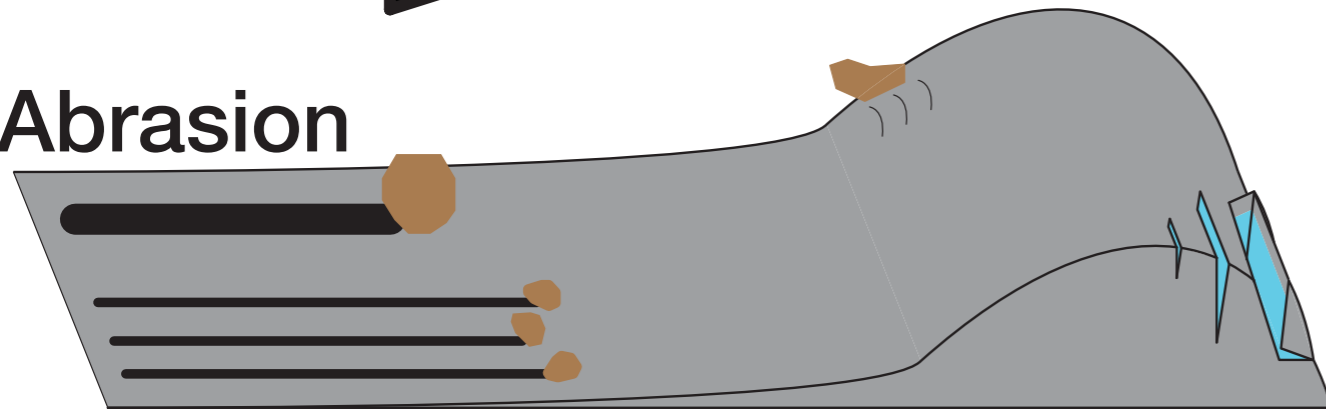# Exploring quarrying with ELMER/Ice

Flavien Beaud, Olivier Gagliardini

ICE FLOW

Abrasion

Quarrying

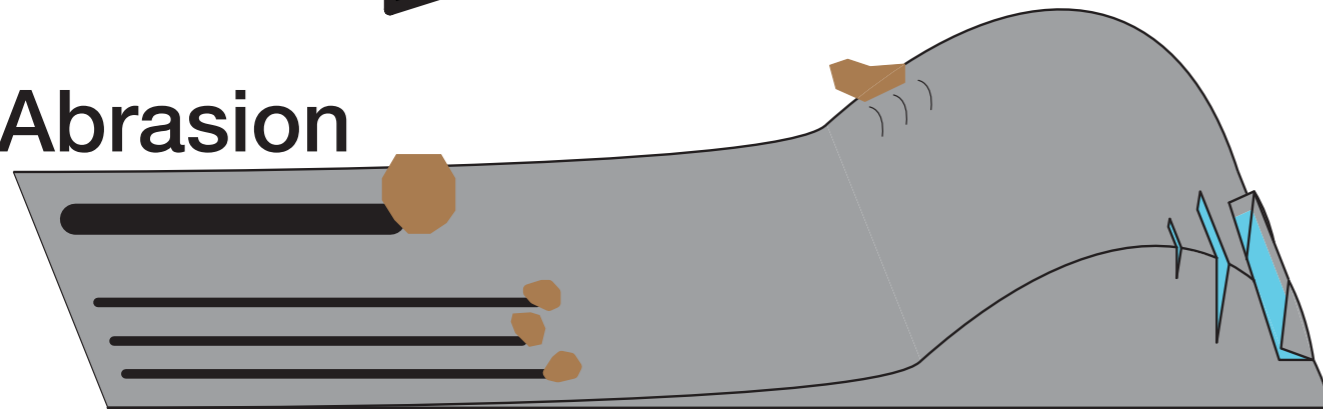# Exploring quarrying with ELMER/Ice

Flavien Beaud, Olivier Gagliardini

Exploring quarrying with ELMER/Ice

Flavien Beaud, Olivier Gagliardini

ICE FLOW

Abrasion

Quarrying

Abrasion: Scales with **sliding speed.**

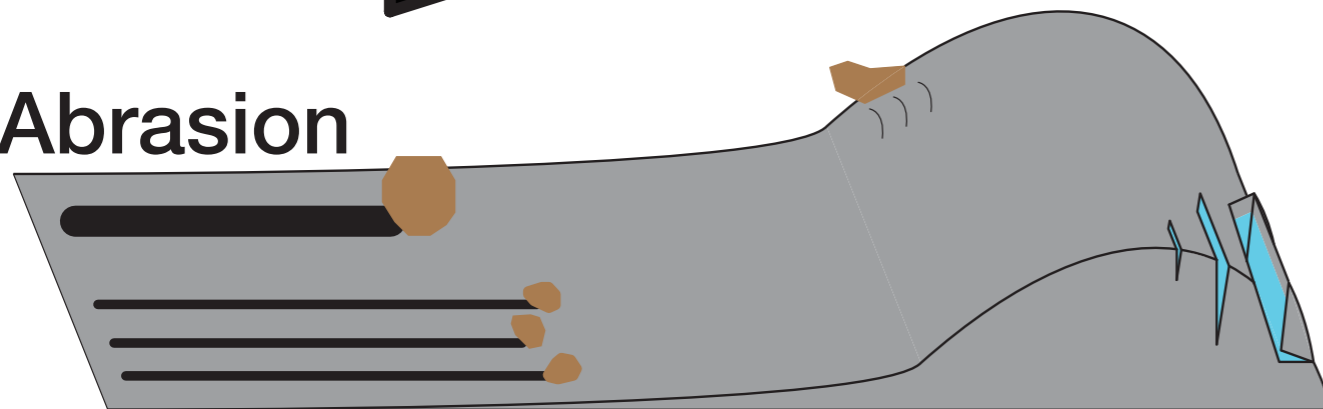Plucking: function of **pressure gradients** around bump.

