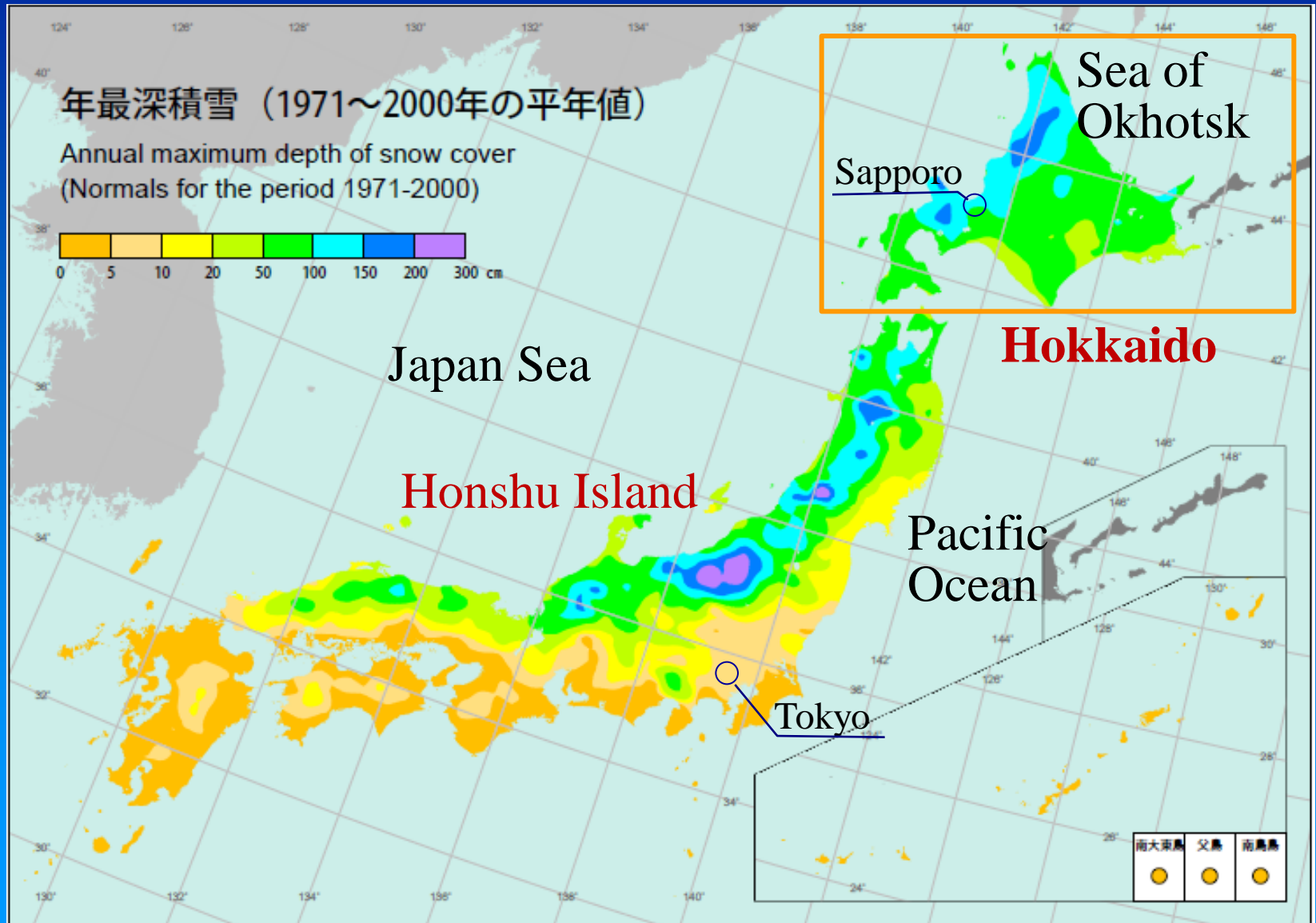


**Recent Changes in Pressure Patterns
and Their Regional Occurrence
at Times of Heavy Snowfall
and Blizzard Events
in Hokkaido, Japan**

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Annual Maximum Depth of Snow Cover



