Seas reacted to naval churning

The theme

Although physical laws are the same for hot soup and for the “stirred” seas, things tend to become more complex when naval activities occur in the North and Baltic Seas. This is because location, season and applied forces are diverse in many respects in the latter case. This would not matter so much if science had established a comprehensive and sufficient coverage of temperature measures throughout a seawater body a long time ago. Such a system was not available before WWII and is still not available today. Only a few coastal stations recorded sea surface temperatures since long time ago. This is by far too little as far as climate research is concerned. Only a sufficiently complete picture of the interior of the seas and oceans would help detect the course of the climate. Such a hope was out of the sight of the meteorologists in the early 20th century.

But when the seas determine the pace of the weather and climate one can turn ‘the table around’ by using meteorological data and citing deviations from usual atmospheric wintertime conditions caused by the turning about of waters of North and Baltic Sea. However, behind each and every reasoning, there stands the overriding fact that, in the autumn of 1939, some mechanism must have invited an arctic winter to prevail in Northern Europe for four months after WWII had started. It is a fact that an uncommon arctic winter could not have occurred without a cause.

Before proceeding further to the conditions concerning the winter 1939/40, a reference may be made to the three cold and snow-rich war winters of 1939/40, 1940/41 and 1941/42, by outlining the interesting observation made by a scientist from Kew Observatory at Richmond/UK in 1943[17]: "The present century has been marked by such a widespread tendency towards mild winters that the "old–fashioned winters", of which one has heard so much, seemed to have disappeared for ever. The sudden arrival at the end of 1939 of what was considered to be the beginning of a series of cold winters was therefore all the more surprising.

Since the winters of 1878-79, 1879-80 and 1880-81, there have never been such severe winters, three in succession, as those of 1939/40, to 1941/42." He further points to another significant aspect with regard to snow conditions in SE England: "Since comparable records began in 1871, the only other three successive winters as snowy as the recent ones (1939-1942)[18] were those during the last war, namely 1915/16, 1916/17 and 1917/18, when snow fell on 23%, 48% and 23% of the days, respectively". Should this statement not raise excitement and confirm outright that 'great' wars leave behind indelible fingerprints? The 'surprise' of three successive cold winters will be come up again at a later stage. At this point it is to note the starting line: the polar winter of 1939/40 came unexpectedly, as confirmed by contemporary WWII witnesses.

Based on the features of Europe's northern seas, the following three topics will be discussed:

- Lost west wind drift due to making the seas steaming.
- Cooling the seas too early.
- Sea ice conditions during winter 1939/40.

17 Drummond, A.J.; ‚Cold winters at Kew Observatory, 1783-1942'; Quarterly Journal of Royal Met. Soc., No. 69, 1943, pp 17-32, and: Drummond, A.J.; Discussion of the paper: ‚Cold winters at Kew Observatory, 1783-1942'; Quarterly Journal of Royal Met. Soc., 1943, p. 147ff.

18 Instead usual 10% days of snowfall at Kew Observatory during January and February , there were 1940 (28%), 1941 (32%), and 1942 (44%)

Europe’s northern waters

North Sea

North Sea is one of the principal factors in Europe’s climatology. On the one hand, North Sea is a part of the North Atlantic Ocean and is like a big bight. On the other hand, it curves into the landmasses of the European continent. Climatic conditions are therefore transitory. Its climate is neither maritime nor continental. Nevertheless, due to its geographical location, prevailing westerly winds travelling through the hemisphere within a zone of 2,000 kilometres breadth usually ensure a temperate humid climate.

Britain, the most western Atlantic outpost, has its weather influenced by Atlantic depression and presumably would outline a general picture as it follows: between predominant occurrences of depressions, there are often small mobile anticyclones that bring a period of fair weather. Sometimes large, stationary anticyclones effectively act as a 'block' to the regular passage of depressions. These larger anticyclones can often last for over a month and completely change the character of wet, windy and cloudy weather of Britain. If one of these anticyclones
established over Scandinavia and easterly winds on their southern side, they can drive very cold air from the continent of Europe. In any of these cases, North Sea plays a vital role in deciding Europe’s climate.

	North Sea diagonals (England – Continent)		
Water depth	Southern section West/East	Middle section West/East	Northern section West/East
	Temperature °C		
Surface	10/12.5 °C	8/15 °C	6/10 °C
7.5 m	11/13 °C	8/15 °C	5.5/10 °C
20 m	11/13 °C	7/13 °C	5.5/8.5 °C
30 m	11 °C	6.5/12 °C	5/7.5 °C
40 m	-	6/11 °C	4.5/6 °C
60 m	-	4,4 °C	4.5/3.5 °C
80 m	-	3,5	4.5/1.5
100 m	-	-	4/1.5

The principal factors affecting the climate of any ocean and sea body interior are temperature and salinity. The latter varies in the North Sea more than in any other sea but is less related to the season. Seawater temperatures vary according to depth and to seasons.
It is of great importance to demonstrate developments in autumn 1939 according to statistics and observed air temperature data, as seawater and atmospheric temperatures are closely interconnected.

Water depth in the North Sea can be roughly divided into two sections. The southern section comprises a plateau south of a line running from mid-England (Hull) to North Denmark that is mostly less than 40m deep. The northern section is a triangle between North Denmark –Hull – Shetland Islands with a water depth generally ranging between 60 and 120m (the deepest place is 263 m), and the submarine valley along the Norwegian coast with depths ranging between 240 and 350 metres, and 500-700m depths in Skagerrak. The inflow of warm water from the Atlantic Gulf current enters the sea from the north and influences the current system from the surface to the bottom in the northern part only. The 40m deep southern plateau is hardly affected by the northern water, but receives some Atlantic water via the Strait of Dover and some freshwater from the rivers. Thus the North Sea is rich in different water masses, which vary seasonally and fluctuate annually. As all coastlines are subject to marked tidal forces, considerable water masses actually vary on a daily basis.

