TALLINNA TEHNIKAÜLIKOOLI TOIMETUSED
PUBLICATIONS FROM THE TECHNICAL UNIVERSITY OF ESTONIA
AT TALLINN
Series A № 13 (July 1940)

Longitude and Latitude Determinations in Estonia from 1935 to 1937

BY

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I. Introduction.

The present paper gives the longitude and latitude determinations in Estonia measured by the author in 1935, 1936, and 1937. The paper is meant as a continuation of my "Longitude and Latitude Determinations in Estonia from 1930 to 1933", Publications from the Tallinn Institute of Technology, Series A, No. 1, 1937. The methods of observation and the instruments being the same as mentioned in my previous paper, their description will not be repeated. I should only like to say that the time determinations were made with the Bamberg transit instrument No. 80752 fitted with an impersonal micrometer; as timekeeper the Ulysse Nardin contact chronometer No. 2451 was used. The latitudes were determined with the same transit instrument according to the Talcott method. Longitude determinations were made at each field-point on 3 nights, latitude determinations on 2 nights. Before and after the observations at the field-points, longitude determinations were made at the reference station at Tallinn.

The duration of the contacts of the impersonal micrometer was in 1936 found to be 0.0104 revolutions of the screw, and the value of the dead lag 0.00005 revolutions of the screw. Thus we have for "half duration of contact + dead lag" 0.00525 revolutions of the screw. The value of one revolution of the screw is $10\overset{s}{.}56 \sec \delta$. For the mean latitude of Estonia the diurnal aberration is $0\overset{s}{.}0110 \sec \delta$. Thus the correction for the impersonal micrometer is c = "half duration of contacts + dead lag + diurnal aberration"

$$\text{upper culmination: } c = +\,0\overset{s}{.}0444 \sec \delta$$

$$\text{lower culmination: } c = +\,0\overset{s}{.}0664 \sec \delta.$$

The above-mentioned values were used for the years from 1935 to 1937.

For the value of one revolution of the Talcott micrometer there was found

1935.	Hummuli	$79''.27 \pm 0''.010$	(mean error)
1936.	Ebavere	$79''.26 \pm 0''.015$	
.	Emumäe	$79''.24 \pm 0''.024$	
1937.	Vaivara	$79''.24 \pm 0''.021$	
	Kaseküla	$79''.28 \pm 0''.025$	

When computing the latitudes, the following values of the revolution of the screw were used: 1935. (Hummuli) $79''.27$; 1936. (Ebavere, Emumäe) $79''.25$; 1937. (Vaivara, Kaseküla) $79''.26$.

II. Time Determinations.

The following tables give the observed time determinations in chronological order. In the tables we denote by

1) $\ast$ — the number of the observed star according to "Berliner Astronomisches Jahrbuch";

2) α — the right ascension of the star in the system of Eichelberger[1]) (contains also short period nutation terms);

3) t — the observed transit moment;

4) cC — the correction for the duration of the contacts and the dead lag of the micrometer, and for the diurnal aberration;

5) iI — the correction for the inclination of the horizontal axis; i is directly given by level observations, while $I = \cos z. \sec \delta$;

6) p — the correction for the parallax of the chronograph pens;

7) aA — the correction for the azimuth error;

8) r — the correction for the rate of the chronometer (the rate being always accepted as linear);

9) ΔT — the chronometer correction;

10) a_1, a_2, a_3 — the azimuth values given by each polar (azimuth) star, in chronological order;

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[1]) Astronomical Papers prepared for the use of the American Ephemeris and Nautical Almanac, vol. X, part I.

11) a_m — the mean (or weighted mean) of obtained individual azimuth values; this a_m was used in computing aA, where $a = a_m$, and $A = \sin z . \sec \delta$;

12) E — the mean epoch of observation (of clock stars).

In order to convert the moments of the electric contacts of the chronometer into the moments indicated by the second-hand, we subtract from all mean ΔT $1\overset{s}{.}000$ in 1936, and $1\overset{s}{.}500$ in 1937. This subtraction was necessary since the moments of the wireless time signals are marked according to the second-hand of the chronometer.

