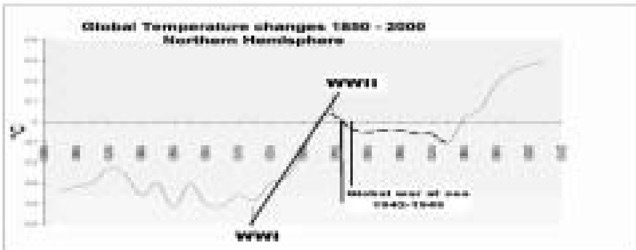
Ocean System affected (4_12)

Oceans as a theme



It is true that the North Atlantic has a huge heat storage and a circulation system that sustains human life in the Northern Hemisphere. It is even truer that this water body is extremely variable and will never repeat itself. But the most reliable fact is that this system will survive, even the next Ice Age.

If an ocean has so much 'potential', the question is: Can a war at sea influence the natural course of an ocean structural system? The answer is clear! A war at sea can indeed influence the course by multiple means. Actually, manipulating the ocean system would possibly be one of the easiest and most sufficient ways of changing the course of the climate. This option is fully reflected in the definition this investigation is based on: 'Climate is the continuation of the ocean by other means'. Once the original (the seas) is changed, the copy (the atmosphere) will reflect those changes[1&2]. For this reason it seems better to analyse the factors, which would indicate the change of ocean dynamics, viz. means, forces, location, time, and the period of time.

World War One (WWI) and the Northern North Atlantic

Nobody has seriously undertaken to study the subject until now. Unfortunately, during two world wars in the last century, parties to war had unknowingly put the matter to test without any idea that extensive war at sea activities could change the course of climate. With regard to the sudden warming at Spitsbergen in 1918 (A), and subsequently in the North Atlantic rim with staggered time periods in Greenland, Iceland and Europe, it has been proved that there was only the war at sea around Britain to blame immediately before the climatic change occurred in 1918.

This sudden increase in temperature remained stable at a number of locations, and in the whole of Europe for two decades, which is an important point of evidence to support the thesis about the relationship between war at sea activities and the change in climate. Huge warm water masses must have

---

[1] Bernaerts, Nature [2] Bernaerts, Climate 1992, p.23f

reached the Northern Atlantic and remained there, particularly in the depths of the Norwegian and Greenland Sea, by supplying warmer water to Greenland in the early 1920s, resulting in the emergence of the Dust Bowl in 1931, which ensured the warming of Europe until the commencement of WWII. (B)

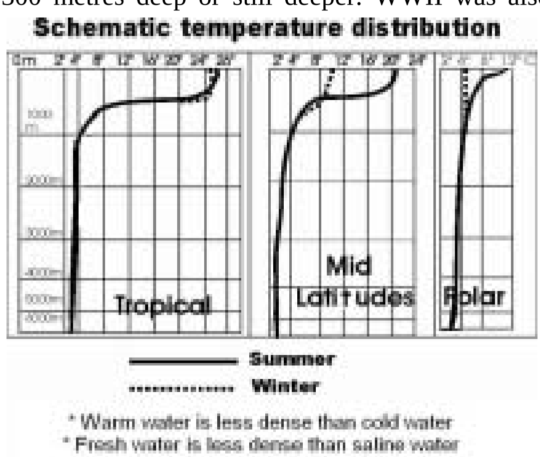
> Further details: (A) Spitsbergen warming, 5_12; (B) Greening of Greenland, 5_15.

World War Two (WWII) and the Ocean System in the Northern Hemisphere

Providing a similar chain of circumstantial evidence in respect of WWII is difficult, much more difficult than in respect of WWI. As Kelly et. al.[3] observed some time ago (1982): “There is some evidence that the pattern of Arctic cooling that occurred after 1940 was more complex than the warming that affected the whole Arctic during the 1920s and 1930s”.

This ‘higher complexity’ is not due to less intensity in fighting, or that there had been a ‘smaller experiment’ during 1939-1945 than during 1914-1918. But ironically WWII was a much bigger calibre event than WWI. WWII was on a much higher platform with respect to the deployment of ‘destructive forces’. The forces unleashed were more severe than 20 years earlier. During WWII all parts of the North Atlantic and the East Pacific became battlefields. All corners of the seas had seen severe war at sea actions.

The WWII war machinery could directly penetrate lower sea levels never reached before, viz. 200-300 metres deep or still deeper. WWII was also fought in the most climate-sensitive parts of the Northern Oceans, the Aleutian and in the triangle: Greenland, Norwegian and Barents Sea. More than 100,000 sea mines had been moored across the North Atlantic from Faroe Island to Iceland and to Greenland. On the Atlantic convoy routes between 300,000 to 1 million depth charges



[3] Kelly

could have been dropped on submarines, and many hundred thousands of bombs, torpedoes, or shells, and ships and air planes sank to the sea bottom.

Two-and-a-half years of war at sea in European waters from 1939 to 1942, were followed by the global war at sea from 1942 to1945. The Northern Pacific had suffered in the war, but the USA managed to keep the eastern part of the North Pacific (east of Hawaii) 'battle free'. An 'impact report' of the war in the Atlantic and the Pacific is given in the previous chapter: Oceans at war.

