

PUBLIKATIONER
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DET DANSKE METEOROLOGISKE INSTITUT
—
AARBØGER —

NAUTISK-METEOROLOGISK AARBOG
NAUTICAL-METEOROLOGICAL ANNUAL

1923



KØBENHAVN
I KOMMISSION HOS G. E. C. GAD

DANMARKS TEKNISKE BIBLIOTEK

Bolag 356

300002093158

Isforholdene i de danske Farvande i Vinteren 1922—1923.

Bearbejdet af Statsmeteorolog Kaptajn SPEERSCHNEIDER.

Oplysningerne om Isforholdene i danske Farvande i den forløbne Vinter er indsamlede og bearbejdede paa lignende Maade som tidligere.

Tabel I viser Middeltemperaturen og Afgigelserne fra Normalen paa 7 Steder i Landet. Det fremgaar af Tabellen, at Afgigelserne var positive i December, Januar og Marts og paa nær Fanø negative i Februar.

December 1922. Middellufttrykket^{*)} var ved Skagen 753.6 mm, i København 756.1 mm, eller henholdsvis 4.8 og 3.7 mm lavere end normalt. Vindretningen var overvejende Vest og Sydvest. Middeltemperaturen var i Forhold til det normale næsten overalt 2 à 3° for høj. Paa Fyrskibene, hvor Temperaturen aflæses 6 Gange i Døgnet, var den laveste Temperatur $\div 3.5^{\circ}$ (Lappegrund).

Januar 1923. Middellufttrykket var ved Skagen 756.4 mm, i København 759.5 mm eller henholdsvis 4.2 mm og 2.6 mm lavere end normalt. Vindretningen var overvejende omkring Vest. Middeltemperaturen var i Forhold til det normale de fleste Steder $2\frac{1}{2}^{\circ}$ — $3\frac{1}{2}^{\circ}$ for høj. Paa Fyrskibene var den laveste Temperatur $\div 3.5$ (Lappegrund).

Februar. Middellufttrykket var ved Skagen 758.6 mm, i København 758.4 mm, eller henholdsvis 1.5 og 2.7 mm lavere end normalt. Vindretningen var overvejende omkring Øst og Sydost. Middeltemperaturen var i Forhold til det normale gennemgaaende lidt for lav. Paa Fyrskibene var den laveste Temperatur $\div 10.2^{\circ}$ (Lappegrund).

Marts. Middellufttrykket var ved Skagen 767.7 mm, i København 767.6 eller henholdsvis 9.5 og 8.5 mm højere end normalt. Vindretningen var overvejende omkring Øst og Sydost. Middeltemperaturen var i Forhold til det normale overalt for stor, de fleste Steder 1° — 2° . Paa Fyrskibene var den laveste Temperatur $\div 3.2$ (Skagen Rev).

^{*)} Reduceret til 0° C., Havets Overflade og Tyngden ved 45° .

The State of the Ice in Danish Waters during the Winter 1922—1923.

Prepared by Commander SPEERSCHNEIDER, Marine Superintendent.

The information concerning the state of the ice during the past winter has been gathered and prepared in a similar manner as formerly.

Table I shows the mean temperature of the air and the variations from the normal state at 7 different stations. It will appear from the table that the variations were positive in December, January and March, while they were negative in February except at Fanø.

December 1922. The mean pressure of the air^{*)} at the Scaw was 753.6 mm, at Copenhagen 756.1 mm or respectively 4.8 mm and 3.7 mm below the normal. Westerly and southwesterly winds were predominant. The mean temperature was almost everywhere 2° to 3° above the normal. At the light ships where the temperature is read 6 times in the 24 hours, the lowest temperature was $\div 3.5^{\circ}$ (Lappegrund).

January 1923. The mean pressure of the air at the Scaw was 756.4 mm, at Copenhagen 759.5 mm, or respectively 4.2 mm and 2.6 mm below the normal. The main direction of the wind was about west. At most of the stations the mean temperature was $2\frac{1}{2}^{\circ}$ to $3\frac{1}{2}^{\circ}$ above the normal. At the light ships the lowest temperature was $\div 3.5^{\circ}$ (Lappegrund).

February. The mean pressure of the air at the Scaw was 758.6 mm and at Copenhagen 758.4 mm, or respectively 1.5 and 2.7 mm below the normal. Easterly and southeasterly winds were predominant. The mean temperature was generally a little below the normal. At the light ships the lowest temperature was $\div 10.2^{\circ}$ (Lappegrund).

March. The mean temperature of the air at the Scaw was 767.7 mm and at Copenhagen 767.6 mm or respectively 9.5 and 8.5 mm above the normal. The direction of the wind was generally about east and southeast. The mean temperature at most of the stations was about 1° to 2° above the normal. At the light ships the lowest temperature was $\div 3.2^{\circ}$ (Skagens Rev).

^{*)} Reduced to 0° C., the level of the sea and the gravity at Lat. 45° .

Tabel 2 viser de Frostperioder og Frostdage, som indtraf i Vinterens Løb. Baade i November, December og Januar var der af og til enkelte Frostdage. Vinterens eneste Frostperiode faldt fra ca. 10de Februar til 26de Februar og var gennemsnitlig paa ca. 17 Dages Varighed. I Marts faldt der enkelte spredte Frostdage, der ikke forårsagede Isdannelse.

Af Stationerne i Tabel 2 havde Skagen den største Kuldesum (86.0), Fanø den mindste (37.3).

