A Method of Estimating Winter Climate Parameters Using Future Projections from the Global Climate Model

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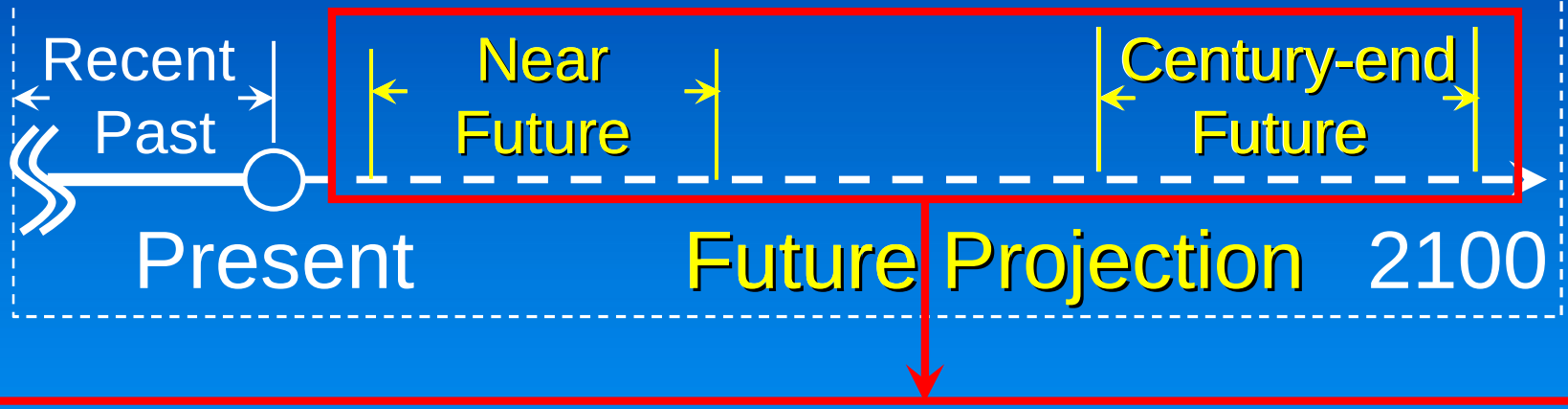
1. Purpose

Develop long-range road snow control plans

Max. snow depth, Heavy snowfall, etc.



1. Estimate more accurately winter climate parameters for future projections using the global climate model
2. Apply this methodology for northern Japan to clarify the trends for future period changes

Winter Climate Parameters

1) Maximum snow depth

Road snow-control facilities are designed based on the 30-year annual max. snow depth

2) Maximum 24-hour snowfall

Width of the snow piling zone at the road shoulder is designed based on the 10-year max. daily snowfall

3) Frequency of 10 cm or more of daily snowfall

Snowplows are deployed to national highways when the depth of newly fallen snow reaches 10 cm and continuous snowfall is expected

