DEN NORSKE NORDHAVS-EXPEDITION

1876—1878.

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1. ASTRONOMISKE OBSERVATIONER.

H. MOHN.

2. MAGNETISKE OBSERVATIONER.

C. WILLE.

3. GEOGRAFI OG NATURHISTORIE.

MED 6 FARVETRYKTE BILLEDER, 13 TRÆSNIT OG 2 KARTER.

H. MOHN.

CHRISTIANIA.
GRØNDAHL & SØNS BOGTRYKKERI.
1882.

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WITH 6 CHROMO-LITHOGRAPHS, 13 WOOD ENGRAVINGS AND 2 MAPS.

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H. Mohn. Astronomiske Observationer til Tids- og Stedsbestemmelse.

De i denne Afhandling meddelte astronomiske Observationer gjordes under Expeditionens Ophold i Havn væsentlig med det Maal for Øje at tjene til Grundlag for de Tids- og Azimuthbestemmelser, der udfordredes til de magnetiske Iagttagelser. Ved Siden deraf tilsigtedes ogsaa Bredde- og Længdebestemmelser, der kunde være af geografisk Interesse, som paa Jan Mayen og Spidsbergen. Den gunstige Lejlighed, som de gjennem Telegrafen givne Tidssignaler frembød til Verification af Længden af Punkter paa Kysten af det nordlige Norge, ønskede jeg ogsaa at benytte efter Lejligheden.

Observationerne ere Solhøjder, maalte med Sextant. Af Bestyreren for det astronomiske Observatorium i Christiania, Professor C. Fearnley, fik jeg udlaant en Observatoriet tilhørende Sextant af Troughton, med Kviksølvhorizont og Stativ, det samme Instrument, som Hansteen benyttede paa sin Rejse i Sibirien i Aarene 1828—1830. I Brugen af Instrumentet modtog jeg selv Prof. Hansteens Vejledning paa Observatoriet i 1861. Paa Sextanten aflæses ved Nonien directe 10″. Ved samtlige Observationer benyttedes den lange Kikkert med ca. 10 Ganges Forstørring. Glastaget over Kviksølvhorizonten prøvede jeg, paa Røst, ved at stille det foran Kikkerten paa en Theodolith, der var indstillet paa en god Mire (et Kirkespir): Virkningen af en prismatisk Form af Glassene var saagodtsom umerkelig, og kan neppe udgjøre et Par Sekunder.

Saagodtsom alle de her meddelte Observationer ere gjorte med dette Instrument. Under Jan Mayen observeredes fra Skibsborde ogsaa med et Par andre Sextanter.

Af Uhre havdes i 1876 ombord 3 Boxchronometre, af Kullberg, Frodsham og Mewes samt et Lommechronometer, foruden almindelige Lommeuhre, hvoraf et mig tilhørende Duplexuhr. I 1877 og 1878 havde vi foruden de nævnte Uhre et Boxchronometer af Reid og i 1878 havde

H. Mohn. Astronomical Observations for determining Time, Latitude and Longitude.

The astronomical observations set forth in this Memoir were made during our stay in certain of the harbours at which the Expedition touched, — chiefly to serve as a basis of the time and azimuth determinations required for the magnetical observations. A secondary object lay in performing, if possible, divers latitude and longitude determinations that might prove of geographical interest, as, for instance, on the islands of Jan Mayen and Spitzbergen. Moreover, of the excellent opportunity afforded by the telegraph time-signals to verify the longitude of points on the northern line of the Norway coast, I was specially desirous of taking advantage.

The observations are solar altitudes, measured with the sextant. On application to Professor C. Fearnley, Director of the Astronomical Observatory at Christiania, he kindly lent me a sextant belonging to that establishment, one of Troughton's, furnished with a mercury-horizon and stand, — the identical instrument used by Hansteen on his travels in Siberia (1828—1830). In the use of the instrument Hansteen had himself given me the necessary instructions, at the Observatory, in 1861. The vernier reads 10 seconds. For all the observations, the long telescope, magnifying about 10 diameters, was exclusively used. The glass covering the mercury-horizon I tested at Røst, by placing it in front of the telescope of a theodolite directed to a good mark (a church steeple). The effect resulting from a slightly prismatic form in the glasses was well-nigh inappreciable, amounting as it did to hardly a couple of seconds.

Almost all of the observations were made with this instrument, a very few only having been taken on board with other sextants, off the coast of Jan Mayen.

Of time-keepers, we had on the first cruise, in 1876, 3 box-chronometers, made respectively by Kullberg, Frodsham, and Mewes, and a pocket-chronometer, exclusive of watches, one of which — that belonging to myself — was a duplex lever. In 1877 and 1878, we had in addition a

jeg til Observationsuhr et Lommechronometer, der var prøvet paa Observatoriet i Neufchatel.

Boxchronometrene havde sin Plads ombord i et Skab i Arbeidssalonen. De bleve hver Morgen optrukne og sammenlignede indbyrdes. I 1876 tjente Kullberg som Hoveduhr og i 1877 og 1878 Reid. Kun Hoveduhret har været benyttet til Længdebestemmelserne, da det viste sig at have en meget jevnere Gang end de øvrige. Under Rejserne blev det af de daglige Sammenligninger constateret, at der ikke indtraf nogen merkelig Forrykkelse i Hoveduhrets daglige Gang.

Ved Observationer paa Land eller paa Dæk benyttedes saagodtsom uden Undtagelse et af de andre Boxchronometre eller et Lommechronometer, stundom ogsaa et almindeligt Lommeuhr. I ethvert Tilfælde blev Observationsuhret sammenlignet med Hoveduhret før og efter Observationerne.

Før Expeditionen tiltraadte sine Rejser, bleve Boxchronometrene, med Undtagelse af Reid, daglig sammenlignede med Pendeluhret paa Observatoriet i Bergen af dettes Bestyrer, Hr. Åstrand. Under Expeditionens Ophold i norske Havne blev deres Stand for Greenwich Middeltid bestemt ved de fra Observatoriet i Christiania gjennem Telegrafen givne Tidssignaler. Disse gives hver Søndag og hver Onsdag Morgen. Signalapparatet (Morse's) staar lige ved Siden af Observatoriets Normalpendel. Der gives hver Gang 3 Signaler, nemlig $8^h\ 59^m\ 0^s$, $9^h\ 0^m\ 0^s$ og $9^h\ 1^m\ 0^s$ Greenwich Middeltid om Søndagene og $7^h\ 59^m\ 0^s$, $8^h\ 0^m\ 0^s$ og $8^h\ 1^m\ 0^s$ om Onsdagene. Tidssignalet, der høres meget skarpt paa Modtagelsesstationens Morse-Apparat, bestaar i et enkelt Slag. For at skille mellem de 3 Signaler slaaes efter det første 1 Dobbeltslag, efter det andet 2 og efter det 3die Signal 3 Dobbeltslag. Signalerne sendes til alle norske Telegrafstationer.

Med Hensyn til Nøjagtigheden af de i det Følgende givne Tids-, Længde og Bredde-Bestemmelser maa jeg bemerke Følgende:

Den af Beregningerne udledede sandsynlige Fejl af en enkelt observeret Højde (paa Land med Stativ og Kviksølvhorizont) er omkring $\pm\ 5''$. Der er imidlertid, som det paa sit Sted skal vises, Tegn til, at der, foruden de egentlige tilfældige Observationsfejl, optræder constante Fejl, hvis Aarsag kunne ligge i forskjellige Omstændigheder, som i Bestemmelsen af Indexfejlen, mangelfuld Justering af Instrumentet, Excentricitet m. m. Hvad Indexfejlen angaar, da er den i Regelen bestemt samtidig med Observationerne og ved gjennemsnitlig 4 Satser Dobbeltcontacter af Solrenderne. Middelfejlen af Resultatet af en enkelt Sats finder jeg at være $\pm\ 5''.7$ og Middelfejlen for en Bestemmelse af Indexfejlen skulde saaledes være $\pm\ 2''.85$. Instrumentet holdtes altid godt justeret og om Excentricitet af nogen merkelig Virkning nævner Prof. Hansteen ikke Noget. Ved Observationerne i Hammerfest (Fuglenes) og i Bodø antydes imidlertid Tilstedeværelsen af constante Feil i Højden af respektive $+8''$ og $-8''$. En Del heraf kunde

box-chronometer by Reid, and in the latter year I took observations with a pocket-chronometer, tested at the Observatory of Neufchatel.

The box-chronometers were kept in a cupboard in the work-room. They were wound up every morning and duly compared. In 1876, Kullberg's served as chief time-keeper, in 1867 and 1878 that by Reid. For determinations of longitude, exclusive use was made of the chief time-keeper, its rate having proved much more uniform than that of the other chronometers. On each cruise the result of the daily comparison showed that no appreciable disturbance had occurred in the diurnal rate of the chief time-keeper.

For observations on shore, or from the deck of the vessel, we used almost without exception one of the other box-chronometers, or a pocket-chronometer, nay sometimes a watch. The chronometer or watch, whichever it might be, was, however, invariably compared with the chief time-keeper both before and after the observations.

Previous to the departure of the Expedition on its several cruises, the box-chronometers, with the exception of Reid's, were daily compared with the standard-clock of the Bergen Observatory, by the Director, Mr. Åstrand. During the stay of the Expedition at Norwegian ports, their error on Greenwich mean time was determined by the time-signals telegraphed from the Observatory at Christiania. These signals are sent every Sunday and Wednesday morning. The signalling apparatus (Morse's) stands close beside the standard-clock of the Observatory. Three signals are given, viz. at $8^h\ 59^m\ 0^s$, $9^h\ 0^m\ 0^s$, and $9^h\ 1^m\ 0^s$, Greenwich mean time, on Sundays, and at $7^h\ 59^m\ 0^s$, $8^h\ 0^m\ 0^s$ and $8^h\ 1^m\ 0^s$ on Wednesdays. Each signal, distinctly delivered by the apparatus of the receiving-station, consists of a single click. As a means of readily distinguishing between the 3 signals, the first is followed by a double-click, the second by 2 double-clicks, and the third by 3. These signals are transmitted to all Norwegian telegraph-stations.

As regards the accuracy of the observations for determining time, latitude, and longitude, I must observe as follows: —

The computed probable error of a single observed altitude (using on shore the sextant with a stand and mercury-horizon) is about $\pm\ 5''$. Meanwhile, there is reason to believe, as will afterwards appear, that, apart from the accidental errors of observation, certain constant errors occur, arising probably from various sources, such as the determination of the index-error, imperfect adjustment of the instrument, excentricity, &c. With regard to the index-error, this has usually been determined when taking the observations, and on an average from 4 sets of double contacts of the solar limbs. The mean error of the result of one double contact I found to be $\pm\ 5''.7$, and the mean error of the determination of the index-error should accordingly have been $\pm\ 2''.85$. The instrument was always kept well adjusted, and of excentricity that could have any appreciable effect, Hansteen says nothing whatever. Meanwhile, the observations taken at Hammerfest (Fuglenes) and at Bodö indicate the existence of constant errors in the

muligens tilskrives Ujevnhed i Chronometrets Gang, men saameget bliver tilbage som Fejl i Højderne, at jeg anser det rigtigst at antage, at mine Højder, med et rundt Tal, kunne være beheftede med en sandsynlig constant Fejl for hver Station af $\pm$ 10″.

Paa den Nøjagtighed, hvormed Observationsuhret angiver Greënwich Middeltid, har jeg søgt at faa et Maal ved følgende Overslag:

Observationsuhrets Sammenligning med Hoveduhret. Der toges flere Sammenligninger for og efter Højdeobservationerne. Af disse finder jeg for 1877, mit Duplexuhr, en sandsynlig Fejl af den anvendte Uhrforskjel af $\pm$ 0.ˢ15 (efter 4 Sammenligninger) og $\pm$ 0.ˢ11 af 4 Sammenligninger før og 4 efter Observationerne. For 1878 finder jeg for Sammenligningen mellem mit Lommechronometer og Chronometer Reid saavel i Søen som i Havn, Middelfejlen af en enkelt Sammenligning $\pm$ 0.ˢ10. I Regelen gjordes 3 Sammenligninger, saaat Middelfejlen ved en Sammenligning for eller efter Højdeobservationerne kan sættes til $\pm$ 0.ˢ06 og af Mediet af begge til $\pm$ 0.ˢ04. Jeg kalder i det følgende denne sandsynlige Fejl D_1 og sætter med et rundt Tal $D_1 = \pm$ 0.ˢ1.

Naar Tidssignal skulde observeres, var Regelen den, at Skibschefen, Capt. Wille, først sammenlignede Observationsuhret, et Lommechronometer, der slog 0.ˢ4, med Hovedchronometret, derpaa gik i Land paa Telegrafkontoret og efter Tilhagekomsten ombord atter tog en Uhrsammenligning. Jeg antager, efter et Skjøn, denne Operations Resultat at have en sandsynlig Fejl af $\pm$ 0.ˢ1, som jeg kalder D_2.

