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# Norwegian 19th century instrumental and non-instrumental meteorological series

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Wishman, E. H. 1996. Norwegian 19th century instrumental and none-instrumental meteorological series. *AmS-Varia*, ISSN 0332-6306, vol. 25, pp. 33-37, Stavanger. UDK 551.582: 948.1(093.3)"654" The project «Establishment of a national historic-climatological database at the Museum of Archaeology, Stavanger» has been supported by the Norwegian Research Council in the period of 1990-1992. One of the tasks is to search for old meteorological observation records from before 1900, records which have not been the responsibility of the Norwegian Meteorological Institute (DNMI), and to register them in a database. An instrumental meteorological record from Stavanger covering the year 1840 is presented. Comments are given on none-instrumental records from light-houses and on a cooperation programme with the COADS database in Boulder, USA, concerning punching of instrumental records from Norwegian merchant ships in foreign trade 1867-1900. (COADS = Comprehensive Ocean-Atmospheric Data Set).

## The Løwold records from Stavanger

Fig. 1 shows the first page of a meteorological diary for the year 1840 written by A. Løwold. He made meteorological observations three times a day, morning, midday, evening, from Jan 1st to Dec 31st 1840. Unfortunately, we do not know where the meteorological station was situated. This causes serious problems to the interpretation and use of the data in meteorological and climatological research.

The observations include barometer and temperature readings and notes on wind and weather. The writing is an easily read German hand. The arrangement of the data fields is very similar to that of the meteorological diaries used at meteorological stations today.

The barometer and thermometer readings are in «French thumbs and lines» and «degrees Reaumur» respectively. The figures are easily transformed to standard units as hekto-pascal (hPa) and degrees centigrade (deg. C). The graph presented in fig. 2 shows the morning records of air pressure and temperature from Løwold's station through January 1840 expressed in modern units.

## Interpretation

The interpretation of A. Løwold's notes on wind and weather is a troublesome task. We do not know if he, when estimating the wind directions, keeps to 8 or 16 directions

of the compass, neither do we know the exact meaning of his expressions for wind force. His expressions for the weather character are sometimes ambiguous or obscure. It is possible, however, by comparing with contemporary observations within the region, and by statistical means, to reconstruct credible values for winds and for weather character.

We cannot know how representative the temperature readings are, as we do not know whether the thermometer was placed outdoors or indoors in an unheated, N-faced room. This was often the practice by private persons in this early phase of measuring temperature for meteorological purposes. Lack of knowledge of which surroundings the instruments needed, makes a correct estimate of the outside air temperature extremely difficult or impossible.

Heating strongly affects the barometer readings (for instance the length of the mercury column of the barometer, which indicates the pressure level). Thus a barometer always has to be corrected for the temperature in the room where the it was placed. In the present case, this temperature is unknown.

The most serious problem as to the interpretation of the Løwold records, is that we do not know the exact geographical site where he made his observations. This includes lack of knowledge about h.a.s.l. of his station. For comparison with other stations and for construction of sea level circulation maps, the pressure readings must be reduced to zero level (sea level). This cannot be done

