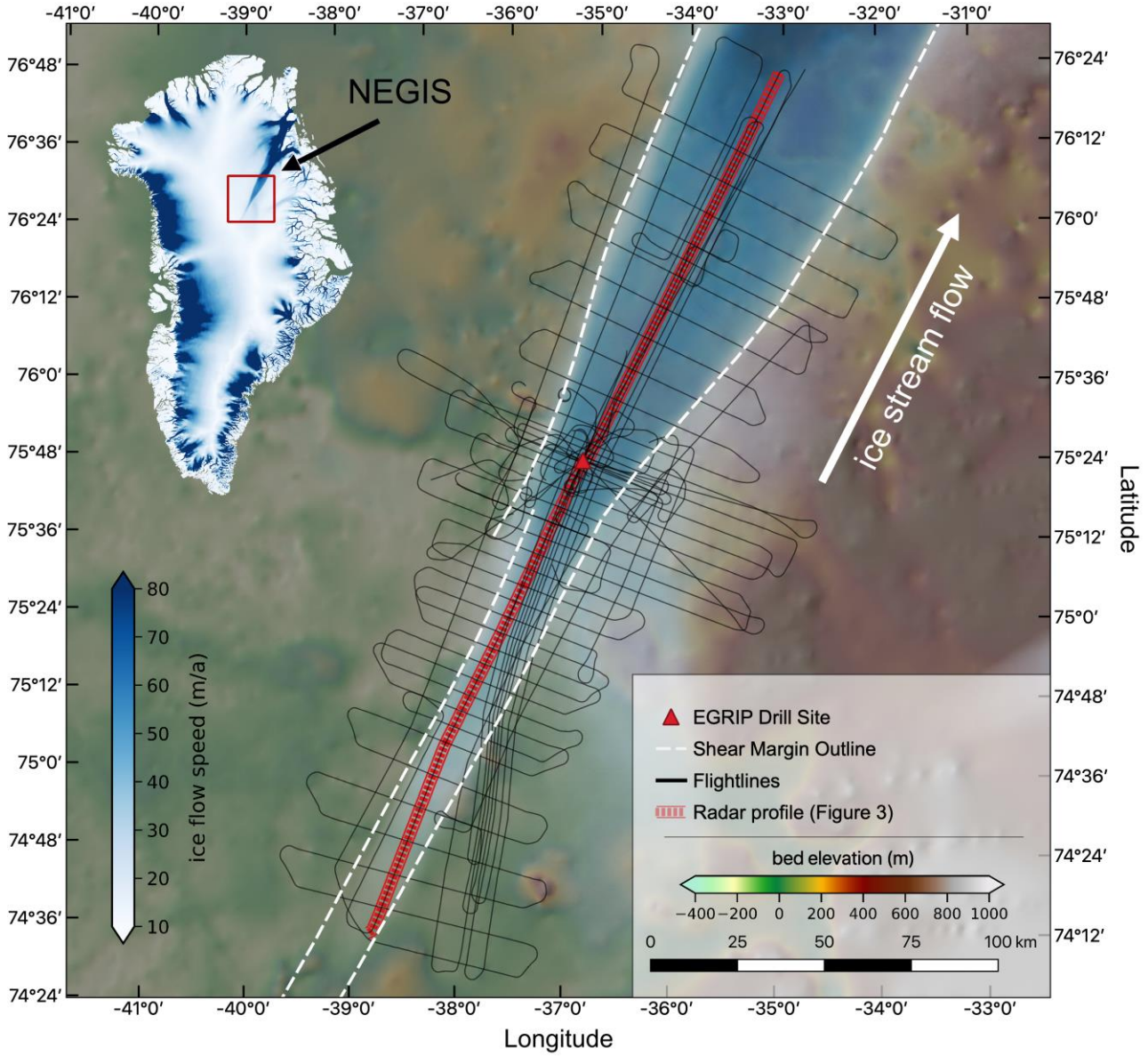
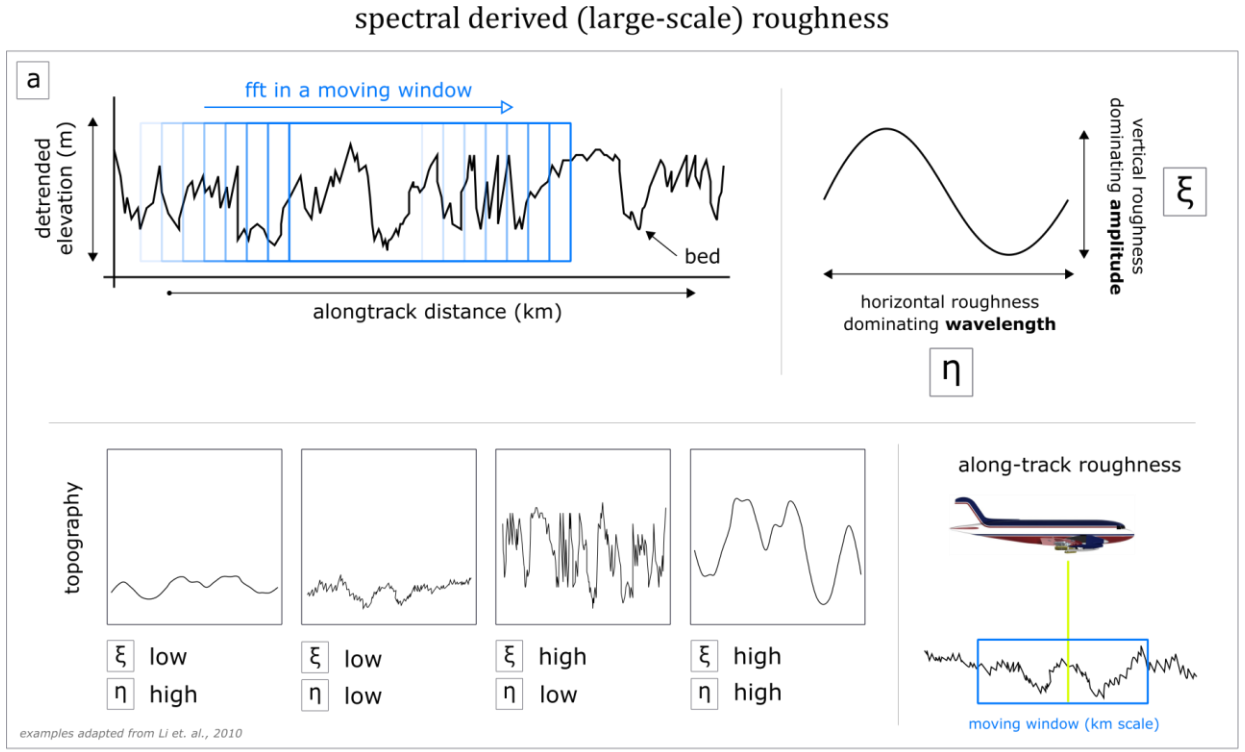
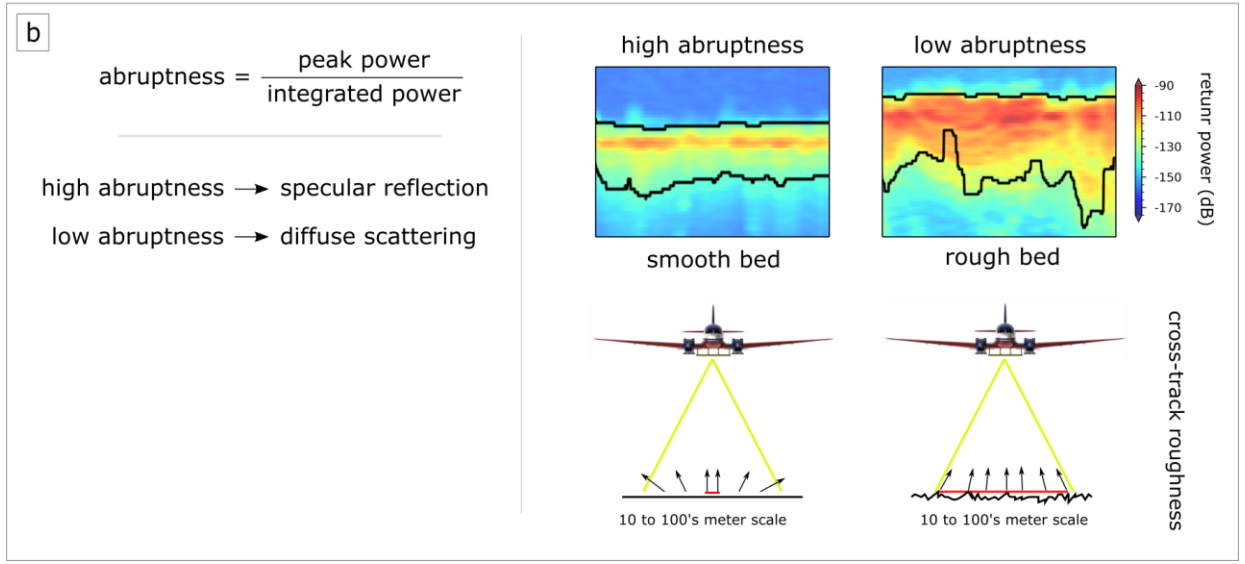


Radar derived basal conditions at the onset of the Northeast Greenland Ice Stream.

