Rib-like patterns in inverted basal resistance of ice sheets

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High-resolution data sets

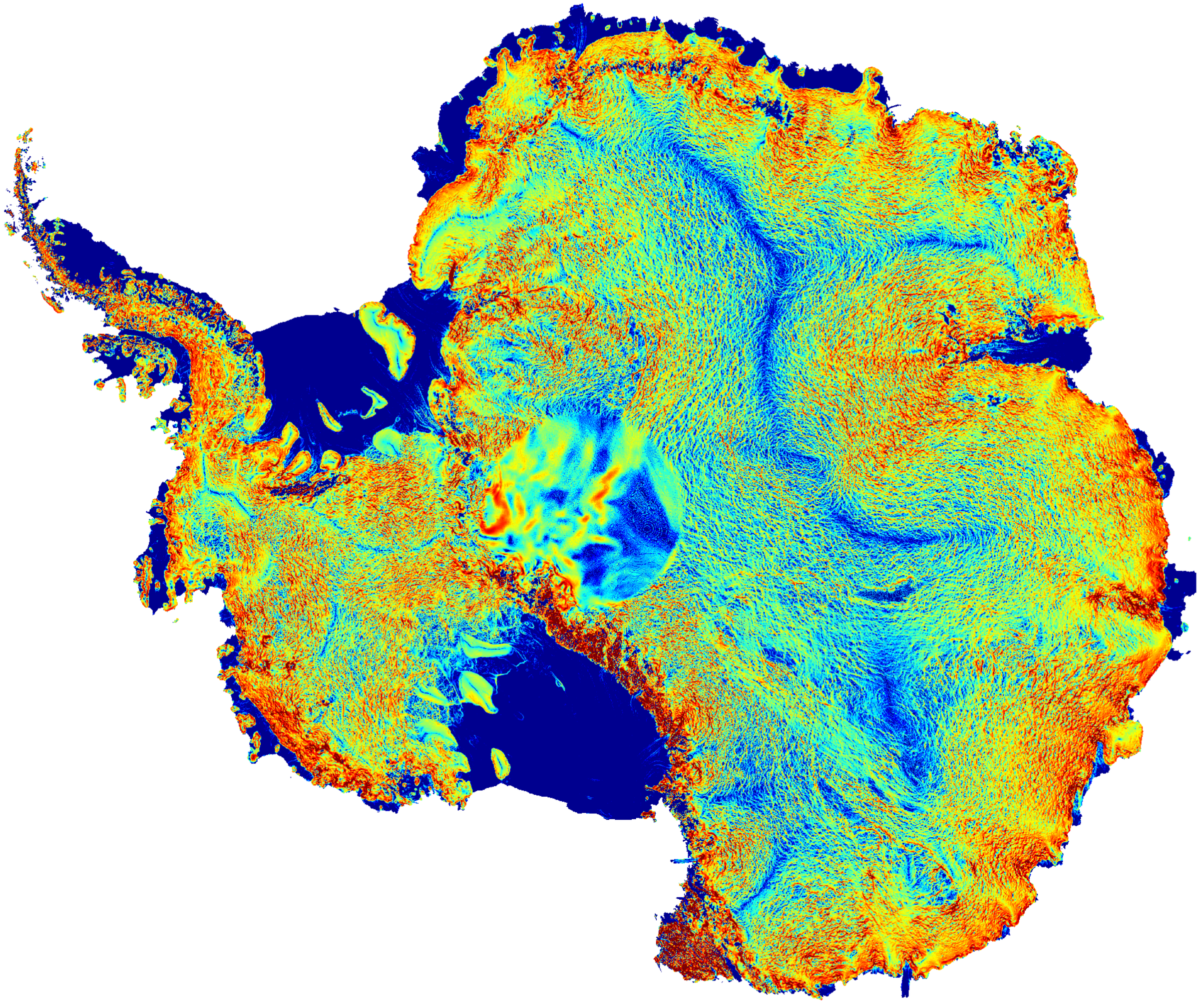
Antarctic geometry: BEDMAP 2 (2013)

Greenland geometry: Bamber et al. (2013)

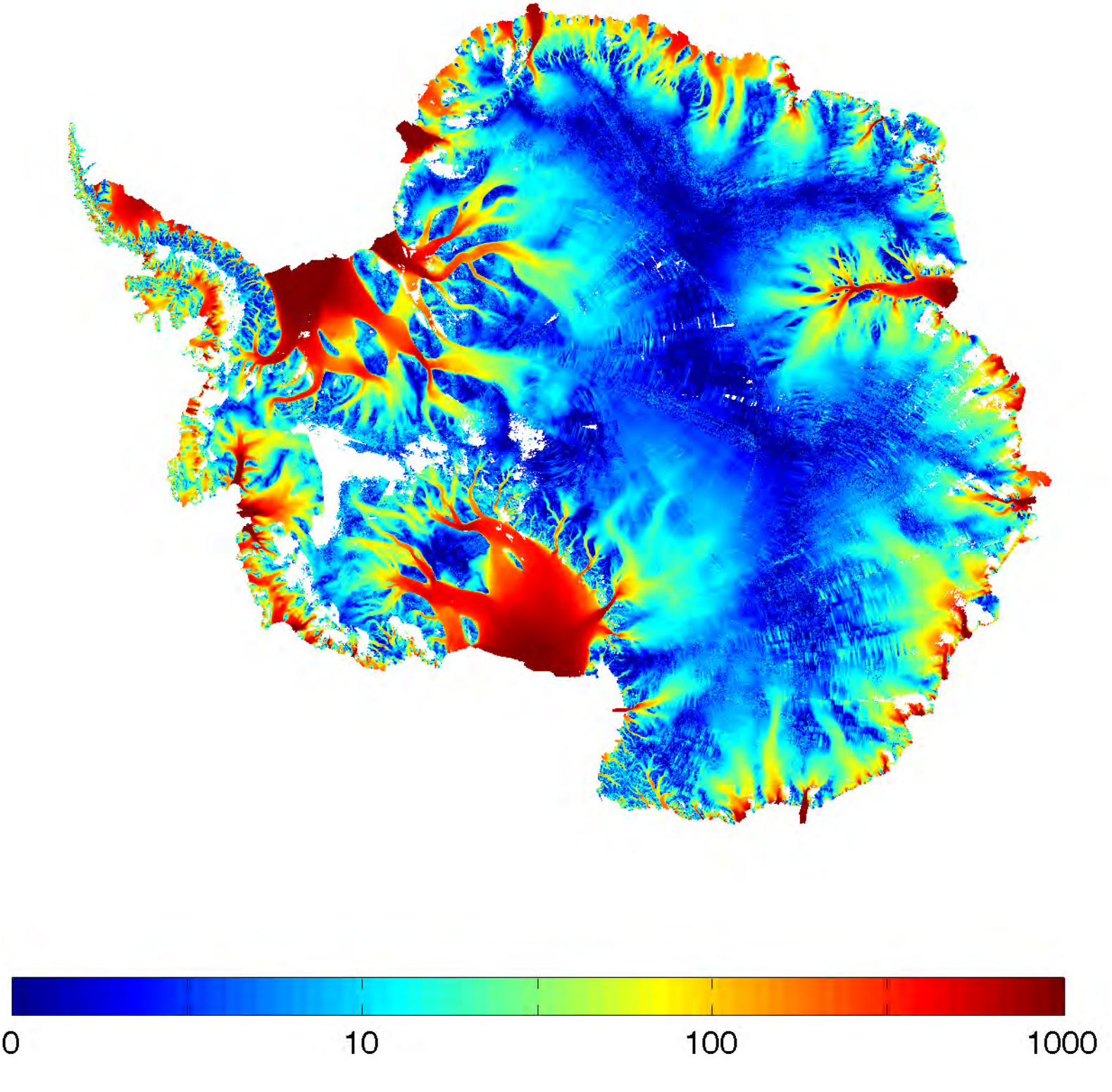
Antarctic surface velocities: Rignot et al. (2011)

