Thorben Dunse

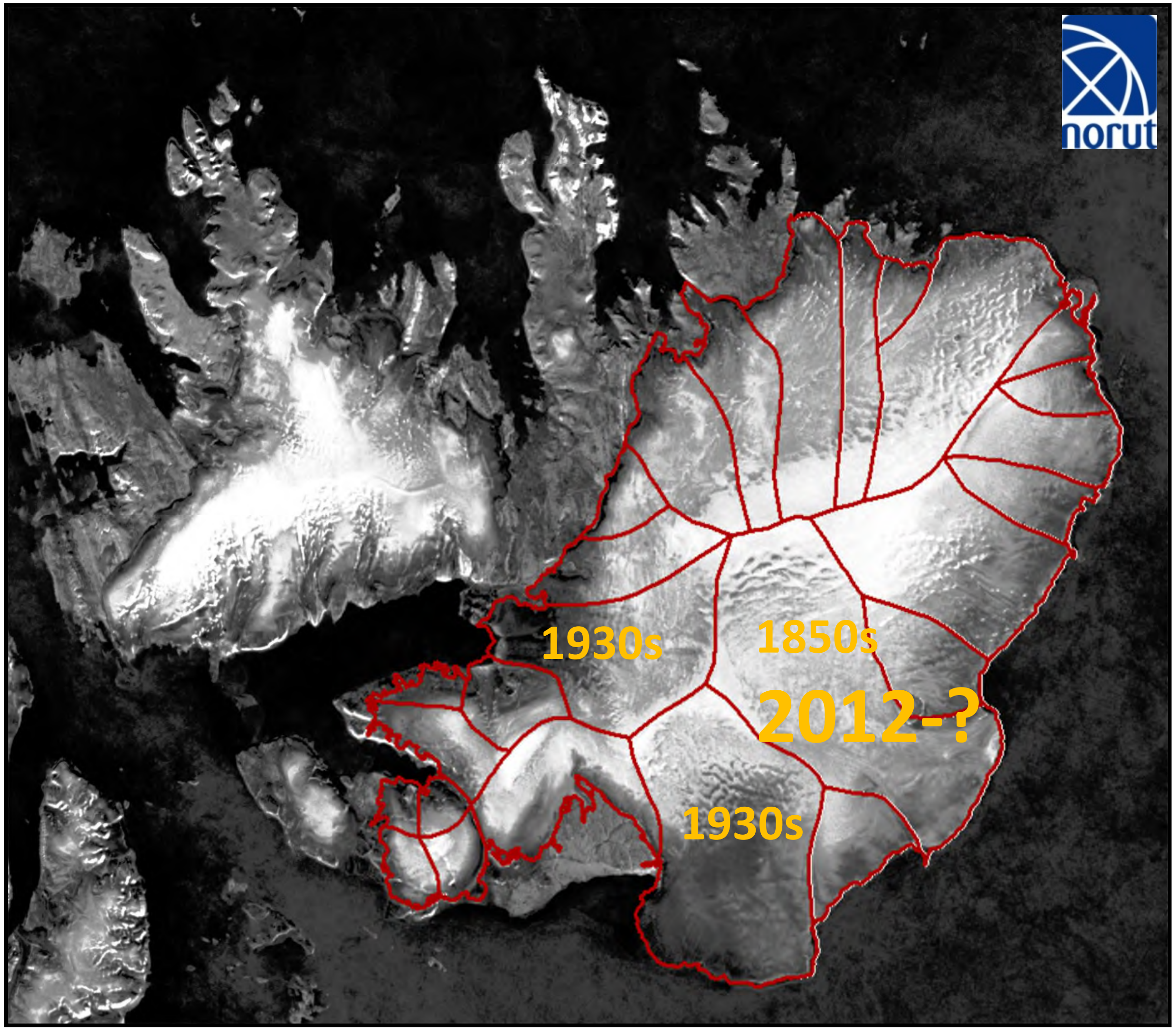
Researcher in Glaciology
Department of Geosciences
University of Oslo, Norway

