An aerial photograph of a glacier surface, showing a textured, light blue-grey ice field. A white rectangular box with a thin black border is centered in the upper half of the image, containing the title text. The background shows the vast expanse of the glacier under a clear sky.

Ice Stream Dynamics Near the Siple Coast Grounding Line: GPS and Passive Seismic Observations

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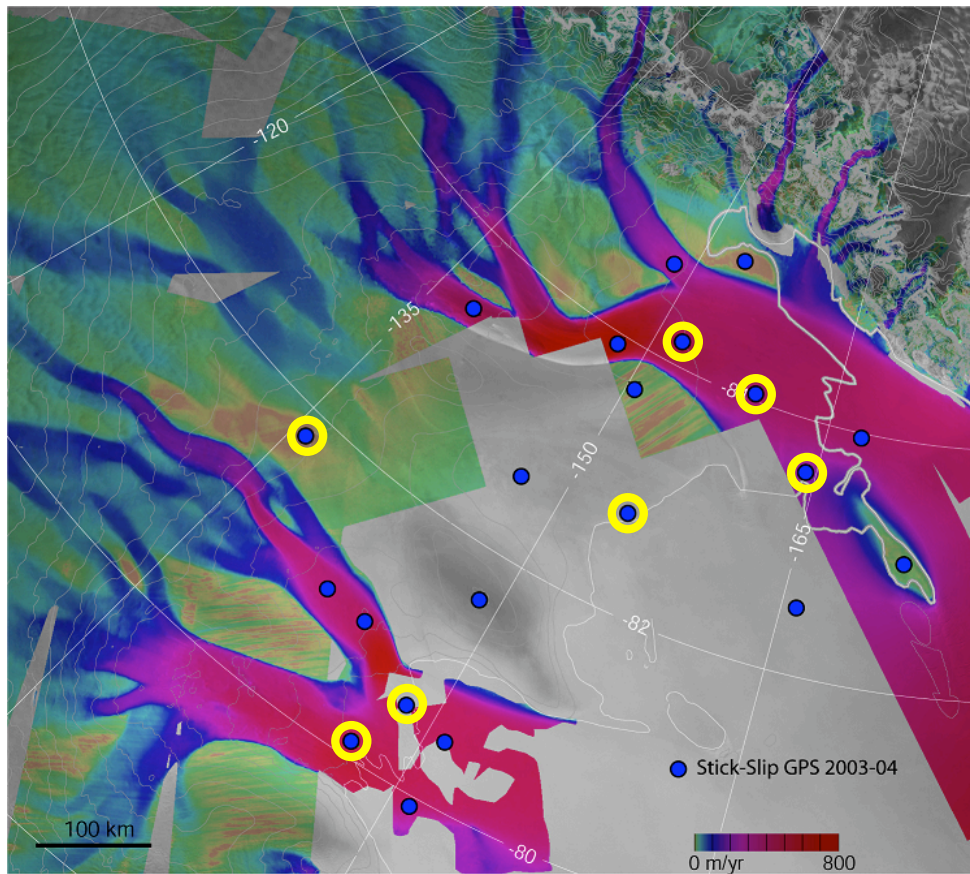
Univ. of Newcastle