Introduction

Recent Winter Events in Hokkaido

Jan. 13-16, 2004



Feb. 23-24, 2008



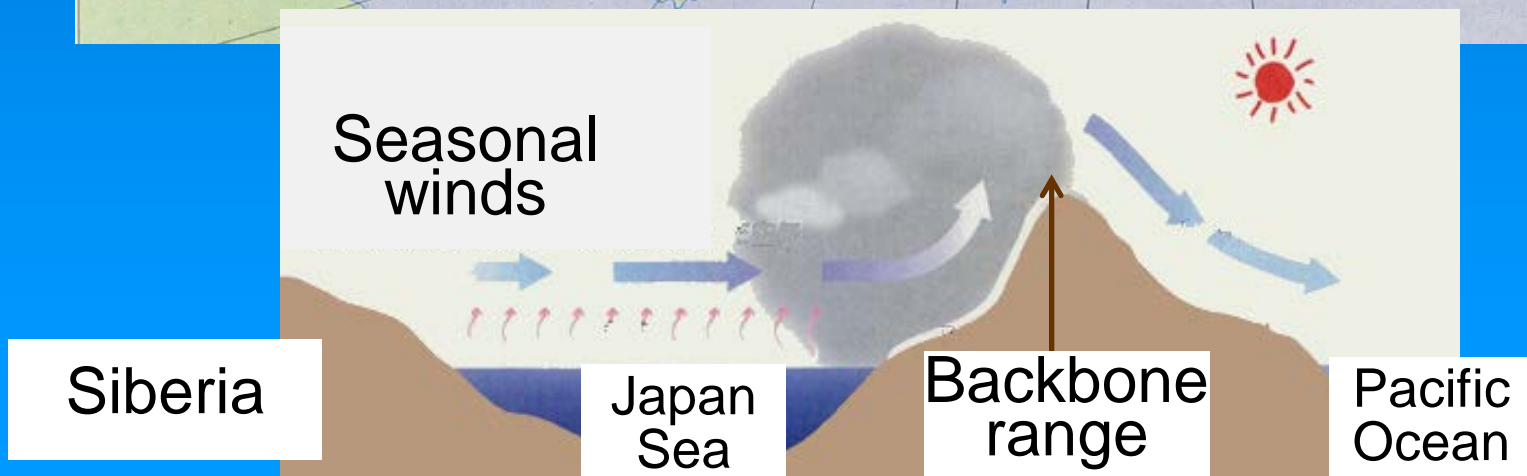
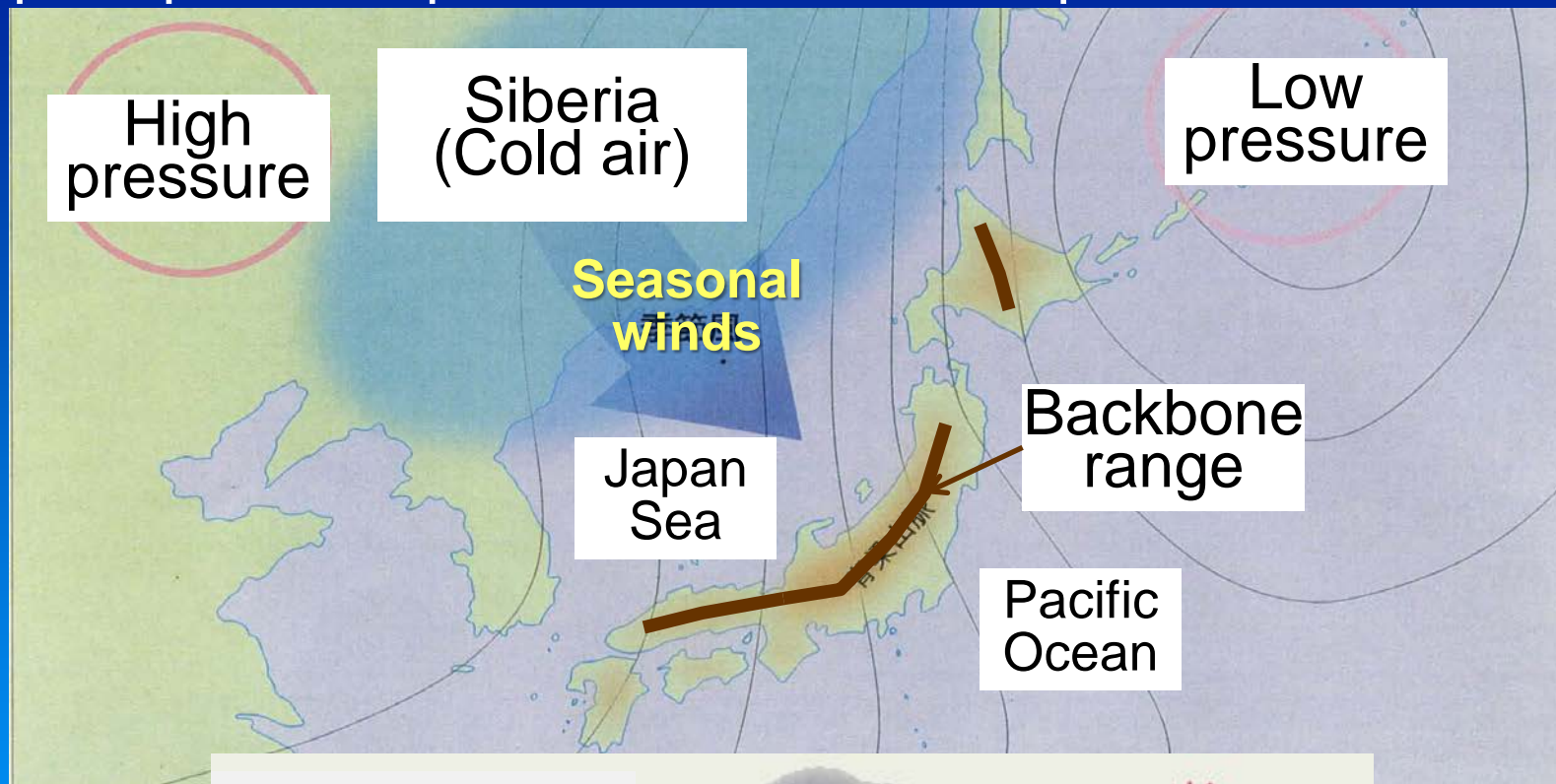
March 2-4, 2014