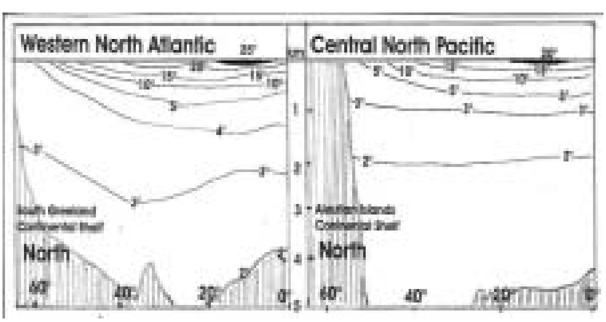
Under these circumstances it would be unpardonable to exclude WWII from being the prime cause for the climate change from winter 1939/40 to the end of WWII and also for the cold period until the late 1970s. As explained elsewhere, the immediate result of WWII covers two phases:

- The time from September 1, 1939 until the third war winter of 1941/42, when the war at sea turned global after the Pearl Harbour attack on December 7, 1941.
- The war period from early 1942 until the armistices with Germany and Japan in 1945.

Although WWII came to an end in 1945, the climate remained cooler than before the war and remained so until the end of the 1970s.

The immediate impact of the war at sea since 1942, when it went global, until 1945 will be discussed in this paper under following sections:

- o Some oceanographic features of the North Atlantic
- o Some oceanographic features of the Northern Pacific
- o Different impacts of WWI and WWII
- o 'Global Warming' or 'Cooling': is this an oceanic question?

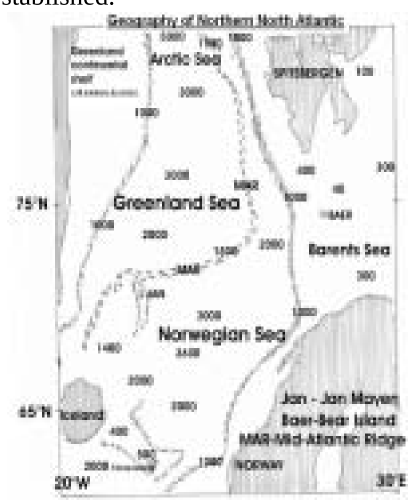


In a later chapter (Climatic shifts) the short- and long-term impact of WWII during the three phases, viz. 1939/42, 1942-1945, and particularly 1945-1980, including the extreme winter in Northern Europe in 1946/47, will be elaborately discussed. But the assessment of the long-term impact of WWII does not stop with the end of the cold period in the 1970s, but raises such questions as: Is it not possible that the impact of the war at sea on the oceans is still reflected in the increased warming since the 1980s? Is the world's day-by-day treatment of the seas over the past 150 years not the most relevant source of warming of the global climate? Therefore, the concluding remarks will be made on the warming trend since the middle of the 19th century by discussing which conclusions should be drawn from the two 'shifts' caused by two wars at sea in the 20th century, and what role the oceans played with regard to the warming since the 1980s until today.

Some Features of the North Atlantic

The Atlantic since 1942

Roger Pocklington[4] summarized the North Atlantic conditions after WWII in 1972 as follows:
"Over the last 2 decades it has become apparent that the worldwide warming of the climate observed since the turn of the century has been reversed, particularly in the North Temperate zone. A steep decline in sea and air temperatures in the Canadian Maritime provinces and New England, a quasi-linear decline in mean winter air temperature from the high Arctic to north Iceland with active ice formation off that coast, a delay in the initiation and development of the spring plankton bloom in the Norwegian Sea, and other changes have been observed. A cooling trend in sea surface temperatures as measured at nine North Atlantic Ocean weather stations has been established."



Kelly[5] states that the Northern Hemisphere warmed from 1880 to 1940 by 0.7°C and then fell to 0.2°C by the 1960s, whereby the low and middle latitude underwent a cooling during the period 1951-1975, the higher latitude cooled until the mid-1960s after which a slight warming occurred.
"The cooling which began ca. 1940 was delayed in spring and autumn until the mid-1950s, and occurred very abruptly in winters during the mid-1940s."
"The cooling after the 1940s has been more complex (as the 1920s warming) affecting different regions, particularly the western and eastern hemisphere, at different times."

[4] Pocklington [5] Kelly

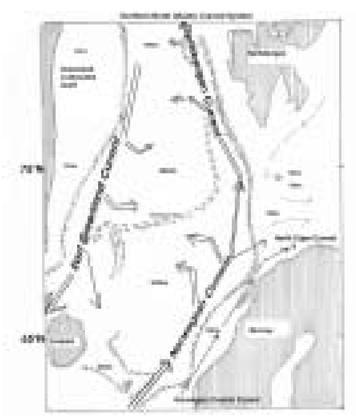
The authors C.K. Folland et al.[6] writing in 1992 concerning ‘Deep Ocean Heat Storage’ provided the following explanation:

> “A possible cause of the cooling trend in the Northern Hemisphere between the 1940s and the 1960s relates to a change in the ocean circulation in the North Atlantic which temporarily took more heat from the atmosphere into the deep ocean”.

This paper considers a different scenario as the cause. The cooling was related to interior processes within the North Atlantic water bodies sustaining cooler water in the upper levels for a number of years after WWII.

