

ESA'S Earth Orientation Parameter Product

S. Bruni², E. Schoenemann¹, V. Mayer³, M. Otten², T. Springer², F. Dilssner², W. Enderle¹, and R. Zandbergen¹

1 Navigation Support Office ESA/ESOC

2 PosiTim@ESA/ESOC

3 LSE Space@ESA/ESOC

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- Motivation
- Overview of the ESA EOP software
- Evaluation of products
- Future perspective
- Conclusions

ESA's Navigation Support Office will provide an independent solution for the Earth Orientation Parameters (EOPs) in order to ensure the unrestricted access to space for ESA, EC and European industry.

- All the required input geodetic products are generated by ESA
- ESA is still relying on a single non European provider for EOP products.

ESA's Navigation Support Office is responsible for providing the Geodetic reference for ESA missions, and acts as Coordinator of the Galileo Reference Service Provider (GRSP) to provide the Geodetic reference and corresponding EOP's to Galileo.

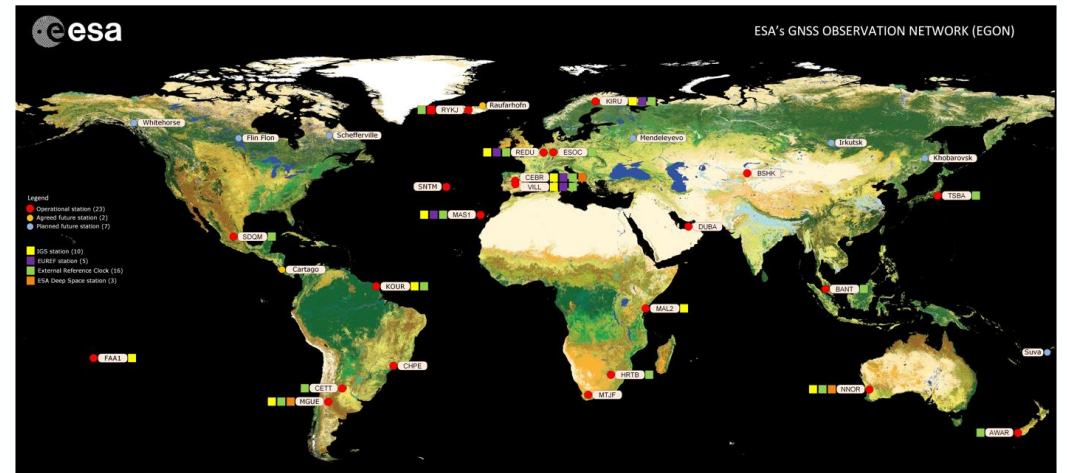
ESA operates Ground Infrastructure

- [ESA's GNSS Observation Network \(EGON\)](#)
- ESA/Europe is building up SLR stations
- European Space Tracking network (ESTRACK)
Note: Stations and correlator are not yet ready for VLBI

ESA operates Data Centres

- [GNSS Science Support Centre \(GSSC\)](#)

ESA generates all the geodetic products needed for the computation of EOPs (see Schönemann et al. in Session G2.3)
ESA routinely contributes as an official AC to IGS, ILRS and IDS; the analysis capability of VLBI data is also being finalized.



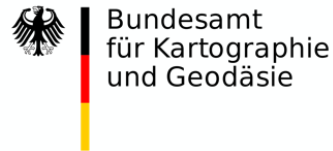
ESA's EOP Software Development



ESA's Earth Orientation Parameter generation and prediction software has been developed by:



Reference:
Dill et al., JGR, 2020
doi: 10.1029/2020JB020025

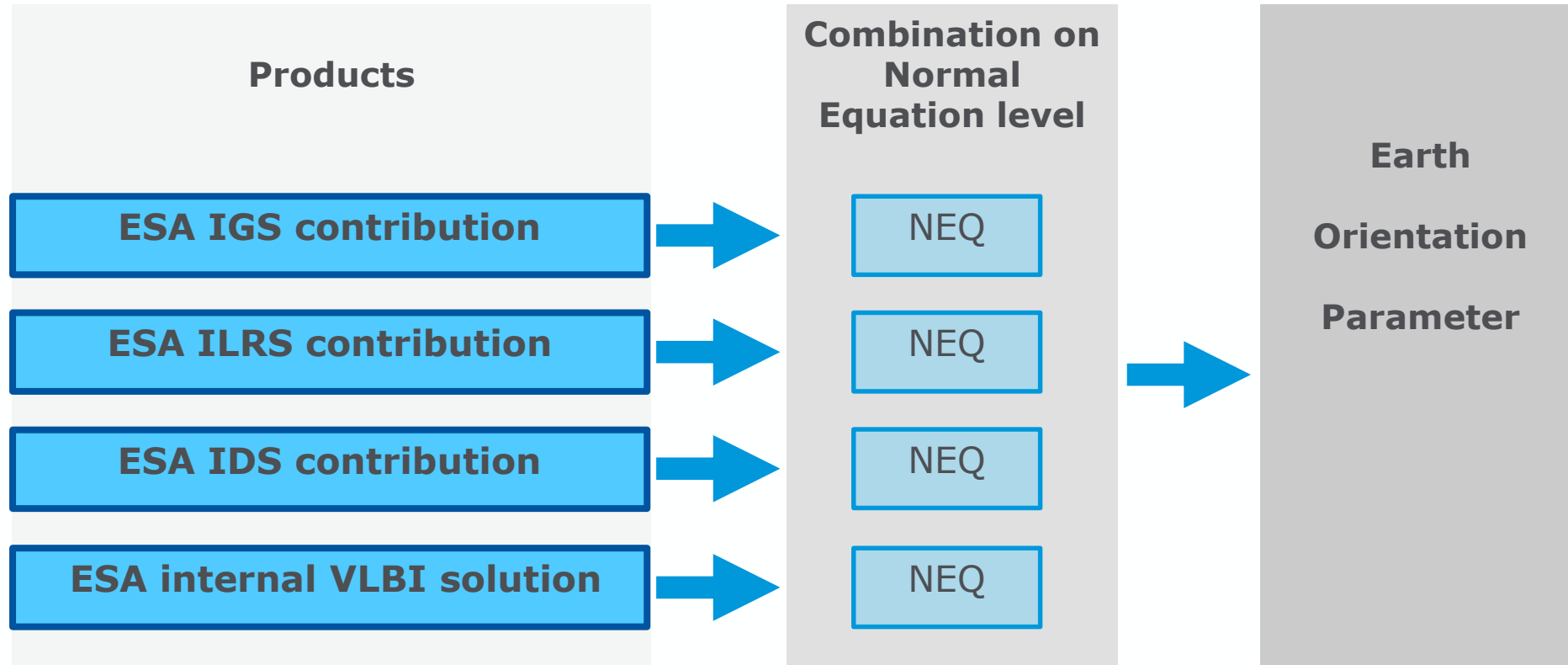


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in the frame of an ESA study activity. The study was successfully concluded in October 2020.

