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COHERENT DELINEATION OF CLIMATIC
CHANGES OVER THE NORTH PACIFIC OCEAN.
ICE IN THE SOUTHERN OKHOTSK SEA

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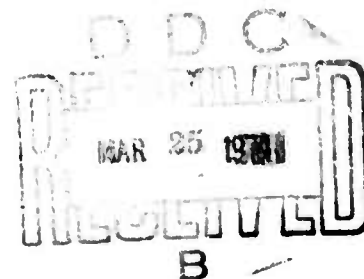
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I. I. Schell and E. N. Sabbagh

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13. ABSTRACT An analysis was made of the decadal ice conditions in the Southern Okhotsk Sea as observed along the coast of northern Hokkaido, in relation to the strength of the northeasterly winds over the Kamchatka Peninsula, the Okhotsk Sea, and adjacent areas the last 50 years 1921-1970. The results were then compared to the ice conditions off Iceland (Greenland Sea) and also the frequency of icebergs off Newfoundland. It is found that the severity of the ice conditions in the southern Okhotsk Sea are related to the strength of the northeasterly winds in winter, the decade with the lightest ice conditions (1931-40) being associated with weaker northeasterlies, and the decade with the heaviest ice conditions (1941-50) with stronger northeasterlies than in the other decades of the period. The ice conditions in the southern Okhotsk Sea bear only a moderate relationship with the ice conditions off Iceland. The decade with very light ice conditions in the southern Okhotsk Sea (1931-40) coincided with very light ice conditions off Iceland, but the decade 1961-70 with the heaviest ice conditions in the last 50 years off Iceland was only moderately severe in the southern Okhotsk Sea. Also this decade was the lightest on record off Newfoundland, with only 151 bergs per year as compared with 251 bergs in the decade 1951-60 and 431 on the average in the three decades which preceded them.			

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Frequency of Icebergs off Newfoundland						

Coherent Delineation of Climatic Changes over the North Pacific
Ocean. Ice in the Southern Okhotsk Sea.

By I. I. Schell and E. N. Sabbagh

In reviewing the literature on climatic changes over the oceans we find most attention given to the North Atlantic Ocean. The recent increased availability of data from the North Pacific makes it possible to give attention also to this ocean by investigating the possible changes in the atmospheric circulation and the changes in other elements with long records of observation that form an integral part of the circulation system, specifically, the ice in the southern Okhotsk Sea as observed from a point along the northern coast of Hokkaido (Abashiri).

Ice in the Southern Okhotsk Sea.

The record of ice along the northern coast of Hokkaido (Abashiri) goes back to 1892. Ice first appears at Abashiri on the average January 14 and is last observed April 22. The decade with the least duration of the ice at Abashiri was the decade 1931-40 with 88.4 days on the average per year, and that with the longest duration, the decade 1941-50 with 104.7 days (see Table 1).

As was shown by Agakawa (1973) (see also Schell, 1972), heavier than usual ice conditions along the northern coast of

Hokkaido develop with stronger, and lighter than usual ice conditions with weaker northeasterly winds, and we may assume, with changes in the intensity of the Aleutian Low and the High over northeastern Siberia.

Since the average onset of the ice along the northern coast of Hokkaido (Abashiri) is mid-January, we can take as a rough measure of the strength of the northeasterly winds over the Kamchatka Peninsula and the Okhotsk Sea, the winter pressure difference between 160°E , 50°N , and 140°E , 70°N each decade beginning with 1921-30 (Figs. 1-5). Data on pressures for the earlier decades were too uncertain to be used in our analysis. Table 1 shows moderate agreement with the strength of the northeasterly winds over the region. Thus, the difference in pressure for the decade 1931-40 with the shortest duration of ice along the northern coast of Hokkaido was 21.4 mb, as compared with the difference of 23.5 mb for the decade 1931-40 with the longest duration.

Coherence with the ice off Iceland (Greenland Sea) and the frequency of icebergs off Newfoundland.