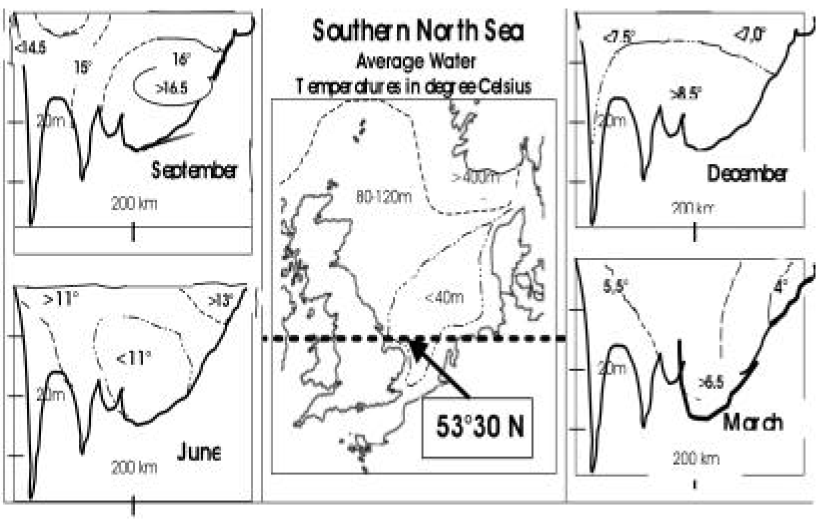
The annual approximate temperature variation data in three West-East diagonals across the North Sea[19] is as it follows:

19 Tomezaqk,G. und Goedecke,E.; Die thermische Schichtung der Nordsee, Publisher: Deutsches Hydrographisches Insitut, Hamburg 1964

Southern section

Due to the shallowness and tidal forces of the water body, its temperature structure can be described as a homogeneous one (from surface to the bottom), with small variations as the average temperatures indicate: December (8.5°C), January (6.5-7°C), February (5.5°C), March (5°C), April (6.5°C), suggesting that water very close to the coasts has lower temperatures during the winter season. Between May and August, temperatures increase from 8.5°C to 14.5°/17°C and
decrease as it follows:

Depth	August	September	October	November
Surface, West-East	14.5-17°C	14-16 °C	12-13.5 °C	09°-10° (*)
20 m, West-East	14-16 °C	15-16.5 °C	13.5-14 °C	9.5-11 °C

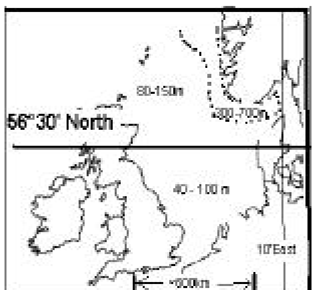


(*) in mid North Sea, the figure is with 11.5° higher than in West & East.

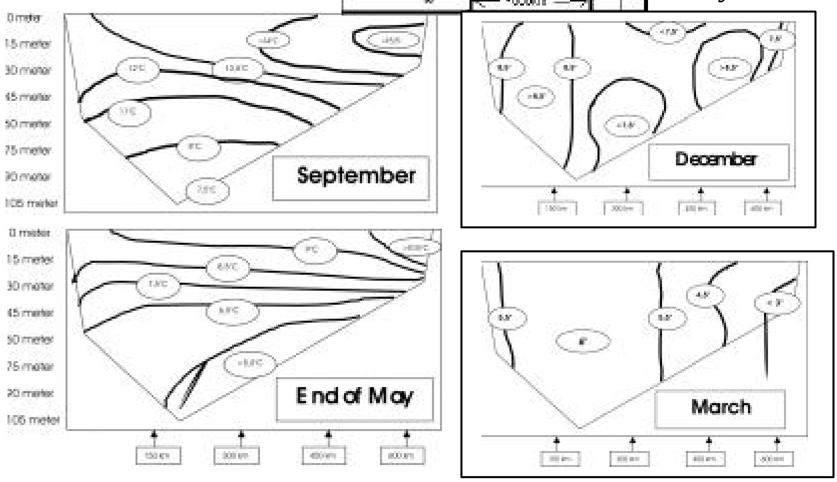
Fairly homogeneous figures of the water body temperature, with 15°/16°C at peak time and the lowest temperature in March (5°C), indicate that the water body experiences an average change of about 1.5°C per month.

Northern section

In March, the lowest annual average temperatures at the surface of the water ranged between 7°C in the northwest (Atlantic water) and 4.5°C in the southeast (Dutch coast). At the end of August, the highest average temperatures at the surface of the water ranged correspondingly (NW and SE) between 13°C and 17.5°C in the Helgoland Bight.



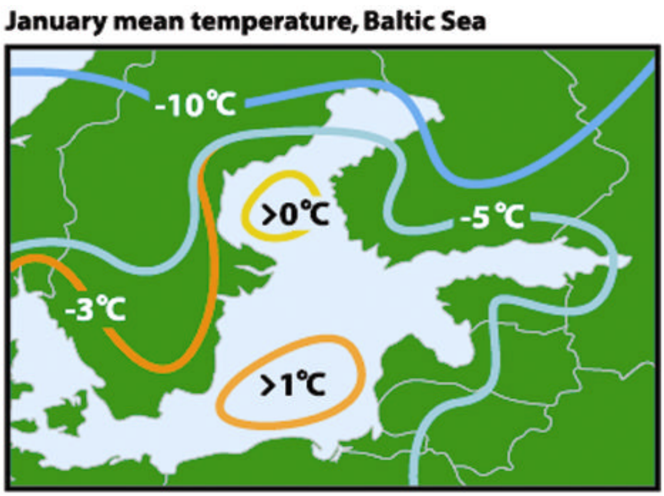
From May to August, a horizontal thermocline builds up but declines during the autumn months. It is worth noting that while temperature level increases at lower water levels (e.g. 20m, 40m) in autumn, it decreases at the bottom (60m). It is therefore possible for the whole water body to be warmer



in September than in August. While calculation of 'monthly averages' is an approximate figure, it nevertheless gives an indication that the monthly decrease in temperature (or energy release) takes place in small quantities only from 11°C in August to 4.5°C in March, i.e. on an average it could be as little as just one degree per month.

Baltic Sea

In terms of size, the Baltic Sea is a mere 'drop' of water in the world's oceans, but thanks to its strategic location and specific features it represents a 'significant' force and influences the weather in the countries surrounding it. It is an excellent location for the climatology study.



The image demonstrates how important the Baltic Sea water temperatures influences the air temperatures during the month of January

The total area of the Baltic Sea is of 400,000 square kilometres, with an average depth of 55m, including the Gulf of Bothnia (55-294m) and the Gulf of Finland (30m). Except for the eastern part (Gdynia Bight with a maximum of 114m), Southern Baltic is less than 50m deep. Climatically speaking, an important feature of this sea is a

2,500m high mountain ridge from the north to the south of Norway, drawing a sharp line between maritime and continental belonging.

Behind this barrier continental and polar air have much easier access than in areas where Atlantic air travels east at a low elevation level. This frequently guarantees warm summers to Baltic countries by significantly delaying the arrival of continental winter conditions. There is hardly any other sea in the northern hemisphere which can convincingly demonstrate the importance of heat storage and release process throughout all seasons as the Baltic Sea does it.
Actually, very cold conditions cannot prevail on sea and in nearby coastal areas over a longer period as long as the sea is open and not iced. Icing is a very critical point in regional climatology. Every sea area covered with ice loses ten times less energy to the atmosphere than an open sea area[6]. The importance of heat flux can be clearly demonstrated with temperature data records which show that winter average temperatures at the seaside are considerably higher than farther inland whereby temperature sometimes decreases in great leaps, i.e. by 1°C per 50 km or more, depending on the distance from the coast.