Paa Telegrafkontoret observerede Capt. Wille Tidssignalerne efter Observationsuhret. Den sandsynlige Fejl af Observationen af et enkelt Signal antager jeg at kunne sætte til $\pm$ 0.ˢ2. Da i Regelen neppe mere end 2 af de 3 Signaler kunne antages at blive godt observerede (ved de 2 sidste er man forberedt paa Secundet), sætter jeg den sandsynlige Fejl af Resultatet af Observationen af Tidssignalerne til $\pm$ 0.ˢ15 (D_3). Ved en Lejlighed, da vi begge observerede Tidssignalerne, stemte vor Bestemmelse af Hovedchronometrets Stand paa 0.ˢ1.

Ved Signalets Afsendelse paa Observatoriet i Christiania kan den sandsynlige Fejl, efter Vidnesbyrd fra vedkommende Astronomer, sættes til 0.ˢ15 pr. Signal, $\pm$ 0.ˢ10 pr. 2 Signaler (D_4).

Ligeledes sættes den sandsynlige Fejl af Normalpendelens beregnede Stand for Christiania Stjernetid, corrigeret efter efterfølgende Tidsbestemmelse, til $\pm$ 0.ˢ1 (D_5).

Den sandsynlige Fejl af den nedenfor antagne Tidsforskjel mellem Christiania og Greenwich Observatoriers Meridianer sættes til $\pm$ 0.ˢ2 (D_6).

Ved Længdeberegningerne er forudsat en jevn Gang hos Hovedchronometret mellem de Tidspunkter, da dets

altitude amounting respectively to +8″ and —8″. Some part of this error may perhaps be ascribed to want of uniformity in the rate of the chronometer: but even with this deduction, the remainder is, I think, as an actual error in the altitudes, sufficient to warrant assuming that my solar altitudes may be affected by a probable constant error at each Station of $\pm$ 10″.

Of the precision with which the chronometer used for noting the observations indicates Greenwich mean time, I have sought to find a measure as follows: —

Comparison of the watch or chronometer selected for the observation with the chief time-keeper. Several comparisons were made before and after the observations of altitude. Now, for 1877 (my duplex watch), I find a probable error of the assumed difference of the errors of the time-pieces (4 comparisons) of $\pm$ 0.ˢ15, and with 4 comparisons before and 4 after the observations, of $\pm$ 0.ˢ11. For 1878, I find the mean error of a single comparison between my pocket-chronometer and the box-chronometer by Reid, both at sea and in harbour, to have been $\pm$ 0.ˢ10. The number of comparisons having as a rule been three, the mean error of one comparison before or one after a series of altitudes may be put at $\pm$ 0.ˢ06, and the mean error of two comparisons, one before and one after, at $\pm$ 0.ˢ04. In the sequel I shall call this probable error D_1, and assume $D_1 = \pm$ 0.ˢ1.

The time-signals were generally observed as follows: — Shortly before their arrival, the commander of the vessel, Capt. Wille, compared a pocket-chronometer, beating 0.ˢ4, with our chief time-keeper. He then went on shore to the telegraph-office, observed the signals, and, on his return to the ship, again compared the respective time-pieces. The probable error of these comparisons on board may, I think, be estimated at $\pm$ 0.ˢ1, which I shall call D_2.

At the telegraph-office Capt. Wille observed the time-signals with the pocket-chronometer mentioned above. The probable error of the observation of one signal I have put at $\pm$ 0.ˢ2. Now, as only 2 of the 3 signals, on an average, will be accurately observed (for the 2 last the observer is prepared to the second), I shall estimate the probable error of the result of our observations of the time-signals at $\pm$ 0.ˢ15 (D_3). On one occasion, when both of us (myself and Capt. Wille) observed the time-signals, our determination of the error of the chief chronometer agreed within 0.ˢ1.

According to the estimate of the astronomers of the Christiania Observatory, the probable error of one signal as given with the key at the Observatory may be put at $\pm$ 0.ˢ15, of two signals $\pm$ 0.ˢ10 (D_4).

The probable error of the computed error of the standard clock on Christiania sidereal time, corrected from later transits of stars, is put at $\pm$ 0.ˢ1 (D_5).

The probable error of the difference in time, as given below, between the meridians of the Christiania and Greenwich Observatories, is put at $\pm$ 0.ˢ2 (D_6).

For computations of longitude, the chief chronometer is assumed to have had a uniform rate between the moments

Stand er bestemt ved Tidssignaler. Den sandsynlige Fejl eller Afvigelse fra den absolut jevne Gang sætter jeg, da den midlere Gang hos Chronometret Reid viser sig saa udmerket jevn, til $\pm$ 0.^{s}25 (D_i).

Den galvaniske Strøm, ved hvilken Tidssignalerne gives, gaar ikke directe gjennem alle Stationers Apparater, men sendes ved Overdrag videre fra visse Overdragsstationer. For de Stationers Vedkommende, hvorom her er Spørgsmaal, er der Overdrag i Christiania, Throndhjem, Lødingen og Kistrand. Ved Overdragene lider Signalet en Forsinkelse. Størrelsen af denne fik jeg ved Telegrafdirektør Nielsen's og Telegrafintendant Collett's Velvilje bestemt paa følgende Maade: Strømmen sendtes fra Christiania over Throndhjem til Lødingen og tilbage til Christiania ad to forskjellige Traade med 3 Overdrag paa Vejen. Det med en Nøgel givne Signal kom igjen og hørtes paa et ved Siden af Afsendelsesapparatet staaende Apparat. Naar jeg signalerede med Nøglen i Takt og Coincidents med mit Lommechronometer, hørtes det tilbagekommende Signal midt imellem de med Nøglen givne Signaler. Da mit Uhr slaar 4 Tiendedels Secunder, var Signalets Forsinkelse 0.^{s}20 for 3 Overdrag. Sættes Forsinkelsen lige stor for hvert Overdrag, bliver den 0.^{s}07 for hvert, og altsaa for 2 Overdrag 0.^{s}14, og for 4 Overdrag 0.^{s}28.

Ved Beregningen af Normalpendelens Angivelse for Signaløjeblikket er gaaet ud fra en Tidsforskjel af $0^h\ 42^m\ 54.^s5$ mellem Christiania og Greenwich. Efter den af Prof. Auwers i Geographisches Jahrbuch für 1880 givne Tabel over de vigtigste Observatoriers Bredde- og Længde er den nævnte Tidsforskjel $0^h\ 42^m\ 53.^s8$. Forskjellen mellem de to Tal beror paa de nyere telegrafiske Bestemmelser af Længden af Kjøbenhavns Observatorium, med hvilket Christianias er forbundet chronometrisk. Idet jeg gaar ud fra den nyere Bestemmelse, bliver følgelig Klokkeslettet i Greenwich i Signaløjeblikket 0.^{s}7 større end oprindelig antaget.

Observator Geelmuyden har velvilligen meddelt mig de corrigerede Tidspunkter for Signalernes Afsendelse, der ere beregnede efter Tidsbestemmelser gjorte saavel før som efter Signalernes Afsendelse. Den følgende Tabel viser de efter de oven anførte Correctioner, Strømtid, Længdecorrection og senere Tidsbestemmelser, rettede Signaløjeblikke, som ere observerede under Expeditionen, samt Hovedchronometrenes Stand og Gang.

at which its error was found by the time-signals. The probable error or deviation from a uniform rate, I shall put — the mean rate of the Reid chronometer having proved so remarkably uniform — at $\pm$ 0.^{s}25 (D_i).

The galvanic current by which the time-signals are transmitted, does not reach every station direct, being sent on by relays from certain stations selected for that purpose. As regards the stations at which the time-signals were observed on the Expedition, the relay-stations were at Christiania, Throndhjem, Lödingen, and Kistrand. These breaks occasion some loss of time in transmitting the signal. The approximate extent of the delay I was enabled by the kindness of Mr. Nielsen, Director of Telegraphs, and of Mr. Collett, Electrician, to determine as follows: — The galvanic current was transmitted from Christiania, viâ Throndhjem, to Lödingen, and thence back to Christiania, by two different wires, and broken by three relays. The signal, given with a key, came back, being distinctly delivered from another apparatus, also standing beside the observer. When signalling with the key, its clicks coinciding with the beats of my pocket-chronometer, the returning signal would be heard at the mid-point of the interval between two successive signals given with the key. Now, as my pocket-chronometer beats four-tenths of a second, the delay in transmitting a signal must have been 0.^{s}20 with three relays; hence, with one relay, assuming it equal for each, the delay will be 0.^{s}07, with two relays 0.^{s}14, and with four 0.^{s}28.

In computing the indication of the standard-clock for the moment of the despatch of a signal, the difference in time between Christiania and Greenwich has been put at $0^h\ 42^m\ 54.^s5$. According to the Table furnished by Professor Auwers in Geographisches Jahrbuch for 1880, showing the latitude and longitude of the chief Observatories, the difference is $0^h\ 42^m\ 53.^s8$. The want of agrement in the respective figures must be ascribed to the late telegraphic determination of the longitude of the Copenhagen Observatory, with which that at Christiania is chronometrically connected. Taking the latter of the two determinations, the assumed Greenwich time at the moment of despatch will require a correction of + 0.^{s}7.

Mr. Geelmuyden, of the Christiania Observatory, has kindly furnished me with the corrected moments for the despatch of the signals, computed from transists observed alike before and after transmission. In the following Table will be found the moments of despatch for the signals observed on the Expedition, corrected for the above-specified errors, viz. the propagation of the current, correction of assumed longitude, and subsquent determinations of clock error — as also the error and rate of the chief chronometers.

Sted. (Place.)	Datum. (Date.)	Greenwich Middeltid. (Greenwich Mean Time) a. m.	Hovedchronometer Corr. til G. M. T. (Standard Chronometer. Corr. to G. M. T.)	Daglig Gang. (Daily Rate.)
Christiansund	1876 Juni (*June*) 25	$9^h\ 0^m\ 0.^s0$	$-0^h\ 38^m\ 59.^s6$	$0.^s59$
Namsos	„ Aug. (*Aug.*) 20	9 0 0.8	—0 39 32.8	
Bergen	1877 Maj (*May*) 23	8 0 0.7	+0 7 23.7	0.97
Bodø	„ Juni (*June*) 24	9 0 0.9	7 54.9	0.94
Tromsø	„ Juli (*July*) 11	8 0 0.9	8 10.9	0.87
Tromsø	„ Juli (*July*) 22	8 59 59.3	8 20.5	0.97
Bodø	„ Aug. (*Aug.*) 12	9 0 1.3	8 40.8	
Hammerfest	1878 Juni (*June*) 23	9 0 1.0	+0 15 5.5	0.87
Hammerfest	„ Juli (*July*) 10	8 0 1.2	0 15 20.2	0.96
Hammerfest	„ Juli (*July*) 28	9 0 1.0	0 15 37.5	0.97
Tromsø	„ Aug. (*Aug.*) 28	8 0 0.8	0 16 7.6	

I. Husø.

En liden Ø ved Sognefjordens Munding. Sterk Nordenvind. Observationerne gjordes i Læ af Hr. Lexaus Hus. Efter Kystkartet er Bredden $\varphi = 60^0\ 59.'6$, Længden $\lambda = 4^0\ 37' = 18^m\ 28^s$ E. Greenwich $= 2^m\ 41^s$ W. Bergen. Corresponderende Højder. Chronometer Mewes No. 575. 2h′ = aflæst dobbelt Højde. T_0 ucorrigeret Middag, ΔT_0 Middagscorrection, E. Tidsjevning, MT Middeltid.

I. Husø.

A small island at the mouth of the Sognefjord. Blowing hard from the north. The observations were taken to leeward of Mr. Lexau's house. On the coastal chart, the latitude, φ, is $60^0\ 59.'6$, the longitude, λ, $4^0\ 37' = 18^m\ 28^s$ E. Greenwich $= 2^m\ 41^s$ W. Bergen. Equal altitudes. Chronometer, Mewes No. 575. 2h′ signifies Observed double altitude; T_0 Mean of all chronometer-times; ΔT_0 Equation of equal altitudes; E Equation of time; MT Mean time.

1876. Juni (*June*) 10.

☉ 2h′	Chron. a. m.	Chron. p. m.	T_0
$89^0\ 30'$	$22^h\ 6^m\ 59.^s5$	$2^h\ 48^m\ 34.^s0$	$0^h\ 27^m\ 46.^s75$
50	8 51.0	46 44.0	47.5
90 0	9 45.5	45 48.5	47.0
10	10 42.0	44 52.5	47.25
20	11 37.0	43 56.5	46.75
30	12 33.0	43 1.0	47.0
40	13 29.5	42 3.0	46.25
50	14 27.0	41 6.0	46.5
91 0	15 25.5	40 9.0	47.25
10	16 22.5	39 12.5	47 5
20	17 21.0	38 12.5	46.75
30	18 18.0	37 14.5	46.25
40	19 17.0	36 17.9	47.45
50	20 14.7	35 19.0	46.85
92 0	21 15.0	34 20.0	47.5

$T_0 =$	$0^h\ 27^m\ 46.^s97$
$\Delta T_0 =$	-4.34
	0 27 42.63
E =	47.32
Mewes foran Husø Middeltid *(Fast on Husø M. T.)*	0 28 29.95
Reduction t. *(to)* Bergen	2 41.
Correction t. *(Error on)* Bergen M. T.	$-0^h\ 25^m\ 49.^s$

Maj *(May)* 30	$2.^h55$	Corr. t. *(Error on)*	Bergen	M. T. =	$-0^h\ 24^m\ 44.^s3$
Juni *(June)* 10	0. 45	— „ (— „)	—	„ „ =	— 0 25 49. 0
Daglig Acceleration *(Gaining daily)*					$5.^s93$

2. Reykjavik.

Den 1ste August 1876 toges af Capt. Wille og Lieutn. Petersen følgende corresponderende Højder paa den grønne Plæne ved Konsul Simsons Hus. $\varphi = 64^0\ 9.'0$, $\lambda = 1^h\ 27^m\ 36.^s6$ W. Gr. Chronometer Kullberg.

