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Did the North Atlantic play a role in the tumultuous weather conditions and the Indian drought in 1918?

By Dr. Arnd Bernaerts – web edition January 2010

ABSTRACT: *The year 1918 has seen a number of extreme meteorological conditions world wide, e.g. an El Nino event, and presumably the worst drought in India of the 20th Century. Less known is the sudden start of a warming in the Arctic in winter 1918/19, which had been one of our major research topic over many years. Based on this work we investigate the special situation in the Northern Atlantic (NA) prior and in the year 1918, and whether there had been features significant enough to play a role in the region or globally. Meteorological data from the Arctic Ocean region, Greenland, Iceland, North Europe, and Russia are analyzed in order to establish uncommon deviations from means, with regard to location and timing, which is a paramount precondition to discuss the source that presumably had made the year 1918 special. As Prof. B.N. Goswami of the IITM, Pune, recently assumed that additional freshwater melting from Greenland's ice sheet could weaken the monsoon to the extent of threatening perpetual drought, we will look at the sea ice conditions in the NA during that time period. The paper will finally refer to the mentioned sudden Arctic warming since winter 1918/19, which started and was sustained by a local source, namely the West Spitsbergen Current. This makes it most unlikely that meteorological events in distant regions had had a significant effect on the situation in the NA, but suggesting to look the other way around. Did the NA influenced events, e.g. in India and the Central Pacific, during 1918?*

Introduction

The year 1918 will always be remembered as one of the deadliest year in modern times. About 3% of the world's population, approximately 1.6 billion at the time, died due to an influenza pandemic lasting until about mid 1920[1], which could have resulted in three to seven times the casualties of the First World War with about 15 million. But the year 1918 should also be remembered and studied as an exceptional year with highly remarkable weather pattern that had significant global implications. Well known is that India experienced one of its worst droughts of the 20th Century, and more recently it was said that the El Niño 1918/19 was one of the strongest of the 20th Century (Giese et al., 2009), and that it is possible to link the Atlantic Multidecadal Oscillation (AMO) to the intensity of the Indian summer monsoon rainfall (Goswami et al., 2009)

This paper wants to add and discuss a third area of action, which may have played a decisive role for the remarkable weather patter during the year 1918, the Northern North Atlantic. This shall be done by temperature data form the winter months in three steps:

- What was the situation in the North Atlantic before and after 1918;
    - with the highest sea ice cover during the 20th Century in summer 1917,
    - and the Arctic warming from 1919 to winter 1939/40.
- How do the Indian drought and the El Niño 1918/19 fit into the scenario?
- Do the climatic special events of the year 1918 are attributable to 'natural variability' or did other forces contributed?

Concentrating the investigation on the winter half year, respectively the core winter months December, January, and February uses the advantage that any direct influence of the sun is minimal or not existent.

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[1]It is said that the pandemic lasted from March of 1918 to June of 1920, and about 500 million people worldwide became infected. The mortality is estimated with between 25 million to 100 million persons, most of them young adults. An estimated 17 million died in India, between 500,000 to 675,000 died in the U.S. and another 400,000 died in Japan.

It is the clear aim of the investigation to show that not only an El Niño should be regarded as a source of global climate variability, but that the North Atlantic has an equal potential and demonstrated it around the year 1918. It is a too narrow view to say that:

> *"Climate patterns such as a weak Atlantic hurricane season, failure of the Indian monsoon and weak all-Australia rainfall are widely recognized as El Niño teleconnections (Giese et al., 2009, with reference to Gray 1984; Torrence and Webster 1999, Power et al. 2006).*

While the research of Giese et al. (2009) will be briefly commented, a particular interest was raised by a recent news paper article on 28 September 2009 which reported that:

> "….according to BN Goswami, director of the Indian Institute of Tropical Meteorology (IITM), Pune, freshwater melting from Greenland's ice sheet could weaken the monsoon to the extent of threatening perpetual drought. The Greenland ice melt will add more freshwater to the north Atlantic Ocean, making it less saline. This could weaken the circulation of ocean waters and temperature variations over the Indian subcontinent -- two key factors that could also weaken the summer monsoon, says Goswami." *(Sinha, R. 2009)*

While it seems possible to deny outright any link between melting of Greenland ice and the Indian drought in 1918, Goswami's notion of the possible influence of less saline surface water in the North Atlantic, may have been caused by unusual sea ice condition during the winter 1916/17.

We do not expect to provide conclusive proof, but we hope to present a climatologically relevant scenario that calls for more interest in the year 1918, and that it would be worth to know in detail why this year became very special.

What was the situation in the North Atlantic before the spring of 1918 and after the winter of 1918/19?

An overview

The Northern North Atlantic (NNA), mean the part of the Atlantic south of the Arctic Ocean and a line from South Greenland, Iceland, the Shetland Islands/Scotland to SouthNorway. Its principle features are the warm and cold ocean currents (Fig. 1), the minimum sea ice cover (Fig.2), and the maximum sea ice cover (Fig.3), which throughout the 20th Century left a tongue-like open sea area up to the Fram Strait, which forms the boundary between the Atlantic and the Arctic Ocean. The reason is obvious. Here an extended arm of the Gulf Current with warm and high saline water, flows from North Norway to the Arctic Ocean as West Spitsbergen Current (Fig.1), while cold and less saline water flows south along the East Greenland coast. All sea ice free ocean space create maritime with low air pressure condition, while sea ice covered water space strengthen continental, and high air pressure conditions. This is particularly relevant during the winter season, during which the influence of the sun is low at higher latitude than 50° North.