Following the widespread amelioration of the climate including lighter ice conditions off Iceland with its peak in the 1930's, a worsening of climate began in the form of a downturn in temperature in many regions including a moderate increase in the ice off Iceland in the decade 1941-50 and with a sharp increase also in the duration of the ice in the

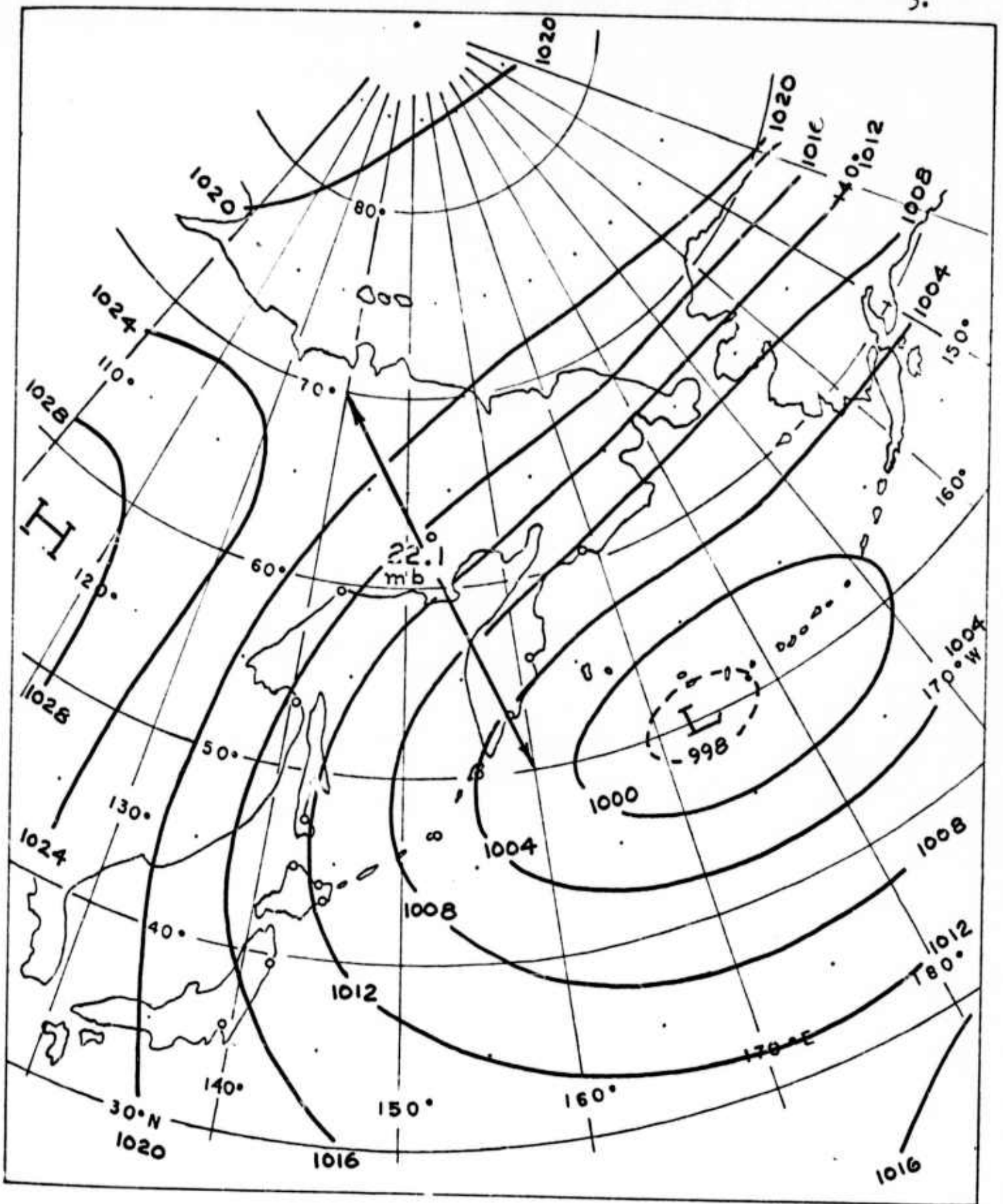


Fig. 1. December-February 1920/1-1929/0 Pressure and Pressure Difference: 160°E, 50°N to 140°E, 70°N (mb). Duration of ice at Abashiri: 99.1 days.

