



## **Flow modulation by ocean tides at Helheim Glacier, East Greenland, observed using GPS**

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Observations at high spatial and temporal resolution are key for improving our understanding of the physical processes that govern outlet-glacier flow variations. We collected simultaneous high-rate GPS observations at several locations distributed along and across Helheim Glacier, East Greenland, during the three Arctic summers of 2006-2008, along with other geophysical observations, to study glacial earthquakes and glacier dynamics. GPS-derived position estimates of centimeter-level precision reveal the surface expression of glaciological signals, occurring from sub-hourly to daily time-scales and beyond. We find that the flow velocity of Helheim Glacier on both sides of the grounding line is modulated by ocean tides. Moreover, the short floating section of the glacier changes its direction of flow as a response to tidal height. An admittance analysis of the tidal signal shows an exponential decrease in amplitude with distance from the calving front, along with increasing time delays in both the vertical and horizontal components. We will present an analysis of the tidal modulation signals observed at Helheim and discuss how those signals can be used to place new constraints on models for glacier flow variations.