2. Method

Key points

1. **Weather data used**

2. **Adjustment process**

Target Area

Northern Japan <snowy area>

Weather Data Used

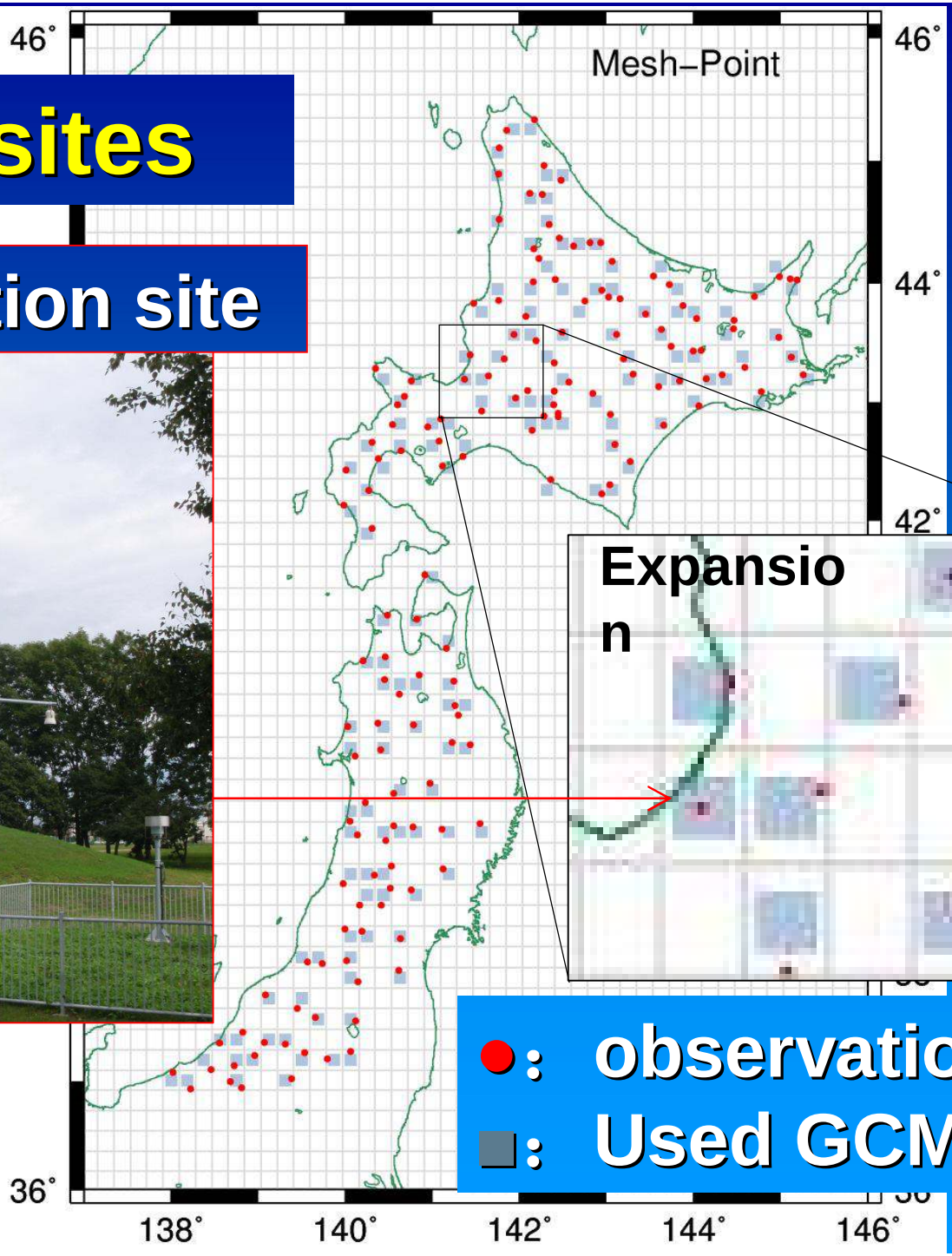
1) Snow depth data automatically measured every hour at 161 sites (1979-2002)

2) MRI-AGCM3.2S (Japan Meteorological Agency)

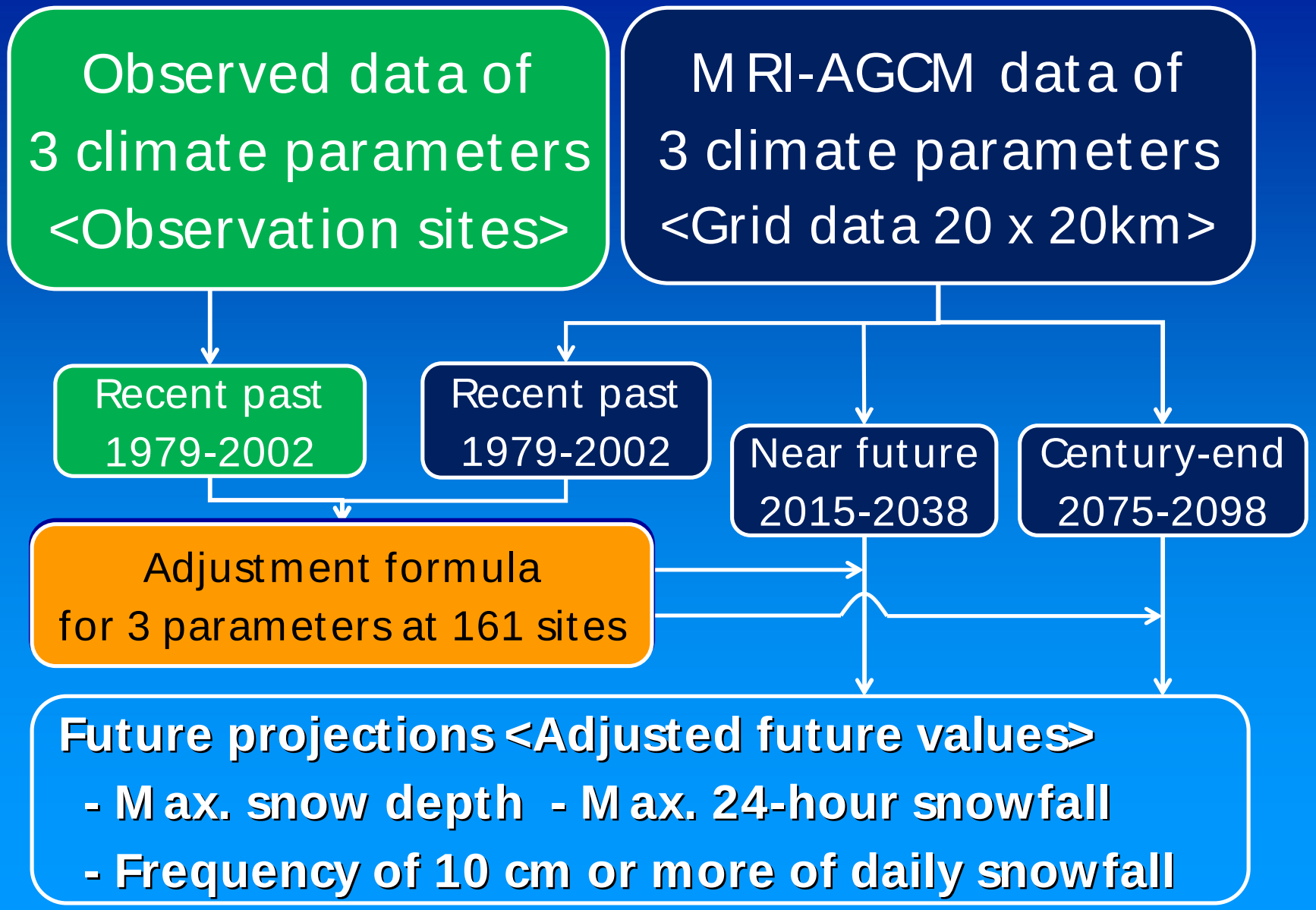
Resolution	Grid size: 20 km × 20 km		
Meteorological Elements	Hourly	Daily	Monthly
	-Temperature -Precipitation	-Snow water equivalent	-Average snow depth
Period (Winter)	- Recent past (1979-2002) - Near future (2015-2038) - Century-end future (2075-2098)		
Greenhouse gas emissions scenario		A1B of IPCC	

