Toward substantial social implementation of climate change adaptation technology. An advanced attempt in Hokkaido

An answer to Takayabu-san's question of
"what topics in downscaling researches for the next decade"

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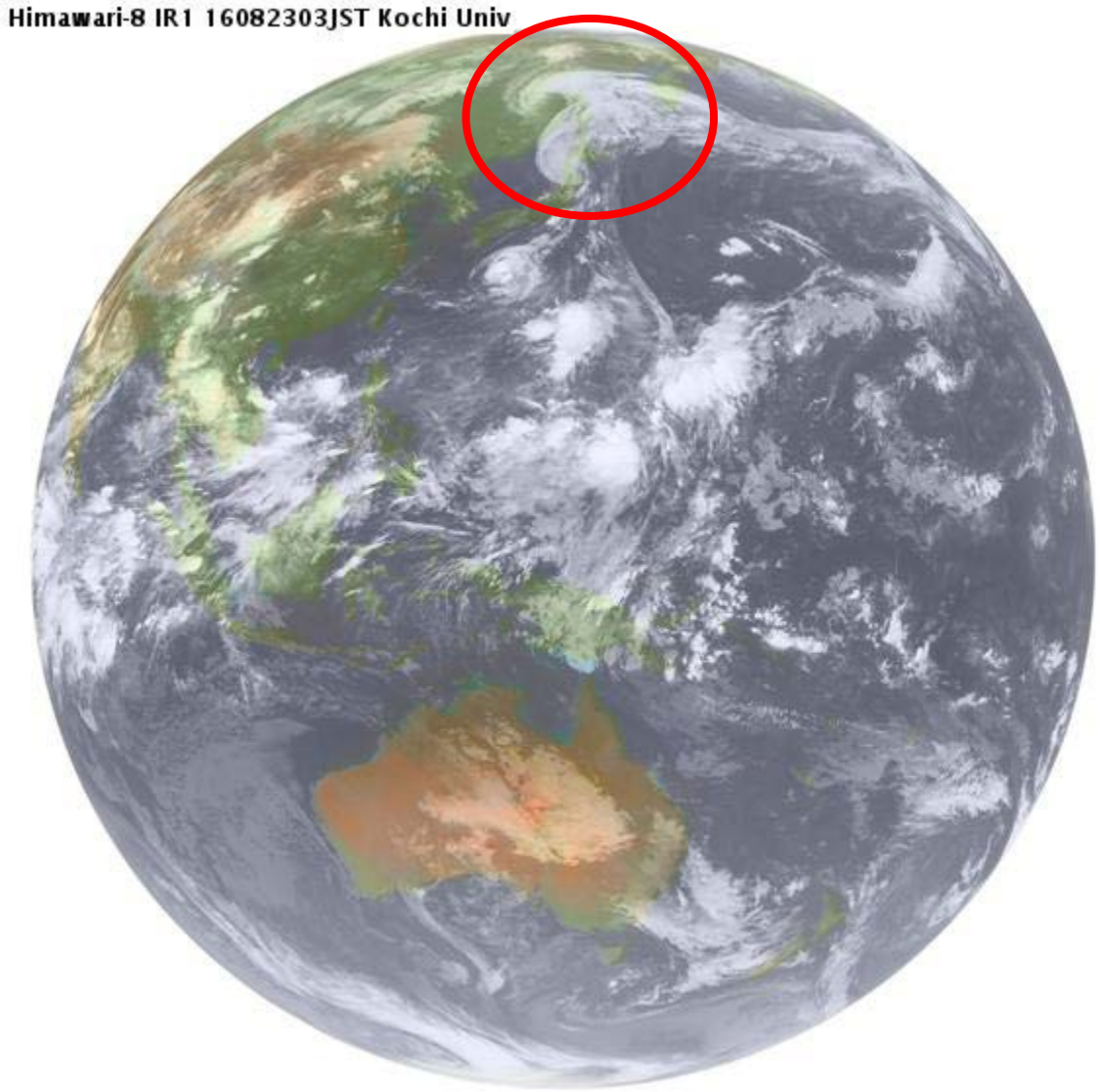
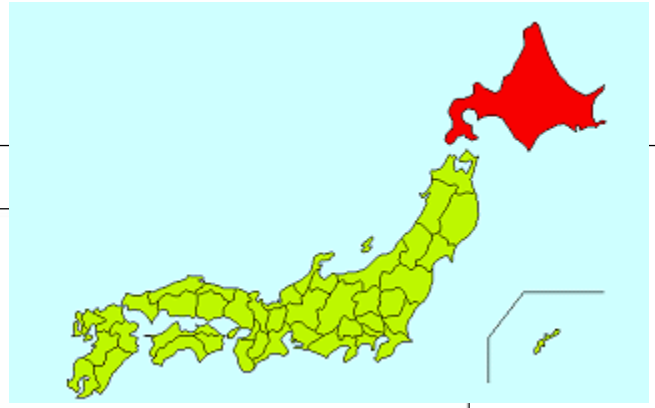
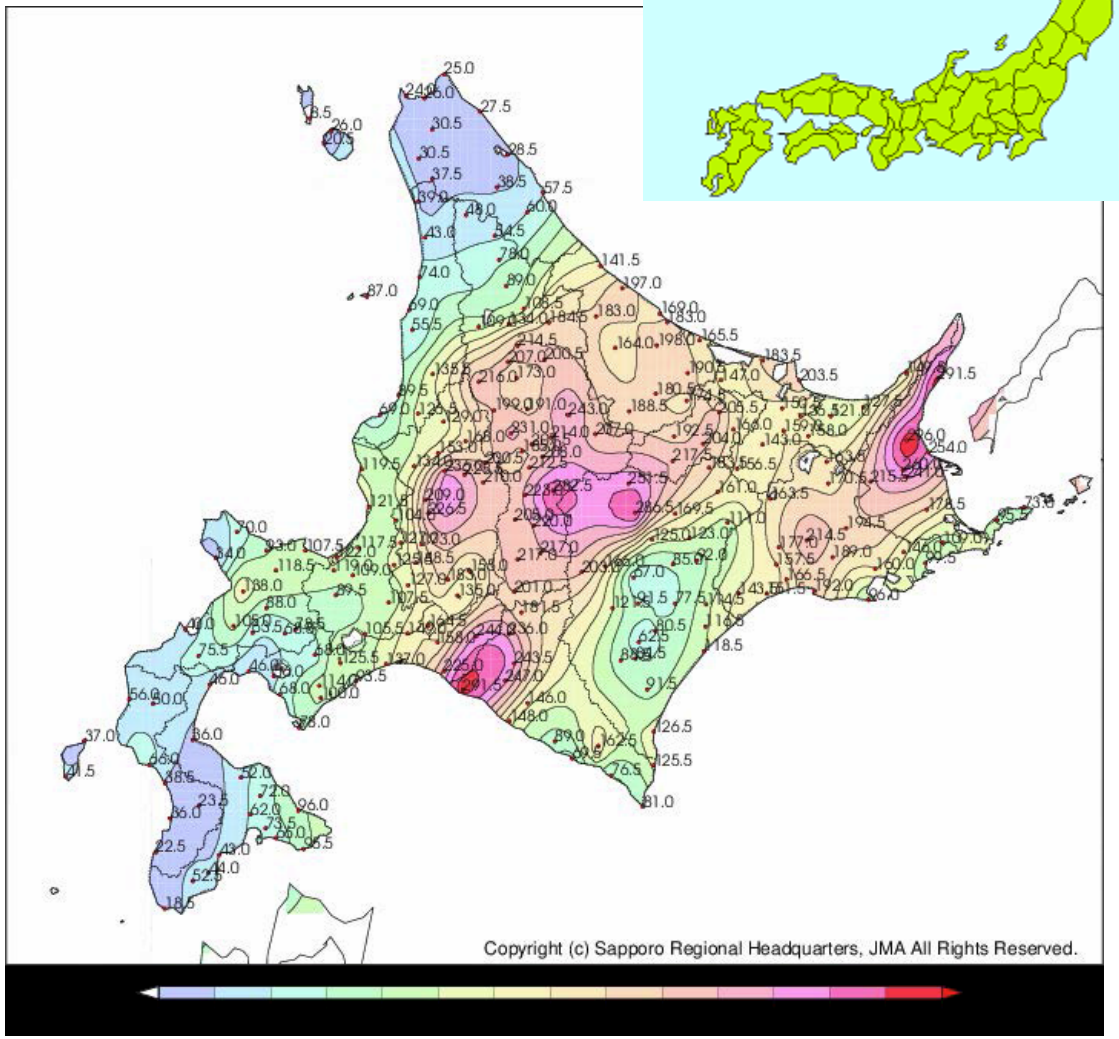
August 2016 in Hokkaido







