

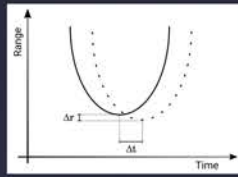
Analyzing prediction quality with the Potsdam Time Bias Service

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1. How does it work?

Normal Point data uploaded to EDC is continuously downloaded and processed. For each satellite pass obtained by a station the differences between measured and predicted ranges are analysed. Using station coordinates from SLRF2014 and a minimal atmospheric model, the time and range bias of a pass with respect to each CPF file covering the pass is estimated.

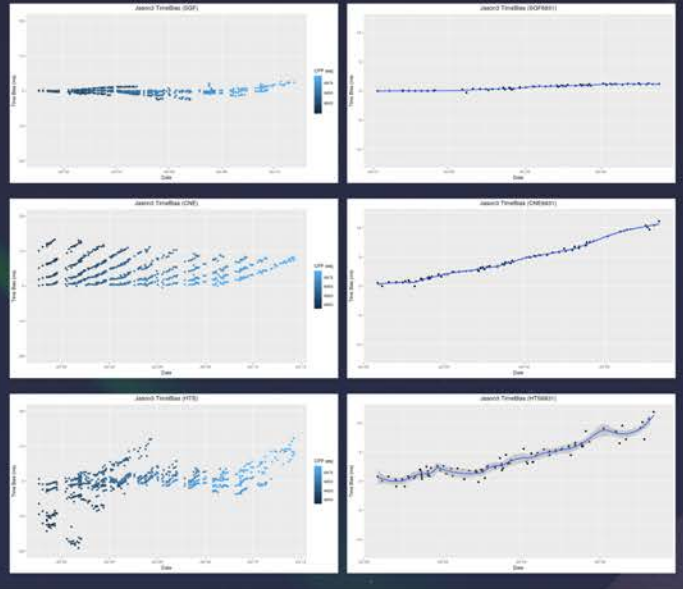


The estimated time bias can then be used as a metric for the quality of the orbit prediction, which allows to:

- Select the best prediction provider for each satellite,
- Identify problems (temporary or long term) in the (often automated) prediction generation process (e.g. due to introduced leap seconds),
- Contact prediction providers upon issues or provide feedback about their performance,
- Provide a prediction accuracy estimation during the commissioning phase of new missions,
- Provide time bias corrections in near real time for the individual satellites and providers,
- Develop accuracy requirements for prediction providers.

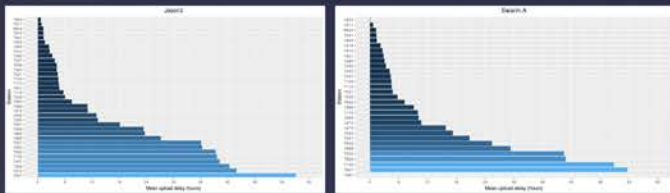
4. How do orbit predictions differ?

If there is more than one prediction provider, selecting the best one can make a difference in station productivity. Providers are using different models and tools which lead to differences in short and long term prediction quality. Below is a comparison of predictions from different providers for Jason3. The short term stability for all three providers is acceptable, while SGF has the far better prediction (for the given time frame).



2. When do stations upload their data?

In general new CPFs are published every 24 hours. A CPF therefore has a typical life time of about 24 hours. To provide meaningful time bias estimations, the delay between obtaining the range measurements by a station and upload to the data centers must be as short as possible. About half of the station are able to process and upload their Normal Point data in less than 6 hours. But some stations need 24 hours or more to upload, which means the data points are only available after the end of the CPF life time.



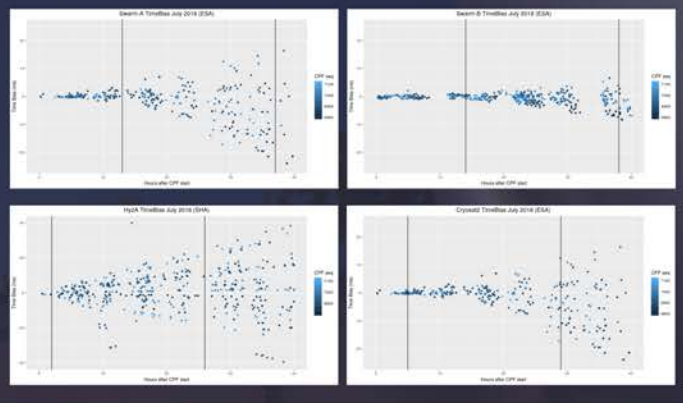
3. How much data is uploaded?

The data yield differs largely between satellites. The mean number of obtained passes depends on the quality of predictions, the particular orbit configuration and network & station priorities. In case of Jason3 the mean number of pass segments every 24 hours is about 30, for Swarm-A it's about 10, whereas the mean number of pass segments for TechnoSat is just 1.5! Obviously, having fewer data points makes it harder to provide reliable time bias corrections to the stations.



5. How does prediction quality behave over the day?

The quality of predictions for some targets has the tendency to rapidly decrease long before a new CPF is published. Below are examples for four different satellites from July 2018. CPFs for each of these satellites are published once a day (first vertical line indicates the time of day) and are containing data starting at midnight the same day. At the time the new CPF is published (second vertical line) the time bias can often reach the double digits which often means that the target is outside the FOV.



Webservice and outlook

The current database frontend is a simple table based webpage which manual maintained lists of satellite targets.

A new HTTP/Json based API which will enable stations to query information about individual CPF files is under development and will be finished by the end of the year.

<http://slr.gfz-potsdam.de:5000/tb/v1/>