161 sites

observation site

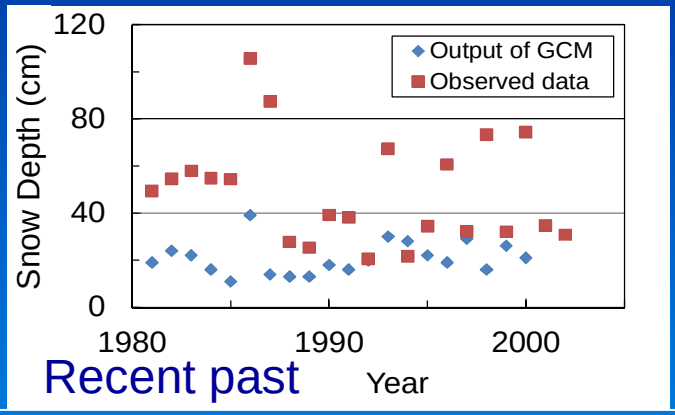


Adjustment Process

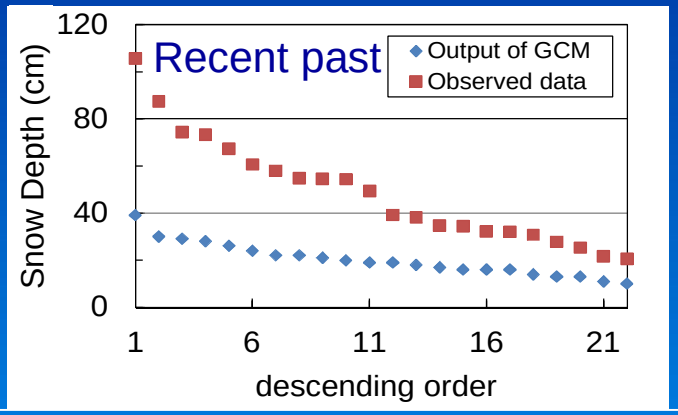


Adjustment Formula

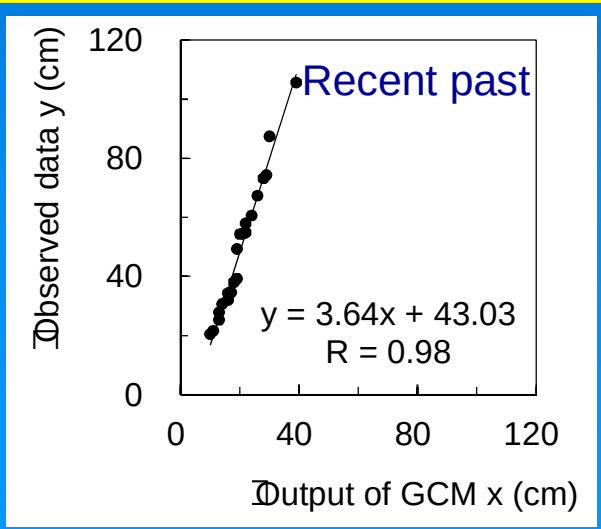
1) Extract the maximum snow depth for each winter.