Aug – Dec 2009:
JSPS fellow (predoctoral, short-term)
Institute of Low Temperature Science (ILTS),
Hokkaido University, Sapporo, Japan

PhD project in Glaciology:
Mass balance and dynamics of Austfonna ice cap

Area:
~8000 km^2

Calving-front:
> 200 km length



Envisat composite image courtesy of K. A. Høgda

Glacier surges: Outlet glacier has advanced by 5km

Understand ice-cap dynamics -> computer simulations

Prof. Ralf Greve
Glaciers and Ice Sheet Research
ILTS, Hokkaido University
Sapporo, Japan

Dr. Ralf Greve
Professor
Glacier and Ice Sheet Research Group
Institute of Low Temperature Science
Hokkaido University

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Sapporo 060-0819, Japan
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Postfach 20 04 04
D-53134 Bonn
Germany

6 January 2009

Application of Mr. Thorben Dunse for a JSPS short-term pre-doctoral fellowship: Invitation letter

Dear Madam or Sir:

Herewith I am inviting Mr. Thorben Dunse to work as JSPS pre-doctoral fellow (short-term) under my supervision in the Glacier and Ice Sheet Research Group at the Institute of Low Temperature Science, Hokkaido University, Sapporo, Japan. I am approving a 3.5-month term starting no earlier than 01 September 2009. His proposed work on simulations of the Austfonna ice cap, Svalbard, is highly interesting and fits well into the research environment of our working group.

I know Mr. Dunse as an open-minded, ambitious and communicative young scientist who is skilled in numerical modelling as well as field work, and who has already established a strong international cooperation for his studies. Therefore, I am confident that he can carry out the proposed work successfully. I hope very much that his application will be approved, and that I can welcome him as a pre-doctoral fellow later this year.

Yours sincerely

Ralf Greve

Glacier and Ice Sheet Research Group at the Institute of Low Temperature Science (ILTS)

Prof. Shin Sugiyama

Prof. Ralf Greve
Glaciers and Ice Sheet Research
ILTS, Hokkaido University
Sapporo, Japan