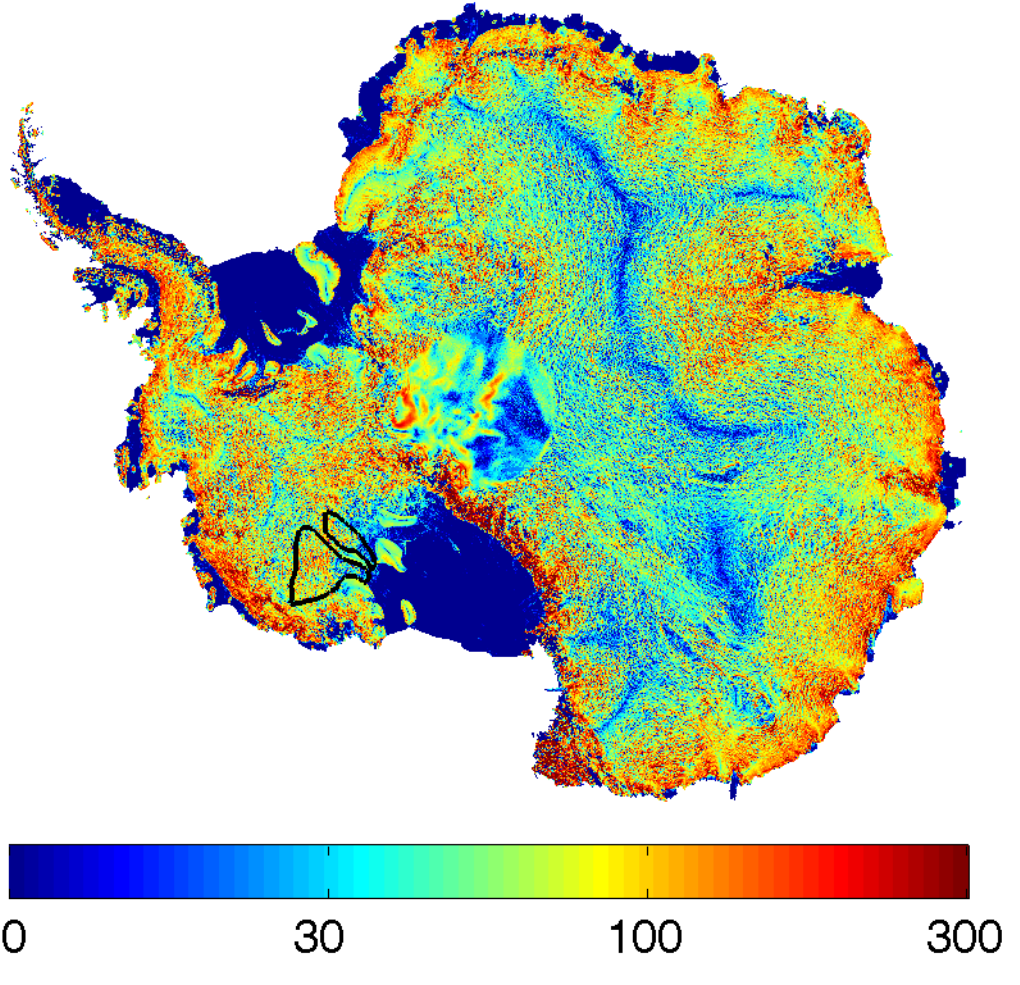
Greenland surface velocities: Joughin et al. (2009)

Driving stress (kPa)



Ice speed (m yr^{-1})




10
30
100
300

Inversions

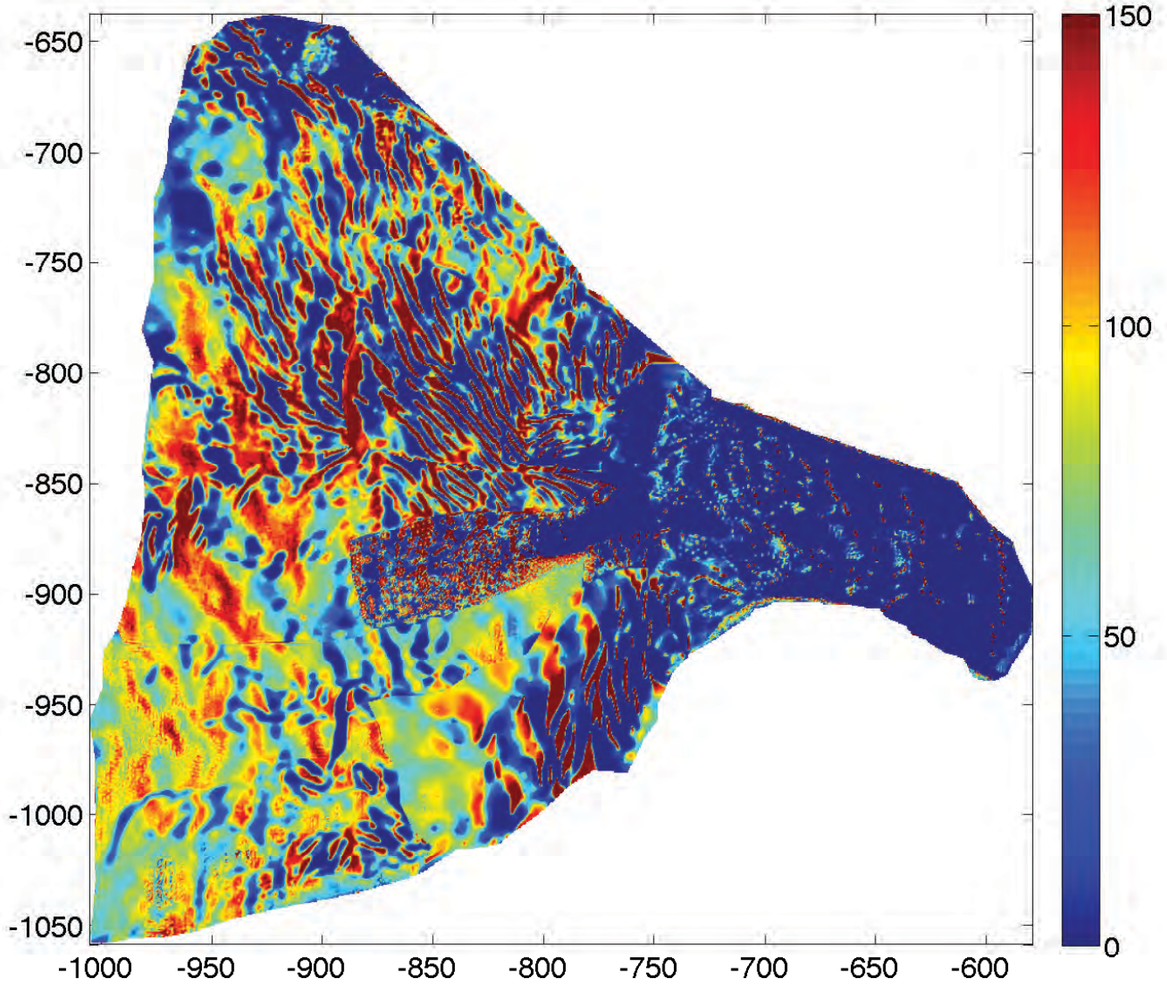
observations

(surface velocities , bed and surface elevations)