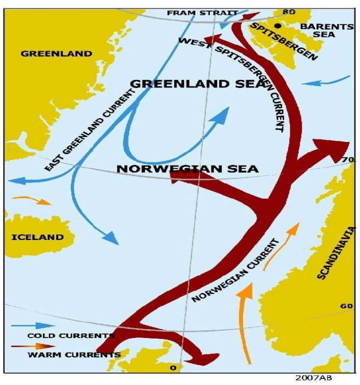
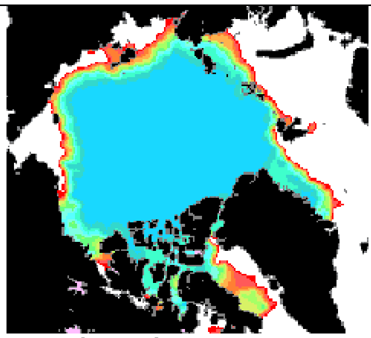


Fig. 1; The North Atlantic warm and cold water current system



Source: http://polar.ncep.noaa.gov/seaice
September 1916

Fig. 2; Minimum Arctic Sea Ice Usually in September

Fig. 3; Annual Maximum Usually in April

The general situation during the first half of the 20th Century is well illustrated by the annual temperature records from Angmagssalik (South-East Greenland), Grimsey/Iceland, and Andenes (North-West Norway), (Fig. 4-6). They indicate a shift of the mean temperature level of approximately 1.5 to 3 degrees between the decade prior and after 1920, and that the period with an increased mean lasted until about 1940.

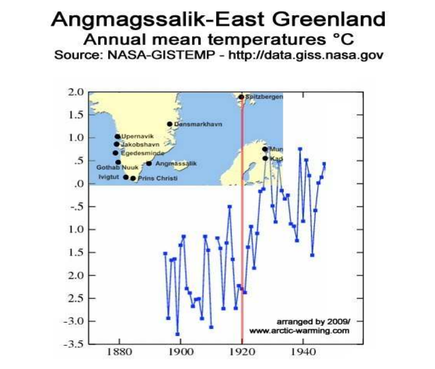


Figure 4: Annual mean temperature at Angmagssalik/South-East Greenland 1895 -1945, (Nasa/Giss, 2009)

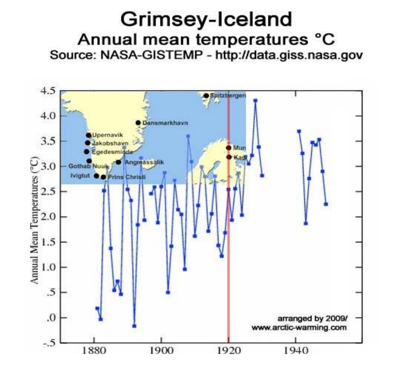


Figure 5: Annual mean temperature at Grimsey/North Iceland, 1895 -1945, (Nasa/Giss, 2009)

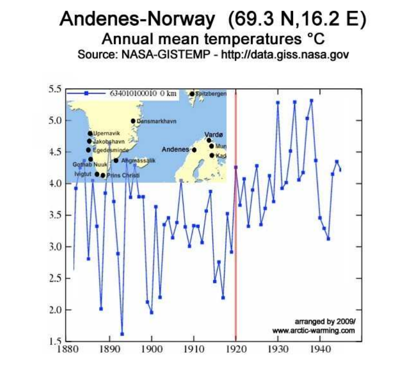


Figure 6: Annual mean temperature at Andenes/North-West Norway, 1881-1945, (Nasa/Giss, 2009)

With regard to the shown annual temperatures (Fig. 4-6) it seems worth to note that the immediate pervious years before 1920 (the red vertical line), indicate a cooler phase, which correlates with the First World War (August 1914 – November 1918), particularly pronounced at Andenes (Fig. 6). Here the time period from 1903 to 1914 shows a stable situation (+3.5°C), a significant drop from 1914 to 1917, with an annual average of + 2.3°C (1917), +3.5°C (1918), +2.8°C (1919), and +4.2°C (1920).

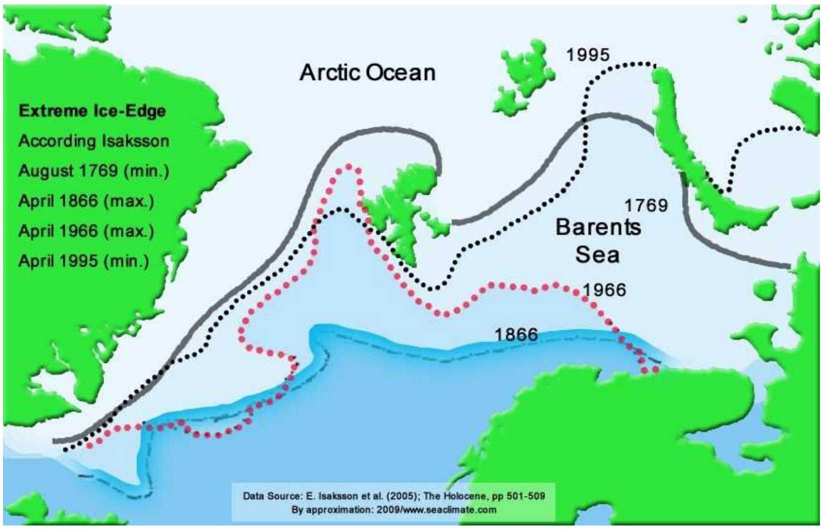


Fig.7 – "Extreme Ice Edge"

The sea ice aspect

Special attention needs to be paid to the sea ice conditions. The Indian scientist BN Goswami (see above) assumes that fresh water from a melting Greenland reaching the NNA can have an influence on Indian's monsoon season. That could have a similar effect as sea ice conditions.