Exploring quarrying with ELMER/Ice

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ICE FLOW

Abrasion

Quarrying

Abrasion: Scales with **sliding speed.**

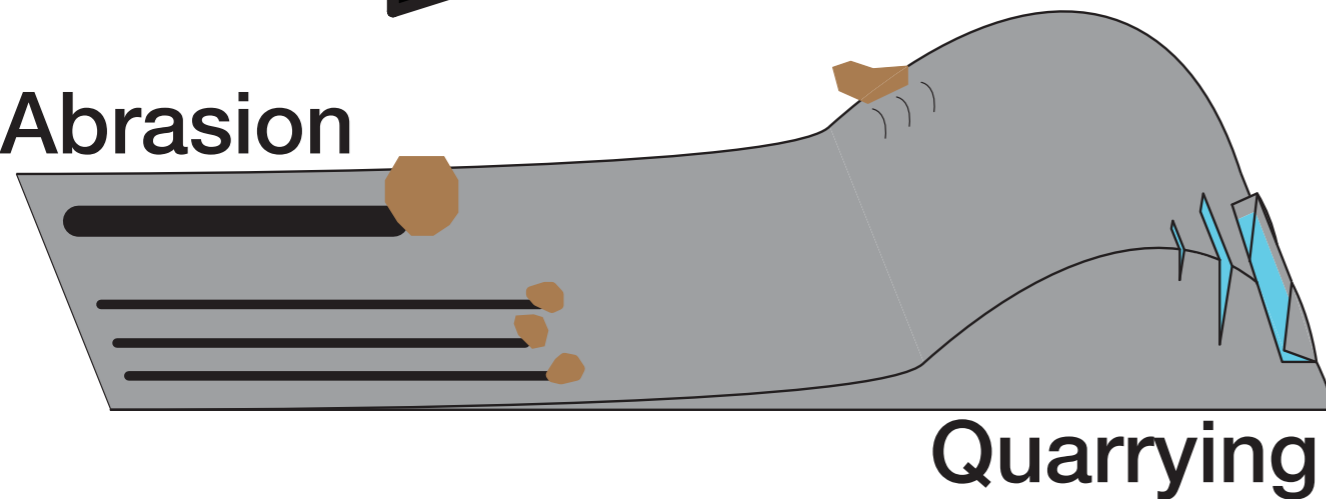Plucking: function of **pressure gradients** around bump.

Goal: Assess importance of ice pressure and water pressure fluctuations.

Exploring quarrying with ELMER/Ice

Flavien Beaud, Olivier Gagliardini

ICE FLOW

Abrasion

Quarrying

Abrasion: Scales with **sliding speed.**

Plucking: function of **pressure gradients** around bump.