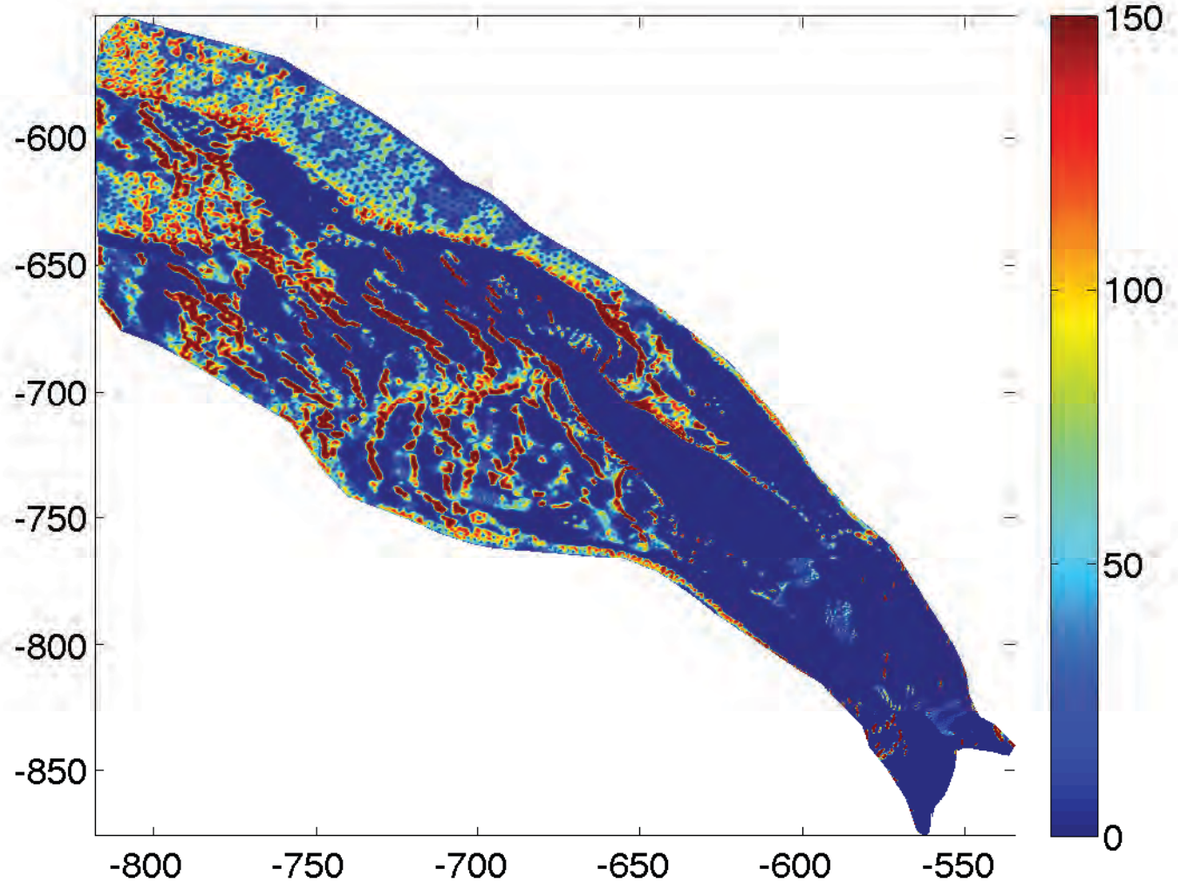
+

full-Stokes forward model

Basal shear stress (kPa)