That the sea ice conditions in the NNA can vary over decades is well known as shown in the graphic "Extreme Ice Edge" (Fig. 7), e.g. indicating the maximum for April 1866 (dark blue) & and April 1966 (red dotted). Nevertheless, compared with the 19th Century, it seems that the first half of the 20th Century had been comparable uniform and stable. The most remarkable feature was the sea ice free tongue up to the Frame Strait throughout the last 110 years (see Fig. 3) except in the year 1917. From about March to June 1917 the sea ice covered the entire Northern North Atlantic from the Jan Mayen to Bear Islands (Fig. 8a – 8d), having created a comparable situation as in April 1866 (Fig. 7), if not worst, as the high sea ice cover lasted in 1917 throughout the entire summer.

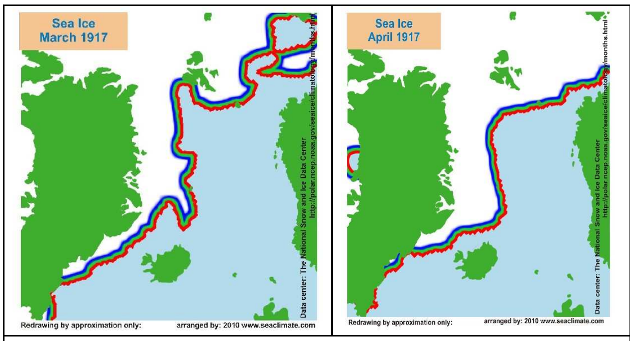


Fig.: 8a & 8b: While March 1917 was still showing the sea ice free area off Spitsbergen, it became covered in April 1917

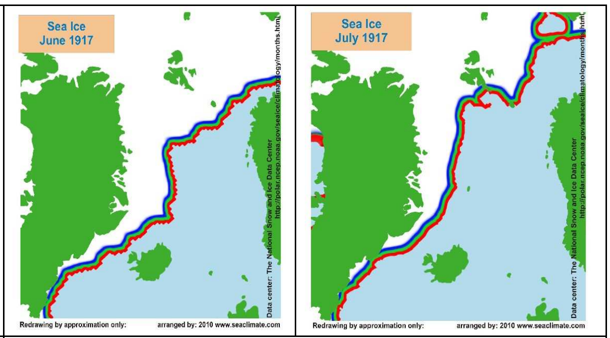


Fig.: 8c & 8d: The high sea ice cover continued throughout May and June 1917, only retreating slowly since July 1917

The winter temperatures 1912 –1923 at NNA stations

For the presentation of the winter temperature situation in the NNA area (Fig. 9) five stations have been selected, two from the western part (Greenland and Iceland), two the eastern part (Norway), and the Isfjord Radio station on Spitsbergen (Fig. 10) that show the winter months January, February and the previous December (D-J-F) from 1912 to 1923.

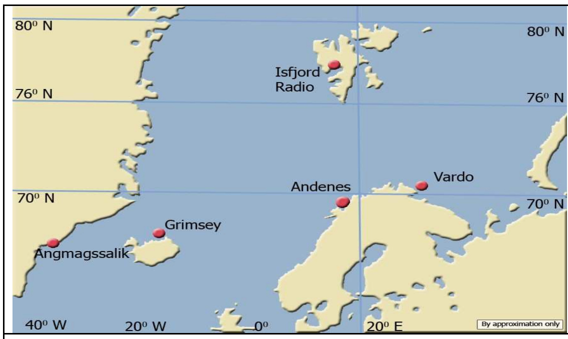


Figure 9: The five stations subject to investigation of winter temperature (D/J/F) from 1912 to 1923

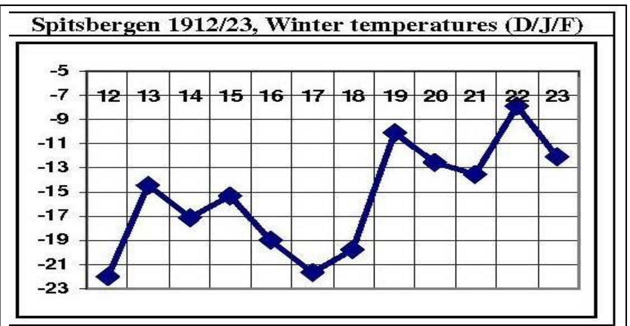


Fig.10: Spitsbergen – Isfjord Radio – winter temperatures (D/J/F) 1912 to 1923 (Nasa/Giss, 2009)

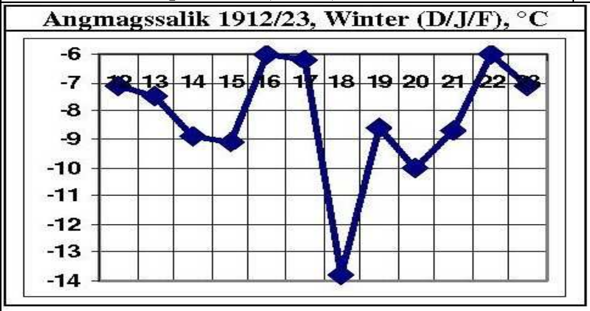


Figure 11; Angmagssalik, Temperatures (D/J/F) 1912 to 1923 (Nasa/Giss, 2009)

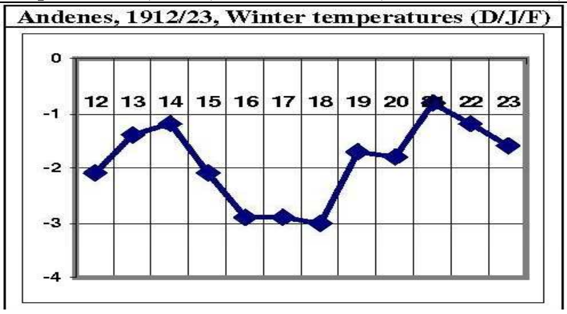


Figure 12; Andenes, Temperatures (D/J/F) 1912 to 1923 (Nasa/Giss, 2009)