Tallinn. July 28-th, 1935.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
726	39.331	11.020	+ 69	— 36	— 41	+ 325	+ 68	27.926
738	45.280	16.930	+ 65	— 36	— 22	+ 428	+ 48	.867
742	0.007	31.540	+ 59	— 22	— 22	+ 598	+ 38	.816
750	0.369	32.129	+ 68	— 42	— 22	+ 346	+ 26	.864
310	27.602	54.428	+ 259	+ 56	— 22	......	+ 7	......
765	57.253	28.634	+ 54	— 53	— 22	+ 734	— 2	.908
788	48.547	19.969	+ 55	— 36	— 22	+ 712	— 40	.909
795	54.255	28.964	+ 194	— 216	— 22	......	— 53	......
803	5.422	37.805	+ 89	— 86	— 22	— 183	— 64	.883
807	6.540	38.219	+ 60	— 58	— 22	+ 559	— 75	.857
								s
								27.879

$a_1 = +1\overset{s}{.}727$, $a_2 = +1\overset{s}{.}662$; $a_m = +1\overset{s}{.}694$

$E = 20^h 18^m.3$.

Tallinn. July 29-th, 1935.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
707	17.690	51.034	+ 81	+ 135	— 64	+ 6	+ 55	26.443
713	34.122	6.758	+ 49	+ 84		+ 871	+ 48	.380
719	2.298	35.020	+ 51	+ 60		+ 799	+ 38	.396
726	39.328	12.485	+ 69	+ 100		+ 293	+ 27	.418
734	42.840	19.060	+ 223	+ 232		......	+ 15	......
738	45.255	18.400	+ 65	+ 102		+ 412	+ 5	.335
742	0.003	32.979	+ 59	+ 61		+ 574	— 4	.398
750	0.352	33.598	+ 68	+ 86		+ 332	— 16	.348
759	10.562	46.368	+ 189	+ 57		......	— 35	......
765	57.255	30.117	+ 54	+ 38		+ 704	— 45	.451
795	54.259	30.276	+ 194	+ 23		......	— 97	......
803	5.434	39.312	+ 89	+ 32		— 176	— 108	.349
								s
								26.391

$a_1 = +1\overset{s}{.}612$, $a_2 = +1\overset{s}{.}632$, $a_3 = +1\overset{s}{.}637$; $a_m = +1\overset{s}{.}627$

$E = 19^h 39^m.6$.

Tallinn. July 30-th, 1935.

∗	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
260	39.651	9.836	+ 281	— 191	— 138	......	+ 51	......
713	34.117	8.448	+ 49	+ 72		+ 858	+ 45	24.783
719	2,294	36.701	+ 51	+ 60		+ 788	+ 36	.796
726	39.319	14.178	+ 69	+ 96		+ 289	+ 25	.800
734	42.789	20.618	+ 223	+ 206		......	+ 15	......
738	45.250	20.046	+ 65	+ 84		+ 406	+ 5	.782
742	59.999	34.689	+ 59	+ 62		+ 566	— 3	.764
750	0.348	35.248	+ 68	+ 50		+ 327	— 15	.808
759	10.539	47.942	+ 189	+ 101		......	— 33	......
765	57.258	31.891	+ 54	+ 30		+ 695	— 42	.768
767	33.156	8.594	+ 91	+ 17		— 204	— 51	.847

$a_1 = +1^{s}.633$, $a_2 = +1^{s}.567$, $a_3 = +1^{s}.612$; $a_m = +1^{s}.604$ — $24^{s}.794$

$E = 19^{h}39^{m}.8$.

Hummuli. August 1-st, 1935.

∗	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
310	27.635	18.799	+ 260	— 54	— 22	......	+ 68	......
765	57.257	52.252	+ 54	+ 16		+ 561	+ 58	4.338
767	33.147	28.808	+ 91	+ 82		— 261	+ 49	.400
782	47.880	43.320	+ 77	+ 138		+ 24	+ 32	.311
795	54.257	51.801	+ 195	+ 188		......	+ 6	......
803	5.455	1.146	+ 89	+ 188		— 222	— 5	.281
807	6.580	1.771	+ 60	+ 89		+ 408	— 16	.290
813	0.182	55.768	+ 77	+ 142		+ 31	— 27	.213
821	27.066	22.334	+ 63	+ 122		+ 331	— 35	.273
830	5.679	1.456	+ 90	+ 166		— 244	— 56	.287

$a_1 = +1^{s}.442$, $a_2 = +1^{s}.361$; $a_m = +1^{s}.402$ — $4^{s}.299$

$E = 21^{h}12^{m}.6$

Hummuli. August 2-nd, 1935.