Photos: Hokkaido Regional
Development Bureau

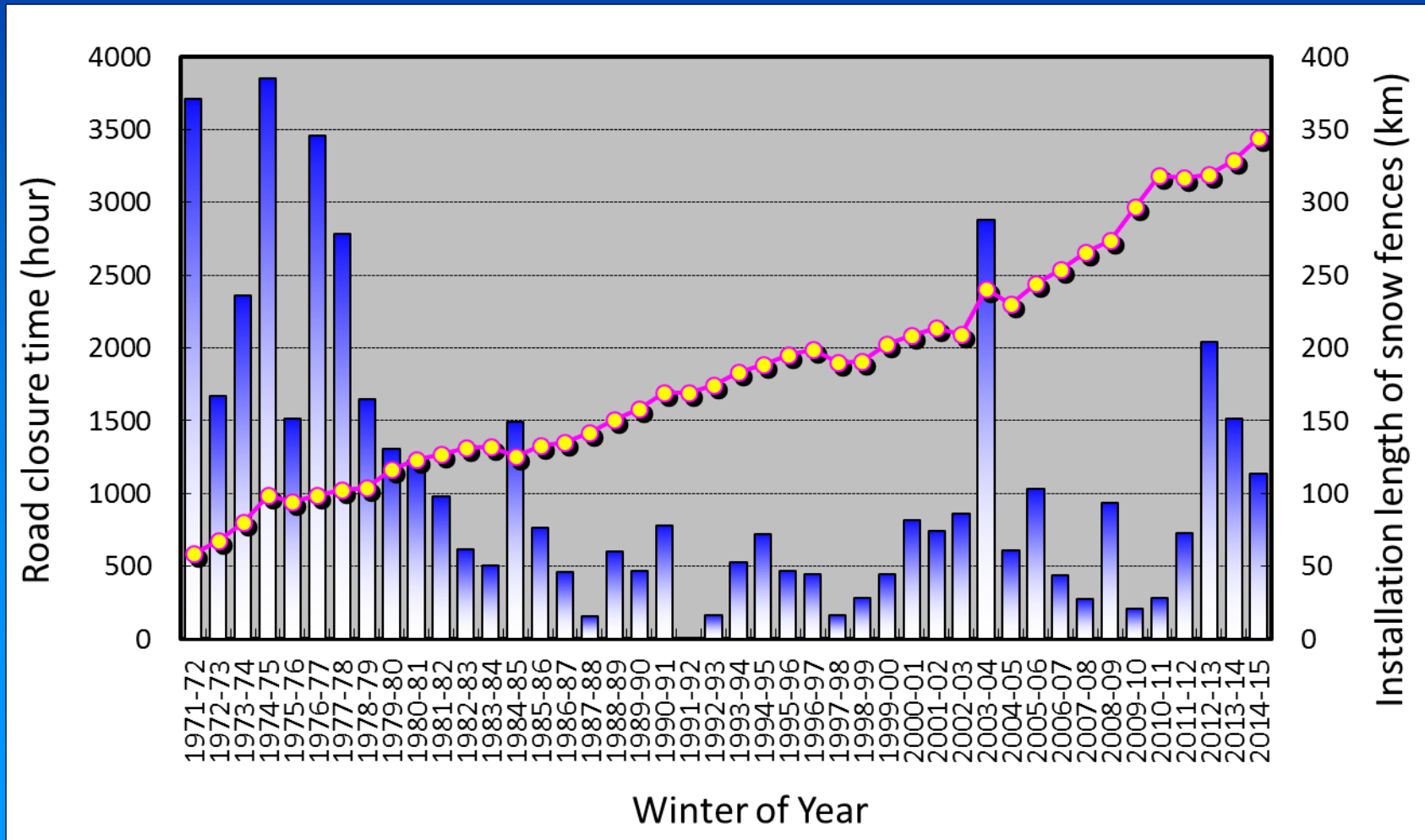
Introduction

Typical pressure patterns in winter in Japan



Introduction

- Cumulative hours of road closure by snowstorms on national highways in Hokkaido



Study Purpose

- Recent trends in the frequencies of heavy snowfall and severe blowing snow events
- Areas of heavy snowfall and severe blowing snow



- Relation between routes of low-pressure systems and/or pressure distributions and areas of heavy snowfall or severe blowing snow
- Changes in charted weather patterns at times of heavy snowfall and severe blowing snow

Investigation Method

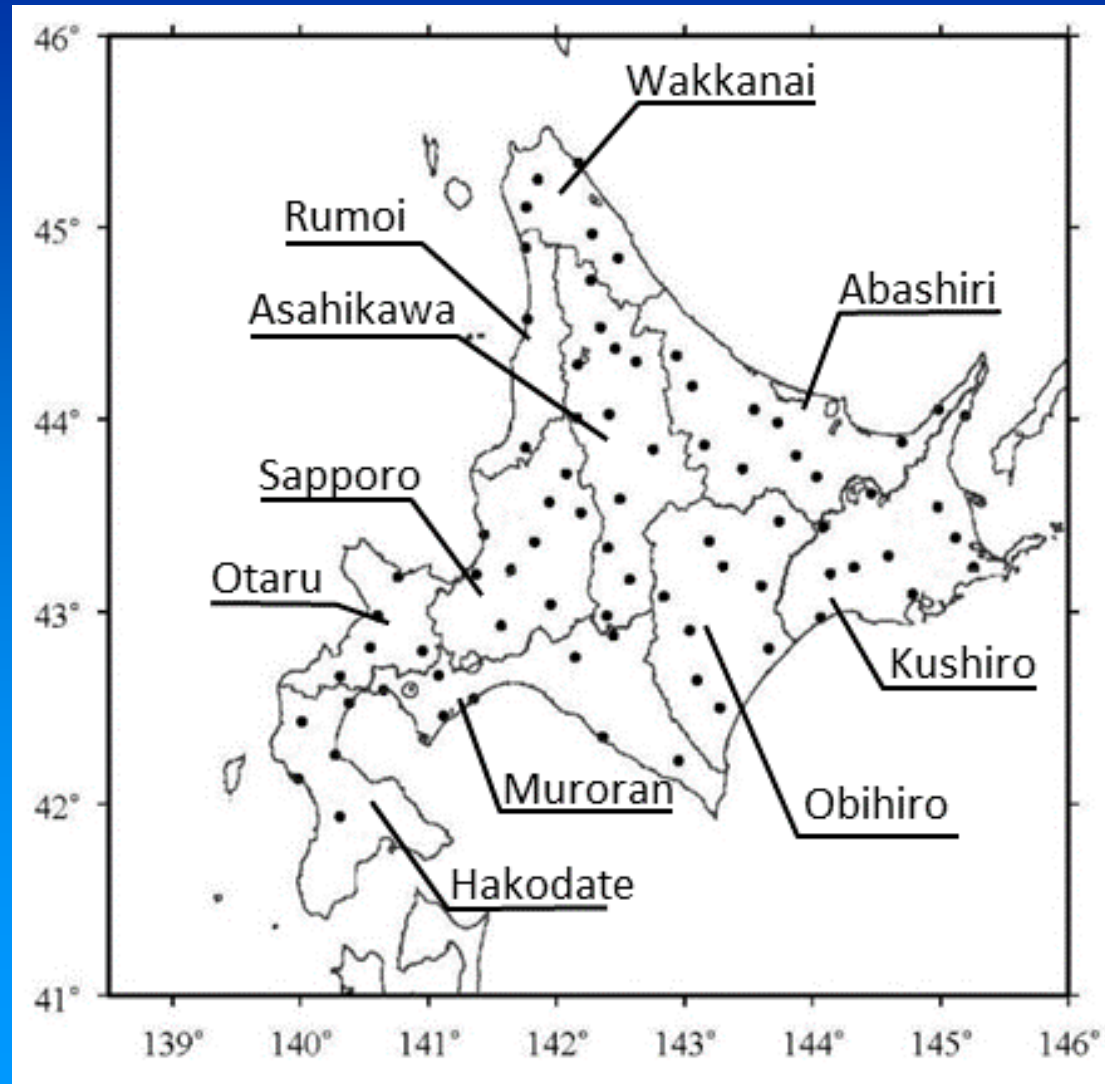
Heavy Snowfall and Severe Blowing Snow: Case extraction

(1) Data

Hourly data on snow depth, air temperature and wind velocity at 77 weather stations

Right-hand figure:
Locations of the 77 stations in the 10 national road maintenance districts

Winter:
Nov. 1 to Apr. 30.