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http://www.jma-net.go.jp/sapporo/tenki/yohou/saigai/pdf/KishoH280820-0823.pdf

August 2016 in Hokkaido

http://yukimiti.com/10.gensai/132.shinpo.html

http://weather.is.kochi-u.ac.jp/sat/gms.globe/2016/08/23/ql.16082303.jpg
http://www.jma-net.go.jp/sapporo/tenki/yohou/saigai/pdf/KishoH280820-0823.pdf

RECCA Hokkaido project FY2010-2014

Introduction

Land-use change impact

Basic Researches

Sampling DS

Hokkaido University

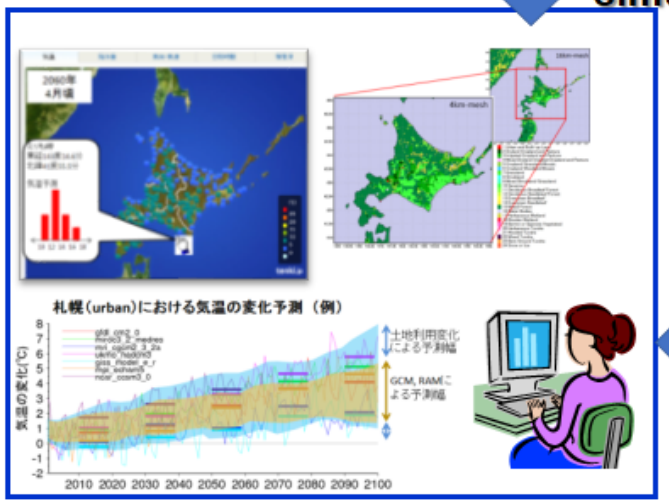
Hybrid DS

Multi-GCM x Multi-RAM simulations

Climate dynamics & hydrology

GUI-based viewer

5km-mesh simulations



Frequent contacting

Meetings on Climate Change Adaptation

Local Government & Private Companies

Access to data by stakeholders

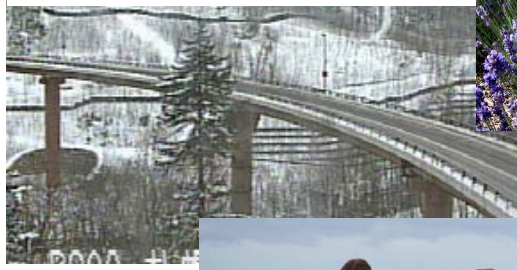
Agriculture

Energy

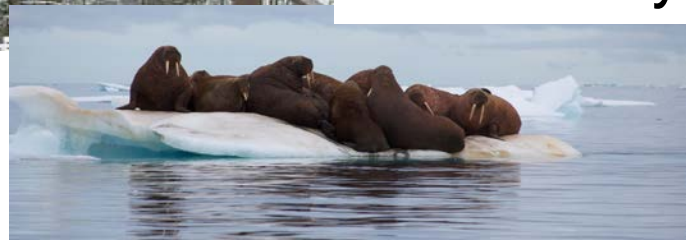
Water resource

Tourism

Transportation



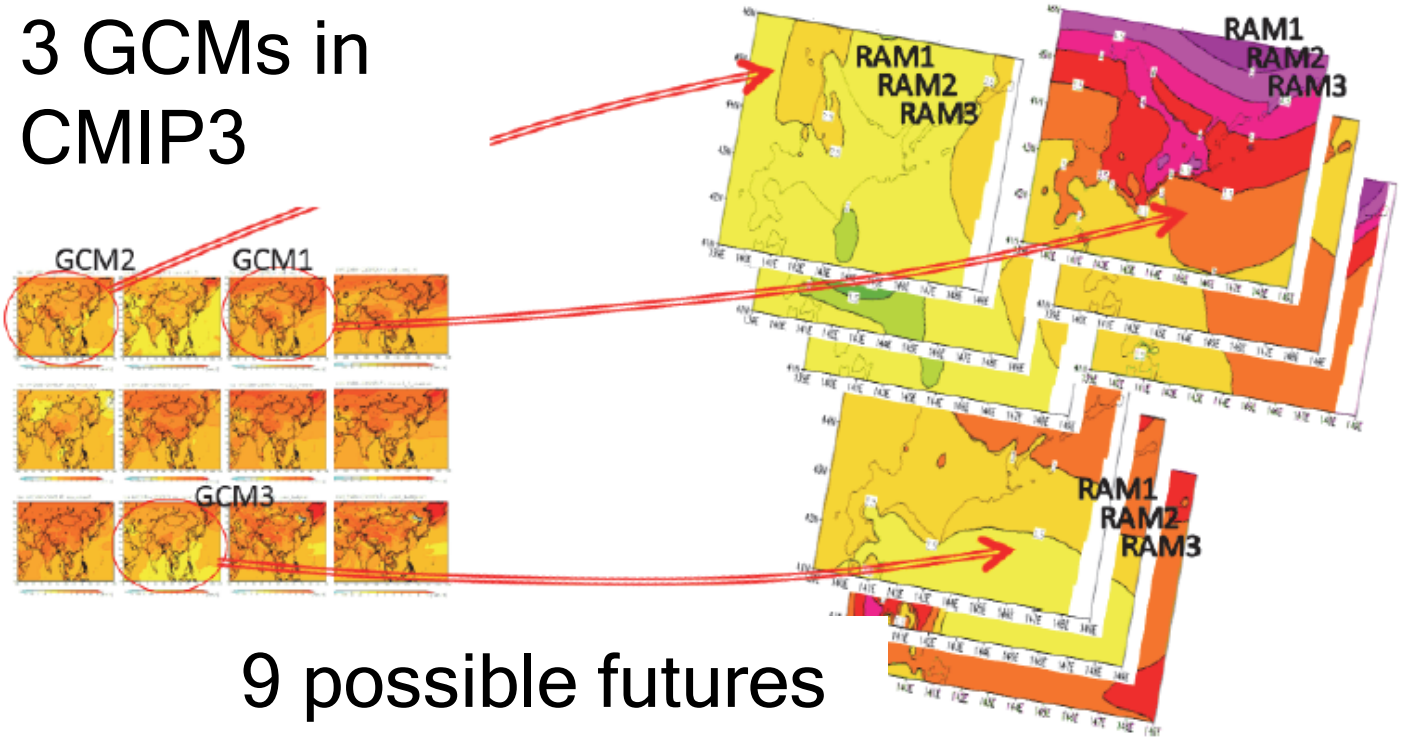
Biodiversity



Multi-GCM by Multi-RAM

3 RAMs for DDS

3 GCMs in CMIP3



9 possible futures

We will show 3 among 9, because results are not so sensitive to RAM.