2. Reykjavik.

On the 1st of August, 1876, Capt. Wille and Lieut. Petersen took the following equal altitudes from the grass-plot adjoining Mr. Simson's house. $\varphi = 64^0\ 9.'0$, $\lambda = 1^h\ 27^m\ 36.^s6$ W. Gr. Kullberg's chronometer.

⊙ 2h′	Chron. a. m.	Chron. p. m.	$T_0 + \Delta T_0$
75^0 0′	$23^h\ 49^m\ 8.^s0$	$4^h\ 36^m\ 10.^s0$	$2^h\ 12^m\ 57.^s75$
10	50 12. 5	35 5. 5	57. 73
20	51 17. 5	34 0. 0	57. 44
30	52 24. 5	32 55. 0	58. 41
40	53 29. 5	31 48. 0	57. 38
50	54 40. 5	30 40. 5	59. 10
76 0	55 45. 5	29 31. 5	57. 08
76 40	0 0 18. 5	4 25 1. 5	57. 96
50	1 26. 0	23 52. 0	56. 43
77 0	2 37. 0	22 40. 5	57. 15
10	3 49. 0	21 31. 0	58. 38
20	4 58. 0	20 21. 0	57. 85
30	6 9. 5	19 11. 5	58. 82
40	7 18. 5	17 57. 0	56. 04
			$2^h\ 12^m\ 57.^s68 \pm 0.^s13$
	E.:		6 2. 06
Chron. Corr. t. *(Error on)*	Reykjavik M. T.		$2^h\ 6^m\ 55.^s62$
— — „ (— „)	Greenwich —		39 21. 8
	Reykjavik W. Greenwich		$1^h\ 27^m\ 33.^s8$

Sættes $D_1 = 0$, da Hovedchronometret anvendtes til Observationerne, $D_2 = \pm\ 0.^s1$, $D_3 = \pm\ 0.^s15$, $D_4 = \pm\ 0.^s1$, $D_5 = \pm\ 0.^s1$, $D_6 = \pm\ 0.^s2$, $D_7 = \pm\ 0.^s25$, saa bliver den sandsynlige Fejl af den beregnede Længde

Now, putting $D_1 = 0$, the observations having been taken with the chief chronometer; $D_2 = \pm\ 0.^s1$, $D_3 = \pm\ 0.^s15$, $D_4 = \pm\ 0.^s1$, $D_5 = \pm\ 0.^s1$, $D_6 = \pm\ 0.^s2$, $D_7 = \pm\ 0.^s25$, the probable error of the computed longitude will be

$$D_\lambda = \pm \sqrt{(0.^s13)^2 + D_2^2 + D_3^2 + D_4^2 + D_5^2 + D_6^2 + D_7^2} = \pm\ 0.^s41$$

Den af ovenstaaende Observationer beregnede Længde stemmer paa $2.^s7$ med den, der ifølge de Opgaver, som velvillig ere mig meddelte af Commandør Rothe, Directør for det Kongelige Danske Søkaart-Archiv i Kjøbenhavn, efter tidligere Iagttagelser og Beregninger er antaget som den sandsynligste, nemlig $1^h\ 27^m\ 36.^s6$. Observations-

The longitude computed from the observations given above agrees within $2.^s7$ with that which, according to the results kindly furnished me by Commodore Rothe, Hydrographer to the Royal Danish Navy, from former observations and computations, is deemed the most probable, viz. $1^h\ 27^m\ 36.^s6$, the point of observation lying about 38″,

punktet ligger nemlig 38″ eller 2.ˢ5 østenfor det Punkt ved Reykjavik, hvis Længde er antaget at være 21° 54′ 46″ eller 1ʰ 27ᵐ 39.ˢ1.[1]

or 2.ˢ5, east of a point at Reykjavik of which the longitude is assumed to be 21° 54′ 46″, or 1ʰ 27ᵐ 39.ˢ1.[1]

3. Namsos.

Corresponderende Højder. $\varphi = 64^{\circ}\ 28.'2$, $\lambda = 0^{h}\ 46^{m}\ 6^{s}$ E. Greenw. Observationerne gjordes paa Nordsiden af Byen, c. 20 Skridt fra Stranden. Chron. Frodsham.

3. Namsos.

Equal altitudes: $\varphi = 64^{\circ}\ 28.'2$; $\lambda = 0^{h}\ 46^{m}\ 6^{s}$ E. Gr. The observations were taken north of the town, about 20 paces from the shore. Frodsham's chronometer.

1876. August 19.

☉ 2h′	Chron. a. m.	Chron. p. m.	$T_o + \Delta T_o$
72° 50′	22ʰ 7ᵐ 26.ˢ5	0ʰ 54ᵐ 47.ˢ0	23ʰ 31ᵐ 30.ˢ94
73 0	9 14.5	52 58.5	30.67
73 10	11 5.0	51 7.0	30.14
20	13 0.0	49 12.5	30.35
30	15 0.5	47 20.5	34.57
40	16 54.0	45 19.0	30.54
50	18 50.5	43 21.0	29.73
74 0	21 2.0	41 15.0	32.48
10	23 9.0	39 7.5	32.21
			23 31 31.29 ± 0.ˢ34
		E.	0 3 19.14
		Corr. t. *(Error on)* Namsos M. T.	+ 0 31 47.85

Den 19de August, 21ʰ 0ᵐ 0.ˢ8 Greenwich M. T., var, ifølge Tidssignal pr. Telegraf, observeret directe efter Frodsham, af Capt. Wille, dette Chronometer 14ᵐ 23.ˢ0 foran Greenwich M. T. Da Chronometret accelerede 5.ˢ12 i 24ʰ, bliver for Signaløjeblikket dets Correction til Namsos Middeltid + 31ᵐ 43.ˢ22, og den af disse Tal resulterende Længde for Namsos

$$\lambda = 0^{h}\ 46^{m}\ 6.^{s}22 \text{ E. Greenwich}$$

med en sandsynlig Fejl af

On the 19th of August, 21ʰ 0ᵐ 0.ˢ8 Greenwich M. T., Capt. Wille found the Frodsham chronometer, with which he observed the time-signals, to be 14ᵐ 23.ˢ0 fast on Greenwich M. T.; and hence, gaining as it did 5.ˢ12 in twenty-four hours, the error on Namsos M. T. for the moment of despatch will be + 31ᵐ 43.ˢ22, and the longitude of Namsos computed from these figures,

$$\lambda = 0^{h}\ 46^{m}\ 6.^{s}22 \text{ E. Greenw.}$$

with a probable error of

$$\pm \sqrt{(0.^{s}34)^{2} + D_{3}^{2} + D_{4}^{2} + D_{5}^{2} + D_{6}^{2} + D_{7}^{2}} = \pm\ 0.^{s}49$$

Efter det af den geografiske Opmaaling construerede, endnu ikke udgivne, nyeste Kart over disse Egne ligger mit Observationspunkt 0° 46′ 29″ eller 0ʰ 3ᵐ 5.ˢ9 E. Christiania, og skulde saaledes, med den her antagne

On the latest charts of these regions, constructed by the Geographical Survey but not yet published, my point of observation lies 0° 46′ 29″, or 0ʰ 3ᵐ 5.ˢ9 E. Christiania, and should therefore, with the longitude here assumed

[1] Se ogsaa "Geografisk Tidskrift", udgivet af Bestyrelsen for det kongelige danske geografiske Selskab, 4de Bind, 1880, S. 111, 112.

[1] See also "Geografisk Tidskrift," edited by the Directors of the Royal Danish Geographical Society, Vol. 4, 1880, pp. 111, 112.

Længde for Christiania, $0^h\ 42^m\ 53.^s8$, ligge $0^h\ 45^m\ 59.^s7$ E. Greenwich, det er $6.^s5$ vestligere, end min astronomiske Bestemmelse giver. Nogen Grund til denne betydelige Forskjel formaar jeg ikke at angive.

for that place, viz. $0^h\ 42^m\ 53.^s8$, lie $0^h\ 45^m\ 59.^s7$ E. Greenwich, that is, $6.^s5$ farther west than determined by my astronomical observations. Any reason for so considerable a difference I am unable to suggest.

4. Bodø.

Samtidig med at Capt. Wille gjorde magnetiske Observationer, tog jeg den 13de August 1877 en Række Solhøjder paa et Sted nogle hundrede Skridt østenfor den østligste Landgangsbrygge. En Del af Højderne vare correspondérende, en Række var Circummeridianhøjder, og senere om Eftermiddagen toges, med lav Solstand, en kort Række absolute Højder. Til de fleste Observationer benyttede jeg Chronometer Frodsham, men til nogle af Circummeridianhøjderne mit Duplexuhr, hvis Angivelser, efter samtidige Sammenligninger, umiddelbart reduceredes til Frodsham. Dette Chronometer sammenlignede jeg med Normalchronometret Reid Morgen og Aften.

Frodsham	19^h	54^m	$30.^s0$	7^h	0^m	$30.^s0$
Reid	18	50	46. 5	5	56	44. 25
Fr. Corr. t. Reid	— 1	3	43. 5	— 1	3	45. 75

Sextantens Indexfejl fandtes:

Før Middag	+ 1′ 58.″1	± 1.″8	4	Observationer.
Efter Middag	+ 1 50. 3	± 5. 2	4	—
Om Aftenen	+ 1 63. 5	± 1. 7	4	—

Højderne ere beregnede med en Indexfejl af + 1′ 57.″3 indtil Frodsham $12^h\ 10^m\ 55^s$ og de følgende med + 1′ 59.″5.

Efter de ombord gjorte meteorologiske Iagttagelser var

Kl. 8 a. m.	Barometer	770.^{mm}2.	Temperatur	21.°0 C.
„ 2 p. m.	—	69. 8.	—	21. 0
„ 8 p. m.	—	69. 3.	—	16. 0

Efter en foreløbig Beregning fandt jeg som approximative Værdier af Bredden og Længden $\varphi_0 = 67^0\ 17'\ 10''$ og $\lambda_0 = 0^h\ 57^m\ 39.^s6$. Kaldes den af disse Værdier for hvert Observationsøjeblik beregnede Højde af Solens Centrum h_0, den af Observationerne, rettede for Indexfejl, Refraction, Parallaxe og Solradius, fundne Højde h, den sandsynligste Værdi af Bredden og Længden $\varphi_0 + \Delta\varphi$ og $\lambda_0 + \Delta\lambda$, saa giver hver Observation en Ligning af Formen

$$-\cos a\ \Delta\varphi - \cos\varphi \sin a\ \Delta\lambda = h - h_0$$

hvor a er Azimuth. Af samtlige Ligninger udledes ved de mindste Kvadraters Methode de sandsynligste Værdier af $\Delta\varphi$ og $\Delta\lambda$. Denne sidste Beregning er udført af Bestyreren af Bergens Observatorium, Hr. Åstrand, der efter min Anmodning velvillig paatog sig dette Arbejde.

Grupperes Differentserne mellem de observerede og de efter de fundne sandsynligste Værdier for Bredden og

4. Bodø.

Whilst Capt. Wille was engaged in making magnetical observations, I took on the 13th of August, 1877, a series of solar altitudes, from a point a few hundred paces east of the most easterly landing-pier. Part of them were equal altitudes, part (one series) circum-meridian altitudes, and later in the afternoon I took a short series of absolute altitudes. For most of the observations I used the Frodsham chronometer; but for some of the circum-meridian altitudes, my duplex watch, its indications, however, having been immediately compared with, and reduced to, those of the Frodsham. This chronometer I myself compared morning and evening with the Reid, our chief timekeeper.

Frodsham	19^h	54^m	$30.^s0$	7^h	0^m	$30.^s0$
Reid	18	50	46. 5	5	56	44. 25
Fr. Corr. to Reid	— 1	3	43. 5	— 1	3	45. 75

The index-error of the sextant was found to be —

Before Noon	+ 1′ 58.″1	± 1.″8	4	Observations.
After Noon	+ 1 50. 3	± 5. 2	4	—
In the Evening	+ 1 63. 5	± 1. 7	4	—

The altitudes have been computed with an index-error of + 1′ 57.″3 up to $12^h\ 10^m\ 55^s$ Frodsham, and the remainder with an error of + 1′ 59.″5.

The results of the meteorological observations taken on board, were as follows: —

8 a. m.	Barometer	770.^{mm}2,	Temperature	21.°0 C.
2 p. m.	—	69. 8.	—	21. 0
8 p. m.	—	69. 3.	—	16. 0

As approximate values for latitude and longitude, a preliminary computation gave $\varphi_0 = 67^0\ 17'\ 10''$ and $\lambda_0 = 0^h\ 57^m\ 39.^s6$. Now, if the altitude of the sun's centre, computed for each moment of observation from these values, be called h_0, the altitude found from the observations, after correction for the index-error, refraction, parallax, and the sun's semidiameter, h, the probable value of the latitude and longitude, $\varphi_0 + \Delta\varphi$ and $\lambda_0 + \Delta\lambda$, — then each observation will give an equation of the following form —

$$-\cos a\ \Delta\varphi - \cos\varphi \sin a\ \Delta\lambda = h - h_0$$

in which a signifies the azimuth. From all the equations were found, by the method of the least squares, the most probable values of $\Delta\varphi$ and $\Delta\lambda$. This computation was made by Mr. Åstrand, Director of the Bergen Observatory, who at my request kindly undertook the work.