2) Sort the values extracted in descending order.



3) Generate an adjustment formula.

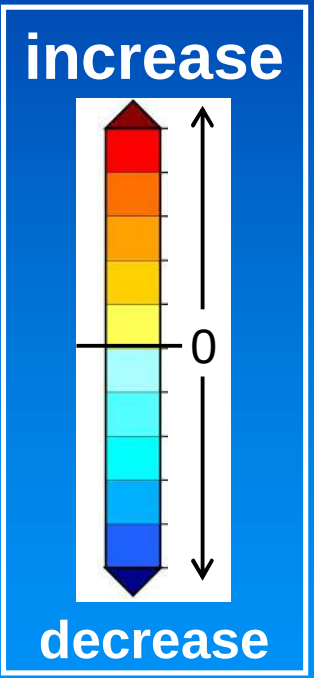


Max. snow depth
at Shinshinotsu site

3. Results

Differences in the average values for three climate parameters

1) Maximum snow depth
2) Maximum 24-hour snowfall
3) Frequency of daily snowfall of 10 cm or more



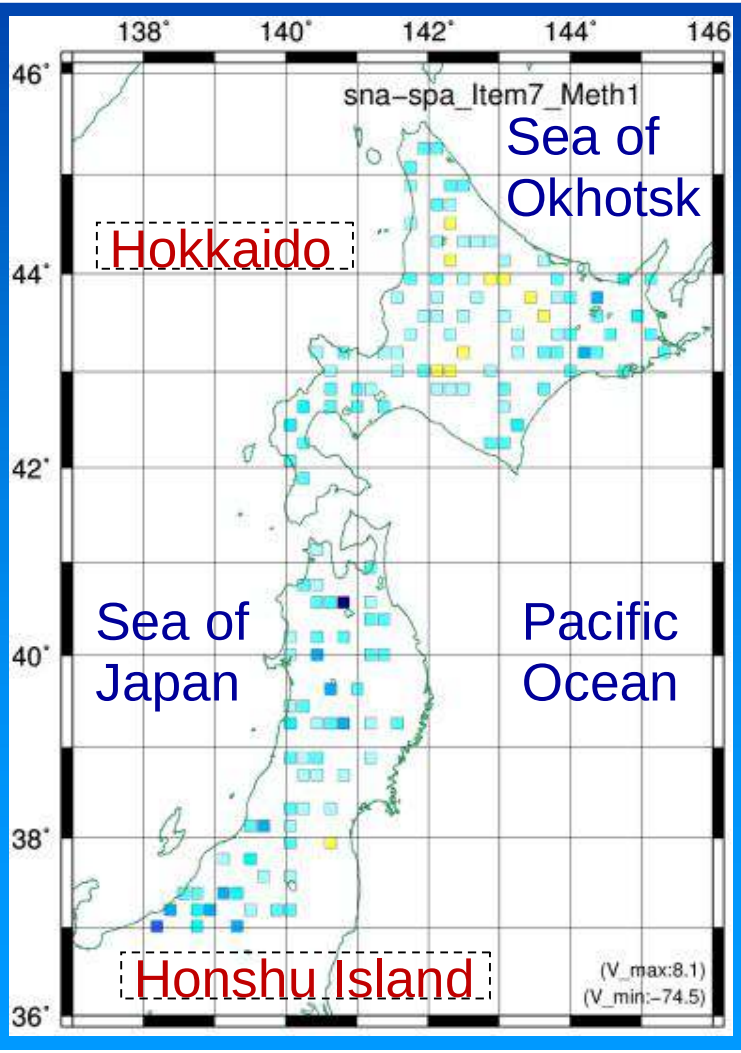
Distribution maps

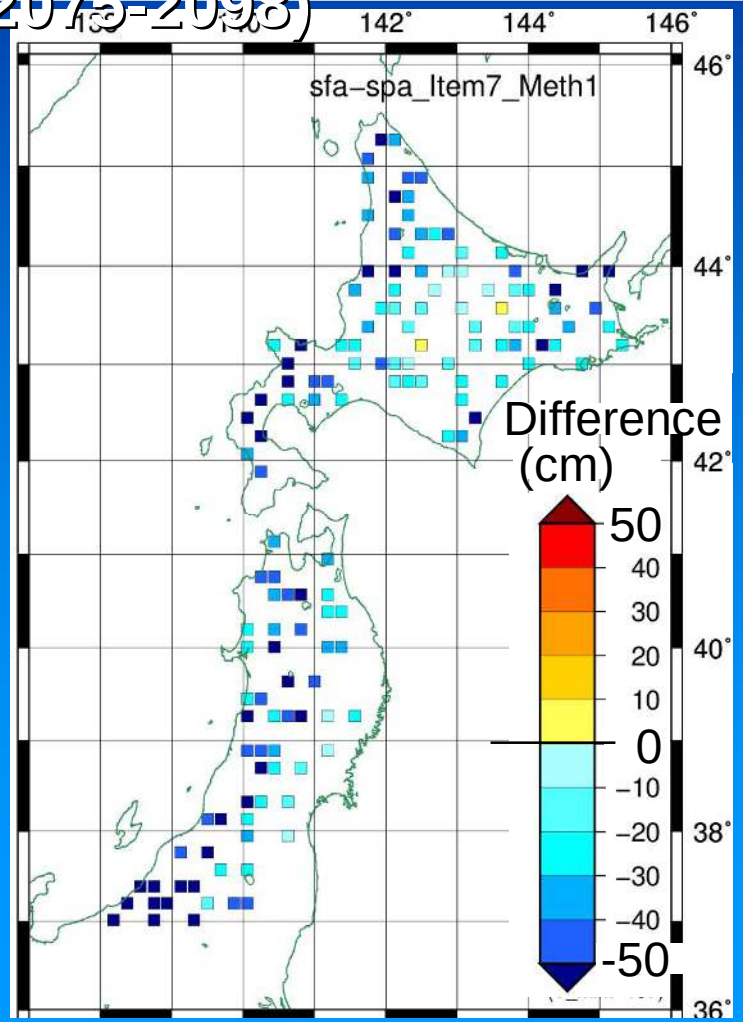
Near-future (2015-2038)	vs.	Recent past (1979-2002)	Century-end (2075-2098)	vs.	Recent past (1979-2002)