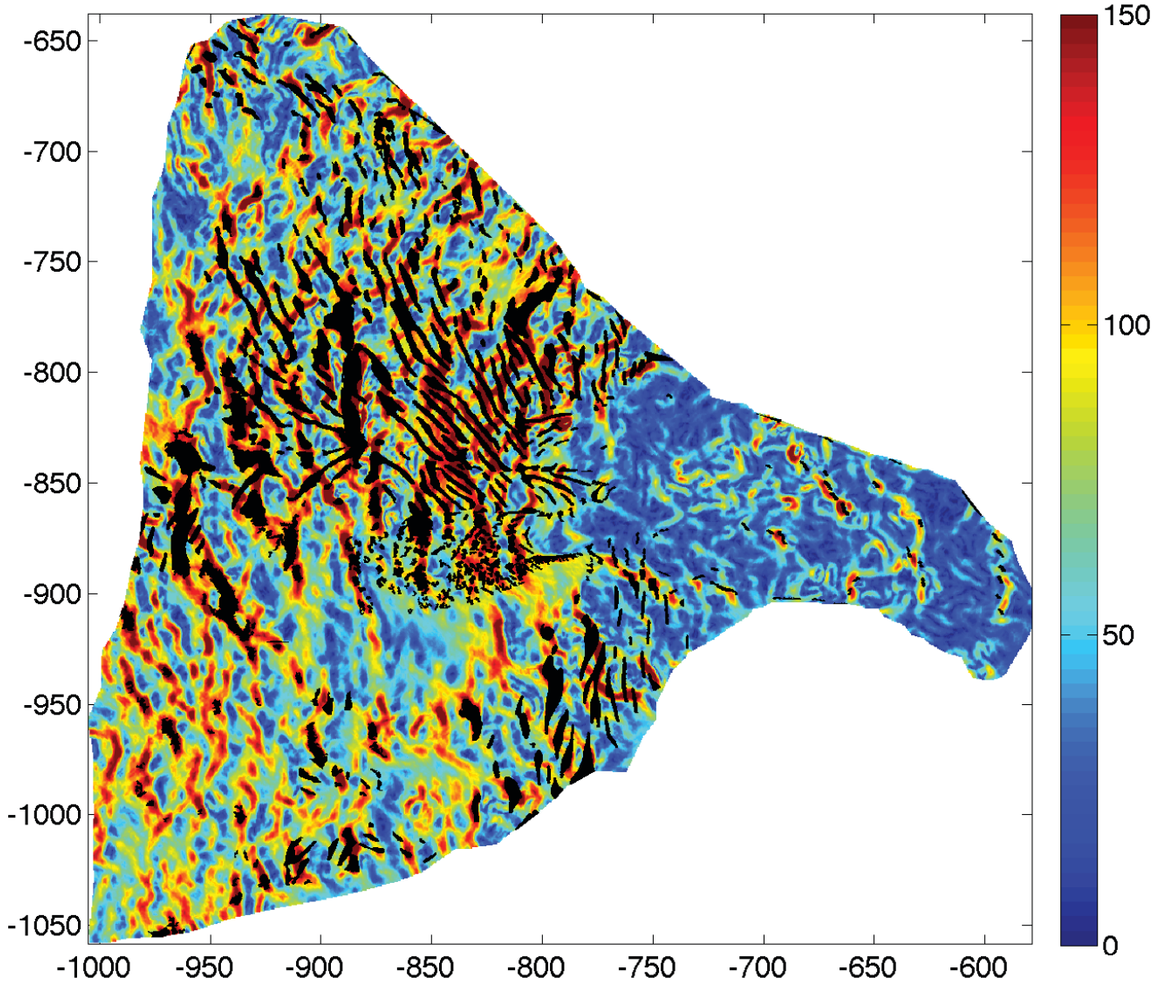


MacAyeal IS

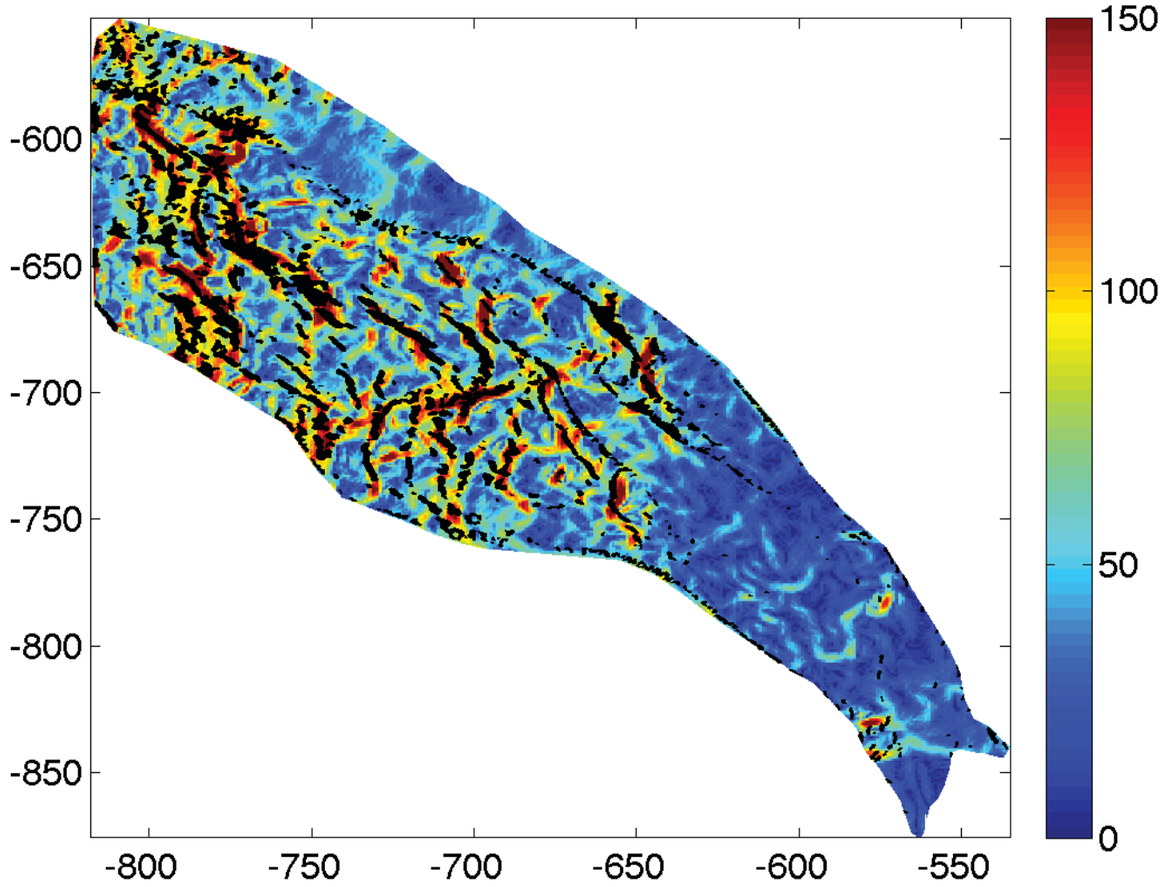


Bindshchadler IS

Driving stress (kPa)