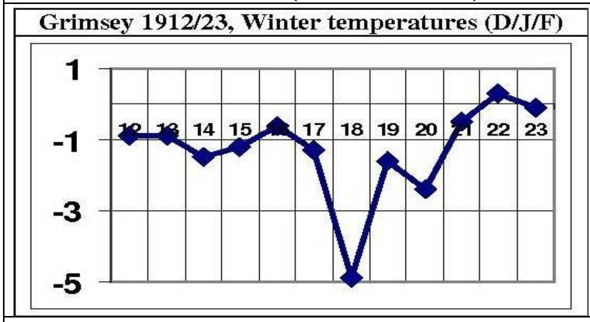


Figure 13; Grimsey, Temperatures (D/J/F) 1912 to 1923 (Nasa/Giss, 2009)

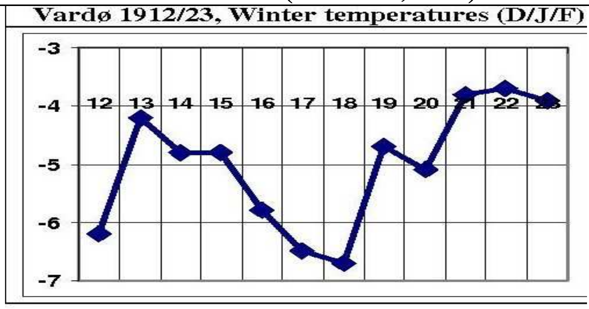


Figure 14; Vardø, Temperatures (D/J/F) 1912 to 1923 (Nasa/Giss, 2009)

Even at first glance the difference between the eastern and western NNA is striking. At Angmagssalik and Grimsey the winter temperature range is modest between 1912 and 1917, but is dropping sharply in 1918 (Fig. 11 & 13). In contrast stand eastern NNA with a decline of temperatures from 1914/15, with its lowest level during the winters 1916/17 and 1917/18 followed by an extreme increase after 1918.

The Situation after 1918 – The Arctic Warming from 1919 -1939

The by far most interesting climatic aspect after the year 1918 was the most brisk warming of the Arctic, which was felt throughout the Northern Hemisphere, and lasted until winter 1939/40. The warming had been reaching levels that were comparable to those as currently observed, but was interrupted by a period of cooling from about 1940 to the mid 1970s, due to some reasons not convincingly explained yet.

Figures 15 & 16 indicate that the high warming in the Arctic in the 1920s and 1930s did not effect the entire polar region, but primarily the NNA area and the riparian section of the Arctic Ocean.

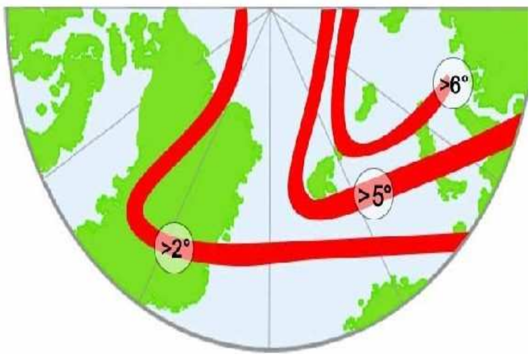


Fig. 15 : Winter, differences 1921-30 minus 1911-20. Redrawing (Lamp, 1982: Fig. 7.10a)

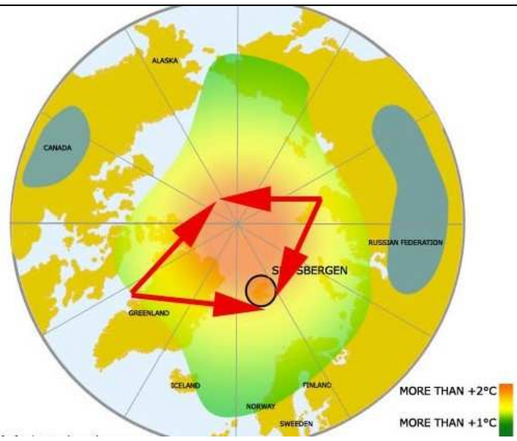


Fig. 16: Winter, diff. (Nov/Mar) 1920 to 1939; (Redrawing: Johannessen, 2004, Fig. 2a)

The impact of the warming in the mid 1930s and the main areas effected is shown in the Fig. 17 (winter) & 18 (annual), as published by R. Scherhag in the second half of the 1930s.

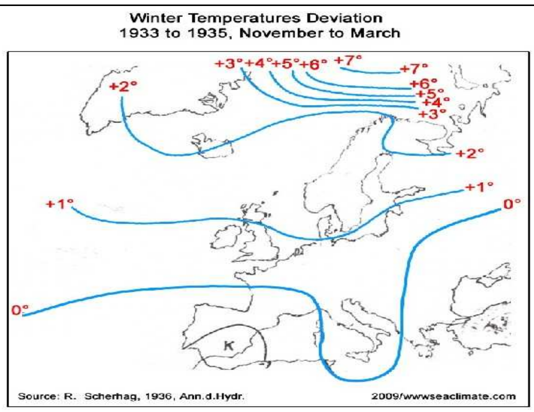


Fig. 17: Winter temperature deviation 1933 to 1935 (Scherhag, 1936a:Fig4)

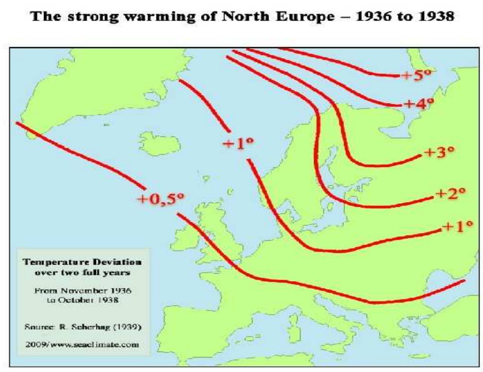


Fig. 18: Full year temperature deviation from 11/1936 to 10/1938 (Scherhag, 1939/Abb.2)