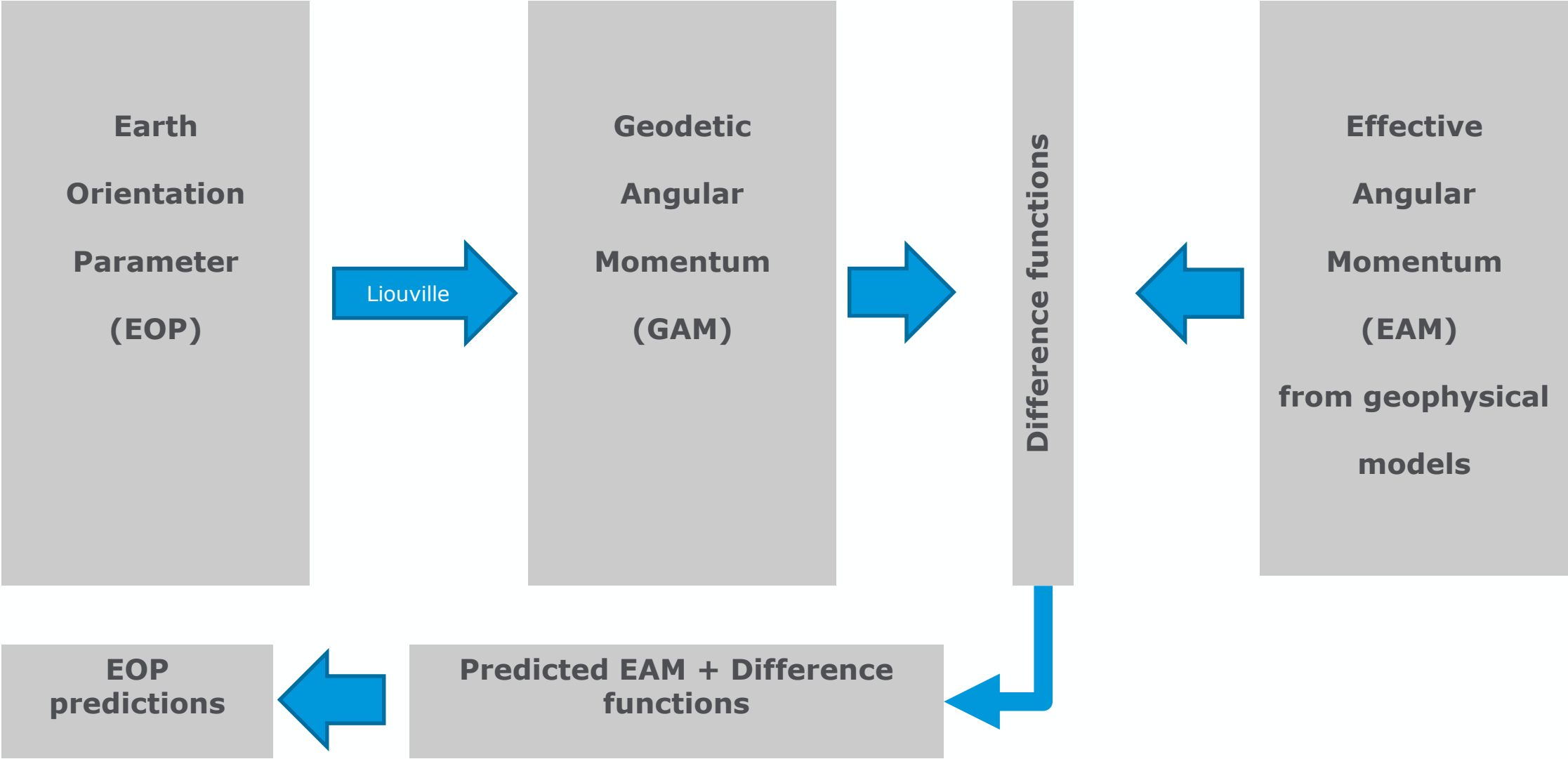




Advantages:

- Highest consistency: same software and models used in the data analysis
- The combination on NEQ level allows to take correlations into account

ESA approach to EOP predictions



ESA's EOP Software Operation



The software is currently operated on the ESA/ESOC infrastructure in pre-operational mode.

Two runs are performed every day at 10:00 and 22:00 (official daily solution) UTC.

Two test campaigns were run:

- 1st campaign: 01/11/2020 – 26/12/2020
- 2nd campaign: 07/03/2021 – ongoing

The geodetic solutions used in the analysis are ESA's official contributions to the IAG Services, with the only exception of VLBI. The ESA VLBI solution is implemented, tested and shows good results (@Schönemann et al. vPICO in Session G2.3 for more details), but it is not operational yet. For the transition period, the EOP setup will rely on the DGFI-TUM solutions for 24h rapid sessions and the BKG solutions for 1h intensive sessions. EAM functions are provided by GFZ.

It is expected that the software will become fully operational in the third quarter of 2021.