Tabel 3 viser Vandets Overfladetemperatur og Saltholdighed i Løbet af Vinteren, Middeltal er opført for hvert Tidøgn. Vandets Temperatur faldt jævnt fra de første Dage af Februar, indtil ca. den 20de Februar, hvorefter Temperaturen holdt sig paa de forskellige Steder mellem 1° og $\frac{1}{2}^{\circ}$ Maaneden ud. Overfladen havde gennemgaaende sin laveste Temperatur i Slutningen af Februar, ved Bornholm dog først midt i Marts.

Kort før Isen dannedes laa Grænselinien mellem Overlag og Bundlag i Kattegat gennemsnitlig i 20 Meters Dybde.

Den 18de Februar indtraf der ved de nordlige Fyrskibe en Afkøling under Nul i 5—15 Meters Dybde.

Den 19—20de, da Isen dannedes i Kattegat, laa Overfladens Temperatur mellem $\frac{1}{2}^{\circ}$ og $\frac{1}{1}^{\circ}$, og da Frysepunktet herved var naaet, maatte Isen dannes i Overfladen. At Isen dannedes over hele Kattegat, skyldtes den stille, klare Nat mellem den 20de og 21de, samt at Saltholdigheden var meget lav i Overfladen. Den 22de, da Vinden friskede af Ostsydost, steg Overfladens Temperatur igen, idet varmere Vand fra de underliggende Vandlag maa være blevet blandet med Overfladens Vand.

Saltholdigheden var endnu i Marts særdeles lav overalt.

I Tabel 4 gives en Oversigt over samtlige Stationer, hvorfra der føres Observationer over Is.

Table 2 gives the occurrence of frosty periods and frosty days during the winter. While frosty days occurred now and again in November, December and January, the only frosty period of the winter which generally lasted about 17 days occurred between the 10th and 26th of February. In March there were some odd frosty days, but no ice was formed.

Of the stations mentioned in Table 2 the Scaw had the greatest amount of cold (86.0) and Fanø the smallest (37.3).

Table 3 gives the temperature and the salinity of the surface water, the mean values being quoted for each decade. From the first days of February till the 20th the temperature of the water sank gradually, but from that date till the end of the month the temperature at the various stations kept lying between $+1^{\circ}$ and $\frac{1}{2}^{\circ}$. Altogether the temperature of the surface water was lowest about the end of February, except at Bornholm where the lowest temperature was reached about the middle of March.

A short time before the ice was formed the line of separation between the surface layer and the bottom layer in the Kattegat was generally lying at a depth of 20 m.

On February 18 the temperature of the water at the northerly light ships sank below 0° in the layer between 5 to 15 m below the surface.

On the 19th and 20th when the ice in the Kattegat was formed, the temperature of the surface water was lying between $\frac{1}{2}^{\circ}$ and $\frac{1}{1}^{\circ}$, and as thus the freezing point was reached, the surface water must freeze. That the whole Kattegat froze over must be ascribed to the calm clear night between the 20th and 21st combined with the very low salinity of the surface water. On the 22nd when the wind freshened from eastsoutheast, the surface temperature rose again because the warmer water from the deeper layers of water became mixed with the surface water.

Still in March the salinity was very low at all the stations.

Table 4 contains a summary of all the stations in the country where observations concerning the ice are taken.

For at hjælpe til en ensartet Bedømmelse er Isforholdene udtrykt ved Bogstaver, som har følgende Betydning:

Isfrit	A	Svær Driv-Is.....	F
Løs Sjap- og Kvadde-Is	B	Pak-Is	I
Sammenpakket Sjap- og		Skrue-Is	H
Kvadde-Is	E	Tynd Fast-Is	D
Spredt Driv-Is	C	Svær Fast-Is.....	G
Driv-Is	K		

Til nærmere Forklaring paa disse Benævnelser tjener følgende Beskrivelse:

- B. *Sjap-Is* kaldes den Masse, der dannes af Sne og Vand eller af smaa Ispartikler, saalænge den ikke er frosset sammen endnu. *Kvadde-Is* kaldes de smaa, i Reglen afrundede Isflader eller Isklumper, som kan optræde for sig, ført sammen af Vind og Sø, men som hyppig træffes i Forbindelse med Sjap-Is.
- E. *Sammenpakket Sjap- og Kvadde-Is* er Sjap-Is eller Kvadde-Is eller begge Dele i Forening, som paa Grund af Kuling eller Strøm, eller mulig Hindring for Isens Bevægelse er pakket sammen i en grødliggende Masse af antagelig Tykkelse.
- C. *Spredt Driv-Is*. Isflager eller Iskodser, som med større Mellemrum er spredte over Farvandet, og som er i Drift.
- K. *Driv-Is*. Isflader eller Iskodser i mere samlede Masser, som er i Drift.
- F. *Svær Driv-Is*. Svære Isflager eller Iskodser i samlede Masser, som er i Drift.
- I. *Pak-Is*. Svære Iskodser, som af Kuling eller Strøm, eller, hvad oftest er Tilfældet, paa Grund af Indsnævring af Farvandet, er pakke sammen til en svær tæt Masse.
- H. *Skrue-Is*. Is, som skruer.
- D. *Tynd Fast-Is*. En sammenfrosset, landfast Isflade af mindre Styrke.
- G. *Svær Fast-Is*. En sammenfrosset, landfast Isflade af betydelig Styrke.