Two water basins and two water bodies

It has been known for a long time that only the northern arm of the Gulf current prevents the Northern Hemisphere from being covered by ice mountains, due to the thermal potential and the current circulation system within the huge water body between Greenland, Iceland, Scotland and Norway, and due to the capacity of the Arctic Basin to ‘consume’ a permanent inflow of water. Temperature and salinity differences within the sea water body are the principal internal forces setting the system in motion, while external forces (solar radiation, wind, rain, ice, rivers, etc) may only have an immediate direct effect on the upper sea surface layer. These two factors determine the density of water, e.g. more dense water sinks; thus the water at the bottom is the densest.



What matters in the first place is the thermocline structure. Practically all physical processes occurring in the sea have an effect on thermocline characteristics[7]. The seasonal characteristic is the most pronounced. In the northern North Sea (Aberdeen) the difference is 6-7°C between summer and winter in the surface layer at 40 metres depth and about half that figure in the North Atlantic. However, below these layers the water is only remotely affected seasonally. For a water column to be stable, its density must increase downwards.

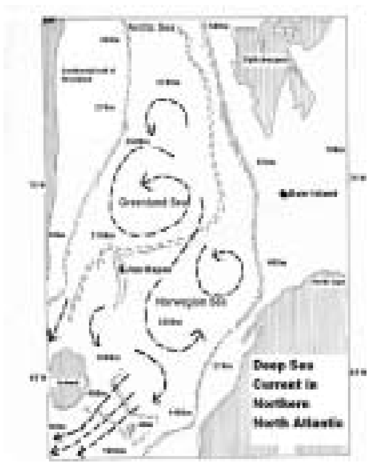
According to its profile, the ocean can be divided into three layers:

(a) upper, wind-mixed zone;
(b) thermocline (beginning at 100 metres up to 1000 metres); and

---

[6] Folland, Observed, p.165. [7] Parker, p.495

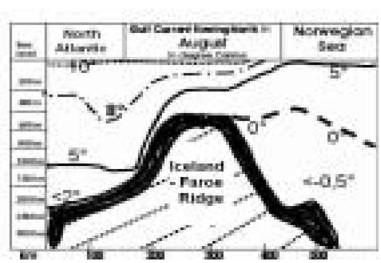
(c) uniformly deep region (lower than about 1,000 metres), with uniform temperatures and salinity.



The Norwegian and Greenland Seas are the major source regions of water below the thermocline in the northern hemisphere. Water from these seas sinks and flows southwards, mixing with overlying waters from the North Atlantic Deep water (2°C with a salinity of 34.95 per mille).

Any process influencing the decrease in the salt content of the northern Atlantic surface waters (increased precipitation, decreased evaporation, or ice-sheet, iceberg and sea ice melting) would act to decrease the conveyor-belt circulation system and thus the flow of ocean heat towards the pole[8].

Middle and Northern North Atlantic



Actually, these parts of the oceans are very different and have separate systems, interconnected by three principal ‘gates’, one for incoming water, two for outgoing water. The inflow of Atlantic Gulf Current water into the Norwegian Sea takes place mainly through a small channel between Scotland and Faroe Island. The inflow is about 3 million cubic metres per second. As the inflowing water has a high salinity, it is denser and tends to sink the cooler it gets[9]. The Faroe Bank Channel has a minimum sill depth of 800 metres and that is the deepest known passage through the Greenland-Scotland ridge by approximately 200 metres[10].

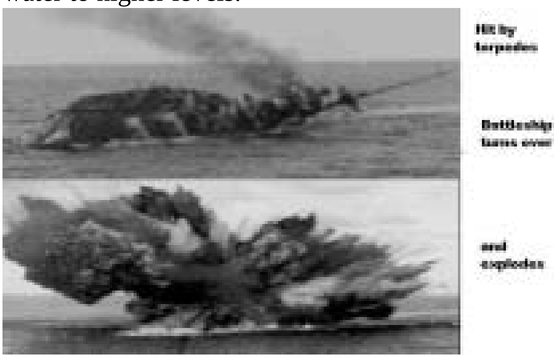
The main outflow back to the Atlantic is through the Denmark Straits, west of Iceland. The third gate is not actually a gate but more a ‘spill over’ along the Iceland - Faroe ridge. Very deep cold water from the Norwegian Sea travels southwards, as far as 50° South[11].

A very substantial part of the Gulf Current water which has passed Faroe Island, continues as Norwegian Current flowing northwards to the Arctic. A

[8] Lehman [9] Sverdrup, p 174 [10] Crease
[11] Kennish, p.102

part of the water continues to flow to the Arctic Sea; a smaller part to the Barents Sea and another part of the water turns west to circle the Greenland Sea.

Here in the northern North Atlantic water can stay in the surface layer or the thermocline (100 – 1000 metres depth) region for many years or decades or go down to the deep basin, forcing, for example, less dense or less colder water to higher levels.



A war at sea can interfere with the above-mentioned 'natural process' innumerable times every day. A sinking ship, a submerged U-boat, an exploding depth charge, etc. can change the temperature and salinity composition of the water, sometimes only to depths of a few metres, sometimes over 200 metres and sometimes over 2,000 metres. A sunken ship may release thousands of tons of cargo into the sea at depths of 50, 1000 metres or even deeper below sea surface.