Investigation Method

Heavy Snowfall and Severe Blowing Snow: Case extraction

(2) Extraction method

Heavy snowfall criteria

Snowfall >40cm /24hr, or >60cm /48hr, or >80cm /72hr

Severe blowing snow criteria

24hr estimated snow drift transport* > 1,750 kg/m

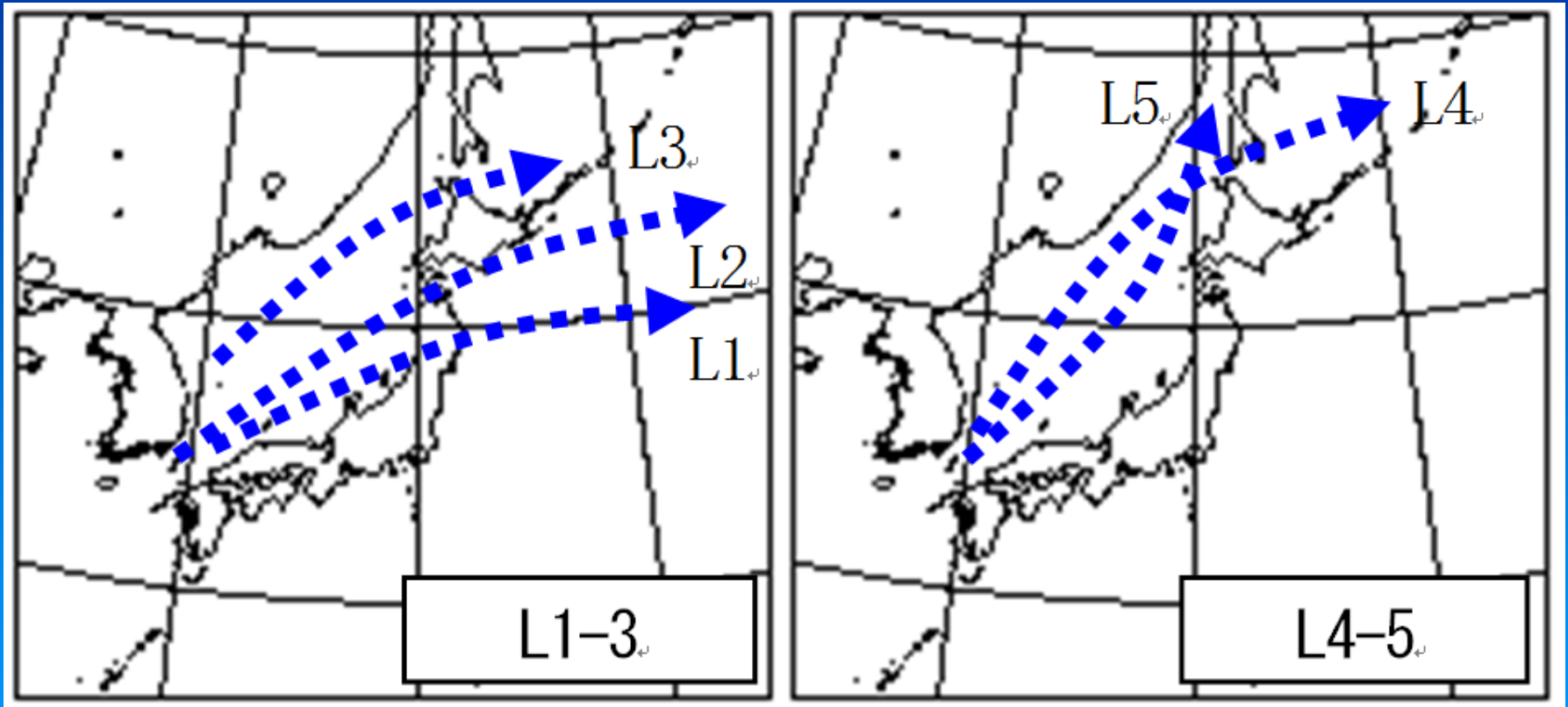
If any of the criteria are met at no fewer than 5 of the 77 stations, that case is extracted as a case of heavy snowfall (or severe blowing snow).

*Snow drift transport rate: the mass of snow passing a unit width perpendicular to the wind direction per unit time [$\text{gm}^{-1}\text{s}^{-1}$].

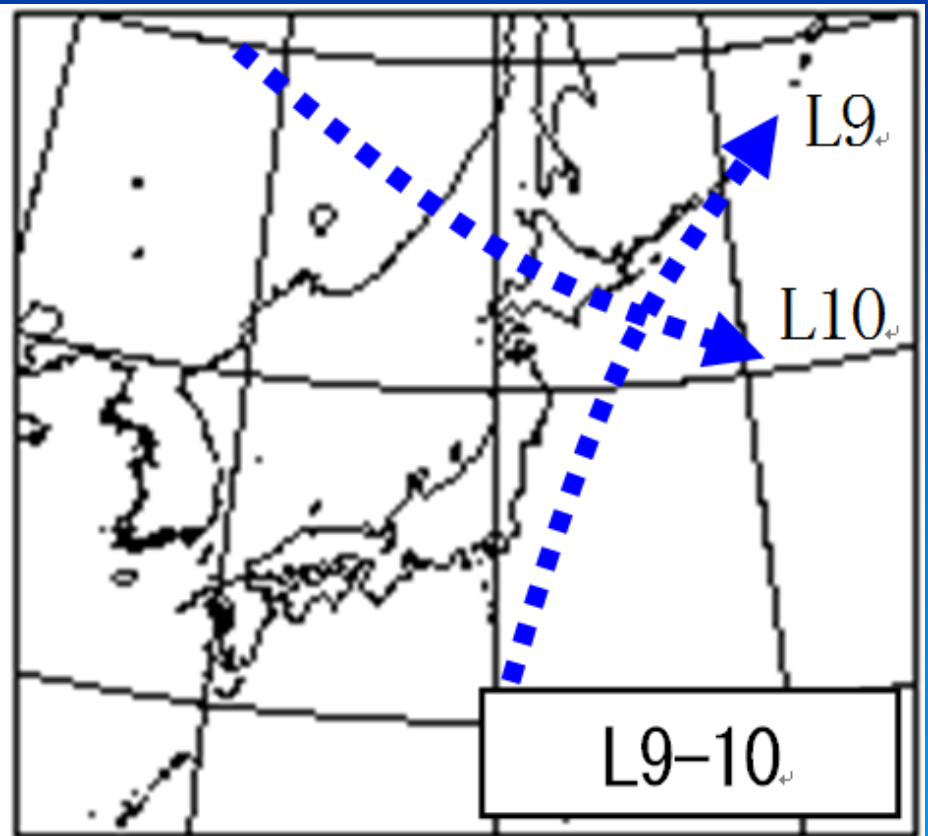
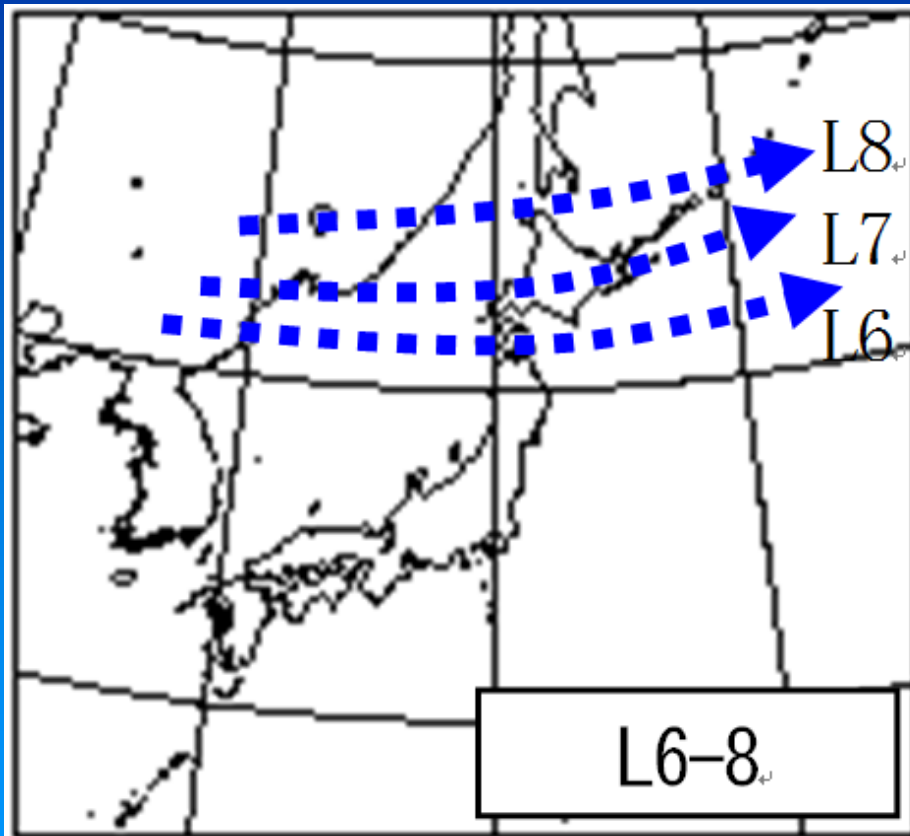
$$Q = 0.05V_{1.2}^4 \text{ [gm}^{-1}\text{s}^{-1}\text{]}$$