As for the question, where has the heat has been coming from, there is no region or location that could be identified from where the rise of winter temperature at Spitsbergen could have been evoked at the end of the 1910s accept at Spitsbergen itself. That applies for the Northern Hemisphere in general as well as for the North Atlantic in particular. Although all investigated stations have registered a warming after 1919, in no case this happened earlier than at Spitsbergen. At the Greenland/Iceland stations the change in winter temperature was modest and manifested only after 1920, while the IPCC noted some time ago:

> "Stronger westerlies over the Atlantic do not, therefore, account for the Arctic warming of the 1920s and 1930s on their own: in fact they preceded it by 20 years." (IPCC, 1990: 228)

In summary, it can be said that the source of the Arctic warming in the early 20th Century had had its place in the north of Iceland and Scandinavia, but was precisely located in the sea section between Andeans/Norway and the Fram Strait/Arctic Ocean.

How does the Indian drought and the El Niño fit into the scenario in 1918?

Special Conditions and Observation in 1918

As this section is about the Indian drought and the El Niño in the second half of the year 1918, we have primarily to talk about the time before these events occurred. Before doing this systematically, here are some few observations:

- UK/Norwich, 1916: A very wet year. On 28th. March a heavy snowstorm resulted in many vessels being lost at sea. During this year, sunshine amounted to just 1,304 hours, a deficiency of 259 hours.
- Europe, Winter 1916/17: A very cold winter throughout northern Europe, and the third coldest on record in the UK.
- Spitsbergen: 28th March 1917, minus 49.2°C, the coldest ever measured, after the February 1917 had been presumably been the coldest on record (see: Table 1)
- New York: Coldest winter (25.5 °F) for at least 45 years, average since 1871 (ca. 31°F), NYT, 06.April 1919, while January 1918 still stands as the coldest registered in NY Central Park (Giese et. al., 2009).[2]

Table 1: Winter temperatures from 1912 to 1923 at five stations (see Fig. 9)

Angmagssalik Greenland: 66°N, 38°W				Grimsey Iceland : 66.5°N, 18.0°W				Spitsbergen Isfjord R. 78°N, 14°E				Andenes Norway : 69°N, 16°E				Vardø Norway: 70.4°N, 31.1°E			
YEAR	**JAN**	**FEB**	**D-J-F**	**YEAR**	**JAN**	**FEB**	**D-J-F**	**YEAR**	**JAN**	**FEB**	**D-J-F**	**YEAR**	**JAN**	**FEB**	**D-J-F**	**YEAR**	**JAN**	**FEB**	**D-J-F**
1912	-4.9	-10.6	-7.1	1912	0.3	-3.5	-0.9	1912	-21.4	-24.1	-22.0	1912	-2.7	-5.1	-2.1	1912	-7.0	-10.0	-6.2
1913	-7.3	-8.0	-7.5	1913	-0.7	-1.0	-0.9	1913	-14.0	-18.5	-14.4	1913	-1.5	-1.3	-1.4	1913	-3.4	-5.3	-4.2
1914	-5.1	-12.3	-8.9	1914	0.1	-3.8	-1.5	1914	-20.0	-19.9	-17.1	1914	-1.2	-1.1	-1.2	1914	-6.2	-4.8	-4.8
1915	-7.1	-12.8	-9.1	1915	-0.7	-2.3	-1.2	1915	-12.5	-17.3	-15.3	1915	-2.6	-3.5	-2.1	1915	-5.5	-6.0	-4.8
1916	-6.5	-6.7	-6.0	1916	-0.3	0.3	-0.6	1916	-21.6	-14.7	-19.0	1916	-1.2	-1.2	-2.9	1916	-5.3	-4.5	-5.8
1917	-2.5	-5.8	-6.2	1917	0.5	-0.6	-1.3	1917	-20.4	-25.3	-21.7	1917	-2.0	-4.2	-2.9	1917	-6.0	-9.2	-6.5
1918	-14.8	-13.0	-13.8	1918	999	-4.9	-4.9	1918	-24.4	-17.2	-19.8	1918	-5.1	-1.6	-3.0	1918	-9.5	-5.8	-6.7
1919	-4.1	-14.9	-8.6	1919	-0.3	-3.5	-1.6	1919	-5.7	-19.7	-10.1	1919	-0.4	-4.1	-1.7	1919	-4.1	-7.0	-4.7

In the wider context, the question is, whether the NNA conditions, between 1916 and 1919, initiated, established, or sustained a "teleconnections" to events in the central Pacific and the Indian subcontinent. Thus our investigation does not look for Multidecadal Atlantic Oscillation (Goswami et al., 2009), nor whether a connection between the events in the Pacific and the Indian drought is possible. But this paper strongly supports the option that a considerable share of the 1918 events in questions had contributed by the physical dynamics of the NNA before and during 1918. The general picture includes that

[2] NOAA records February, 1934, as the coldest month with avg. 19.9°Fahrenheit, http://www.erh.noaa.gov/okx/climate/records/extremes.html