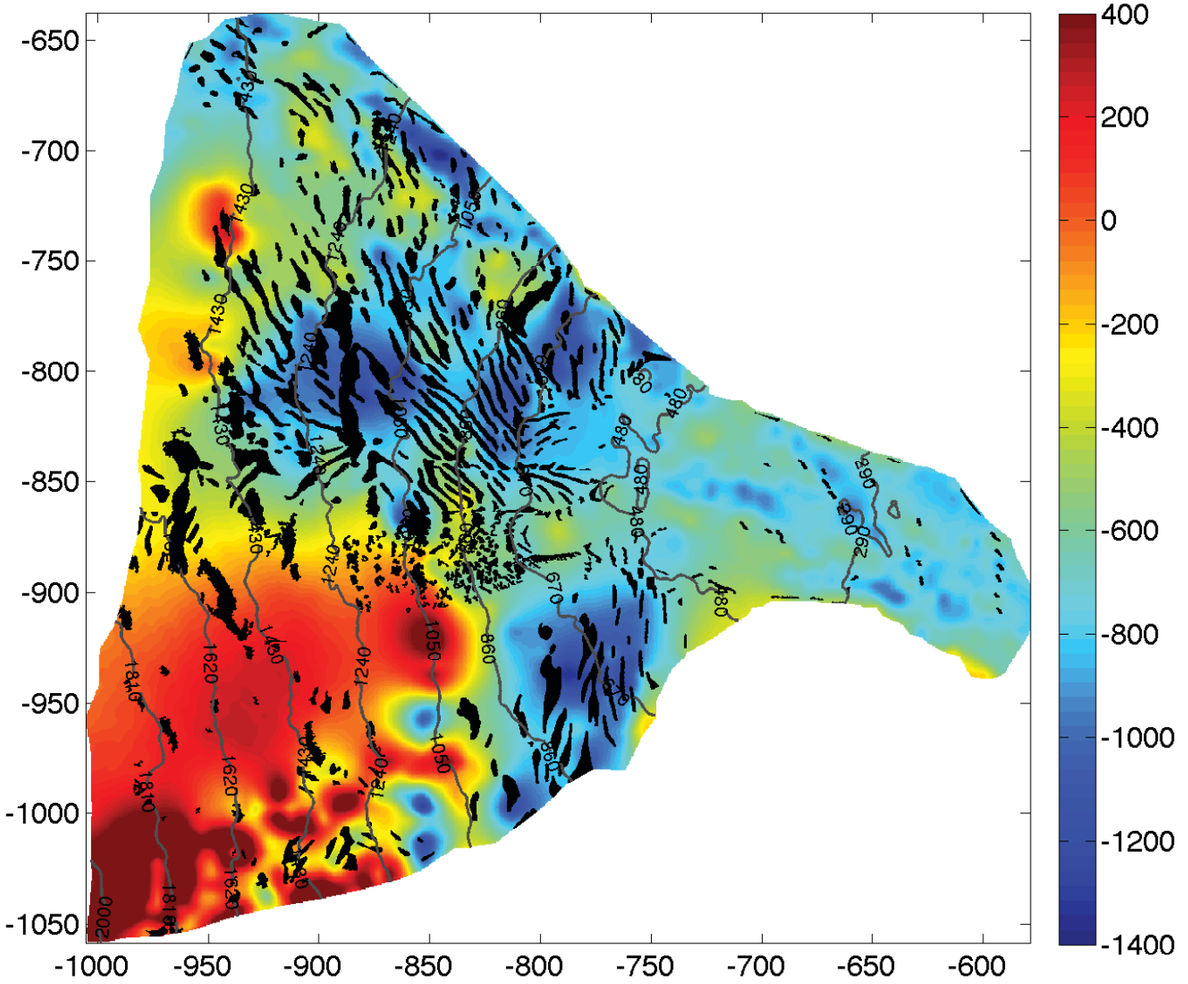


MacAyeal IS

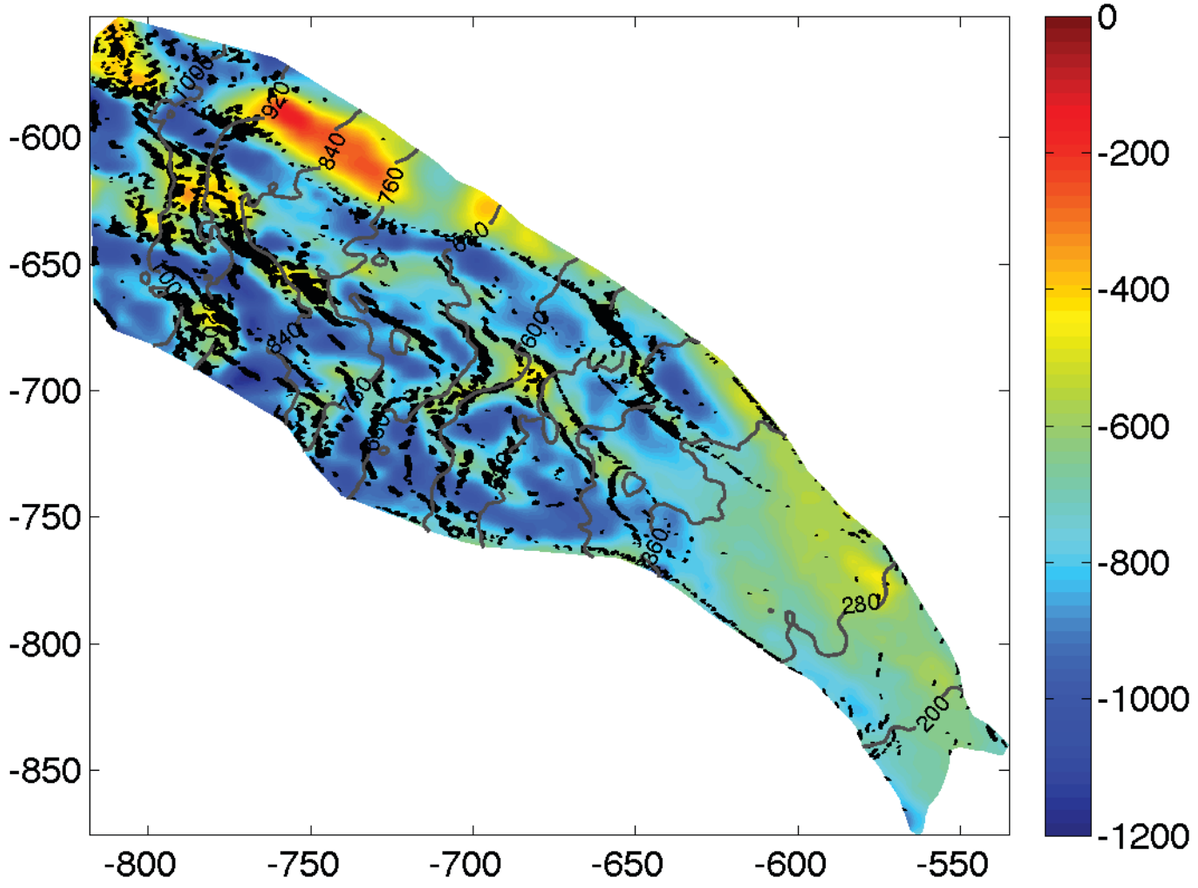


Bindshchadler IS

Bed and surface elevation (m)

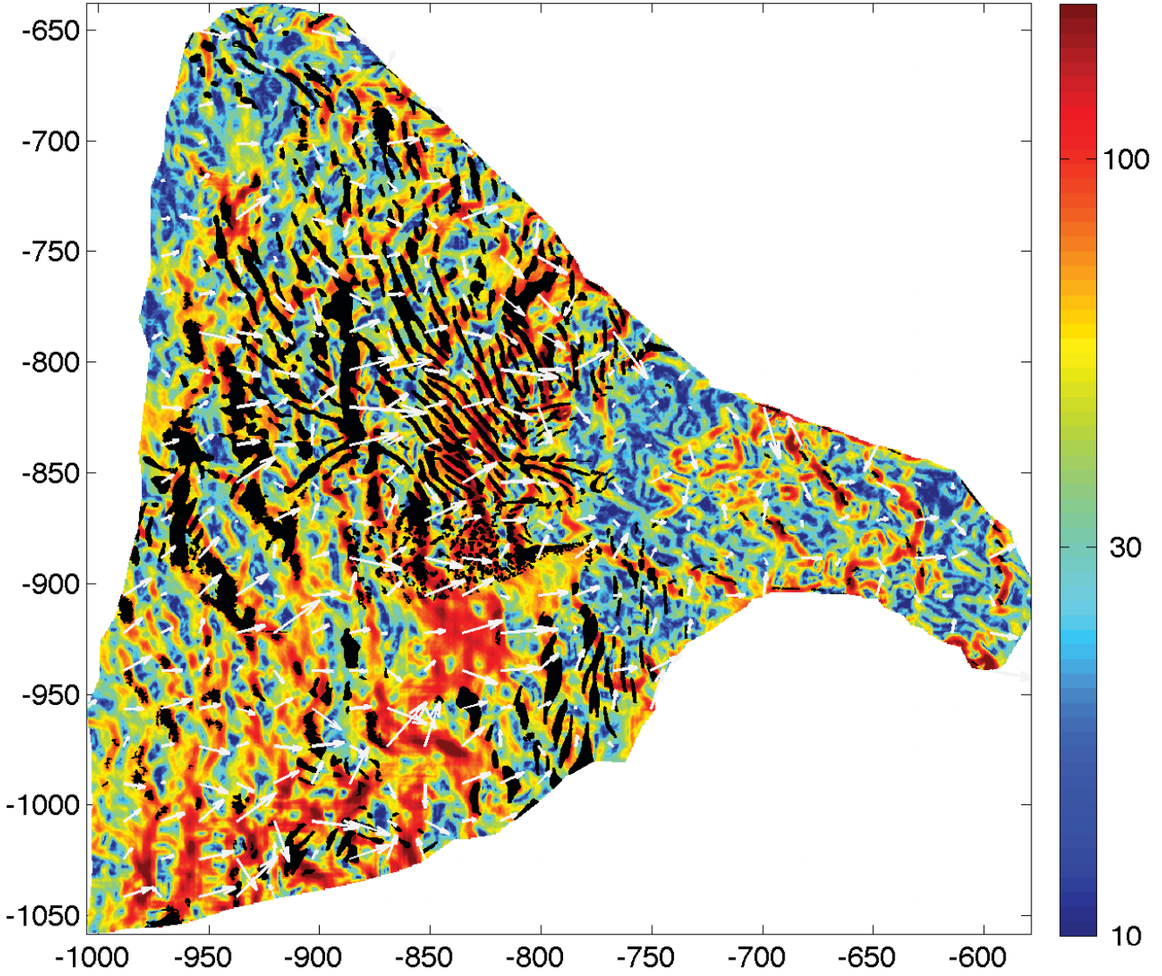


MacAyeal IS

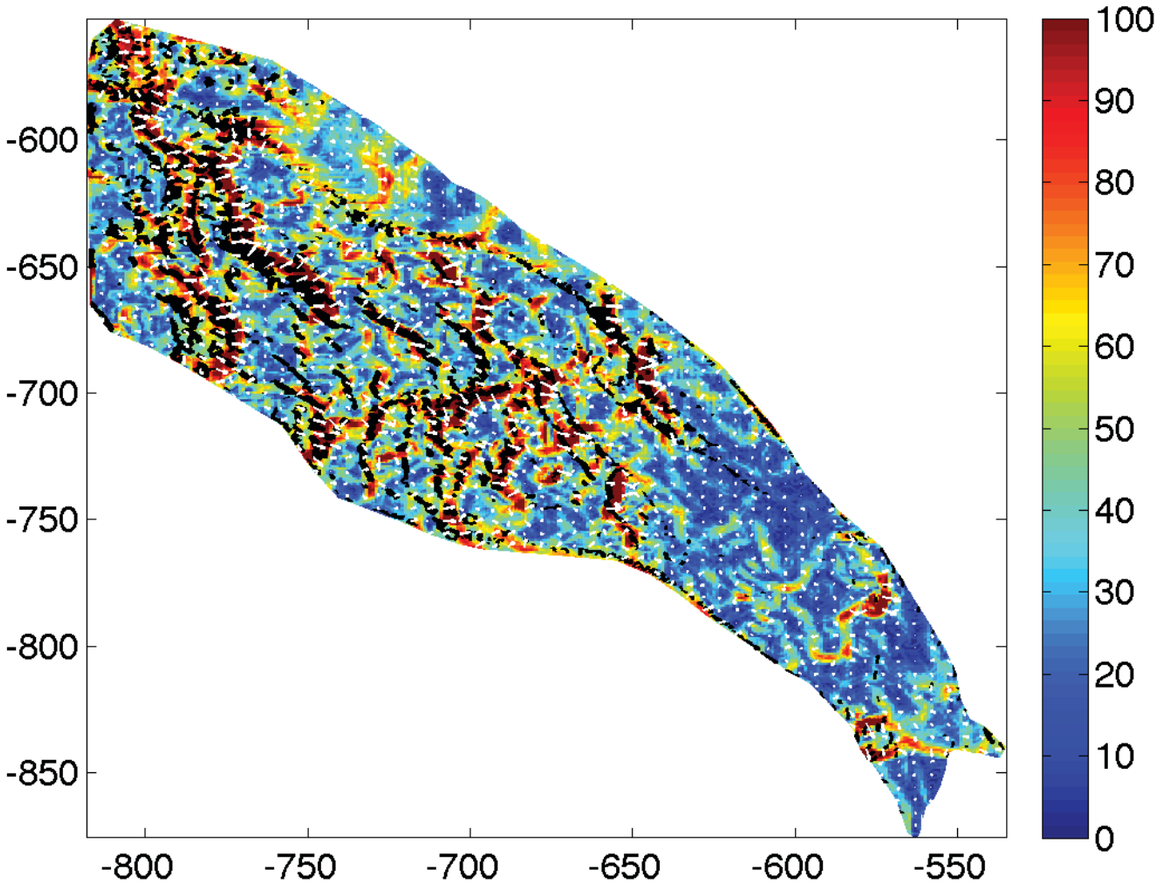


Bindshchadler IS

Gradient of hydraulic potential (Pa m^{-1})