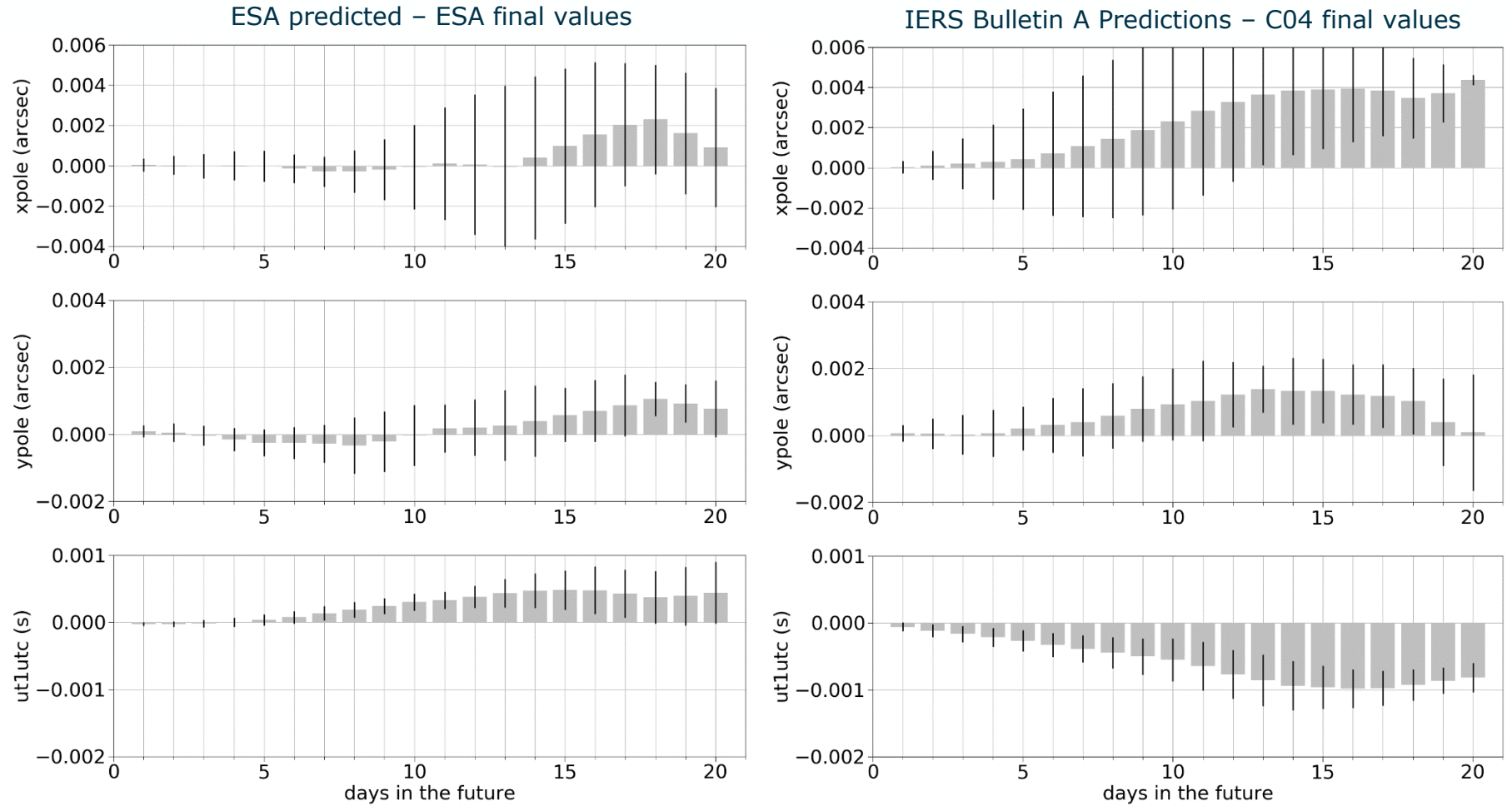


Evaluation of Internal Consistency (from 1st campaign)



Comparison of ESA predicted (PRE) against ESA final (FIN) values with a latency of 30 days. Histogram bars show the average discrepancy, whiskers show the standard deviation.

The corresponding results computed over the same period using the IERS BulletinA results are shown for comparison.