Where $V_{1.2}$: wind velocity at 1.2 m in height

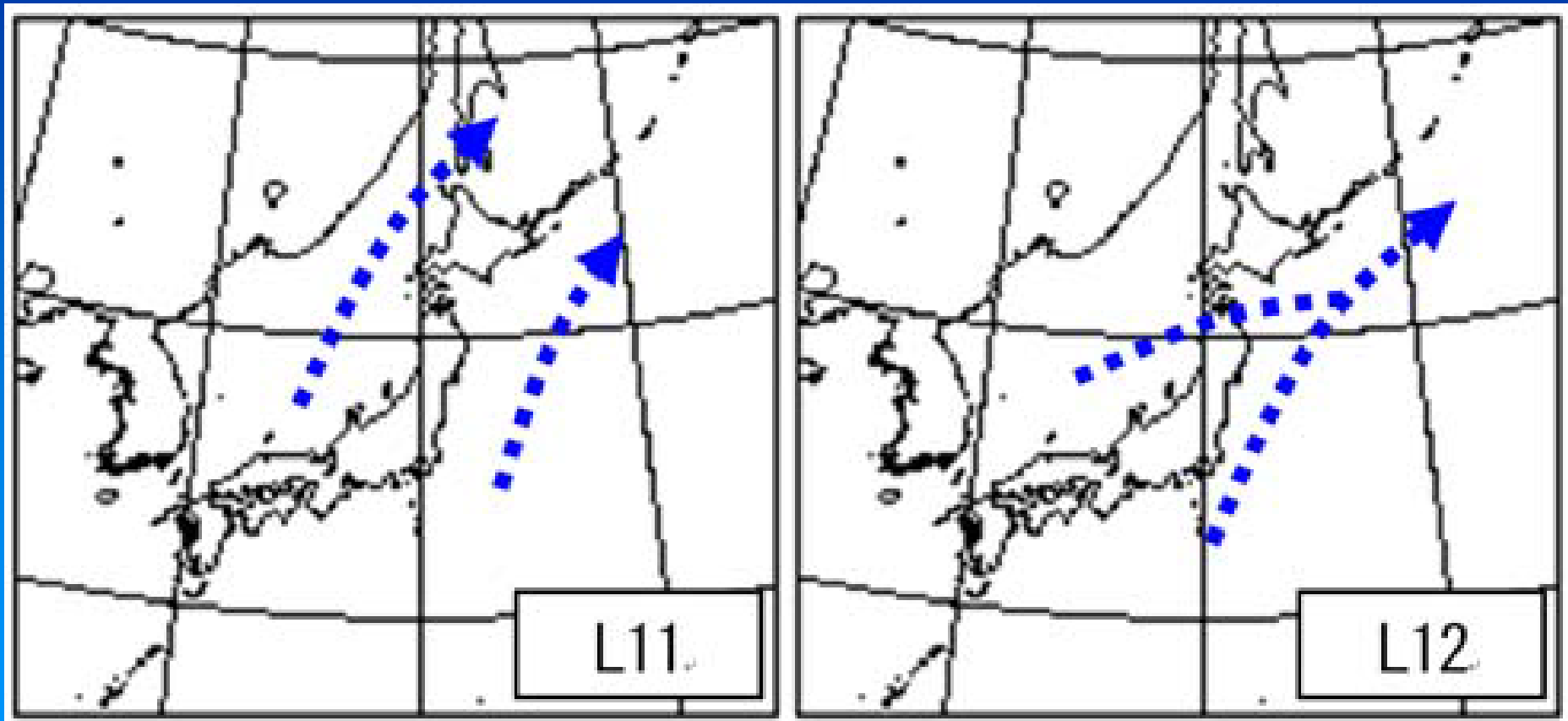
Classification of Charted Surface Weather (L1, L2, L3, L4, L5)