From mid-September to the end of February, when air is colder than seawater, water temperature decreases between 13°C and 15°C, which is significantly more than that of the North Sea (9.5-11.5°C). This actually means that the surface temperatures, with an average ranging between 0°C (north) and 3°C (south) in January, quickly come close to zero. Deeper waters (80 metres and below) have just 4-5°C, while water column above varies according to the seasons[20]. These temperature changes during various seasons are effective only from surface to about 80m depth. While surface water reaches its peak temperature by the end of August, lower levels may reach its peak later on (e.g. 40m with 10°C in late October). Therefore, all activities

20 Finnish Institute of Marine Research; M.Leppäranta et.al; "Phases of the ice season in the Baltic Sea' No. 254, Suppl.2; Helsinki 1988

that took place at sea in the autumn of 1939 could have had two principal effects:

1. Churning the upper sea water layer causes a soup cup effect by increasing evaporation;
2. Turning seawater masses about will force considerable warm water masses to greater depths, which is to 'resurface' later thus contributing to milder air (as usual) or delaying icing processes by days or weeks.

Killing of westerly winds

The western European weather is famous for the predominant flow of wind blowing from the North Atlantic above the Euro-Asian landmasses (from west to east). The wind brings warm air from the depression but soaked up with humidity from the ocean. In contrast, anticyclones influence the weather conditions through high air pressure combined with dry and cold air masses.

This is immediately clear when comparing the climates of Amsterdam and Moscow. The latter has similar latitude as the Netherlands, but the Netherlands have cooler summers and milder winters. This is because Moscow is situated away from the warming effects of the Gulf Stream and other warm ocean currents that could keep winter temperatures mild. Moscow has less humidity and less cloudy air.

Also Northern Germany and Southern Scandinavia which have coastlines to North and Baltic Sea have maritime climate caused by the warm westerly winds of the Atlantic. Further inland or further east, the climate is more continental: marked by greater diurnal and seasonal variations in temperature, with warmer summers and colder winters.

These conditions would have also prevailed during the winter of 1939/40 if German Reichskanzler Adolph Hitler had not started the Second World War. From the 1st of September 1939, huge naval war machineries interfered in the common struggle between cyclones and anti-depressions, between Low and High air pressure areas. To them, North and Baltic Sea serve as a blueprint. Whether the seas are warm or cold determines the prevalence of continental or maritime air. The war machinery changed the weather blueprint so quickly and so decisively that the westerly winds were already sealed off from passing through Central Europe after a few weeks.

North and Baltic Sea reaction

North and Baltic Seas play their role according to the physical laws. By the end of August, they had reached the highest seasonal heat capacity. At this time, the upper water column (down to 30 meters depth) is about 10°C warmer than six months later, in March. If the seas are left in peace and not more than usual winter winds and storms make waves and other internal currents exchange the cold water for warm water at sea surface, then seasonal cooling from September to December and March occurs gradually, but close to long term statistical average. That is what climatology tells ever since: "climate is average weather over a long period of time"[21].

However, statistics become useless if a spoon is stirred forcefully in hot soup or if naval means and forces interfere and turn seas up side down. Warm water starts to steam. The more water is turned and twisted, the more steam goes up. When more steam goes up, physical laws require that rising water vapour is replaced by more heavy air. Statistically, Britain is surrounded by warm water which ensures the wet, windy, and cloudy weather character of The Isles during autumn and winter more than during any other season. But sometimes large, stationary anticyclones act effectively as a 'block' of the regular passage of Atlantic depressions. This is exactly what happened in autumn 1939. Seawater around Britain (particularly in the southern North Sea, Helgoland Bight, and Baltic Sea) was forced to evaporation at a rate above any other climate data average. Air above the seas became 'thin' and needed replacement with 'heavy' air. This

21 Cf. Houghton, J.T. et.al. (ed), Climate Change, The IPCC Scientific Assessment, Cambridge, 1990, p. xxxv.

replacement air needed to come from somewhere. Heavy air was abundantly available in the depths of Northern Russia and in the Arctic region. Consequently, cold air travelled from North to East, in the direction of Western Europe. The NE winds are not suspected for blocking the depressions from crossing Britain and Central Europe, but should be regarded as a strong evidence that naval warfare acted in North and Baltic Sea like a rapidly turned spoon in a cup filled with hot soup. The next three subsections aim at confirming this picture, discussing 'losing the west wind', 'raining cats and dogs along western war front' and highlighting exceptional sea icing conditions in North and Baltic Sea.

'Seewarte' awaits Atlantic depression

While considering the faith of the west-wind during the months between September and December 1939, one might receive an answer from Seewarte. "Deutsche Seewarte", the distinguished German meteorological office in Hamburg, was under the supervision of the Minister of Air Travel and Commander-in-Chief of the Air Force Hermann Goering (between 1935-1945, as already mentioned in the Preface). Although all weather information was classified as top secret by all warring nations, the preparation of daily weather charts and weather analysis was done with great efforts and care. Precise and best possible forecasts were of the highest importance for naval, aerial and military planning. The Seewarte did the job like other Met-Offices: presentation of data, preparation of weather charts and analyses. The daily analysts made numerous comments about an unusual weakness of the west wind and passing of depressions. They wondered, predicted and disputed that the west wind was lost or had disappeared and none of the wartime meteorologists in charge ever realised why. In the following section, some extracts from "Seewarte" weather analysis are reproduced which concern the deviation of the west wind or the movement of low air pressure areas.

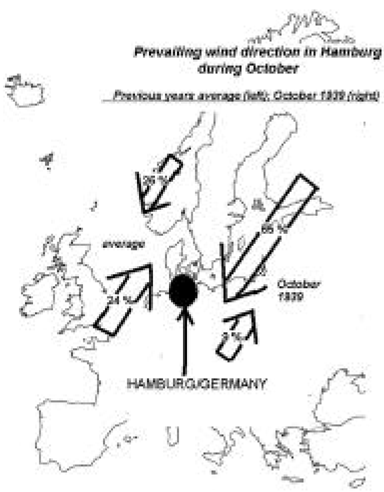
Between the 16-28th of September 1939: daily weather charts show a high-pressure area between Iceland and Scotland. The most significant comments of the Seewarte analysts are:

The 19th of September 1939: cyclonic activities over the Arctic Ocean (Nordmeergebiet) are intensive. The west-drift in the North will consequently move more and more to the South.

The 23rd of September 1939: with the advance of air into Middle Europe a more forceful cyclone can develop along this channel (Rinne) which could extend its influence in the Middle Europe later.

> Remark: The two previous extracts show high expectation that cyclonic activities in Middle Europe will resume soon. However, this did not occur as indicated in the following extract, one week later.