But it is not only this 'stirring and mixing' by events mentioned above that may change a certain part of the sea body, but it could initiate a 'turbulent process' that would increase the mixing. It may happen every time when the 'equilibrium' between temperature and salinity is no longer 'tuned'. A new equilibrium must be found. This might occur in rotary motions, just like a tornado (eddies or gyres), that can move water masses further up or further down.

What could a sea body, with regard to temperatures and salinity structures look like after a convoy such as SC 118 consisting of 64 slow vessels had finished its Atlantic crossing? The convoy covering a wide area of over fifty square-miles had a very large fleet of escort vessels after two more US destroyers and a coastguard cutter had joined somewhere south of Greenland in heavy sea on 5 February 1943. From 60 submarines in the area, 16 were sent to form a trap. It became a feast for the hunter but a nightmare for the hunted. Thirteen ships were sunk by torpedoes; followed by three depth-charged submarines[12].

[12] Slader, p 150

Two weeks later, westbound convoy ONS 166 consisted of sixty-three vessels and six escort vessels. Hampered by constant northwest gales, the convoy gained only 4 knots (ca. 8 km/h) over four days, upon which a five days battle commenced which covered over 1,000 miles of ocean. In the course of this battle 14 vessels were sunk. One long distance airplane sank U-623. At that time these airplanes (VLR Liberator) were able to stay in the air for half a day and to search and attack submarines for hours.

With regard to the Norwegian Sea the Arctic convoys between Britain and Murmansk, frequently under attack by the Reichsmarine and Luftwaffe, must have brought considerable disturbance to this sensitive area of the sea. One disastrous event was the destruction of 13 vessels within 24 hours by more than 150 German bomber airplanes and a number of submarines on July 5/6, 1942[13]. An overview of the convoy operations, together with further information concerning the battles unleashed in the seas, has been given in the previous chapter.

While considering this aspect it can hardly go unnoticed, that the oceans from the Arctic Circle down to the equator had never been stirred and turned upside-down to the same extent as during WWII and particularly since the war at sea went global in December 1941.

Arctic

Some meteorological events in brief:

<u>*Arctic*</u> According to Lamb[14], the geography of surface temperature changes continued to show the greatest cooling from the 1940 level in the Arctic (Lamb provides a list of the number of warmer and colder months north of 70°N during the 1950s to 1970s in Table 18.8/9).

---

[13] Schofield, p.58 [14] Lamb, p.531 [15] Jones, Surface

Arctic According to Jones et al[15] the early 1940s were notably cold over the Greenland Sea and northwest Europe in winter although longer term cooling in winter did not affect the Greenland sector until later. 1943, 1944 and 1947 were notably warm years in the Arctic.

Arctic Jones at al[16]:

- By the 1960s, the Arctic as a whole had cooled by ca. 0.85°C since the 1930s. The coldness of the 1960s was pronounced in the Kara Sea region.
- In the 1970s the warming began to affect the Arctic during the first half of this decade, particularly in the Barents Sea and Kara Sea region.

Spitsbergen; Hesselberg[17]: The mean temperatures recorded at Isfjord from 1912 to around 1955 show that the mean temperature did not 'jump' during WWII as it had done twenty years earlier. Actually, after a 'down time' during the winter 1939 – 1945, the mean varied on a 'neutral' basis.

Barents Sea Lamb[18] reproduces data from Rodewald (1972) showing that at Franz Josephs Land (80°N, 53°E) a deep fall in temperatures occurred in 1950 by over 5°C in one decade after the mean temperatures had varied between -10°C and - 11°C between 1936 and 1950.

Kola peninsula The highest water temperature in the top 200m of the Barents Sea at 70-72°N, 33°E north of the Kola peninsula, appeared to have been reached already in the 1935-39 period and despite a secondary maximum about 1951-55 had fallen by 0.5°C in 1960[19].

Winter icing in the Northern Atlantic 1939-45

The extent of winter icing in the Northern Atlantic may sometimes hold a clue as to what 'the climate is doing'. With regard to the war period this seems difficult, if not impossible. The long-term situation was summarised by Nusser[20], in the 1950s as follows:

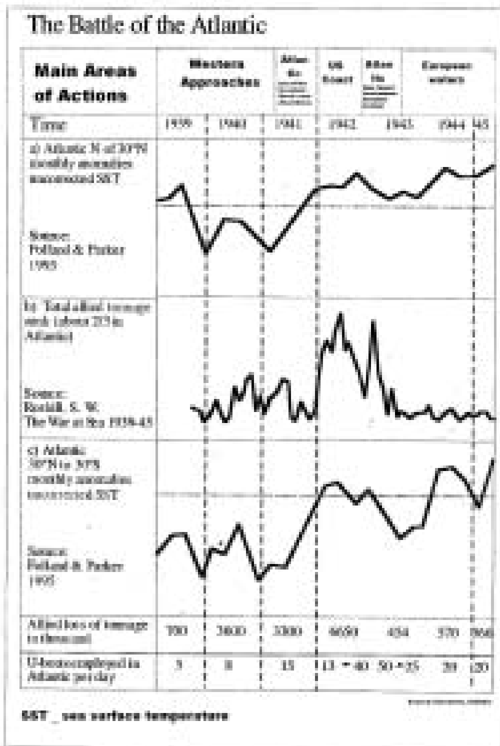
> "In the 1890s and around the turn of the century Jan Mayen island was surrounded by ice each winter and spring. Now it lies at the extreme edge of the ice, due to the general withdrawal of ice. For instance, in 1930 only in March did the ice come to 20 miles off Jan Mayen. However, ice-free years are succeeded in turn by years rich with ice, as for instance, the year 1942 when the isle was surrounded

---

[16] Jones, Surface
[17] Hesselberg, p.23, Fig. 2
[18] Lamb, p.532
[19] Lamb, p.528
[20] Nusser, Arctic
[21] Personal Communication

> by ice almost continuously from the beginning of March till the middle of July".