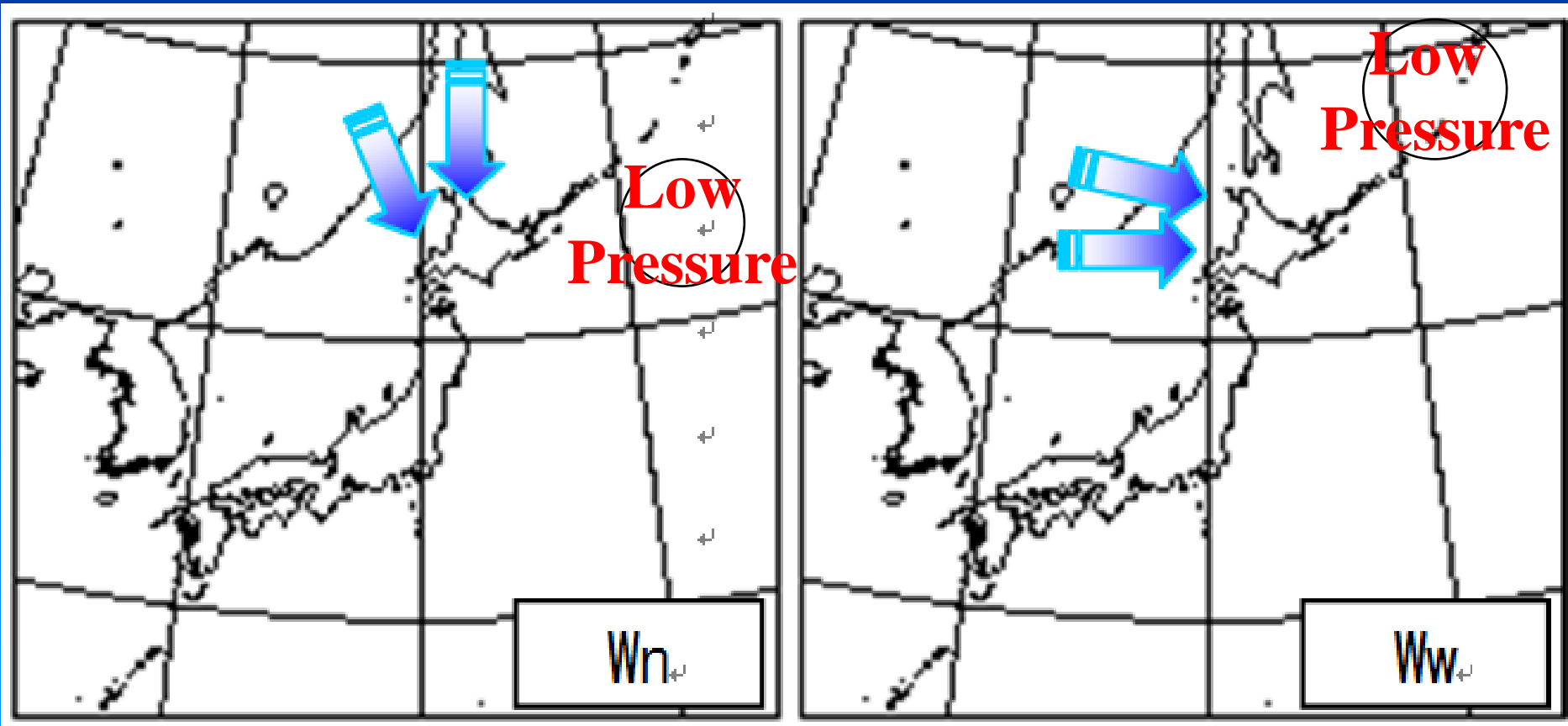
Classification of Charted Surface Weather (L6, L7, L8, L9, L10)



Classification of Charted Surface Weather (L11, L12)



Classification of Charted Surface Weather (Wn, Ww)

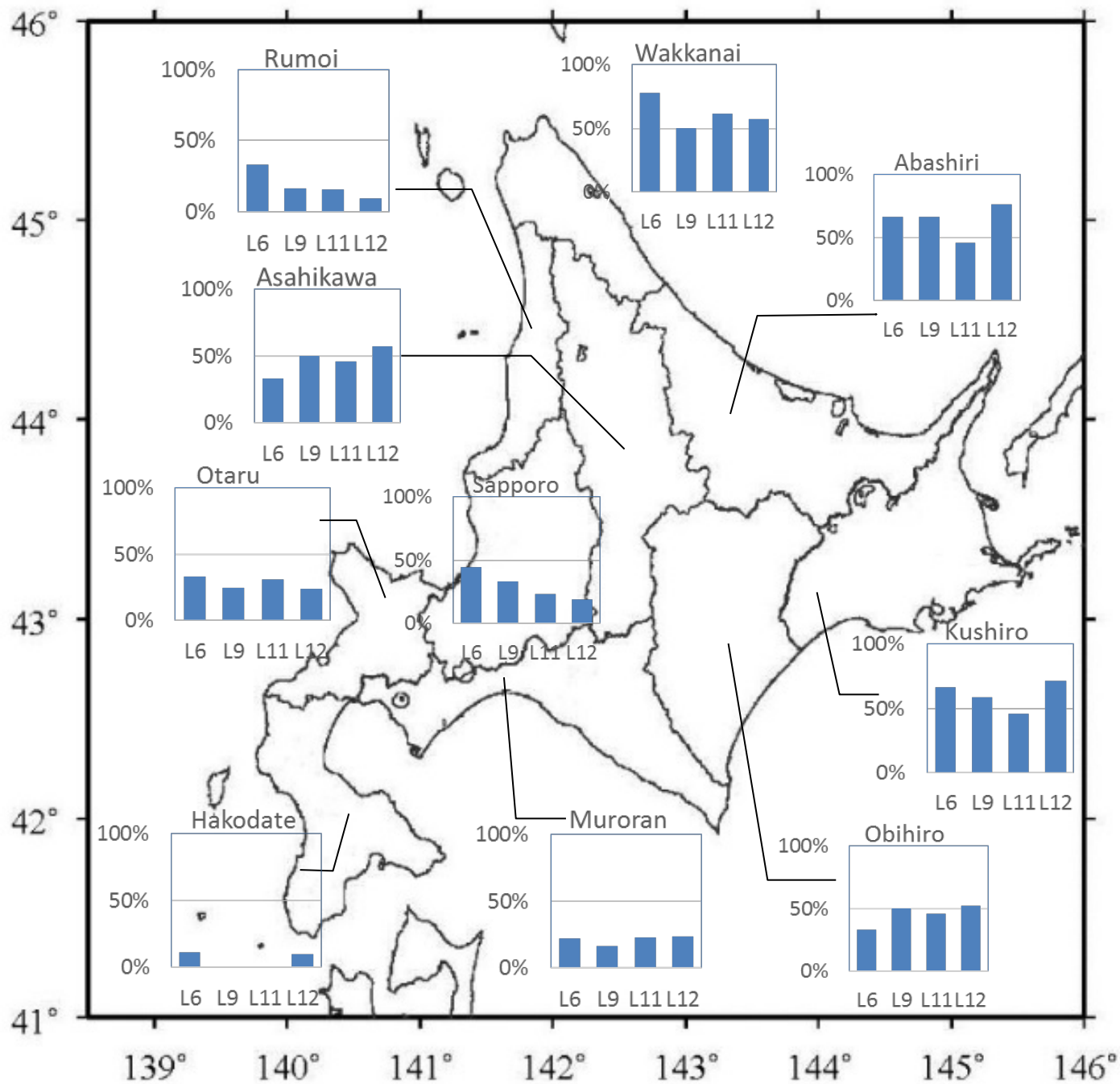


Number of cases of heavy snowfall and severe blowing snow classified by the route of the low-pressure system and winter pressure distributions