1) Maximum Snow Depth

Near-future (2015-2038) vs. **Recent past (1979-2002)**

Century-end (2075-2098) vs. **Recent past (1979-2002)**

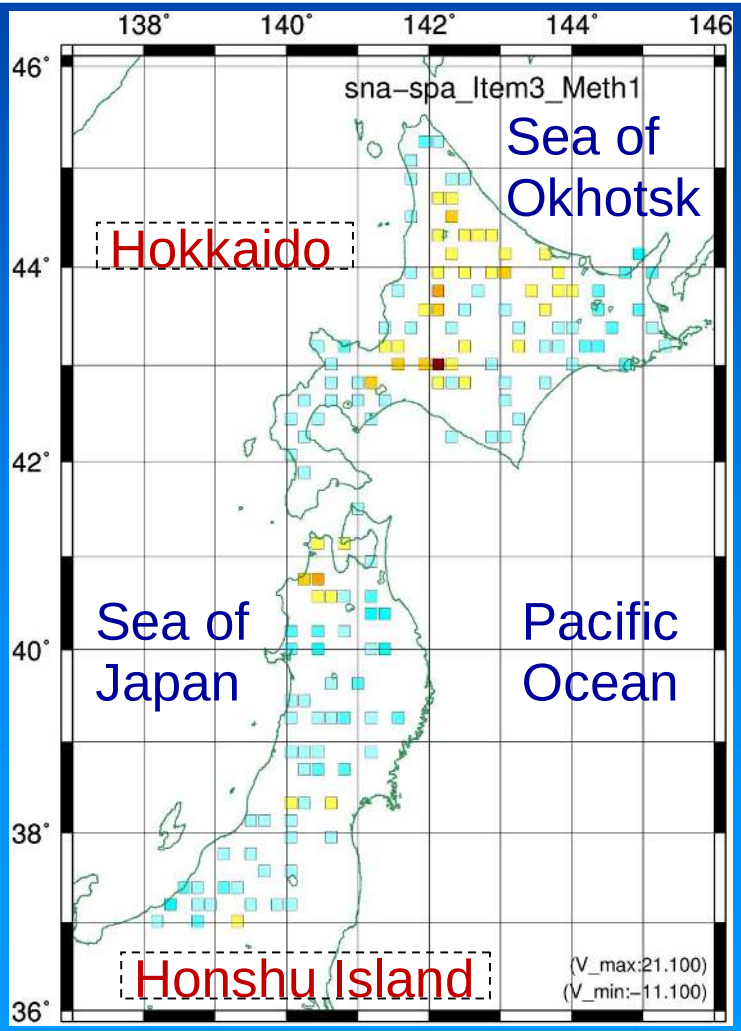