Kuno and Inatsu (2013)

PLUS 2-K climate scenario

What years do you want to see?

We are concerned about the uncertainty from

- climate sensitivity

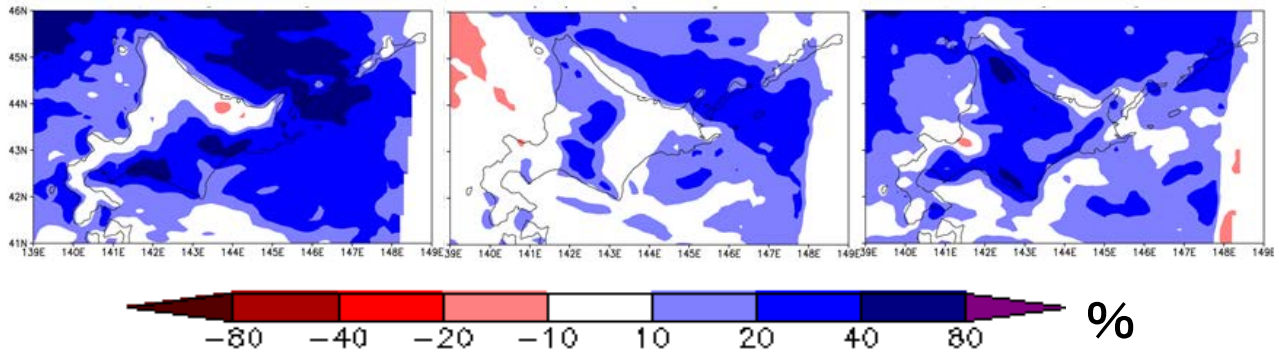
- emission scenario.

The uncertain future in a particular period might be less useful in a DDS community.

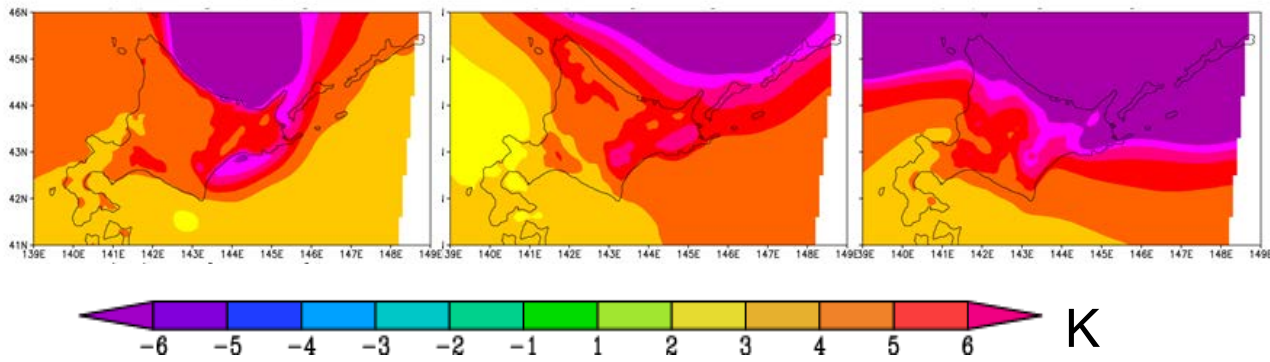
We proposed the PLUS 2 K climate scenario as MIROC model for 2050s, MPI model for 2060s, and NCAR model for 2080s

RECCA Hokkaido's results (Winter)

Precipitation change rate



Surface air temperature change



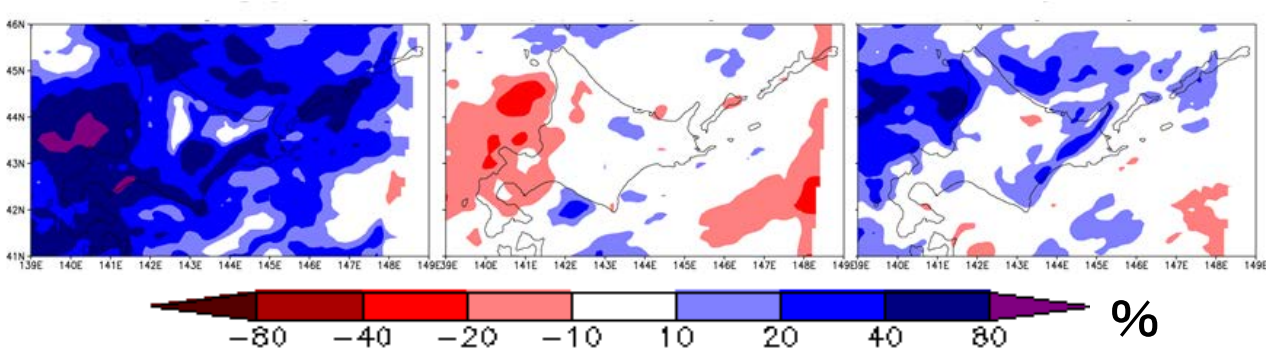
Precipitation likely increases by 20-40% because of the increase of water vapour.

Temperature very likely increases by 3-4 K in land and greater over the Sea of Okhotsk.

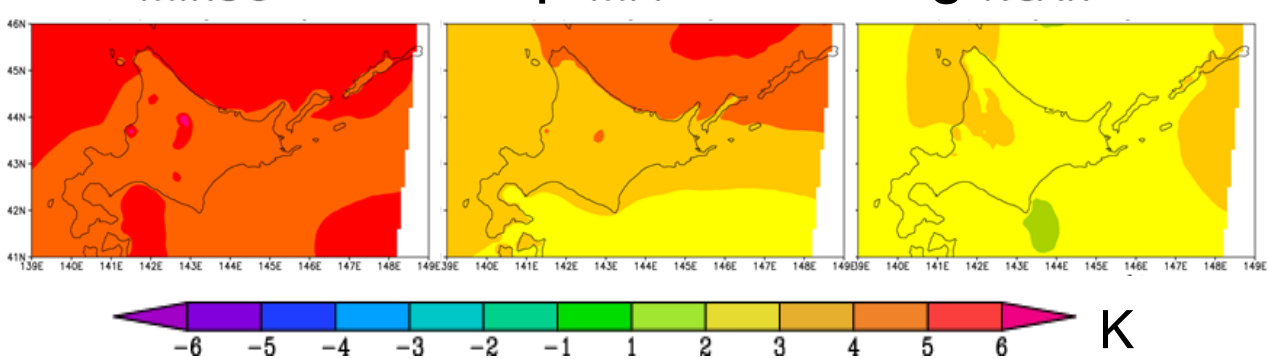
Inatsu et al. (2015)

RECCA Hokkaido's results (Summer)

Summer precipitation change rate



Summer 2-m temperature change



Precipitation change is model dependent, probably because the change of Baiu front and stationary anticyclone is not certain.

