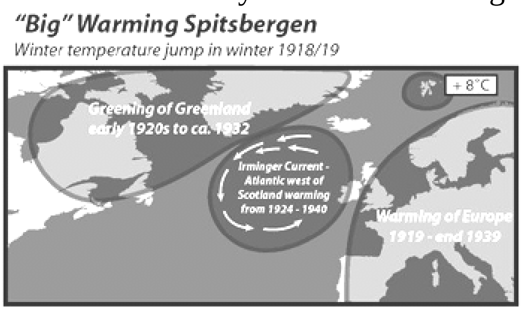
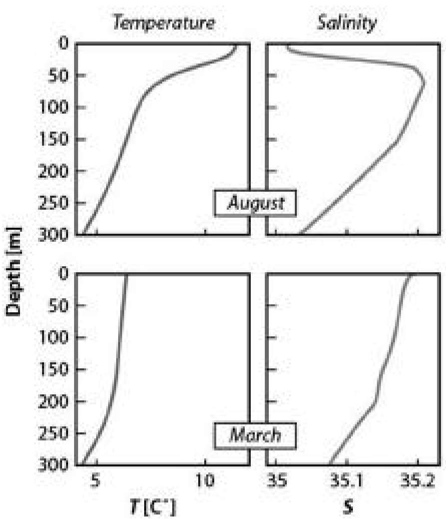
Spitsbergen 1918: warming jump by sea war south of it

The Jump

The most significant climatic event of World War One occurred at Spitsbergen, a remote archipelago between North Cape of Norway and the North Pole. There, winter temperatures suddenly exploded around the winter 1918/19, described by the eminent Norwegian scientist B.J. Birkeland in the year 1930 as being probably the greatest known statistical temperature deviation on earth[1].



The temperature jump which lasted until the war winter of 1939/40 has still not been scientifically explained. A sudden increase with plus 8°C in average winter temperature over a short period of time is an event which could have improved the understanding of the climate almost a century ago. Surprisingly, it might not be so difficult to find clues on causation as it looks in the first place. Timing, duration and location may help us exclude or include options and possible causations.



Concerning timing, there was no other force on sight before the winter 1918/19 than a devastating land and naval war in Europe, while nature ran its course without any significant earthquake, volcano eruption, meteorite falling down from the sky, or unusual sunspots.

Concerning duration, it needs to be noted that it was a sustained and

…itzbergen', Meteorologische Zeitschrift, Juni 1930, p.234-236 lasting event, for two decades in Europe and for one decade in Greenland. From 1920 until about 1930, these events were so pronounced that the terms “Greening of Greenland” and “Warming of Europe” took birth. The sustainability is strong proof that warming was generated in the Northern North Atlantic, north of the Faeroe Island and south of the Arctic Sea.

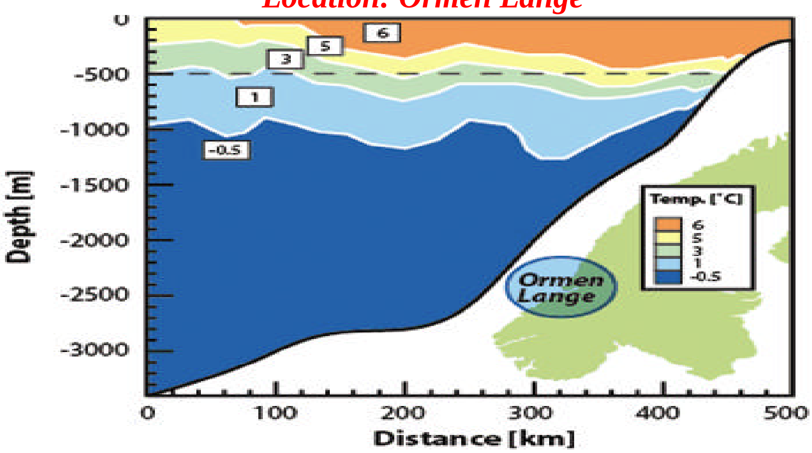
Concerning the location, the sustained warming lasting two decades holds also the clue concerning the direction from which the warmth must have arrived. One can quickly exclude all sea areas around Spitsbergen, except for the Norwegian Sea. The Barents Sea, east of Spitsbergen, contains within its average depth of 300 metres too little water masses to sustain a warming over many years, if not constantly supplied with warm water coming from the Norwegian Sea. The Arctic Sea, north of Spitsbergen, is too cold and widely covered with sea ice to have played any role. The Greenland Sea can be also definitely excluded as a source of warming at Spitsbergen, as the Greenland Sea receives a huge bulk of inflowing water masses from the Norwegian Sea, via the Gulf Current, the Norwegian Atlantic Current and the Spitsbergen Current, and not vice versa.