The 29th of September 1939: general weather situation towards the end of the month clearly reveals changes indicating the end of the Indian summer spell, which leads to a period of increased cyclone frequency in Europe.



Remark: This also did not happen, as confirmed by the next extract.

The 13th of October 1939: the first effective gust of maritime air has reached Northern Germany. A continuous west-wind-drift (WWD), however, cannot be expected yet.

The 19th of October 1939: a broad, high-pressure bridge has been formed between the Atlantic and the Scandinavian heights. Again this results in a weather situation similar to those which have been witnessed frequently before, during corresponding month, viz. a high-pressure zone moving from the Atlantic via Southern Scandinavia to Russia, with low-pressure disturbances to the North and South of it.

The 23rd of October 1939: usual weather is changing now and the high pressure bridge which links the Azores high with the West Russian high is broken up. A transition to a west wind situation is on the verge of the German seas.

The 28th of October 1939: since a high pressure bridge from Middle Scandinavia to Scotland remains there, a further stream of cold air from the Arctic Ocean (Nordmeerraum) is cut off.

The 2nd of November 1939: an unusual and explicit analysis is given on change in the direction of wind: "Germany lies in the South (Southern part) of the high-pressure area and mostly experiences winds coming from East to North (NE- directions), which is clearly shown by the climatic data from October: Hamburg reported winds from the North-Eastern quadrant on almost two thirds of the dates observed (33% easterly winds out of 65%) while North-Eastern winds accounted only for a quarter (26%) of several previous years' averages. Otherwise, most frequent direction of the wind – South-West (24%) – accounted for 9% of all cases. Thus the observations at this station alone show what the weather charts of an extensive area would obviously indicate."

> Remark: This is a very strong and clear indication that huge air masses moved towards the North Sea (including southern part of Baltic Sea), presumably caused by unusually high evaporation in this sea area. While water of the North Sea was 'stirred and turned', 'steam' rose upwards into the sky causing air to flow in from Easterly direction, which subsequently prevented low-pressure systems to travel along the west-wind-drift channel, via the North Sea and Central Europe, into the eastern hemisphere.

Data for next four weeks are mixed. Four statements made during that month may illustrate the situation as seen by the analysts who thought they were worth mentioning at that time.

The 5th of November 1939: it appears that now – like during many earlier years – a west-wind-drift with lively cyclonic activities will begin to move over Europe at about the middle of the month.

The 14th of November 1939: it seems that a mainly sectional circulation is going to happen in the general weather situation: its pressure field will be characterized by a long, high-pressure zone – Azores–Southern Germany–Southern Russia – and west-wind-drift like turbulence activity in the North of these regions.

The 29th of November 1939: West Siberian high is slowly retreating towards the East thereby allowing the disturbance coming from the West to penetrate still deeper into the regions of European Russia.

The 30th of November 1939: a very distinct west-wind weather situation prevails over the North and Middle Europe.

Expectations of 'lively cyclonic activities' did not materialize. At that time, weather men could not imagine seawater changes caused by devastating war machinery.

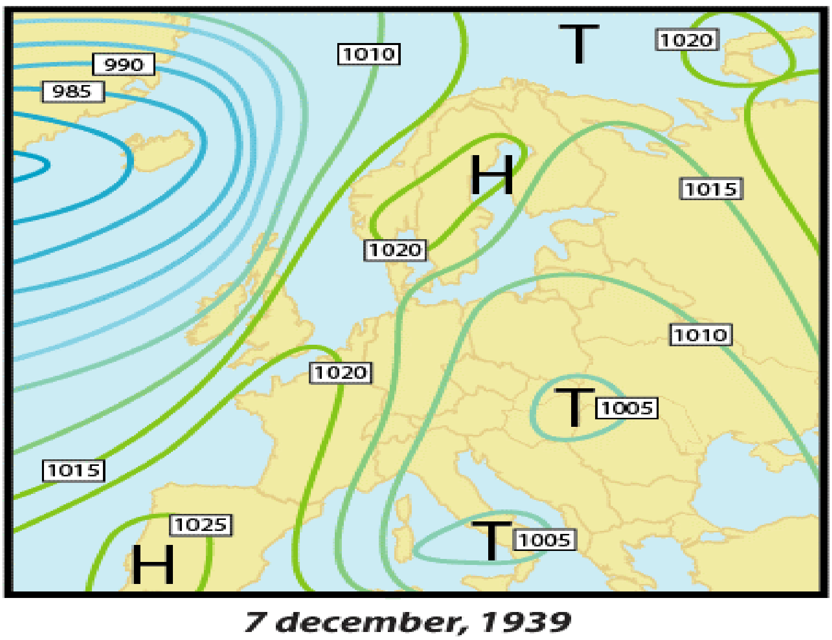
Westerlies gone

During the first few days of December, we witnessed the attempts of rather weak cyclonic storms to reclaim their common travel path from the Atlantic to the Eastern hemisphere. By the 7th of December 1939, a high pressure field forms near Aachen (West

Germany/Belgium), stretching to Norway, the 'last straw' that lead to severe winter conditions. At this time, any Atlantic air power had been lost for Western Europe, as the 'Neue Zürcher Zeitung' brilliantly acknowledged in its issue dated the 14th of January 1940 (extract):

"Severe cold which invaded the whole Europe in the course of this week was by no means an accidental phenomenon which settled in

Supremacy of High Pressure from North Cap to Gibraltar



Atlantic low pressure areas are barred to enter Central Europe

surprisingly. It rather constitutes the peak of a development which had its beginning in the first week of December. Towards its end, high pressure began to stabilize in North and Middle Europe, keeping away the low Atlantic cyclones from the continent and diverting them mainly through Greenland and Iceland waters, to the Sea…. As soon as occasional Atlantic depressions moved East, through the North and Baltic Sea, they were immediately replaced by the entry of cold air coming from the Greenland area."

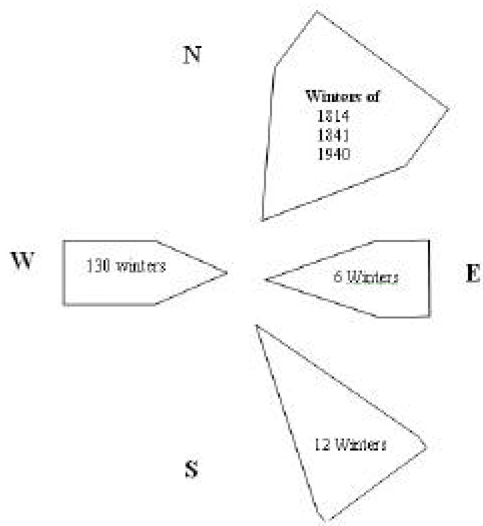
So far, this is an impressive analysis. What the weather expert of NZZ had not realised is the fact that the 'blocking' of the westerlies had occurred since September 1939 and that the war at sea could have been responsible for it.

