



## **Simulation study on the Inter-Satellite Links contribution to satellite clock estimation**

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This research aims at evaluation of advantages of the Inter-Satellite Links (ISL) in simulated Galileo constellation as a contribution to the satellite clock estimation. The ISL provides precise range measurements between satellites in specific constellation which is one of the key requirements for improving accuracy and reliability of the orbit determination.

Our previous simulation results (Kur and Kalarus, EGU2018-786, EGU General Assembly 2018) based on various ISL connection schemes (observation scenarios) indicated that by using this independent from GNSS measurements technique orbit estimation is improved mainly by reducing RMS error in cross-track and along-track directions. Additionally, the ISL makes the constellation more resistant to reduction of the number of the ground stations. This study, however, is focused on satellite clocks. They give crucial contribution to the performance of navigation system and therefore a good clock error estimation is essential for orbit determination and positioning. In this context, we would like to evaluate possible advantages of including the ISL into estimation procedure which considerably improves satellite orbits and clock estimation. Preliminary study shows that clock estimation errors are sensitive to chosen observation scenario. In order to assess potential impact on estimation process, three types of scenarios can be considered. First, that eliminates clock errors from the ISL observations, second, which fairly good contributes to the clock estimation and the last, which has no significant impact on clock estimation error. The performance of the estimation process is also tested with respect to the different number of GNSS stations and variable ISL measurement interval. First results show that both the reduction of ground stations and various quantity of the ISL measurements do not strongly influence the outcomes while the quality of clock estimation with the ISL increases in comparison to standard solution based on GNSS measurements only.

This work is concluded with general advantages and disadvantages as well as with formulation of the initial requirements, in terms of the scenarios that are potentially optimal for better estimation of the satellite orbits and clocks based on the ISL measurements.