Temperature very likely increases by 2-3 K.

Inatsu et al. (2015)

Impact assessment

1. Agriculture (Potatoes, beets, and wine grapes)

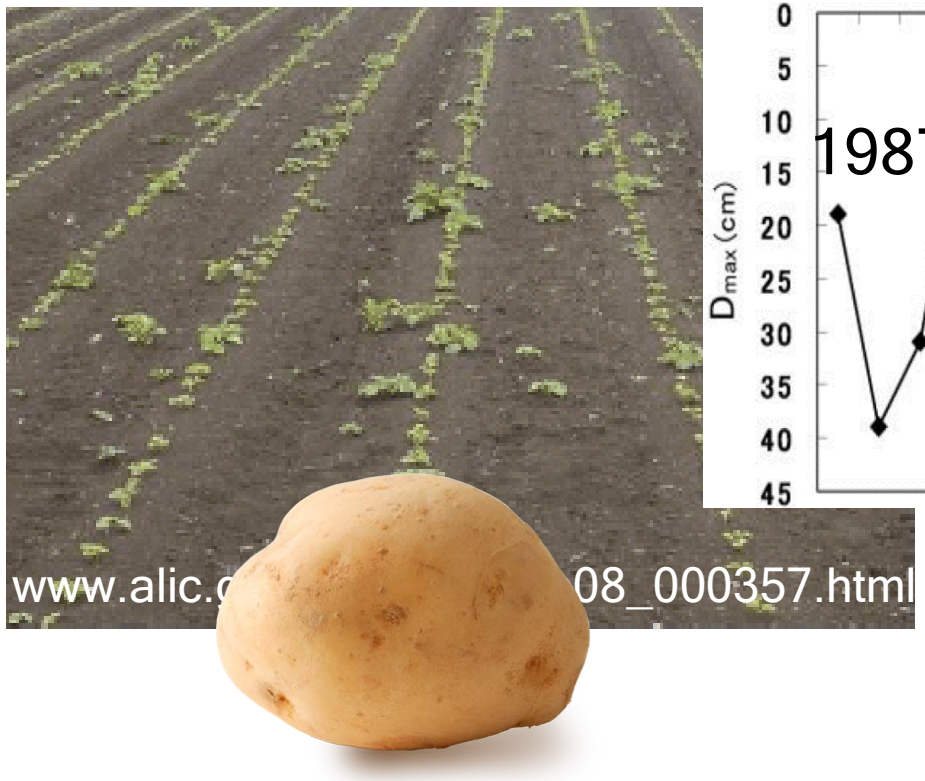


2. Tourism (Ski resort)

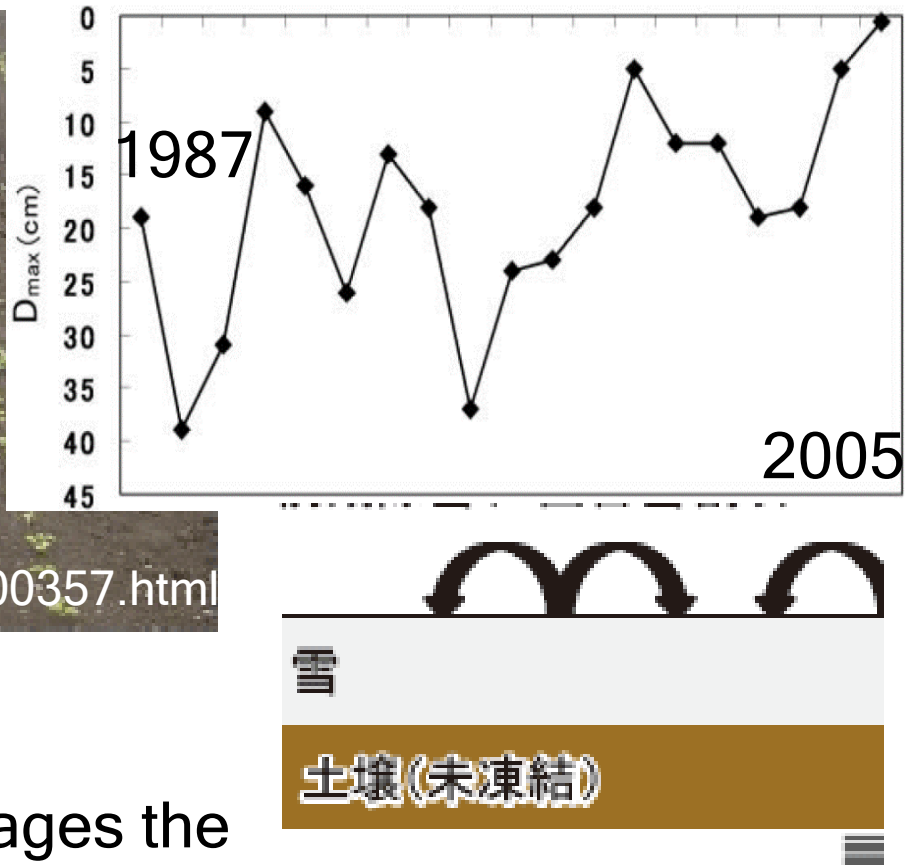
3. Water hazard management (Rain band, Flood risk)

Soil freezing “favourably” kills left-over potatoes.

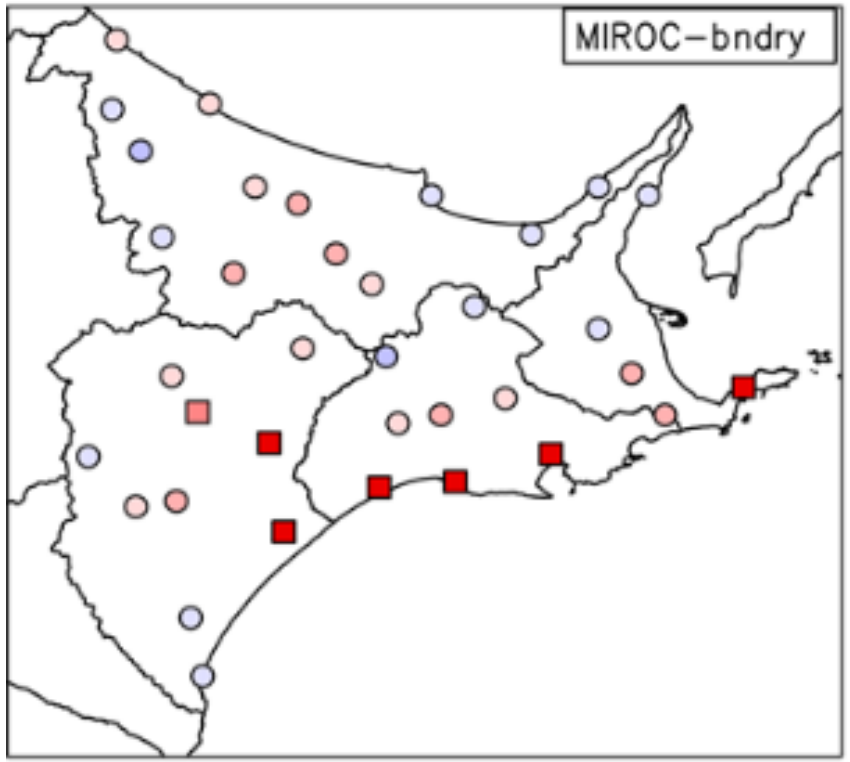
Survived potatoes over winter sprout in spring