On grouping the differences between the observed altitudes and the altitudes computed from the most pro-

Længden beregnede Højder efter de observerede Solrender, finder man, at i Gjennemsnit give nedre Solrands Observationer Højderne 6.″8 for store, og øvre Solrands 6.″6 for smaa. Den i Beregningen benyttede Solradius, 15′ 59.″5, er saaledes for stor og bør, for at bringes i Overensstemmelse med Observationerne, formindskes til 15′ 52.″8. Beregnes med denne Værdi faar man de nedenstaaende Værdier for Forskjellen mellem observerede og beregnede Højder, hvis Kvadratsum er Minimum.

bable values resulting for the latitude and longitude according to the observed solar limbs, the lower-limb observations are found to give on an average the altitudes 6.″8 too high, the upper-limb 6.″6 too low. Hence, the assumed semidiameter of the sun, — 15′ 59.″5, will be too great, and should, to make it agree with the observations, be reduced to 15′ 52.″8. Computed with these figures, we get the subjoined values for the difference between observed and computed altitudes, the sum of the squares of which is a minimum.

1877. August *(August)* **12—13.**

Chron. Frodsham.	Dobbelt aflæst Højde. *(Double obs. Altitude.)*	Obs. — Ber. Højde. *(Obs. — Calc. Alt.)*
$21^h\ 26^m\ 35.^s0$	☉ $62^0\ 40'\ 0''$	+ 8″
27 51.5	50 0	— 4
29 8.5	63 0 0	— 19
30 23.0	10 0	— 18
31 35.5	20 0	— 9
32 50.0	30 0	— 5
34 4.7	40 0	— 8
35 22.5	50 0	+ 8
36 35.5	64 0 0	+ 3
21 38 44.5	☉ 65 20 0	— 8
40 4.0	30 0	— 14
41 23.0	40 0	— 17
42 42.0	50 0	— 17
44 1.5	66 0 0	— 16
45 19.5	10 0	— 11
46 40.0	20 0	— 8
48 1.0	30 0	— 7
49 23.0	40 0	— 7
23 17 52.0	☉ 74 10 0	+ 9
19 47.0	14 30	— 14
20 51.0	18 15	+ 20
21 47.0	20 0	+ 5
22 33.0	22 0	+ 7
23 33.0	24 20	+ 8
24 25.0	26 30	+ 13
25 28.0	28 40	+ 5
26 35.0	31 5	+ 7
23 29 45.0	☉ 73 33 50	0
31 20.0	36 40	+ 25
32 39.0	39 30	+ 19
34 32.0	42 25	0
36 4.0	45 5	+ 6
38 46.0	49 20	+ 14
39 57.0	50 50	+ 7
41 0.0	52 5	+ 6
41 55.0	53 10	+ 2
23 55 32.0	☉ 74 3 55	— 8
57 10.0	4 10	— 1
58 12.0	4 25	— 2
59 16.0	4 25	— 7
0 0 2.0	4 40	— 3
1 0.0	4 35	— 7
2 4.0	4 30	— 11
2 46.0	4 25	— 11
3 26.0	4 30	— 7
5 45 23.0	☉ 29 30 0	+ 1
47 4.0	10 0	+ 12
47 56.0	0 0	+ 13
48 46.0	28 50 0	+ 2

Chron. Frodsham.	Dobbelt aflæst Højde. *(Double obs. Altitude.)*	Obs. — Ber. Højde. *(Obs. — Calc. Alt.)*
$0^h\ 4^m\ 22.^s0$	☉ $75^0\ 8'\ 5''$	+ 1″
5 40.0	8 5	+ 3
7 51.0	7 0	— 1
9 7.0	6 55	+ 11
10 57.0	5 40	+ 2
12 2.0	5 0	+ 2
13 8.0	4 35	+ 13
14 12.0	3 20	— 5
15 16.0	2 20	— 5
0 21 14.0	☉ 73 52 50	— 3
22 55.0	50 40	— 4
25 9.0	47 20	— 10
26 26.0	45 20	— 15
27 21.0	44 15	— 4
28 12.0	42 55	— 4
29 25.0	41 0	— 1
30 25.0	39 0	— 11
31 24.0	37 20	— 6
0 36 27.0	☉ 74 31 5	— 13
37 33.0	28 40	0
38 32.0	26 30	— 1
39 25.0	24 20	— 4
40 22.0	22 0	— 7
41 18.0	20 0	0
42 18.0	18 15	+ 14
43 18.0	14 30	— 14
45 13.0	10 0	+ 1
2 13 45.0	☉ 66 40 0	+ 7
15 6.0	30 0	+ 2
16 29.5	20 0	+ 9
17 48.5	10 0	— 10
19 6.7	0 0	— 3
20 28.0	65 50 0	+ 2
21 46.0	40 0	— 2
23 4.0	30 0	+ 1
24 23.0	20 0	+ 5
2 26 32.0	☉ 64 0 0	+ 13
27 47.5	63 50 0	+ 17
29 3.0	40 0	+ 9
30 15.5	30 0	— 3
31 34.0	20 0	+ 14
32 46.5	10 0	+ 4
34 1.5	0 0	+ 4
35 16.0	62 50 0	+ 7
36 28.5	40 0	— 15
5 50 48.0	☉ 29 30 0	+ 9
51 41.0	20 0	+ 14
52 31.0	10 0	+ 3
53 24.5	0 0	+ 12

Ifølge Tidssignal var den 12te August $9^h\ 0^m\ 1.^s3$ a. m. Chronometer Reid's Correction til Greenwich Middeltid $+\ 8^m\ 40.^s8$, der voxer med $0.^s97$ i 24^h. Herefter bliver Correctionen for Reid til Greenwich Middeltid ved den første Observation om Formiddagen $+\ 8^m\ 41.^s8$, ved den sidste af de corresponderende Højder om Eftermiddagen $+\ 8^m\ 42.^s0$ og ved Aftenobservationerne $+\ 8^m\ 42.^s1$.

Af Ligningerne findes den sandsynlige Fejl af en enkelt Højde

$$\delta = \pm\ 6.''3$$

og de sandsynligste Værdier for

On the 12th of August, $9^h\ 0^m\ 1.^s3$ a. m., the correction for the Reid chronometer to Greenwich mean time, as determined by the time-signals, was $+\ 8^m\ 40.^s8$, increasing $0.^s97$ in twenty-four hours. Hence, the Reid correction to Greenwich mean time for the first observation in the forenoon, will be $+\ 8^m\ 41.^s8$; for the last of the equal altitudes in the afternoon $+\ 8^m\ 42.^s0$; and for the evening observations $+\ 8^m\ 42.^s1$.

From the equations, the probable error of a single altitude is found to be

$$\delta = \pm\ 6.''3,$$

and the most probable values for

$$\Delta\varphi = +\ 3.''9 \pm 0.''74 \qquad \Delta\lambda = -\ 2.''4 \pm 3.''3 = -\ 0.^s19 \pm 0.^s22$$

Forudsættes en sandsynlig constant Fejl af $\pm\ 10''$ i de maalte Højder, vil denne i den beregnede Bredde give en sandsynlig Fejl af $\pm\ 10.''76$, og man faar saaledes som Resultat

$$\varphi = 67^0\ 17'\ 13.''9 \pm 10.''8$$

En constant Fejl af $10''$ i de maalte Højder giver en Fejl af $0.^s51$ i Længden. Den sandsynlige Fejl af den beregnede Længde kan derfor sættes lig

If we assume a probable constant error of $\pm\ 10''$ in the observed altitudes, this error will affect the computed latitude with a probable error of $\pm\ 10.''76$, and the final result will be

$$\varphi = 67^0\ 17'\ 13.''9 \pm 10.''8.$$

A constant error of $10''$ in the observed altitudes, entails an error of $0.^s51$ in longitude. The probable error of the computed longitude may accordingly be put at

$$\sqrt{(0.^s22)^2 + (0.^s51)^2 + D_1^2 + D_2^2 + D_3^2 + D_4^2 + D_5^2 + D_6^2 + D_7^2} = 0.^s63$$

og man faar som Resultat

$$\lambda = 0^h\ 57^m\ 39.^s4 \pm 0.^s63 \text{ E. Greenwich}$$
$$= 14^0\ 24'\ 51'' \pm 9.''5 \text{ „ —}$$

Ifølge de norske Kystkarter ligger mit Observationspunkt paa

Bredde $67^0\ 17'\ 15''$
Længde $14^0\ 25'\ 40'' = 0^h\ 57^m\ 42.^s7$ E. Greenwich.

Der er saaledes meget god Overensstemmelse i Bredden, medens min Bestemmelse lægger Bodø $3.''3$ vestligere end Kartet, en Afstand, der svarer til 594 Meter.

and the final result will be

$$\lambda = 0^h\ 57^m\ 39.^s4 \pm 0.^s63 \text{ E. Greenwich}$$
$$= 14^0\ 24'\ 51'' \pm 9.''5 \text{ „ —}$$

On the Norwegian coastal charts my point of observation is in

Latitude $67^0\ 17'\ 15''$
Longitude $14^0\ 25'\ 40'' = 0^h\ 57^m\ 42.^s7$ E. Greenwich.

Hence the agreement in latitude is quite satisfactory, whereas my determination, as compared with the chart, places Bodø $3.''3$ farther west, a difference corresponding to 594 metres.

5. Røst.

Observationerne toges paa en større Holme, Skruholmen kaldet, den 26de Juni 1877. Ved Middagstider toges en Række Circummeridianhøjder og om Eftermiddagen en Række Højder i Nærheden af første Vertical. Ved den første Række benyttede jeg mit Duplexuhr, der sammen-

5. Røst.

The observations were made on a large holm, or islet, called Skruholmen, June the 26th 1877. At noon were taken a series of circum-meridian altitudes, and in the afternoon a series of altitudes near the prime vertical. For the first series, I used my duplex watch, which, imme-

lignedes, umiddelbart efter at Observationerne vare tagne, med Chronometer Frodsham, og hvis Angivelser paa Stedet reduceredes til dette. Ved Eftermiddagsobservationerne benyttede jeg Frodsham.

Indexfejlen fandtes ved Middag $= +2'\ 8.''8 \pm 5''$. 5 Obs.
om Efterm. $= +2\ 1.\ 7 \pm 2\ .\ 3$ „

	8 a. m.	2 p. m.	8 a. m.
Barometer	750.^{mm}6	750.^{mm}6	749.^{mm}2
Temperatur	8.^{0}9	9.^{0}0	8.^{0}9

Efter Tidssignal, observeret i Bodø den 24de Juni, er for Frodshams Chronometer beregnet for Eftermiddagsobservationerne Correction til Greenwich Middeltid

$$-0^h\ 52^m\ 12.^s7.$$

Som foreløbige Værdier er sat

diately after taking the observations, was compared with the Frodsham chronometer, and its several indications reduced on the spot to those of the latter timepiece. For the afternoon-series, I used the Frodsham.

Index-error at Noon $= +2'\ 8.''8 \pm 5''$. 5 Observations.
— after Noon $= +2\ 1.\ 7 \pm 2\ .\ 3$ —

	8 a. m.	2 p. m.	8 a. m.
Barometer	750.^{mm}6	750.^{mm}6	749.^{mm}2
Temperature	8.^{0}9	9.^{0}0	8.^{0}9

The Frodsham correction to Greenwich mean time, as determined from the time-signals at Bodø on the 24th of June, was found to be

$$-0^h\ 52^m\ 12.^s7.$$

As approximate values,

$$\varphi_0 = 67^0\ 29'\ 50''\ \text{and}\ \lambda_0 = 0^h\ 48^m\ 29.^s1\ \text{E. Greenwich.}$$

1877. Juni *(June)* 26.

Chron. Frodsham.	2h′	Δ
0h 13m 6.s6	☉ 92° 13′ 45″	— 7″
14 6.6	13 20	— 6
15 6.6	12 50	— 3
19 6.6	10 0	— 3
20 36.6	8 30	— 9
21 58.6	7 30	+ 4
22 36.6	6 30	— 6
24 30.6	☉ 91 1 35	+ 7
25 28.6	0 10	— 2
26 38.6	90 59 5	+ 14
27 46.6	57 30	+ 14
29 8.6	55 30	+ 14
29 51.6	54 0	+ 1
30 54.6	51 50	— 16

Chron. Frodsham.	2h′	Δ
4h 46m 31.s7	☉ 57° 40′ 0″	— 14″
47 26.7	30 0	— 2
48 19.0	20 0	+ 4
49 12.5	10 0	— 2
50 6.5	0 0	+ 4
50 58.7	56 50 0	+ 1
51 51.0	40 0	— 2
52 43.8	30 0	— 3
53 35.5	20 0	— 8
55 37.0	☉ 57 0 0	+ 4
56 30.0	56 50 0	+ 3
57 22.0	40 0	— 1
58 15.8	30 0	+ 6
59 8.5	20 0	+ 8
5 0 0.2	10 0	+ 1
0 54.5	0 0	+ 12
1 45.5	55 50 0	— 3
2 38.8	40 0	+ 7

Differentserne Δ mellem de observerede og beregnede Højder ere tagne efterat den benyttede Solradius er formindsket med 7.″2 forat tilfredsstille Observationerne af begge Solrender.

