# Questions

[1]Parizek and Alley (2004), [2]Alley and others (2005), [3]van der Veen (2007)

## Seasonal accleration along western flank of GIS

Some observations after the fact:

(1) Zwally et. al (2002) interpretation is based on observations at a single location on the ice sheet (one GPS receiver)

(2) 10-20% is relatively small w.r.t. seasonal accelerations observed on other polar glaciers[1] and at other sites on the GIS[2,3]

[1]Bingham and others (2005), [2]Mohr and others (1998), [3]Rumrill and others (2006)

# Outline

- brief background on Greenland ice sheet (GIS)
- background on seasonal flow acceleration along the western flank of the GIS (the “Zwally effect”)
- **a more general hypothesis for explaining the ZE**
- testing this hypothesis using:
    - flow modeling
    - recent observations
- summary and conclusions

field camp, central Greenland

# Expanded Hypothesis

# Outline

- brief background on Greenland ice sheet (GIS)
- background on seasonal flow acceleration along the western flank of the GIS (the “Zwally effect”)
- a more general hypothesis for explaining the ZE
- **testing this hypothesis using:**
    - **flow modeling**
    - recent observations
- summary and conclusions

field camp, central Greenland

# Flow Modeling

**Model:**

- 2D flowband model solves equations for thermomechanical flow in plane-strain using Finite Volume Method[1]
- “sliding” through basal layer with power-law rheology (can parameterize basal motion due to hard or soft bed)

**Boundary Conditions:**

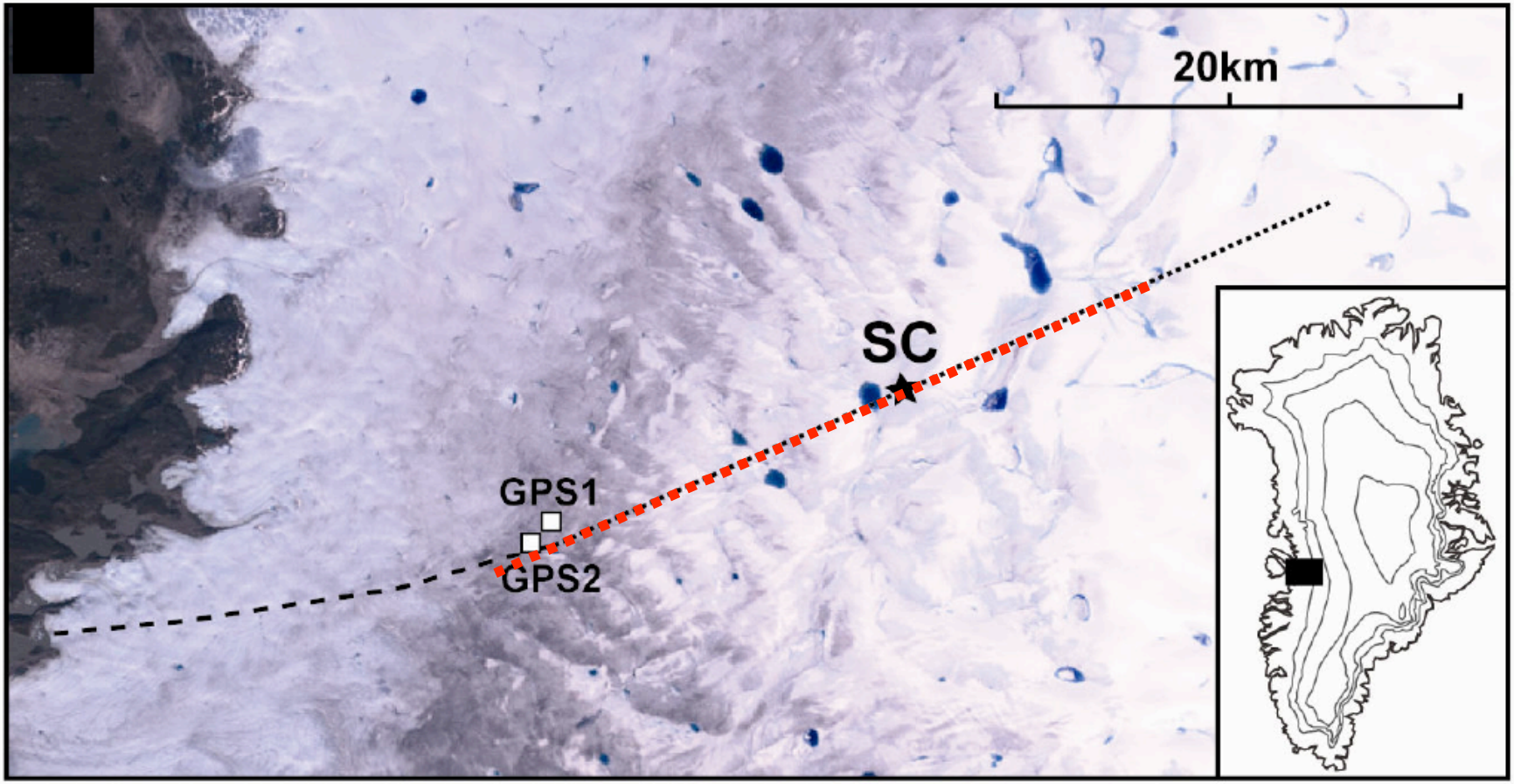
- zero flux at up/downstream boundary (hundreds of km upstream is flow divide, downstream is terminus)
- free surface
- no slip at base of sliding layer