MacAyeal IS



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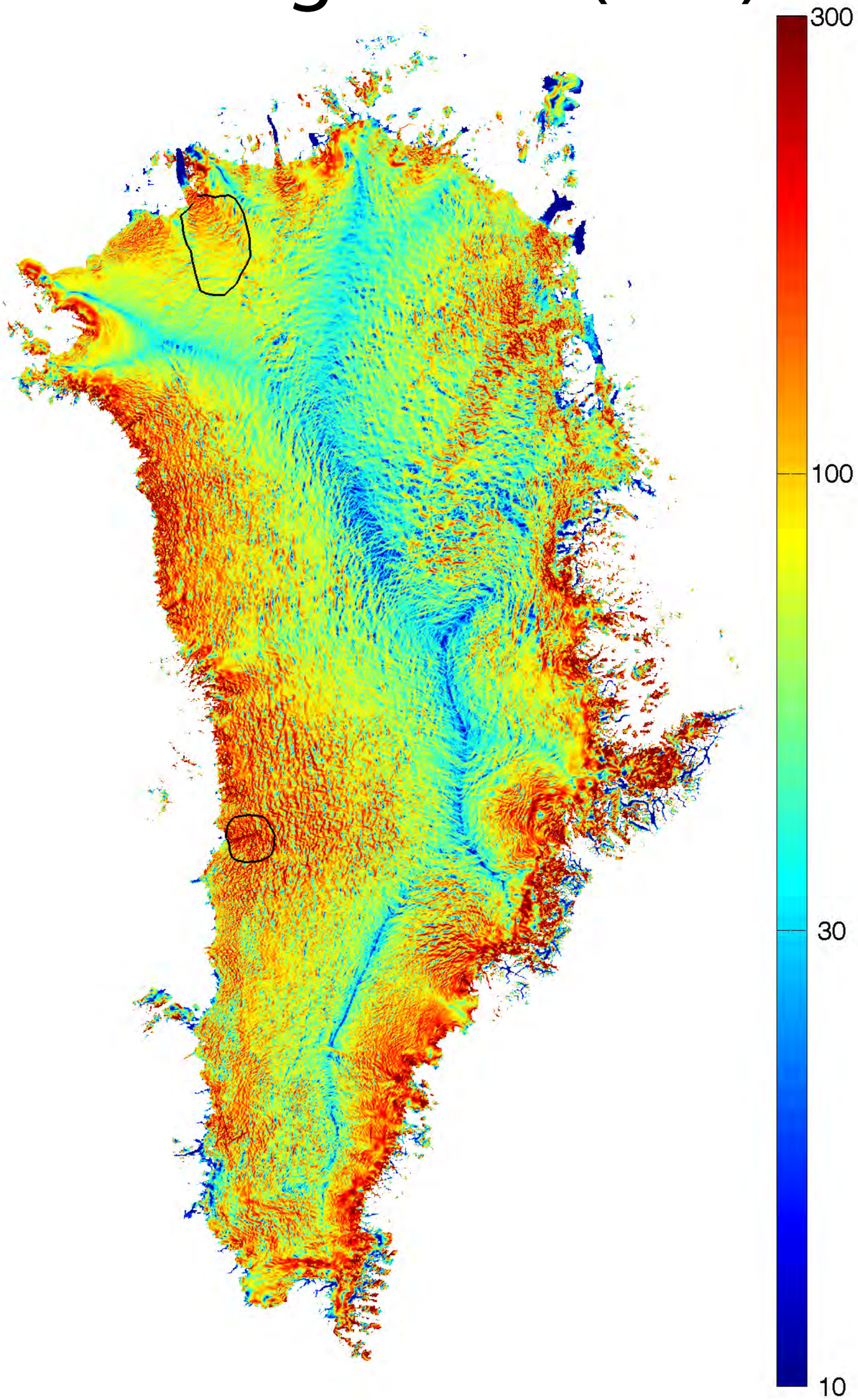
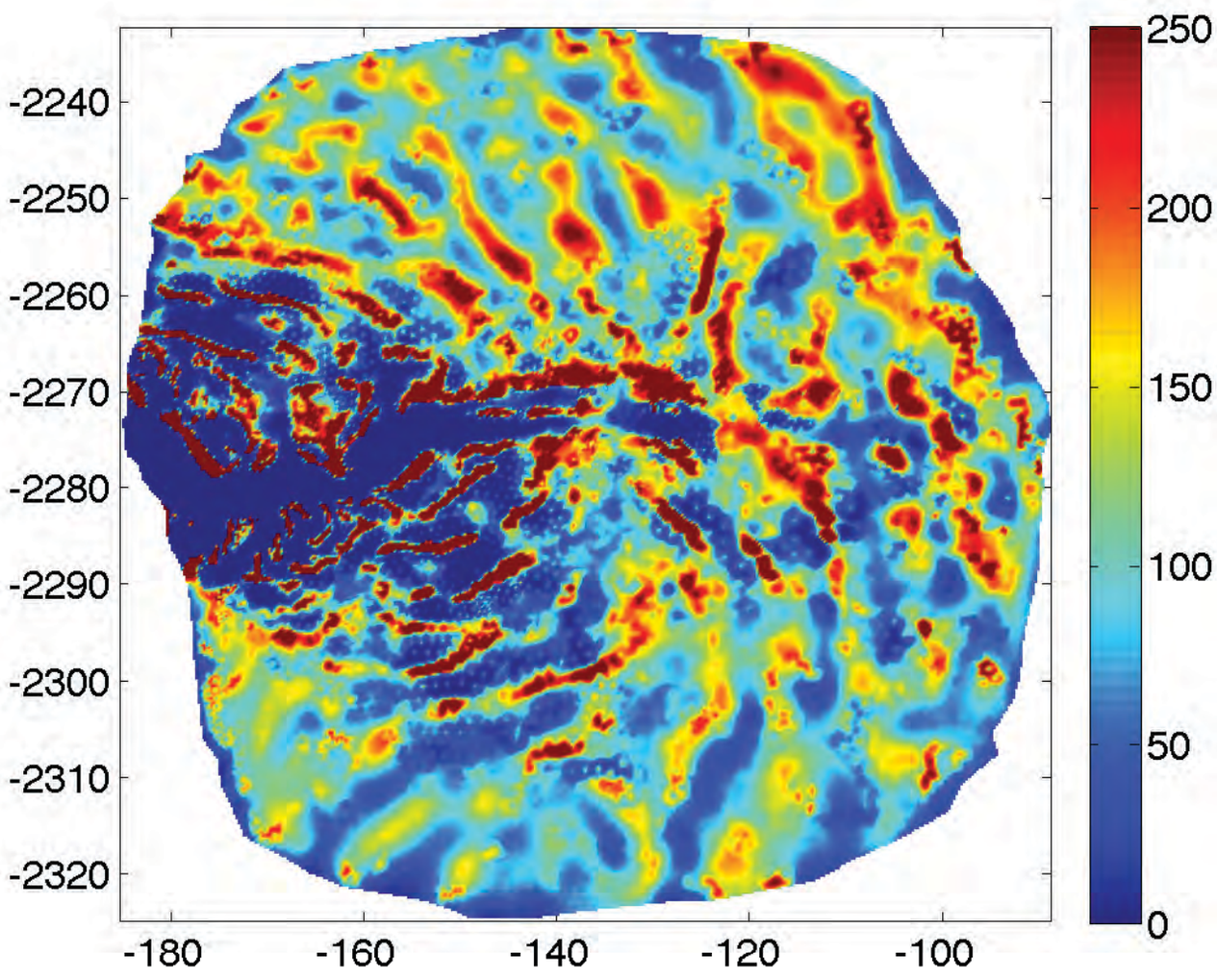
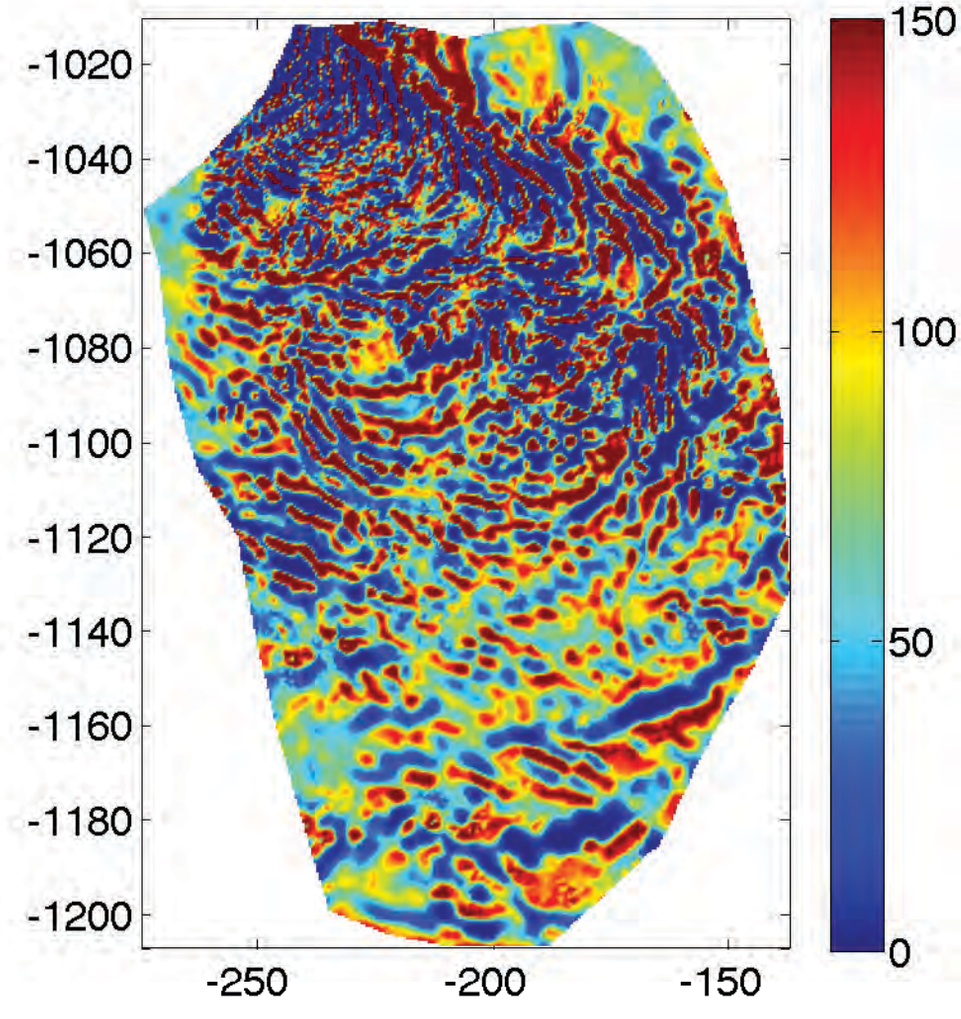
Driving stress (kPa)