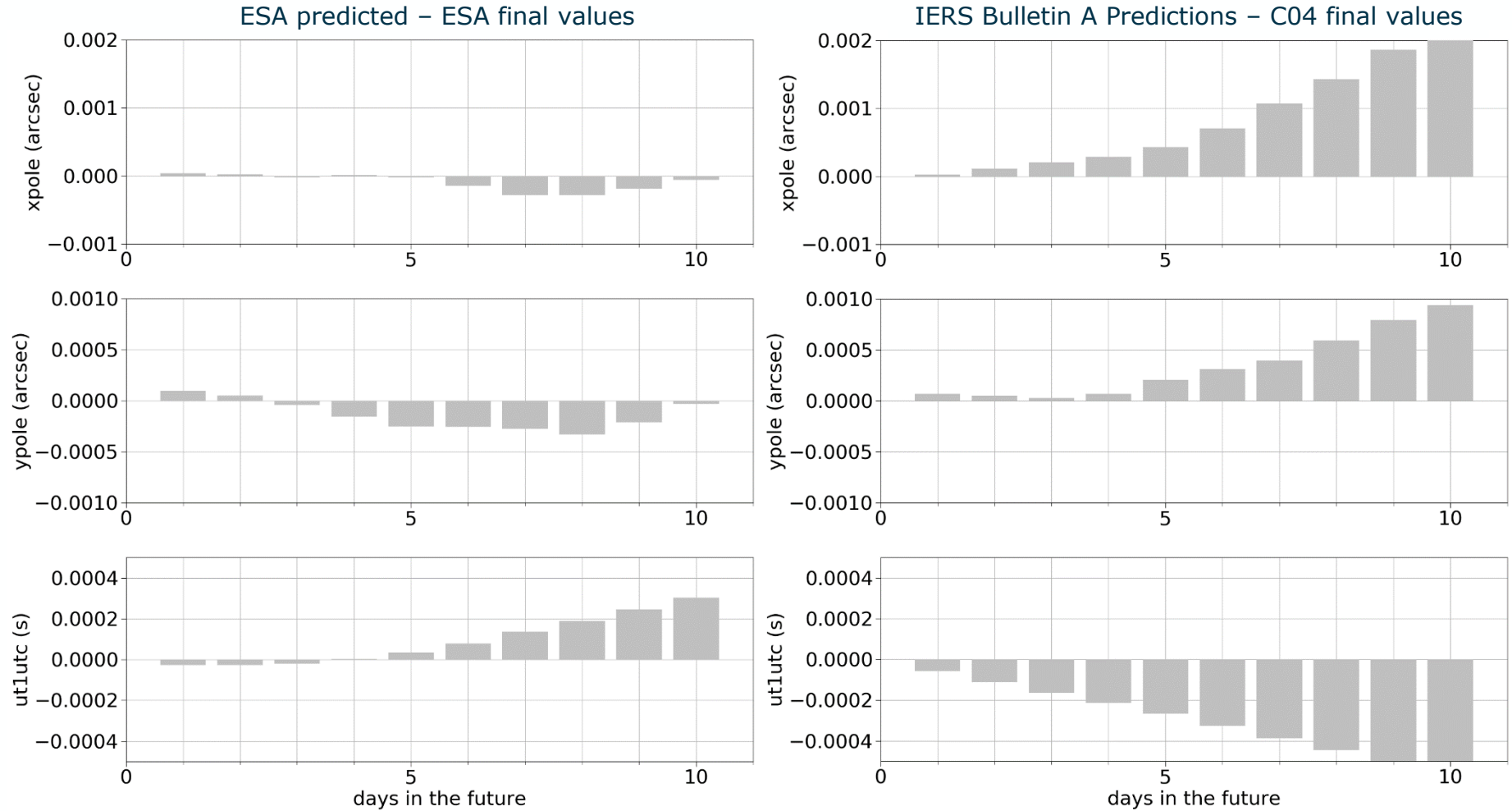
!These results are still preliminary, as all the displayed statistics rely on a limited number of points: considering the length of the test campaign, only 27 epochs were available to evaluate the performance of predictions referred to 1 day in the future (8 epochs for 20day-predictions). No outlier rejection was performed.