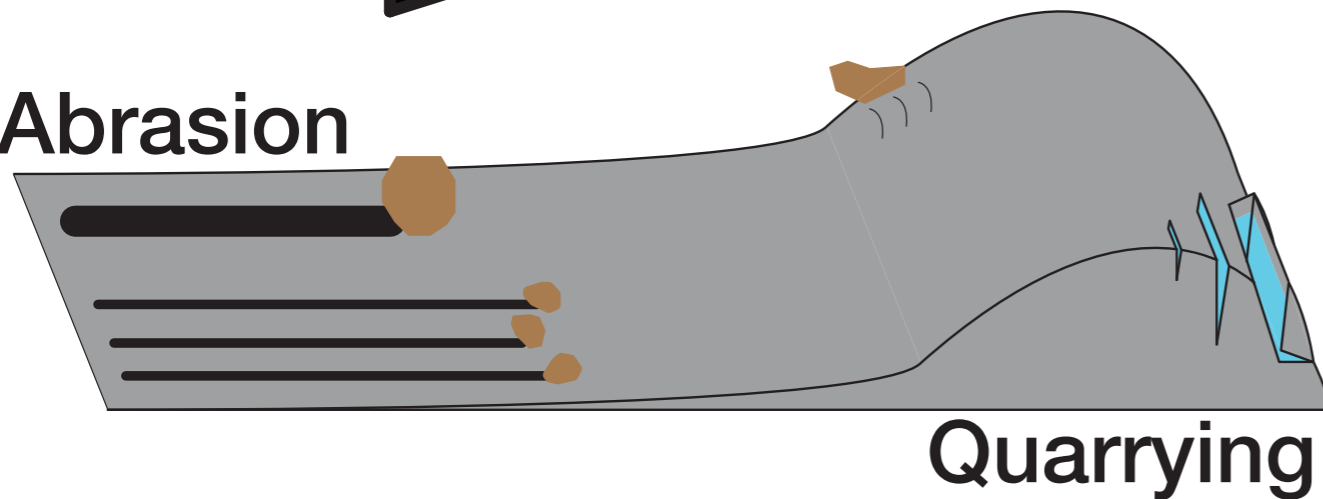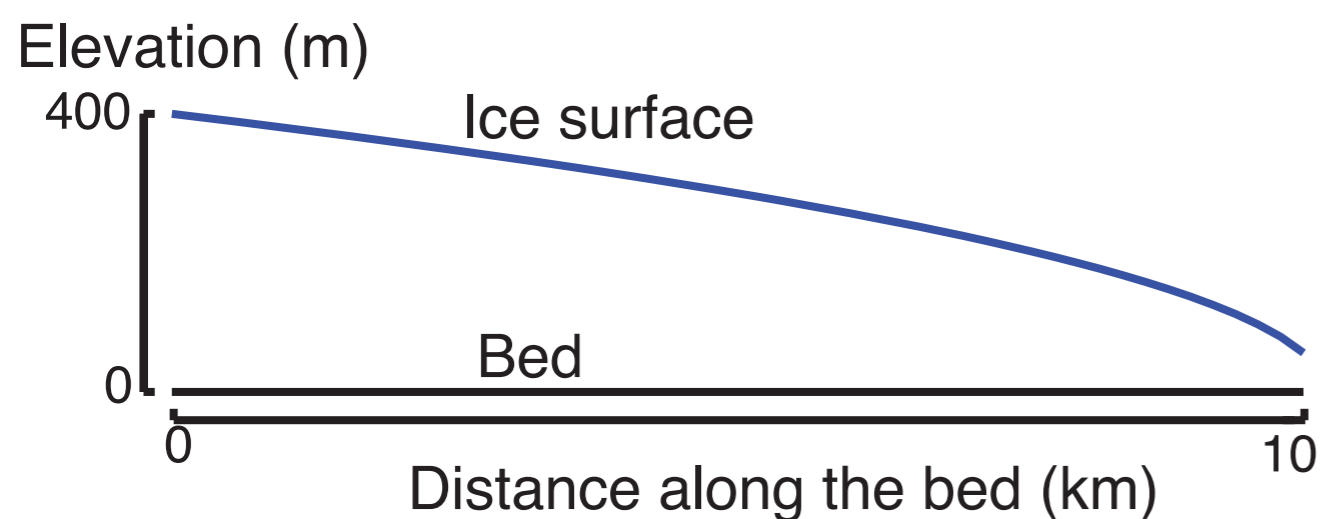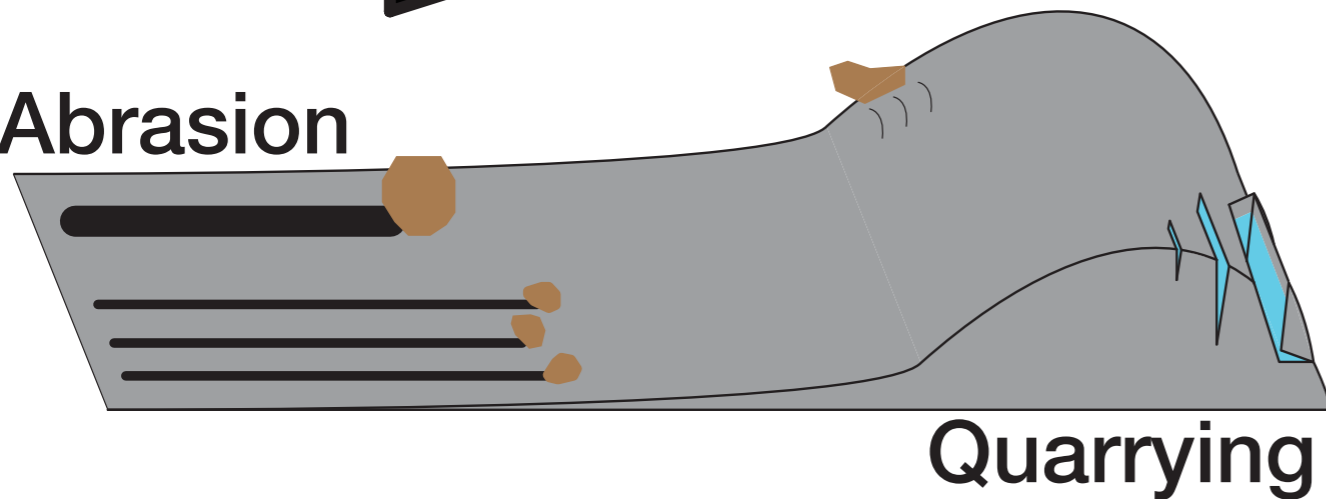**Goal**: Assess importance of ice pressure and water pressure fluctuations.

Elevation (m)

400

Ice surface

Bed

0

0

10

Distance along the bed (km)