∗	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
260	39.909	32.593	+ 281	— 22	— 39	......	+ 69	......
713	34.092	30.455	+ 49	+ 20		+ 605	+ 62	2.940
719	2.270	58.654	+ 51	+ 30		+ 550	+ 51	.973
726	39.282	36.000	+ 69	+ 63		+ 161	+ 38	.990
734	42.637	41.510	+ 223	+ 173		......	+ 26	......
738	45.224	41.890	+ 64	+ 72		+ 253	+ 15	.969
742	59.982	56.581	+ 58	+ 41		+ 378	+ 5	.958
750	0.328	57.112	+ 68	+ 65		+ 191	— 9	.940
759	10.468	9.057	+ 189	+ 126		......	— 30	......

⁎	a	t	cC	iI	p	aA	r	ΔT
765	57.257	53.734	+ 54	+ 61		+ 478	— 40	3.009
767	33.143	30.267	+ 91	+ 52		— 222	— 51	3.045
783	1.815	58.906	+ 87	+ 94		— 162	— 70	2.999
								$2^s.980$

$a_1 = +1^s.288$, $a_2 = +1^s.118$, $a_3 = +1^s.170$; $a_m = +1^s.194$

$E = 19^h46^m.9$

Hummuli. August 4-th, 1935.

⁎	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
260	40.025	37.900	+ 281	— 25	— 58	......	+ 73	......
713	34.073	33.688	+ 49	000		+ 261	+ 66	0.067
719	2.251	1.954	+ 51	+ 17		+ 238	+ 54	59.995
726	39.255	39.046	+ 69	— 8		+ 70	+ 40	0.096
734	42.544	43.136	+ 223	+ 56		.....	+ 28	......
738	45.206	45.020	+ 64	— 11		+ 109	+ 16	0.066
742	59.968	59.748	+ 58	+ 29		+ 163	+ 5	0.023
750	0.314	0.207	+ 68	— 8		+ 82	— 10	0.033
759	10.431	10.998	+ 189	+ 92		......	— 32	......
765	57.253	57.018	+ 54	+ 21		+ 206	— 43	0.055
767	33.134	33.172	+ 91	+ 33		— 96	— 54	0.046
783	1.816	1.840	+ 87	+ 21		— 70	— 75	0.071
								$0^s.050$

$a_1 = +0^s.576$, $a_2 = +0^s.450$, $a_3 = +0^s.519$; $a_m = +0^s.515$

$E = 19^h46^m.9$

Tallinn. June 10-th, 1936.

⁎	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
580	34.819	5.344	+ 58	— 61	— 130	— 852	+ 42	30.418
590	22.315	48.986	+ 213	— 370		......	+ 34	......
595	19.391	49.395	+ 77	— 107		— 272	+ 27	.401
598	44.457	14.252	+ 88	— 145		— 48	+ 24	.416
608	52.193	22.600	+ 64	— 125		— 653	+ 11	.426
615	10.507	40.186	+ 93	— 217		+ 162	+ 7	.406
621	5.564	36.144	+ 60	— 143		— 790	+ 1	.422
173	11.933	46.652	+ 271	+ 334		......	— 5	......
Ng	32.34	56.862	+ 325	— 796		......	— 14	......
636	44.643	15.280	+ 58	— 156		— 852	— 24	.467
643	52.270	23.076	+ 55	— 147		— 960	— 29	.405
671	28.473	58.624	+ 81	— 291		— 162	— 58	.409
								$30^s.419$
								— 1.000
								$29^s.419$