Besejlingsforholdene er udtrykt ved Bogstaver, som har følgende Betydning:

Skibsfarten uhindret.....	N
» vanskelig for Sejlskibe	O
» vanskelig; for Sejlskibe kun mulig med Bugserhjælp.....	P
Skibsfarten lukket for Sejlskibe.....	Q
» kun mulig for kraftige Dampere. R	
» kun mulig med Isbryderhjælp ... S	
» helt lukket..... T	
Rende holdes aaben med Isbryder	U

I Tabel 5 er for hvert Sted anført, hvormange Dage der har været Is af de forskellige Arter, og hvormange Dage Skibsfarten har været paavirket deraf. Endvidere findes Rubrikker for det samlede Dageantal med Is samt for Tiderne for første og sidste Ismeldung. Det maa dog erindres, at Stedet i Mellemtiden godt kan have været isfrit selv i længere Tid.

In order to further uniformity of judgement, the state of the ice is indicated by letters having the following signification.

Free of ice.....	A	Heavy drift ice.....	F
Brash and pancake ice. B		Pack	I
Packed brash and pancake ice	E	Screw ice.....	H
Open ice	C	Thin fixed ice	D
Drift ice.....	K	Heavy fixed ice	G

The following description gives a more precise explanation of the designations above:

- B. *Brash ice* is a mass consisting of snow and water, or of very small pieces of ice not yet frozen together. *Pancake ice* consists of small, generally round, ice flakes or ice lumps. It may appear alone, brought together by the wind or the sea, but it often appears in connection with *brash ice*.
- E. *Packed brash and pancake ice* is brash ice or pancake ice or both at the same time, which has been packed together in a turbid mass of considerable thickness either by the wind or the current or by some obstruction to the free drift of the ice.
- C. *Open ice* is drifting ice flakes or hummock ice scattered over the water at greater intervals.
- K. *Drift ice* is drifting ice flakes or hummock ice in more collected masses.
- F. *Heavy drift ice* is drifting heavy ice floes or hummock ice in close masses.
- I. *Pack* means heavy ice floes, which have been packed together in heavy, dense masses, either by the wind or the current or — as is generally the case — by a narrowing of the waters.
- H. *Screw ice* means ice that is screwing or nipping.
- D. *Thin fixed ice* means thin land ice.
- G. *Heavy fixed ice* means heavy land ice.

The conditions for navigation are indicated by letters having the following signification.

Navigation unimpeded	N
» difficult for sailing vessels.....	O
» difficult, impossible for sailing vessels without tug-boat.....	P
Navigation closed for sailing vessels	Q
» only possible for powerful steamers R	
» impossible without the assistance of icebreaker.....	S
» quite closed	T
Channel kept open by means of ice breaker U	

In Table 5 is for each station put down the number of days with ice of the various descriptions and the number of days on which navigation has been affected by the ice. Further rubrics will be found giving the total number of days with ice, and the dates of the first and the last report of ice. However, it must be noted, that in the interval the station may very well have been free of ice, even for a longer period.

I sidste Rubrik er der for enkelte Pladser anført den største Tykkelse i cm, som Isen har naaet.

Oversigt over Isforholdene i de forskellige Farvande.

Vinterens eneste Frostperiode begyndte ca. den 10de Februar; allerede d. 18de dannedes der Is Nord for Hesselø, den 19de begyndte Isdannelsen i Sundets nordlige Del og den 20de omkring Læsø, hvor Temperaturen i 5 Meters Dybde var negativ. Natten mellem den 19de og 20de sad mindre Dampere fast mellem Anholt og Lysegrund. Den 21de efter en stille, klar Nat havde hele Kattegat fra Skagen til Sjællands Nordkyst Nyis og Tallerkenis og var praktisk talt lukket for Sejlskibe, samt enkelte Steder f. Eks. ved Kullen og Læsø Trindel endog besværlig for Dampere. I Sundet var Isen ret svær Nord for en Linie fra København til Landskrona, medens der Syd for denne Linie var isfrit overalt.

Den 22de, under en stiv Kuling af OSO, blev Isdækket i Kattegat, der i Nattens Løb havde været meget vanskelig for Dampere i Nærheden af Kullen, brudt og begyndte at drive Vest over, og næste Dag var Kattegat praktisk talt isfrit, medens Isen laa som et bredt Pakisbælte under jydsk Kyst fra Skagen Syd efter til Mariagerfjord og i Sundet fra Helsingør og Vest for en Linie over Hveen til Middelgrundsfortet og Syd paa i Kongedybet.

De følgende Dage var Forholdene uforandrede, men fra den 26. Februar blev Sejladsen helt standset ved Limfjordens østlige Indløb af metertyk sammenpakket Is, medens Kystisbæltet i Sundet og langs jysk Kyst fra Frederikshavn til Syd for Hals jævnt aftog.

Den 2den Marts var Sundet isfrit, og under jysk Kyst laa Isen kun fra Sæby til Hals. Denne Kystis begyndte den 6te at drive Nord paa. Paa selve Barren ved Hals, hvor Isen havde været stærkt sammenpakket, blev Isen liggende længe, og her var først helt isfrit den 27de Marts.

In the last column is given — for some of the stations — the greatest thickness in cm which the ice has attained.

Summary of the state of the ice in the various waters.

