We report on spatially extensive GPS records of flow of the Larsen C (LCIS) and Filchner-Ronne (FRIS) ice shelves. Variations in speed are evident at all sites with periods from a few hours to ~182 days, including semi-diurnal, diurnal and ~14.76 days. LCIS varies in its long-terms speed by ±10% at fortnightly periods but at diurnal timescales it is up to ±100%. The fortnightly signal is near synchronous across the ice shelf pointing to a common source mechanism. We model the modulation of flow as a non-linear function of basal shear stress (tau) including tidal perturbations in the ice shelf grounding zone. Close agreement with the observations is found with tau=10 kPa and exponent m=3, suggesting the presence of a viscous and non-linear till in the grounding zone. This LCIS observations and model are similar to those seen on Rutford Ice Stream some 1000km distant, and the existence of similar signal across the FRIS may suggest that the flow of many of its inflowing ice streams are similarly modulated by the tides and have similar basal characteristics. While the fortnightly signal and the structure of the diurnal and higher frequency signal is closely reproduced by the model, it does not explain the entire signal. We suggest that an elastic response to tidal tilting of the ice shelf may be contributing to some of this misfit. We present a model of the effect of tidal tilt and compare this to the along- and across-flow variations observed on both ice shelves.