ad 1840 16. 2. 11 n

# Meteorologische Tagtäglicher

## holdner in Stawangal April 1840.

Datum	Morgens		Wind u. Weisheit	Mittags		Wind u. Weisheit	Abends	
	Therm.	Barom.		Therm.	Barom.		Therm.	Barom.
Januar								
1.	28.3	+ 3	S.O. Stimm.	27.10	+ 2	N.O. Stimm. bewölgt	27.11	+ 1
2.	28.2	+ 2	N.O. Stimm.	27.9	+ 3	N.O.	27.12	+ 4
3.	28.1	+ 2	N.O.	27.8	+ 3	N.O.	27.11	+ 4
4.	28.0	+ 2	Stille	27.7	+ 3	N.O.	27.10	+ 4
5.	27.9	+ 2	Stille	27.6	+ 3	N.	27.9	+ 4
6.	27.8	+ 2	Stille	27.5	+ 3	N.	27.8	+ 4
7.	27.7	+ 2	Stille	27.4	+ 3	N.	27.7	+ 4
8.	27.6	+ 2	Stille	27.3	+ 3	N.	27.6	+ 4
9.	27.5	+ 2	Stille	27.2	+ 3	N.	27.5	+ 4
10.	27.4	+ 2	Stille	27.1	+ 3	N.	27.4	+ 4
11.	27.3	+ 2	Stille	27.0	+ 3	N.	27.3	+ 4
12.	27.2	+ 2	Stille	26.9	+ 3	N.	27.2	+ 4
13.	27.1	+ 2	Stille	26.8	+ 3	N.	27.1	+ 4
14.	27.0	+ 2	Stille	26.7	+ 3	N.	27.0	+ 4
15.	26.9	+ 2	Stille	26.6	+ 3	N.	26.9	+ 4
16.	26.8	+ 2	Stille	26.5	+ 3	N.	26.8	+ 4
17.	26.7	+ 2	Stille	26.4	+ 3	N.	26.7	+ 4
18.	26.6	+ 2	Stille	26.3	+ 3	N.	26.6	+ 4
19.	26.5	+ 2	Stille	26.2	+ 3	N.	26.5	+ 4
20.	26.4	+ 2	Stille	26.1	+ 3	N.	26.4	+ 4
21.	26.3	+ 2	Stille	26.0	+ 3	N.	26.3	+ 4
22.	26.2	+ 2	Stille	25.9	+ 3	N.	26.2	+ 4
23.	26.1	+ 2	Stille	25.8	+ 3	N.	26.1	+ 4
24.	26.0	+ 2	Stille	25.7	+ 3	N.	26.0	+ 4
25.	25.9	+ 2	Stille	25.6	+ 3	N.	25.9	+ 4
26.	25.8	+ 2	Stille	25.5	+ 3	N.	25.8	+ 4
27.	25.7	+ 2	Stille	25.4	+ 3	N.	25.7	+ 4
28.	25.6	+ 2	Stille	25.3	+ 3	N.	25.6	+ 4
29.	25.5	+ 2	Stille	25.2	+ 3	N.	25.5	+ 4
30.	25.4	+ 2	Stille	25.1	+ 3	N.	25.4	+ 4
Febr.								
1.	27.10	+ 0	S.O.	27.5	+ 1	O.	27.8	+ 1
2.	27.9	+ 1	O.N.O.	27.4	+ 2	O.	27.7	+ 2
3.	27.8	+ 2	O.	27.3	+ 3	O.	27.6	+ 3
4.	27.7	+ 3	+ N.O.	27.2	+ 4	O.	27.5	+ 4
5.	27.6	+ 4	+ S.O.	27.1	+ 5	O.	27.4	+ 5
6.	27.5	+ 5	+ O.	27.0	+ 6	O.	27.3	+ 6
7.	27.4	+ 6	S.O.	26.9	+ 7	O.	27.2	+ 7
8.	27.3	+ 7	+ S.O.	26.8	+ 8	O.	27.1	+ 8
9.	27.2	+ 8	Regen + S.O.	26.7	+ 9	O.	27.0	+ 9