Evaluation of internal consistency – *close-up*

Whiskers are not reshown. However, note that most of these offsets are not significant if the standard deviations are considered (see previous slide).

The displayed average values are likely to be time-dependent.

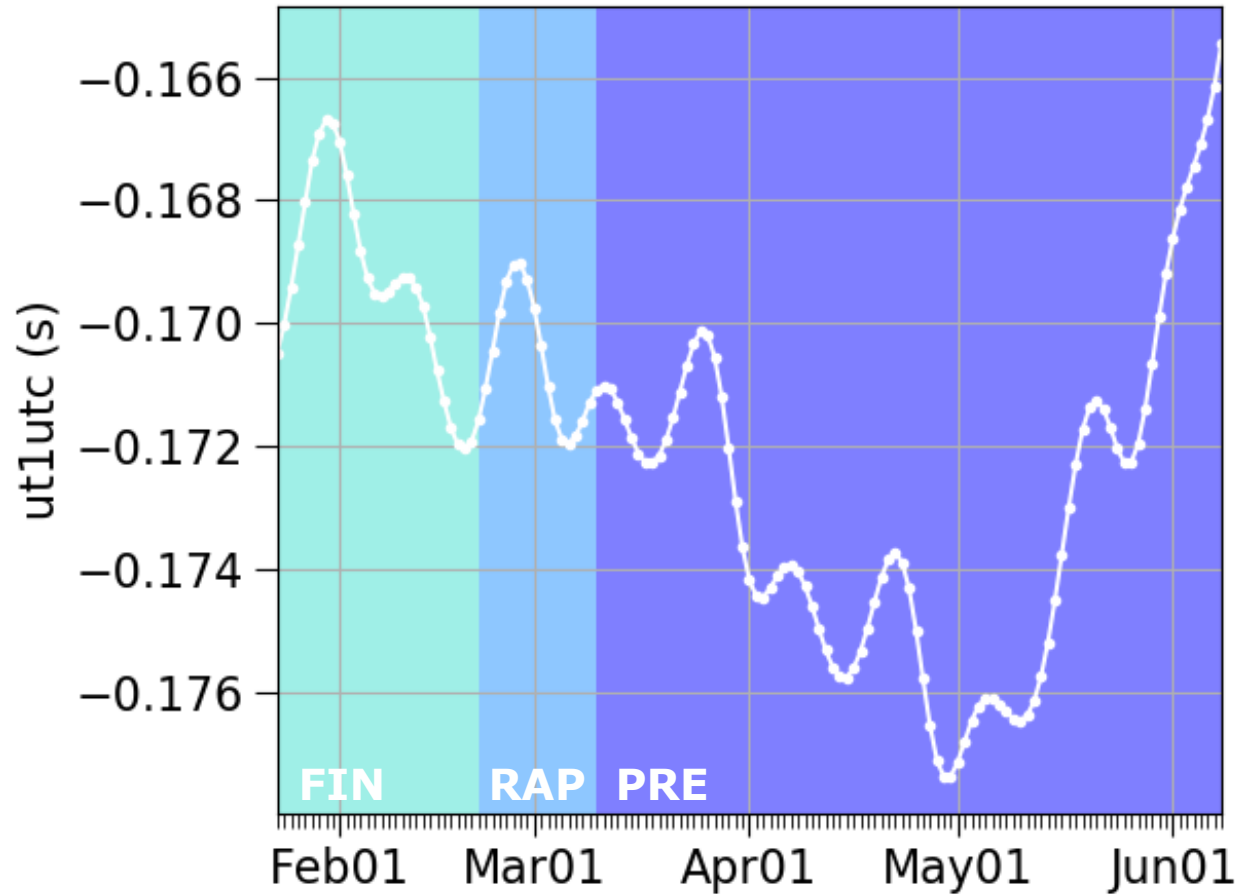


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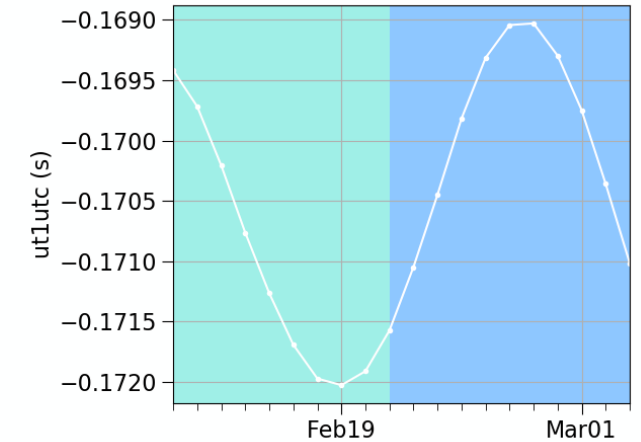
Continuous Solution (FIN-RAP-PRE values)

The processing ensures a seamless transition between final, rapid and predicted values.