Recent tendency of soil-frost depth in eastern Hokkaido



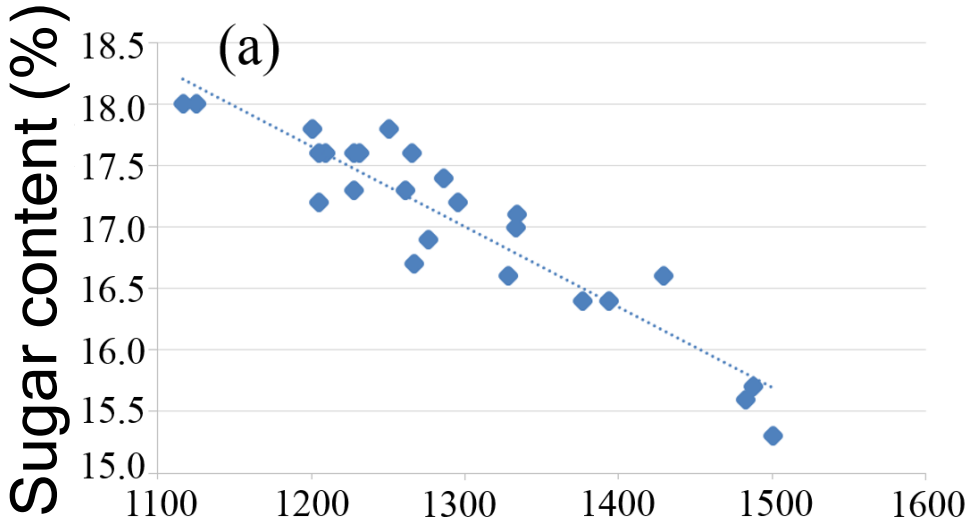
DDS result indicated global warming melts the soil.

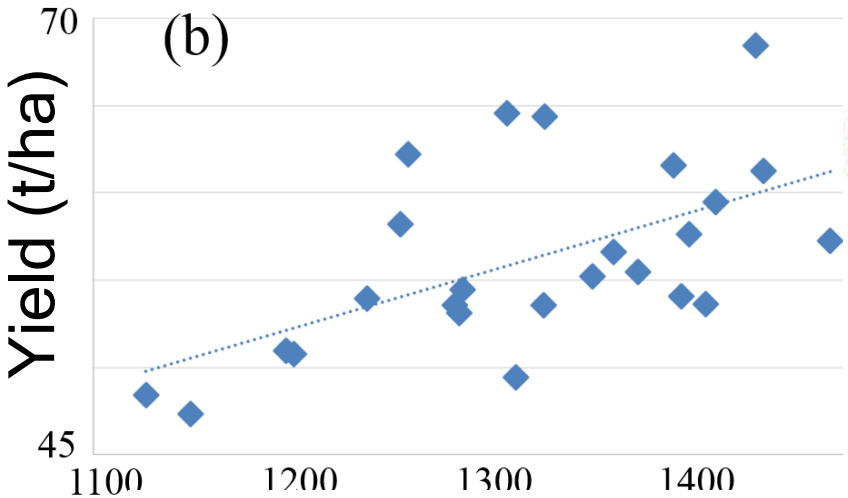


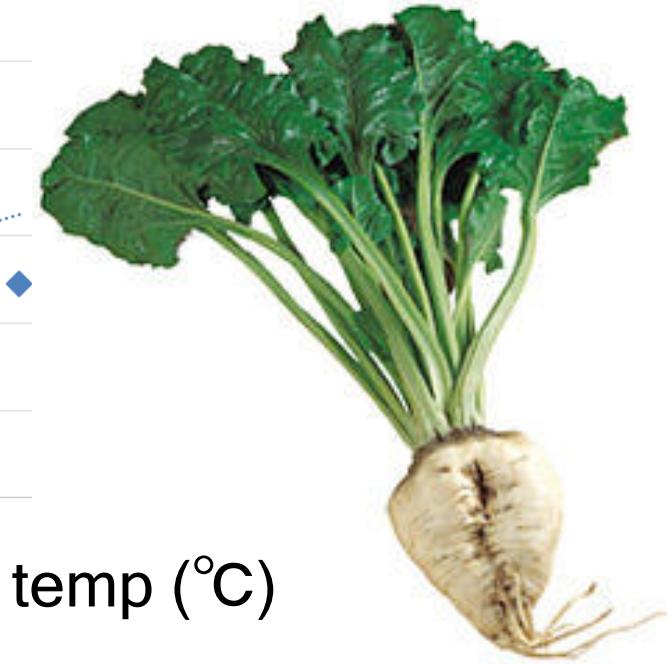
Snow ploughing encourages the soil freezing: this is an agricultural adaptation technology.

Hirota et al. (2006)
Yazaki et al. (2013)
Inatsu et al. (2016)

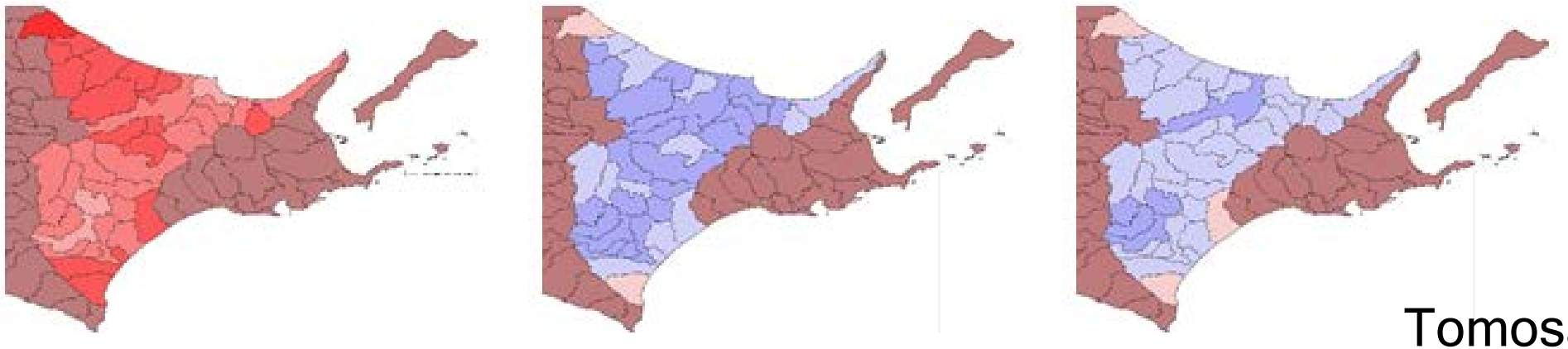
Temperature increase decreases sugar content.