Steven Franke, Daniela Jansen, Sebastian Beyer, Tobias Binder, John Paden, and Olaf Eisen





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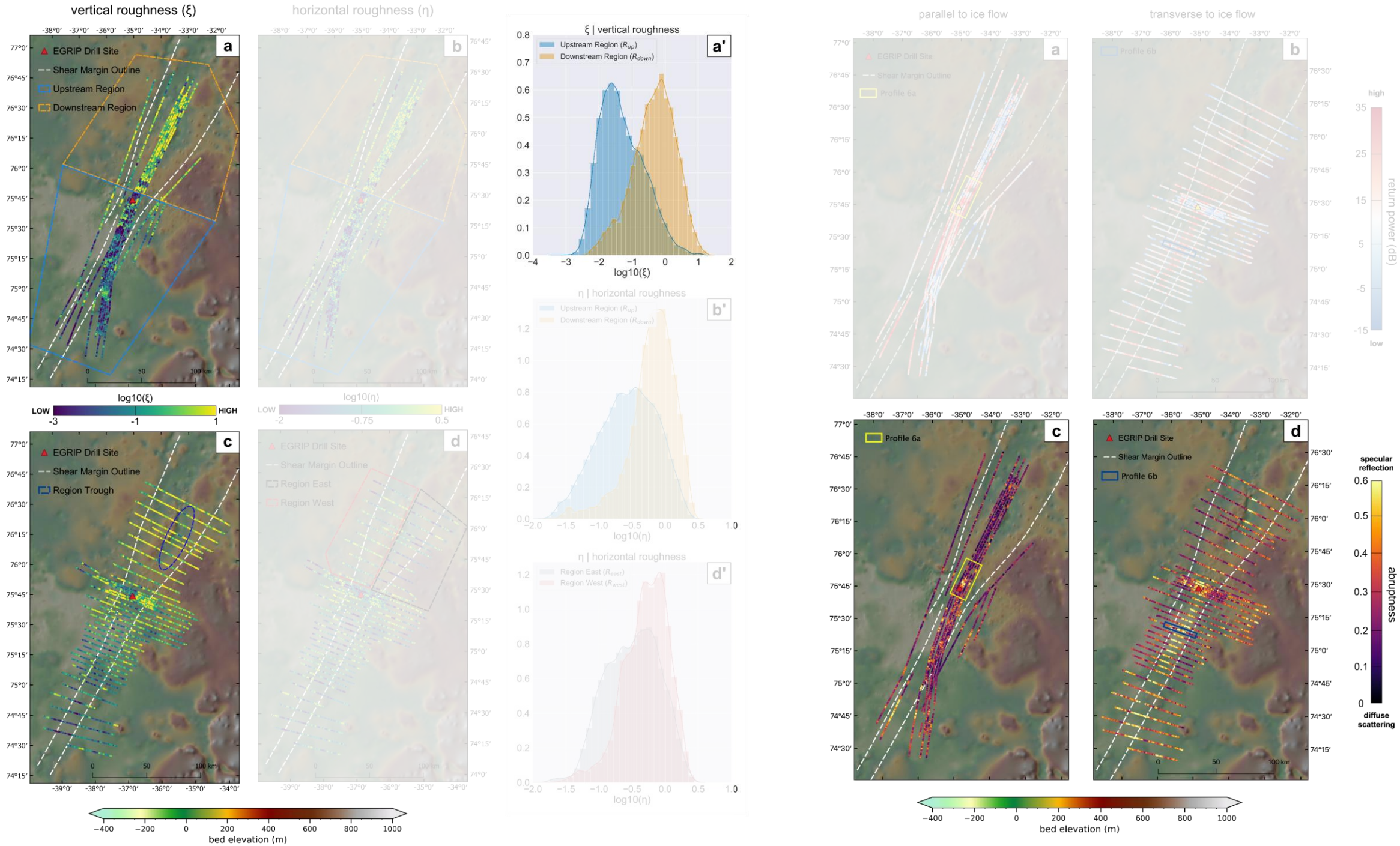
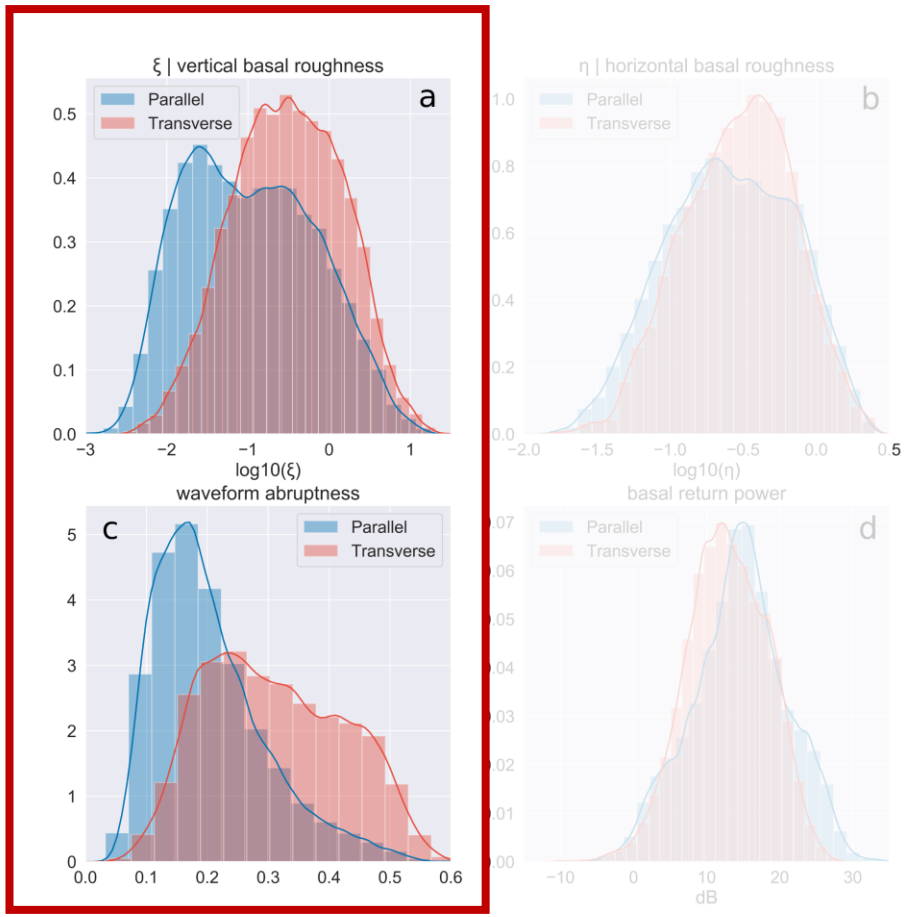
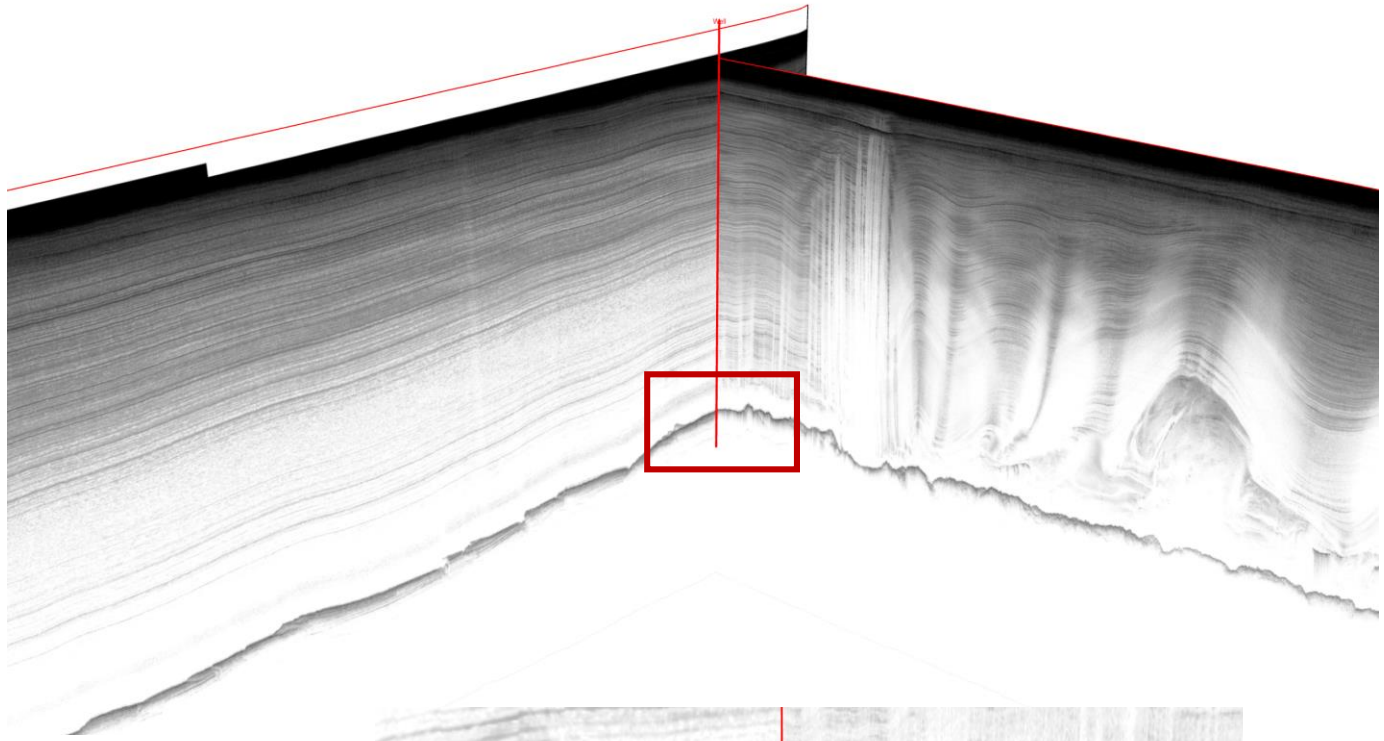
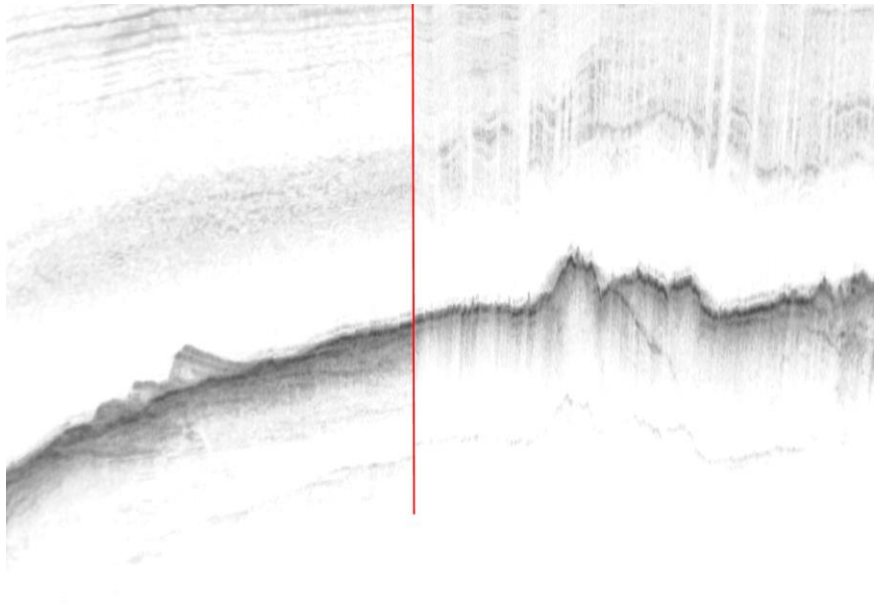
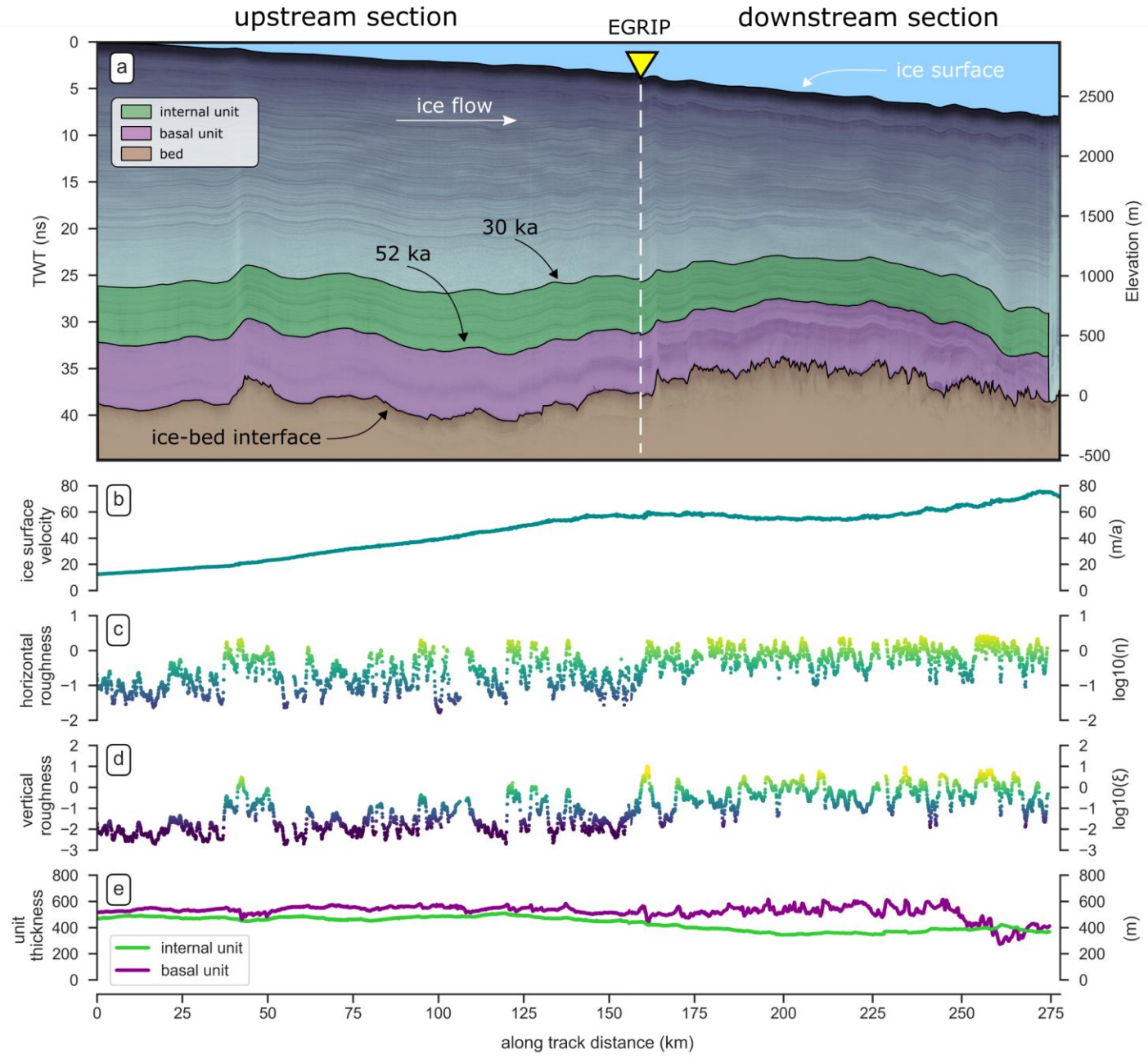