Efter de mindste Kvadraters Methode har Hr. Åstrand fundet

The differences, Δ, between the observed and the computed altitudes, were found after diminishing the assumed semidiameter of the sun by 7.″2, to satisfy the observations of both limbs.

By the method of the least squares, Mr. Åstrand found

$$\delta = \pm\ 5.''1;\quad \Delta\varphi = -\ 2.''6 \pm 1.''4;\quad \Delta\lambda = +\ 0.^s69 \pm 0.^s21.$$

Forudsættes en sandsynlig constant Fejl af ± 10″, bliver dens Virkning paa den beregnede Bredde ± 9.″9, og Resultatet bliver

$$\varphi = 67^0\ 29'\ 47.''4 \pm 10.''0.$$

Assuming a probable constant error of ± 10″, the effect on the computed latitude will be ± 9.″9, and the result therefore

$$\varphi = 67^0\ 29'\ 47.''4 \pm 10.''0.$$

En constant Fejl af 10″ i de maalte Højder giver en Fejl af 1.′66 i den beregnede Længde. Sættes den sandsynlige Fejl af den beregnede Længde lig

A constant error of 10″ in the observed altitudes, entails an error of 1.′66 in the computed longitude. Putting the probable error of the computed longitude at

$$\sqrt{(0.'21)^2 + (1.'66)^2 + D_1^2 + D_2^2 + D_3^2 + D_4^2 + D_5^2 + D_6^2 + D_7^2} = \pm 1.'72$$

faaes som Resultat

the result will be

$$\lambda = 0^h\ 48^m\ 29.'8 \pm 1.'72 = 12^0\ 7'\ 27'' \pm 25.''8 \text{ E. Greenwich.}$$

Efter de norske Kystkarter ligger Skruholmen paa
Bredde 67° 29′ 48″
Længde 12° 6′ 36″ = 0ʰ 48ᵐ 26.′4 E. Greenwich.

Der er saaledes god Overensstemmelse i Bredden, medens min Bestemmelse lægger Røst 51″ eller 3.′4 østligere end Kartet, en Afstand, der svarer til 602 Meter.

On the Norwegian coastal charts, Skruholmen is in
Latitude 67° 29′ 48″
Longitude 12° 6′ 36″ = 0ʰ 48ᵐ 26.′4 E. Greenwich.

Hence the agreement in latitude is quite satisfactory, whereas my determination of longitude, as compared with the chart, places Røst 51″, or 3.′4, farther east, a difference corresponding to 602 metres.

6. Hammerfest.

Observationerne gjordes om Eftermiddagen den 9de Juli og om Morgenen den 10de Juli 1878 paa Fuglenes i Meridian-Støttens Meridian, omtrent 5 Meter i Syd for samme. Polhøjden af Meridian-Støtten, der danner det nordlige Endepunkt af den Russisk-Svensk-Norske Gradmaaling, er bestemt af Professor Lindhagen til 70° 40′ 11.″3. Omstændighederne vare meget gunstige, Luften klar og rolig.

6. Hammerfest.

The observations were taken in the afternoon of the 9th of July and on the morning of the 10th, 1878, at Fuglenes, in the meridian of the "Meridian-Column," about 5 metres farther south. The latitude of the Column, which constitutes the northern terminal point of the Russian-Swedish-Norwegian arc of meridian, has been determined by Professor Lindhagen at 70° 40′ 11.″3. Circumstances were remarkably favourable, the atmosphere both clear and still.

Den 9de Juli Eft. fandtes Indexfejlen (*Index-error p. m.*) + 2′ 7.″2 ± 2.″2. 6 Obs.
„ 10de „ Form. — — (— *a. m.*) + 2 3. 3 ± 3. 1. 3 „

Som Observationsuhr benyttede jeg mit Lommechronometer.

For these observations, I used my pocket-chronometer.

Chron. Reid	Juli 9	*(Reid's Chronometer)*	2ʰ	21ᵐ	30.′0	6ʰ	25ᵐ	0.′0	17ʰ	7ᵐ	0.′0	19ʰ	23ᵐ	0.′0	20ʰ 3ᵐ 30.′0.
Lommechron.	„ 9	*(Pocket-chronometer)*	3	15	14.0	7	18	42.9	18	0	41.7	20	16	41.1	20 57 10.9.
Corr. t. Reid		*(Corr. to Reid)*	— 53		44.0	— 53		42.9	— 53		41.7	— 53		41.1	— 53 40.9.

Juli 9 Eft. Barom. 760.ᵐᵐ0 Temp. 8°
„ 10 Morgen — 759.ᵐᵐ3 — 11°

Paa Telegrafcontoret i Hammerfest observerede jeg den 10de Juli

Lommechronometer	8ʰ	38ᵐ	22.′0	
Corrigeret Tidssignal	8	0	1.2	Greenwich M. T.
Corr. af Lommechron.	— 38		20.8	til Gr. M. T.
„ „ —		53	41.0	„ Reid.
Corr. for Reid	+ 15		20.2	til Greenwich M. T.

July 9 p. m. Barom. 760.ᵐᵐ0 Temp. 8°
„ 10 a. m. — 759.ᵐᵐ3 — 11°

At the telegraph-office in Hammerfest, I observed on the 10th of July

Pocket-chronometer	8ʰ	38ᵐ	22.′0	
Corrected Time-signals	8	0	1.2	Greenwich M. T.
Corr. for Pocket-chron.	— 38		20.8	to Gr. M. T.
— —		53	41.0	to the Reid chron.
Corr. for the Reid	+ 15		20.2	to Greenwich M. T.

Med Polhøjden 70° 40′ 11.″2 beregnede Hr. Åstrand Længden saaledes:

With the latitude 70° 40′ 11.″2, Mr. Åstrand computed the longitude as follows: —

Af Observationerne Juli 9 Eft.	*(From the observations July 9th p. m.)*	⊙ 1ʰ 34ᵐ 44.ˢ5	1ʰ 34ᵐ 43.ˢ95	
		☉ 1 34 43. 4		
Juli 10 Morg. (— „ —	*July 10th a. m.)*	⊙ 1 34 40. 7	1 34 40. 60	
		⊙ 1 34 40. 1		

For at bringe Eftermiddagsobservationerne af begge Solrender i Overensstemmelse, trænger den benyttede Solradius en Tilvæxt af 2.″7. For Morgenobservationernes Vedkommende trænges en Tilvæxt af 1.″4.

De to Observationsrækker give, som man ser, mærkelig forskjellige Værdier af Længden. Sammenstillingen af de af begge udledede Uhrcorrectioner giver for Normalchronometret Reid en Acceleration af flere Secunder i Mellemtiden: 14 Timer, medens dette Chronometer stadig, ifølge Tidssignalerne, har en Retardation af henimod et Secund i Døgnet. De ovenfor anførte Uhrsammenligninger vise ogsaa, at Lommechronometret den hele Tid retarderer i Forhold til Reid, men langsommere i Løbet af Natten, medens det modsatte maatte være Tilfældet, om Reid i Løbet af Natten havde accelereret. Jeg tør derfor ikke lægge Skylden for Uoverensstemmelsen mellem de beregnede Resultater af Eftermiddags- og Morgen-Observationerne paa Chronometret. Da Højderne ikke ere langt fra at være corresponderende, antager jeg Tilstedeværelsen af en constant Fejl i alle maalte Højder, og har efter de mindste Kvadraters Methode søgt den sandsynligste Værdi af denne samtidig med den sandsynligste Værdi af Længden. Til denne Beregning kunde jeg benytte de Beregninger, som Hr. Åstrand, efter min Opfordring, havde gjort, uden at antage nogen constant Fejl. Som foreløbig Værdi for Længden satte jeg $\lambda_0 = 1^h\ 34^m\ 41.''6$ og indførte de ovenfor nævnte Correctioner for den apparente Solradius.

To satisfy the p. m. observations of both solar limbs, will require an increase in the semidiameter of the sun of 2.″7. For the a. m. observations, is needed an increase of 1.″4.

The two series of observations give remarkably different values for the longitude. A comparison of the chronometer-errors deduced from both indicates for the chief chronometer — the Reid — an acceleration of several seconds during the interval (14 hours), whereas that chronometer, according to the time-signals, invariably exhibited a retardation of one second in twenty-four hours. Moreover, the comparisons of the respective timekeepers show the pocket-chronometer, as compared with the Reid, to have been steadily gaining, — more slowly however in the course of the night; whereas the reverse must have been the case had the Reid gained in the night. Hence, I cannot ascribe this want of agreement between the computed results of the p. m. and a. m. observations to the chronometer. The altitudes being very nearly equal, I have assumed the presence of a constant error in all the observed altitudes, and by the method of the least squares sought to find its most probable value, together with the most probable value of the longitude. For this computation, I could apply the greater part of the calculations kindly made at my request by Mr. Åstrand, who had not assumed any constant error. As a preliminary value for the longitude, I put $\lambda_0 = 1^h\ 34^m\ 41.''6$, introducing also the above-mentioned corrections for the sun's apparent semidiameter.

1878. Juli *(July)* 9.

Lommechronometer. *(Pocket-Chronometer.)*	2h′	Δ
$4^h\ 15^m\ 26.'0$	☉ 50° 20′	+ 4″
16 27.6	10	+ 8
17 27.1	0	+ 3
18 26.0	49 50	— 5
19 26.4	40	— 6
20 27.6	30	— 3
21 29.2	20	+ 1
22 28.8	10	— 3
23 29.6	0	— 4
4 26 52.0	☉ 49 30	+ 5
27 51.2	20	— 0
28 51.2	10	— 4
29 51.2	0	— 7
30 52.8	48 50	— 2
33 54.4	20	— 0
34 56.4	10	+ 8
35 56.0	0	+ 6
36 56.4	47 50	+ 3
37 55.2	40	— 3

Lommechronometer. *(Pocket-Chronometer.)*	2h′	Δ
$18^h\ 50^m\ 48.'4$	☉ 59° 10′	— 14″
51 50.4	20	— 10
52 54.4	30	— 7
53 56.4	40	— 3
54 59.6	50	— 4
56 2.4	60 0	+ 1
57 8.4	10	— 10
58 10.4	20	— 1
59 13.2	30	+ 4
19 0 18.0	40	— 1
1 21.4	50	+ 4
2 23.6	61 0	+ 13
3 28.8	10	+ 8
4 34.0	20	+ 6
19 7 5.6	☉ 60 40	— 2
8 9.6	50	+ 2
9 13.2	61 0	+ 8
10 20.4	10	— 2
11 23.6	20	+ 7
12 30.4	30	+ 1
14 42.4	50	— 4
15 45.2	62 0	+ 10
16 52.8	10	+ 2
18 0.0	20	— 4
19 5.2	30	+ 10
20 12 8	40	— 5
21 20.0	50	— 9
22 24.8	63 0	+ 0

Beregningen giver $\delta = \pm\ 4.''0$.

$\Delta\lambda = +\ 11.''5 \pm 1.''8 = +\ 0.'77 \pm 0.'12$; Const. Corr. paa Højderne $= +\ 8.''0 \pm 0.''6$ og som Resultat, naar den sandsynlige Fejl af den beregnede Længde sættes

The computation gives $\delta = \pm\ 4.''0$.

$\Delta\lambda = +\ 11.''5 \pm 1.''8 = +\ 0.'77 \pm 0.'12$; const. corr. in the altitudes $= +\ 8.''0 \pm 0.''6$, and as result, the probable error of the computed longitude being put

$$= \sqrt{(0.'12)^2 + D_1^2 + D_2^2 + D_3^2 + D_4^2 + D_5^2 + D_6^2 + D_7^2} = \pm\ 0.'41$$

$$\lambda = 1^h\ 34^m\ 41.'7 \pm 0.'41 = 23°\ 40'\ 25.''8 \pm 6.''1 \text{ E. Greenwich.}$$

Den sandsynlige Fejl svarer til en Afstand af 74 Meter.

Efter Professor Fearnleys Beregning af Gradmaalingen, med Udgangspunkt Dorpat, skulde Længden af Meridianstøtten paa Fuglenes være 23° 40′ 0.″9 E. Gr. Efter den af Svenskerne (Meddelelse fra Prof. Rosén til den geografiske Opmaaling) senere udførte telegrafiske Længdebestemmelse af Kokkomäki ($\varphi = 65°\ 49'\ 16''$) — Stockholm, bliver Længden af Meridianstøtten paa Fuglenes

$$23°\ 40'\ 22.''1 = 1^h\ 34^m\ 41.'5 \text{ E. Gr.}$$

fra hvilken Bestemmelse min afviger kun 3.″7 eller 0.′25, der svarer til en Afstand af 39 Meter.

The probable error corresponds to a distance of 64 metres.