Basal shear (kPa)

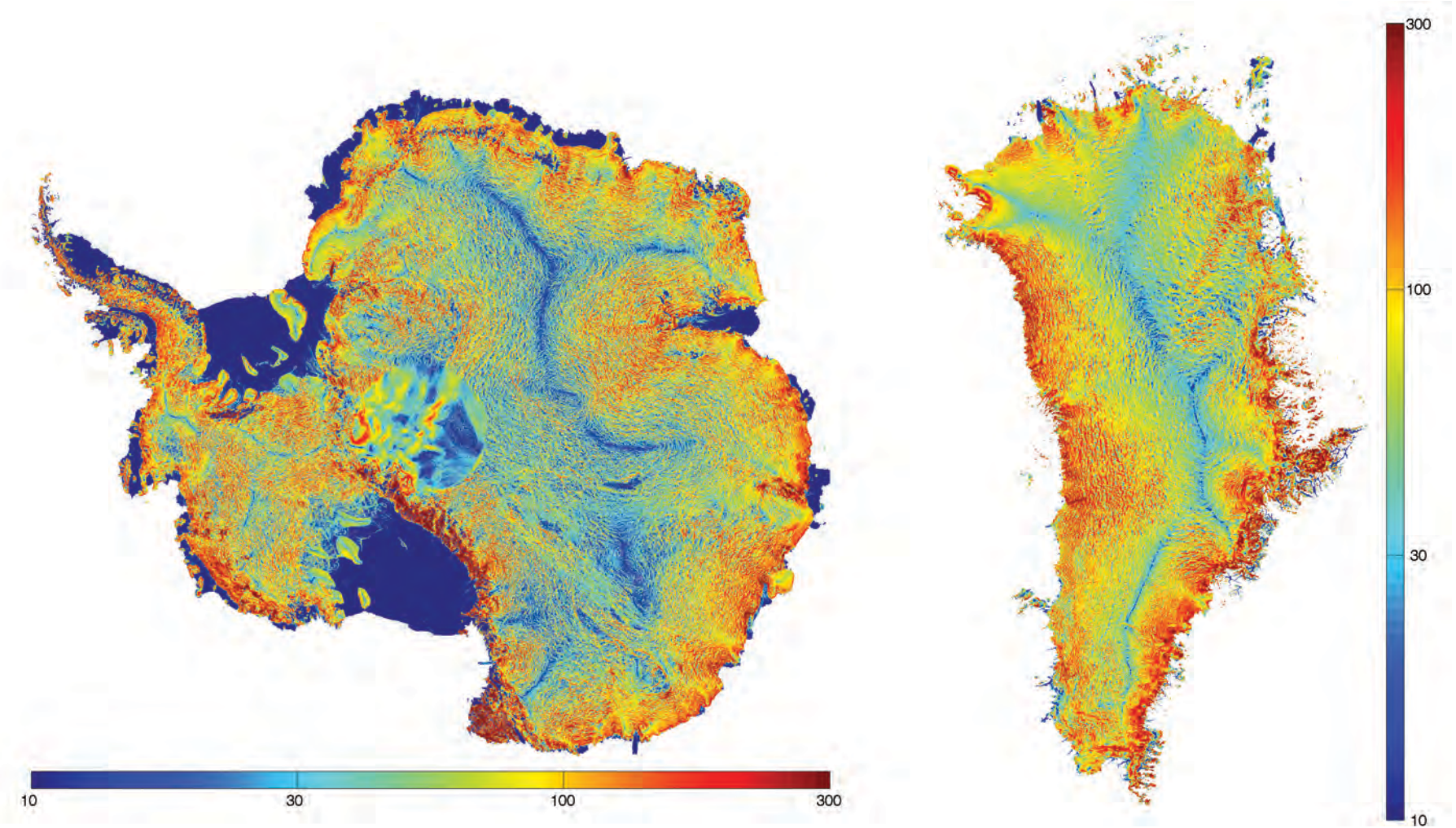


Jakobshavn Isbræ



Petermann Glacier

Driving stress (kPa)