Actually, the ice situation remained during the whole war period almost on par with pre-war conditions obtaining in 1939, extending the spread only slightly further out in the Northern Atlantic, never circling Spitsbergen in full[21].



This paper does not propose to discuss this matter any further, although it assumes that a detailed analysis of the ice conditions from 1939-1945 and later on could provide a few clues as to how the Northern Atlantic 'reacted' to the war. Particularly the Arctic convoys during the winter accompanied with numerous military activities could have prevented the sea surface layer from freezing by 'stirring and shaking' the sea. According to Jones et.al.[22]: "The Northern Hemisphere warming peaked in the late 1930s in annual, spring, summer and autumn values. The fact that in winter, the warming continued into the mid 1940s", would underline the thesis, that the war at sea forced the seas further in the north to 'steam more' during the war winters. After all, during the Arctic Convoy operations, while the Germans lost about 35 naval vessels, a battleship, a cruiser and three destroyers, 30 submarines and a number of airplanes, the loss on the Allied side had been 21 naval vessels (Cruiser, destroyers, etc.). The Russian Northern Fleet lost some 20 submarines operating along the coast[23]. Of 715 merchantmen sailing in escorted convoys, only 27 ships had been lost while the total loss on the Artic route was 100 transport vessels.

[22] Jones, Surface [23] Schofield, p.150f [24] Lamb, p.516

However, it seems remarkable that the annual reach of ice was restrained. This can be regarded as proof that WWII had not reversed the warming trend that had started at Spitsbergen in 1918. It could even mean that, as in 1918, the Norwegian Sea received another push for a 'little warming up' (see next section Rodewald).

A complete picture of the variations in the extent of Arctic sea ice at the end of the winter and summer, during the period from 1901 to 1955, is given by Lamb[24].

Sea surface temperature observation – North Atlantic

Sea surface temperatures (SST) on record are a helpful tool in research, but difficult to handle for a number of reasons[25]. To name only two: (1) the fact that for a long period of time most of the data had been collected by merchant ships during their voyages and (2) available data is extremely limited considering the relationship of the oceans and the climate system. The SST data collected especially during war time must be treated with particular care[26]. This paper will therefore refer briefly to a few scientific opinions as how to interpret SST data relating to the North Atlantic after WWII. The references are only selective and not necessarily complete.

Goudie[27] assessed about 1977: Water temperatures over most of the North Atlantic north of 40° have shown some decline in recent years, with sharp falls up to 2.5°C in the 1950s in the west Atlantic between 40° and 60°N.

Rodewald[28]; Information provided by Rodewald on those SST data taken by ocean weather stations from 1951 to1960. They are possibly the most reliable data during that period of time. The general trend at these stations has been as follows:

[25] Bernaerts, Atlantic [26] Bernaerts, Pacific [27] Goudie, p.146
[28] Rodewald, Sea-surface

	Sea Area (at station, e.g. M, A)	Major trend 1951-60	10-year means	Average
M	Norwegian Sea	Increase until 1955, total + 0,5°C	8.3°C	7.7°C
A	Iceland/Greenland	Increase since 1955	7.1°C	6.7°C
B	Greenland/Newfoundland	Decrease since 1955	5.2 °C	4.8°C
C	Atlantic West (ca. 52N)	Steady decrease	9.0°C	9.4°C
D	Atlantic West (ca. 45N)	Strong decrease	17.3°C	16.6°
E	Atlantic West (ca. 35N)	Decrease until 1957	21.7°C	21.5°
I	Atlantic East (ca. 60N)	Increase since 1954	10.7°C	9.9°C
J	Atlantic East (ca. 45N)	Increase until 1957	12.5°C	12.1°
K	Atlantic East (ca. 35N)	Nearly steady	15.3°C	14.9°

Comment: It seems particularly worth noting that Station 'M' in the Norwegian Sea does not show downward temperatures, thus indicating that the major trend since 1918 was in principle not reversed.
On the other hand, sub polar North Atlantic showed a predominantly negative trend that could be regarded as supporting the 'war at sea' thesis. Unfortunately, the first series starts six years after WWII had ended.

Destroyer burning and sinking

Lamb[29]: He mentions the sea water data record taken since 1867 at Faeroe Islands stating: "The warmest water was observed between 1940 and 1957, the peak being in 1951 (average 8.9°C)".