Shun Tsutaki, PhD

Tatsuru Sato, PhD

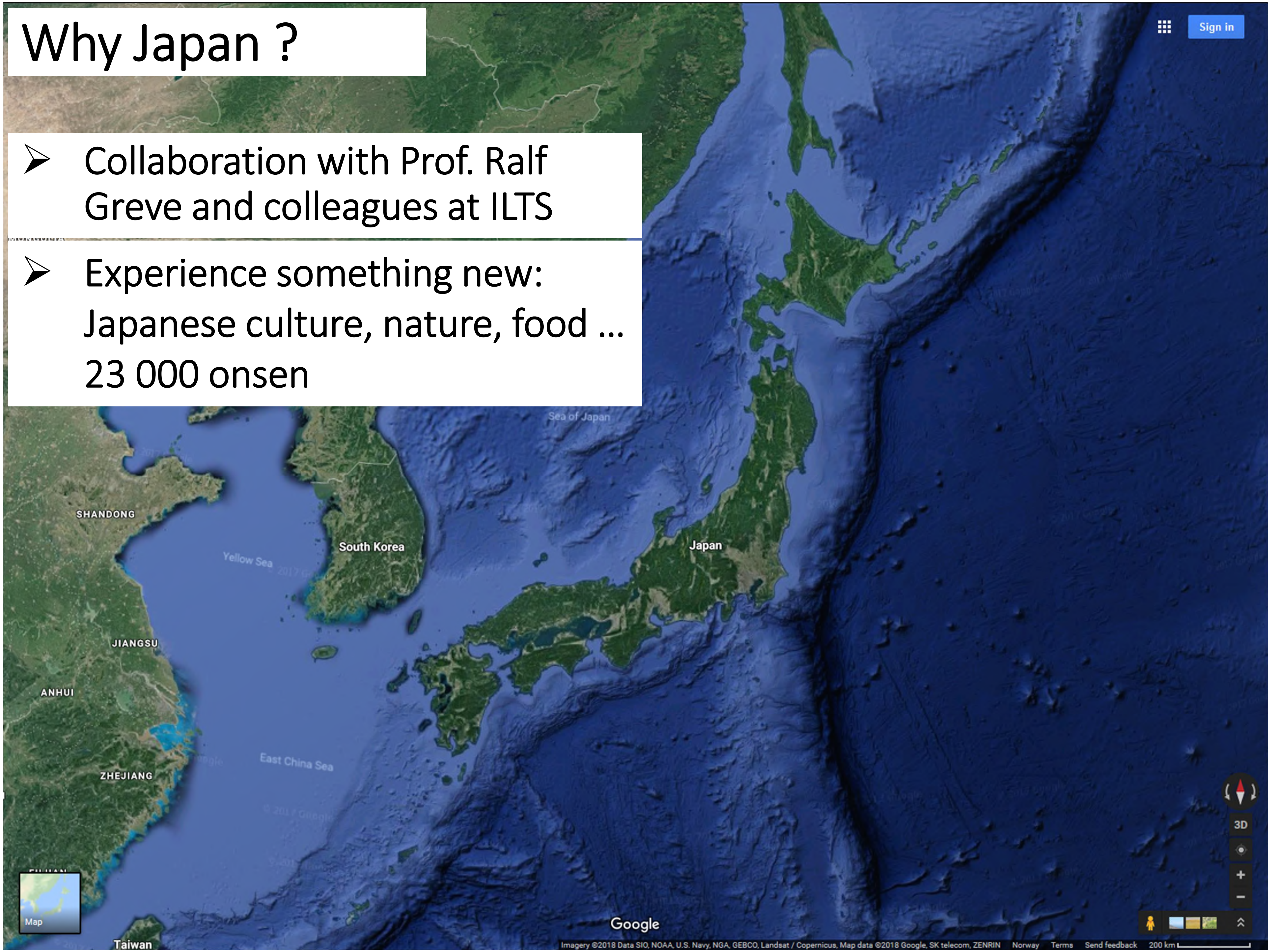
and many more...

Paper work

Visa, insurances, bank account, driving liscense...

Why Japan ?

- Collaboration with Prof. Ralf Greve and colleagues at ILTS
- Experience something new: Japanese culture, nature, food … 23 000 onsen



Get to know the place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Терней
Plastun
ластун
Nayoro
名寄
Monbetsu
紋別
Rumoi
留萌
Asahikawa
旭川
Biei
美瑛町
Kitami
北見
Shari
斜里町
Teshikaga
弟子屈町
Nemuro
根室
Sapporo
札幌
HOKKAIDO
Obihiro
帯広
Kushiro
釧路
Tomakomai
苫小牧
Hakodate
函館
津波注意!
Oga
男鹿
Akita
秋田
Map
3D
Imagery ©2018 Data SIO, NOAA, U.S. Navy, NGA, GEBCO, Landsat / Copernicus, Data Japan Hydrographic Association, Map data ©2018 Google, ZENRIN
Norway
Terms
Send feedback
50 km