Exploring quarrying with ELMER/Ice

Flavien Beaud, Olivier Gagliardini

Exploring quarrying with ELMER/Ice

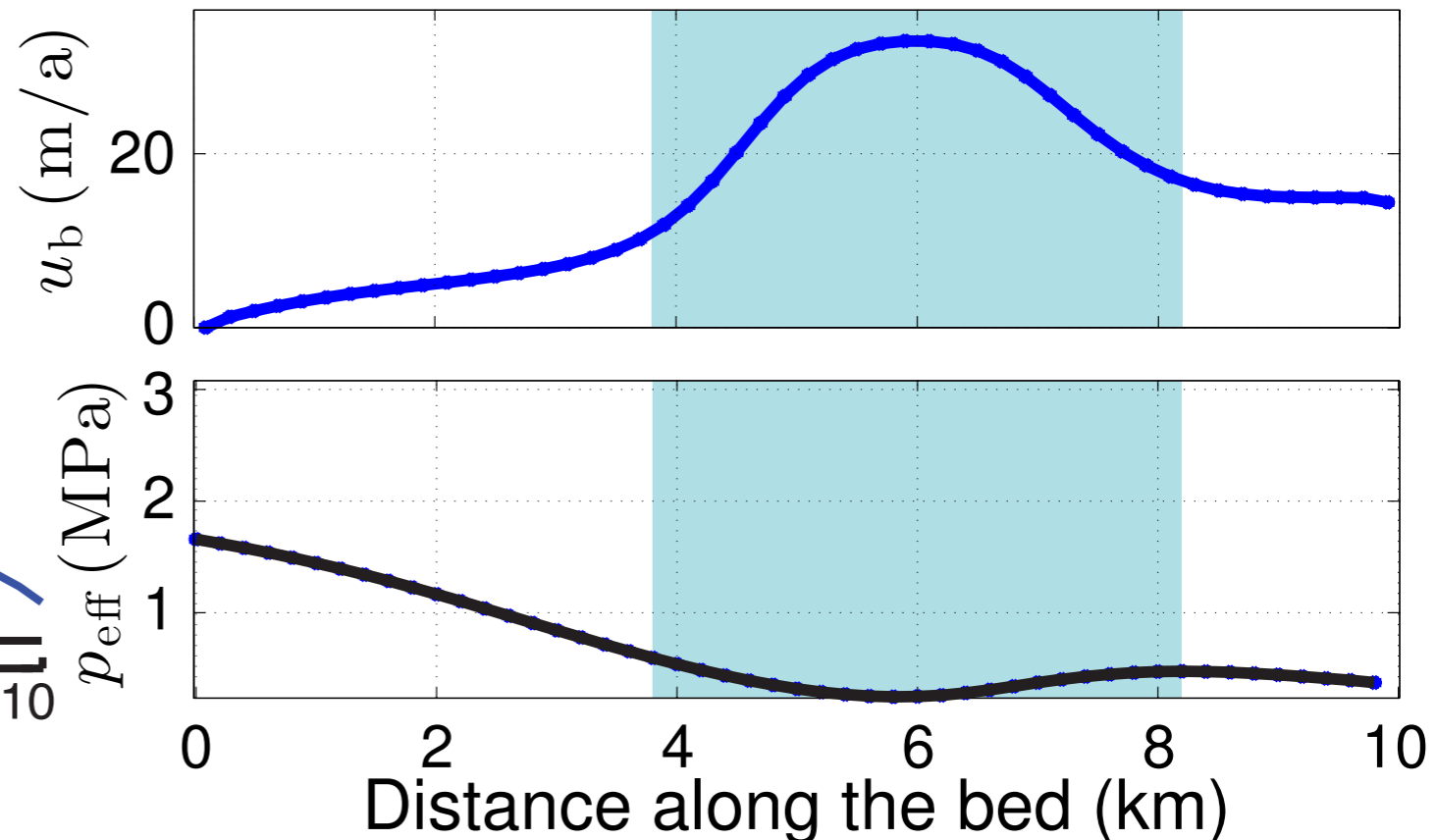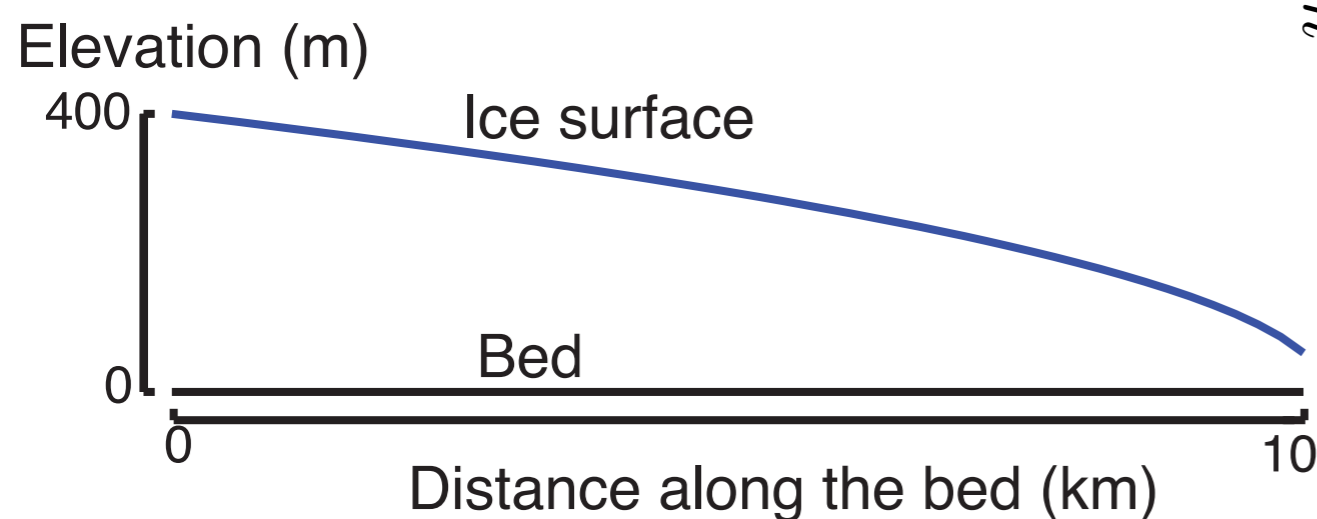