According to Professor Fearnley's computation from the triangulation, — starting from Dorpat, — the longitude of the Meridian Column at Fuglenes should be 23° 40′ 0.″9 E. Gr. Meanwhile, the telegraphic determination of longitude for Kokkomäki ($\varphi = 65°\ 49'\ 16''$) — Stockholm, subsequently performed by Swedish astronomers (communication from Professor Rosén to the Geographical Survey), places the Meridian Column at Fuglenes in longitude

$$23°\ 40'\ 22.''1 = 1^h\ 34^m\ 41.'5 \text{ E. Greenwich}$$

from which result my determination differs only 3.″7, or 0.′25, corresponding to 39 metres.

De norske Kystkarter give for samme Punkt

$$\varphi = 70^\circ\ 40'\ 25''\ \text{og}\ \lambda = 23^\circ\ 39'\ 54''$$

altsaa Bredden 14″ for stor og Længden c. 30″ eller 2′ for liden (310 Meter).

The Norwegian coastal charts give for the point in question

$$\varphi = 70^\circ\ 40'\ 25''\ \text{and}\ \lambda = 23^\circ\ 39'\ 54''$$

the latitude, therefore, 14″ too far north, and the longitude about 30″, or 2′ (310 metres), not far enough east.

7. Vardø.

Observationerne gjordes den 26de Juni 1878 omkring Middag paa et Punkt, der, ifølge Observationer med Theodolithen, ligger 175 Meter Nord og 51 Meter Vest for Midtpunktet af Fæstningen Vardøhus. Luften, der i Begyndelsen var klar, blev efter Middag taaget, saa at den sidste Række Højder maatte tages med svage Blændglas foran begge Spejle, og tilsidst maatte Observationerne afbrydes, da det skyede ganske over. Jeg opnaaede saaledes ikke at faa lige mange Højder af hver Solrand, og Indexfejlens Bestemmelse blev mangelfuld. I Middel af 4 Bestemmelser fandtes Indexfejlen + 2′ 13″ ± 3″.

Som Observationsuhr benyttede jeg mit Lommechronometer.

Reid	18^h	43^m	0.^{s}0
Lommechron.	19	37	52. 8
Corr. t. Reid	—	54	52. 8

Lommechronometret taber i Forhold til Reid 0.^{s}23 pr. Time.

Efter de meteorologiske Observationer i Vardø var:

Juli 26 8 a. m. Barom. 765.^{mm}9 Temp. C. 6.°0
— „ 2 p. m. — 765. 9 — „ 9. 4

7. Vardø.

The observations were taken on the 26th of June, 1878, about noon, from a point which, as determined with the theodolite, lies 175 metres north and 51 metres west of the centre of Vardøhus fortress. The atmosphere, clear at first, soon got hazy, so that the last series of altitudes had to be taken with light-coloured glasses, and ere long the observations had to be broken off, the sky becoming quite overcast. Hence, I did not succeed in getting an equal number of altitudes of each solar limb; and the index-error was not very well determined. As a mean of 4 observations, the index-error was found to be + 2′ 13″ ± 3″.

On this occasion, I observed with my pocket-chronometer.

Reid	18^h	43^m	0.^{s}0
Pocket-chron.	19	37	52. 8
Corr. to the Reid	—	54	52. 8

The pocket-chronometer was losing hourly 0.^{s}23 more than the Reid.

The meteorological observations at Vardø gave the following results: —

July 26 8 a. m. Barom. 765.^{mm}9 Temp. C. 7.°0
— „ 2 p. m. — 765. 9 — „ 9. 4

1878. Juni *(June)* **25—26.**

Lommechron. *(Pocket-Chronometer.)*	2 h′	Δ
21h 31m 36.′8	⊙ 83° 30′ 0″	— 0″
33 8. 0	35 0	— 10
34 30. 8	40 0	— 2
35 58. 8	45 0	+ 1
37 30. 0	50 0	+ 1
39 5. 2	55 0	— 1
40 41. 2	84 0 0	0
42 17. 6	5 0	+ 4
44 5. 6	10 0	— 5
52 36. 4	⊙ 85 36 10	+ 4
53 45. 6	38 35	— 7
54 52. 4	41 25	— 1
55 58. 4	43 50	— 5
57 17. 2	46 30	— 13
58 27. 6	49 10	— 4
59 53. 6	52 30	+ 0
22 1 44. 4	56 0	— 6
2 57. 6	58 10	— 12
4 51. 2	86 2 0	— 11
5 43. 6	3 35	— 1
7 17. 6	6 5	— 5
8 18. 8	7 45	— 6
9 59. 6	10 50	+ 7
11 32. 4	13 10	+ 9
12 40. 0	14 30	+ 2
13 37. 6	15 40	— 2
14 48. 8	17 5	— 5
15 36. 4	18 0	— 7
17 0. 8	19 50	— 1
17 58. 8	21 0	+ 1

Lommechron. *(Pocket-Chronometer.)*	2 h′	Δ
22h 18m 54.′4	⊙ 86° 22′ 0″	+ 2″
19 55. 6	23 5	+ 8
20 46. 0	24 30	+ 22
22 58. 0	25 55	+ 7
24 16. 8	26 40	— 1
24 59. 2	27 20	+ 2
25 55. 8	27 45	— 3
26 44. 8	28 35	+ 7
27 45. 6	28 40	— 7
28 32. 8	29 20	— 0
30 27. 2	30 0	+ 9
31 32. 0	31 0	+ 12
32 31. 2	31 10	+ 8
22 37 17. 2	⊙ 85 28 20	— 6
38 29. 6	28 35	+ 2
39 28. 0	28 35	+ 4
40 37. 2	28 35	+ 9
41 30. 8	28 5	— 1
42 45. 2	27 40	— 6
43 50. 4	27 20	— 3
45 24. 0	26 45	— 4
47 34. 8	26 0	+ 5
49 32. 4	25 0	+ 11
23 43 6. 0	⊙ 84 35 0	— 2
44 34. 0	30 0	— 4
45 55. 2	25 0	— 13
47 20. 4	20 0	+ 0
48 50. 0	15 0	+ 11
50 1. 6	10 0	+ 5
51 14. 0	5 0	— 5

I Betingelsesligningerne har Hr. Åstrand indført en Correction ($\Delta\,\varrho$) for den benyttede Solradius. Som tilnærmede Værdier er antaget $\varphi_0 = 70^\circ\ 22'\ 28.''3$ og $\lambda_0 = 2^h\ 4^m\ 28.'8$, og Reids Correction til Greenwich Middeltid ved Observationernes Begyndelse sat til $+\ 15^m\ 8.'1$.

In the equations of condition, Mr. Åstrand introduced a correction ($\Delta\,\varrho$) for the assumed semidiameter of the sun. As approximate values, he put $\varphi_0 = 70^\circ\ 22'\ 28.''3$ and $\lambda_0 = 2^h\ 4^m\ 28.'8$, and the Reid correction to Greenwich mean time at the beginning of the observations $= +\ 15^m\ 8.'1$.

Af Ligningerne findes:

From the equations, he found

$$\delta = \pm\ 4.''6;\ \Delta\,\varrho = +\ 5.''9 \pm 0.''66$$
$$\Delta\,\varphi = -\ 4.''3 \pm 0.''7;\ \Delta\,\lambda = +\ 34.''4 \pm 9.''4 = +\ 2.'29 \pm 0.'63.$$

Antages en sandsynlig constant Fejl i de maalte Højder af $\pm\ 10''$, saa er dennes Indflydelse paa den beregnede Bredde $\pm\ 11.''4$, og paa den beregnede Længde $\pm\ 0.'39$. Resultatet bliver:

Assuming a probable constant error in the observed altitudes of $\pm\ 10''$, its effect on the computed latitude will be $\pm\ 11.''4$, and on the computed longitude $\pm\ 0.'39$; as result we get

$$\varphi = 70^\circ\ 22'\ 24.''0 \pm 11.''4$$
$$\lambda = 31^\circ\ 7'\ 46.''4 \pm 12.''6 = 2^h\ 4^m\ 31.'1 \pm 0.'84 \text{ E. Greenwich.}$$

Reduceres til Fæstningens Midte faaes:
Vardøhus

Reduced to the centre of the fortress, we get for Vardøhus —

$$\varphi = 70^\circ\ 22'\ 18.''4 \pm 11.''4$$
$$\lambda = 31^\circ\ 7'\ 51.''3 \pm 12.''6 = 2^h\ 4^m\ 31.'4 \pm 0.'84 \text{ E. Greenwich.}$$

Efter de norske Kystkarter ligger Vardøhus paa:
Bredden 70° 22′ 5″
Længden 31° 7′ 35″ = 2ʰ 4ᵐ 30.ˢ3 E. Greenwich.

Efter en senere fundet Correction for en Regnefejl skulde imidlertid Punkterne østenfor Nordkap ligge c. 22″ østligere end i Kartet, altsaa Vardøhus paa Længden 31° 7′ 57″ = 2ʰ 4ᵐ 31.ˢ8, hvilken Værdi kun er 6″ eller 0.ˢ4 større end den af mig fundne.

On the Norwegian coastal charts, Vardøhus is in
Latitude 70° 22′ 5″
Longitude 31° 7′ 35″ = 2ʰ 4ᵐ 30.ˢ3 E. Greenwich.

Meanwhile, the points east of the North Cape should, according to an error of calculation subsequently discovered, lie about 22″ farther east than on the chart, Vardøhus therefore in longitude 31° 7′ 57″ = 2ʰ 4ᵐ 31.ˢ8; and this value exceeds my determination by only 6″, or 0.ˢ4.

Sammenstilles de af mig fundne Længder med de paa de norske Kystkarter udmaalte, faar man følgende Oversigt:

A comparison between my determinations of longitude and those on the respective Norwegian charts gives the following results: —

	Astron. telegr. Længde. *(Longitude Astr. Telgh.)*	Kartets Længde. *(Long. on Chart.)*	Forskjel. *(Difference.)*
Namsos . . .	11° 31′ 33″ ± 7.″4	11° 30′ 45″	45″ = 3.ˢ0
Bodø	14 24 51 ± 9. 5	14 25 40	— 49 = — 3. 3
Røst	12 7 27 ± 25. 8	12 6 36	59 = 3. 4
Hammerfest . .	23 40 26 ± 6. 1	23 39 54	32 = 2. 1
Vardø	31 7 51 ± 12. 6	31 7 35	16 = 1. 1

Med Undtagelse af Bodø ere Kartets Længder mindre østlige end mine. Forskjellen er imidlertid kun en Brøkdel af et Minut, i Storcirkel kun en Brøkdel af et halvt til et Trediedels Minut, og Tilstrækkeligheden af Nøjagtigheden af Karternes Længde for Skibsfarten antages saaledes godtgjort. Karternes Bredder synes gjennemgaaende nøjagtige, saavidt ovenstaaende Iagttagelser kunne tjene til deres Verification.

Saving that of Bodø, the longitudes on the chart are none of them so far east as mine. Meanwhile, the difference does not amount to more than a fraction of a minute, and in arc of great circle it is only a fraction of half to one-third of a minute; hence, the accuracy of the longitudes on the charts may be regarded as sufficient for all practical purposes of navigation. The latitudes on the charts would appear to be generally correct, so far as the results set forth above can serve for their verification.

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8. Advent Baj.

Paa Odden, ved den vestre Bred af Indløbet til Advent Baj, der gaar i sydostlig Retning ind fra den indre Del af Isfjorden paa Spidsbergens Vestkyst, tog jeg den 20de August 1878 to Rækker Solhøjder til Bestemmelse af Bredden og Længden af det Punkt, der var Udgangspunktet for Iagttagelserne til Constructionen af det Kart, som Capt. Wille optog over Bajen med Omgivelser.

Omstændighederne vare ikke meget gunstige. Luften var tildels meget taaget, saaat Blændglassene ofte maatte vexles, ja kunde stundom endog undværes. En Følge af

8. Advent Bay.

On the tongue of land jutting out from the western shore of the entrance to Advent Bay, which extends in a south-easterly direction from the inner part of Ice Sound on the west coast of Spitsbergen, I took on the 20th of August, 1878, two series of solar altitudes, to determine the latitude and longitude of the point at which were commenced the observations for the survey made by Capt. Wille of the Bay and its environs.

Circumstances were anything but favourable, the atmosphere being so hazy at intervals that the coloured glasses had to be frequently changed, nay could now and again

lisse Omstændigheder var det desværre, at jeg ikke kunde faa nogen brugbar Bestemmelse af Indexfejlen. Denne har jeg senere søgt at finde saaledes:

be dispensed with. As a consequence of these atmospheric conditions, I failed to obtain a trustworthy determination of the index-error. This I sought subsequently to find in the following manner: —

I Hammerfest den 9de Juli 1878 ved en Temperatur af + 8° C. var Indexfejlen *(Index-error)* + 2′ 7″
„ — „ 10de „ — „ „ — „ + 10 „ „ — — + 2 3
„ Christiania „ 11te Decb. — „ „ — „ — 3 „ „ — — + 2 27

Under Observationerne i Advent Baj var Luftens Temperatur + 3°, hvortil, efter grafisk Interpolation, svarer en Indexfejl af + 2′ 16″, der er benyttet til Beregningen af Højderne.

Den benyttede Solradius er den, som er udledet af Sammenligning mellem Observationerne af øvre og nedre Solrand.

Observationsuhr var mit Lommechronometer, der før og efter sammenlignedes med Hovedchronometret Reid ombord.