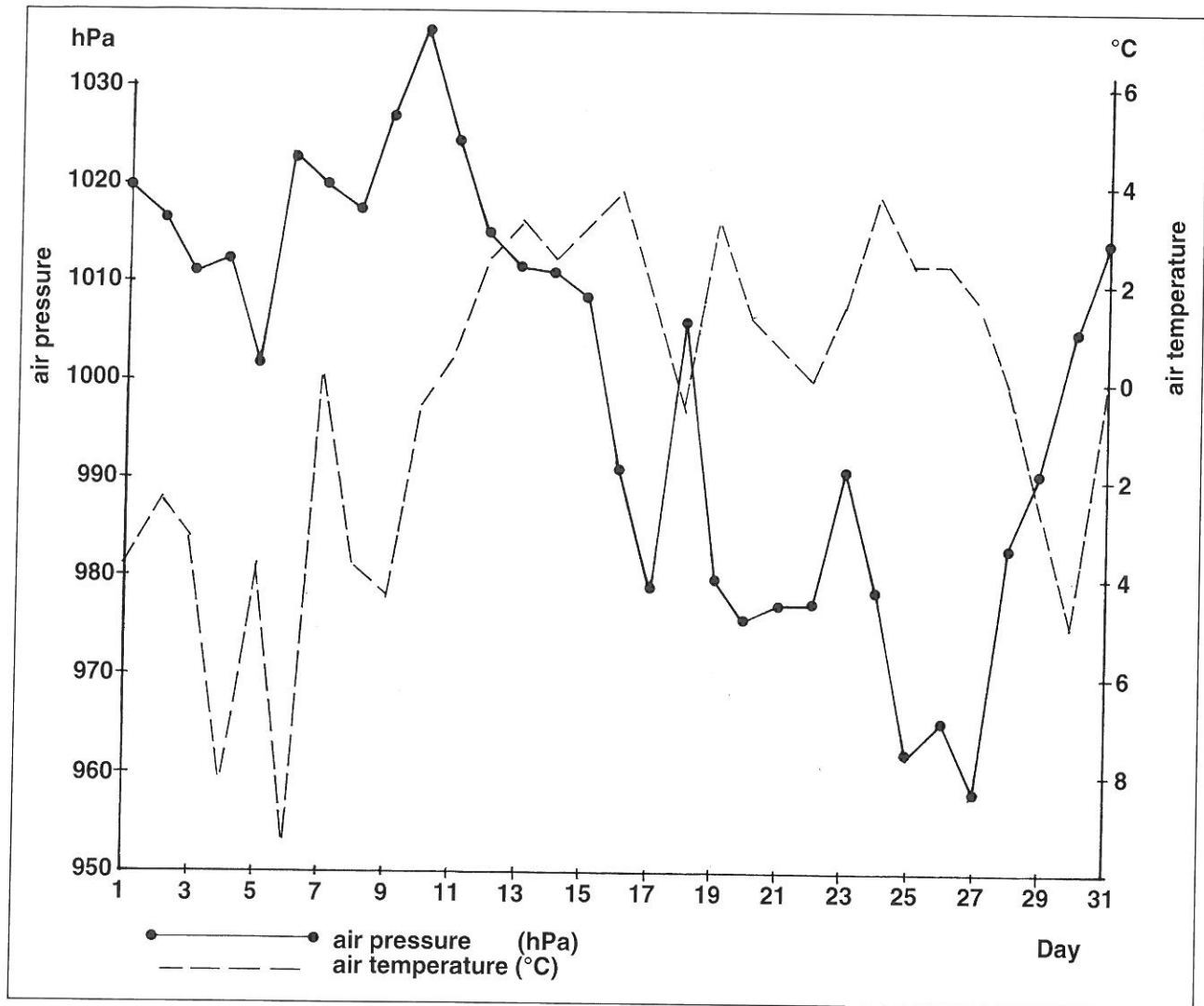


Fig 2. Day-to-day variability of the morning readings of the barometer (hPa) and thermometer (deg. C) taken from the Løwold diary for January 1840. The values are uncorrected.

for Løwolds barometer readings without knowing the h.a.s.l. of the station.

We must have these critical remarks in mind, if we intend to give a comment on the variability and trend of the combined «unreduced» temperature and pressure diagram shown in fig. 2.

The day-to-day variability of the two elements is strong, but apparently within an order of magnitude comparable with a series which would arise from a modern station of today. Furthermore, temperature extremes +4 and -9 coincide well with the normal extremes of January in Stavanger the last 30 years. But a pressure below 960 hPa which seems to have occurred on the 27th is so low, that it must have other reasons than a very close presence of an extremely deep cyclone center.

Fig. 1. One page of the the Løwold meteorological diary, recorded in Stavanger in 1840-41. The records shown on the opposite page, cover the observations from January 1st to February 9th 1840.

