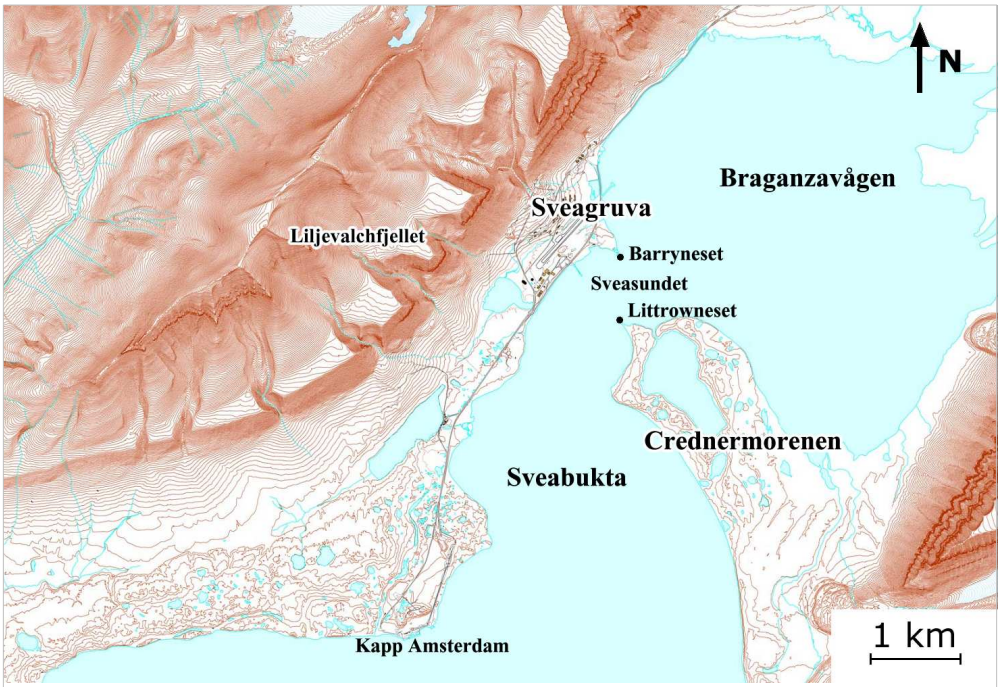
CONTEXT

Ispallen, cross Sveasundet

[NEXT] map



source: Store Norske

Many challenges for a causeway, especially
- seabed stability
- ice loads
- water transit

[NEXT] ice at old quay

Damages at old quay > expected ice would be a problem

> GOAL: action of sea ice on coastal structures

METHOD: full-scale experiment on a test breakwater

PLAN:
- bw construction process

- observations

- some quantitative results

- further work

[NEXT] Investigations – drilling

Soil properties (e.g. water content, grain size)

Lars and Lene

[NEXT] Vane test

Vane test from the sea ice (shear strength of the seabed)