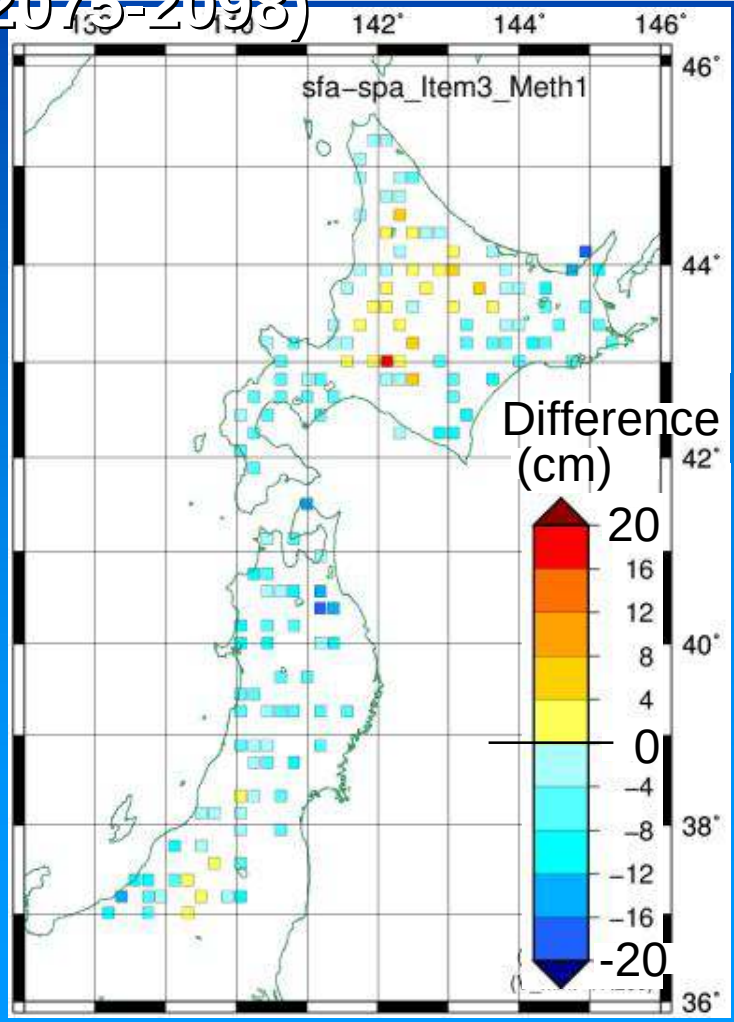


2) Maximum 24-hour Snowfall

Near-future (2015-2038) vs. **Recent past (1979-2002)**

Century-end (2075-2098) vs. **Recent past (1979-2002)**

