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Long-range tidal effects on Rutford Ice Stream, Antarctica.

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GPS measurements conducted in Dec 2003 to February 2004 on Rutford Ice Stream revealed fluctuations in surface velocities with a periodicity of two weeks. Tidalanalysis of the data, and comparison with GPS measurements made in the same time period on Ronnie Ice Shelf, show these temporal variations in flow to be tidally controlled and related to spring-neap tidal cycles. Tidal effects on flow were observed at the upper-most station some 50 km upstream from the grounding line. Analysis suggests that these effects could be felt some 100 km upstream from the grounding line. A model which explains the key features of these observations is presented. It is proposed that elastic stresses associated with tidal flexing of the ice shelf affect basal shear stress distribution upstream of the grounding line, and this in turns affects basal sliding velocities. This leads to perturbations in sliding velocities that are related in a non-linear fashion to tidal amplitude. Possible constrains on the form of the sliding law are discussed.