Sapporo: capital of Hokkaido

Sapporo, Hokkaido

1.9 Million inhabitants

Home of olympic winter games 1972

Hokkaido University campus

The Institute of Low Temperature Science

My home in Sapporo: *Maison de Grue*






Daily routines & range of activity

Morning: study Japanese at home

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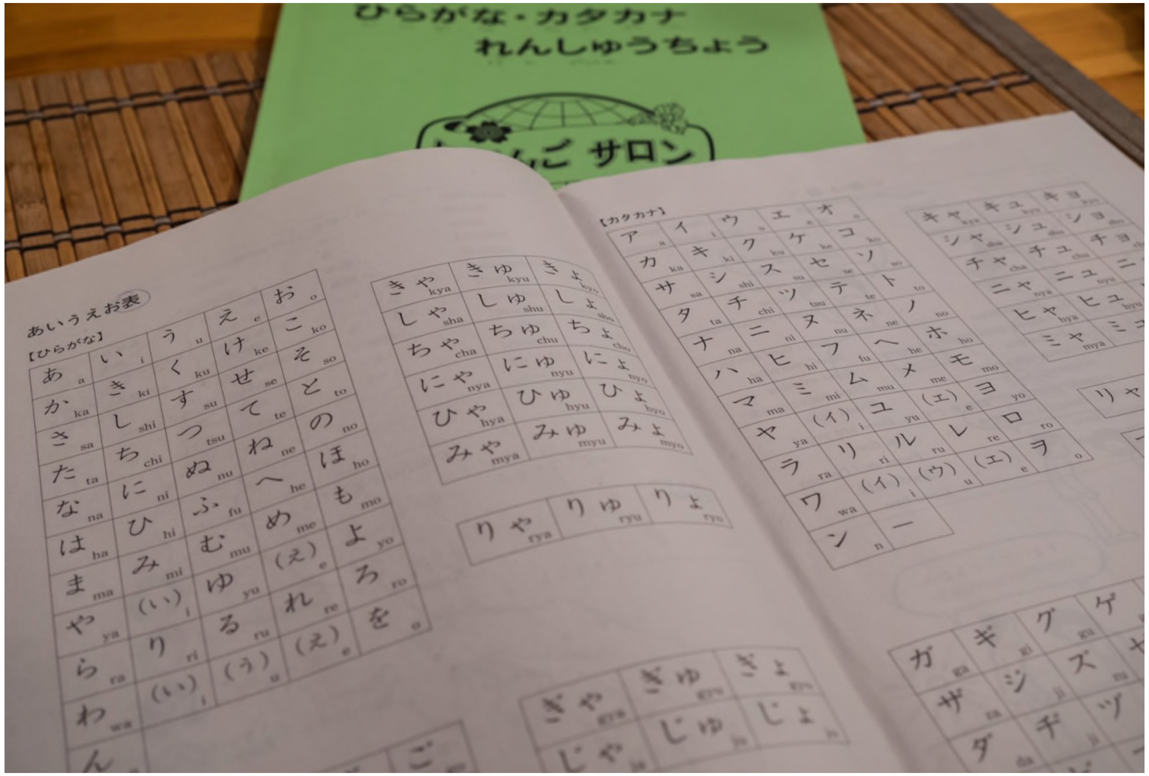
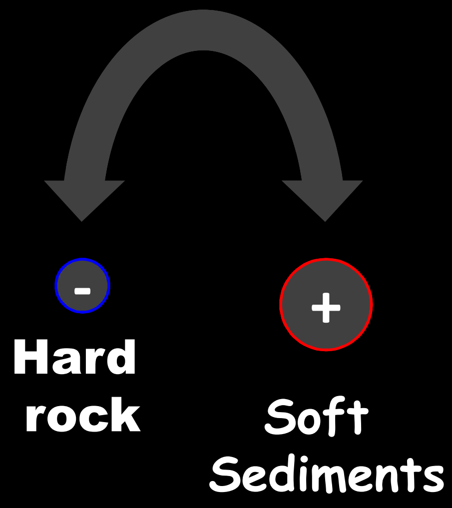