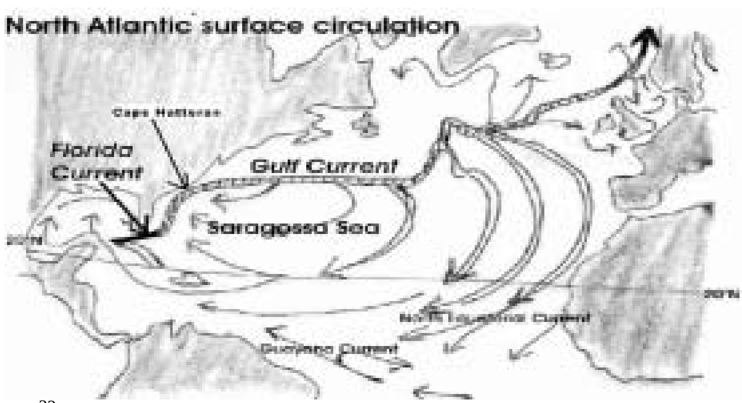
Comment: This can only mean, that the sea south and north of the island was 'normal', and obviously disconnected from the continental weather, whereby the high values in the 1940s could be seen as resulting from 'stir and mix' processes. The indicated circumstances are a substantial support for the sea war thesis.

29 Lamb, p.508

Extract from „Climate Change & Naval War – A Scientific Assesment 2005
Trafford on demand publishing, Canada/UK © Arnd Bernaerts

Lee[30]: In 1949 south of Bear Island arctic water moved to the south-west over denser Atlantic water, giving rise to an area with marked temperature inversion to the south and west of Bear Island. (Note: The text shall only indicate what is 'happening up there', i.e. how an interaction between Eastern North Atlantic and Barents Sea works).

Folland[31]: On a global basis the warmest decade for marine air temperatures is probably from 1940 to 1949 (anomaly 0.11°C) and the coldest from 1903 to1912 (anomaly –0.5°C).



Folland[32]: "The jump in the level of uncorrected SST anomalies around 1941 and the sudden decrease in the annual cycle of SST in extra tropical regions at the same time provides strong evidence that the chief cause for this was a change in observational practices such as the use of un-insulated buckets to engine intakes that was sudden in many, though not all, parts of the world."

Kushnir[33]:

- These new procedures of measuring SST led to an apparent "warming" in measured SST beginning at about 1940.
- The spatial distribution of North Atlantic inter-decadal SST variability also supports the hypothesis that changes in the large-scale oceanic circulation are involved.
- The unique association between the inter-decadal SST pattern and surface meteorological conditions suggests that the atmospheric circulation change may be the response to the change in SST.

---

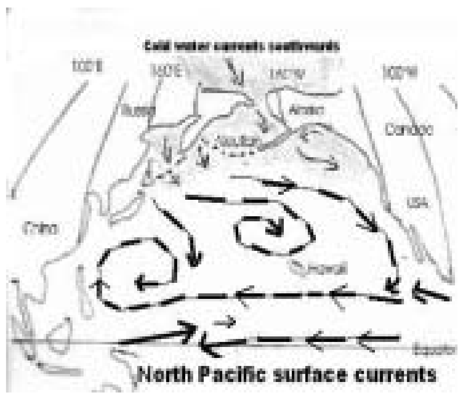
[30] Lee
[31] Folland, Worldwide, Figure 4b
[32] Folland, Corr. p.330
[33] Kushnir
[34] Deser, p.1752
[35] Smith

Deser[34]: It should be noted that the spatial pattern of cooling during the 1950s to 1960s was somewhat different from that of warming during the 1920s and 1930s.

Smith et.al.[35]: Based on sea-surface anomalies; large, significant cooling in the 40°N to 60°N band occurred at about 1903, 1913, and 1977.

Jones[36]:
Comparison between coastal land and marine air temperature data: Northern Hemisphere

1861-73	1874-89	1903-41	1942-45	1946-79
-0.35	-0.50	0.23	-0.49	-0.02



Barnett[37]: All data, however, suggest a multi-year climatic event did occur in the ocean-atmosphere system over much of the globe in the late 1930s till mid 1940s.

Bjerknes[38]: A ‘time series’, 1850-1960, given for the sea surface temperature south of Iceland indicates a small decrease by 0.5°C from 1945-55.

Hansen[39];

- In 1948 the North Atlantic was in a predominantly cold state, with cold anomaly features in both high and low latitudes.
- Maximum subsurface temperature anomalies led those at the surface for as much as 2 years.

Some features of the North Pacific

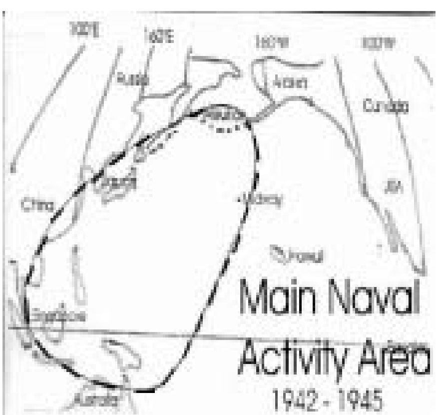
The Pacific Ocean is by area and volume the greatest and the deepest of all three oceans under study. Although the North Pacific is larger than the North Atlantic, the climatic relevance of the latter for the weather in the Arctic and the upper Northern Hemisphere is several times higher, due to the Atlantic Gulf Current of which a considerable part flows high to the north and into the

36 Jones, Global 37 Barnett, Surface 38 Bjerknes, Fluctuation, Fig.5
39 Hansen & Bezdek

Arctic Basin. In the Pacific big currents can only go as far north as the Aleutian Islands, that is 50° North, corresponding the latitude of Paris.