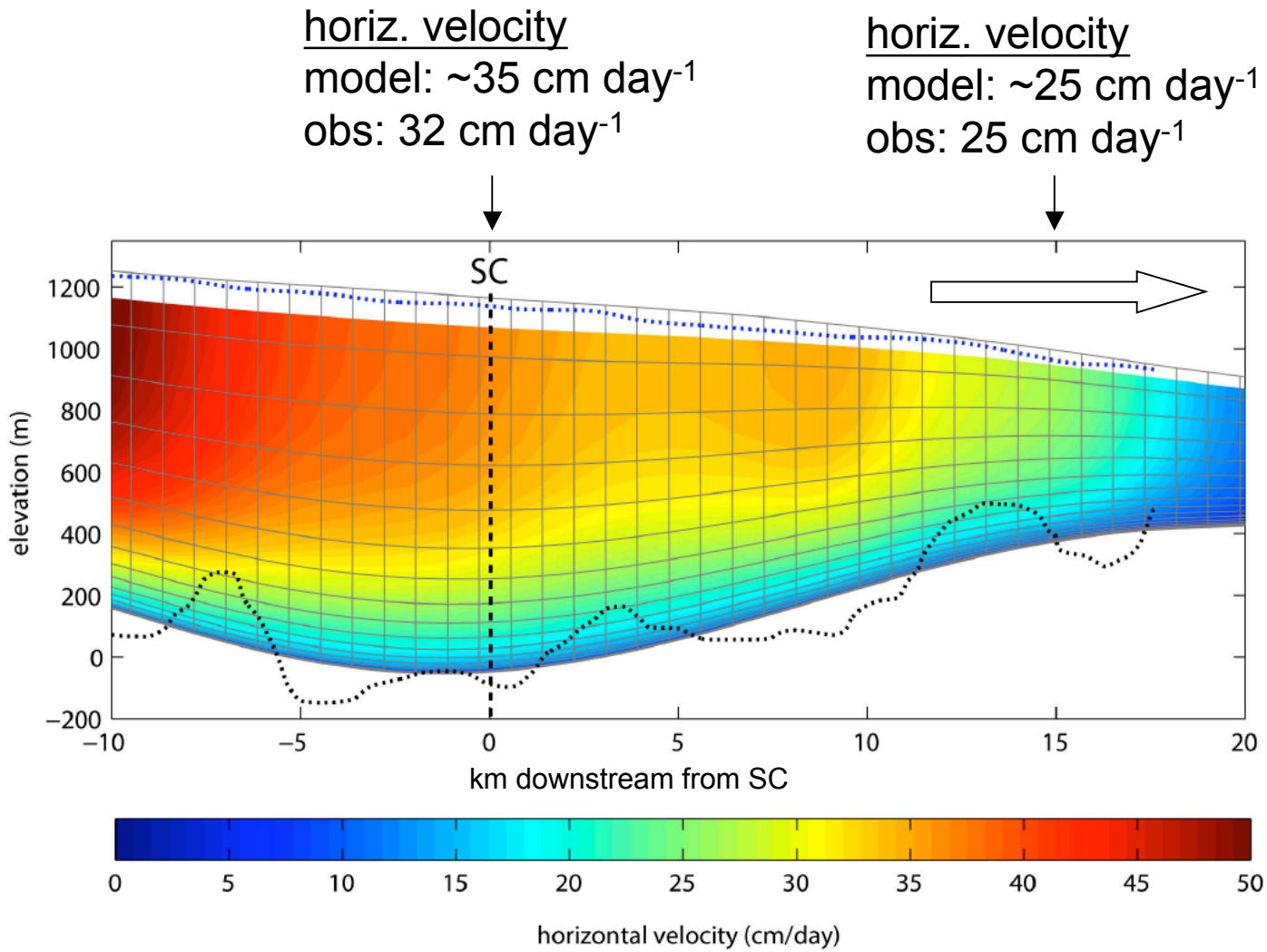
[1]Price and others (in review)