Total sugar product change (t/ha)



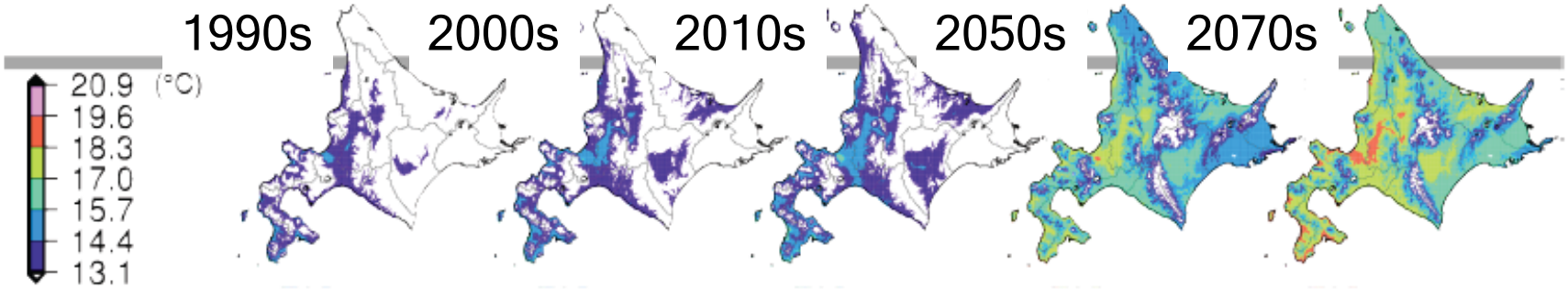
Tomosada and Sato (2015)

Hokkaido “becomes” Burgundy

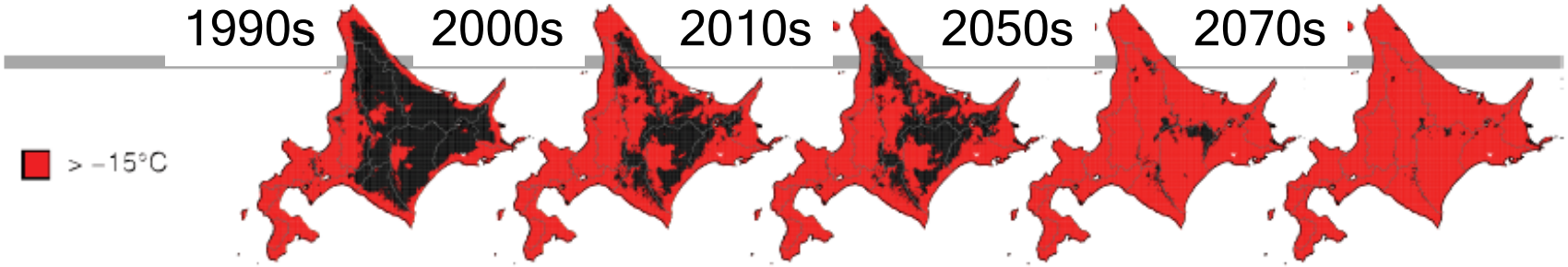
Vitis vinifera

Nemoto et al. (2016)

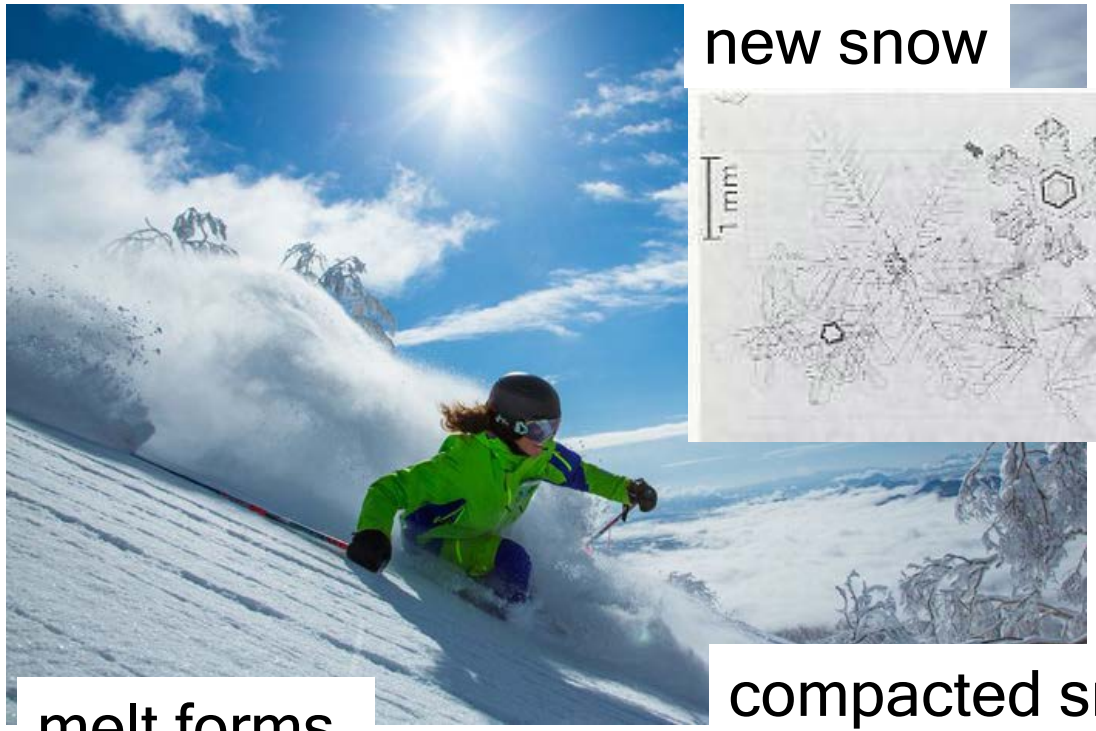
Apr-to-Oct temperature b/w 13.1C and 20.9C.



Monthly daily-minimum temperature > −15 C.