P. Delmas

[NEXT] sea depth

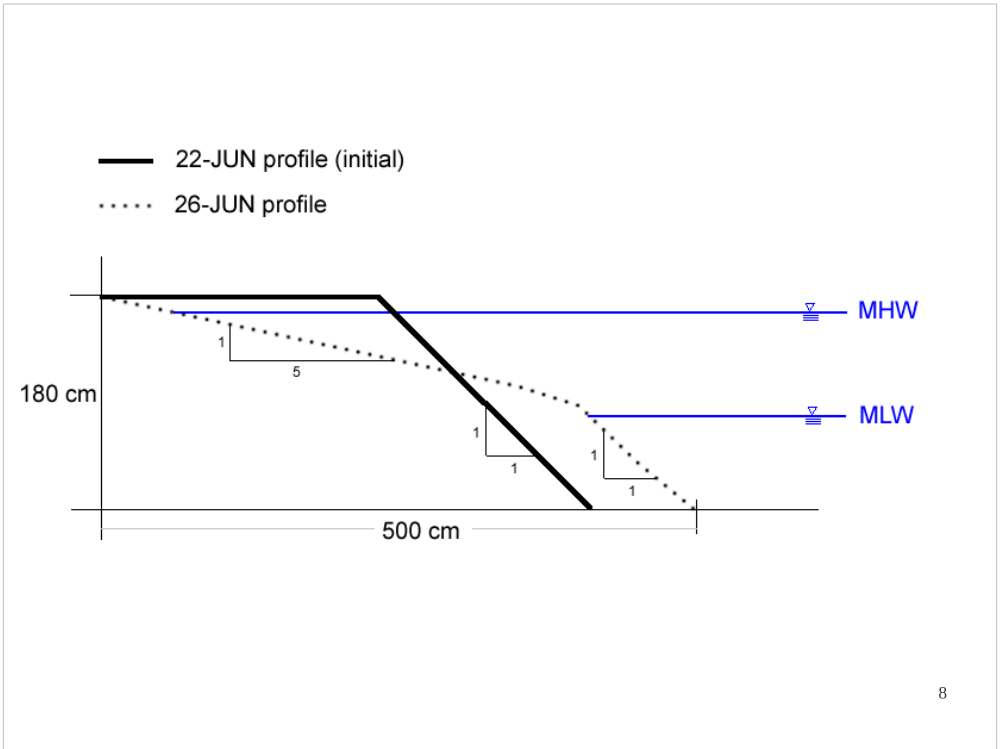
data: courtesy Louise Hansen / NGU

sea depth meas. with shallow-water swath bathymetry system

[NEXT] Construction

Built in two stages for stabililty reasons

[NEXT] erosion sketch



Structure will quickly erode if not protected

[NEXT] bag layer

Geobags – geosynthetic bags

Filter layer

Protection against wave erosion

Subject of a project I was involved in but not covered in the thesis

[NEXT] front with bags

[NEXT] Aerial view

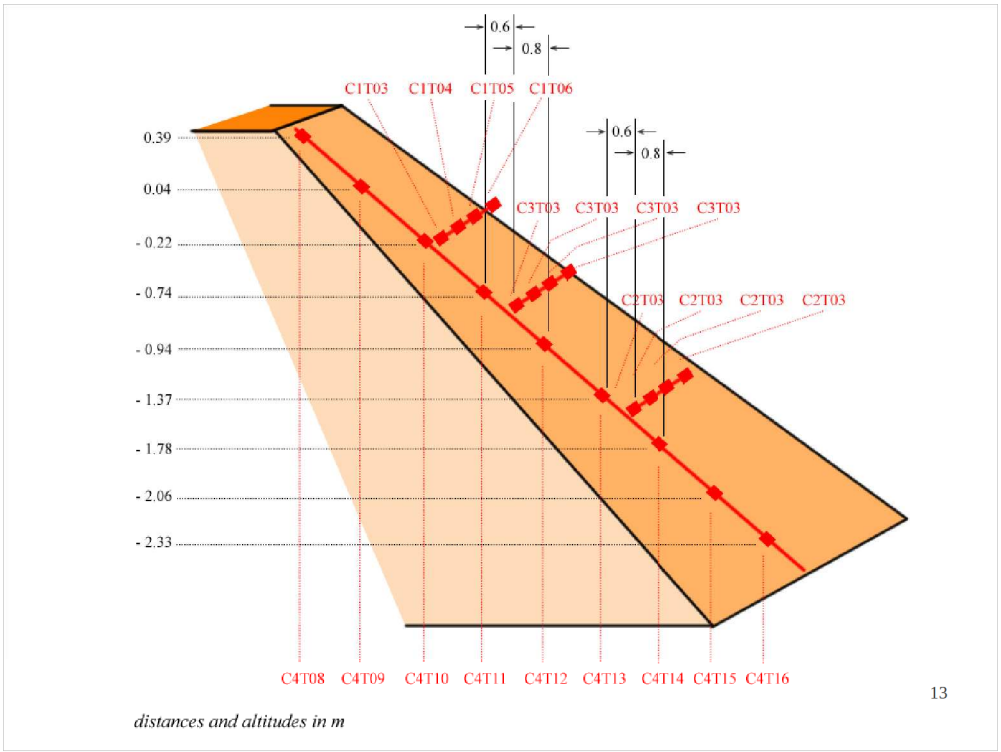
50 m long

8 m high (highest)

25 m wide

[NEXT] aerial view

[NEXT] EBA cables



along-slope and vertical

[NEXT] cables connected to loggers in Dyrebu

Power

weather station

headlights

wifi

surveillance cameras

ALSO: tide and wave gauge

[NEXT] time-lapse camera

max 2 pix / hr

[NEXT] (blank) Ice observations

ICE OBSERVATIONS

Felt safe because I had instruments to measure a lot of stuff

BUT describing coastal ice processes required meticulous visual observations and some actual thinking