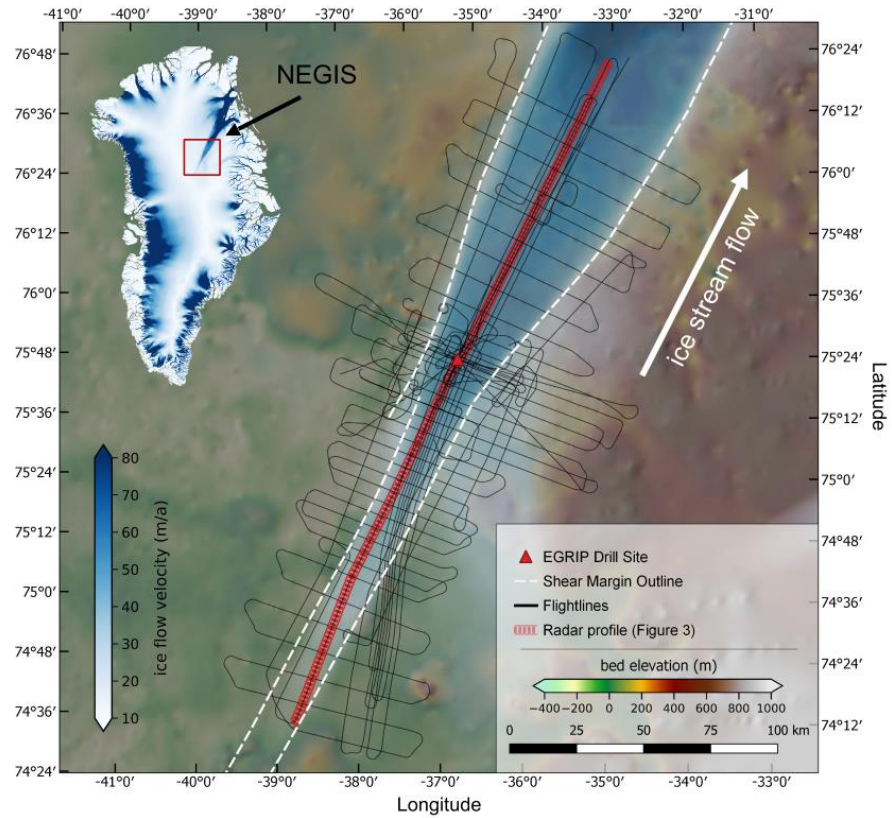

vertical roughness (ξ)
horizontal roughness (η)
parallel to ice flow
transverse to ice flow
a
b
c
d
EGRIP Drill Site
Shear Margin Outline
Upstream Region
Downstream Region
Region Trough
Region East
Region West
Profile 6a
Profile 6b
log10(ξ)
log10(η)
LOW
HIGH
ξ | vertical roughness