The only frosty period of the winter commenced about February 10, and already on the 18th ice was formed north of Hesselø. On the 19th the ice commenced to form in the northern part of the Sound, and on the 20th around Læsø where the temperature at a depth of 5 m had become negative. In the night between the 19th and the 20th smaller steamers stuck fast between Anholt and Lysegrund. On the 21th after a calm and clear night the whole Kattegat from the Scaw to the north coast of Sealand was covered with young ice and pancake ice so as to be practically impassable for sailing vessels, and at some places for instance at Kullen and Læsø Trindel even steamers had some difficulty in getting through the ice. In the Sound the ice was rather heavy north of a line from Copenhagen to Landskrona while there was open water south of this line.

On the 22nd a strong eastsoutheasterly wind broke up the ice in the Kattegat, where the conditions during the night had caused the steamers much difficulty in the vicinity of Kullen. The ice was driven towards the west and the next day the Kattegat proper was practically open, while the ice formed a broad belt of pack along the coast of Jutland from the Scaw to Mariagerfjord. In the Sound the ice was now lying west of a line from Elsinore over Hveen and Middelgrundsfort and further south in Kongedybet.

During the following days the conditions remained unaltered, but from February 26 the eastern entrance to Limfjorden became completely blocked by packed ice that was more than 1 m thick, while the belt of ice gradually decreased along the coast in the Sound and along the coast of Jutland from Frederikshavn to south of Hals.

On March 2 the Sound was free of ice, and along the coast of Jutland there was only ice from Sæby to Hals. On the 6th this coast ice began to drift northward. On the bar at Hals where the ice had been very much packed, the ice remained for a long time, and it was not until March 27 that the bar became quite free of ice.

I alle 3 Bælter og i Sundets østlige og sydlige Del samt i den vestlige Østersø fandt der ingen Isdannelse Sted hele Vinteren.

Vestkysten. I Graadyb var der Drivis i sidste Halvdel af Februar, og Ringkøbing Fjord havde Is i 4 Uger.

I Limfjorden laa Isen fra den 16de Februar til den 25de Marts; Isen lagde sig omrent samtidig over hele den midterste Del af Fjorden og et Par Dage senere i den vestlige og østlige Del. Isen holdt sig længe i Farvandet fra Aalborg til Hals Barre.

Af Fjordene ved Kattegat havde Mariager Fjord Is i ca. 3 Uger, Randers Fjord i 4 Uger og Odense Fjord i $2\frac{1}{2}$ Uge.

I Sundet havde Helsingør og København Is i ca. 1 Uge.

I Store Belt havde Nyborg Fjord Is i ca. 1 Uge og Nakskov Fjord i 2 Uger.

I Lille Belt havde Vejle-, Kolding- og Haderslev Fjorde Is i 2 à 3 Uger.

I den vestlige Østersø havde Nysted Bredning Is i 2 Uger og Præstø Fjord i $5\frac{1}{2}$ Uger.

De indre Farvande. I Isefjorden begyndte Isdannelsen midt i Februar, og Isen blev liggende længst i Roskilde Fjord, hvor den laa til 18. Marts. Havnene havde Is i 3 à 4 Uger.

I Smaalandsfarvandet var der Is fra midt i Februar til Begyndelsen af Marts. Fjorde og Havne havde Is i 2 à 3 Uger.

I Farvandet mellem Øerne Syd for Fyen var der Is i en Ugestid i Slutningen af Februar.

Af 141 Stationer var der i Vinteren 1922—23 i alt 36 Stationer isfri. 13 Stationer havde Is i mere end 1 Maaned.

Det højeste Antal Dage med Is — 39 — havde Præstø Havn og Fjord. Den første Is viste sig den 13de Januar (Mariager Fjord og Limfjorden Vest for Nørre Sundby); den sidste Is saas 26. Marts (Hals Barre).

Isens Tykkelse blev maalt fra 42 Stationer. Gennemsnits-Tykkelsen var ens for Farvande, Fjorde og Havne, nemlig 13 cm. Den største Tykkelse af ren Is opgives til 20 cm (Skive Havn og Fjord). Pak-

Throughout the winter no ice was formed in the 3 Belts, nor in the eastern and southeren part of the Sound and the western part of the Baltic.

The west coast of Jutland. During the last half of February there was drift ice in Graadyb, and Ringkøbing Fjord had ice for about 4 weeks.

In Limfjorden the ice was lying from February 16 to March 25. In the whole middle part of the Fjord the ice was formed almost simultaneously, while the western and southern part froze over a few days later. The ice remained for a long while in the waters from Aalborg to the bar off Hals.

Of the Fjords at the Kattegat Mariager Fjord had ice for about 3 weeks, Randers Fjord for 4 weeks and Odense Fjord for about $2\frac{1}{2}$ weeks.

In the Sound Elsinore and Copenhagen had ice for about 1 week.

In the Great Belt Nyborg had ice for about 1 week and Nakskov for 2 weeks.

In the Little Belt there was ice for 2 to 3 weeks in Vejle Fjord, Kolding Fjord and Haderslev Fjord.

In the western part of the Baltic Nysted Bredning had ice for 2 weeks and Præstø Fjord for $5\frac{1}{2}$ weeks.

The inner waters. In Isefjorden the ice commenced to form about the middle of February and at Roskilde the ice remained till March 18. The harbour had ice for 3 to 4 weeks.

In Smaalandsfarvandet there was ice from the middle of February to the beginning of March and the harbours had ice for 2 to 3 weeks.

In the waters between the islands south of the Funen there was ice for about a week during the end of February.

During the winter 1922—23 althogether 36 stations out of 141 were free of ice, while 13 stations had ice for more than a month.