Method: understanding and describing the processes taking place before quantifying them

> weekly observations (2—3 days a week)

[NEXT] Freeze-up

FREEZE-UP

ice foot formation: ice cap

[NEXT] Ice foot east side

Stacking-up of ice cakes

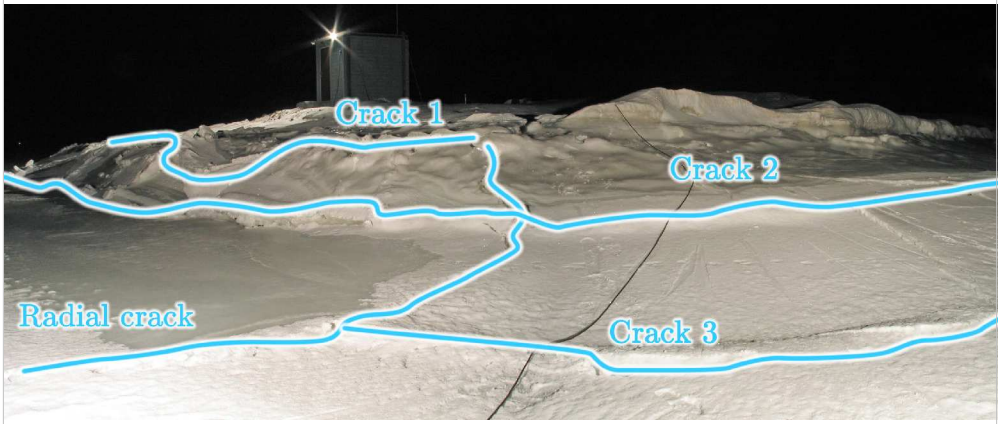
[NEXT] Stationary ice cover period / cracks

Stationary ice cover period

Cracks > hinge zone

No clear boundary between ice foot and sea ice

[NEXT] cracks with numbers



[NEXT] (blank) videos ice mvt

VIDEOS

obs1-crack1_opening

obs2-flooding

obs3-ice-tidal_mvt

[NEXT] Break-up: spring river flow

BREAK-UP

Flows probably on top of the ice

[NEXT] (blank) time-lapse video

vid: obs4-time_lapse

pic every hour

back-and-forth movement

large chunks breaking loose from B-vågen

[NEXT] break-up ice foot

Ice foot back

[NEXT] Ice foot decay

Ice foot decay along cracks

[NEXT] axis pile-up

Picture series of 3 pix, 5 sec time-lapse

[NEXT] pile-up (Theo)

pile-up

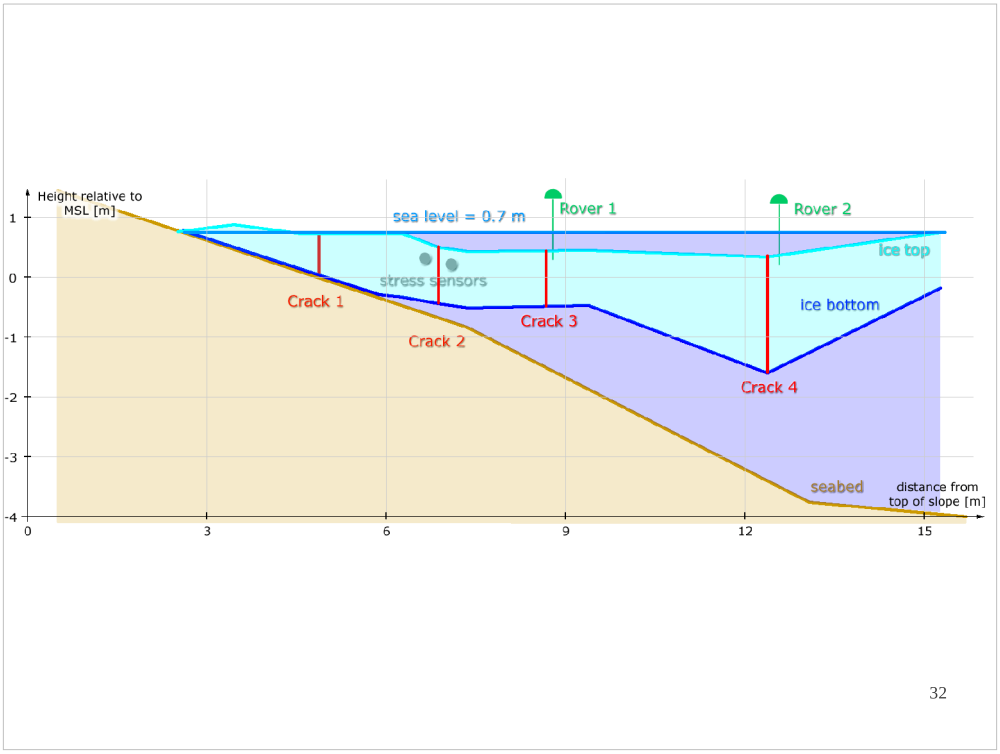
[NEXT] ride-up (aerial photo)