Four further excerpts from the daily Seewarte analysis demonstrate how the 'Seewarte' civil servant on duty judged the developments from December.

The 1st of December 1939: a quite distinct Atlantic frontal zone of the last few days is disintegrating.

The 8th of December 1939: it appears that the influx of warm air from the West is stronger than the retreating stream of cold air, so that the high pressure bridge might stay, although the English frontal zone is currently progressing very slowly towards the East.

The 19th of December 1939: A high-pressure ridge stretches….(etc). These conditions, however, are not likely to exist. The same pressure ridge is attacked from two sides and has gained more than 10mb in the past 24 hours….



The 21st of December 1939: a high pressure area, which installed yesterday over the Northern coast of Scotland, lies today over Central Germany, with a central pressure of 1,034mb. The heavy fall in pressure over the Artic Sea area (Nordmeerraum) has produced a drop there.

After this date, the West Wind Drift was definitely barred from entering Western Europe. The return of the Ice Age conditions became a consequential result.

Changed wind direction

The foregoing investigation emphasized the significance of the changes observed in wind direction, in Hamburg, in October 1939. Wind direction had dramatically changed from prevailing SW winds to dominating NE winds, due to the churning of the sea in Western Europe.

At this stage, it might be worth mentioning that a research conducted by Drummond[22] for Kew Observatory (London), in the early 1940s, mentioned that prevailing wind directions in South-West England during 155 winters, between 1788 and 1942, had only 21 easterly resultants, whereby the few winters 1814, 1841, and 1940 had resultants from NE to ENE. Another few winters since 1841 (1845, 1870, 1879, 1891, 1895, 1904, 1929) had prevailing SSE to ESE winds. With the exception of the winters of 1801 and 1804, all these 21 winters with predominant easterly winds had temperatures below the average (40.1°F = 4.5°C). While eleven of the above winters had mean temperatures between 34°F and 36°F, only six with westerly resultants had means lower than 37°F, these being: 1820, 1830, 1847, 1855 and 1886.

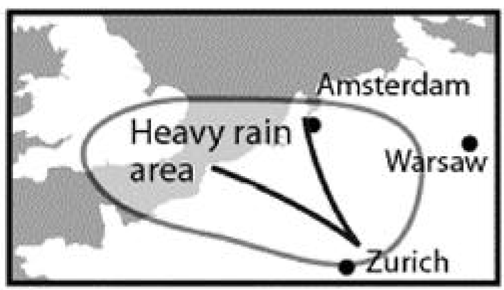
Observing the way Drummond highlights the exceptionality of the first war winter, one can only wonder why he seemed to have thought that such things happened simply out of the blue. While expressing some surprise, not even the prominent German meteorologist Richard Scherhag made anything out of his conclusion: “the famous winter of 1939/40 was the consequence of a general decrease in general

22 Drummond, ‘Cold winters at Kew Observatory, 1783-1942’, 1943, see reference above

circulation”[23]. And what reduced circulation in the first place? Neither Scherhag nor any of his numerous academic fellows around the world ever asked themselves this question.

Why did it rain cats and dogs?
The picture

First and most important picture: when there is less humidity in the air, it is easier for the cold air to take control. During the winter season, when the Northern Atmosphere is drier, general circulation decrease makes it easier for the polar air to travel to southern latitudes and to determine lower temperatures in many other regions. Some may even wonder about the appearance of such arctic conditions. January 1940 reflected this exact situation. North America, China and Europe froze under extreme low temperatures and there was plenty of snow everywhere. However, the record winter of 1939/40 in North Europe was ‘homemade’ due to naval warfare in its seas and to the forming of ‘dry air’ which may have brought its small share[24].



200% to 300% rain above average during October & November 1939

The next important picture is about the situation in which precipitations actually ‘dilute’ the atmospheric humidity. If it rains abundantly in one place, precipitations statistically diminish in other places until humidity restores average equilibrium again. This process may take more than a few weeks. If war can cause abundant precipitations during the winter season, nature needs much more time

23 Scherhag, Richard (1951); ‘Die grosse Zirkulationsstoerung im Jahr 1940’, in: Annalen der Meteorologie, 4. Jahrgang, Heft 7-9, 1951, p.321-329.

24 In New York about every tenth January was much colder and every fifth winter (January & February).

to ‘fill’ the gap during the summer season. So far this information represents only physical laws and not facts.

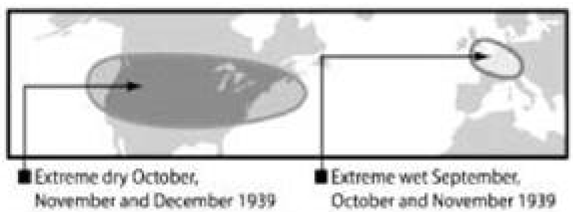
World War Two had hardly started when it began to rain excessively in Western Europe, from Berlin and Basel to Paris, Amsterdam and London, for three months, i.e., 200% above average in September, 300% in October, and more than 200% in November. In the Western, Middle and Southern Germany, the quantity of rain recorded at most observation–stations was more than double, in some cases even 3.5 times more than usual: Augsburg 366%; Noerdlingen 362%, Kaiserslautern 336 %, Wuerzburg 316 %. Southeast England recorded rainfall of more than three times above average in October 1939. Greenwich saw a higher rainfall only in 1888 and, before that, in 1840. Greenwich total for October (6.16 in.) and November (4.13 in.) together –10.29 inches – was the highest ever since recording had begun at Greenwich. Similar conditions had been observed at Camden Square (London), where hours of rainfall are recorded as it follows: October 77.3 hours, November 96.7 hours. These were 50 hours higher than the average. Some places at the southern end of Maginot/Westwall Line recorded 30 days of rain during October (e.g. Freiburg,); a number of other locations had up to 24 days of rain.

In November 1939, weather conditions were not much better than in October. In general, it was a bit too warm and too wet, 200% more than normal for that season, in Hannover, Aachen, Kassel, Frankfurt a.M., Magdeburg, Ulm, Wuerzburg. This weather conditions actually saved France from being attacked and invaded in 1939. On the 19th of October, the “Yellow” plan for the invasion of France was finalised. On 7th of November, the beginning of the invasion plan was postponed for the first time. A Blitzkrieg was not advisable in such muddy soil conditions. Soldiers and tanks would have been defeated by ‘General Mud’. Hitler wanted to go ahead and would have sent the Wehrmacht across the boarders in late 1939, but, due to excessively wet autumn weather conditions, the invasion was postponed until June 1940.

The appearance of excessive rain in West Europe raises a paramount question: where did all water vapors come from?

Where did all the water come from?