The highest number of days with frost — 39 days — was reported from Præstø. The first ice appeared on January 13 (Mariager Fjord and Limfjorden west of Nørre Sundby); the last ice was observed March 26 (Hals Barre).

The thickness of the ice was measured at 42 stations. The mean thickness was 13 cm and it was the same in the fairways as in the Fjords and harbours. The greatest thickness of clean ice was 20 cm

isen var 50—100 cm (Køge Bugt inderste Del og Kysten fra Frederikshavn til Hals); ved Hals Barre opgives Pakisen til metertyk.

Tabel 6 viser, hvorlænge Fyrskibene gennemsnitlig har været inde for Is siden 1879. Det fremgaar af Tabellen, at Fyrskibene indenfor Skagen som Regel inddrages i 1 af 3 Vintre. Naar Fyrskibene inddrages er de gennemsnitlig inde i ca. 5 Uger.

Ismeldingstjenesten, som træder i Virksomhed, naar Is begynder at optræde i Hovedfarvandene, var etableret fra 19de Februar til 10de Marts, ialt i 20 Dage. Af 30 Vintre har Istjenesten været etableret i 11, hvilket svarer til Is i Hovedfarvandene i 1 af 3 Vintre. I ingen af Vintrene er Istjenesten begyndt før 24de Januar, og gennemsnitlig varer Istjenesten 35 Dage.

Issignaler var hejst for Is ved Frederikshavn fra $\frac{27}{2}$ — $\frac{28}{2}$ og fra $\frac{7}{3}$ — $\frac{8}{3}$. For Is i Læsø Rende fra $\frac{21}{2}$ — $\frac{25}{2}$ og for Is i nordlige Indgang til Sundet fra $\frac{21}{2}$ — $\frac{24}{2}$.

Til Sammenligning mellem Vinteren 1922—23 og de 16 foregaaende Vintre tjener Tabel 7, hvor Talene angiver det gennemsnitlige Antal Dage med Is for de forskellige Slags Farvande og Havne. Det ses, at Vinteren 1922—23 ikke havde megen Is, idet Gennemsnittet af Antal Isdage for »Alle Stationer« var 11.0, medens Gennemsnittet for 17 Aar er 16.5 Dage med Is.

De sidste 17 Vintre grupperer sig med Hensyn til Isdagenes Antal i 2 skarpt adskilte Grupper. For de 5 isrige Vintre, med Is i Hovedfarvandene, er Gennemsnittet 37.0 Dage med Is med Grænserne 30.3 og 44.9. Gennemsnittet for de 12 isfattige Vintre er 8.0 Dage med Is og med Grænserne 0.9 og 15.3. Af disse Vintre var Vinteren 1920—21 en særlig isfattig Vinter.

Gennemsnittet af Antal Isdage for »Aabne Farvande« var for de 4 Isvintre 1907, 1909, 1912 og 1917 16.1 Dage, men for den særlig strænge Isvinter 1922 ialt 30.6 Dage. For »Aabne Farvande« er efter det foreliggende Materiale antagelig 1 af 20 Vintre en særlig stræng Isvinter.

I *Tabel 7* er tillige anført Middeltallene af Kuldesummen for Stationerne i *Tabel 2*, heraf ses, at

(Skive harbour and Fjord). The pack ice attained a thickness of 50 to 100 cm (the inner part of Køge Bugt and the coast from Frederikshavn to Hals). On the bar off Hals the ice was more than 1 m thick.

Table 6 gives the mean duration of the withdrawal of the light ships since 1879. It appears from the table that the light ships inside the Scaw as a rule are withdrawn during 1 winter out of 3. When the light ships are withdrawn, the withdrawal usually lasts for about 5 weeks.

The ice signal service, which is carried into effect when the ice begins to appear in the main waters, was established from February 19. to March 10. or altogether for 20 days. The ice signal service has been established during 11 winters out of 30, which corresponds with the appearance of ice in the main fairways during 1 winter out of 3. The ice signal service has never been established before January 24 and on an average the service lasts about 35 days.

Ice signals were hoisted indicating ice at Frederikshavn from $\frac{27}{2}$ to $\frac{28}{2}$ and from $\frac{7}{3}$ to $\frac{8}{3}$, in Læsø Rende from $\frac{21}{2}$ to $\frac{25}{2}$ and in the entrance to the Sound from $\frac{21}{2}$ to $\frac{24}{2}$.

To be able to compare the winter 1922—23 with the 16 preceding winters Table 7 has been compiled, the ciphers of which give the average number of days with ice in the various waters and harbours. It will be seen that the winter 1922—23 did not have much ice, the average of the days with ice at all the stations being 11.0; while the mean for 17 years is 16.5 days with ice.

Relative to the number of days with ice the last 17 winters form 2 distinctly different groups. During the 5 cold winters with ice in the main fairways the mean is 37 days with ice, the limits being 30.3 and 44.9. The mean for the 12 mild winters is 8.0 days with ice, the limits being 0.9 and 15.3. Of these winters the winter 1920—21 was specially mild.

The average number of days with ice in the »open fairways« during the 4 cold winters 1907, 1909, 1912 and 1917 was 16.1 days, while it was 30.6 days during the specially severe winter 1922. Concerning the »open fairways« we may according to the material in hand, reckon that 1 winter out of 20 will be specially severe.

In *Table 7* is also given the means of the amount of cold at the stations mentioned in *Table 2*, and it

Gennemsnittet af Middeltallet for de 5 haarde Vintre er 147.2 og for de 12 andre Vintre 51.7.