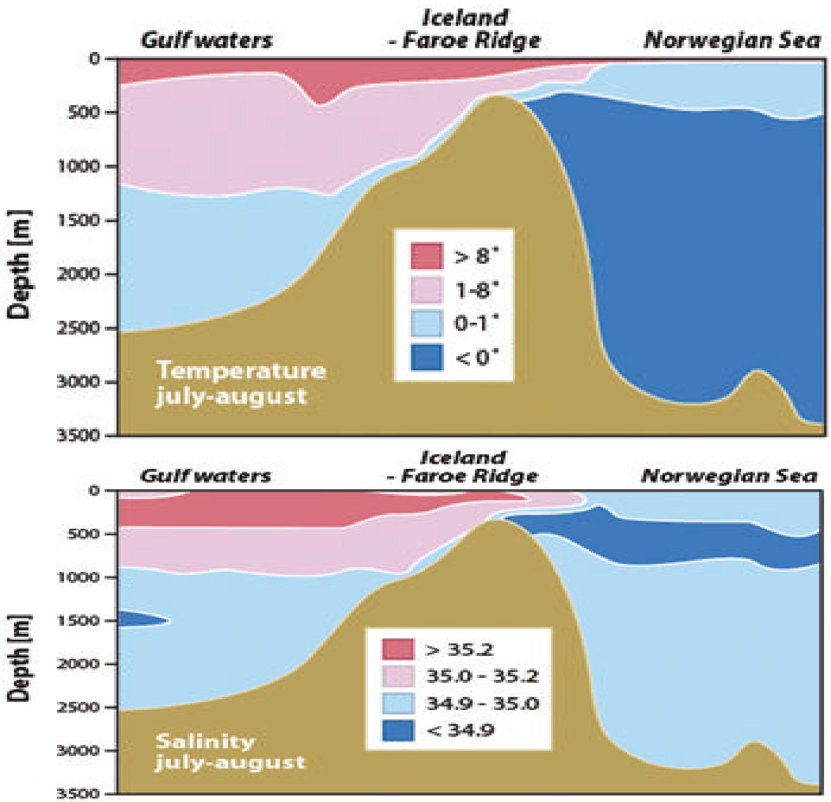
Actually, the warming can only have been generated in the Norwegian Sea, which means that, during WWI, the southern border of the warming source is immediately connected to the northern border of the naval war area. In addition, on the way to the Norwegian Sea, the most significant warm water supply coming from the North Atlantic Gulf Current was passing Great Britain where a devastating naval war had been waged for four long years. Viewing the distance between Spitsbergen and Scotland of about 2000 kilometres under such a perspective, we observe that sea water which had passed Scotland needed only few months to reach Spitsbergen. The warming in the north and the war at sea in Europe can almost be regarded as neighbours. One can thigh both events even more closely together if one considers certain typical seawater behaviour as well. A brief overview shall be given in the next section.

Seawater physics in Norwegian Sea.

In the Norwegian Sea the seawater behaves physically as it behaves everywhere around the globe. Nevertheless, the warm water from the Gulf Current, the high latitude with cold winters, the passing of many forceful low pressure cyclones, and the massive Norwegian mountain ridge with plenty sweet water runoff, as well its size and depth produce a unique wealth and variation of physical appliances. Fortunately, the basic rules are simple: salty and cold water is heavy and sinks, sweet water and warm water are light and "swim" over more heavy water. Therefore, cold freshwater can form a layer above warm water current. Cold freshwater may stay and flow below of warm saline rich water. And it is much more at stake because water is an excellent isolator. For example, 'swimming' rainwater of several centimetres thick can be as good as a refrigerator shielding stored food from outside temperatures. Without the mixing of rain and melted

Below: Norwegian Sea profile off Southern Norway
Location: Ormen Lange





water near the Norwegian coast, the Norwegian Sea would be frozen over frequently each winter regardless how much warm Gulf water would pass through the Norwegian Sea.

Therefore, there is a long way from registering all principal physical rules to assessing the thousands of possible variations that occur. Usually, the Norwegian Sea surface water, which determines the weather and climate for the whole Northern Hemisphere, is particularly influenced by three natural events: the warm Gulf current, the freshwater from land and rains, and, last but not least, the wind. In addition, after the replacement of sailing ships with machine driven vessels, a lot of surface water mixing took place every day. Particularly during the two World Wars, large sea areas and water masses have been turned upside down.

The significant feature of the Gulf Current water that enters the Norwegian Sea is the high temperature and salinity. As soon as water has been cooled down, it sinks like fruit syrup in a glass with water. Due to high salinity, it is warmer than the water it replaces at lower level. The more water sinks, the more water will follow from the Atlantic, with subsequently more “warming potential” in the area than before. The more water is cooled down by mixing, the more forcefully this water masses will start sinking.

In comparison with salty water, freshwater is very light. Fresh, rain, river, and melt water has the strong tendency to float on brackish and salty water until it gets much colder than the saline water below, or otherwise an external force must occur and determine the mixing phenomenon.

Wind in any form is the most powerful means for sea surface water mixing. Actually, it is practically the only external source nature has at hand to do the mixing. In so far, one cannot emphasise the importance of this mixing means enough. On the other hand, the mixing range the wind reaches is extremely limited and goes hardly further than the 50-meter sea surface layer. All other seawater mixing occur according to internal processes, based on temperature, salinity, and density.

And what does naval war do? Naval war certainly does a lot of water mixing. Particularly during winter time, in any sea area north of the Biscay, it not only forces a rapid mixing between freshwater and more saline water, but also forces cooled down sea surface water to greater depth in exchange of warmer water, until the summer warmed water in shallow enclosed seas is exhausted and arctic air can easily take reign. This has already been explained in great detail in Chapter B. In the next section, we will focus on the sea situation between Britain and Spitsbergen during WWI, whereon the impact on the Norwegian Sea will be discussed to conclude the chapter about the warming of

Europe between 1918 and 1939 by severe warming of Spitsbergen due to naval warfare.