Actually one can discuss the matter under two aspects: (1) where did excessive water vapor come from? (2) how was it brought down? The first aspect is more important for this investigation than the second one because it serves as evidence that naval forces increased evaporation rate, which means that the seas lost a considerable part of their seasonal heat budget too early and, this way, their capacity to keep polar air at bay decreased tremendously during pre-winter months.



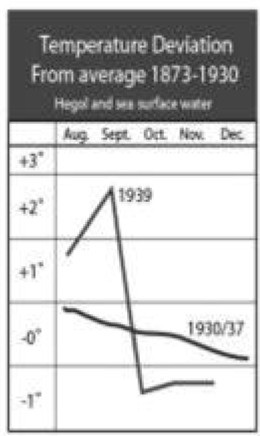
Since the 1st of September 1939, a huge defense area from Basel to Dunkerque (Maginot Line) and from Basel to Emden (Westwall) was activated and manned with one million soldiers on each side. From now on, small and big encounters, shelling, air fights, and aerial bombings occurred frequently. On the 7th of September 1939, The New York Times reported: "First substantial clash saw 700 French tanks and planes moving seven miles over the Saarland border, while 300 airplanes attacked German positions in the Aachen industrial region and munitions area, some 125 miles farther north".

Meanwhile, exploding sea mines and depth charges, shelling among enemy ships or ship versus coastal battery, and thousands of ship movements churned and turned around the waters of North and Baltic Sea. Evaporation rate increased. Soaring water vapour attracted cold air flowing in from north-easterly directions, pushing the excessive water vapour in south-westerly direction towards Westwall and

Maginot Line, including South England. A record rain period started there due to three reasons:

1. Naval activities ‘produced’ a high and constant humidity all over the western war front, including SE of England, North of France, North of Switzerland, Bavaria, and, further north, the Netherlands, the West, Middle and South of Germany (including Berlin and Silesia).
2. Water vapour condenses using the molecules as condensation nucleus. Condensation occurs on a wide variety of aerosol particles e.g. particles of dust, salt, desert sand or smoke. Ambushes and burning down of villages and cities in Poland, in September, and frequent military encounters along the front lines produced abundant condensation nuclei. Clouds could form and ‘burst’ into rain.
3. Air coming in from north-easterly direction was cold. When high humid air laid over Western Europe and resisted being pushed farther south, arriving air would cool down the high humid air and it would inevitably rain.

The scenario was perfect. Plenty of water vapour in the atmosphere, abundant condensation nuclei around and a constant arrival of cold air from NE made it rain cats and dogs in Western Europe.



Helgoland Bight water temperature

Reliable seawater temperature data are scarce. 100 years ago, temperatures were measured randomly and at sea surface. That makes data not very convincing. Nevertheless, on the North Sea island of

Helgoland, about 50 km off Germany's coast, sea surface temperatures had been taken since 1872. In 1954, Erich Goedecke[25] from Hamburg investigated data series from 1872 until 1950 and observed the following changes:

- A modest temperature rise since 1915 (World War I had just started) lasting until about 1920[26], varying in a narrow band until 1929.
- A strong rise occurred since 1929 until 1939.
- Mean temperature decreased dramatically since 1939 until 1942, then reverted back to the increasing trend of 1929-1939.

One should not rely on this type of data because they can be conditioned by a number of reasons, e.g. too shallow and tidal waters, etc. However, the sudden turnaround in 1939 is interesting as it came simultaneously with the commencement of WWII. Since the 1st of September, huge naval forces and supply ships stayed or navigated close to Helgoland. For a couple of weeks, mine laying flotillas paved huge areas with sea mines. Helgoland roadsteads had become start- and return point for many naval missions. September suddenly showed a 1°C higher deviation than during 60 pervious years, with a record extreme decline during October 1939 and lower than usual average from thereon. If these data tell anything, they confirm that there is a link between naval activities and diminishing heat capacity of North and Baltic Sea, earlier and more lasting than one would usually expect. This means the cooling of seas and attracting arctic air flowing in. Early sea icing and prolonged ice duration are other evidential points which establish a connection between naval war and weather formation.

25 Goedecke, Erich; ‚Das Verhalten der Oberflächentemperatur in der Deutschen Bucht während der Jahre 1872 – 1950 und der Zusammenhang mit dem nordwest-europäischen Meere', in: Berichte der Deutschen Wissenschaftlichen Kommission für Meeresforschung, Bd.XIII, November 1952, pp.1-31, & Juli 1954, pp.283-297.

26 Temperature increase from 1915 – 1920 is a strong indication for high naval activities during World War One.

Sea Icing winter 1939/40

Icing along the Danish, German and Finnish coasts started early and sea ice conditions lasted longer than in dozens of previous years. For example, in December 1938, ice formation started early due to a sudden cold spell, but it lasted only for two to three weeks. The winter of 1938/39 is listed as a quite moderate one, in fact, the warmest for decades. Circumstantial evidences throwing light to the war winter of 1939/40 are manifold and include the following facts concerning sea ice:

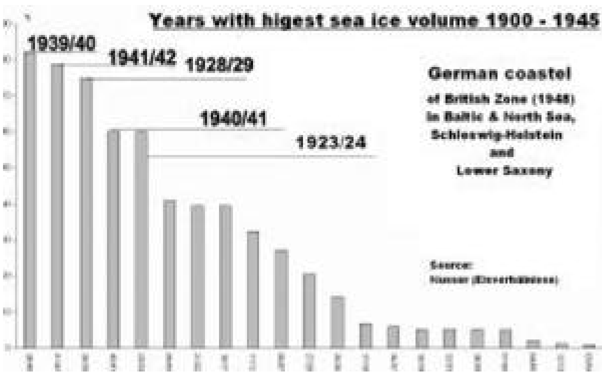
- suddenness with which icing started;
- early start and longer persistence of ice;
- severity of icing;
- long duration of the icy period caused by two cold waves, one in January and another one in February 1940.

However, icing had different features in different places. This applies particularly to coastal areas at Germany's North Sea coast on one hand, and Southern Baltic Sea on the other, where the most intensive naval activities took place. This will be outlined in two of the following items. But first we will give a brief description of the Danish and Swedes water circumstances and a final picture will emerge from Northern Baltic Sea where raging Winter War between Russia and Finland left its marks on sea icing.

Denmark – Sweden

First ice was reported around mid December, which increased soon in the inner and closed waters and later on outside this area. The number of ice days had generally been large, a maximum of 115 days. While 34 stations reported more than 100 days, 99 stations reported 75-100 days. Last ice was reported in the Sounds, on the 19th of April 1940. Due to an early start of the winter, there were the severest ice conditions on sea for many decades. The lowest temperatures recorded were in December –22.2°C, in January –24.3°C, in February –27.4°C, and in March –22.0°C. Ships were to be convoyed and accompanied by icebreakers through the Kattegat East-channel if the supplies were to reach Copenhagen. These proceedings were not accomplished without damages to ships convoyed, as well as to accompanying icebreakers.[27] The coldest month in Copenhagen, viz. February, usually has a mean temperature of 0°C.