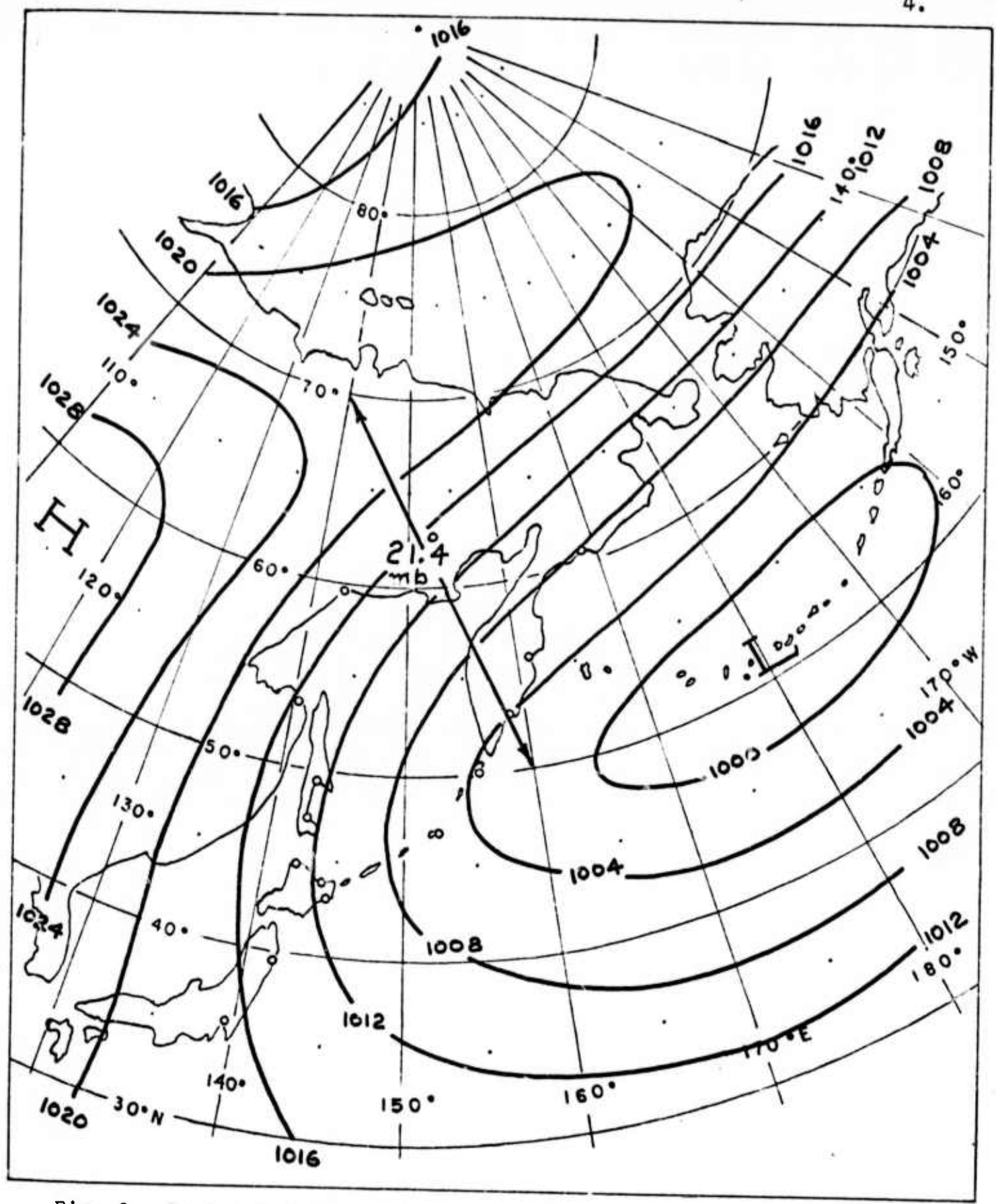


Fig. 2. December-February 1930/1-1939/0 Pressure and Pressure Difference: 160°E, 50°N to 140°E, 70°N (mb). Duration of ice at Abashiri: 88.4 days.

