Geophysical Research Abstracts,
Vol. 11, EGU2009-8915-3, 2009
EGU General Assembly 2009

An up-close examination of tidewater outlet-glacier flow and glacial earthquakes using GPS

P. Elosegui (1), M. Nettles (2), J. de Juan (1), J. L. Davis (3), G. S. Hamilton (4), T. B. Larsen (5), and the SERMI and EGGCITE Team

(1) Institute for Space Sciences, CSIC, Barcelona, Spain (pelosegui@ice.csic.es), (2) Lamont-Doherty Earth Observatory, Columbia University, Palisades, NY, USA, (3) Harvard-Smithsonian Center for Astrophysics, Cambridge, MA, USA, (4) Climate Change Institute, University of Maine, USA, (5) Geological Survey of Denmark and Greenland, Copenhagen, Denmark

There is overwhelming evidence that fast-moving tidewater glaciers in Greenland have recently experienced extraordinary changes in flow speed, thickness, and calving-front position in response to environmental forcing. These changes are also often accompanied by glacial earthquakes, whose number has increased in recent years. Helheim Glacier and Kangerdlugssuaq Glacier in East Greenland exemplify such behavior, and are the focus of a coordinated effort to understand their kinematics and dynamics. As part of this effort, we deployed an array of geodetic, seismological, oceanographic, and other sensors on and around Helheim Glacier during the Arctic summers of 2006–2008. The high-rate GPS data acquired during these campaigns reveal several fascinating aspects of Helheim Glacier's behavior, including significant spatio-temporal variation in glacier flow, large accelerations during glacial earthquakes, and glacier speed modulation due to ocean tidal forcing. To extend the glacier observing period beyond the summer and help ensure data return in this hazardous environment, we have developed a high accuracy, low-cost, L1-only GPS receiving system that enables determination of glacier flow with both high temporal sampling and high spatial density. The system includes two-way communications, thus also enabling real-time monitoring and remote GPS data retrieval. We deployed two continuously operating networks of such GPS instruments, at Helheim Glacier and Kangerdlugssuaq Glacier, at the end of the summer of 2008 to help characterize seasonal flow dynamics. We present our GPS analysis, and discuss our current understanding pertaining to glacier flow and glacial earthquakes as derived from the GPS data acquired during the summer campaigns and by these new GPS instruments.