

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

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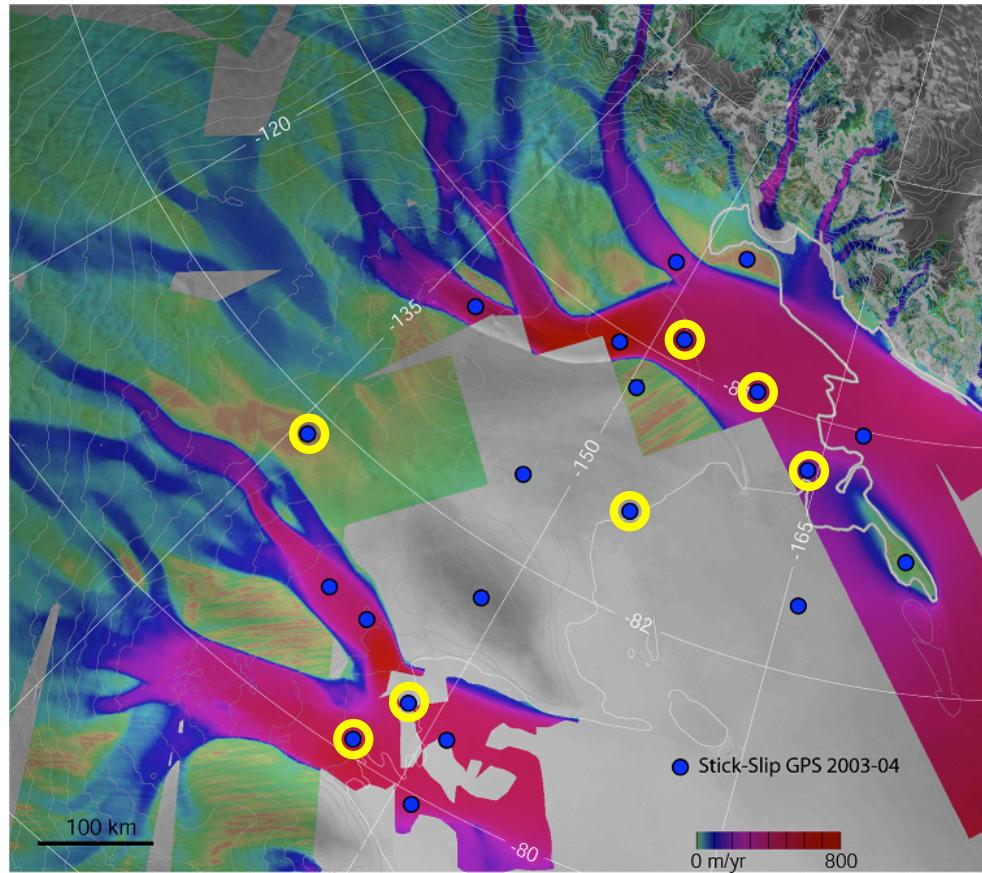
Univ. of Newcastle