# Flow Modeling

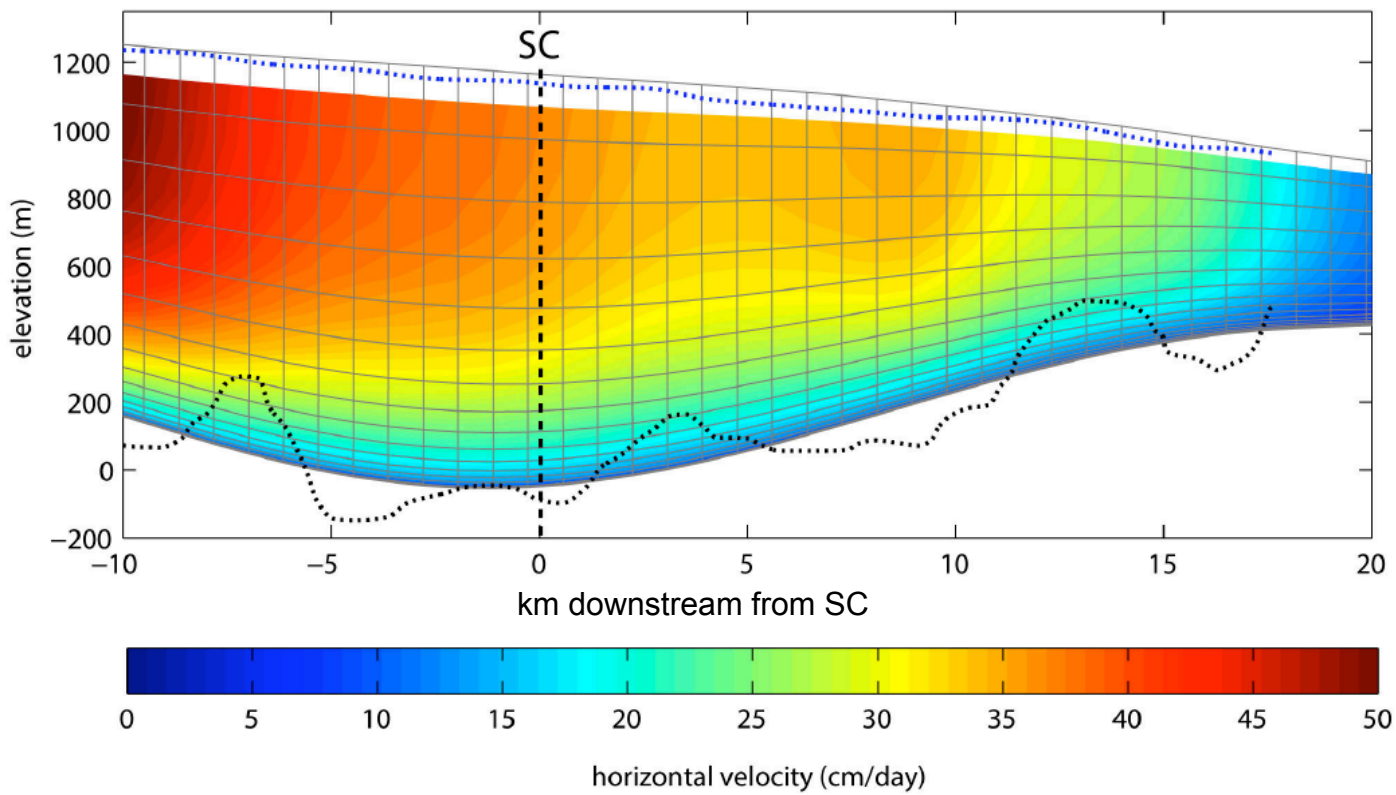
## Simplifying assumptions:

**a thawed, sliding bed is assumed in both cases


20km
SC
GPS1
GPS2

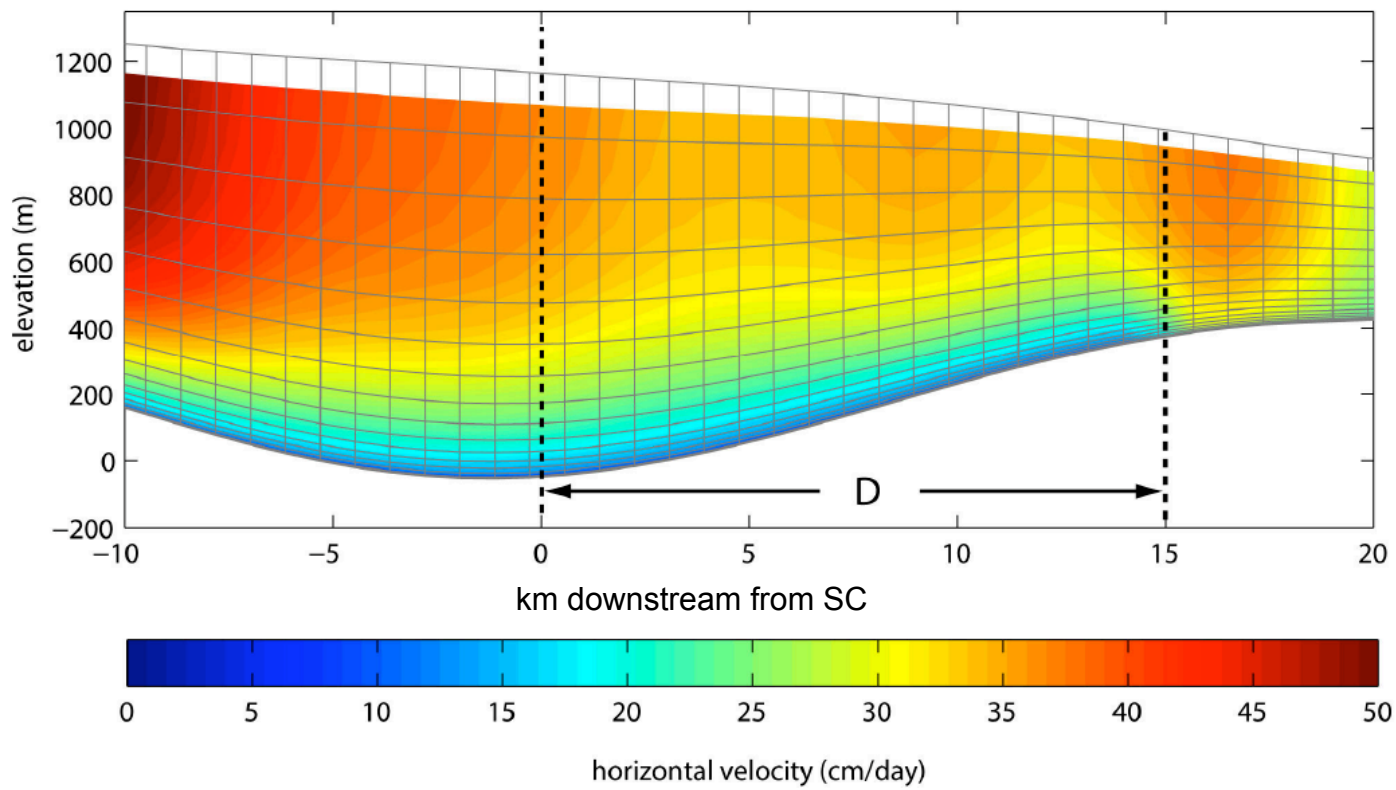



Initial, steady-state for isothermal model




… to simulate an increase in basal lubrication and sliding initiated from 15km downstream of SC to the margin, soften the basal layers there …

… increase in surface velocity D km downstream is ~25% ($U_s/U_0$=1.25 = A)
… increase in surface velocity at SC is ~2%




We want to compile results for many model runs in which we systematically vary the length scale, “D”, and “A”, the magnitude of the acceleration at D (through Δsliding)