



Copernicus POD Service: Orbit Determination of the Sentinel Satellites

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The Copernicus POD (Precise Orbit Determination) Service is part of the Copernicus Processing Data Ground Segment (PDGS) of the Sentinel-1, -2 and -3 missions. A GMV-led consortium is operating the Copernicus POD Service being in charge of generating precise orbital products and auxiliary data files for their use as part of the processing chains of the respective Sentinel PDGS.

Sentinel-1A was launched in April 2014 while Sentinel-2A was on June 2015 and both are routinely operated since then. Sentinel-3A is expected to be launched in February 2016 and Sentinel-1B is planned for spring 2016. Thus the CPOD Service will be operating three to four satellites simultaneously in spring 2016.

The satellites of the Sentinel-1, -2, and -3 missions are all equipped with dual frequency high precision GPS receivers delivering the main observables for POD. Sentinel-3 satellites will additionally be equipped with a laser retro reflector for Satellite Laser Ranging and a receiver for DORIS tracking. All three types of observables (GPS, SLR and DORIS) will be used routinely for POD.

The POD core of the CPOD Service is NAPEOS (Navigation Package for Earth Orbiting Satellites) the leading ESA/ESOC software for precise orbit determination. The careful selection of models and inputs is important to achieve the different but very demanding requirements in terms of orbital accuracy and timeliness for the Sentinel -1, -2 & -3 missions. The three missions require orbital products with various latencies from 30 minutes up to 20-30 days. The accuracy requirements are also different and partly very challenging, targeting 5 cm in 3D for Sentinel-1 and 2-3 cm in radial direction for Sentinel-3. Although the characteristics and the requirements are different for the three missions the same core POD setup is used to the largest extent possible. This strategy facilitates maintenance of the complex system of the CPOD Service.

Updates in the dynamical modelling of the satellite orbits, e.g. improvements of the box-wing models, have been done to deliver best possible orbit solutions for the satellite. Quality control of the CPOD orbits is done by validating them with independent orbit solutions provided by the Copernicus POD Quality Working Group. The cross-comparison of orbit solutions from different institutions is essential to monitor and to improve the orbit accuracy because for Sentinel-1 and -2 this is the only possibility to externally assess the quality of the orbits. Sentinel-3 orbits may additionally be validated by using SLR and DORIS observations.

This paper presents the Copernicus POD Service in terms of operations and orbital accuracy achieved by the different orbit products of the different missions. For Sentinel-1 and Sentinel-2, this paper presents the impact of the box-wing models. For Sentinel-3, the orbital accuracy will be assessed using the very first data after launch.