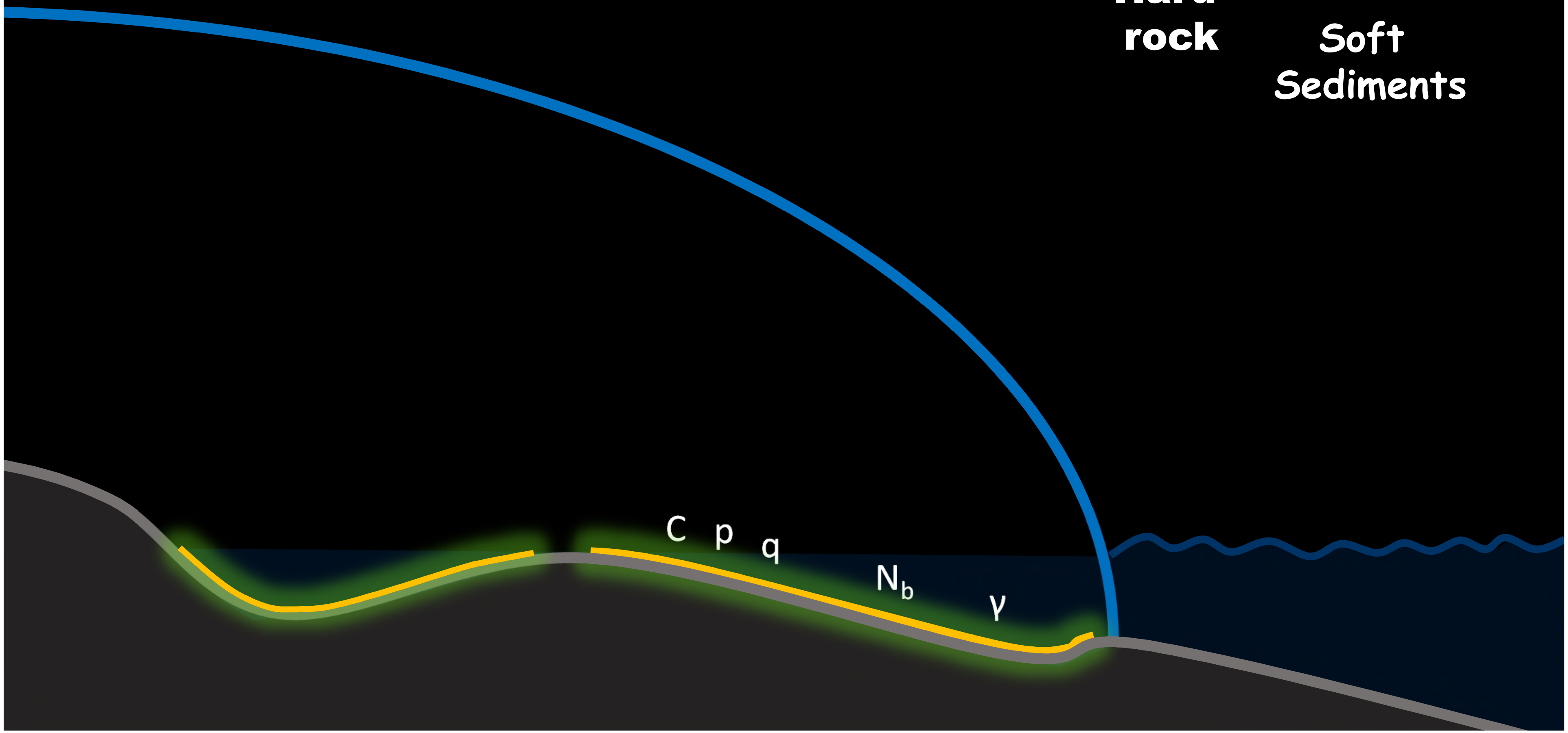
language course for «wives of guest professors, run by Japanese wives of local professors»