Looking at the relative day-to-day difference of the pressure values in fig. 2, comparing them with the corresponding values of temperature, the simple graph shows a noticeable overall trend during the month. It probably reveals a change in the weather type in Southwest Norway between the first and the second half of the month. Temperatures are generally low until about the 11th when they exceed zero. Until the 27th the temperatures keep relatively high, but fall rapidly the last couple of days of the month. This trend may be explained by a high pressure situation in the first part of the month. Towards the middle of the month the high pressure has been replaced by series of strong cyclones advecting milder air in the direction of Rogaland. This activity comes to an end towards the end of the month, when the pressure rises again and weather becomes colder. Details about this weather development are confirmed by the information given under the wind and weather columns of January 1840 (fig. 1).

Schema No. 1.

# Vagtjournal

holdt ved *Lille Presteskjæret* Fyr for *November* Maaned 18*95*

Datum	Time.	Vind. Sæ- gang.	Luftens Beskaffen- hed. Nedbør.	Time.	Vind. Sæ- gang.	Luftens Beskaffen- hed. Nedbør.	Fyret			Fyrets Olie- for- brug. Kg.	Vagt- haven- de.	Vagt fra Kl. til Kl.	Taagesignal- apparatet anvendt fra Kl. til Kl.	Hvilke Fyre synbare.	Anmærkning.
							sluk- ket Kl.	tændt Kl.	brændt i Døgnet.						
1	Fm. 2			Em. 2											Følger Ordrer Landets Lysdag det meste af d. og di- stans fra Lille Presteskjæret. Løstholdet vil blive holdt i 4.0
	Fm. 8			Em. 8			4 <sup>24</sup>		4 <sup>24</sup>	15 <sup>24</sup>	4.0				
2	Fm. 2	NØ 1	Skjel	Em. 2	NØ 1	Skjel									20 3/4 skudt. Man kunne forst. for reglement da der gik for sig i 4.0
	Fm. 8	NØ 1	g?	Em. 8	NØ 2	Skjel	4 <sup>41</sup>	4 <sup>19</sup>	15 <sup>14</sup>	4.8					
3	Fm. 2	NØ 3	Skjel	Em. 2	NØ 3	Skjel									
	Fm. 8	NØ 2	g?	Em. 8	NØ 2	g?	4 <sup>44</sup>	4 <sup>16</sup>	15 <sup>25</sup>	5.2					
4	Fm. 2	NØ 2	g?	Em. 2	NØ 1	Skjel									Lysdag
	Fm. 8	NØ 2	g?	Em. 8	NØ 3	g?	4 <sup>46</sup>	4 <sup>14</sup>	15 <sup>30</sup>	5.0					
5	Fm. 2	NØ 2	g?	Em. 2	NØ 3	Skjel									
	Fm. 8	NØ 3	Skjel	Em. 8	NØ 3	Skjel	4 <sup>48</sup>	4 <sup>12</sup>	15 <sup>34</sup>	5.3					
6	Fm. 2	NØ 4	Skjel	Em. 2	NØ 3	Skjel									
	Fm. 8	NØ 4	Skjel	Em. 8	NØ 4	Skjel	4 <sup>51</sup>	4 <sup>10</sup>	15 <sup>39</sup>	5.1					
7	Fm. 2	NØ 4	g?	Em. 2	NØ 3	Skjel									Ingen Fyre synbare
	Fm. 8	NØ 4	g?	Em. 8	NØ 5	Skjel	4 <sup>53</sup>	4 <sup>07</sup>	15 <sup>43</sup>	5.2					
8	Fm. 2	NØ 3	Skjel	Em. 2	NØ 3	Skjel									Lysdag
	Fm. 8	NØ 3	g?	Em. 8	NØ 3	g?	4 <sup>55</sup>	4 <sup>05</sup>	15 <sup>48</sup>	5.2					
9	Fm. 2	NØ 3	g?	Em. 2	NØ 3	Skjel									
	Fm. 8	NØ 3	g?	Em. 8	NØ 3	g?	4 <sup>58</sup>	4 <sup>02</sup>	15 <sup>52</sup>	5.2					
10	Fm. 2	NØ 3	Skjel	Em. 2	NØ 3	Skjel									Skiftet Brander
	Fm. 8	NØ 2	g?	Em. 8	NØ 4	Skjel	8 <sup>0</sup>	4 <sup>0</sup>	15 <sup>58</sup>	5.6					
11	Fm. 2	NØ 5	g?	Em. 2	NØ 4	Skjel									Ingen Fyre synbare
	Fm. 8	NØ 5	g?	Em. 8	NØ 8	Skjel	8 <sup>02</sup>	3 <sup>58</sup>	16 <sup>02</sup>	5.3					
12	Fm. 2	NØ 3	Skjel	Em. 2	NØ 3	Skjel									Lysdag
	Fm. 8	NØ 3	g?	Em. 8	NØ 3	Skjel	8 <sup>05</sup>	3 <sup>56</sup>	16 <sup>02</sup>	5.2					