North Sea – Helgoland Bight



Icing and ice floats emerged on river Elbe on the 16th of December 1939. In Hamburg, about 100 kilometres of river upstream from Helgoland Bight, at a mere 80 km distance from the Baltic Sea, there had been constant temperatures of sub-zero degrees Celsius since the 8th of December. Icing intensified massively since the 26th of December and extreme ice conditions maintained for 90 days, until mid-March 1940.

First ice at Helgoland Bight occurred on the 17th of December, in Tönningen, at a distance of about 80 km from Helgoland, and was immediately followed by all other German North Sea stations south of Tönningen, until the 21st of December. Only at the most northern

27 Det Danske Meteorologicial Institute; 'Is- og Besejlingsforholdene i de danske Farvande in Vinteren 1939-40', Kobenhavn.

station of the island of Sylt[28], icing started about 2 weeks later, a clear indication that deeper waters in more northern parts of North Sea had more heat reserves than shallow southern sea areas, which also saw much more naval activities. In the latter case, ice stayed for 60 to 70 days (until the end of February), in the Elbe river delta for 70 to 102 days, at Tönningen for 100 days, and at north of Tönningen for 60 days, from early January until early March.

Southern Baltic Sea

Conditions for building up the ice differed in three ways from the average of previous years.

1) Even though ice started to form in the very North of Scandinavia very early, solid sea ice developed at usual time.
2) Ice formation started at first in the southern Baltic Sea as early as mid-December 1939, and
3) full icing in the Gulf of Finland started only with the cold wave of the 14 –24th of January 1940.

These events should not have come so much as a surprise if naval activities since the 1st of September 1939 are considered:

A) German Navy ambushed Polish coastal positions with intensive shelling in eastern Baltic during September 1939.
B) Germans laid a number of mine fields particularly at the south of Danish waters, with several thousands of sea mines. Denmark also laid sea mines.
C) German Navy patrolled Western Baltic Sea intensively day and night. Danish and Swedish Navies were more active in coastal waters than during peacetime.
D) German Navy trained all their crews, developed weapons and tested them in this water.
E) Since defeat and occupation of Poland in the end of September 1939, navigation and transportation increased many times.

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28 Only ca. 80 km north of Tönningen (near Husum), respectively 120 km north of Helgoland island

In the South, at Greifswald Bodden (an open bight SE of the island of Rügen), icing started on the 18th of December 1939. Solid ice remained in place without interruption until the 4th of April 1940. Last ice disappeared on the 11th of April 1940.

Western Baltic, presumably including Bornholm, was temporarily ice-covered. We cannot provide a complete picture of southern coast from Lübeck to Königsberg (Kaliningrad) as it is claimed that German surveillance data have been lost. Here are some individual data instead:

The 19th of December 1939: ice reported in Kiel Channel (from Elbe to Kiel), Lübeck and Travemünde, remained there for three months.

The 20th of December 1939: first ice from Stralsund to Palmerort. Since the 1st of January 1940, solid ice continued until early April.

The 21st of December 1939: ice reported in Schlei (north of Kiel) was to stay until the 31st of March 1940.

The 28th of December 1939: ice which was reported in Flensburg (at Danish border) lasted till the 28th of March 1940.

Sweden

Swedish ice expert C.J. Östman[29] summarized his detailed report on Baltic Sea ice conditions in 1940 as it follows (excerpts):

> *"A survey was conducted on ice covering the Swedish coast during the particularly cold winter of 1939/40. As regards the thickness of ice, it was generally greater than usual. Thus the values vary between 75-95 centimetres in the harbours of the Gulf and Sea of Bothnia while the normal is of about 70-75 cm. In the harbours of the Baltic, with the exception of the*

29 Östman, C.J.; 'Den svara isvintern 1939/40', Statens Met-Hydro. Anst., Meddelanden Ser. Uppsatzer, No.33, Stockholm 1940, pp. 1-25

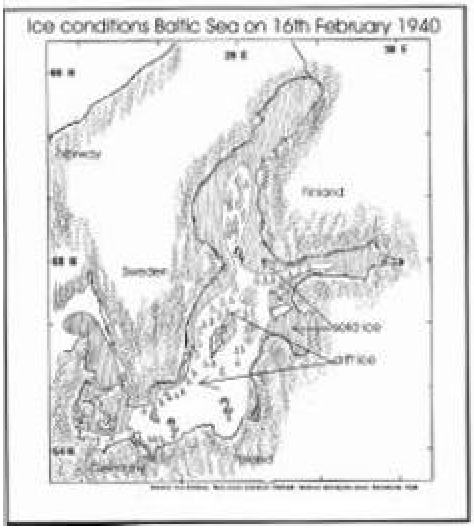
most southerly ones, the thickness was of 30-60 cm compared to the normal of 25-35 cm. The value of 40-60 cm at the Swedish west coast is about two times the normal value."

Northern Baltic Sea[30]

The waters around Finland had not seen as much ice as in the war winter of 1939/40 since 1883. And from the 30th of November the region was especially affected by the most devastating winter war ever carried out under the Arctic Circle, where the sun never shines for many weeks. On land, the Russian Red Army attacked with more than 300,000 men on a front of one thousand kilometres. At sea, the Russian Baltic Fleet attacked Finnish shore batteries on islands and coastal points with big shells. Submarines operated in the Gulf of Finland and the Gulf of Bothnia, and laid many thousands of sea mines. Finish Navy was small but still operational. Due to high naval activities, the picture of icing seems to be unclear, which is not the case. It actually confirms that naval activities influenced substantially sea-icing processes.

Just to remind, sea ice formation started first in the southern Baltic. In Hanko/Finland (at the western entrance in the Gulf of Finland), icing started on the 27th of December 1939; solid ice formed on the 4th of January 1940; end of ice came on the 7th of May 1940, at almost the same time as in Helsinki. However, on the 15th of January 1940, the Gulf of Finland was still open as far as Pellinki. The Gulf of Bothnia was also open in most of its parts. Ice then formed rapidly although the Gulf of Bothnia is far in the North and has a depth of over 200 metres – in the Baltic Sea area the deepest water – holding considerable heat for a long period even during cold winters. An 'ice-bridge' between Turku and the island of Åland (maximum depth of 30 m) formed on the 6-7th of January 1940, about 2 ½ weeks earlier than usual.