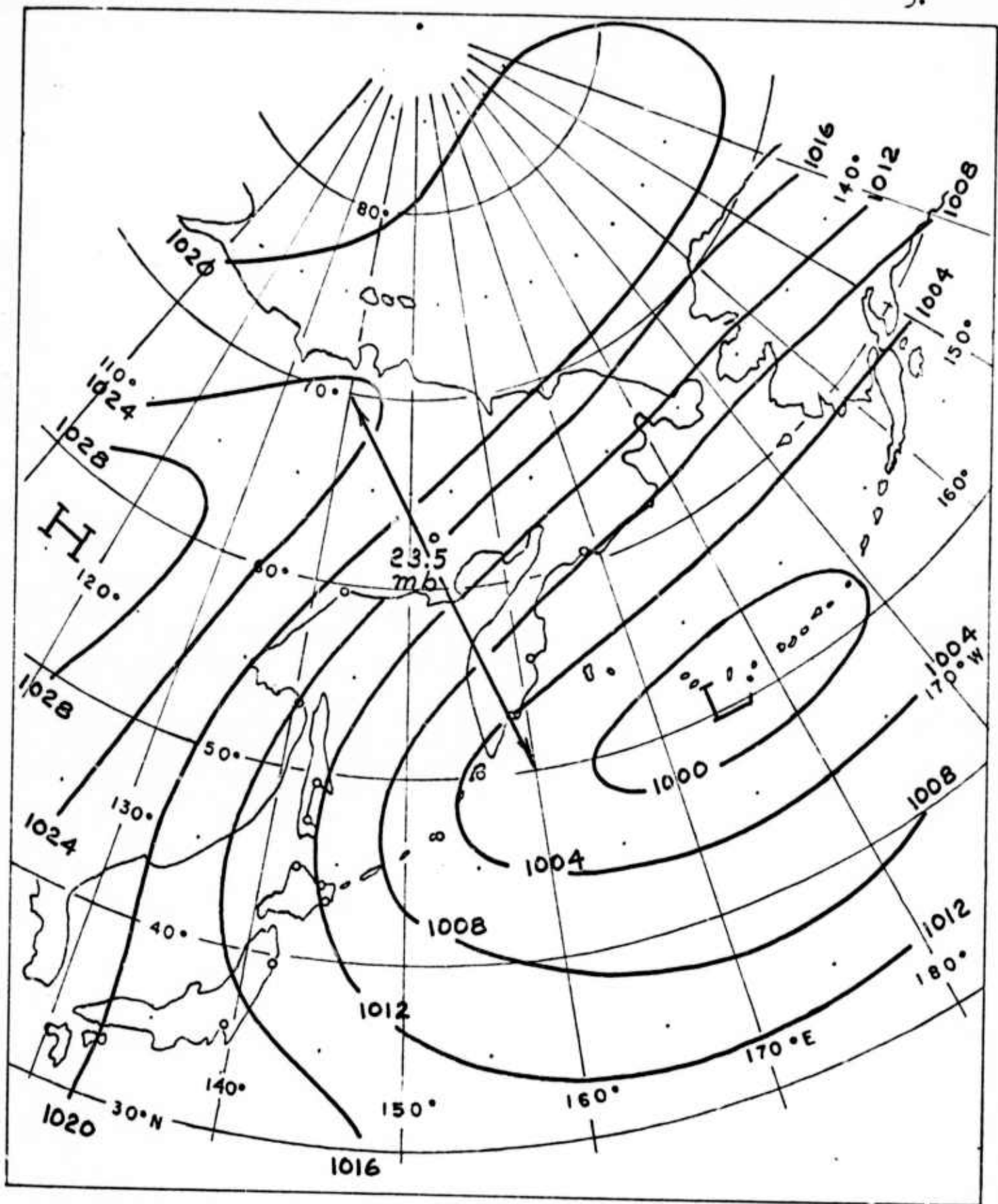


Fig. 3. December-February 1940/1-1949/0 Pressure and Pressure Difference: 160°E , 50°N to 140°E , 70°N (mb). Duration of ice at Abashiri: 104.7 days.

