CC1: 'Comment on egusphere-2024-1476', Ralf Greve, 02 Jul 2024 reply

I think the authors should discuss their findings against the results of the modelling study by Seddik et al. (2019). Quoting the abstract:

"Reduction of the basal drag by 10-40% produces speed-ups that agree approximately with the observed range of speed-ups that result from warm weather and precipitation events. In agreement with the observations, tidal forcing and surface speed near the calving front are found to be in anti-phase (high tide corresponds to low speed, and vice versa). However, the amplitude of the semi-diurnal variability is underpredicted by a factor ~3, which is likely related to either inaccuracies in the surface and bedrock topographies or mechanical weakening due to crevassing."

Thank you very much for the comment related to our publication on Bowdoin Glacier (Ralf Greve and Shin Sugiyama are the coauthors of Seddik et al., 2019).

In particular, it would be interesting whether there is any new insight in possible reasons for the underprediction of the amplitude.

The amplitude of the tidal ice speed variations modeled by Seddik et al. (2019) was approximately 1/3 of the observation. The modeling was performed at the lowermost GPS site (GPS1).
First of all, the model neglected elasticity, which played a role in the tidal modulations according to the tide-speed plots (Figure 7). Second, the power of the semidiurnal signal decays rapidly upglacier (see attached Fig. 3). The power at the second GPS (2 km upglacier) is 30% of that at the lowermost GPS, thus it is sensitive to the sampling point. Third, bed elevation map was generated by interpolation of field data (Figure 1b in Seddik et al., 2019). Fourth, The model does not consider fracture of ice, which may be important for ice motion near the calving front.
The discrepancy of the modeled results from the observation can be attributed to these processes and details not incorporated in the model.

Reference:
Seddik, H., R. Greve, D. Sakakibara, S. Tsutaki, M. Minowa and S. Sugiyama. 2019. Response of the flow dynamics of Bowdoin Glacier, northwestern Greenland, to basal lubrication and tidal forcing. Journal of Glaciology 65 (250), 225-238, doi: 10.1017/jog.2018.106.