30 For data details in section consult item 2_17 on: www.seaclimate.com



There is no other valid explanation for any deviation in ice formation from earlier averages than the war activities at sea. Most of the factors relevant to the Baltic Sea phenomena are the long open sea areas in the Gulf of Finland, a clear indication that, due to military activities, a high mixing of water took place and delayed ice formation. On the other hand, early formation of the 'Turku-Åland ice bridge' showed that the water of that area had already cooled down enough to freeze; in this case, more than two weeks earlier than in a place like Hanko, less than 100 km away.

Some further ice forming data, chronologically:

Mid-October 1939: some lakes and rivers froze in Northern and middle of Norrland/Sweden, as well as in the NW of Svealand (Middle Sweden), which usually happens only towards the end of the month.

The 8th of December 1939: navigation was closed at Kalix, a Northern port in the Gulf of Bothnia.

The 11th of December 1939: navigation was closed at Oulu. Last vessel sailed on the 7th of December.

The 19th of December 1939: navigation was closed in several ports in the Gulf of Bothnia, except for those which had icebreaker assistance until the end of December or middle of January.

The 9th of January 1940: heavy ice in Riga – navigation possible for powerful steamers only.

The 13th of January 1940: Gulf of Bothnia. A minesweeper and two patrol boats dropped depth bombs in an attempt to cripple a Russian submarine, which had trailed a small Finnish steamer, *Bore*, through the international waters of the Gulf of Bothnia. (NYT, the 14th of January 1940)

The 15th of January 1940: the Finnish ice expert Erkki Palosuo made the following meteorological assessment[31]: "By the 15th of January, the atmospheric pressure in Greenland had reached a remarkably high level, 1,065mb. As a low pressure of 995mb simultaneously prevailed in Central Russia, very cold air began to flow westward at high speed from the northern side of this low pressure and a very severe frosty period began in the region of the Baltic. The outbreak of cold air resulted in an independent 'cold air plug' (Kaltluftpfropfen) in Germany, which persisted in the area for nearly a week. On the 24th of January, the cold air plug in the German area began to move towards the Baltic region from where, reinforced, it pushed back to German territory on the 7th of February. On the 12th of February, its centre was in the region of Hamburg from where, moving slowly, it arrived in East Germany around the 20th of February." This assessment is a convincing explanation for the severely 'under cooled' North and Baltic Sea, particularly Helgoland Bight and Southern Baltic Sea. On the 12th and 13th of February, temperatures in Hamburg were down to – 29°C. Hamburg thus became an arctic cold centre.

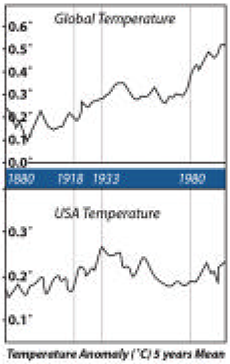
Chapter summary

While the previous chapter described the severity of war winter 1939/40 on one hand, and the naval activities during four pre-war months on the other, this chapter attempted to link anthropogenic

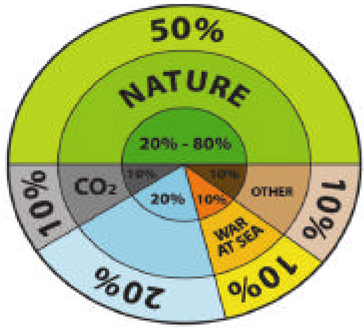
31 Palosuo, Erkki; ‚A Treatise on severe ice conditions in the central Baltic', Fennia 77 No.1, Helsinki 1953, p.92.

causes with corresponding reactions in regional environment. As navies churned huge sea areas about, the evaporation of the seas increased and eventually changed the prevailing winds, declined the movement of the Atlantic depression on common routes and caused record deviations of the sea water temperatures. At least in one case, the build-up of sea ice conditions in the North and Baltic Seas demonstrates several aspects of the naval war and of its implication in environmental issues.

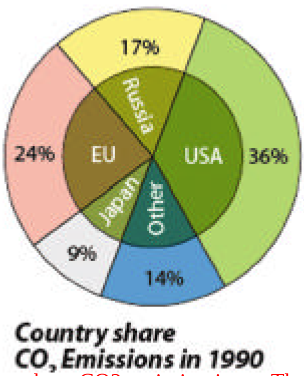
The events presented above are not mere incidents. Why were North and Central Europe affected and why Hamburg became a 'cold air plug'? This city is closely placed between two seas that were most heavily churned during the pre-winter months. Why Southern Europe, Switzerland and the Mediterranean region were not dragged into cold sphere? Why excessive rain occurred along a busy war front between France and Germany while the regions with heavy naval activities only four hundred kilometres further north, from Helgoland to Königsberg, saw less rain than usual? Why sea-icing started more powerfully in the coastal waters of Germany than in an area 1,000 km farther north in Finish waters? All questions could be convincingly explained as being the result of sudden naval activities at sea.



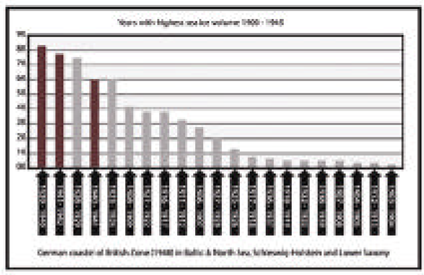
An interesting comparison between global and USA temperature trend, in USA a decrease cam in 1933 (see 'Greening of Greenland, page) , while the overall trend change in war winter 1939/40



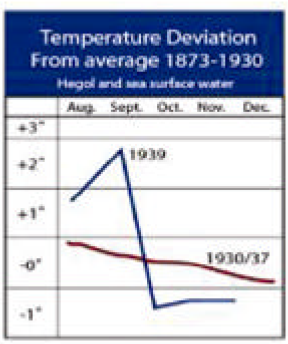
The graph is about contribution to global warming, to which nature is contributing 55%, shipping and other ocean uses 20%, while CO2, Naval War, and 'other' effects (cities, roads, deforestation etc) contribute each about 10%, as estimated by the author..



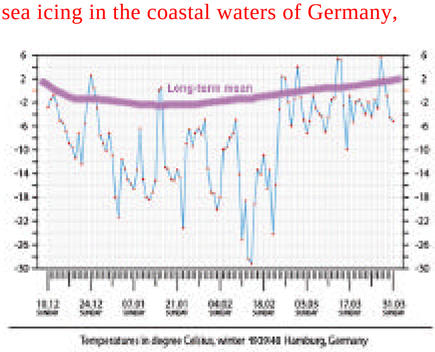
Country share CO2 emission in 1999



The impact of naval warfare is well demonstrated by the sudden extreme sea icing in the coastal waters of Germany,



Naval activities in the German Bight in autumn 1939 result in the pick in September and subsequent rapid cooling, B/W p.105



The winter temperatures in Hamburg are usually around +/- zero, while the graph shows, that during winter 1939/40 (10 Dec. to 31 March) the naval war pushed temperatures to record lows.