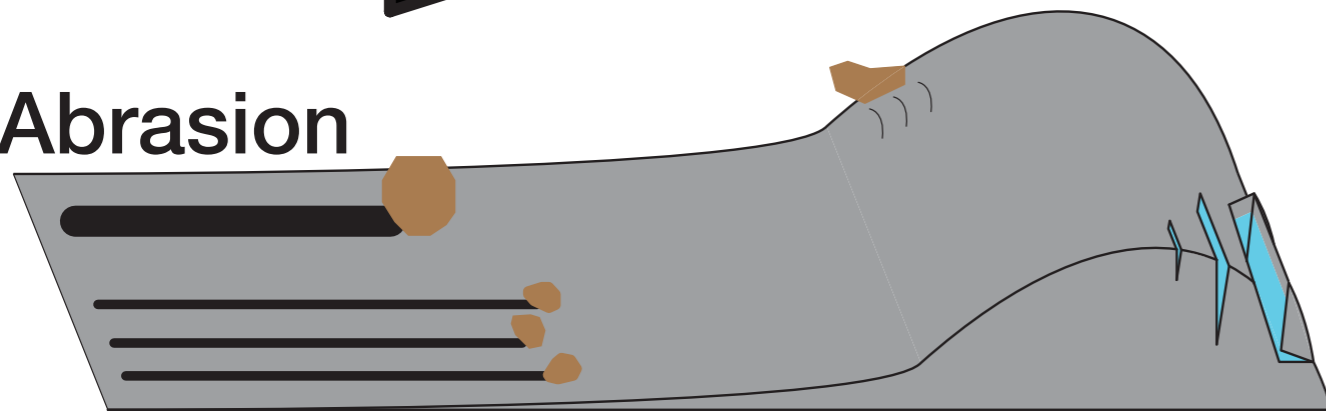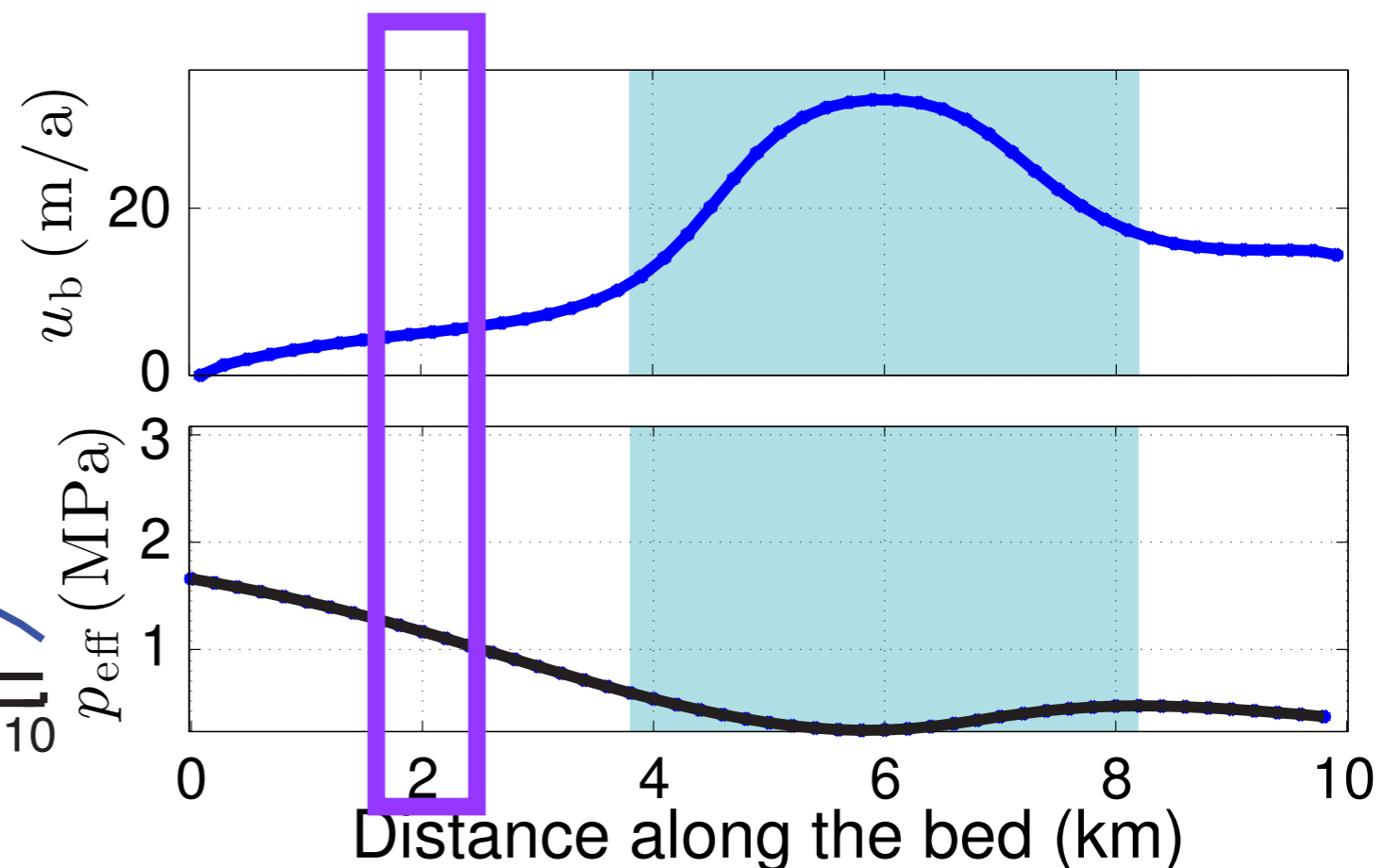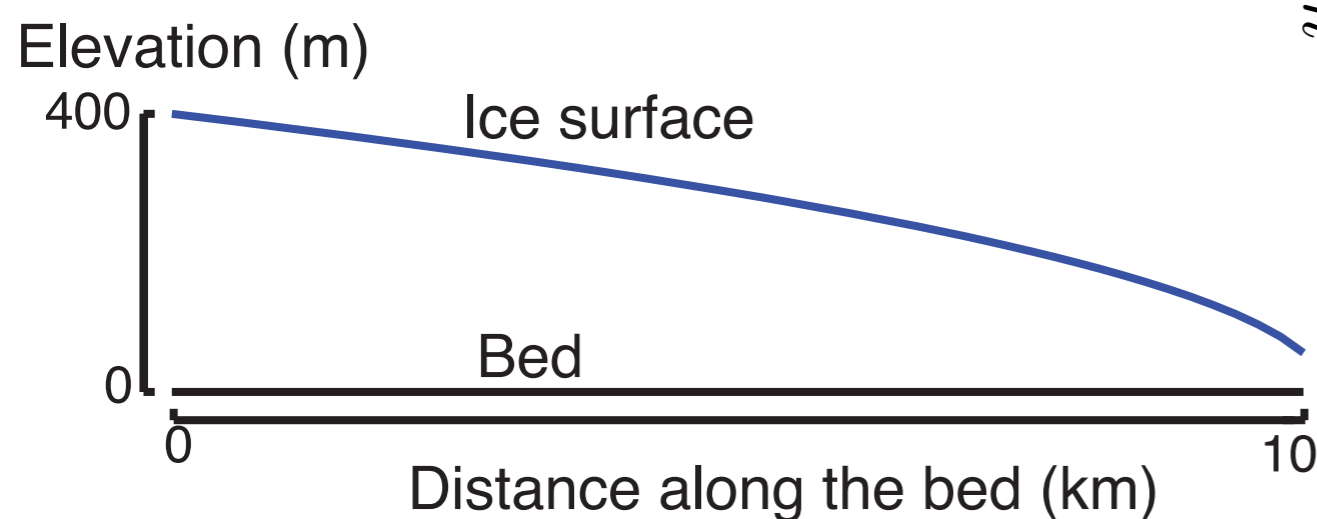Flavien Beaud, Olivier Gagliardini

