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Vertical and horizontal bedrock displacements near Jakobshavn Isbræ due to glacial ice mass loss.

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We analyze GPS data from four continuous Global Positioning System (GPS) receivers located between 5 and 150 km from the glacier Jakobshavn Isbræ, West Greenland. The GPS stations were established on bedrock to determine the vertical and horizontal crustal motion due to the unloading of ice from Jakobshavn Isbræ. All stations experienced uplift, but the uplift rate at Kangia North, only 5 km from the glacier front, was about 10 mm/yr larger than the rate at Ilulissat, located only ∼45 km further away. This suggests that most of the uplift is due to the unloading of the Earth's surface as Jakobshavn thins and loses mass. The observed rates are consistent with a glacier thinning model based on repeat altimeter surveys from NASA's Airborne Topographic Mapper (ATM), which shows that Jakobshavn lost mass at an average rate of 22 +- 2 km3/yr between 2006 and 2009. The fact that the GPS uplift rates are much larger closer to Jakobshavn than further away, and are consistent with rates inferred using the ATM-based glacier thinning model, shows that GPS measurements of crustal motion are a potentially useful method for assessing ice-mass change models.