Solid Earth Discuss.,
https://doi.org/10.5194/se-2020-22-RC1, 2020

Solid Earth
Discussions

Interactive comment on "Estimating ocean tide loading displacements with GPS and GLONASS" *by* Bogdan Matviichuk et al.

Anonymous Referee #1

Received and published: 21 May 2020

This paper characterizes the impact of GLONASS, when supplementing GPS, on the recovery of ocean tidal loading (OTL) signals from geodetic stations. GPS techniques are somewhat impaired in estimating K2 and K1 tide constituents, due to errors that resonate with the sidereal repeat periods of the GPS satellite orbits and the constellation geometry. The results of this paper support that GLONASS, sampling for which is not sidereal, can significantly overcome this weakness. While the results are based on data from a European network, they are likely more widely applicable. The results hint at the potential benefits of combining observations from other GNSS systems (e.g., Galileo, Beidou, in addition to GLONASS—with their varying geometries and repeat periods—for addressing some of the most demanding geodetic problems. The outcome also provides new perspectives on potential scientific contributions of the

GLONASS system. The approach is thorough and densely documented, but seems not notably inventive, leaning heavily on the prescription of Penna et al. (2015). While the results are not unexpected, they are certainly noteworthy and warrant publication.

I am a bit puzzled, however, by certain aspects of the solution strategy. Why, for example, is the OTL signal removed a priori in the GipsyX PPP solutions (using FES2004_Gbe, cf. Line 106)? Later, the OTL signal is added back in (imperfectly) using HARDISP (Line 140). Why not simply turn off the OTL model in GipsyX and attempt to recover the full expression of OTL, thus removing any doubt that the a priori model is somehow favored via constraint? In this scenario, one could adopt a less constrained random walk (RW) for recovery of the position. Why indeed does the 3.2 mm/sqrt(s) recipe from Penna et al. (2015) again emerge as the optimal constraint for the RW position estimate? Figure 2 does not seem to suggest that the amplitudes of the recovered OTL constituents become unbounded with higher process noise. Indeed, they seem to stabilize. One wonders what the outcome would be with a more disruptive estimation strategy that allows the position to move more freely and independently (with no background OTL model). Perhaps I am missing something here, and would of course invite the authors to clarify.

I think the estimated clocks and zenith troposphere also provide clues to this sensitivity problem. One could probe the time series of these "nuisance" parameters for signs of energy at the sidereal periods linked to the GPS repeats.

One other suggestion is to consider relegating additional detailed discussion to the supplementary material. The salient points sometimes get obscured by the detailed descriptions of the results and cases. The paper is otherwise well written.

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