Ian Joughin

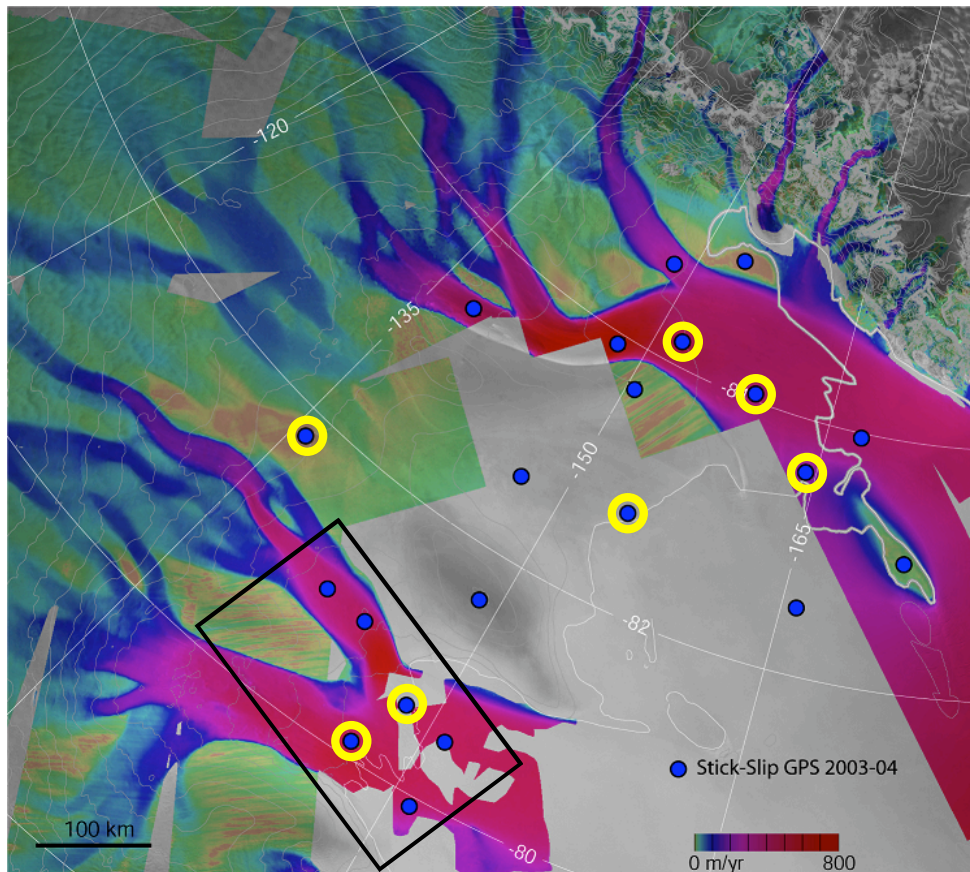
Univ. of Washington

Funding by NSF OPP

2003-2004 Field Season



This talk....



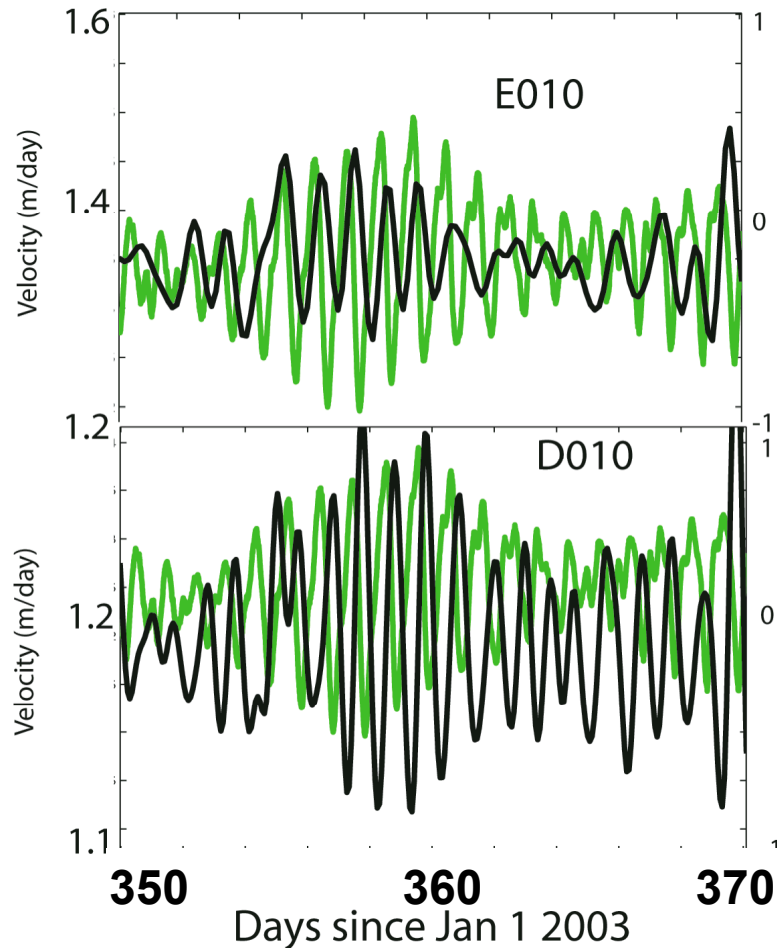
GPS derived velocities:
isD 10 and 90 km from grounding
Line
IsE 10 km from the Grounding