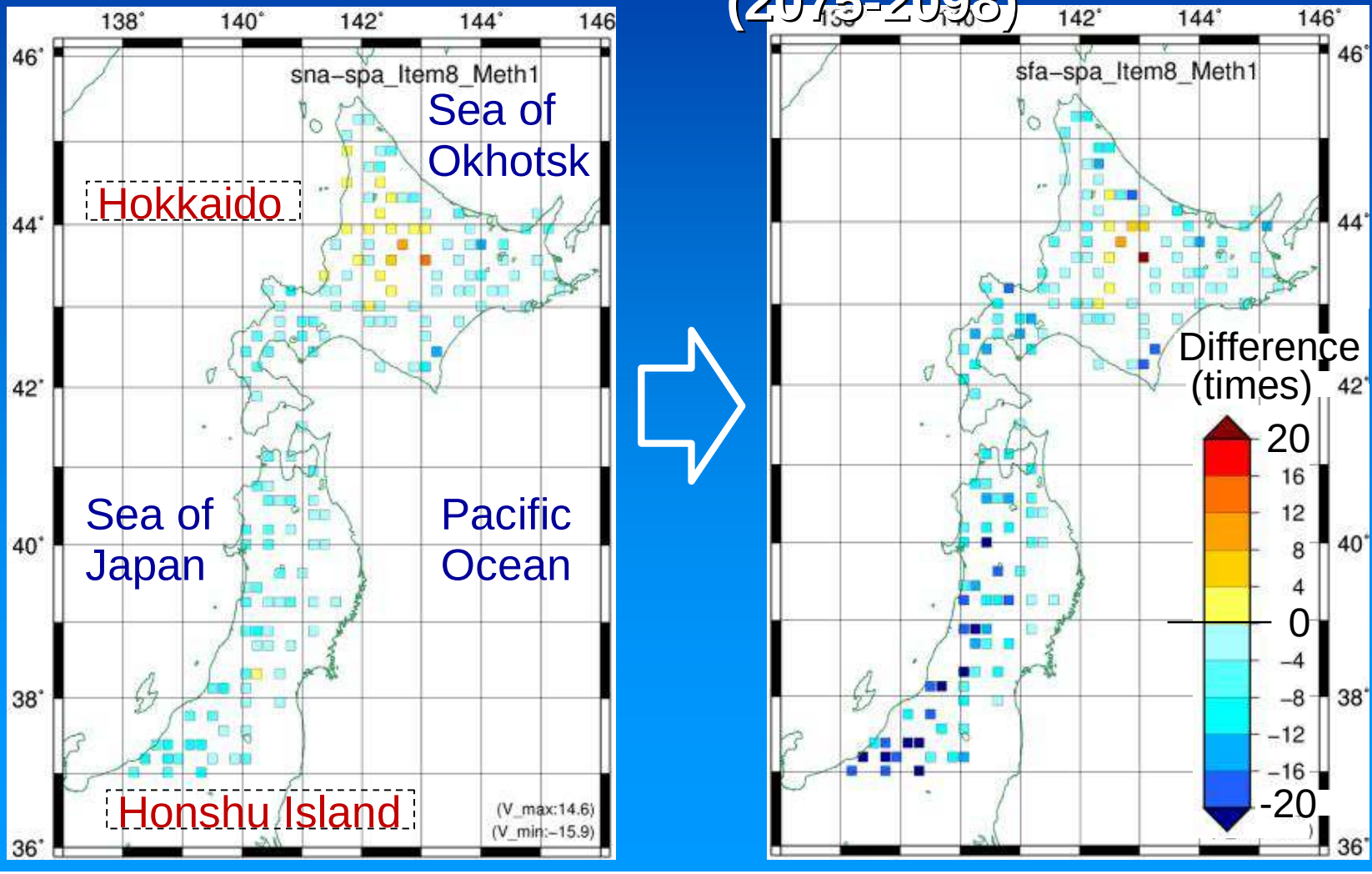




3) Frequency of Daily Snowfall of 10 cm or more

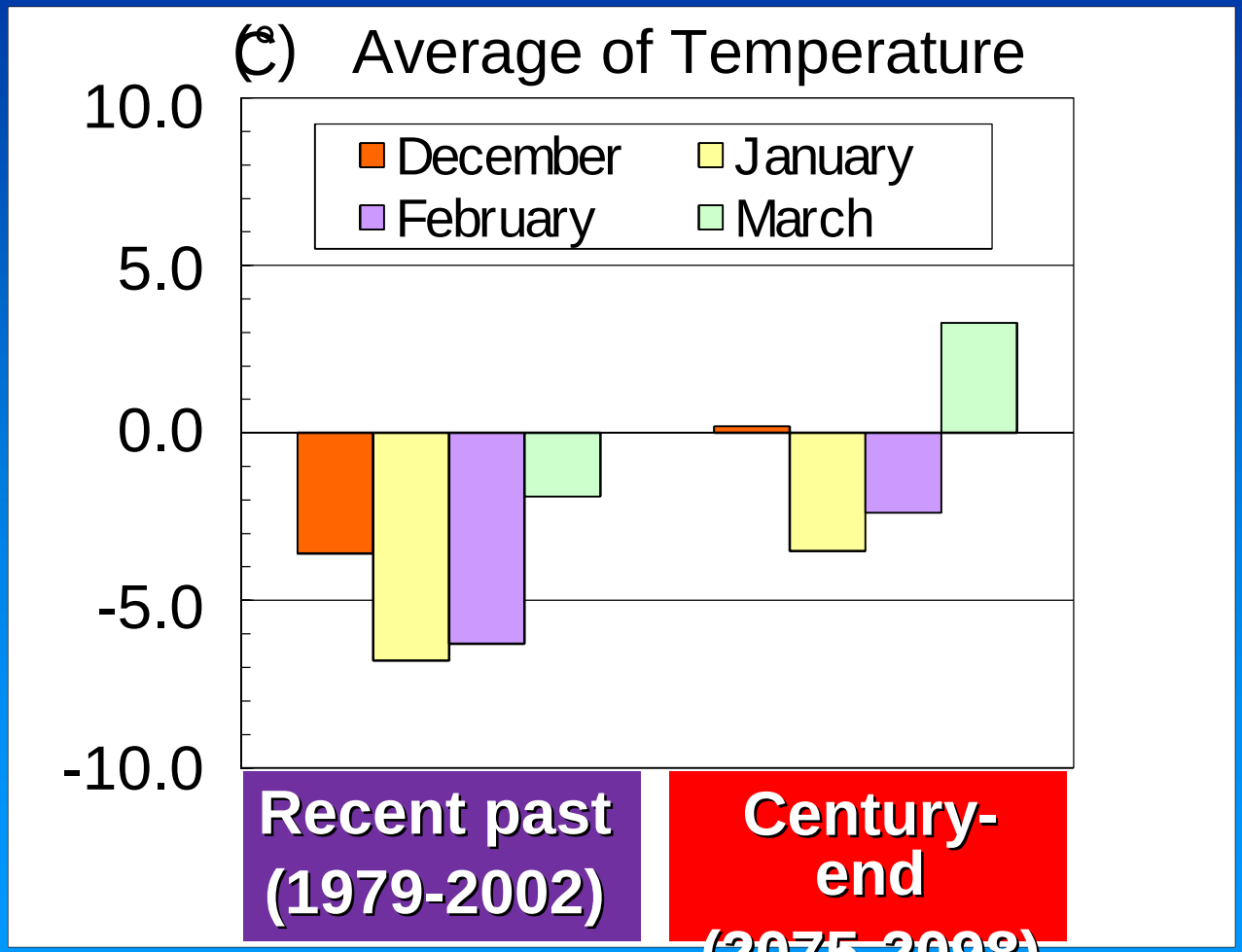
Near-future (2015-2038) vs. **Recent past (1979-2002)**

