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Combination of Precise Orbit Solutions for Sentinel-3A using Variance Component Estimation

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Sentinel-3A is an Earth observation satellite dedicated to oceanography and part of a fleet of satellites of the European Copernicus programme. Among other instruments it is equipped with a dual-frequency GPS receiver used for precise orbit determination (POD). Orbital products are officially provided by the Copernicus POD (CPOD) Service. Within the CPOD Service external orbit validation is regularly performed by comparing the official orbit products to solutions provided by POD expert members (analysis centers) of the Copernicus POD Quality Working Group (QWG). Different software packages, background models and parametrizations are used for the POD by the different analysis centers, resulting in a variety of slightly different solutions for the orbit of Sentinel-3A.

To reduce analysis center specific errors, all individual orbit solutions of the POD QWG may be combined to get an orbit with superior quality. In this presentation we study Variance Component Estimation techniques to derive combined Sentinel-3A orbit solutions as a weighted average from the individual orbit solutions of the POD QWG members. Orbit positions of the individual solutions are treated as uncorrelated in time. Both systematic and random errors of the individual orbit solutions are expected to be reduced by the combination method. In our presentation we first carry out a comparison between the different solutions to reveal systematic and random differences between the different individual solutions. Subsequently, the Variance Component Estimation method is assessed for its suitability by simulation studies in which various types of errors are switched on and off. Finally, the combination method is applied to the real Sentinel-3A orbit solutions from the different analysis centers of the POD QWG and the combined orbit is externally validated by Satellite Laser Ranging (SLR) measurements.