$a_1 = -2^s.057$, $a_2 = -1^s.946$, $a_3 = -2^s.008$; $a_m = -2^s.004$

$E = 16^h33^m.0$

Ebavere. June 15-th, 1936.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
608	52.164	1.474	+ 64	— 84	— 158	— 399	+ 53	51.214
615	10.450	19.330	+ 94	— 120		+ 118	+ 48	.138
623	25.810	33.122	+ 207	— 344		......	+ 39	......
627	8.033	17.178	+ 81	— 139		— 88	+ 29	.130
Ng	32.15	37.703	+ 325	— 692		......	+ 21	......
636	44.651	54.234	+ 58	— 141		— 524	+ 9	.173
191	58.933	11.396	+ 354	+ 503		......	+ 3	......
650	5.584	15.088	+ 67	— 174		— 354	— 9	.124
655	58.074	7.397	+ 78	— 210		— 148	— 14	.129
684	42.503	52.252	+ 60	— 204		— 494	— 54	.101
694	1.702	11.024	+ 86	— 332		— 14	— 62	.158

$a_1 = -1^s.223$, $a_2 = -1^s.323$, $a_3 = -1^s.217$; $a_m = -1^s.254$ — 51.146 s

$E = 17^h15^m.5$ — — 1.000

50.146 s

Ebavere. June 17-th, 1936.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s				s		s
627	8.023	34.864	+ 81	+ 73	— 146	+ 0.869	+ 14	32.268
Ng	32.01	4.682	+ 325	+ 269		......	+ 11	......
650	5.593	30.020	+ 67	— 37		+ 3.499	— 2	.192
655	58.079	24.540	+ 78	— 7		+ 1.464	— 5	.155
663	42.689	6.510	+ 64	— 39		+ 4.045	— 7	.262
675	22.472	37.297	+ 197	— 93		......	— 13	......

$a_1 = +12^s.343$, $a_2 = +12^s.473$; $a_m = +12^s.408$ — 32.219 s

$E = 17^h19^m.5$ — — 1.000

31.219 s

Ebavere. June 18-th, 1936.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
563	58.420	26.946	+ 53	— 38	— 189	— 74	+ 27	31.695
590	21.855	50.171	+ 213	— 396		......	+ 13	......
595	19.299	47.836	+ 77	— 106		— 18	+ 8	.691
598	44.346	12.852	+ 86	— 135		— 2	+ 6	.727
601	48.284	16.822	+ 63	— 95		— 49	+ 4	.728
608	52.153	20.716	+ 64	— 134		— 46	— 1	.743
615	10.410	38.952	+ 94	— 198		+ 13	— 3	.741
621	5.550	34.132	+ 60	— 142		— 55	— 7	.751
627	8.015	36.616	+ 81	— 196		— 10	— 12	.725
Ng	31.93	0.442	+ 325	— 875		......	— 16	......

*	a	t	cC	iI	p	aA	r	ΔT
636	44.666	13.289	+ 58	— 170		— 60	— 21	.759
191	59.153	26.926	+ 353	+ 578		......	— 24	......

$a_1 = -0^s.194$, $a_2 = -0^s.177$, $a_3 = -0^s.057$; $a_m = -0^s.143$ — $31^s.729$

E = 16ʰ15ᵐ.5 — — 1.000

$30^s.729$

Ebavere. June 19-th, 1936.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
563	58.419	27.340	+ 53	— 23	— 98	— 47	+ 27	31.167
571	33.258	2.044	+ 87	— 54		+ 00	+ 22	.257
595	19.290	48.173	+ 77	— 54		— 11	+ 6	.197
598	44.336	13.243	+ 86	— 66		— 1	+ 4	.168
601	48.283	17.228	+ 63	— 55		— 31	+ 1	.175
608	52.153	21.084	+ 64	— 54		— 29	— 5	.191
615	10.409	39.270	+ 94	— 114		+ 8	— 8	.257
623	25.626	54.402	+ 207	— 190		......	— 13	......
627	8.012	36.950	+ 81	— 93		— 6	— 18	.196
Ng	31.86	0.442	+ 325	— 350		......	— 22	......
636	44.671	13.667	+ 58	— 80		— 38	— 29	.191
191	59.219	27.793	+ 353	+ 242		......	— 32	......