η | horizontal roughness
a'
b'
d'
Upstream Region (R_{up})
Downstream Region (R_{down})
Region East (R_{east})
Region West (R_{west})
bed elevation (m)
return power (dB)
high
low
specular reflection
abruptness
diffuse scattering

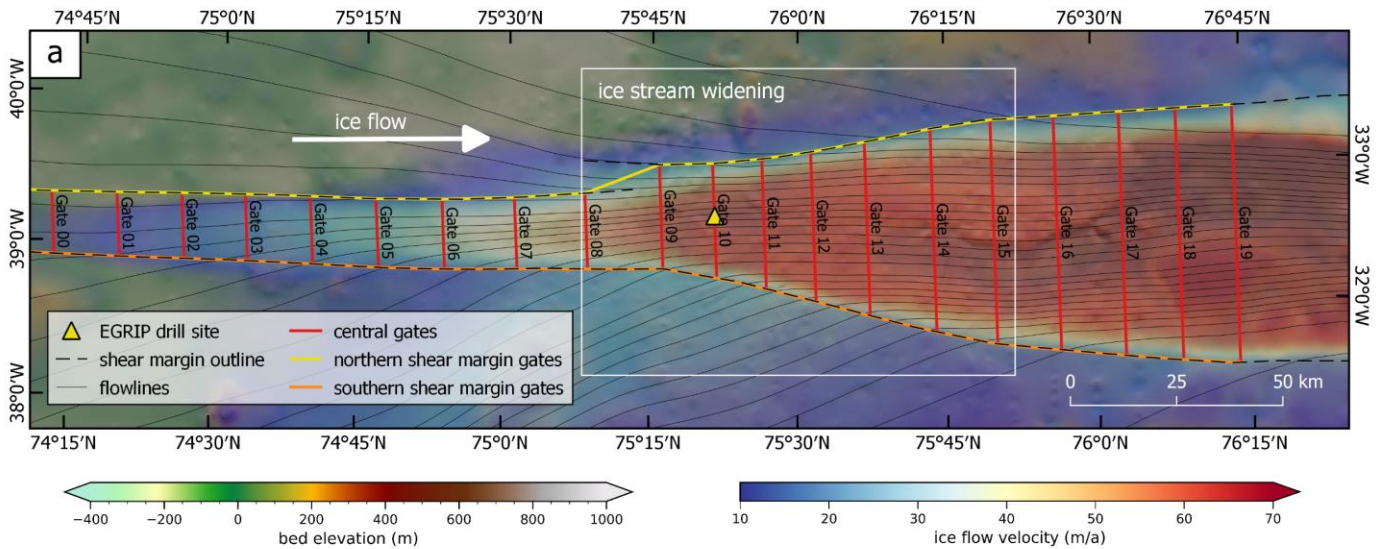

ξ | vertical basal roughness
a
Parallel
Transverse
log10(ξ)
waveform abruptness
