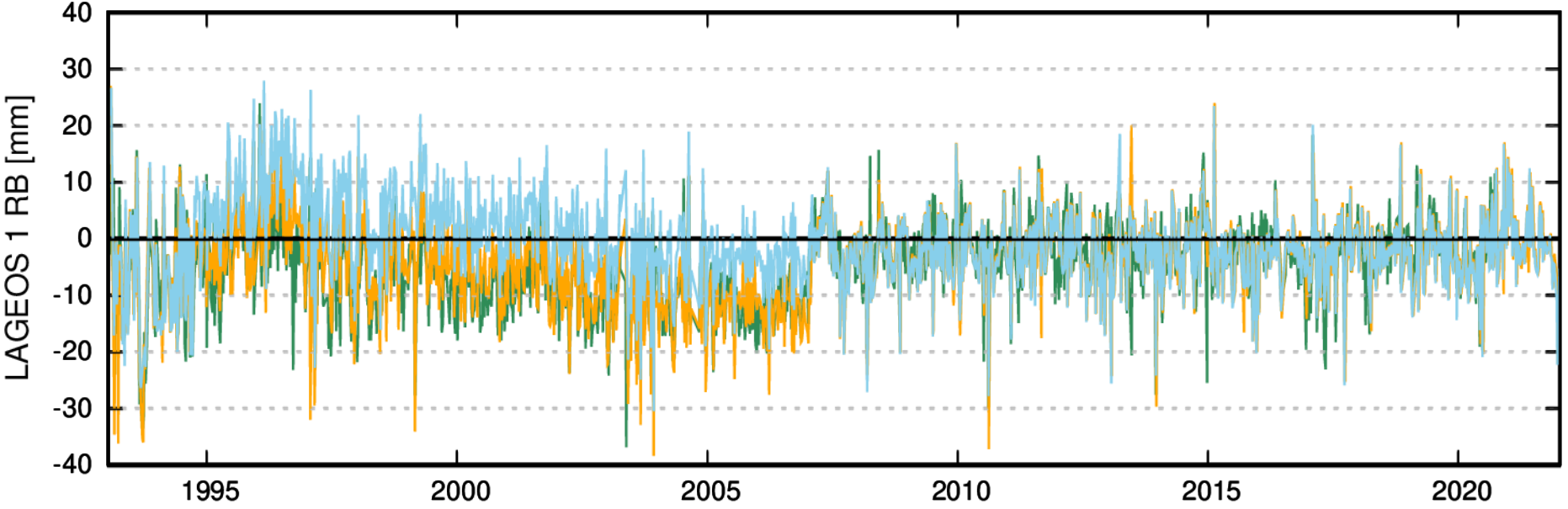

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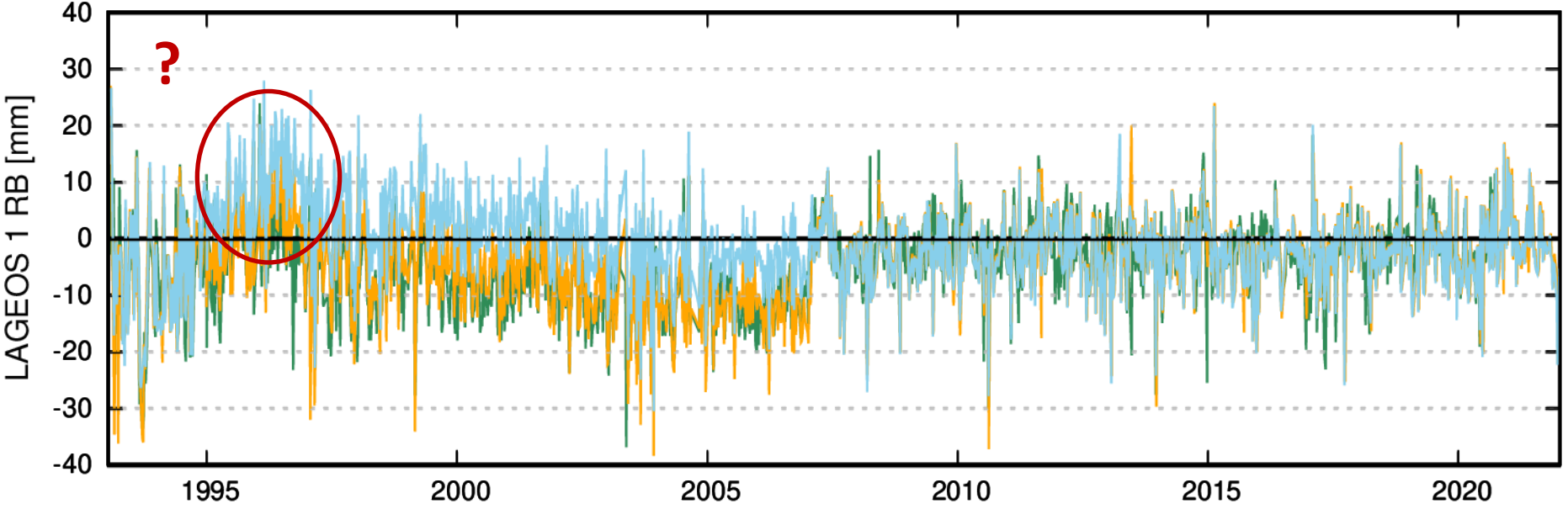

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FINALLY – HERL HEIGHT TIME SERIES 1993-2022