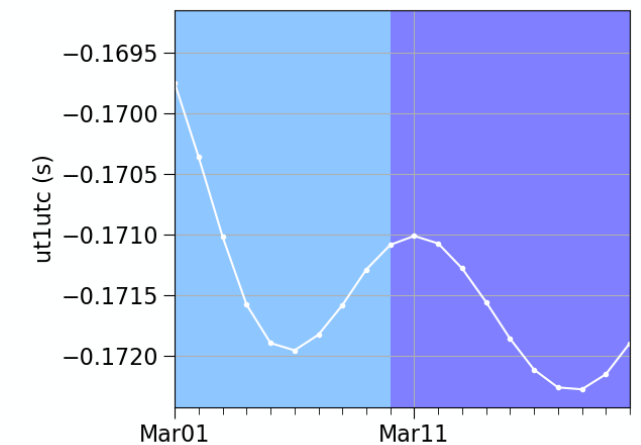
Results computed on March 10, 2021



- Transition between FIN and RAP values

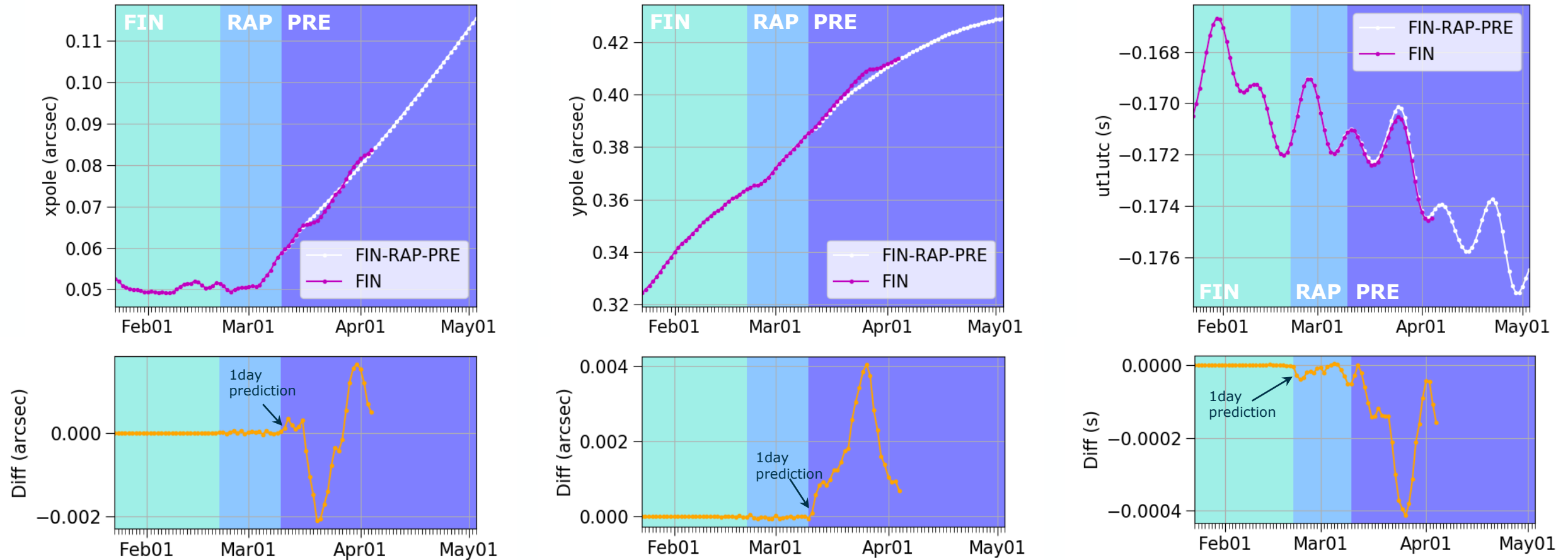


- Transition between RAP and PRE values



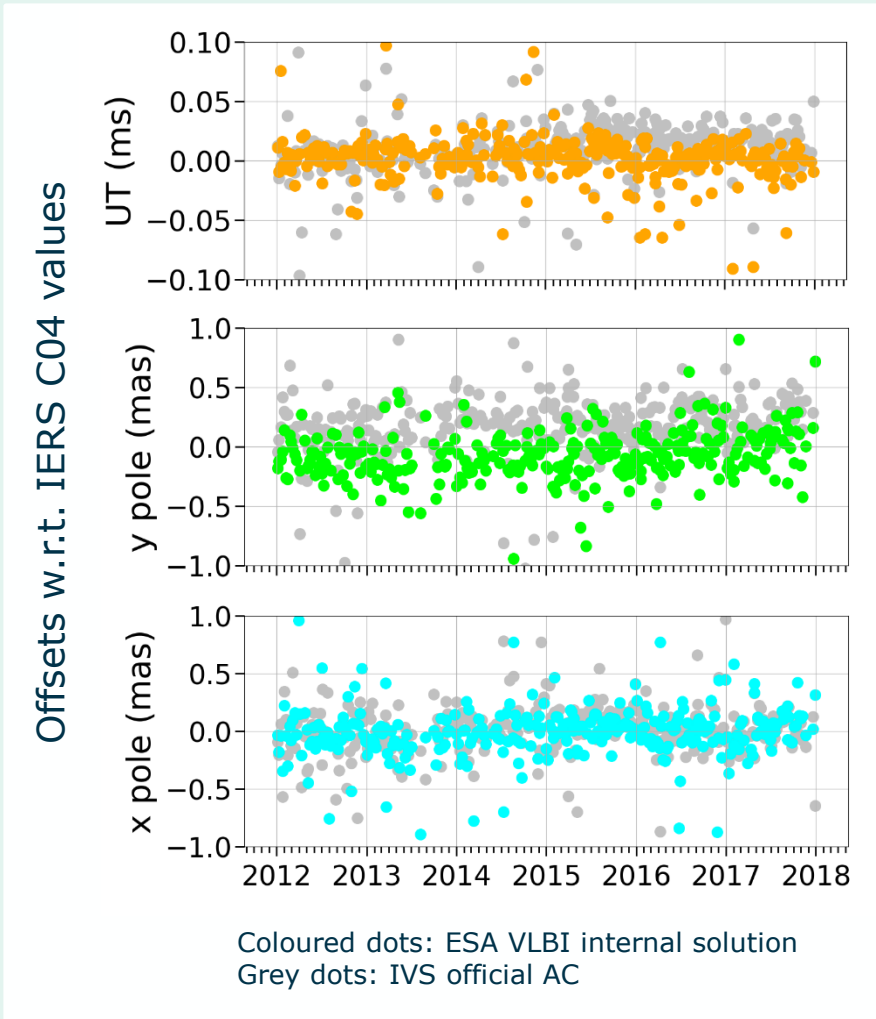
Comparison between two ESA EOP files

Comparison of FIN-RAP-PRE results generated on March 10 vs FIN results available as of April 22. The performance of the prediction generated for 1 day into the future is highlighted.