Meteorologisk Institut bringer sin Tak til alle de Observatorer, hvis Iagttigelser har gjort det muligt at fremkomme med de foreliggende Oplysninger om Isforholdene i de danske Farvande i Vinteren 1922—1923.

April 1923.

will appear that the mean for the 5 cold winters is 147.2 and for the 12 mild winters 51.7.

The Meteorological Institute herewith desires to express its thanks to the many observers who have rendered it possible to publish the present particulars concerning the state of the ice in the Danish waters during the winter 1922—1923.

April 1923.

ab. 1.

Luftens Middeltemperatur samt Afgigelserne fra Normalen i Vinteren 1922—1923.*The mean-temperature of the air and the variations from the normal temperature during the winter 1922—1923.*

		Fanø (Nordby)	Skagen (Fyret)	Randers (Strømmen)	Samsø (Tranebjerg)	Bogø (Navig. Skolen)	København (Trekroner)	Hammershus (Sandvig)
December	Middeltemp..	4.2	3.9	3.6	3.8	3.3	3.7	3.6
	Afgigelser ..	+ 3.3	+ 2.1	+ 3.3	+ 2.0	+ 2.1	+ 2.3	+ 1.7
Januar	Middeltemp..	3.5	3.4	2.5	2.7	2.3	2.8	2.5
	Afgigelser ..	+ 2.8	+ 2.7	+ 3.0	+ 2.3	+ 2.6	+ 2.7	+ 2.2
Februar	Middeltemp..	0.1	— 1.6	— 0.8	— 0.4	— 0.4	— 1.0	— 0.8
	Afgigelser ..	+ 0.2	— 1.6	— 0.2	— 0.6	— 0.3	— 0.9	— 0.9
Marts	Middeltemp..	4.0	1.2	2.2	2.4	2.9	2.4	2.0
	Afgigelser ..	+ 2.5	— 0.1	+ 0.9	+ 0.7	+ 1.2	+ 1.0	+ 0.8

ab. 2.

Frostperioderne og Frostdagene i Vinteren 1922—1923.*The frosty periods and frosty days during the winter 1922—1923.*

		Frostdage <i>frosty days</i>	Frostperioden <i>frosty period</i>	Frostdage <i>frosty days</i>	Samlet Kuldesum <i>Total amount of cold</i>
Fanø (Nordby)	a	27/11	8/12 - 9/12	17/1 - 18/1	
	b	1	2	2	
	c	— 0.5	— 1.1	— 1.3	
Skagen (Fyret)	a		9/12	18/1	
	b		1	1	
	c		— 0.4	— 0.1	
Randers (Strømmen)	a	26/11 - 27/11	8/12 - 10/12	16/1 - 18/1	
	b	2	3	3	
	c	-- 8.0	— 5.0	— 1.5	
Samsø (Tranebjerg)	a		9/12	18/1	
	b		1	1	
	c		— 1.0	— 1.2	
Bogø Navig. Skolen)	a	27/11	8/12 - 9/12	18/1 - 19/1	
	b	1	2	2	
	c	— 0.7	— 3.5	— 2.2	
København (Trekroner)	a	27/11	8/12 - 9/12	18/1 - 19/1	
	b	1	2	2	
	c	— 0.7	— 2.3	— 1.0	
Hammershus (Sandvig)	a	27/11	8/12 - 9/12	30/1	
	b	1	2	1	
	c	— 1.0	— 1.4	— 1.0	
				18 m. Afb.	
				4 m. Afb.	
				— 43.7	
				— 2.1	
				— 0.9	
				— 0.4	

im. 1: a er Frostperiodens Varighed (*the duration of the frosty period*).b er Antal af Dage, hvilke Middeltemperatur var under 0° (*number of days with a mean temperature below 0°*).c er Kuldesummen (Produktet af Frostperiodens Middeltemperatur og Dageantallet) (*the amount of cold (the product of the mean temperature of the frosty period and the number of days of the period)*.m. Afb. betyder med Afbrydelse (*with interruption*).