Ian Joughin

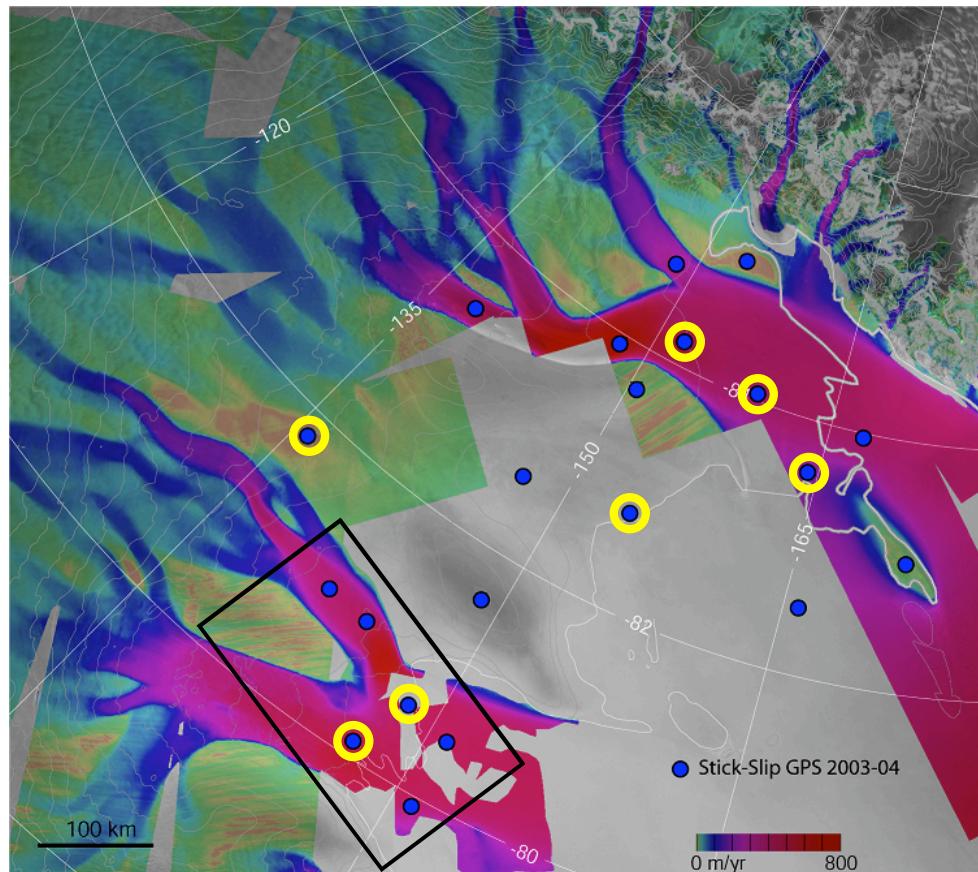
Univ. of Washington

Funding by NSF OPP

2003-2004 Field Season



This talk....

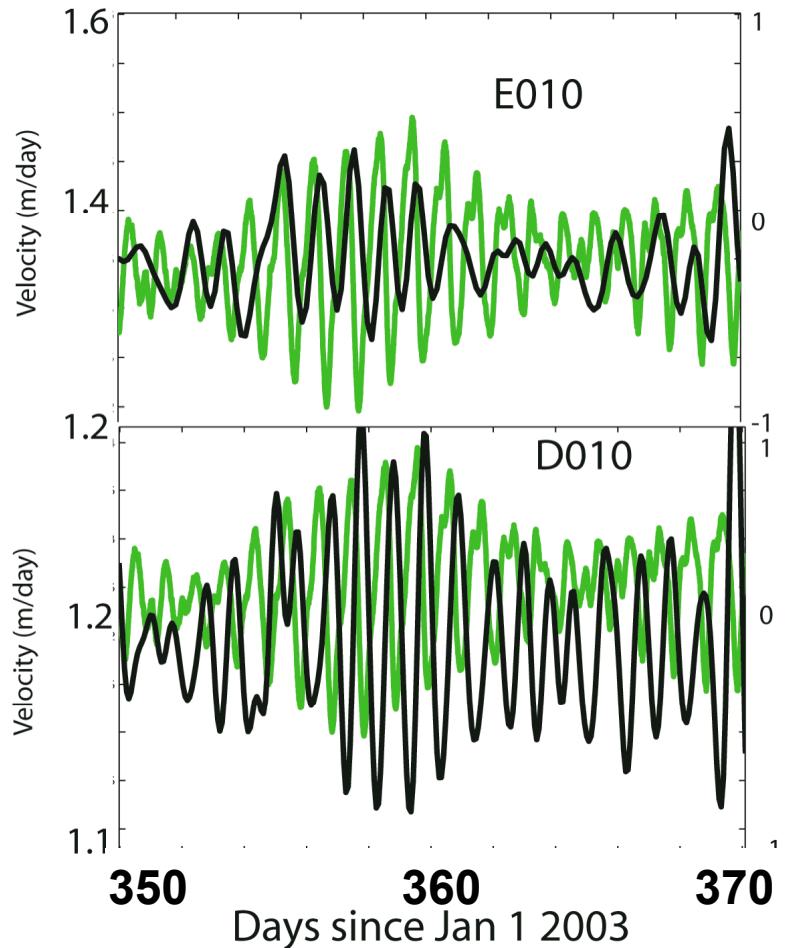


GPS derived velocities:
isD 10 and 90 km from grounding
Line
IsE 10 km from the Grounding