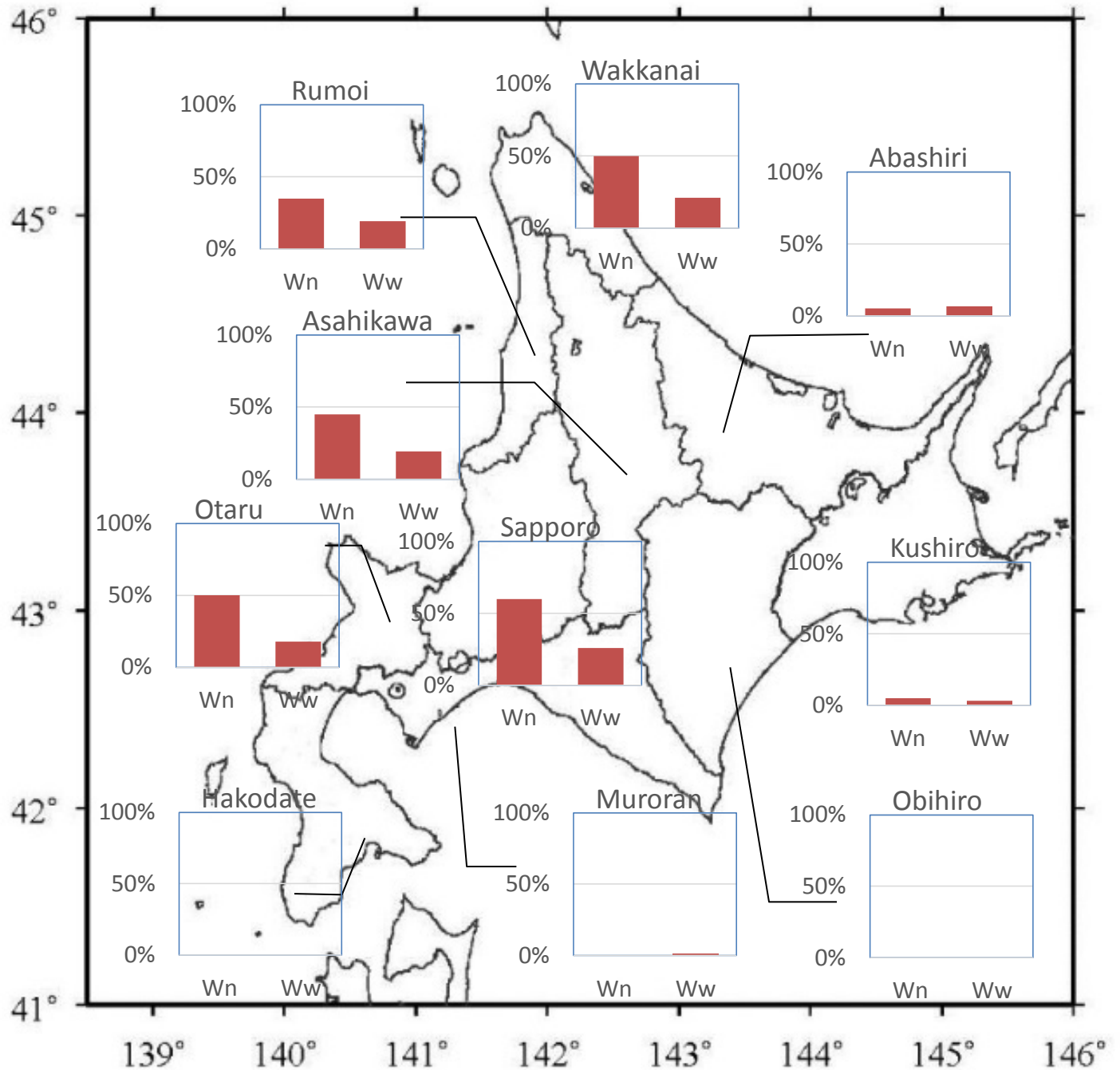
1984/85 - 2014/2015



Occurrence rate of heavy snowfall and severe blowing snow for L6, L9, L11 and L12