ICE FLOW

Abrasion

Quarrying

Abrasion: Scales with **sliding speed.**

Plucking: function of **pressure gradients** around bump.

Goal: Assess importance of ice pressure and water pressure fluctuations.

Elevation (m)

400

Ice surface

Bed

0

0

Distance along the bed (km)

10

u_b (m/a)

20

0

p_{eff} (MPa)
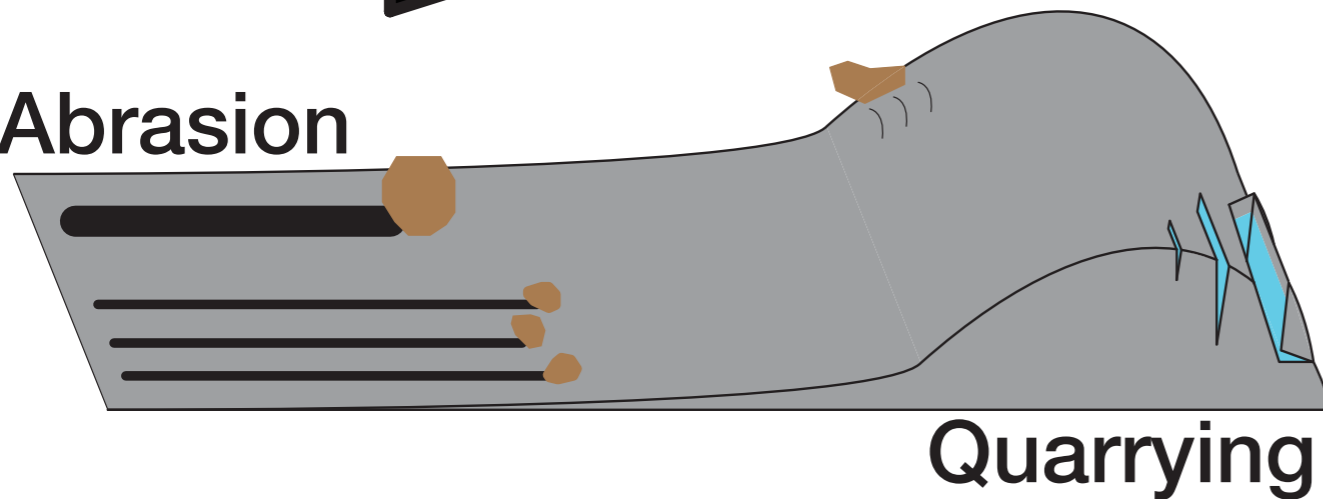
3

2

1

0   2   4   6   8   10

Distance along the bed (km)