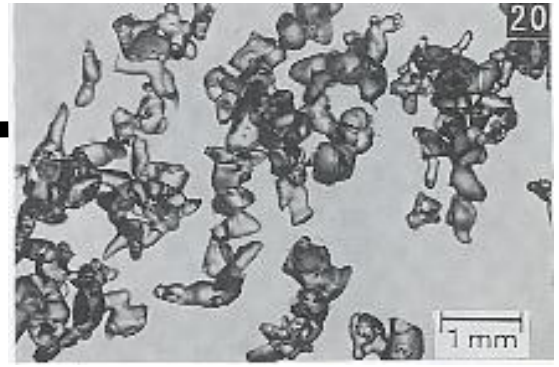


Still enjoy skiing but around the top.



new snow

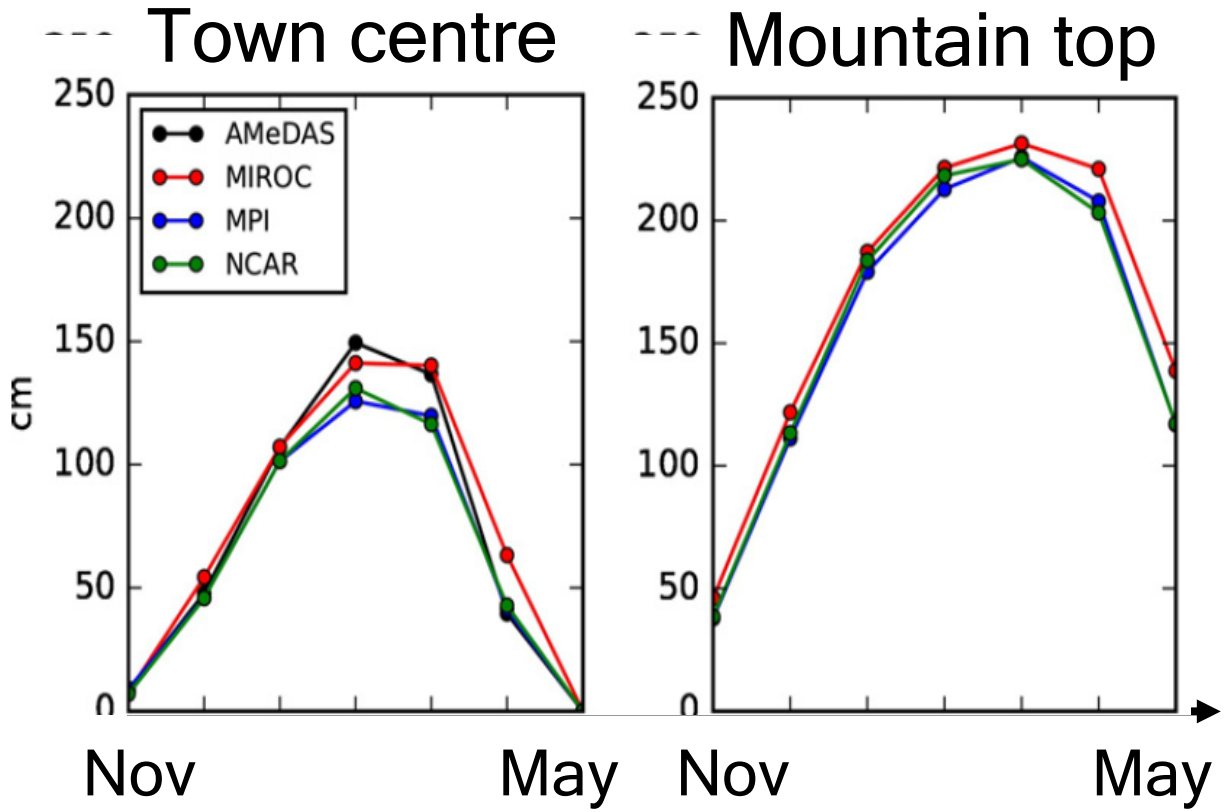
compacted snow



melt forms

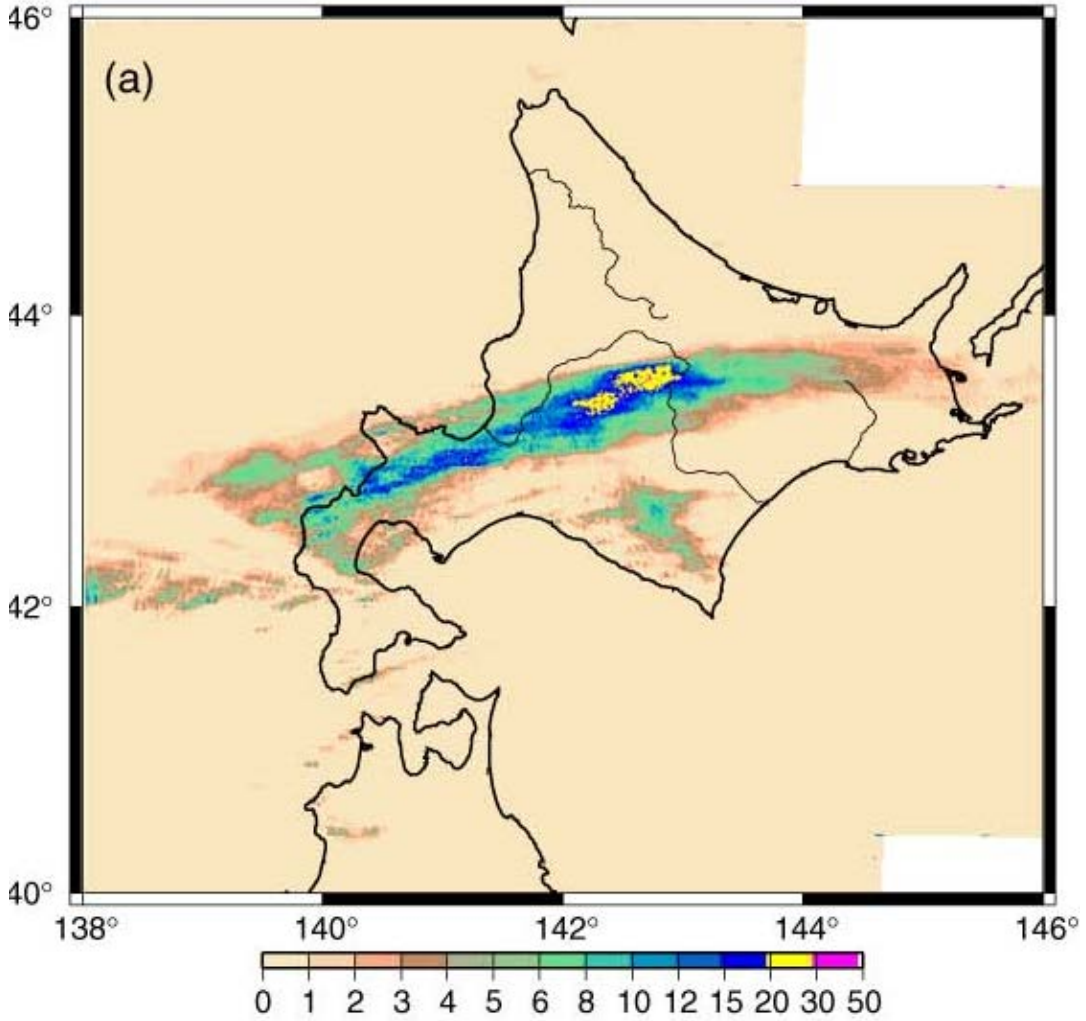
http://niseko.ne.jp/ja/niseko/

Katsuyama et al. (2017)

