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Limitations for near-real-time orbit and clock products and first results of a normal equation stacking approach for orbit and clock determination

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The Navigation Support Office at the European Space Operations Centre (ESA/ESOC) in Darmstadt, as one of the IGS-AC's, performs routinely precise orbit and clock estimation. We contribute to the common IGS-products, as ultra-rapid, rapid and final orbits and clocks, with latencies of 3 hours, 17 hours and 13 days. Furthermore, we are deeply involved in the IGS Real Time Pilot Project, to which we contribute with an experimental solution.

Monitoring tasks, as for hazard mitigation and earth observation desire highly accurate orbits and clocks in near-real-time. Evaluating the products currently available in near-real-time, shows that the predicted orbits (ultra-rapid) provide an adequate accuracy whereas clocks are the weak point. The quality of the prediction of clocks is decreasing rapidly and techniques to keep the prediction time short and to use adequate models are essential. There are different methods for near-real-time clock estimation, delivering more or less middling results. Common for all methods are issues like time delays and data gaps, degrading the already weak network configuration.

We analysed these issues and their influences on the near-real-time products, based on recorded real-time and other observation data modified to include gaps, jumps and other potential pitfalls. The poster will present an extract of our analyses, showing the impact of data gaps on selected sites, as well as the impact of different network configurations.
One of our current research areas is the definition an implementation of a new method to derive the clocks and orbits by stacking normal equations in quasi-real-time (5 minute batches solutions). These method, and some preliminary results, will be presented. We expect this approach to offer accuracies comparable to the IGS non real-time products (in an ideal scenario with a good and reliable real-time network) but with a delay of minutes.