$a_1 = -0^s.081$, $a_2 = -0^s.124$, $a_3 = -0^s.066$; $a_m = -0^s.090$ — $31^s.200$

E = 16ʰ7ᵐ.9 — — 1.000

$30^s.200$

Emumäe. June 25-th, 1936.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
595	19.207	13.674	+ 77	+ 40	— 80	+ 110	+ 30	5.356
608	52.108	46.423	+ 64	+ 65		+ 264	+ 20	.352
615	10.308	4.898	+ 94	+ 52		— 84	+ 17	.411
623	25.363	20.882	+ 206	+ 202		......	+ 12	......
627	7.958	2.462	+ 81	+ 64		+ 55	+ 7	.369
Ng	31.48	27.794	+ 325	+ 337		......	+ 3	......
636	44.669	38.920	+ 58	+ 31		+ 347	— 3	.396
191	59.656	51.028	+ 353	— 150		......	— 6	......
650	5.604	0.009	+ 67	+ 38		+ 233	— 12	.349
655	58.078	52.644	+ 78	+ 84		+ 95	— 15	.272
663	42.717	37.152	+ 64	+ 22		+ 271	— 18	.306
671	28.538	23.114	+ 81	+ 55		+ 55	— 26	.339

$a_1 = +0^s.842$, $a_2 = +0^s.784$, $a_3 = +0^s.893$; $a_m = +0^s.840$ — $5^s.350$

E = 16ʰ59ᵐ.3. — — 1.000

$4^s.350$

Emumäe. June 26-th, 1936.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
595	19.187	14.026	+ 77	+ 237	+ 8	+ 92	+ 34	4.715
598	44.218	39.148	+ 86	+ 243		+ 5	+ 31	.697
608	52.097	46.845	+ 64	+ 153		+ 236	+ 20	.771
615	10.287	5.294	+ 94	+ 227		— 75	+ 16	.723
623	25.315	21.110	+ 206	+ 418		......	+ 9	......
627	7.944	2.928	+ 81	+ 183		+ 49	+ 2	.693
Ng	31.41	27.904	+ 325	+ 545		......	— 4	......
636	44.663	39.502	+ 58	+ 95		+ 311	— 13	.702
191	59.608	52.056	+ 353	— 238		......	— 17	......
650	5.599	0.612	+ 67	+ 98		+ 209	— 26	.631
655	58.072	53.150	+ 78	+ 94		+ 85	— 30	.687
663	42.713	37.638	+ 64	+ 73		+ 243	— 34	.721

$a_1 = +0^s.767$, $a_2 = +0^s.721$, $a_3 = +0^s.772$; $a_m = +0^s.753$ — $4^s.704$

$E = 16^h 46^m.9$. — -1.000

$3^s.704$

Emumäe. June 29-th, 1936.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
601	48.183	45.364	+ 63	+ 128	— 28	+ 267	+ 15	2.374
623	25.148	23.623	+ 206	+ 176		......	+ 3	......
627	7.901	5.393	+ 81	+ 66		+ 51	— 2	.340
Ng	31.16	30.462	+ 325	+ 229		......	— 6	......
636	44.648	41.880	+ 58	+ 36		+ 326	— 12	.388
191	59.791	54.406	+ 353	— 123		......	— 15	......

$a_1 = +0^s.804$, $a_2 = +0^s.762$, $a_3 = +0^s.798$; $a_m = +0^s.788$ — $2^s.367$

$E = 16^h 38^m.9$. — -1.000

$1^s.367$

Emumäe. June 30-th, 1936.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
595	19.107	17.095	+ 77	+ 207	— 48	+ 95	+ 45	1.636
598	44.124	42.198	+ 86	+ 223		+ 5	+ 42	.618
601	48.170	46.102	+ 63	+ 131		+ 263	+ 37	.622
623	25.082	24.118	+ 206	+ 400		......	+ 17	......
627	7.883	5.998	+ 81	+ 156		+ 50	+ 9	.637
Ng	31.074	30.658	+ 325	+ 660		......	+ 2	......
636	44.644	42.578	+ 58	+ 96		+ 321	— 8	.647
191	59.871	55.638	+ 353	— 388		......	— 13	......
650	5.578	3.639	+ 67	+ 120		+ 215	— 23	.608
655	58.046	56.185	+ 78	+ 170		+ 88	— 27	.600

⚹	α	t	cC	iI	p	aA	r	ΔT
663	42.703	40.714	+ 64	+ 128		+ 250	— 32	.627
671	28.520	26.701	+ 81	+ 172		+ 51	— 44	.607

$a_1 = +0\overset{s}{.}825$, $a_2 = +0\overset{s}{.}746$, $a_3 = +0\overset{s}{.}762$; $a_m = +0\overset{s}{.}778$ — $1\overset{s}{.}622$
$E = 16^h55^m.5.$ — -1.000

$0\overset{s}{.}622$

Tallinn. July 3-rd, 1936.