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



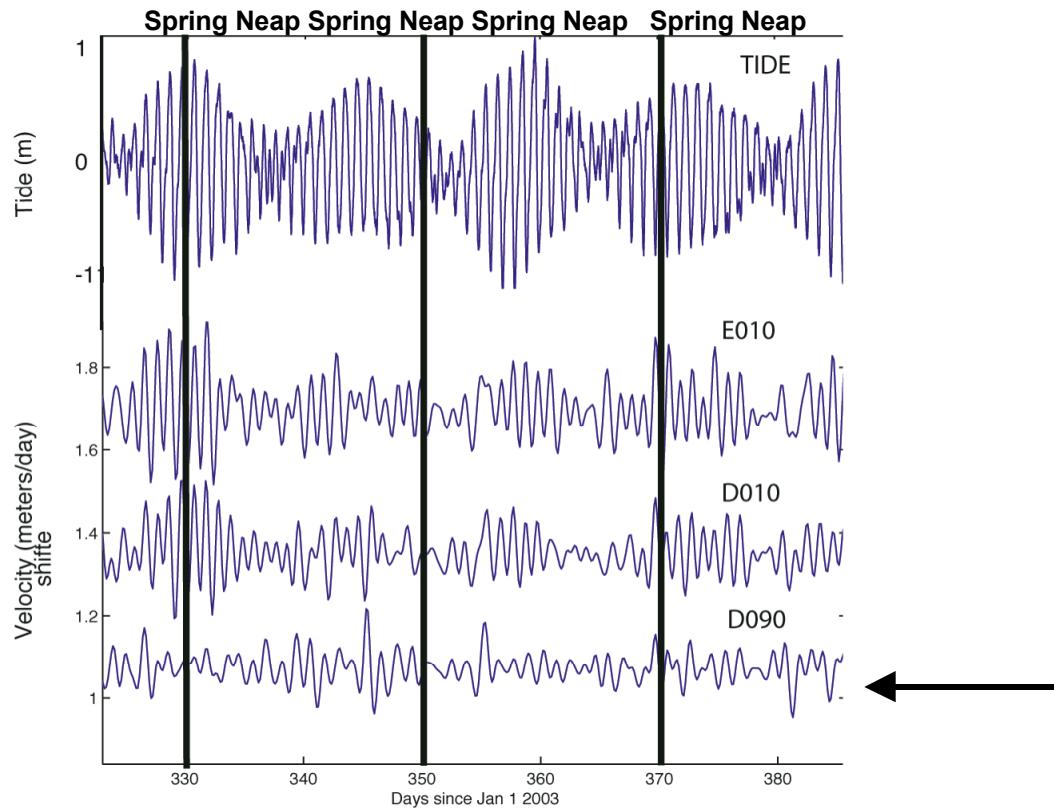
Tide regulates strong (1 m/day) daily fluctuations in ice stream velocity