Exploring quarrying with ELMER/Ice

Flavien Beaud, Olivier Gagliardini
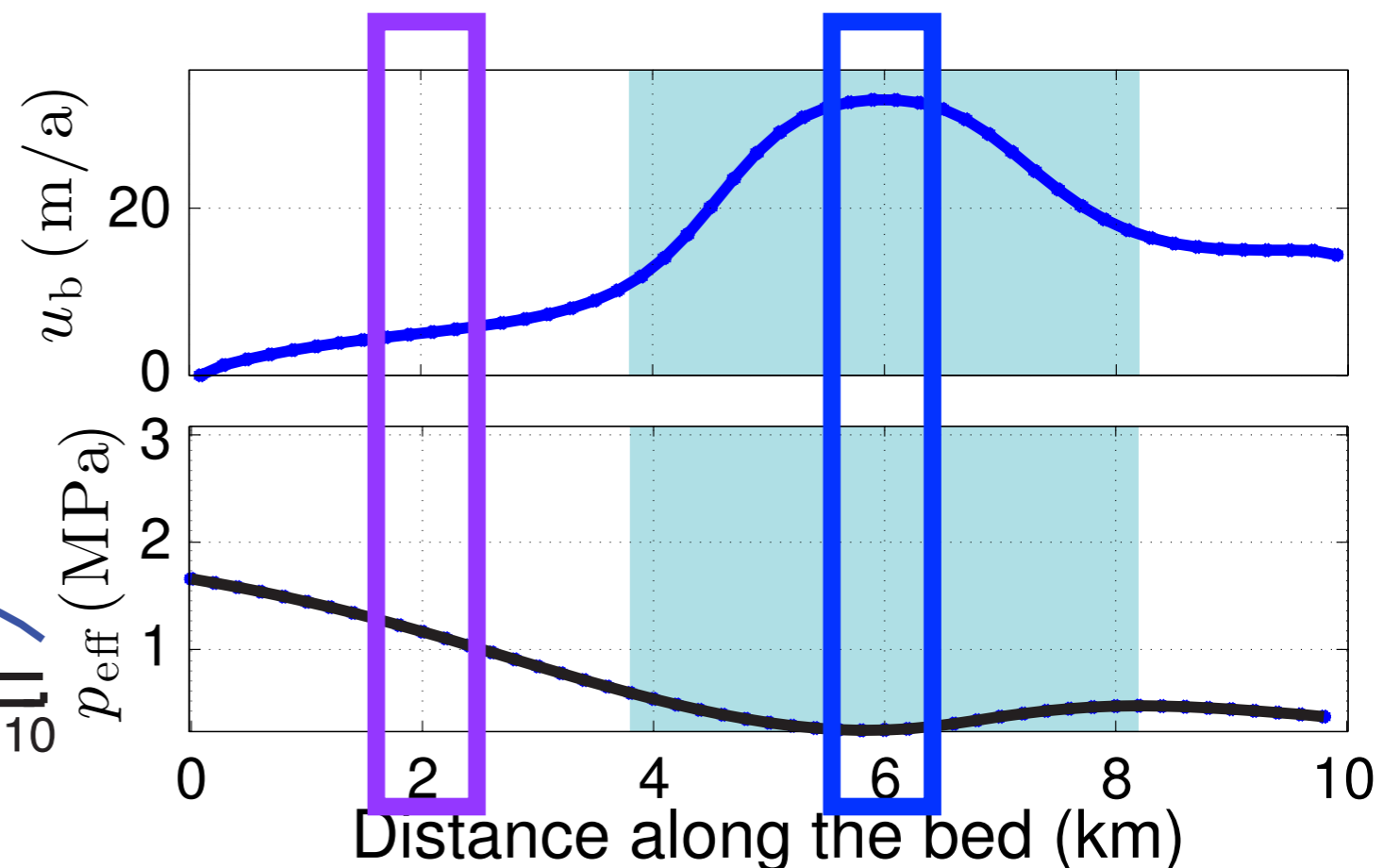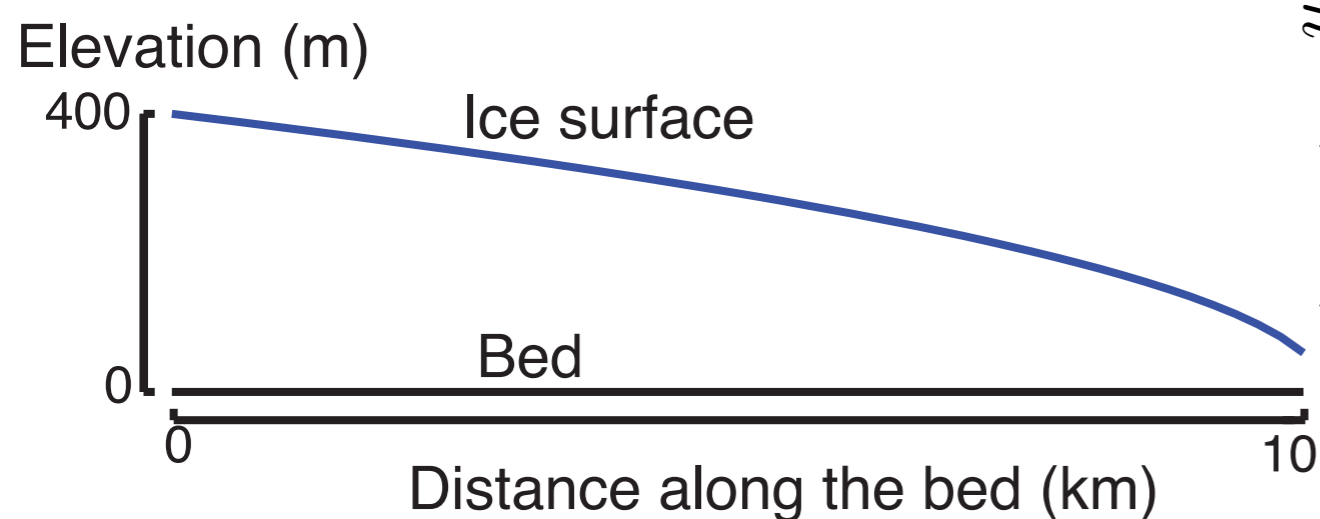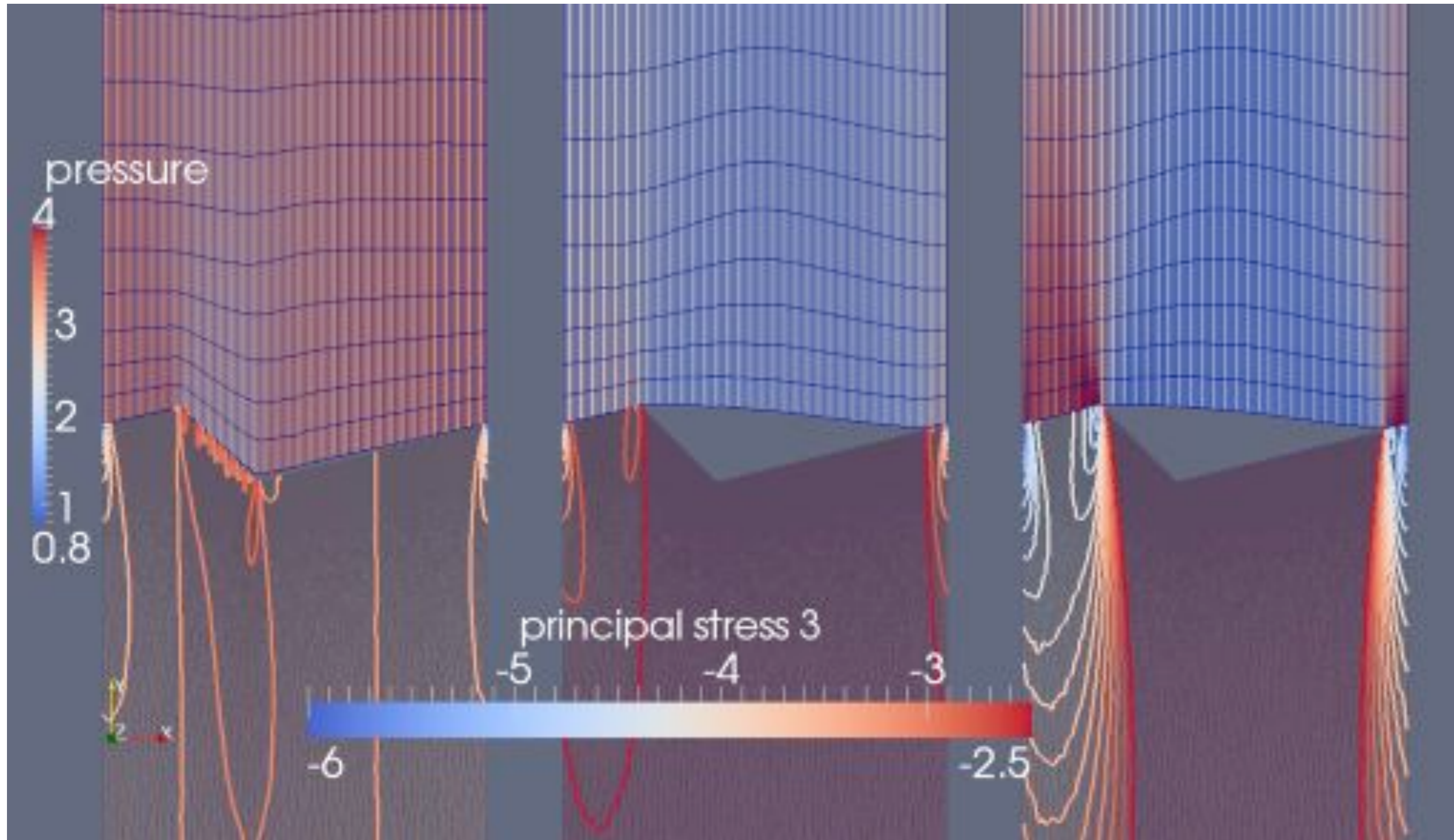
Preliminary results

Preliminary results

Thick ice
low sliding
low water pressure

pressure

4

3

2

1

0.8

principal stress 3

-5   -4   -3

-6   -2.5

Preliminary results

Thick ice
low sliding
low water pressure

Thinner ice
higher sliding
high water pressure

pressure

4
3
2
1
0.8

principal stress 3

-5   -4   -3

-6   -2.5

Preliminary results

Thick ice
low sliding
low water pressure

Thinner ice
higher sliding
high water pressure

Water pressure
drop

pressure

4

3

2

1

0.8

principal stress 3

-5   -4   -3

-6   -2.5

Preliminary results

Thick ice
low sliding
low water pressure

Thinner ice
higher sliding
high water pressure

Water pressure
drop

pressure

principal stress 3

Next step: Compute fatigue and critical crack growth in the bedrock.