⚹	α	t	cC	iI	p	aA	r	ΔT
	s	s						s
636	44.636	19.838	+ 58	— 138	— 48	+ 61	0	24.865
191	0.150	33.928	+ 353	+ 407		......	0	......
650	5.569	40.857	+ 67	— 170		+ 42	0	.821
655	58.029	33.374	+ 78	— 170		+ 18	0	.777
663	42.701	17.954	+ 64	— 152		+ 48	0	.835
675	22.156	57.835	+ 197	— 432		......	0	......
685	34.977	10.421	+ 102	— 276		— 29	0	.807
694	1.789	37.211	+ 86	— 228		+ 3	0	.765
700	54.778	30.456	+ 205	— 552		......	0	......
707	18.831	54.219	+ 87	— 247		0	0	.820

$a_1 = +0\overset{s}{.}201$, $a_2 = +0\overset{s}{.}155$, $a_3 = +0\overset{s}{.}074$; $a_m = +0\overset{s}{.}143$ — $24\overset{s}{.}813$
$E = 17^h52^m.3.$ — -1.000

$23\overset{s}{.}813$

Tallinn. July 4-th, 1936.

⚹	α	t	cC	iI	p	aA	r	ΔT
	s	s						s
615	10.114	45.019	+ 94	+ 162	— 106	— 13	+ 1	24.957
Ng	30.65	5.462	+ 325	+ 507		......	0	......
636	44.635	19.606	+ 58	+ 47		+ 68	0	.962
191	0.444	34.868	+ 353	— 172		......	0	......
650	5.567	40.620	+ 67	+ 44		+ 46	0	.896
655	58.023	33.082	+ 78	+ 66		+ 20	0	.883
663	42.701	17.714	+ 64	+ 32		+ 53	0	.944
671	28.506	3.547	+ 81	+ 48		+ 13	0	.923
685	34.970	10.108	+ 102	+ 2		— 32	— 1	.897
694	1.789	36.944	+ 86	+ 2		+ 3	— 1	.861
700	54.753	29.974	+ 205	— 22		......	— 1	......

$a_1 = +0\overset{s}{.}160$, $a_2 = +0\overset{s}{.}167$, $a_3 = +0\overset{s}{,}149$; $a_m = +0\overset{s}{.}159$ — $24\overset{s}{.}915$
$E = 17^h34^m.0.$ — -1.000

$23\overset{s}{.}915$

Tallinn. July 5-th, 1936.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
598	44.018	18.984	+ 86	+ 110	— 16	+ 2	+ 6	24.846
601	48.120	23.083	+ 63	+ 97		+ 29	+ 4	.860
615	10.093	45.161	+ 94	— 38		— 7	+ 3	.896
Ng	30.55	5.829	+ 325	— 135		......	+ 1	......
636	44.632	19.670	+ 58	— 37		+ 35	0	.922
191	0.339	34.728	+ 353	+ 116		......	0	......
650	5.562	40.676	+ 67	— 40		+ 24	— 1	.852
663	42.700	17.796	+ 64	— 43		+ 27	— 2	.874
671	28.500	3,608	+ 81	— 53		+ 7	— 3	.876
700	54.727	29.945	+ 205	— 215		......	— 5	......
707	18.836	53.950	+ 87	— 106		0	— 7	.928

$a_1 = +0^s.116$, $a_2 = +0^s.079$, $a_3 = +0^s.052$; $a_m = +0^s.082$ 24.882

E = $17^h10^m.2$. — 1.000

23.882

Tallinn. June 12-th, 1937.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
571	34.506	21.570	+ 99	— 253	— 52	— 2	+ 92	13.052
590	19.523	6.614	+ 201	— 707		......	+ 47	......
595	20.637	7.820	+ 73	— 236		— 26	+ 28	.022
598	45.381	32.530	+ 81	— 250		— 4	+ 19	.057
601	50.104	37.276	+ 59	— 194		— 66	+ 7	.074
608	53.886	41.056	+ 61	— 225		— 62	— 14	.122
615	11.144	58.400	+ 88	— 337		+ 15	— 25	.055
621	7.417	54.656	+ 57	— 220		— 74	— 42	.092
627	9.081	56.401	+ 77	— 289		— 15	— 66	.025
Ng	25.68	13.226	+ 306	—1194		......	— 81	......