	Isforholdene State of ice										Besejlingsforholdene Navigation										Bemærkninger Remarks																
	Løs Sjæl og Kvædderis					Sammensætningen Sj. og Kvædderis					Med Is; Skibsf. ubundret					Skibsf. vanskelig for Sejlskibe					Antal Dage med Is					Isens største Tykkelse i cm Greatest thickness of ice in cm											
	b	c	d	e	f	k	l	m	n	o	p	q	r	s	t	u	v	g	h	i	j	k	l	m	n	o	p	q	r	s	t	u	v	w	x	y	z
Jyllands Vestkyst.										Antal Dage										Antal Dage																	
Sjælberg	9	..	..	..	..	..	..	..	..	5	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Haadyb	10	3	3	2	..	..	..	..	..	9	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Arv. v. Vyk Fyrskib .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kingkjøbing Fjord sydl. Del. ....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kingkjøbing Fjord nordl. Del.	4	..	..	..	..	..	..	..	..	2	4	13	2	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Limfjorden.										Antal Dage										Antal Dage																	
Hyborøn Kanal	3	1	1	..	..	..	..	..	..	2	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lemvig Havn og Lem-Vig .....	..	..	5	..	..	..	..	..	..	2	6	6	2	..	..	10	2	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nissum Bredning	1	1	5	..	..	..	..	..	..	..	..	..	..	..	..	..	5	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Øddesund	2	7	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	3	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Struer Havn og Bugt .....	..	..	..	..	..	7	..	10	..	..	5	10	..	..	..	..	20	2	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Thisted-Bredning .....	..	..	1	1	5	6	..	..	..	..	9	19	..	..	..	..	31	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Salling-Sund .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Livø-Bredning	9	2	1	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	6	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Skive Havn og Fjord .....	..	..	..	..	..	..	..	..	..	..	6	25	..	..	..	..	1	6	3	3	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Løgstør-Bredning	9	2	1	1	..	..	..	..	..	..	1	..	..	..	..	..	8	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Limfjorden ud for Løgstør .....	..	..	5	1	4	..	15	..	..	1	..	..	..	..	..	..	5	6	..	..	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Aggersund .....	..	..	14	2	..	..	..	..	..	4	13	18	1	..	..	..	11	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Limfjorden Vest f. Nørre-Sundby	2	5	9	3	..	..	8	..	..	4	..	..	1	12	..	..	4	2	12	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Limfjorden ud for Aalborg	8	18	..	..	..	..	8	..	..	..	..	..	..	6	7	2	19	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Limfjorden Aalborg-Hals	II	23	..	..	..	..	..	..	..	..	..	..	..	11	23	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Hals-Barre	1	10	1	25	5	9	11	10	2
Kattegat.										Antal Dage										Antal Dage																	
Nord for Skagen	3	..	..	..	..	..	..	..	..	..	2	..	..	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Syd for Skagen	1	4	..	..	..	..	..	..	..	..	..	..	..	1	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Skagen Havn	18	..	..	..	..	..	5	..	..	..	..	..	..	2	19	..	..	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Jed Hirtsholmene .....	..	..	4	..	..	..	..	..	..	..	..	..	..	3	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fredrikshavn	6	22	..	1	..	..	6	..	..	..	..	..	..	1	22	..	..	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Cysten Hirsholm-Sæby	1	1	2	..	..	..	..	..	..	..	..	..	..	1	3	..	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Læsø-Rende .....	..	..	4	3	..	..	..	..	..	..	..	..	..	1	3	..	1	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Frhavn-Göteborg vestl. Del.	10	..	..	..	..	..	..	..	..	..	..	..	..	10	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Frhavn-Göteborg østl. Del.	14	2	..	..	..	..	..	..	..	..	..	..	..	1	15	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kattegat Øst for Læsø	1	1	1	1	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kattegat Øst for Anholt	1	1	1	1	..	..	..	..	..	..	..	..	..	1	1	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kattegat Vest for Anholt.	1	..	5	..	..	..	..	..	..	..	..	..	..	3	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Anholt Havn	3	..	2	1	..	..	..	..	..	7	..	..	6	2	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Iden for Hals-Barre .....	..	..	9	1	8	..	..	..	..	7	..	..	18	2	..	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Mariager Fjord .....	..	..	9	1	8	..	..	..	..	7	..	..	21	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
ndlob til Randers-Fjord	I	10	II	..	..	..	..	..	..	3	5	5	14	..	..	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Grenaa Havn	5	7	..	..	..	..	..	..	..	..	5	2	5	..	..	..	..	..</														

Tab. 5.

	Isforholdene State of ice										Besejlingsforholdene Navigation										Bemærkninger Remarks								
	Løs Sjæl- og Kvædderis					Sammenpakket Sjæl- og Kvædderis					Spredt Drivis					Med Is;					Beskæftigelse af Skibsf. uhindret					Antal Dage med Is Number of days with ice	Første Ismedding First ice report	Sidste Ismedding Last ice report	Isens største Tykkelse i cm Greatest thickness of ice in cm
	b	e	c	k	f	i	h	d	g	g	Svær Drivis	Pakis	Skrueis	Tynd Fastis	Svær Fastis	n	o	p	q	r	s	t	u	v	w	x	y	z	
Sundet.																													
Kjøge Bugt ind. Del	I	23	I	..	16	I	6	24	21 1/2	10 2/3	50	
Farv. v. Stevns .....	..	..	..	..	..	..	..	..	..	I	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	Pakis, isfrit.
Store-Bælt.																													
Kallbg. Havn & indenf. Gisseløre	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kallundborg-Fjord	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	isfrit.
St. Bælt ud for Romsø	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kjerteminde Bugt	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nyborg Havn	9	I	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9	2	I	..	..	..	..	..	..	..	..
Nyborg-Fjord	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	3	..	..	..	..	..	..	..	..	..	..
Vesterrenden .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Østerrenden .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Korsør Havn .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..
St. Bælt v. Omø	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	14	..	..	..	..	..	..	..	..	..	..
St. Bælt v. Albuen	1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nakskov Havn	4	7	2	..	..	..	..	..	..	..	..	..	..	..	..	..	2	4	7	..	..	..	..	..	..	..	..
Nakskov-Fjord	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	11	..	..	..	..	..	..	..	..
Indløbet til Nakskov-Fjord	I	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	9	..	..	..	..	..	..	..	..
St. Bælt v. Kjelsnor .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Lille-Bælt.																													
Farv. ud for Æbelø .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	12	I	4	27	..	..	..	..	..	..
Vejle Havn og Fjord	10	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..
Bogense Havn .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..
Fredericia Havn .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
L. Bælt v. Middelfart .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Kolding Havn og Fjord	6	11	3	7	14	
L. Bælt v. Assens .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Haderslev Fjord	3	10	22	
Aarøsund .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Abenraa Havn og Fjord .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Alssund .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Farv. Syd f. Alssund .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Farv. ud for Skjoldnæs	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Østersøen.																													
Gulstav-Kieler-Fjord .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Rødby Havn	II	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	II	..	..	..	..	..	..	..	..	..	..
Femerholt udfor Rødby .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Nysted-Bredning .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	8	10	..	3	5	2	8	..	..	..	..
Farv. ud for Gjedser	3	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Løbene til Gjedser	8	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Gjedser-Warnemünde .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Farv. ud for Møen .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Fakse-Bugt ind. Del .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	15	I	11	3	9	15	..	..	..	39
Præstø Havn og Fjord	4	10	6	..	..	..	..	..	..	..	..	..	..	..	..	..	4	15	..	..	..	..	..	..	..	..	16
Bornholm.																													
Rønne Havn	5	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	5	..	..	..	..	..	..	..	..	..	..
Østersøen v. Rønne .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Østersøen v. Hammeren .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Østersøen v. Christiansø .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Østersøen ved Nexø	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..
Nexø Havn	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	2	..	..	..	..	..	..	..	..	..	..
Østersøen v. Dueodde .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..
Isefjorden.																													
Indløbet til Rørvig	6	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	I	..	5	..	5	3	..	..	..	..	..
Kattegat ved Rørvig	4	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	4	..	..	..	..	..	..	..	..	..	..
Nykjøbing Havn og Fjord .....	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..	..	..	..	..
Holbæk Havn og Fjord	2	..	..	..	..	..	..	..	..	..	..	..	..	..	..	..	7	13	..	..	3	13	..	..	10		