Tide from a station down stream of
isD grounding line.

Passive Siesmic Obervations

10 km from the gounding line on
on isD and isE

GPS velocities



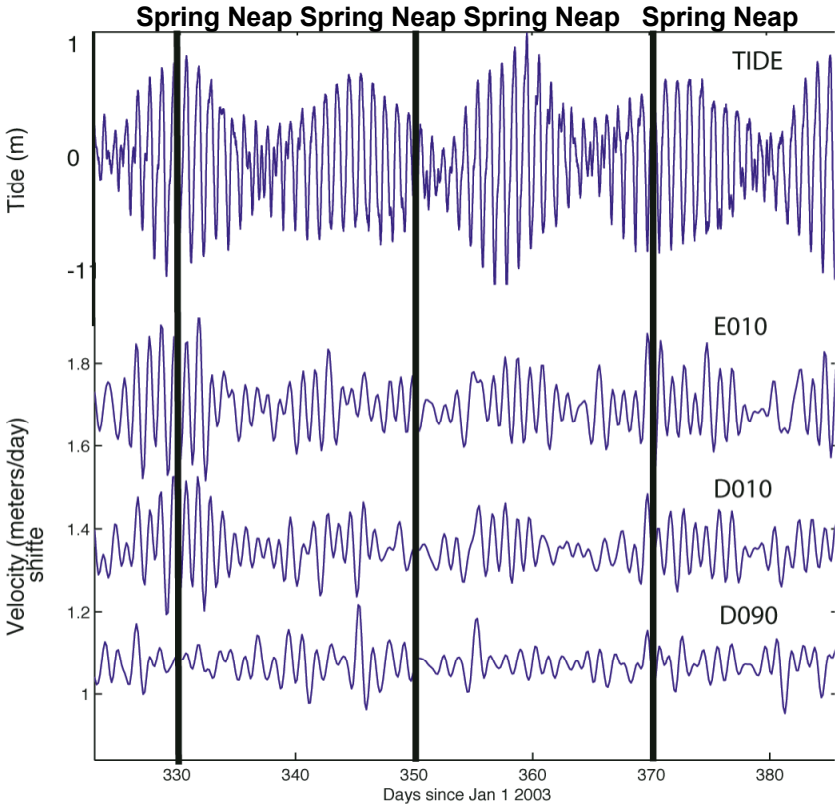
Tide regulates strong (1 m/day) daily fluctuations in ice stream velocity