Ride-up

[NEXT] (blank) ride-up video

vid: obs5-ride_up

[NEXT] Results: ice profile (low / high tide)



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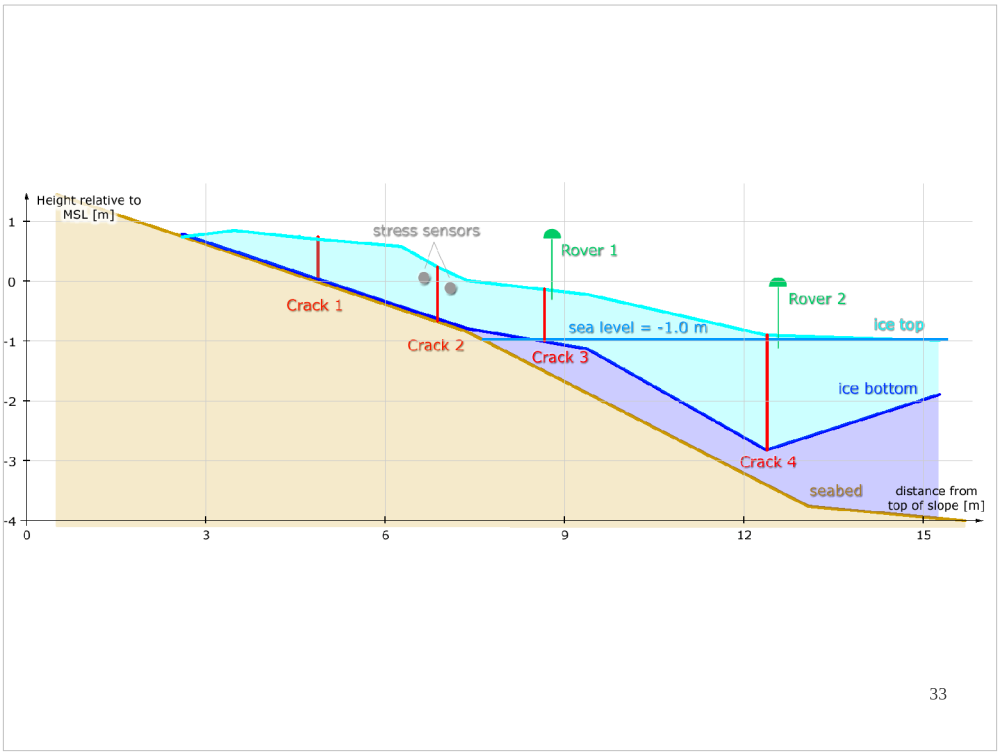
RESULTS – TIDAL MVT, CRACKS, STRESSES

profile at high tide

Describe the figure (ice, sea level, stress sensors)

flooding

[NEXT] low tide



stress sensors (with seb): measuring at the surface

found tidal variations but low confidence in absolute values

[NEXT] (blank) ice properties

ICE PROPERTIES

33 cores, mostly horizontal, 3 depthes, 5 locations

Lab tests with Knekkis (design NTNU for POM and KVH)

Shore:
high porosity
low density
low salinity
low Young (1 GPa vs. 1.5 GPa)
low creep

[NEXT] Further work

FURTHER WORK

Prediction of break-up date

Seabed conditions (subsea permafrost)

Stresses

Modelling – TKK-work with Jukka

Design values (requires stresses + modelling)