Office hours (9am-7pm): Run glacier simulations

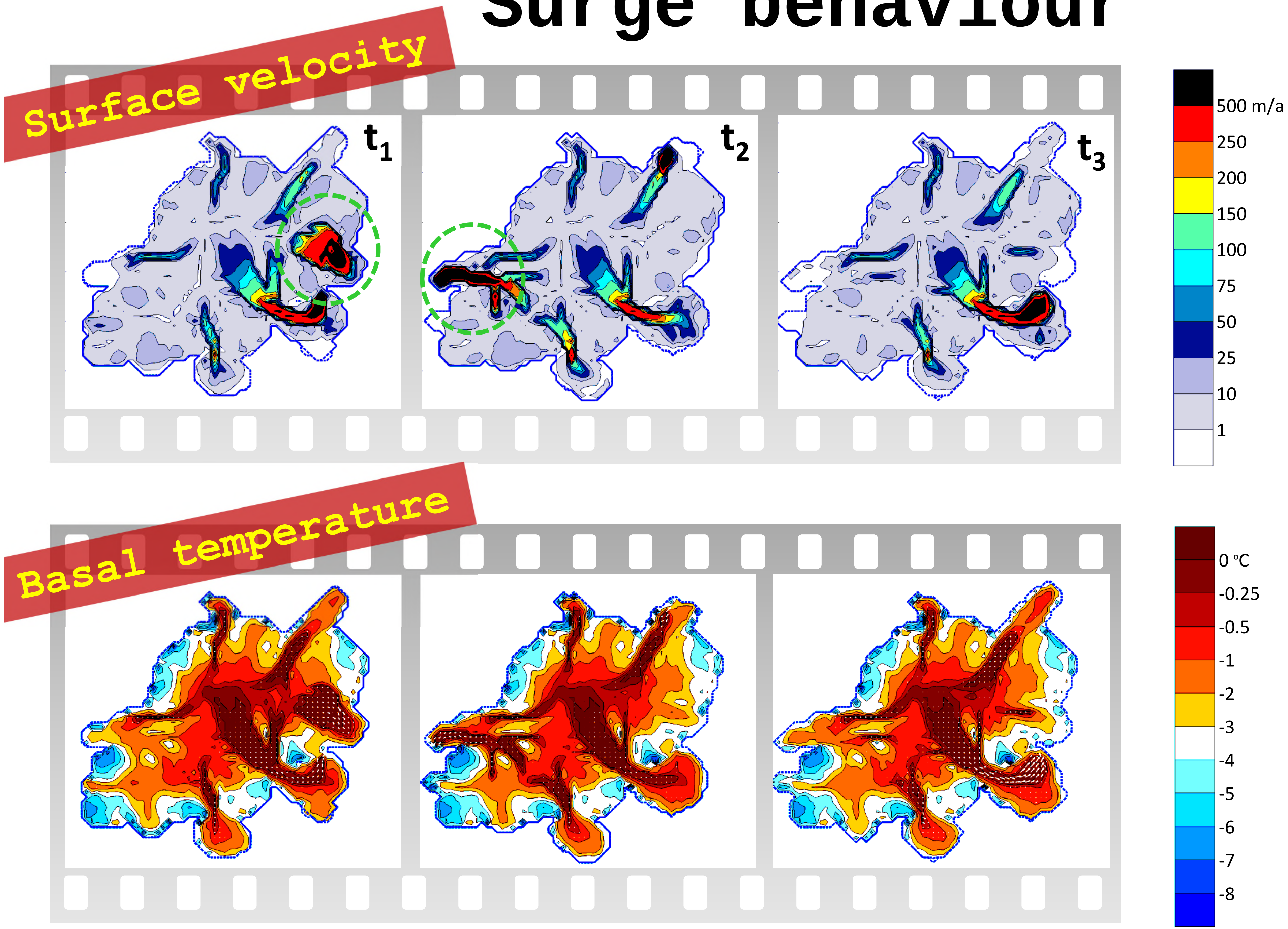
Basal-sliding experiments

A wide range of basal environments





Surge behaviour



Lunch break

Evening:
Hana Yuzuki Onsen

Weekend trips

Outcome / Legacy

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Permanent fast flow versus cyclic surge behaviour: numerical simulations of the Austfonna ice cap, Svalbard

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ABSTRACT. A large part of the ice flux within ice caps occurs through spatially limited fast-flowing units. Some of them permanently maintain fast flow, whereas others operate in an oscillatory mode, characterized by short-lived active phases followed by long quiescent phases. This surge-type behaviour results from intrinsic rather than external factors, thus complicating estimates of glacier response to climate change. Here we present numerical model results from Austfonna, an ice cap on Svalbard that comprises several surge-type basins. Previous studies have suggested a thermally controlled soft-bed surge mechanism for Svalbard. We systematically change the parameters that govern the nature of basal motion and thereby control the transition between permanent and oscillatory fast flow. Surge-type behaviour is realized by a relatively abrupt onset of basal sliding when basal temperatures approach the pressure-melting point and enhanced sliding of marine grounded ice. Irrespective of the dynamic regime, the absence of considerable volumes of temperate ice, both in the observed and simulated ice cap, indicates that fast flow is accomplished by basal motion over a temperate bed. Given an idealized present-day climate, the equilibrium ice-cap size varies significantly, depending on the chosen parameters.