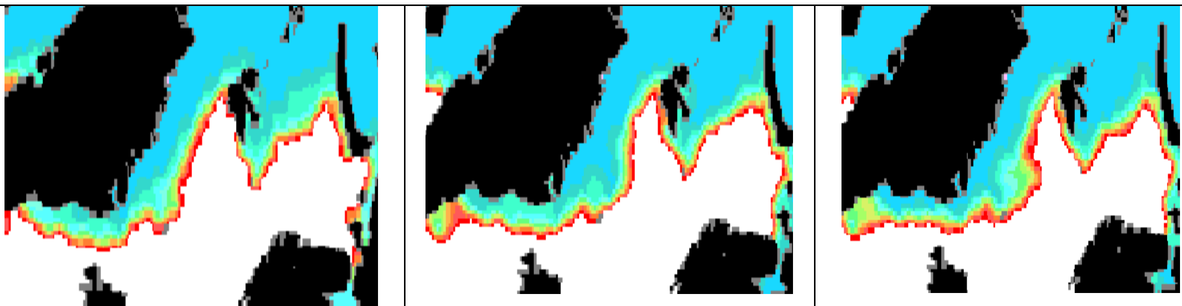
- India began to experience one of its worst droughts of the 20th Century (Kumar, 2009; Giese, 2009; with reference to: Parthasarathy et al. 1994), which in terms of spread, was the most severe, affecting more than 70% of the area, followed by 1899, 1877, 1972, and 1987 (47.7%) (Sinha, 2009).
- According Giese et al. (2009), the modeled El Niño (1918/19) is one of the strongest of the 20th Century, comparable in intensity to the prominent events of 1982/1983 and 1997/1998, and seems likely for being responsible for the failure of the summer monsoon in 1918.

While Giese et al. (2009) ask: “Did the 1918/19 El Niño play a role that unfolded during 1918” (see Introduction), the paper will look primarily into the link between NNA conditions and the Indian drought matter of 1918, and will subsequently make some remarks with regard to the role of the 1918/19’s El Niño, to further more investigation in the matter.

What needed to happen in the North Atlantic to affect the Indian Monsoon?

Recently Goswami et al. (2009) established: *“For the first time, a physical mechanism for the teleconnection has been identified. The fundamental link between the North Atlantic and the Indian summer monsoon is through NAO (North Atlantic Oscillation”*. NAO is a matter of warmer or colder sea surface temperature (SST) in the North Atlantic, respectively a measure of the strengths (positive NAO), or weakness (negative NAO), of the westerly winds blowing across the North Atlantic between 40° N and 60°N (Goswami, et al., 2009). The Indian Monsoon rainfall is strong during a positive NAO phase and weak if the NAO is low (negative). The extreme low summer Monsoon 1918 should therefore correlate with a weak westerly wind-drift, respectively with colder SST. As SST data are rare for that time period, we have to rely primarily on surface air temperatures (SAT).
The first conditions for the Indian drought 1918 were presumably laid latest with the spring/summer sea ice conditions in the NNA, 12 months earlier, which were the most severe during the last 110 years. Usually during the month April the maximum sea ice appears. In 1917 it was in June/July (Fig. 8c), which was presumably as extensive as in April 1866 (Fig. 7). Such extreme conditions necessarily result in an enormous influx of freshwater as soon as the melting starts. The sea surface water becomes less saline, and stays above saltier water. Such situation minimizes the transfer of heat from heavier but warmer sea water to the atmosphere. Insofar the effect is the same as from melting Greenland ice (see Introduction), which can be excluded for the years in question. The relevant surface air temperature records (SAT) of the five locations (Fig. 9) show with regard to the annual record (Fig. 4, 5 & 6) low values prior 1920 (the vertical red line), whereas the winter temperatures for 1917/18 is the lowest over a period of 3-4 years in then eastern NNA (Fig. 12 &14), but a dramatic deviation in the western NNA (Fig. 11 & 13), while a small increase occurred at Spitsbergen (Fig. 10).

While the winter temperatures 1917/18 at the Norwegian stations show only modest changes towards the previous years, the alteration from winter 1916/17 to the next year in the western North Atlantic is extreme different, and in this dramatic decrease occurred only for one year. That is by far the largest deviation in the Nasa/Giss data series displayed for Iceland stations since the period of 1880. Other stations in the region show the same decrease. The deep winter temperatures are not reflected with the sea ice conditions of the winter 1917/18 (Fig.19), which can be regarded as close to the average.



19a, Sea Ice December 1917 | 19b, Sea Ice January 1918 | 19c, Sea Ice February 1918

Figure 11a-11c: The images are provided online by: The National Snow and Ice Data Center; University of Colorado Boulder, section: Monthly sea ice maps since 1900, (NSIDC, 2009)

However extreme winter conditions were felt from Iceland to New York. But from thereon the air temperature data return to a normal range, see as example Table 2.

Table 2: Iceland SAT data, 1916 -1920

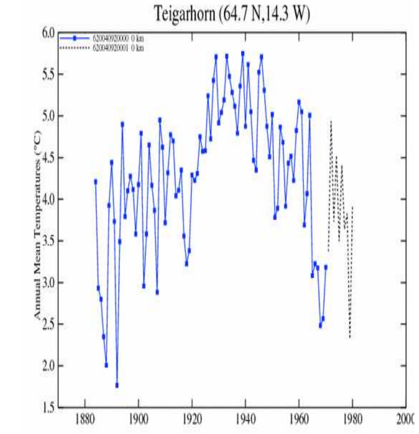
GRIMSEY /ICELAND

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	metANN
1916	-0.3	0.3	-2.2	-1.7	1.5	6.5	10.3	8.7	7.2	4.3	0.9	-3.7	2.81
1917	0.5	-0.6	-0.7	-5.1	2.7	4.8	9.9	8.3	4.5	-1.3	-2.1	-4.9	1.43
1918	999.9	-4.9	-0.7	-2.1	4.3	6.2	6.0	8.1	3.7	3.0	0.7	-0.9	1.22
1919	-0.3	-3.5	-5.7	-2.4	3.7	7.1	10.0	7.1	4.7	2.5	-2.1	-0.9	1.68
1920	-3.5	-2.7	-2.4	-2.5	1.7	7.5	7.9	8.3	7.3	6.4	3.4	0.8	2.54