**Peak velocity on falling tide.
(Anandakrishnan et al. 2003)**

Variation in velocity is higher at spring tide

**Daily velocity variation is higher on D
(lower avg. velocity) than E.**

GPS Velocities

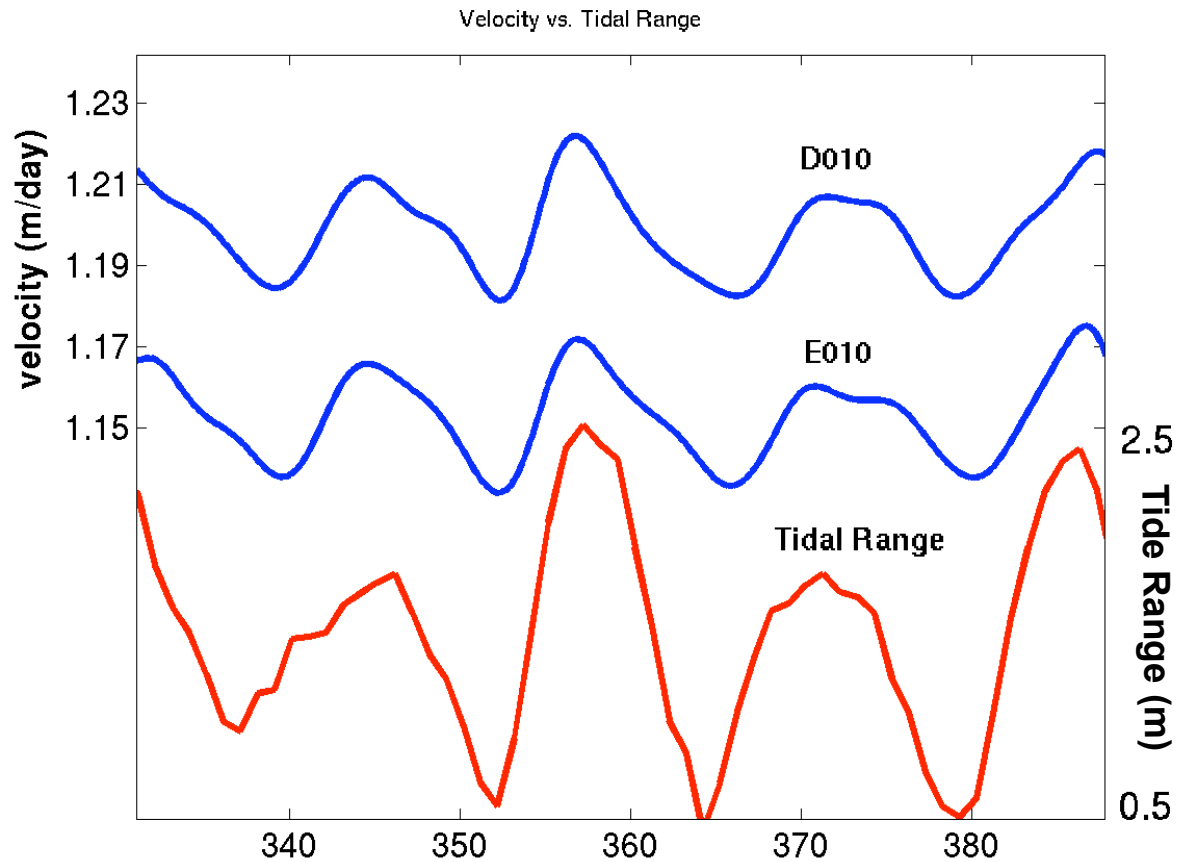


Tidal forcing is seen throughout the entire 70 days of observation

Tidal forcing is seen 90 km Upstream from the grounding line.