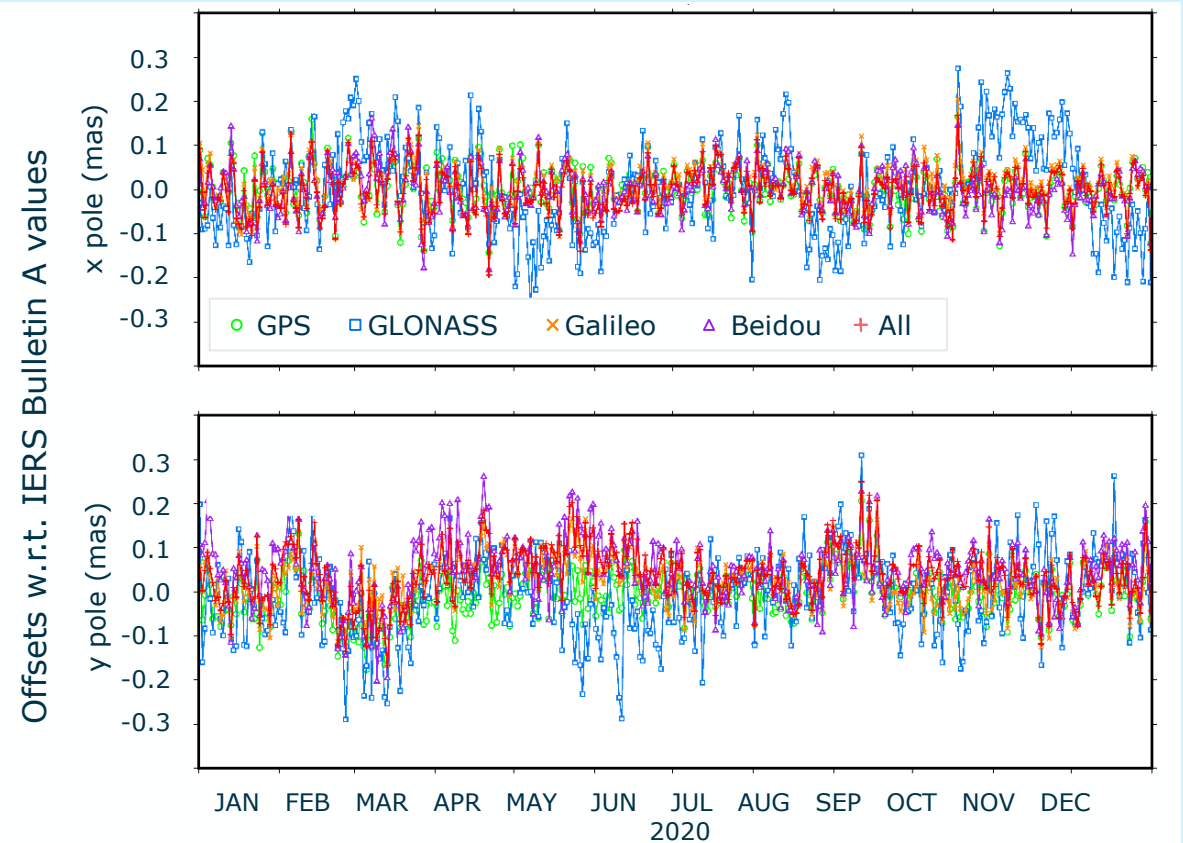
Future perspectives

- Once operational, make use of ESA VLBI solution



- Optimise SLR solution e.g. adding Larets, Stella, Starlette, and Ajisai

- Make use of ESA multiGNSS solution



- ESA's Navigation Support Office will provide independent products and services for the Earth Orientation Parameters, expected in third quarter 2021.
- ESA's independent EOP products and services will ensure the unrestricted access to space for ESA, EC and European industry.
- ESA's Navigation Support Office at ESOC is responsible for the generation of ESA's geodetic reference.
- ESA's EOP software provides excellent initial results and further validation is currently ongoing.
- The processing will soon include also the ESA VLBI solution, to ensure the highest possible consistency among all geodetic input products.
- In the future, the performance of the software might benefit from optimized products, such as the ESA multiGNSS solution or an extended ESA SLR solution including **Larets, Stella, Starlette, and Ajisai**

Thank you for your attention!

sara.bruni@esa.int

PosiTim@ESA/ESOC Navigation Support Office

<http://navigation-office.esa.int>