$a_1 = -0^s.230$, $a_2 = -0^s.148$, $a_m = -0^s.189$ 13.062

E = $16^h10^m.6$. — 1.500

11.562

Tallinn. June 13-th, 1937.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
571	34.491	23.754	+ 99	— 106	+ 78	— 2	+ 70	10.598
573	43.011	32.348	+ 56	— 33		— 69	+ 60	.571
580	36.841	26.248	+ 55	— 31		— 70	+ 46	.515
590	19.482	8.459	+ 201	— 123		......	+ 26	......
595	20.630	10.023	+ 73	— 61		— 22	+ 7	.532
598	45.371	34.768	+ 81	— 74		— 4	— 2	.524

⚹	a	t	cC	iI	p	aA	r	ΔT
601	50.099	39.561	+ 59	— 69		— 58	— 14	.542
608	53.884	43.373	+ 61	— 81		— 54	— 35	.542
615	11.136	0.606	+ 88	— 139		+ 13	— 45	.535
623	22.949	12.308	+ 194	— 185		......	— 65	......
627	9.078	58.558	+ 77	— 106		— 13	— 86	.570
Ng	25.64	14.549	+ 306	— 398		......	— 102	......

$a = -0^s.200$, $a_2 = -0^s.062$, $a_3 = -0^s.229$, $a_m = -0^s.164$ — $10^s.548$

E = 15ʰ59ᵐ.7. — 1.500

$9^s.048$

Vaivara. June 17-th, 1937.

⚹	a	t	cC	iI	p	aA	r	ΔT
650	7.132	40.476	+ 63	+ 110	— 41	— 83	+ 114	26.493
655	59.212	32.452	+ 73	+ 124		— 36	+ 103	.537
663	44.343	17.646	+ 60	+ 118		— 95	+ 89	.566
675	19.778	52.281	+ 185	+ 400		......	+ 61	......
694	2.619	35.864	+ 81	+ 218		— 6	0	.503
248	31.728	6.052	+ 354	— 410		......	— 24	......
707	19.631	52.882	+ 82	+ 225		— 1	— 54	.538
713	38.452	12.010	+ 50	+ 120		— 154	— 66	.533
719	6.402	39.974	+ 52	+ 132		— 140	— 83	,508
726	42.057	15.466	+ 70	+ 186		— 51	— 104	.531
734	36.601	8.654	+ 228	+ 591		......	— 123	......

$a_1 = -0^s.274$, $a_2 = -0^s.194$, $a_3 = -0^s,393$, $a_m = -0^s.287$ — $26^s.526$

E = 18ʰ23ᵐ.1. — 1.500

$25^s.026$

Vaivara. June 18-th, 1937.

⚹	a	t	cC	iI	p	aA	r	ΔT
595	20.561	56.666	+ 73	— 134	— 38	— 155	+ 66	24.082
598	45.295	21.310	+ 81	— 156		— 26	+ 58	.066
601	50.058	26.416	+ 59	— 118		— 402	+ 49	.092
608	53.846	30.152	+ 61	— 81		— 372	+ 31	.093
615	11.066	47.005	+ 88	— 120		+ 96	+ 25	.010
623	22.784	57.079	+ 194	— 128		......	+ 6	......
627	9.042	45.066	+ 77	— 18		— 91	— 12	.058
Ng	25.42	57.740	+ 306	— 52		......	— 25	......
636	46.557	22.942	+ 55	— 5		— 486	— 47	.136
191	9.096	48.840	+ 339	— 64		......	— 57	......