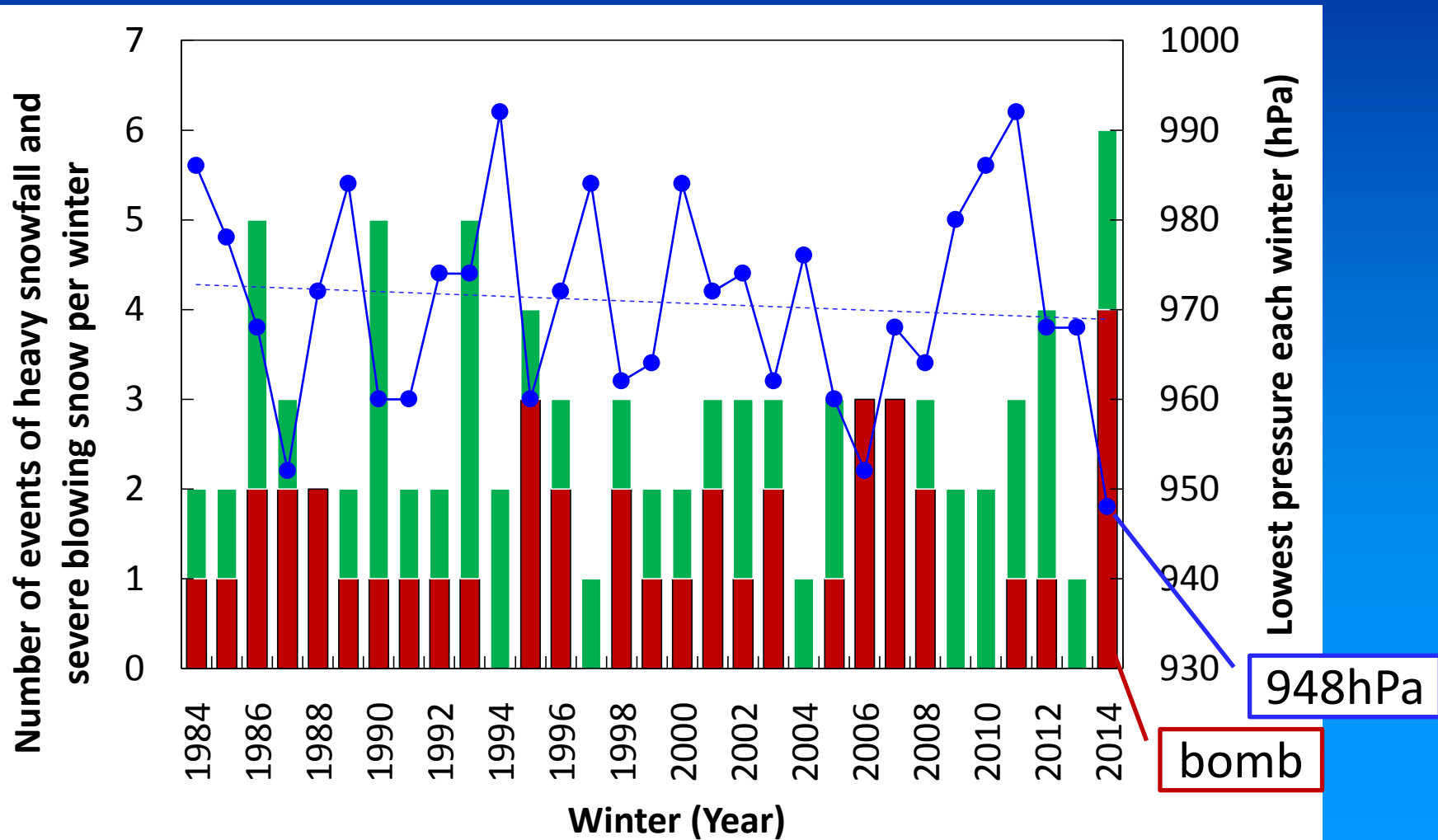
Occurrence rate of heavy snowfall and severe blowing snow for Wn and Ww



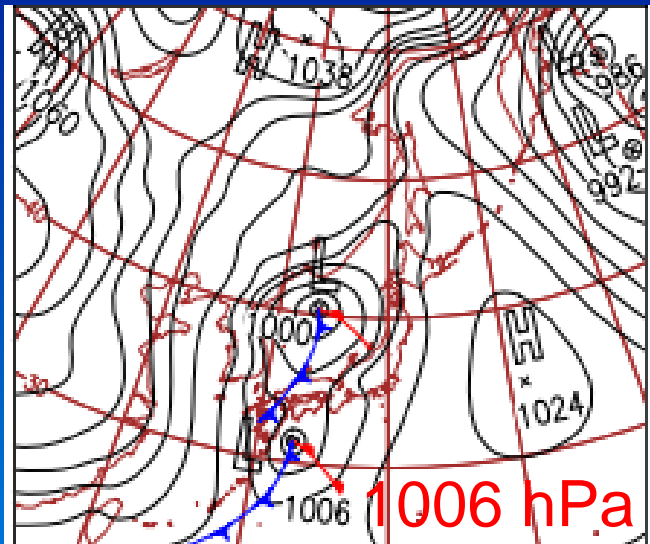
The occurrence frequency of charted surface weather patterns for the winters of 1985/1986 to 2014/2015

Classification Period		1985/86-1994/95	1995/96-2004/05	2005/06-2014/15
Location and route of the low-pressure system	L6	3 (1)	6 (3)	0 (0)
	L9	5 (1)	4 (1)	3 (2)
	L11	3 (3)	4 (3)	5 (2)
	L12	5 (2)	5 (4)	11 (9)
Typical winter pressure distribution	Wn	20 (10)	20 (11)	20 (10)
	Ww	7 (1)	5 (3)	8 (4)

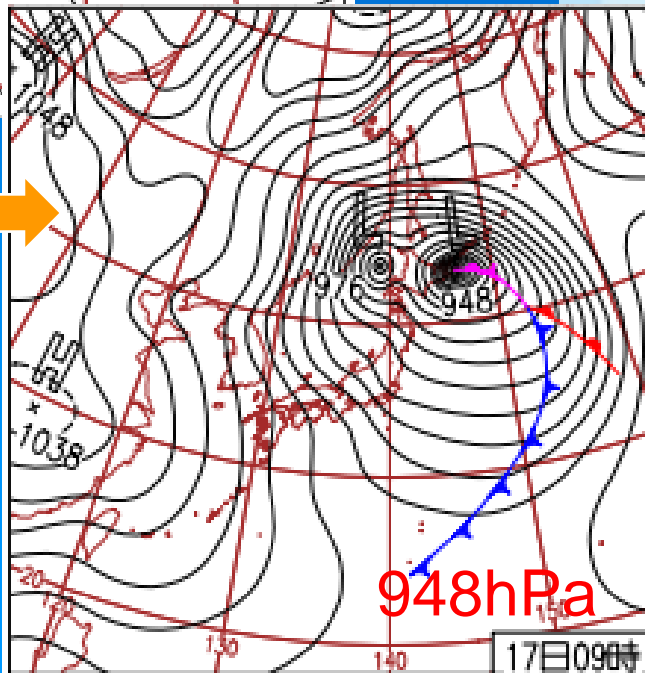
Number of events of heavy snowfall and severe blowing snow per winter, and the lowest pressure each winter



The case of December 17, 2014



9 a.m.
12/16



9 a.m.
12/17



Hokkaido Development Bureau, "Road information in Hokkaido",
<http://info-road.hdb.hkd.mlit.go.jp/RoadInfo/index.htm>

Japan Meteorological Agency, Every day's weather chart,
<http://www.data.jma.go.jp/fcd/yoho/hibiten/>

Conclusion

- Cases of heavy snowfall and severe blowing snow resulting from the L12 pattern, in which one of two low-pressure areas is absorbed by the other, were found to have increased recently.
- In this pattern, heavy snowfall and severe blowing snow are likely to occur in the Abashiri and Kushiro areas of Eastern Hokkaido.
- In Eastern Hokkaido, the occurrence rates of heavy snowfall and severe blowing snow are low for the typical winter pressure distributions.



Further efforts must be made to clarify the regional conditions under which disasters from heavy snowfall or severe blowing snow tend to occur, by integrating the results of this study and analyses of disaster records and road closures.

Thank you for your attention.

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for Cold Region, Japan

www2.ceri.go.jp