**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.

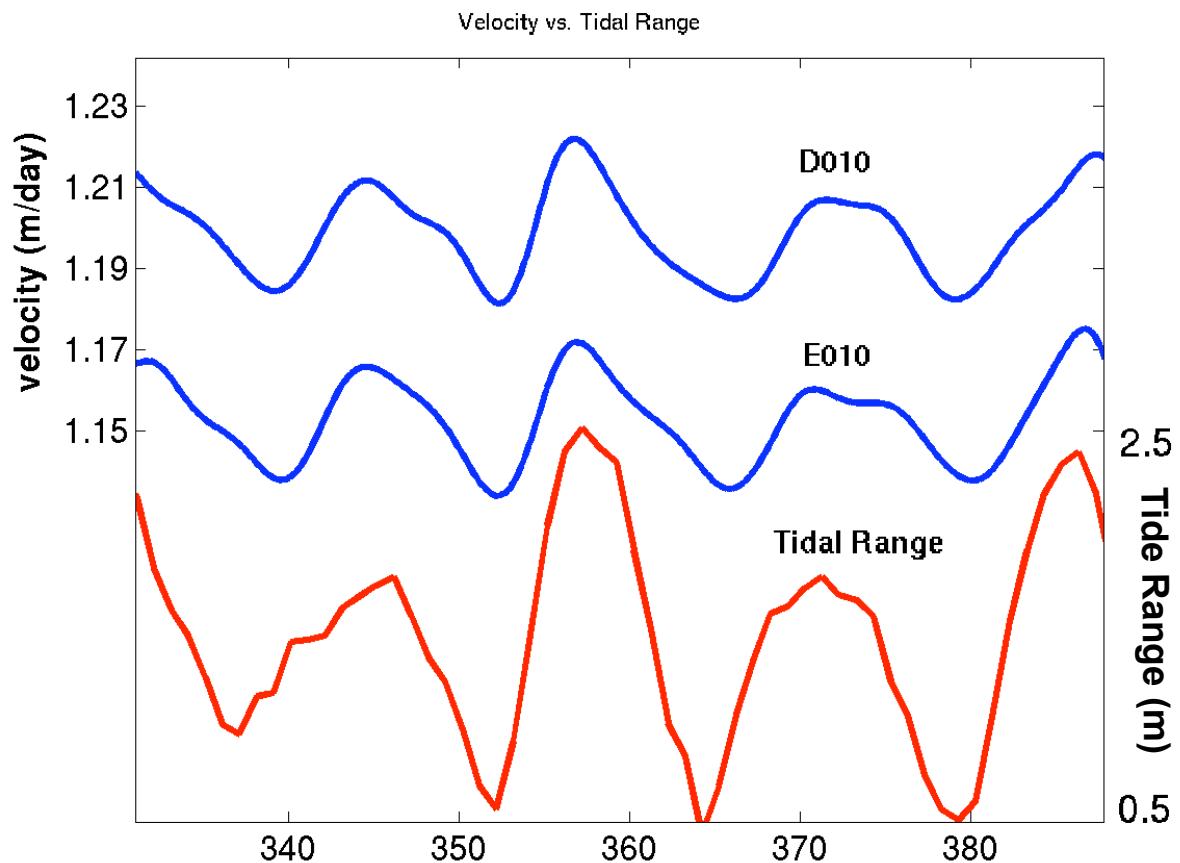
GPS Velocities



Tidal forcing is seen throughout the entire 70 days of observation

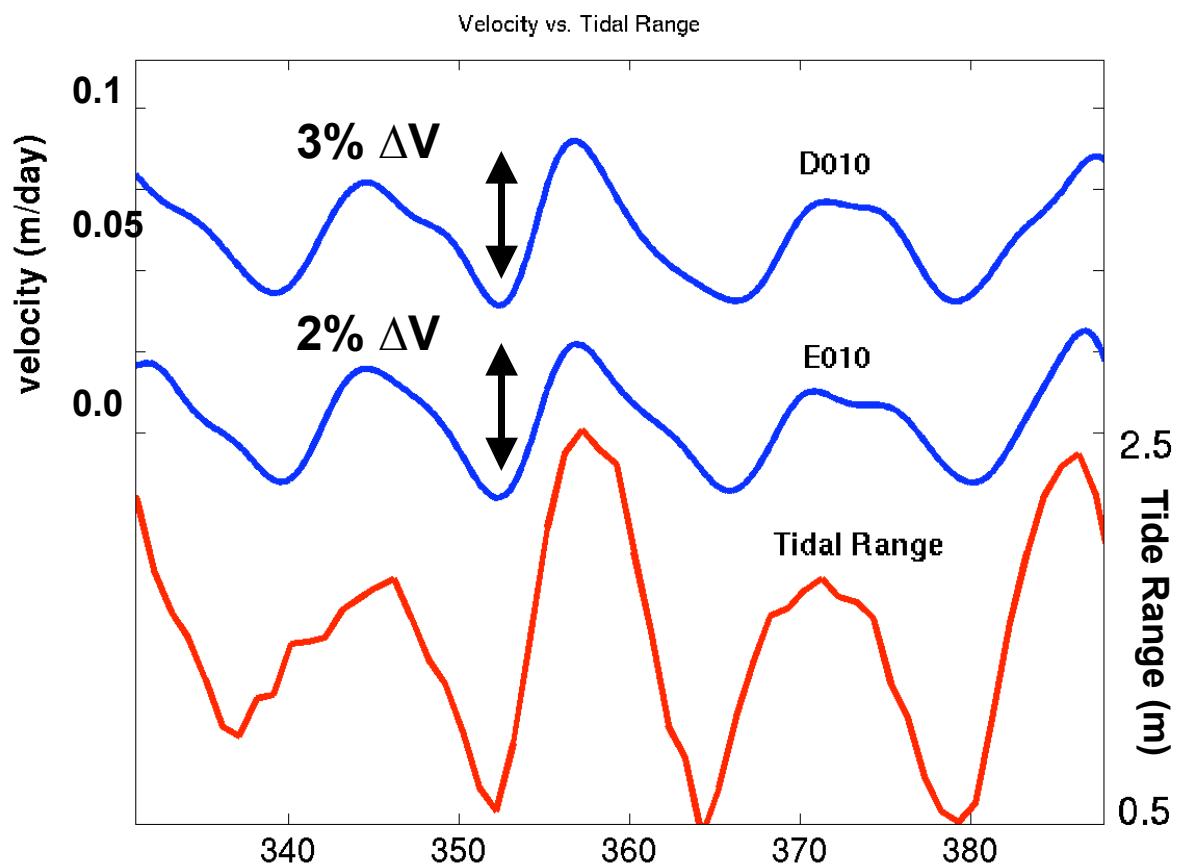
Tidal forcing is seen 90 km Upstream from the grounding line.