A speciality of the North Atlantic (north of the Greenland –Iceland-Scotland ridge) is that cold deep-water masses can form and 'stay' in the quasi semi-enclosed seas only in the Norwegian and Greenland Sea. A situation like the sudden warming at Spitsbergen in 1918, and this warming remaining stable for two decades would not be possible in the North Pacific. Here two major sub-polar gyres circle between the Equator and 40° North. The general temperature structure over the ocean depths is similar to the other seas, although the sea surface is cooler.

The impact of a war at sea in the North Pacific is primarily a matter of 'stirring'. As a short-term effect colder water would replace warmer surface water. Once heat is stored in the sea it can remain there for months, years, or decades. 'Energy' which has been forced into the depths between 1942 and 1945 could 'resurface' after 5, 50 or 100 years. While it is easy to force warm surface water into greater depths within a short time period, it will take much more time to get the heat out again of the water. Once warmer water is in 200, 500 or 1,000 metre depths, by sheer forcing or a current system, it may require many years or generations 'to get out of the store' again.



What actually happened in the interiors of the Pacific is not known. That the well-documented war at sea in the Pacific did not leave any impact on the temperature and salinity structure at innumerable 'places', and at all sea levels, seems to be almost impossible to believe. In so far it is useful to note that the sea surface temperatures were low from 1945 to 1977 (Source:www.pmel.noaa.gov/).
The wartime data are quite high (ditto). While sea surface temperatures had been taken during war time, due consideration should be given to WWII conditions before applying them[40].

[40] Bernaerts, Pacific, p.249

This investigation can only attempt to draw attention to events that, in some way, must have had an impact on the temperature and salinity composition of huge sea water areas, from the surface to considerable depths. For the moment one brief example may provide an impression on what could have happened in one corner of the Pacific.

The Pacific's Northern Front – Aleutian Islands

In June 1942 the Japanese invaded the Aleutian Islands Attu (1,900 km west of Alaska) and Kiska (ca. 1,200 km west of Alaska), belonging to a string of approximately 120 volcano islands between the Bering's Sea and the Pacific stretching from Alaska to Siberia. The seas lying immediately north and south of the islands are deeper than 1,000 metres. Warm water currents from the south and cold Siberian air ensure an unpredictable mix of terrible storms, or a permanently cold weather, with damp fog, or snow, or icy rain, with hardly more than 10 to 14 clear days per year.
In this weather sensitive sea area a 3 ½ year battle at sea, on land, and from the air took place. The war theatre in the high North Pacific was only on the side-line of what took place elsewhere in the Pacific. Hutchison[41] lists in his Fact Book about 2,000 events, not necessarily describing all engagements. The example of July 6, when Japan still occupied Kiska, records the following events:

Three heavy cruisers, one light cruiser and four destroyers bombarded Kiska for 22 minutes. Approximately 100 tons of explosives had been fired. The Japanese sent a rescue force comprising two light cruisers, ten destroyers and a tanker (September 7)[42].

Hutchion (Lit.: p.´xvi -ii)[43] gives a brief description as follows (Excerpts):
"The U.S. Army retook Attu on 30 May 1943 after one of the bloodiest battles of the Pacific war." "The Kiska invasion, August 1943, proved a costly drill." After retaking the islands, the USA could target Japan's bases on the Kurile Islands.
"For the remainder of the war, American aerial and Naval attacks continued ceaselessly except when weather prevented them. The U.S. Navy bombarded Kuriles 12 times, sweeping the seas clear of enemy craft on six occasions. Fleet Air Wing Four bombed Kuriles 113, and the 404th Bombardment Squadron alone flew 699 sorties. By the war's end, American submarines had sunk at least 220,618 tons of shipping, often surfacing and sinking fishing vessels with gunfire. Approximately 745 Americans soldiers of all

[41] Hutchison [42] Hutchison, p.106 [43] Hutchison, p.xvi -ii
[44] Bernaerts, Pacific

branches were killed; the greatest numbers lost in this period were crew of U.S. submarines."

From 1942 to 1945 the USA supplied the Soviet Union with 6.7 million tons of equipment. The material was sent through a number of heavily escorted convoys from Portland/Oregon to Vladivostok. During this operation 25 Russian vessels were torpedoed and sunk[44].
A brief overview of the main features of the war at sea in the Pacific has been given in the previous chapter.

Observation of Sea surface, 1939 plus - in the Pacific

Wright[45] provides the monthly sea surface temperature (SST) anomalies from 1930 to 1960 and the annual SST from 1870 to 1969 for three regions of the North Pacific (20N – 50N). Even if the data taken during WWII is dismissed as being not reliable enough[46], it seems impossible to take any clue from the data series.

Barnett[47], reported that sea surface temperature anomalies are largely confined to the surface mixed layer in the North Pacific Ocean.