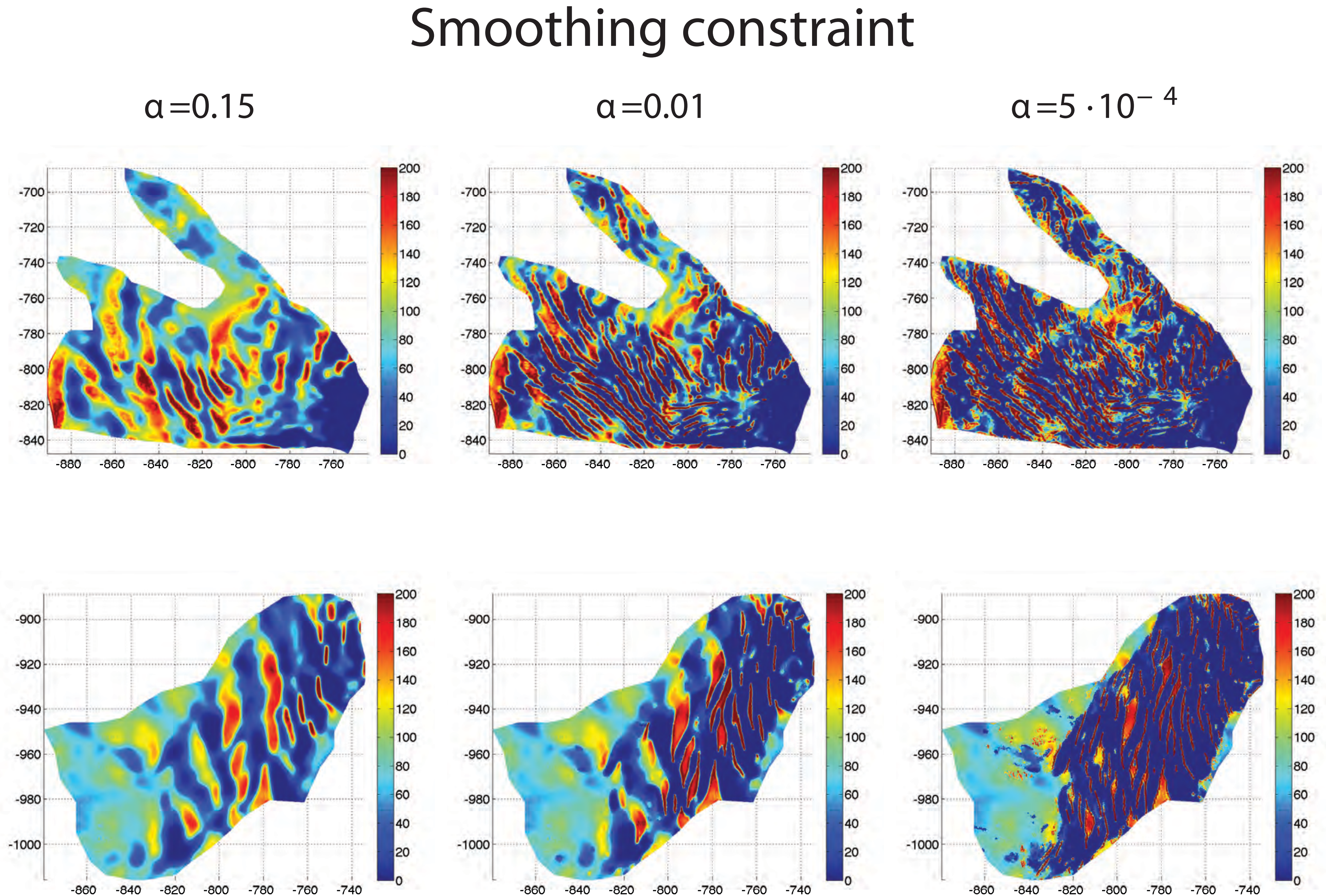


Gazillion $$$ questions

Are the ribs real?

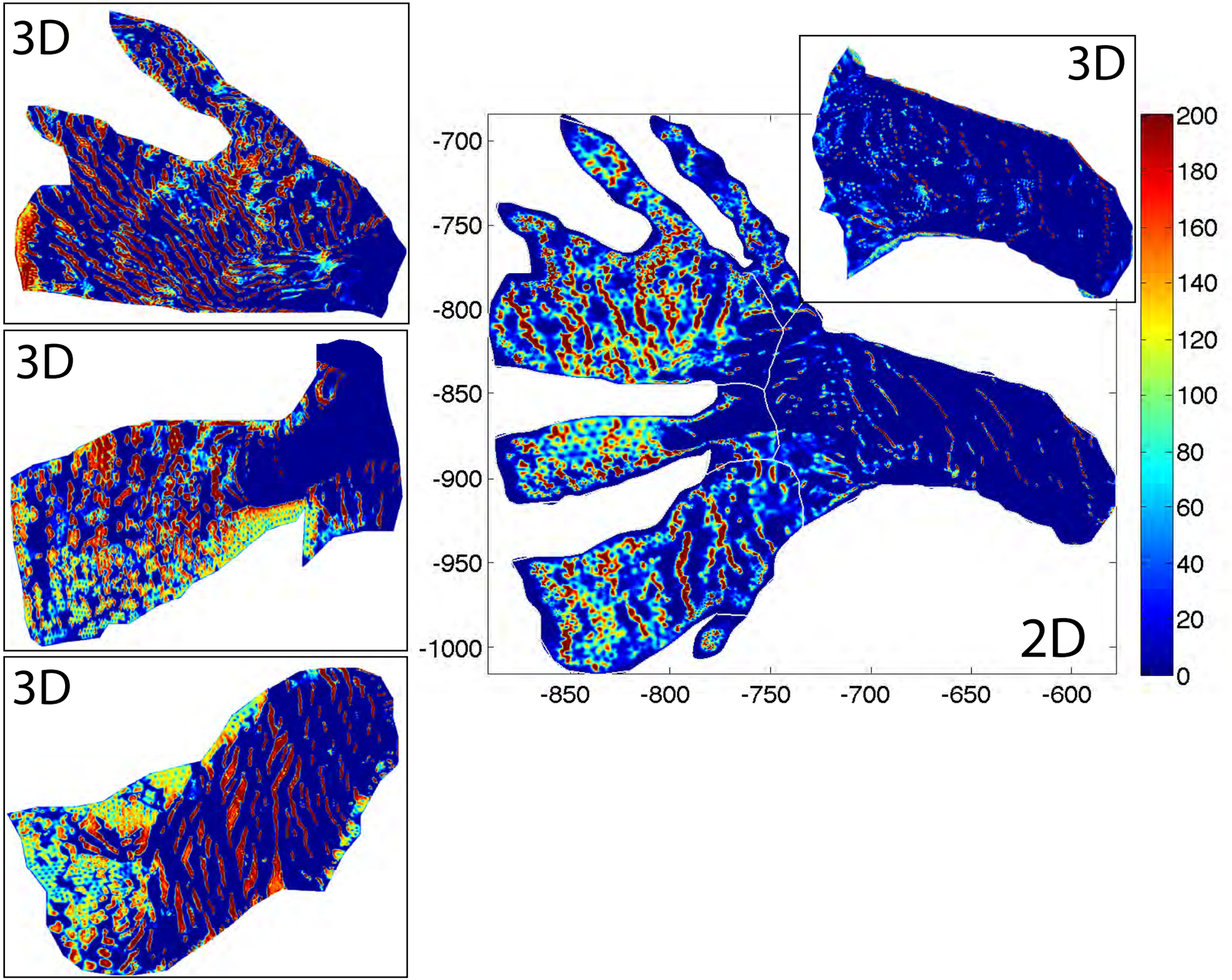
How do they form?

Why are they absent under Siple Coast ice streams?



Smoothing constraint
α=0.15
α=0.01
α=5·10⁻⁴

3D vs 2D


3D
3D
3D
3D
2D
-700
-750
-800
-850
-900
-950
-1000
-850
-800
-750
-700
-650
-600
200
180
160
140
120
100
80
60
40
20
0

Surface slope