c
Parallel
Transverse
η | horizontal basal roughness
b
Parallel
Transverse
log10(η)
basal return power
d
Parallel
Transverse
dB

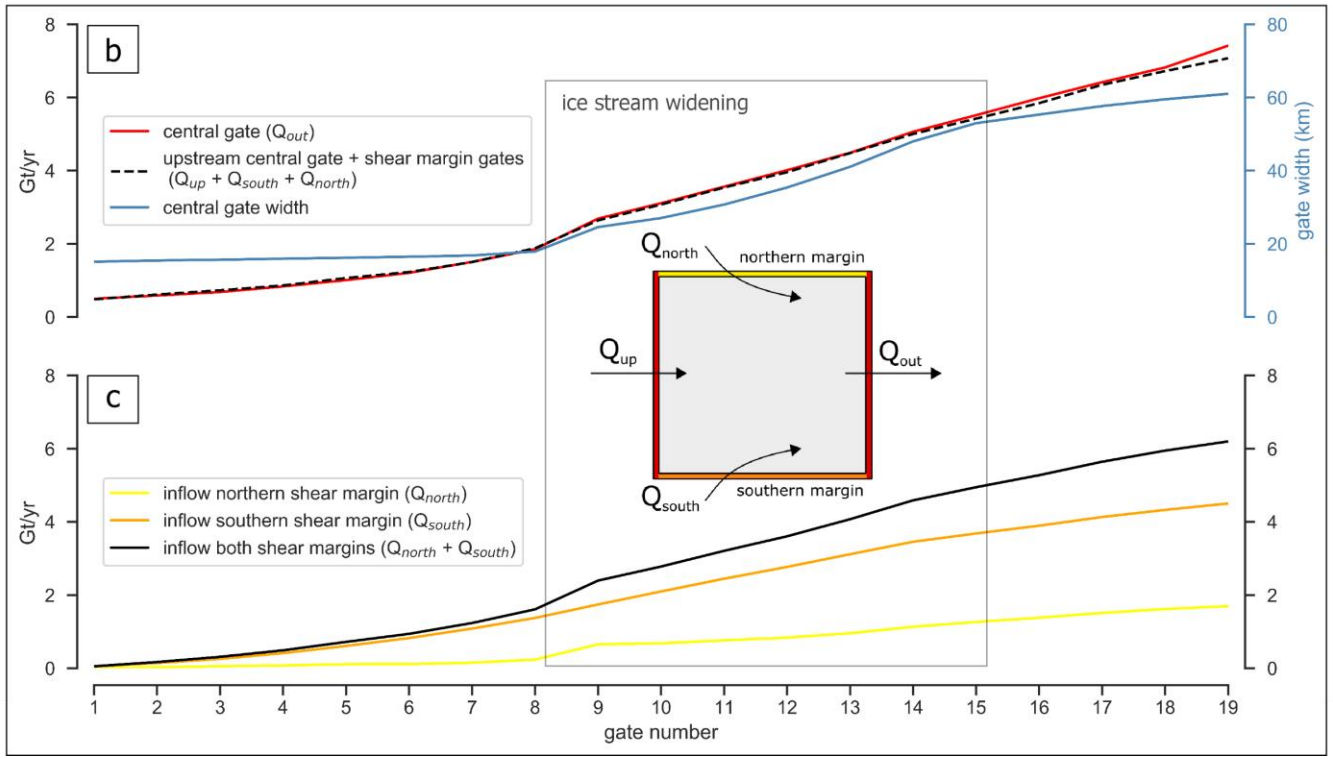





upstream section
EGRIP
downstream section
a
internal unit
basal unit
bed
ice flow
ice surface
30 ka
52 ka
ice-bed interface
TWT (ns)
Elevation (m)
b
ice surface velocity
(m/a)
c
horizontal roughness
log10(η)
d
vertical roughness
log10(ξ)
e
unit thickness
internal unit
basal unit
(m)
along track distance (km)


NEGIS
ice stream flow
ice flow velocity (m/a)
EGRIP Drill Site
Shear Margin Outline
Flightlines
Radar profile (Figure 3)
bed elevation (m)
Longitude
Latitude





- Upstream: smooth bed → acceleration
- Downstream: rough bed → decrease of acceleration/velocity

- Constant increase in mass flux compensated:
  - Upstream by acceleration
  - Downstream by widening

- Where bed is smooth:
  - High abruptness anisotropy → streamlining → probably deformable bed

- Where bed is rough:
  - Increasing layer thickness → higher basal shear stress