Different impacts of WWI and WWII

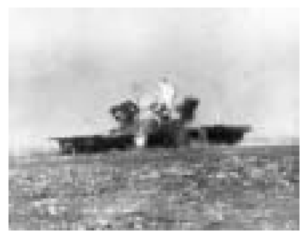
WWI and WWII time periods, viz. 1914-18 and 1939-42 seem to have been quite similar. During these periods the war at sea was mainly fought around Britain. 1916 – 1918 almost as many ships were sunk as during the whole WWII, although WWII had from the first day a much more destructive means and the operational area was wider than at any time during WWI. While in WWI sea mines, submarines, depth charges, etc. were deployed in a greater number only after 1916, i.e. two years after the start of the war, possibly up to 50-100,000 sea mines had already been laid by the end of 1939 itself, i.e. within 4 months of the start of WWII. The Baltic Sea saw many military encounters, and in the North Atlantic a number of German surface naval vessels and submarines were in operation at any time. As the first 2 ½ years of WWII had been a regional war at sea, could one expect the Northern North Atlantic to react as it did at Spitsbergen in 1918? (A). WWII did not stop in

[45] Wright [46] Bernaerts, Pacific [47] Barnett, Pacific

the way as WWI had. Actually, the full ferocity of the war at sea did not start until the Pearl Harbour attack in December 1941. As noted above, WWII had not reversed the pre-war warming trend in the Norwegian Sea that had started in 1918. The trend had only been put ‘on hold’ for some time.

Further detail: (A) Spitsbergen heats up, 5_12.

Differences in the treatment of the oceans by WWI and WWII are quite obvious. WWI could only have initiated indirectly, a ‘reorganisation’ of location and flow of water within the water body north of the Hebrides and Orkney Islands. WWI’s military operations had been extremely destructive south of these islands but had never been extended to the sea areas north of the islands or in the Norwegian Sea, although the North Cape area saw considerable naval activities and many dozen ship sinking.



From the first day of WWII the navies also operated north of the Hebrides, from Norway to Greenland. Therefore, the impact of the war on the Norwegian Sea from 1939 - 42 was not necessarily the same as 20 years earlier, and definitely different after 1941. This seems to be reflected in climatic data, as the Northern North Atlantic water body took eventually a course by not sustaining the upward-warming trend of the atmosphere over the next forty years.

While the Arctic and Northern North Atlantic may have a role in the downward trend of the air temperatures over the Northern Hemisphere, the four decades of cooling could substantially have been generated in the huge

water bodies of the sub polar gyres of the North Atlantic and North Pacific. In the North Atlantic different water bodies, e.g. Gulf Current, North Atlantic Drift and North Equatorial Current, circle the area in decades while eddies may exchange waters over considerable depths, or any other ‘rotary motion’ (see above).

'Warming' or 'Cooling' - is it an oceanic question?

During WWII the cooling of the Northern Hemisphere had started, lasting until the 1970s. How did it happen? In all oceans, and actually in all sea areas where sun radiation is 'sufficiently' available, the answer is very simple. In principle, the war at sea will force warm surface water down and colder water to the surface unless specific conditions prevail. The global war at sea from 1942 to 1945 took place primarily in sub polar waters, south of latitude 60° North, with the consequence that a general cooling was the most likely result. This applies in principle also to the North Atlantic south of Newfoundland, Iceland, and Scotland, although with some modifications during the winter months. To warm a cold body of water takes some time. Heat that has been forced to greater depths of the sea might stay there for decades. In so far this could be the only explanation why there was a cooling for four decades. Any heat stored a long time ago could now accelerate the warming observed since 1980.

The same does not necessarily apply to the Northern North Atlantic and the Arctic Sea. The heat conditions and salinity structure these are heavily influenced by a permanent inflow of warm water, transported, circulated, and processed under a cold sky and many sunless winter days. This made possible the sustained warming of Spitsbergen and of the Northern Hemisphere since 1918, with a time-out between 1939-1979.

An assessment by Jones et. al.[48] may illustrate this; "As regards the Northern Hemisphere, there seems to be little disagreement on the following: the hemisphere warmed between about 1880 and 1940, and cooled after 1940. There is, however, disagreement on other aspects, particularly on whether the post-1940 cooling has ended, and trends since 1965". As indicated earlier, the post-war cooling had only been on a 'time-out', initiated and sustained by the 1939-45 war at sea.

[48] Jones, Surface

Two brief Question. Short answers

- Question: Had the war at sea not gone global in 1942, and had continued at the level of 1939-42, would the winters in Northern Europe have been severe again?
    - Answer: Most likely, yes.
- Question: Had WWII been stopped before Pearl Harbour event in December 1941, would a cooling have occurred for four decades?
    - Answer: Presumably not.

Summary

With reference to the previous chapter 'Oceans at war 1942-45' (4_11), this paper could do little more than try to highlight the 'sensitivity' of the oceans, in that every 'treatment' causes a change that might form a new status with short- or long- term consequences on the interaction between the sea surface and the atmosphere. This paper further intends to provide some ideas on what may have happened to the seas where naval activities had taken place. For these reason the opinions of a number of scientists who could assess their valuable work on their own knowledge about the WWII climatic conditions have been considered. The war-at-sea thesis is the most convincing explanation for the global cooling since 1939/42. By having established that the three arctic war winters of 1939/42 in Europe had definitely been caused by the war- at sea- activities in the North and Baltic Sea, it can be assumed with a high certainty that the significant warming of the Northern Hemisphere for two decades since 1919 had also been caused by the war at sea during WWI (forthcoming p. 251) and that a dozen times or more severe global war at sea from 1942-1945, will not have left the oceans 'unchanged'. Once the oceans change, the climate will change. The blueprint follows the master copy. In winter 1939/40 the war at sea stopped the long-term trend for globally rising temperatures for four decades, which was resumed when the oceans 'recovered' in the early 1980s from the treatment during WWII.