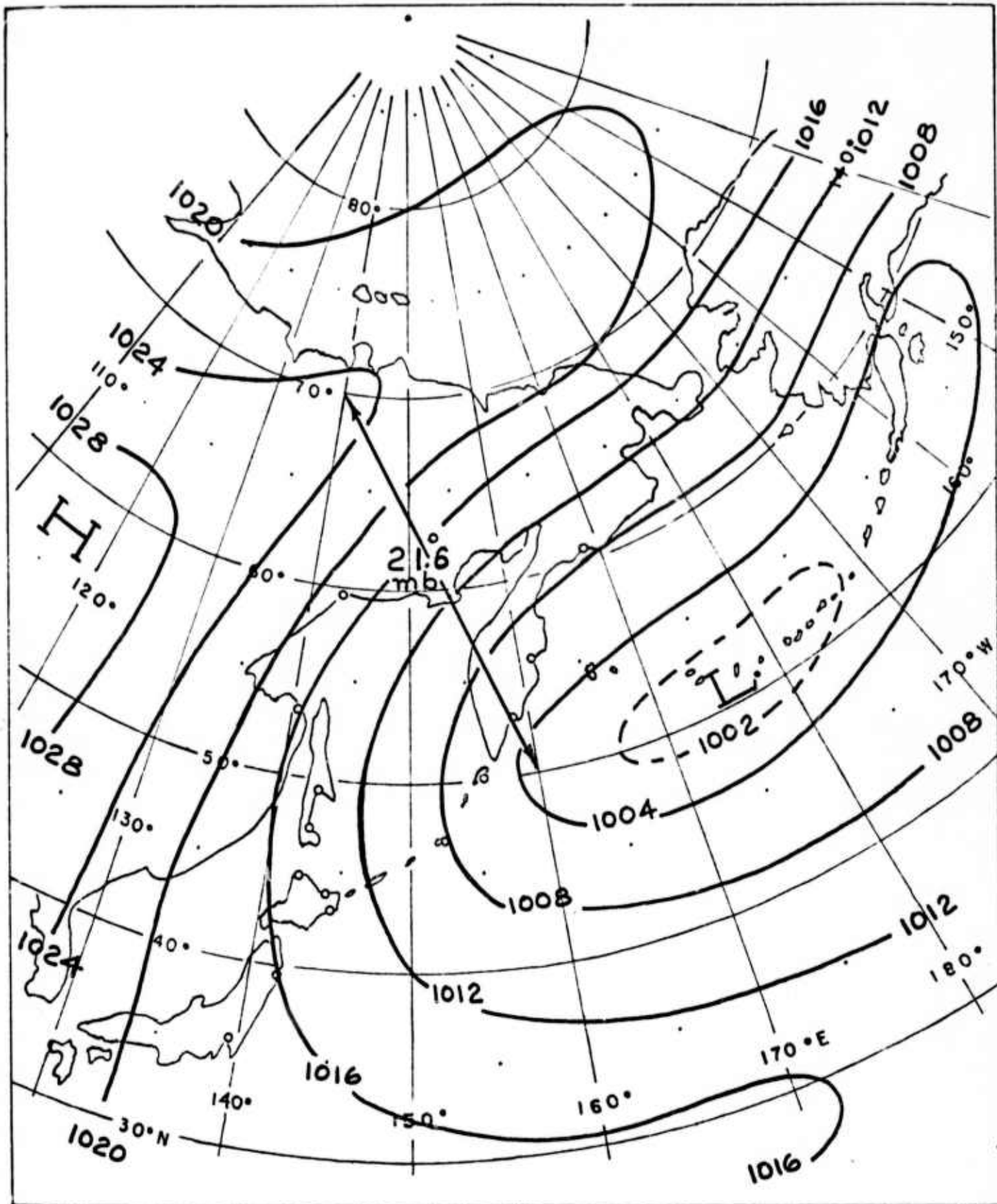


Fig. 4. December-February 1950/1-1959/0 Pressure and Pressure Difference: 160°E , 50°N to 140°E , 70°N (mb). Duration of ice at Abashiri: 94.6 days.