Reid	19ʰ	4ᵐ	0.ˢ0	0ʰ	55ᵐ	0.ˢ0
Lommechron.	19	53	58.6	1	44	57.2
Corr. t. Reid	—	49	58.6	—	49	57.2

Efter de timevise meteorologiske Iagttagelser ombord var

ved Morgenobs. Kl. 9 a. m. Barom. = 755.ᵐᵐ1 Temp. = 3.°0
„ Efterm.obs. „ 1 p. m. — 755. 0 — 2. 6

During the observations taken at Advent Bay, the temperature of the atmosphere was + 3°, to which, as found from diagrammatic interpolation, corresponds an index-error of + 2′ 16″, that assumed for computing the altitudes.

The apparent semidiameter of the sun taken for the computation, is that determined from a comparison of the observations of the upper and lower limbs.

On this occasion, I observed with my pocket-chronometer, which, before and after the observations, was compared on board with the chief timekeeper (Reid).

Reid	19ʰ	4ᵐ	0.ˢ0	0ʰ	55ᵐ	0.ˢ0
Pocket-chron.	19	53	58.6	1	44	57.2
Corr. to Reid	—	49	58.6	—	49	57.2

According to the hourly meteorological observations on board, the temperature and barometric pressure were as follows: —

9 a. m. Barometer 755.ᵐᵐ1 Temp. 5.°0
1 p. m. — 755. 0 — 2. 6

1878. August *(August)* 19—20.

Lommechron. (Pocket-Chronometer)	2 h′	Δ
20ʰ 35ᵐ 59.ˢ6	☉ 40° 50′ 0″	— 7″
37 13.0	55 40	— 1
39 18.4	41 4 55	0
44 43.2	☉ 42 31 40	+ 11
50 37.2	42 56 10	— 2
55 52.0	43 17 50	+ 1
57 20.0	43 23 45	— 1
59 43.2	43 33 15	— 4
21 6 32.0	☉ 42 57 10	+ 3
7 37.6	43 1 20	+ 3

Lommechron. (Pocket-Chronometer)	2 h′	Δ
0ʰ 29ᵐ 55′	☉ 47° 8′ 50″	+ 1″
33 50	☉ 48 5 5	— 7
34 40	48 3 50	— 4
35 40	☉ 46 59 10	— 5
37 28	46 56 10	+ 1
41 55	☉ 47 51 5	+ 5

Ved de mindste Kvadraters Methode har Hr. Åstrand fundet, idet der sættes $\varphi_0 = 78° 14′ 48″$, $\lambda_0 = 1^h 2^m 15.^s9$, og Reids Correction til Greenwich Middeltid ved Formiddagsobservationerne + 16ᵐ 0.ˢ0,

By the method of the least squares, putting $\varphi_0 = 78° 14′ 48″$, $\lambda_0 = 1^k 2^m 15.^s9$, and the Reid correction to Greenwich mean time for the a. m. observations = + 16ᵐ 0.ˢ0, Mr. Åstrand found

$$\delta = \pm 3.''3$$
$$\Delta\varphi = + 0.''4 \pm 1.''1, \quad \Delta\lambda = + 0.''3 \pm 7.''8 = + 0.^s02 \pm 0.^s52.$$

En sandsynlig constant Fejl af 10″ i alle Højder bevirker en Fejl af 11.″6 i den beregnede Bredde og af 0.ˢ90 i den beregnede Længde. Resultatet bliver saaledes

$\varphi = 78^{\circ}\ 14'\ 48.''4 \pm 11.''6$
$\lambda = 15^{\circ}\ 33'\ 58.''5 \pm 16.''7 = 1^{h}\ 2^{m}\ 15.^{s}9 \pm 1.^{s}11$

I Kgl. Svenska Vetenskaps-Akademiens Handlingar, 13de Bind No. 9, findes en Afhandling af Dr. Aug. Wijkander: "Astronomiska Observationer under den Svenska Arktiska Expeditionen 1872—73. I. Tids- och Orts-Bestämningar." I Fortegnelsen over Bredder og Længder findes her, Side 54, ogsaa Punkter ved Advent Baj, nemlig "Rysstugen" og "Mynningen af elfven", begge bestemte efter Observationer af Prof. Nordenskiöld.

Ved Hjelp af det af Capt. Wille tegnede Kart over Advent Baj kan jeg med Lethed reducere mine Bestemmelser for Odden til de to nævnte Punkter. Jeg finder

"Odden"	Br.	78°	14′	48.″4	L.	1ʰ	2ᵐ	15.ˢ92
Red. til "Russestuen"				— 1. 9				— 2.31
Russestuen		78	14	46. 5		1	2	13.61
do. efter Svenskerne		78	15	2.		1	2	31.5
Forskjel				— 15.″5				— 17.ˢ 9.
Red. t. "Mund. af Elven"				29.″5				— 2.ˢ85
Mund. af Elven		78°	14′	18. 9		1ʰ	2ᵐ	13.07
do. efter Sv. Exp.		78	14	11.		1	2	31.0
Forskjel				+ 7.″9				— 17.ˢ 9

Medens Bredderne stemme, i Middel, indenfor den af den sandsynlige Fejl betegnede Grændse, ere de Svenske Expeditioners Længder c. 18′ mere østlige end mine. Da Længden af Punkterne ved Advent Bay af Svenskerne er henført til Længden af Sabine's Observatorium paa Indre Norskøen, og der — som af Dr. Wijkander i nævnte Afhandling Side 48—49 fremhævet, — er flere Grunde tilstede, der gjøre det sandsynligt, at Sabine's Længde er for stor østlig, 16 til 30 Tidssecunder, saa tør jeg anse den af mig fundne Længde for Advent Baj for at være nær den rigtige, og de 18 Tidssecunders Forskjel fra de Svenske Expeditioners som Correction til Sabines Længde af Observatoriet paa Indre Norskøen.

A probable constant error of 10″ in all the altitudes, will entail an error of 11.″6 in the computed latitudes and of 0.ˢ90 in the computed longitude. The result is thus —

$\varphi = 78^{\circ}\ 14'\ 48.''4 \pm 11.''6$
$\lambda = 15^{\circ}\ 33'\ 58.''5 \pm 16.''7 = 1^{h}\ 2^{m}\ 15.^{s}9 \pm 1.^{s}11$

In Kgl. Svenska Vetenskaps-Akademiens Handlingar, Vol. 13, No. 9, Dr. Aug. Wijkander has furnished a paper entitled "Astronomiska Observationer under den Svenska Arktiska Expeditionen 1872—1873. I. Tids- och Orts-Bestämningar." The List of Latitudes and Longitudes, p. 54, includes those of two points at Advent Bay, viz. "Rysstugen" and "Mynningen of elfven," both determined from the observations of Professor Nordenskiöld.

By referring to Capt. Wille's map of Advent Bay, I could easily reduce my determinations for the tongue of land to those of the Swedish observer for the two points. The results were as follows: —

Tongue of land	Lat	78°	14′	48.′4	Long.	1ʰ	2ᵐ	15.ˢ92
Red. to "Russian Hut"	—			— 1.9	—			— 2. 31
Russian Hut		78	14	46.5		1	2	13.61
Do. Swed. Observ.		78	15	2		1	2	31.5
Difference				— 15.″5				— 17.ˢ 9.
Red. to "Mouth of River"				29.″5				2.ˢ85
Mouth of River		78°	14′	18.″9		1ʰ	2ᵐ	13.ˢ07
Do. Swed. Observ.		78	14	11		1	2	31.0
Difference				+ 7.″9				— 17.ˢ 9

Whilst the mean of the latitudes agrees within the limits of the probable error, the longitudes determined on the Swedish Expeditions are about 18′ farther east than mine. The longitude of the points at Advent Bay being referred by the Swedish observers to the longitude of Sabine's Observatory on "Inner Norway Island," and several reasons — as adduced by Dr. Wijkander in the above-mentioned paper, pp. 48, 49, — rendering it highly probable that Sabine's longitude is too far east, — from 16 to 30 seconds in time, — I may regard my longitude for Advent Bay as very nearly correct, and the 18 seconds in time by which it differs from that determined on the Swedish Expeditions, as a correction for Sabine's longitude of the Observatory on Inner Norway Island.

9. Jan Mayen.

Den 30te Juli 1877, om Eftermiddagen, da "Vøringen" befandt sig i Mary Muss Bugten paa Vestsiden af Jan Mayen, brød i korte Stunder Solen igjennem Taagen, og der observeredes to Solhøjder, netop som vi lettede fra Ankerpladsen.

9. Jan Mayen.

In the afternoon of the 30th of July, 1877, — the "Vøringen" lying at anchor in Mary Muss Bay on the west coast of Jan Mayen, — the sun broke at intervals through the mist, and two solar altitudes were taken, just as we were getting under weigh.

Den følgende Dag, den 31te Juli, laa Expeditionen til Ankers i den store Rækved-Bugt paa Jan Mayens Østside. Da Søgangen hindrede os fra at komme i Land, toges fra Skibsborde en Række Solhøjder, med forskjellige Sextanter, dels af Capt. Wille, dels af mig. Omstændighederne vare ikke gunstige. Skyer og Taage tog jevnlig Solen eller Horizonten bort.

Den 1ste August var Vejret noget gunstigere, og der observeredes om Formiddagen en Del Solhøjder fra samme Ankerplads, førend vi lettede.

I den nedenstaaende Tabel betegner G Capt. Grieg og M Mohn; E betegner den Expeditionen tilhørende Sextant og S en Skibet tilhørende Sextant.

Hver Iagttager bestemte sin Indexfejl. Jeg fandt den for Troughtons Sextant den 31te Juli ved Solen + 1′ 38″ og ved Horizonten + 1′ 35″. Benyttet er den første Værdi.

De fleste Observationer gjordes fra Hyttedækket. Øjets Højde regnedes her til 18 norske Fod eller 5.6 Meter.

I Beregningen er benyttet Solradien efter Nautical Almanac. Som det vil sees nedenfor, er den af Observationerne udledede Solradius større.

Som Observationsuhr benyttedes dels Lommechronometer, dels Lommeuhre, der umiddelbart før eller efter hver Observationsrække sammenlignedes med Hovedchronometret Reid. Hr. Tornøe, vor Chemiker, assisterede mig ved flere Observationer, idet han noterede Uhret. Reids Correction til Greenwich Middeltid beregnedes for Observationerne

Juli 30	Juli 31	Aug. 1
til + 8^m 28.′6	+ 8^m 29.′2	+ 8^m 30.′2

Efter foreløbige Beregninger sattes for Ankerpladsen paa Østsiden $\varphi_0 = 70^0$ 58.′0 og $\lambda_0 = 0^h$ 33^m 48.′3 W. Greenwich.

Beliggenheden af Ankerpladsen paa Vestsiden er ret nøje bestemt trigonometrisk i Forhold til Ankerpladsen paa Østsiden. Ved Hjelp af Stormastens Højde, 18.6 Meter, der fra en Baad af Capt. Wille maaltes i Vinkel til 4° 20.′3, fandtes Baadens Afstand fra Skibet = 245 Meter. Fra Baaden og fra Skibet (Mohn) sigtedes samtidig til Toppen af "Fugleberget", en fremtrædende let kjendelig Fjeldtop paa Øens Vestside ved Mary Muss Bugten. Vinkelen Fugleberg—Skib, seet fra Baad, var 86° 3.′7, Vinkelen Fugleberg—Baad, seet fra Skibet, var 90° 13.′3, hvoraf beregnes Afstanden fra Skibet til Fugleberget til 2.′03. Fuglebergets Azimuth fra Skibet fandtes efter 3 Compas-Pejlinger paa 3 forskjellige Kurser = N. 25° W. Derefter ligger Fugleberget 1′ 50.″4 nordligere og 2′ 38.″0 vestligere end Ankerpladsen paa Østsiden. Fra Fuglebergets Fod maalte jeg den 29de Juli Masthøjden til 0° 55.′5, hvilket giver en Afstand af 0.′62. Skibets Azimuth fra Fugleberget var her omtrent 70°. Heraf beregnes, at

The following day, July 31st, the Expedition anchored in Great Wood Bay, on the east coast of the island. The swell preventing us from landing, Capt. Wille and myself took a series of solar altitudes on board, with different sextants. The atmospheric conditions were not favourable, cloud and mist repeatedly blotting out the sun or the horizon.

On the 1st of August the weather cleared a little, and in the forenoon a few solar altitudes were observed from the same anchorage, shortly before we got under weigh.

In the Table given below, G signifies Capt. Grieg, and M, Professor Mohn: E signifies the sextant belonging to the Expedition, and S a sextant belonging to the vessel.

Each observer determined his index-error. For the Troughton sextant, I found the index-error, on the 31st of July, to be + 1′ 38″ by the sun, and + 1′ 35″ by the horizon. The first of these values was applied.

Most of the observations were made from the deck of the roundhouse, where the eye of the observer was assumed to be 18 Norwegian feet, or 5.6 metres, above the sea-level.

For these computations, the sun's semidiameter was taken from the Nautical Almanac. As will appear in the sequel, that deduced from the observations was somewhat greater.

