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Modeling of the GIOVE-B clock as a tool for studying radiation pressure models

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Radiation pressure modeling deficiencies constitute the main source of orbit errors for GNSS satellites. Empirical models are currently widely used and models exploiting the details of interaction between satellites surfaces and radiation are under development. New satellite types may require adaptation of current models. Different radiation pressure models affect the estimated orbits differently. Orbit differences typically show orbit-periodic variations. Radial orbit variations are absorbed by satellite clock corrections.

New satellites such as GIOVE-B carry clocks with unprecedented stability. As a matter of fact orbit modeling deficiencies reflect in orbit-periodic variations of the estimated clock offsets. Different radiation pressure models result in different patterns in the satellite clock offsets. Imposing a linear clock behavior allows to reduce radial orbit errors and thus to investigate the suitability of different radiation pressure models.

Impact of clock linearity constraints on dynamic orbit parameters are investigated for GIOVE-B using tracking data from the CONGO network for different elevations of the Sun above the orbital plane. The quality of orbits derived with different radiation pressure models is quantified using orbit overlaps, orbit predictions, and SLR observations.