Oversigt over Inddragningen af danske Fyrskibe under Isforhold.

Oplysningerne begynder 1879^{*)})

Withdrawal of Danish light-ships during ice.

The reports commence 1879*).

	Vinteren 1922—1923		Antal Dage fra Station paa Grund af Is <i>Number of days of the station on account of ice</i>	Har siden 1879 været inddraget <i>Withdrawn since 1879</i>			Bemærkninger <i>Remarks</i>
	Inddraget <i>withdrawn</i>	Udlagt <i>replaced</i>		i Antal Vintre <i>Number of winters</i>	Alt Dage <i>Total number of days</i>	Antal Dage pr. Vinter med Is <i>Number of days pr. winter with ice</i>	
Horns-Rev.....	—	—	—	1	3	3	
Vyl.	—	—	—	1	12	12	
Graadyb.....	—	—	—	2	30	15	
Skagens-Rev.....	22½	8½	15	13	439	34	
Læsø-Trindel	21½	3½	11	14	478	34	
Læsø-Rende	22½	4½	11	15	506	34	
Østre-Flak.....	21½	3½	11	5	139	28	
Anholt-Knob	21½	4½	12	16	555	35	
Schultz-Grund	23½	1½	7	15	569	38	
Lappe-Grund	20½	28½	9	16	410	26	
Drogden	21½	3½	11	16	609	38	
Gjedser-Rev	—	—	—	13	563	43	
Halskov-Rev.....	22½	24½	3	2	45	23	
							*) {Udlagt i 1906. {Established in 1906.
							*) {Udlagt i Juli 1908. {Established in July 1908.
							*) {Oplysningerne begynder 1883. {The reports commence 1883.
							*) {Udlagt i Juni 1921. {Established in June 1921.

Tab. 7.

Sammenligning mellem de forskellige Vintre.

Comparison between the various winters.

Antal Dage med Is for: Number of days with ice in:	1906 —07	1907 —08	1908 —09	1909 —10	1910 —11	1911 —12	1912 —13	1913 —14	1914 —15	1915 —16	1916 —17	1917 —18	1918 —19	1919 —20	1920 —21	1921 —22	1922 —23
Aabne Farvande..... (The fairways)	6.6	0.2	18.6	0.1	0.0	17.7	0.3	0.1	0.0	0.1	21.4	1.2	0.7	0.0	0.0	30.6	2.5
Havne ved aabent Farvand..... (Harbours situated at the fairways)	17.4	2.9	28.4	2.2	0.5	20.4	3.2	2.1	0.5	2.7	33.5	6.1	4.4	2.7	0.0	34.4	10.1
Tildels lukkede Farvande..... (Partly closed waters)	24.2	6.7	41.0	2.1	0.2	35.1	6.2	4.6	2.7	3.7	50.7	9.1	8.5	6.9	0.1	37.5	8.2
Havne ved indelukkede Farynde. (Harbours situated in closed waters)	52.8	25.5	69.2	14.2	9.6	49.1	18.4	15.0	16.9	18.1	71.6	34.3	28.6	24.8	1.5	52.7	20.5
Indelukkede Farvande..... (Closed waters)	57.9	32.2	66.3	20.7	5.6	52.9	19.1	16.6	19.3	22.1	78.5	48.1	31.1	41.0	4.1	52.9	23.8
Alle Stationer..... (All stations)	30.3	10.1	38.8	5.7	2.4	31.5	7.4	6.0	6.1	7.3	44.9	15.3	11.6	11.9	0.9	39.4	11.0
Middeltal af Kuldemængde for Stat. i Tab. 2..... (Mean amount of cold f. the stations in Tab. 2.)	121.1	65.8	151.6	37.9	23.9	128.6	31.9	49.2	66.3	68.2	169.5	79.4	65.2	64.3	11.3	165.4	57.5