- All known corrections applied to each normal point.
- RB solved-for along with reference frame - at the expense of some increase in noise, essentially bias-free. Standard errors shown in plot are result of full covariance analysis.
- Outliers excluded from fit based on large STD. error, shown on plot without error bars.
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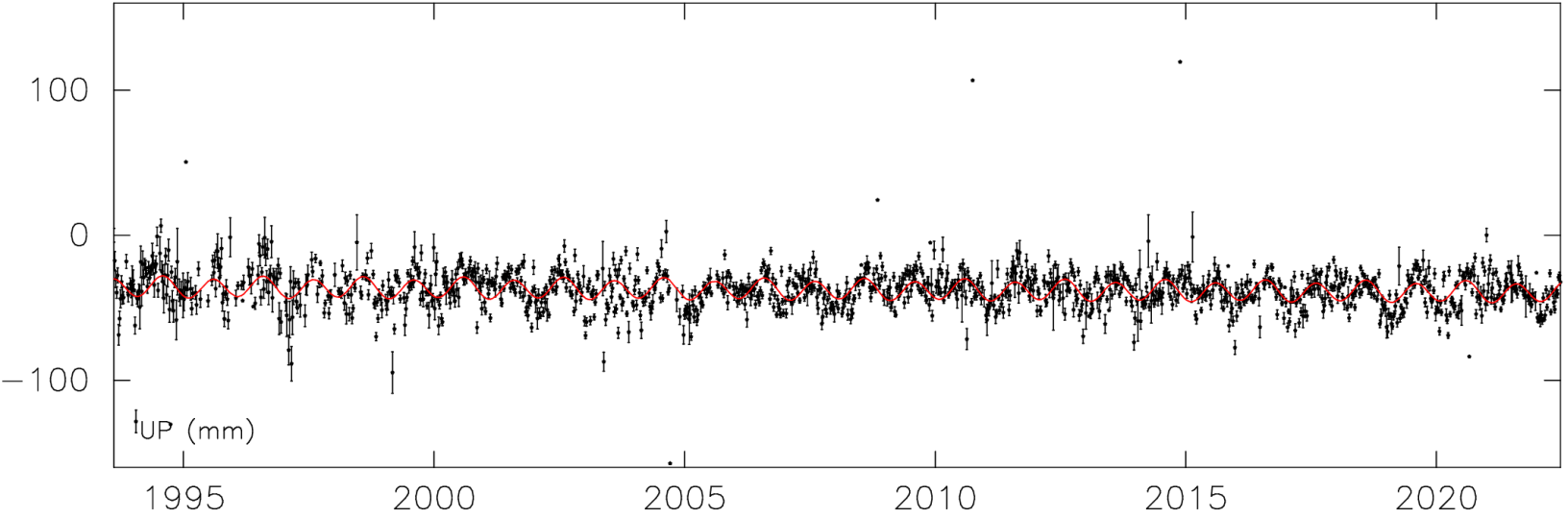

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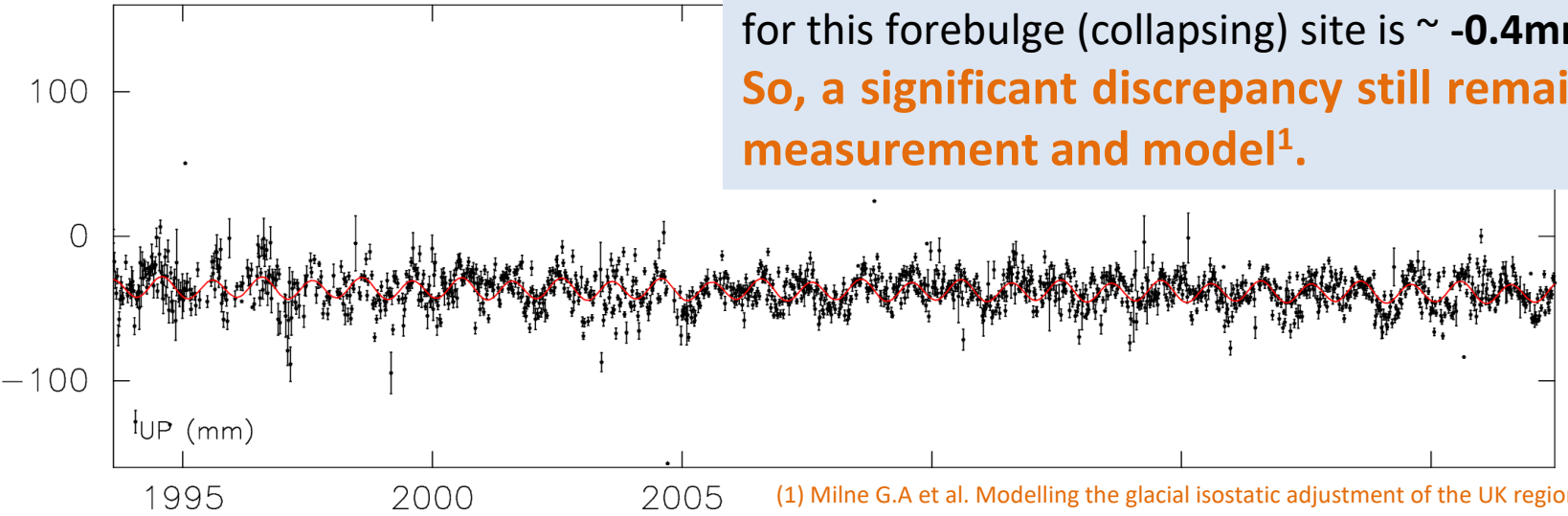
Linear term is -0.12 +/- 0.04 mm/yr; Modeled GIA signal for this forebulge (collapsing) site is ~ **-0.4mm/yr.**

So, a significant discrepancy still remains between measurement and model[1].



(1) Milne G.A et al. Modelling the glacial isostatic adjustment of the UK region; *Phil. Trans. R. Soc. A.*

Thank you