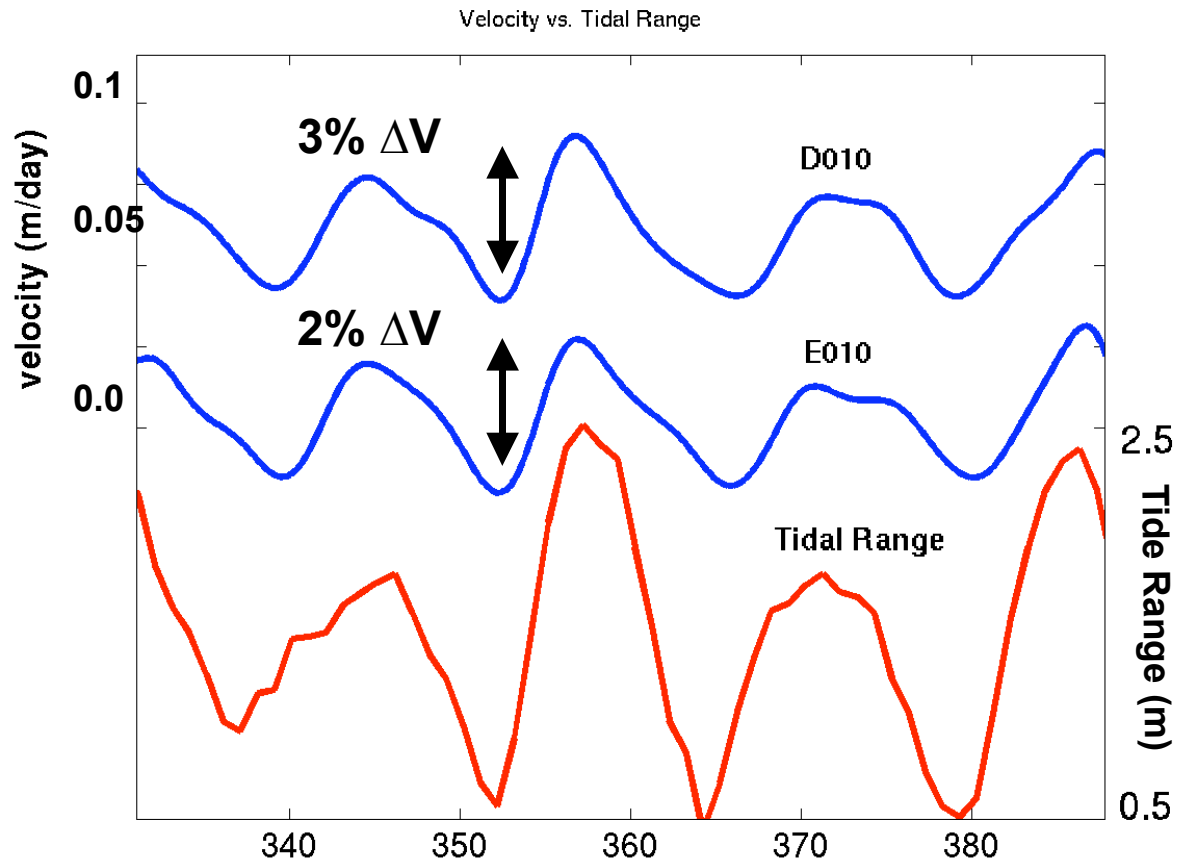


GPS velocities



**Not only daily variations
in stream velocity but
longer term changes**

GPS velocities

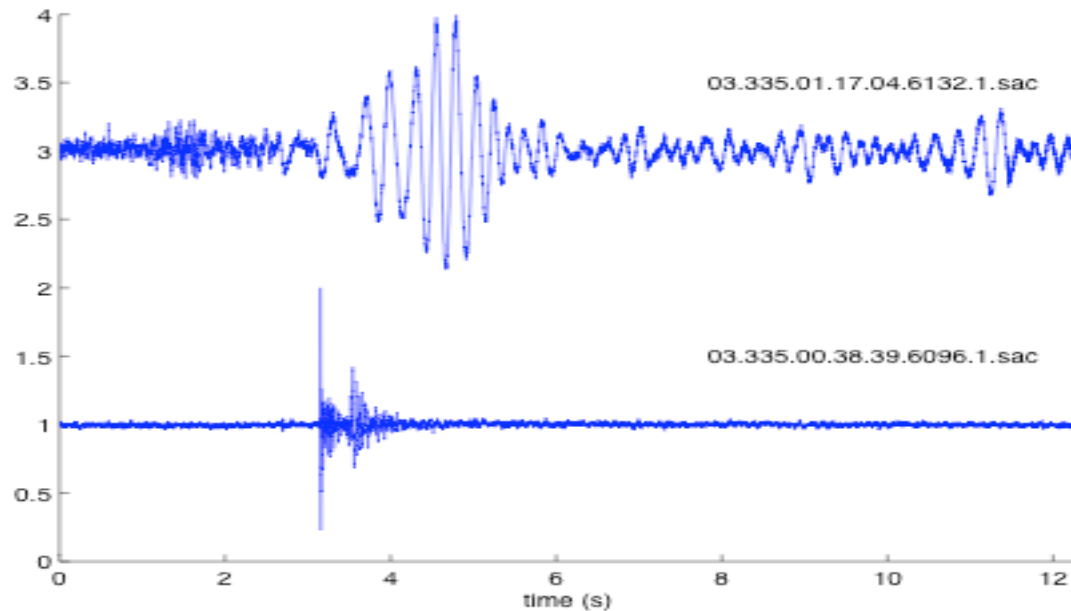


**The higher
the tide range the
faster the flow**

**Both streams
are modulated in
the same way.**

Passive Seismic

Passive seismic survey listens for icequakes produced by glacier sliding:
Tells us about the frictional properties of the ice stream bed



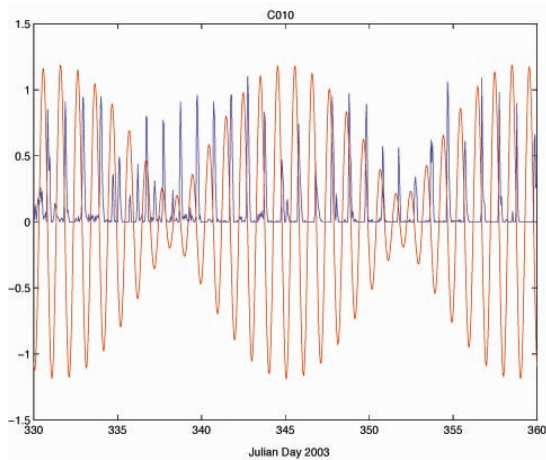
Two Types of icequakes:

Grounding line events

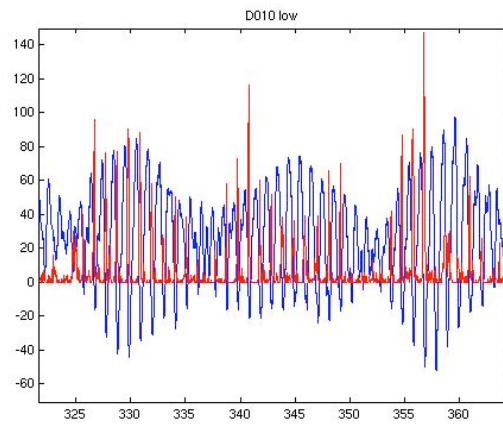
Ice Stream Bed
events

Passive Seismic: Grounding Zone

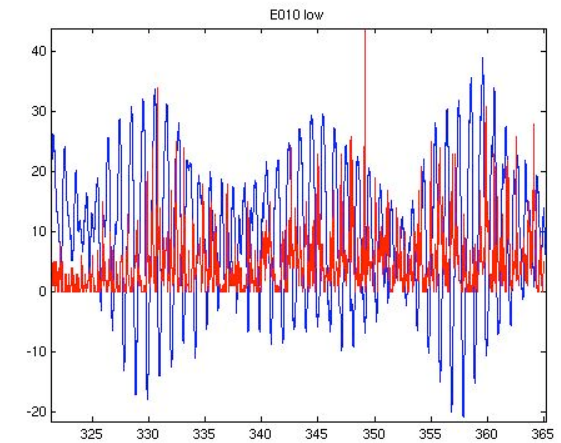
C010



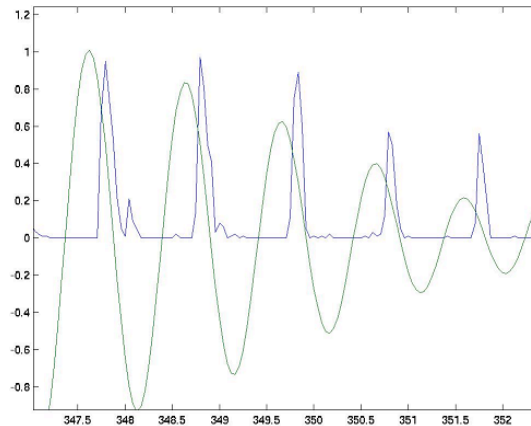
D010



E010



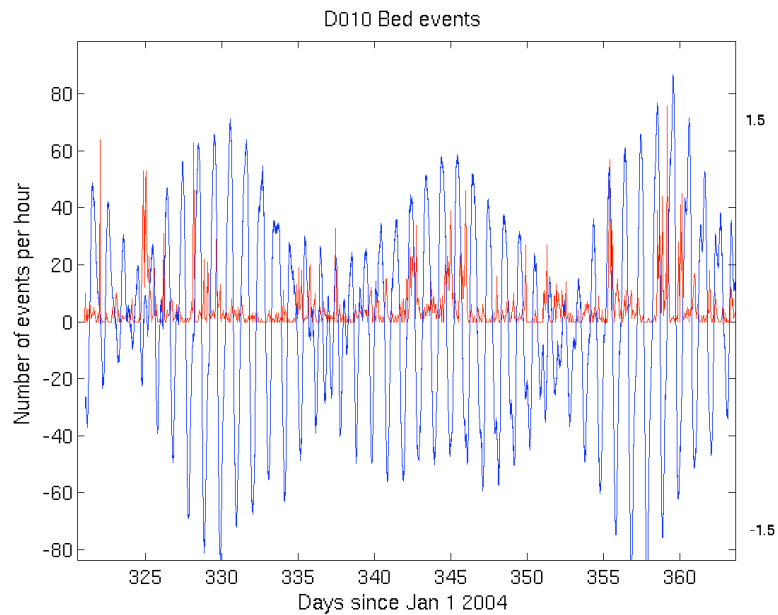
**Number of event are
binned per hour.**



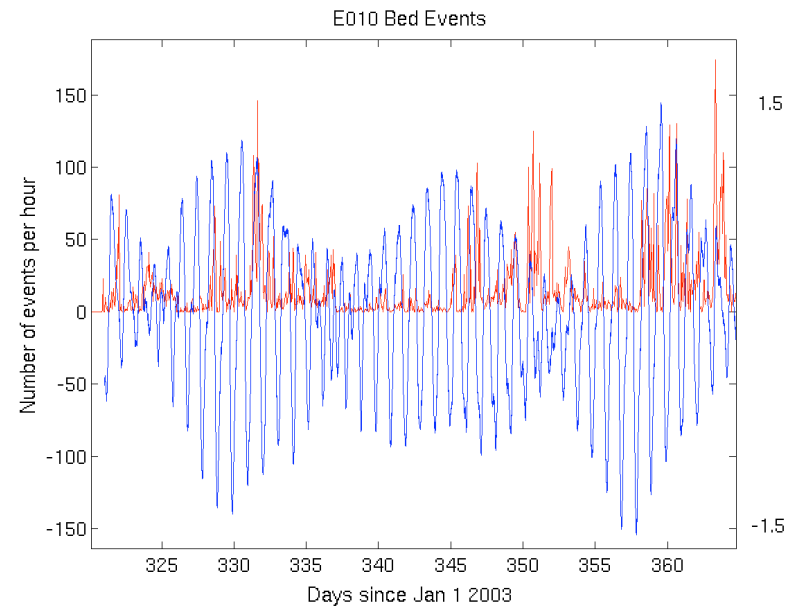
**Peak seismicity associated
With falling tide
(Anandakrishnan and Alley,
1997)**