We observed with the pocket-chronometer and ordinary watches, each timepiece being compared, immediately before and after a series of observations, with our chief chronometer, the Reid. Mr. Tornøe, chemist to the Expedition, assisted me in several of the observations, by noting the indications of the watch. The Reid correction to Greenwich mean time was computed for the observations taken —

July 30	July 31	Aug 1
at + 8^m 28.′6	+ 8^m 29.′2	+ 8^m 30.′2

For the anchorage on the east coast of the island, I put, as the result of preliminary computations, $\varphi_0 = 70^0$ 58.′0 and $\lambda_0 = 0^h$ 33^m 48.′3 W. Greenwich.

The position of the anchorage off the west coast of the island relative to that of the anchorage on the east side, was determined trigonometrically with tolerable exactness. Taking the height of the mainmast, 18.6 metres, which, as measured from a boat by Capt. Wille, gave an angle of 4° 20.′3, the distance of the boat from the ship was found to be 245 metres. From the boat and from the ship (Prof. Mohn), we simultaneously observed the summit of the "Fugleberg" (bird-cliff), a conspicuous mountain-top on the west side of the island, in close proximity to Mary Muss Bay. The angle Fugleberg—ship, as determined from the boat, was 86° 3.′7; the angle Fugleberg—boat, as determined from the ship, 90° 13.′3; and with these results the distance from the ship to Fugleberg was computed at 2.′03. The azimuth of Fugleberg from the ship, we found from 3 compass-bearings on 3 different courses = N. 25° W. The Fugleberg should accordingly lie 1′ 50.″4 farther north and 2′ 38.″0 farther west than our

Ankerpladsen paa Vestsiden ligger 10.″9 nordligere og 1′ 49.″1 vestligere end Fugleberget. Ankerpladsen paa Vestsiden ligger altsaa 2′ 1.″3 nordligere og 4′ 27″ vestligere end Ankerpladsen paa Østsiden. Er for den sidste $\varphi_0 = 70^\circ\ 58.'0$ og $\lambda_0 = 0^h\ 33^m\ 48.'3$, saa bliver for Ankerpladsen paa Vestsiden $\varphi_0 = 71^\circ\ 0'\ 1''$ og $\lambda_0 = 0^h\ 34^m\ 6.'1$.

Efter de mindste Kvadraters Methode beregnede jeg de sandsynligste Correctioner til φ_0 og λ_0.

Naar jeg derefter grupperede Differentserne (hvis Kvadratsum er Minimum) mellem de observerede (reducerede) Højder af Solcentret og de efter de fundne sandsynligste Værdier for Bredden og Længden beregnede, efter de observerede Solrender, viste det sig, at Middeldifferentsen for øvre Rand var + 0.′295 og for nedre Rand — 0.′282. Den observerede Solradius er saaledes gjennemsnitlig 0.′3 større end den til Beregningen benyttede. Corrigeres med denne Størrelse, faaes de i den følgende Tabel anførte Værdier af Differentserne Δ mellem observeret minus beregnet Solhøjde. I Tabellen ere alle Uhrtider reducerede til Reid, og alle maalte Solhøjder corrigerede for Indexfejl, Kimmingdaling, Refraction, Parallaxe og Solradius (Naut. Almanac's). *o* betegner øvre Solrand, *n* nedre Solrand. Aflæsningerne paa Sextanten ere gjorte i Secunder og Reductionen udført med Secunder, men da den sandsynlige Fejl af en enkelt Højde er over et halvt Minut, opføres i Tabellen Tiendedels Minut, ligesom Beregningen efter de mindste Kvadraters Methode er ført med femzifrede Logarithmer.

anchorage off the east coast. From the foot of the Fugleberg, the height of the mast, as measured by myself on the 29th of July, gave an angle of 0″ 55.′5, which corresponds to a distance of 0.′62. At this point, the azimuth of the ship from the Fugleberg was about 70°. Computing with these results, our anchorage off the west coast should lie 10.″9 farther north and 1′ 49.″1 farther west than the Fugleberg. Hence, the anchorage off the west coast lies 2′ 1.″3 farther north and 4′ 27″ farther west than the anchorage off the east coast. Assuming for the latter $\varphi_0 = 70^\circ\ 58.'0$ and $\lambda_0 = 0^h\ 33^m\ 48.'3$, for the anchorage off the west coast $\varphi_0 = 71^\circ\ 0'\ 1''$ and $\lambda_0 = 0^h\ 34^m\ 6.'1$.

By the method of the least squares, I computed the most probable corrections of φ_0 and λ_0.

Then, on grouping the differences (the sum of the squares of which is a minimum) between the observed (duly corrected) altitudes of the sun's centre and those computed with the most probable values found for latitude and longitude, according to the observed solar limbs, the mean difference for the upper limb proved to be + 0.′295, and for the lower — 0.′282. On an average, therefore, the observed semidiameter of the sun is 0.′3 greater than that taken for the computation. Corrected with this quantity, we get the values given in the following Table for the differences, Δ, between the observed and the computed solar altitudes. In this Table all chronometer-times are reduced to those of the Reid chronometer, and all observed altitudes corrected for the index-error, the dip of the horizon, refraction, parallax, and the sun's semidiameter (from Naut. Almanac); *o* signifies upper solar limb, *n* lower solar limb. The readings of the sextant were noted in seconds, and their reduction computed in seconds; but the probable error of a single altitude amounting to more than half a minute, tenths of a minute have been given in the Table. The computation by the method of the least squares is made with five decimals in the logarithms.

Ankerplads paa Vestsiden. 1877. Juli 30.

(Anchorage on the West Side. 1877. July 30.)

Chron. Reid.	Obs. Højde. *(Obs. Altitude.)*	Rand. *(Limb.)*	Sext.	Obs.	Δ
$5^h\ 47^m\ 28^s$	$20^\circ\ 57.'2$	*n.*	*E.*	*G.*	+ 0.′9
5 48 1	20 56. 4	*n.*	*S.*	*M.*	— 1. 3

Ankerplads paa Østsiden. Obs. Capt. Wille.

(Anchorage on the East Side.)

Chron. Reid.	Obs. Højde. *(Obs. Altitude.)*	Rand. *(Limb.)*	Sext.	Δ
Juli *(July)* 31. $0^h\ 38^m\ 59.'$	$37^0\ 11.'2$	*n.*	*S.*	— 1.′1
$0\ 59\ 18.5$	$37\ 2.4$	*n.*	*S.*	— 0.4
$1\ 11\ 56$	$36\ 51.6$	*n.*	*E.*	— 0.1
$1\ 28\ 42.5$	$36\ 30.3$	*n.*	*E.*	— 0.7
$22\ 42\ 17$	$34\ 32.2$	*n.*	*E.*	— 2.1

De 4 første er givet dobbelt Vægt, da de bero paa flere Observationer hver. Man ser, at den observerede Solradius er større end min, sandsynligvis paa Grund af, at der er benyttet svagere Blændglas.

To the first 4 altitudes is attached double weight, each being the mean of several observations. The observed semidiameter of the sun is greater than mine, probably from lighter coloured glasses having been used.

Ankerplads paa Østsiden. Troughton's Sextant.

(Anchorage on the East Side.)

Iagttager *(Observer)*: Mohn. 1877. Juli *(July)* 30—31.

Chron. Reid.	Rand. *(Limb.)*	Obs. Højde. *(Obs. Altitude.)*	Δ
$22^h\ 35^m\ 37.'9$	*n.*	$34^0\ 31.'4$	+ 0.′6
$37\ 58.6$	*n.*	37.4	+ 0.4
$0\ 22\ 54.0$	*n.*	$37\ 11.5$	— 1.0
$37\ 37.5$	*o.*	14.9	+ 1.7
$40\ 18.3$	*n.*	11.3	— 0.8
$42\ 39.0$	*n.*	11.0	— 0.5
$48\ 25.5$	*o.*	10.4	+ 0.4
$58\ 39.6$	*n.*	4.0	+ 0.5
$1\ 0\ 19.5$	*o.*	2.7	— 0.1
$13\ 18.0$	*n.*	$36\ 49.1$	— 1.4
$15\ 9.9$	*o.*	50.0	— 1.2
$19\ 23.6$	*o.*	46.0	+ 1.9
$20\ 57.4$	*n.*	41.9	+ 0.4
$22\ 11.2$	*n.*	39.3	— 0.6
$23\ 41.1$	*o.*	38.5	— 0.1
$25\ 5.0$	*o.*	36.7	— 0.1
$26\ 23.0$	*n.*	34.5	+ 0.1
$27\ 31.9$	*n.*	32.7	0.0
$29\ 18.7$	*o.*	30.4	— 0.4
$29\ 44.6$	*o.*	28.2	— 2.0
$32\ 36.5$	*o.*	26.4	+ 0.6

Chron. Reid.	Rand. *(Limb.)*	Obs. Højde. *(Obs. Altitude.)*	
$1^h\ 33^m\ 58.'3$	*n.*	$36^0\ 22.'4$	— 0.′7
$46\ 23.3$	*o.*	2.2	— 0.1
$47\ 23.2$	*o.*	0.2	— 0.3
$48\ 37.0$	*o.*	$35\ 58.7$	+ 0.6
$49\ 21.0$	*o.*	56.3	— 0.5
$49\ 55.0$	*o.*	55.3	— 0.3
$50\ 39.0$	*o.*	54.0	— 0.3
$51\ 20.4$	*o.*	53.9	+ 1.3
$52\ 32.8$	*n.*	50.1	+ 0.4
$53\ 29.2$	*n.*	47.9	+ 0.1
$54\ 22.1$	*n.*	46.4	+ 0.2
$55\ 7.6$	*n.*	45.3	+ 0.7
$56\ 47.5$	*n.*	41.9	+ 0.7
$58\ 35.4$	*n.*	37.6	+ 0.3
$2\ 0\ 29.7$	*n.*	35.4	+ 2.1
$22\ 41\ 38.0$	*o.*	$34\ 33.2$	+ 0.5
$43\ 57.5$	*o.*	39.0	+ 0.4
$48\ 13.0$	*o.*	49.6	+ 0.5
$23\ 19\ 19.6$	*n.*	$35\ 54.9$	+ 0.6
$22\ 34.0$	*n.*	59.2	— 0.8
$23\ 59.8$	*n.*	$36\ 2.9$	+ 0.4

Af alle Observationer findes $\delta = \pm\ 0.'57 = \pm\ 34''$.

$\Delta\varphi = +\ 0.'07 \pm 0.'09 = +\ 4.''5 \pm 5.''5.$

$\Delta\lambda = -\ 2.'35 \pm 0.'66 = -\ 2'\ 20.''9 \pm 39.''8 = -\ 9.'39 \pm 2.'65.$

All the observations taken together give $\delta = \pm\ 0.'57 = \pm\ 34''$.

$\Delta\varphi = +\ 0.'07 \pm 0.'09 = +\ 4.''5 \pm 5.''5.$

$\Delta\lambda = -\ 2.'35 \pm 0.'66 = -\ 2'\ 20.''9 \pm 39.''8 = -\ 9.'39 \pm 2.'65.$

En constant Fejl af 10″ i Højderne vil forandre den beregnede Bredde saa meget som 10.″02 og den beregnede Længde saa meget som 0.ˢ52. Resultatet bliver saaledes for Ankerpladsen paa Østsiden

A constant error of 10″ in the altitudes will change the computed latitude as much as 10.″02, and the computed longitude as much as 0.ˢ52. Hence, the result for our anchorage off the east coast is --

$$\varphi = 70^{\circ}\ 58'\ 4.''5 \pm 11.''4$$
$$\lambda = 8\ 24\ 43.^{s}7 \pm 41.^{s}0 = 0^{h}\ 33^{m}\ 38.^{s}9 \pm 2.^{s}73 \text{ W. Greenwich.}$$

og for Fuglebergets Top

and for the summit of the Fugleberg —

Bredde *(Latitude)* 70° 59′ 55″ ± 11.″4
Længde *(Longitude)* 8 27 22 ± 41.ˢ0 = 0ʰ 33ᵐ 49.ˢ5 ± 2.ˢ73 W. Greenwich.

Scoresby's Kart[1], paa hvilket Fugleberget let kan identificeres, lægger dette 1.′6 nordligere og 31′ (10 Kvartmil) østligere end min Bestemmelse. Scoresby's Observationer gjordes den 3die og 4de August 1817. I 1878 fandt den hollandske Expedition med Skonnerten "Willem Barendsz", at Jan Mayen ligger vestligere end paa Scoresby's Kart. Efter min Bestemmelse er Øen aflagt paa det af Capt. Wille og mig over samme udarbejdede nye Kart, der følger senere i denne Generalberetning.[2]

Scoresby's Map,[1] on which the Fugleberg may be easily found, places that mountain 1.′6 north and 31′ (10 miles) east of my determination. Scoreby's observations were taken on the 3rd and 4th of August 1817. In 1878, the Dutch Expedition, with the schooner "Willem Barendsz," found the Island of Jan Mayen to lie farther west than it does on Scoresby's map. For the new map of Jan Mayen constructed by Capt. Wille and myself, — to be subsequently published in the General Report,[2] — the position of the island was laid down from my own determination of latitude and longitude.

[1] An Account of the Arctic regions.

[2] Ogsaa publiceret i Petermann's Mittheilungen f. 1878 Taf. 13 og i den nye Udgave af Stieler's Hand-Atlas.

[1] An Account of the Arctic Regions.

[2] This Map has already appeared in Petermann's Mittheilungen for 1878, Pl. 13, and in the new Edition of Stieler's Hand-Atlas.