Teigarhorn 64.7N, 14.3°W

YEAR	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	metANN
1916	0.7	0.9	-0.7	1.8	4.6	9.5	11.3	11.2	8.1	5.0	1.9	-1.3	4.35
1917	0.1	0.8	1.8	-1.5	5.3	7.9	11.2	10.7	7.1	0.9	-0.3	-3.1	3.56
1918	-8.1	-0.6	2.7	1.9	6.7	9.0	9.7	9.1	5.1	4.4	1.9	0.1	3.23
1919	-0.2	-2.3	-4.1	0.7	6.1	9.9	11.5	10.0	6.5	4.3	-1.9	0.7	3.38
1920	-2.3	-2.0	-0.1	0.7	5.3	10.0	10.3	10.6	8.1	6.9	3.3	1.5	4.29

Fig.: 20; ICELAND East Coast
Annual Mean Temp. (°C)



Nasa/Giss

We have good reason to assume that this is due to the increased influence from the sun ray during the spring and summer season, as the sea water temperatures south-west of Iceland and east of Scotland seem to have been very low between 1918 and 1920/21, which can be called dramatic and

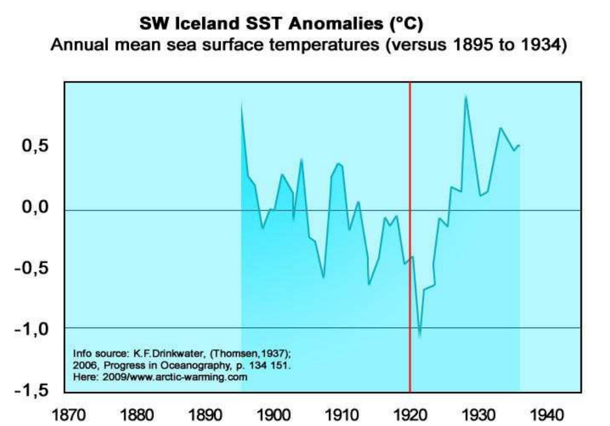


Fig. 21; SW Iceland SST Anomalies (°C); Annual mean sea surface temperatures (versus 1895 to 1934);
Source: K.F. Drinkwater, (2006)

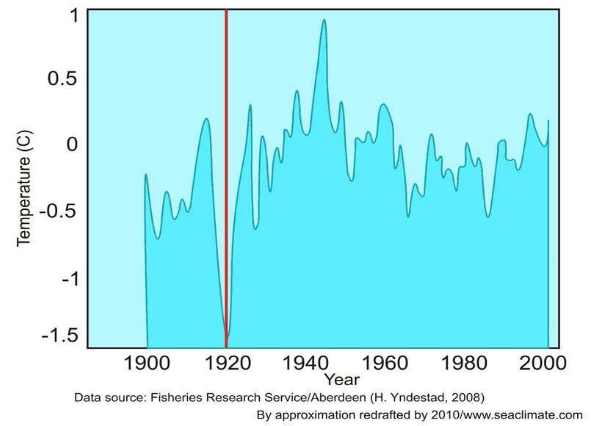


Fig. 22; Sea water temperature measured in the Scotland – Faroe channel (°C) 1900-2005
Source: Fisheries Research Service/Aberdeen; (H. Yndestad, 2008)

unprecedented over the shown time period. At no other time was the sea water temperature so low over a very short period of time. Unfortunately the shown SST series (Fig. 20 & 21) are very rare. Not the meteorology or oceanology collected the data, but institutions or governmental departments concerned with fishery. On the other hand they demonstrate clearly that the sea surface water in the sub-polar section of the North Atlantic (40°N to 60°N) went through an extreme temperature decrease, with a high probability that a major cause could have been an unusual low sea surface salinity due to the extensive sea ice situation a year earlier.

(left) Fig. 23; Sea-Ice in April 1919

For the same reason it is possible to draw a link to the sea ice conditions one year later, when it reached the northern coast of Iceland in April 1919 (Fig. 22). It was after 1911 only the second time that it happened during the previous 20 years.

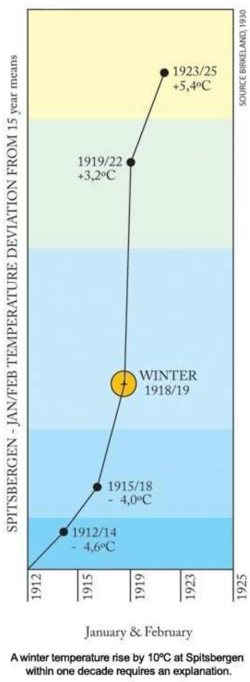
In conclusion it is possible to prove that the winter conditions 1917/18 in the western North Atlantic had been very extreme, which had the potential to show effect elsewhere including on the Indian subcontinent or the equatorial Pacific. While the corresponding spring and summer data do not support necessarily this thesis, as they appear to be on an average level (Table 2), at least the available sea surface temperatures from the SW of Iceland (Fig.20) and between Scotland and Faroe Island (Fig.21) support the thesis thoroughly. If it could be proven as correct that the seawater cooling effected a larger region of the mid North Atlantic, this would presumably sufficient to establish that the Indian summer drought 1918 had gotten a major push from the North Atlantic.

A ‘teleconnection’ from the Pacific or North Atlantic in 1918?