GPS velocities



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

GPS velocities

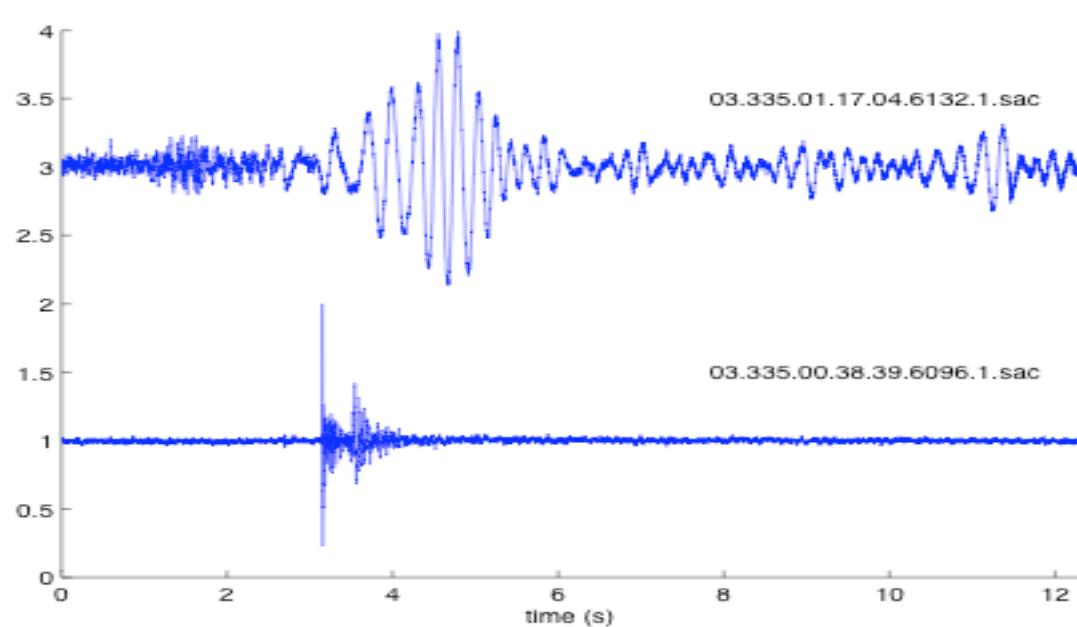


The higher
the tide range the
faster the flow

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**



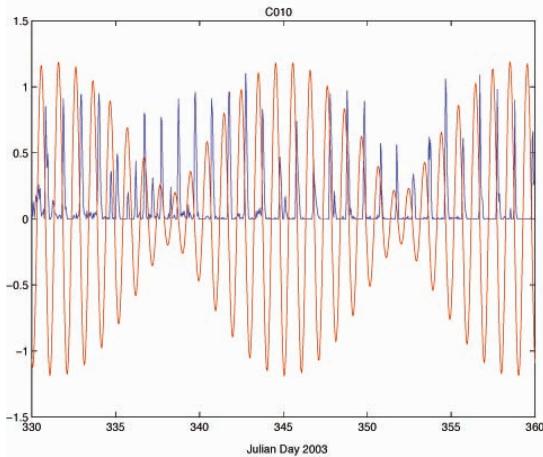
Two Types of icequakes:

Grounding line events

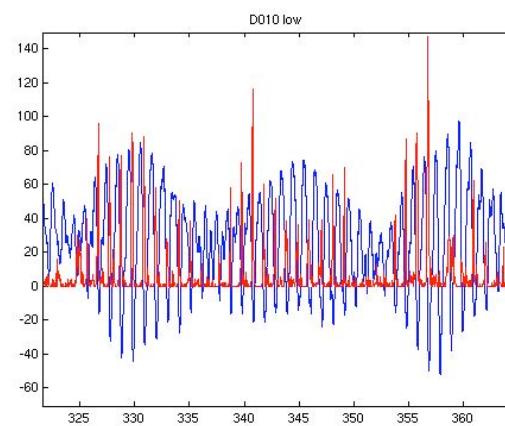
**Ice Stream Bed
events**

Passive Seismic: Grounding Zone

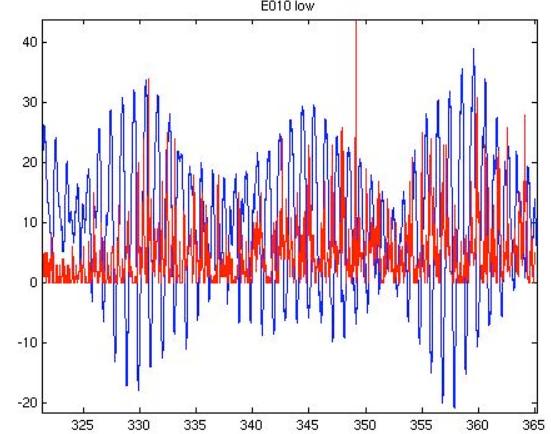
C010



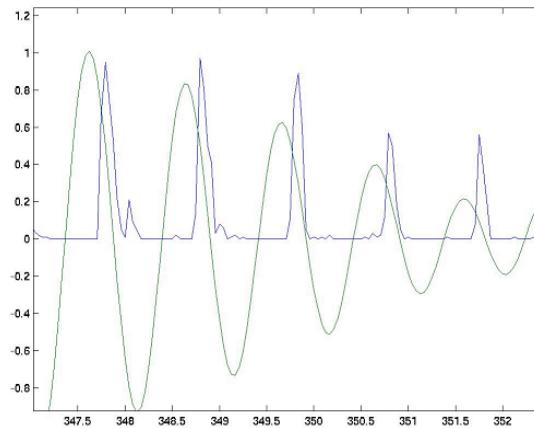
D010



E010



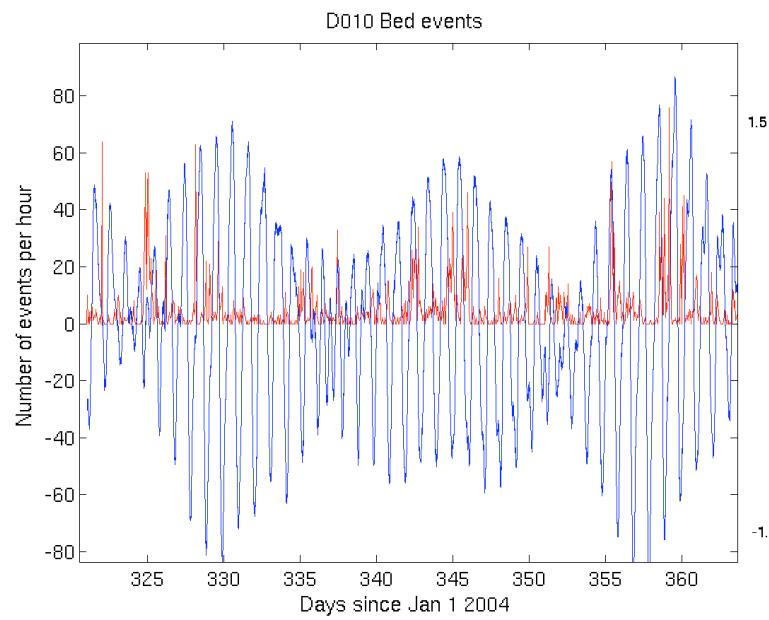
Number of events are
binned per hour.