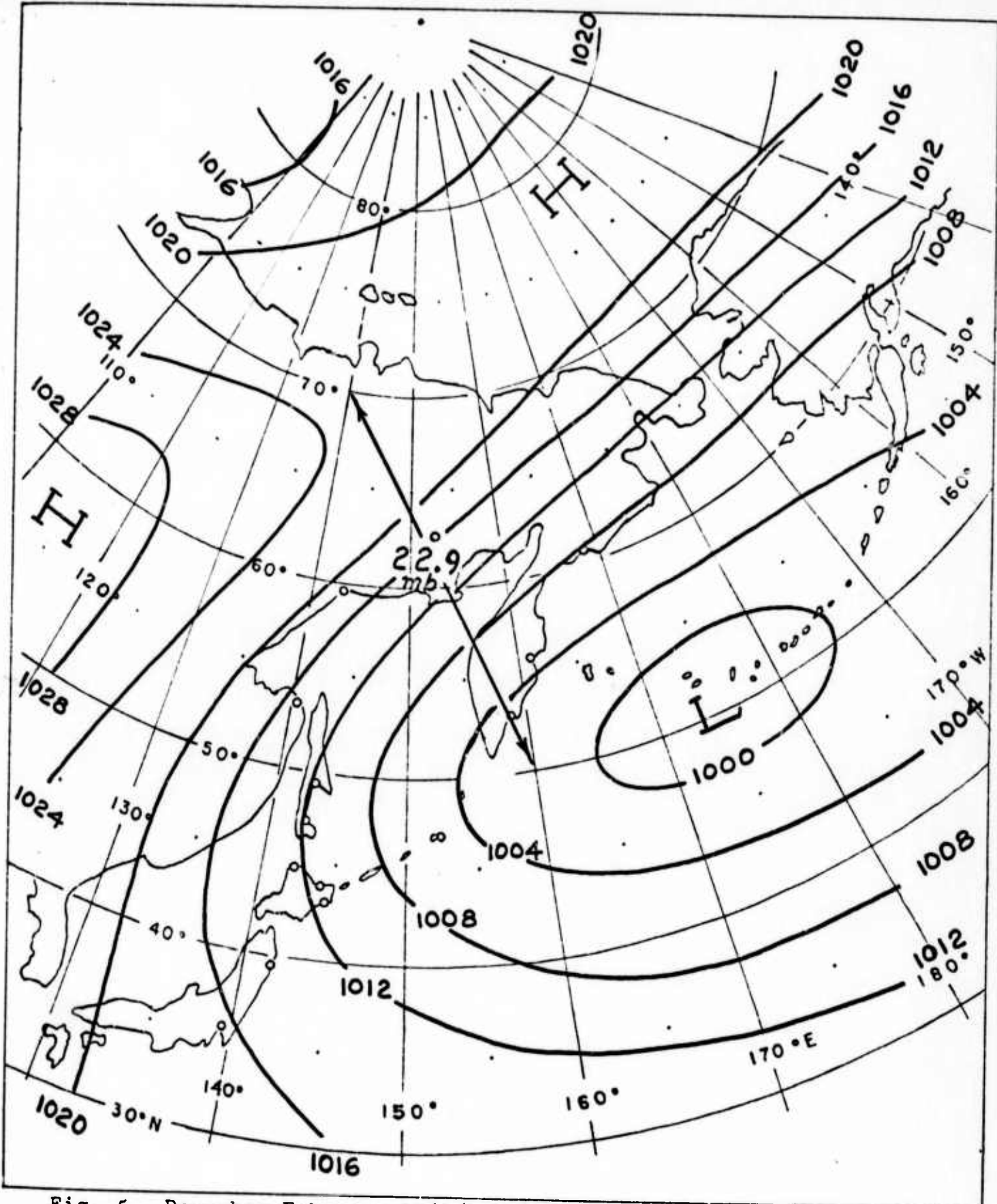


Fig. 5. December-February 1960/1-1969/0 Pressure and Pressure Difference: 160°E, 50°N to 140°E, 70°N (mb). Duration of ice at Abashiri: 96.8 days.

Table 1. Ice Conditions in the Southern Okhotsk Sea. Duration in Days (Ice observed at Abashiri) and December-February Strength of the Northeasterlies (Pressure Difference: 160°E, 50°N to 140°E, 70°N).

Decade*	Duration days	Pressure Diff.** mb
1892-1900	99.9	----
1901-1910	89.7	----
1911-1920	102.4	----
1921-1930	99.1	22.1
1931-1940	88.4	21.4
1941-1950	104.7	23.5
1951-1960	94.6	21.6
1961-1970	96.8	22.9

* Includes December of the preceding year.

** Pressure data for earlier decades too sparse to allow a computation

in the Okhotsk Sea in the same decade making it the decade with the longest duration of the ice in the period of record. However, while the worst ice conditions of Iceland the last 50 years were observed in the 1960's (Eythorsson and Sigtrygsson, 1970), the duration of ice at Abashiri that decade was only moderate (96.8 days) and the frequency of the icebergs off Newfoundland only 151 per year, the least in the last 70 years. This indicates that for periods as short as a decade, the changes in ice conditions are not necessarily coherent with each other in all regions, in agreement with Faegri's principle that the shorter the duration of a climatic change, the smaller the area similarly affected (1950).

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