We will neither deny nor support Giese et al. (2009) claim of a teleconnection between special weather conditions in the Pacific and the Indian monsoon season, which they base on “an ocean model forced winds from an atmospheric reanalysis”. But there are a number of points which do not fit well in the overall situation, for example:

- In 1917 was presumably the strongest La Niña ever measured[3], (which should raise the questions whether its ‘observation’ had been influence by the winter 1916/17 and summer conditions 1917 in the Northern North Atlantic region).
- The change to the 1918/19 El Niño could only have started to commence while India already experienced the drought, although a very quick change from a extreme strong La Niña into the opposite phase could presumably send out stronger impulses then modest alterations.
- That evidently the 1918/19 El Niño had only a weak expression near the coast of South America (Giese et al., 2009), but this to happen is all about this phenomenon and why it is called: El Niño.
- When according Giese et al. (2009) the 1918/19 event was confined to the central portion of the Pacific Ocean, than the area covered was much smaller as usually, and at least logically, less influential.

Such points show that it seems a too narrow view to assess the climatic excesses in 1918 alone from a Pacific Ocean point of view. Vice Versa, the Pacific data used for “an ocean model forced winds” may be have been influenced by the special weather forcing situation in the North Atlantic from summer 1917 to winter 1918/19. All winter air temperature data across the Northern North Atlantic show a dramatic rise during winter 1918/19 (Fig. 11-14), which was particularly steep at Spitsbergen (Fig. 10), which Giese et al. (2009) confirm by saying: *“Surface temperature warmed between 1917/18 and 1918/19 by 8°C in eastern North America with some cooling in the Southwest United States and northern Mexico. Similar dramatic changes in climate occurred across much of central Asia . Indeed, the surface air temperature change from 1917/18 to 1918/19 is among the largest year-to year changes on record.”*



(Left) Fig. 24; Spitsbergen, January & February temperature difference from mean, a change of about 10°C between 1912 and 1923.

[3] According a Classification by the Long Paddock website provided by the Queensland Government/Australia; at: http://www.longpaddock.qld.gov.au/Products/AustraliasVariableClimate/ENSO-Year_Classification/index.html ; giving the following indication from 1920 to 1912: 1920 Neutral 3.67, 1919 El Niño -8.97, 1918 El Niño -5.85, 1917 La Niña 25.03, 1916 La Niña 11.9, 1915 Neutral 3.85, 1914 El Niño -14.15, 1913 El Niño -7.28, 1912 Neutral -3.95.

According an in-deep analysis which has been done elsewhere (Bernaerts, 2009), this warming had been generated by the warm West Spitsbergen Current that enters the Arctic Ocean at Spitsbergen. As this warming was sustained and continued over many years, it would not support the thesis that it occurred due to an event in the Pacific. More likely it was the other way around, and any questions concerning atmospheric “teleconnentions” during the year 1918 should not be done without addressing the situation in the North Atlantic in 1917 and 1918 thoroughly as well.

What may have caused the special situation in North Atlantic during 1917 and 1918?

It could have been mankind itself that initiated strong changes in the Northern Atlantic area during the years 1917 and 1918. The oceans are the driving force for all atmospheric conditions, any modification of ocean conditions may quickly show up behavioral pattern of the weather. When Giese at al. (2009) are saying: “By any measure the year 1918 was tumultuous”, they should not have ignored the extreme weather conditions in the North Atlantic, but should have mentioned the war in Europe from August 1914 to November 1918, generally known as the First World War (WWI), and particularly the impact the naval war may have had. With new weaponry and with many thousand of ships the naval war started in serious in autumn 1916, in the North Sea, English Channel and Eastern Atlantic, of which all water turns up at Spitsbergen only a couple of weeks or months later. It is here not the place to present this matter in more detail (see: Bernaerts, 2009), but to raise the awareness that any research concerning the reasons for the Indian drought in 1918 may not only include the North Atlantic weather pattern during those years, but requires attention to oceanology, ocean currents, and the impact of naval war had had on the marine environment from 1914 to November 1918.

Conclusion

The tumultuous global weather conditions of 1918, including the most devastating drought India experienced during the last century, and a recent claim of a strong El Niño in the Pacific, will only be fully understood when a number of climatological relevant observation in the Northern North Atlantic during the years 1917 and 1918 are taken into account. While studying the year 1918 should have started with the commencement of the First World War in August 1914, which is reflected in the air temperature record of coastal stations in the eastern part of the North Atlantic, the paper merely outlined the general situation before 1917/18 and after winter 1918/19, showing evidently that unusual weather situations had happened , and the reason for deviation of temperature data and sea ice conditions, were primarily related to the North Atlantic itself.

By investigating the highest North Atlantic sea ice extension, at least since 1900, one year before the Indian drought 1918, the thesis that a lower saline North Atlantic influence the intensity of the annual monsoon rainfall could be backed up significantly. That was only partly possible with the winter air temperature date in the western North Atlantic, but substantially with two sea water temperature series.

The way the situation in the North Atlantic developed prior the year 1918 and thereafter, seem to leave little room for any assumed probability that the Indian drought in 1918 had been primarily the result by a must stronger El Niño as recognized until recently. As this claim pays no regard to the role the North Atlantic may have plaid, some major aspects were discussed to indicate that in this case the North Atlantic could have been the main source for unusual climate variability at distant places in 1918. That may not be conclusive enough for being already an evident result, but hopefully convincing enough for doing further research on the raised and discussed matters.

Further material on the North Atlantic issue in the late 1920s:
http://www.arctic-warming.com/ , http://www.arctic-heats-up.com/

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Yndestad Harald; Turrell, William R and Ozhigin, Vladimir, (2008): *Lunar nodal tide effects on variability of sea level, temperature and salinity in the Faroe-Shetland Channel and the Barents Sea*, Deep Sea Research. 55/12, pp 1201-1217. Fig. 22: the “Atlantic Water” image, at: http://ansatte.hials.no/hy/climate/defaul4.gif