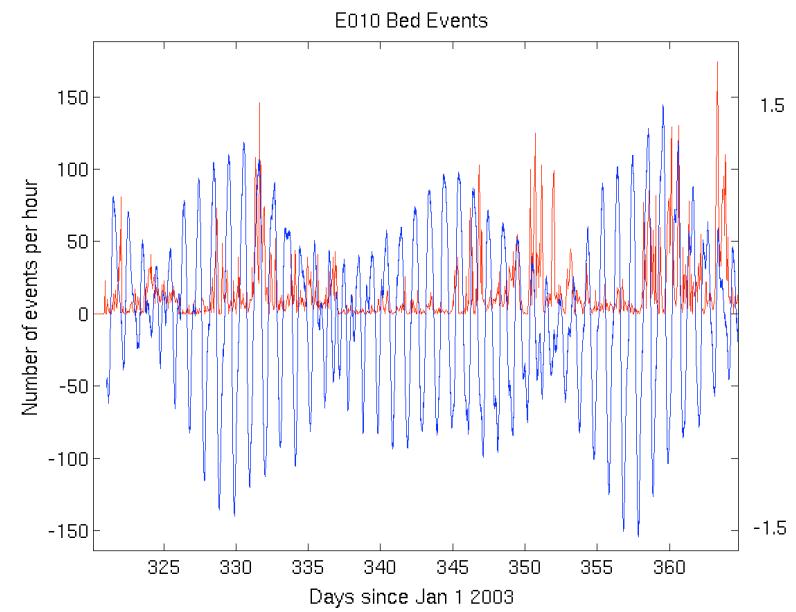
Peak seismicity associated
With falling tide
(Anandakrishnan and Alley,
1997)

Passive Seismic: Ice Stream Beds

D010



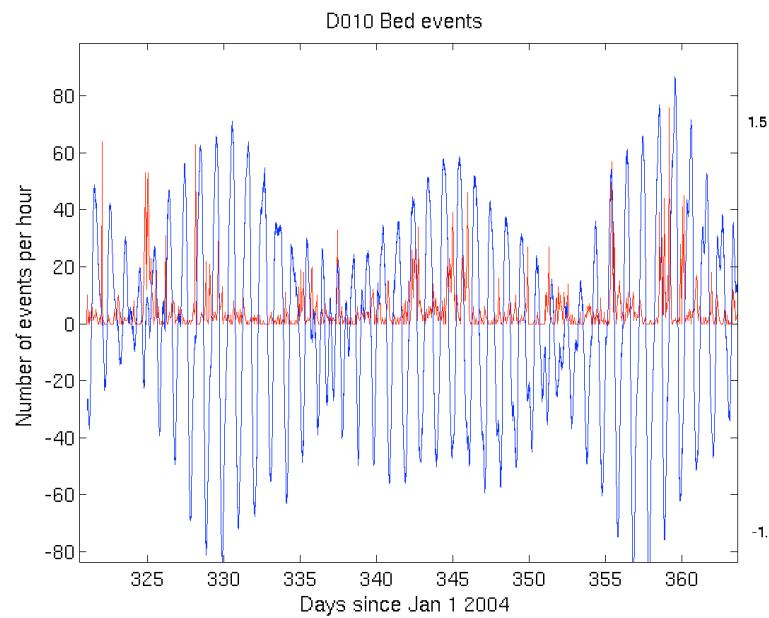
E010



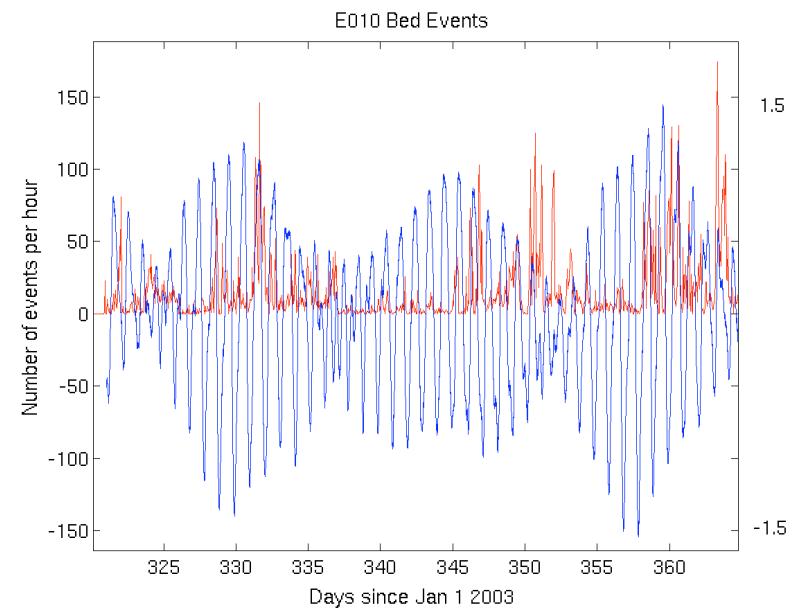
**The number of bed events should
Provide info about the frictional nature of the bed**

Passive Seismic: Ice Stream Beds

D010



E010



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

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

The bed is E 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.

