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Analysis of ionospheric errors and correction techniques in high-rate GPS glaciology

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The ionosphere remains an important effect in GPS positioning, especially at high latitudes where the electric field and associated total electron content (TEC) are most dynamic. The problem is compounded in kinematic applications such as GPS glaciology wherein we seek high-precision and high-rate position estimates of fast-flowing ice sheets and glaciers. The first-order ionospheric effect can be eliminated by forming a linear combination of dual-frequency GPS observations. However, single-frequency systems are a desirable option in harsh, polar environments if we wish to measure glacier flow with high spatio-temporal density and the risk of losing costly GPS equipment (due to crevassing or calving, for example) is great. For this presentation, we will investigate the effect of ionospheric errors in high-rate GPS glaciology by comparing kinematic position estimates using single- and dual-frequency data from a dual-frequency GPS network deployed on a fast-flowing glacier in East Greenland during the boreal summers of 2006 and 2007. Moreover, we will compare results from position estimates using an adapted version of the GAMIT/GLOBK kinematic data processing software TRACK and the GIPSY software package. We will also investigate possible ionospheric correction techniques suitable for small-scale, single-frequency polar GPS networks.