1. INTRODUCTION

The role of glaciers as indicators of climate change and their major contribution to sea-level rise is widely acknowledged. However, extraction of climate signals from glaciers is not straightforward, because the history, current state and future evolution of glaciers result from the interplay of external factors (e.g. changes in surface air temperature or precipitation) and also intrinsic glacier dynamics (Hagen and others, 2005; Yde and Paasche, 2010). Surge-type glaciers illustrate this affinity in a drastic way. Periodically, they experience significant changes in glacier dynamics and geometry that are largely decoupled from climate variability, challenging both observational glaciologists and modellers to deliver estimates about their response to climate change. This is especially true for predictions on decadal timescales, in great demand by the public in general and decision makers in particular.

Surface velocities of the order of several hundred to $1000\,m\,a^{-1}$ are typical for glaciers during the surge phase. Such high flow velocities are achieved through basal motion (Clarke, 1987) and require a temperate glacier bed, i.e. basal temperatures at the pressure-melting point (pmp). For a frozen bed, ice deformation is the exclusive mode of glacier motion, typically yielding moderate surface velocities of the order of $1–10\,m\,a^{-1}$, depending on shear stress and ice temperature. If conditions for basal motion are maintained, the dynamics of a glacier may be characterized by permanent fast flow, such as observed for ice streams, otherwise a temporal pattern of alternating fast and slow glacier flow may evolve. These different dynamic regimes have an impact on the glacier's net mass balance. Surge-type glaciers are characterized by an oscillatory mode of equilibrium and do not maintain a steady mass flux that equals the theoretical balance flux to maintain a steady-state surface profile (Clarke, 1987). Instead, their dynamics are characterized by a long quiescent phase of inefficient ice flow, undershooting the balance flux, and a short-lived surge phase of super-efficient ice flow, greatly overshooting the balance flux. During the quiescent phase, the glacier can be divided into an active thickening zone, the 'reservoir zone', and an almost stagnant depleted zone, the 'receiving zone', separated by the dynamic balance line (DBL) (Meier and Post, 1969; Dolgoushin and Osipova, 1975). The reservoir and receiving zones do not usually coincide with the glacier's accumulation and ablation zones, which are separated by the equilibrium-line altitude (ELA); instead the DBL marks a boundary zone where glacier outflow is restricted (Clarke and others, 1984). The distribution of mass from the reservoir zone into a receiving zone during the surge may be accompanied by a significant advance of the terminus (Meier and Post, 1969).

Observations on Variegated Glacier, Alaska, suggest that 95% of the motion during the surge in 1982–83 was due to basal sliding and only ~5% due to internal deformation (Kamb and others, 1985). Basal processes are therefore considered fundamental in initiating and maintaining glacier surges. Factors determining the absolute contribution of basal motion to the overall ice flow include the thermal regime at the glacier base, basal shear stress, basal water pressure and the lithology of the underlying bedrock, as well as the presence of deformable sediments. Kamb (1987) and Raymond (1987) discussed implications of different basal hydraulic-drainage systems and pointed out that a highly pressurized system of linked cavities may facilitate fast flow and prevail during a surge, while a switch to a hydrologically efficient channel system reduces the basal water pressure and may cause surge termination. Clarke and others (1984) suggested the presence of highly deformable, water-saturated sediments as an alternative explanation of highly enhanced basal motion. Basal motion of polythermal ice bodies is spatially and temporally restricted to basal areas at the pmp. The cold basal areas are frozen to the ground and

CryoJaNo (2015-2018)

project aims

- Impacts of climate change in the Arctic region; cryosphere (snow, glaciers, permafrost).
- strengthen scientific cooperation, research interaction and educational activities between the project partners.

SIU NORWEGIAN CENTRE FOR INTERNATIONAL COOPERATION IN EDUCATION


Thank you
ありがとうございます