Passive Seismic: Ice Stream Beds

D010



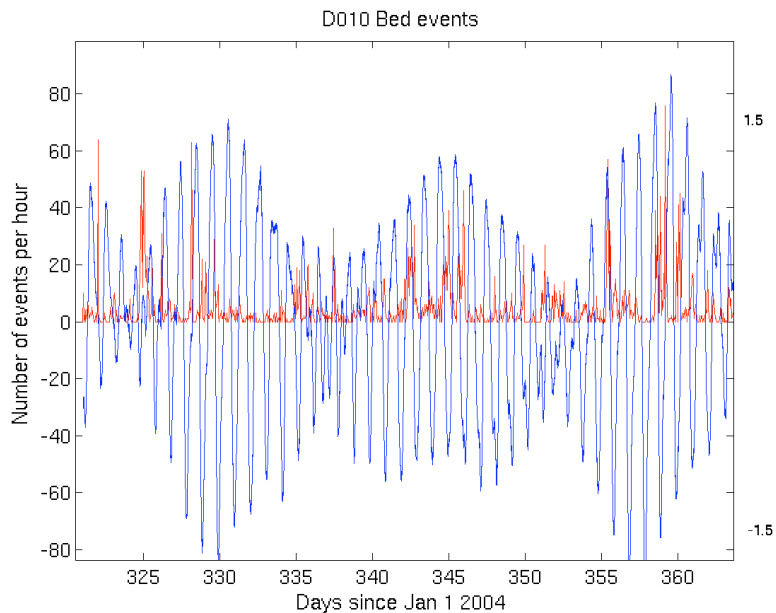
E010



**The number of bed events should
Provide info about the frictional nature of the bed**

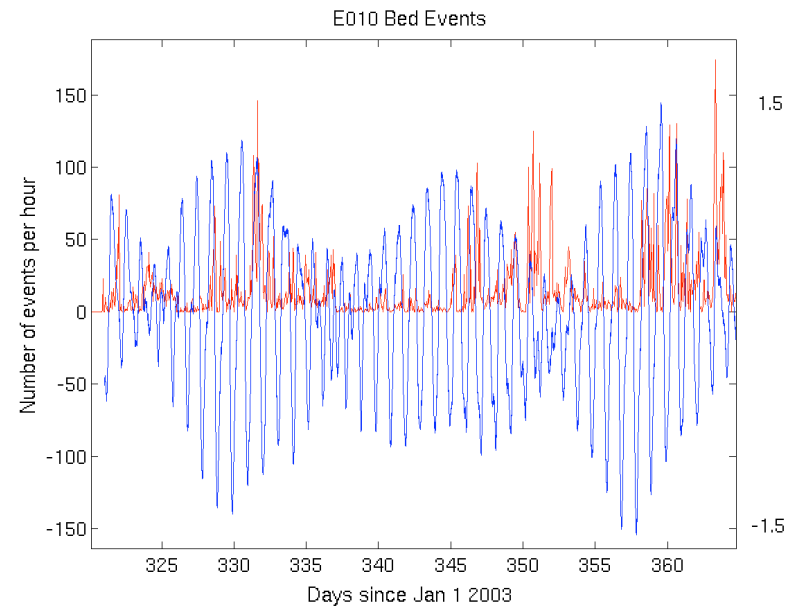
Passive Seismic: Ice Stream Beds

D010



$\frac{\# \text{ of bed events}}{\# \text{ of grounding events}} = 0.7$

E010



$\frac{\# \text{ of bed events}}{\# \text{ of grounding events}} = 3$

The bed isE offers much more resistance to flow

Conclusions

- Tides modulate velocity of ice streams D and E on sub-day scale.
- Tidal range modulates velocity on day-week scale (2-3%)
- The bed of E offers more resistance to flow (friction) than D.
- D and E: same velocity, different bed.