Century-end (2075-2098) vs. **Recent past (1979-2002)**



4. Considerations

Affect of rising temperature on future winter climate parameters



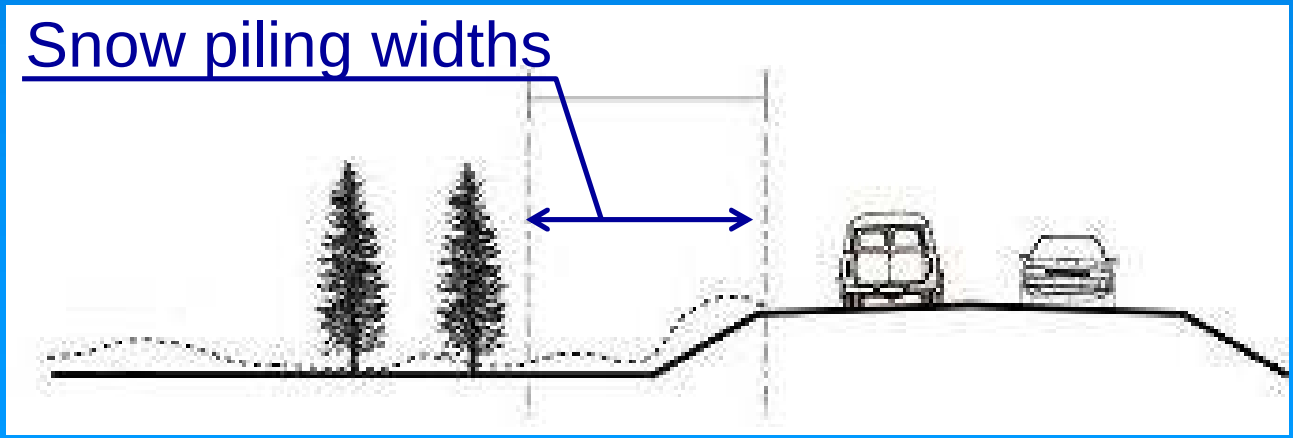
Shinshinotsu site

Maximum 24-hour Snowfall

Predicted to decrease by only 0 to 10 cm

-> Current measures to mitigate the effects of heavy snowfall need to be secured at the same levels as today

-> Snow piling widths on roadsides need to be secured at those levels.



Frequency of Daily Snowfall of 10 cm or more

Expected to increase in central Hokkaido for the both future climate periods.

-> Deployment of snow removal vehicles may need to be reexamined.

Summary

1. Prediction Methodology
2. Future Trends Clarification
3. Projected winter climate parameters
4. Effect on Snow-Control Measures

Thank you for your attention!

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