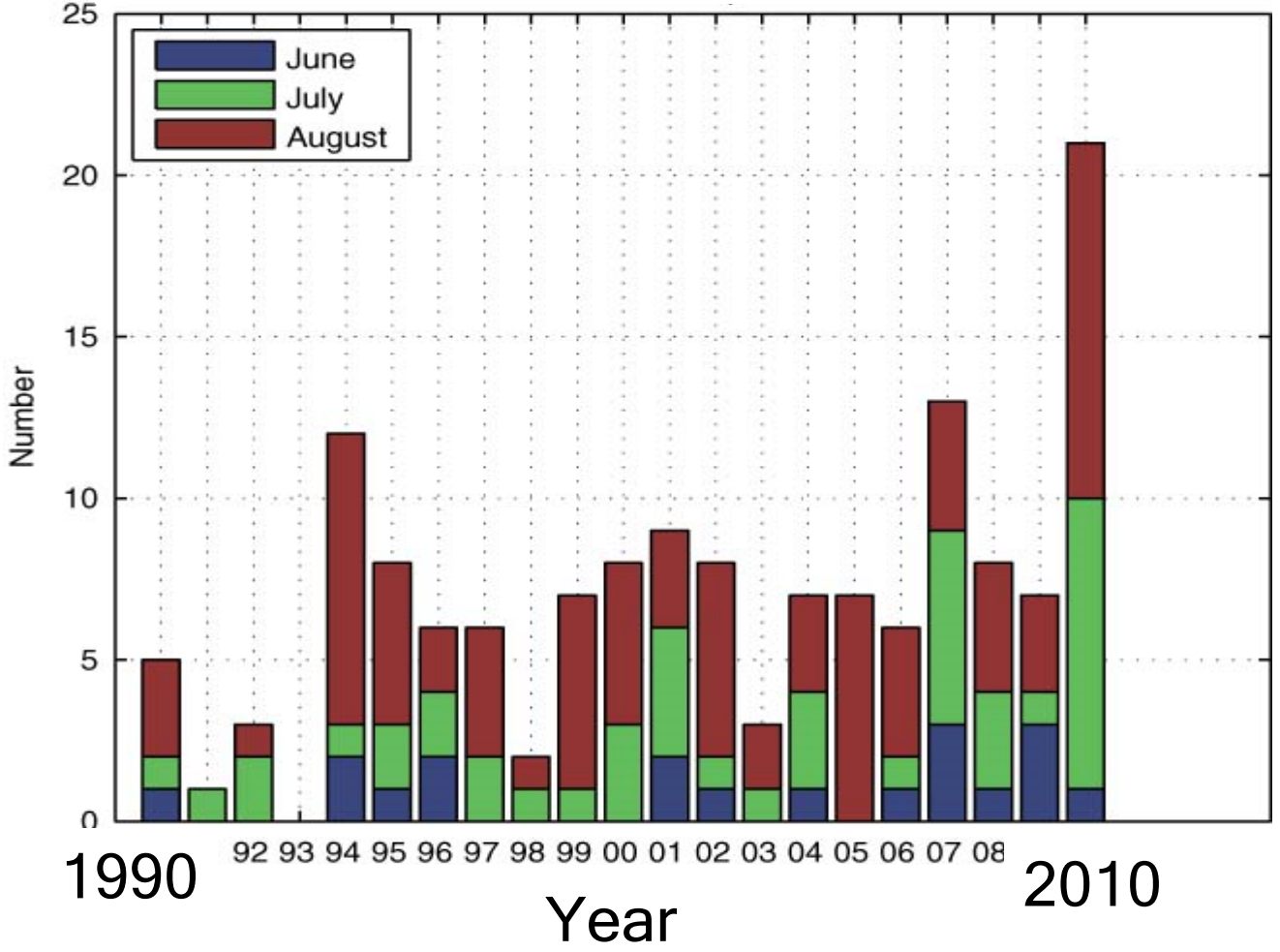


Line-shaped rainband is increasing in Hokkaido.

JMA Radar GPV on 24 Aug 2010



Number of bands over Hokkaido



Yamada et al. (2012)

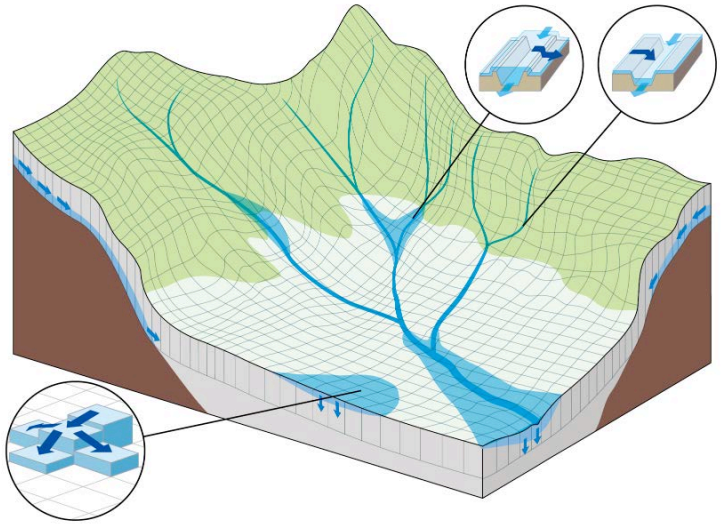
A future hazard map.

Precipitation intensity -> river risk assessment

Present climate

Ishikari River

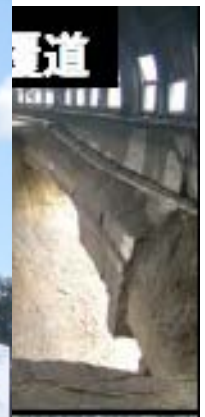
Sapporo City

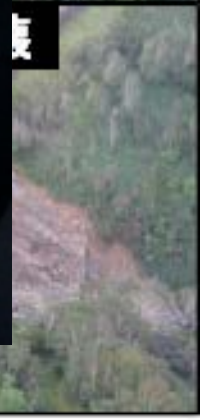


Input the precipitation, comprehensive hydrology model compute possible flood pattern in terms of flood frequency and its water amount.

出典：降雨流出氾濫モデル（RRIモデル）（ http://www.dpri.kyoto-u.ac.jp/SpecialHP/second/detail/index.php?id=7-4-2015025 ）

Remember





https://www.jrhokkaido.co.jp/press/2016/160602-2.pdf
https://www.hkd.mlit.go.jp/ky/saigai/splaat000000otsj-att/splaat000000ougk.pdf

Technical committee just launched.

- August 2016: "A special committee for water hazard treatment following the disaster in Hokkaido on August 2016 due to extremely heavy rainfall" was jointly organised by Hokkaido Local Government and Hokkaido Regional Development Bureau, Japan.
- March 2017: The committee recommended that advanced climate change adaptation including scientific prediction of climate changes, risk assessment for river based on it, and comprehensive flood management plan should be implemented in Hokkaido, where the effect of climate change is much larger in Japan.
- July 2017: Following above, the technical committee for climate change prediction for hydrology has just been launched.

Ongoing massive DDS with great aids.

Extreme rainfall events for the river catchment area for major rivers in Hokkaido will be selected from 3,000 members of present-climate run and 5,400 members of future-climate run in d4PDF data.

DDS with 5 km x 5 km will be performed and simulated rainfall events will be statistically evaluated.

Flood flow and hazard for each river will be assessed, based on the result of rainfall, runoff and inundation model experiments.

Summary and an answer to Takayabu-san

The Hokkaido team has performed downscaling researches.

- Research on snow quality and line-shaped rainband is a kind of meteorological researches but across multiple scales.
- Research on agriculture and river risk management is a kind of interdisciplinary researches toward the society.

In sense of former or latter, it may be expected that downscaling researchers approach a bit more to each organisation and even each individual, not only in the developed countries but in the developing countries.

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