Fig. 3. Part of a page from the logbook kept at Presteskjæret lighthouse at the coast of Rogaland, Southwest Norway, with notes about wind, weather, state of the sea, and visibility, four times a day.

### Structure of the database

In the database for historic meteorological observation series, the data are structured in two connected parts. Part 1 contains information about the station: number and name of the station, geographical coordinates, the identity of the observer and the instruments in use. There is also a field for information about the original manuscript and a field for the name of the puncher.

Part 2 consists of the observation records, one record for each observation. It contains fields for the individual weather elements observed at the station at fixed intervals.

### Meteorological observations from lighthouse logbooks

It appears that during the 19th century regular logbooks were kept in most of the lighthouses, including daily observations of wind and weather. Most of the logbooks seem to be intact and they are kept in regional archives or in the National Archive in Oslo. From the outer Oslo fjord area, the Færder lighthouse logbooks, including daily observations of wind, weather and ice conditions, date back to 1826.

At the regional archive in Stavanger there are logbooks from eight lighthouses on the coast of Rogaland with daily weather observations:

<b>Name of lighthouse</b>	<b>First occurrence of daily observations</b>
Viberodden	Dec. 1855
Fjøløy	Oct. 1854
Flatholmen	Sep. 1862
Kvitsøy	Jan. 1879
Obrestad	Dec. 1873
Eigerøy	Nov. 1854
Utsira	Jan. 1850
Lille Presteskjæret	Nov. 1895

The quality of the observations are generally good, especially towards the end of the century. This runs parallel to the development of the national meteorological service, after the establishment in 1866 of the DNMI. By the end of the century, up to four observations a day were done by the lighthouse keepers. Utsira lighthouse was the first to be equipped with instruments in 1867. In fig. 3 is shown part of a page from the logbook kept at Presteskjæret lighthouse on the coast of Rogaland. It is from November 1895 and contains observations of wind, weather, state of the sea and visibility.

It is an obvious advantage as regards the use of meteorological observations from the lighthouses that it is quite clear where the observations were taken. In addition the history of the lighthouses is well documented (Bjørkhaug and Poulsson 1986-1987).

It must also be emphasized that the observations from the lighthouses to a large degree reflect the characteristics of unmodified winds and of the state of the free air, such

as heat and moisture content. For that reason, they are of a wider and more general importance in climatological research than observations from other land based stations, which are much more modified by local surroundings.

The lighthouse observations and similar systematic series of observations will in the database be structured the same way as the instrumental series.

## Meteorological observations from ships

Logbooks from Norwegian ships prior to 1900, containing meteorological observations, are found in many different archives. However, an extended research has been postponed because of the large amount of pure meteorological diaries from the archives of the DNMI with which we recently have started working. The diaries cover the period of 1867-1890. They contain instrumental observations of air pressure, air temperature, sea temperature and wind and weather observations according to an international coding system. The number of diaries seems to amount to 600, representing more than 500.000 records from waters all around the world. Because of the acute demand among climatologists for increased knowledge about the climate of the oceans over the last 125 years, we have, in agreement with DNMI, given priority to punching the observations for the COADS database. They will be included in the COADS updating process, which is estimated to be finished around 1995/1996. The punching of the records is carried out at AmS in both English and Norwegian versions, securing a complete Norwegian copy of the data. A candidate for the doctorate is at present working on a thesis on maritime climatology of the North Atlantic during the period 1860-1990.

## Literature

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