*	a	t	cC	iI	p	aA	r	ΔT
650	7.133	43.622	+ 63	— 186		— 332	— 78	.082
655	59.212	35.800	+ 73	— 449		— 146	— 88	.060

$a_1 = -1^s.104$, $a_2 = -1^s.203$, $a_3 = -1^s.136$, $a_m = -1^s{,}148$ — $24^s.075$
$E = 16^h 36^m.8$. — $-\ 1.500$

$22^s.575$

Vaivara. June 19-th, 1937.

*	a	t	cC	iI	p	aA	r	ΔT
595	s 20.545	s 58.550	+ 73	+ 14	— 60	— 122	+ 65	s 22.025
598	45.278	23.200	+ 80	— 14		— 20	+ 58	.034
601	50.049	28.318	+ 59	— 15		— 316	+ 49	.014
608	53.838	32.038	+ 61	+ 21		— 292	+ 31	.039
615	11.049	48.866	+ 88	+ 25		+ 76	+ 25	.029
623	22.738	59.327	+ 194	+ 53		......	+ 5	......
627	9.032	47.034	+ 76	+ 22		— 71	— 12	.043
Ng	25.36	0.258	+ 306	+ 47		......	— 25	......
636	46.558	24.950	+ 55	— 10		— 383	— 47	.053
191	9.147	50.052	+ 339	— 18		......	— 57	......
650	7.135	45.486	+ 63	+ 1		— 261	— 78	21.984
655	59.212	37.372	+ 73	+ 37		— 115	— 87	21.992

$a_1 = -0^s.833$, $a_2 = -0^s.987$, $a_3 = -0^s.890$, $a_m = -0^s.903$ — $22^s.024$
$E = 16^h 36^m.8$ — $-\ 1.500$

$20^s.524$

Kaseküla. June 28-th, 1937.

*	a	t	cC	iI	p	aA	r	ΔT
615	s 10.898	s 15.548	+ 88	— 8	— 39	+ 365	+ 107	s 54.837
621	7.351	13.608	+ 57	+ 27		— 1185	+ 89	.794
627	8.947	14.168	+ 76	+ 44		— 165	+ 66	.797
Ng	24.69	20.100	+ 306	+ 128		......	+ 49	......
636	46.556	52.952	+ 55	+ 7		— 1287	+ 23	.845
191	9.753	25,970	+ 339	— 96		......	+ 10	......
650	7.135	13.154	+ 63	+ 18		— 845	— 15	.799
655	59.197	4.681	+ 73	+ 60		— 318	— 27	.767
663	44.372	50.538	+ 60	+ 28		— 988	— 40	.813
675	19.611	20.118	+ 186	+ 131		......	— 69	......
681	8.478	15.508	+ 48	+ 23		— 1798	— 94	.830
685	35.361	39.818	+ 97	+ 79		+ 750	— 110	.766

$a_1 = -3^s.185$, $a_2 = -3^s.135$, $a_3 = -3^s.190$, $a_m = -3^s.177$ — $54^s.805$
$E = 17^h 17^m.5$. — $-\ 1.500$

$53^s.305$

Kaseküla. July 1-st, 1937.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
621	7.318	20.388	+ 57	— 26	— 18	— 1239	+ 86	48.070
627	8.900	20.928	+ 77	+ 22		— 173	+ 69	.005
Ng	24.45	26.302	+ 306	+ 20		......	+ 56	......
636	46.536	59.694	+ 55	+ 38		— 1345	+ 37	.075
191	9.828	33.262	+ 339	— 60		......	+ 29	......
650	7.114	19.860	+ 63	+ 50		— 884	+ 8	.035
655	59.173	11.362	+ 73	+ 57		— 332	0	.031
663	44.357	57.247	+ 60	+ 51		— 1033	— 10	.060
675	19.544	26.524	+ 186	+ 114		......	— 32	......
681	8.481	22.280	+ 48	+ 57		— 1880	— 50	.044
685	35.351	46.434	+ 97	+ 48		+ 784	— 63	.069
694	2.684	14.562	+ 81	+ 97		+ 27	— 77	.012

$a_1 = -3^s.320$, $a_2 = -3^s.284$, $a_3 = -3^s.362$, $a_m = -3^s.322$ — $48^s.045$

E = $17^h 30^m.8$. — 1.500

$46^s.545$

Kaseküla. July 2-nd, 1937.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
621	7.307	18.788	+ 57	— 52	+ 8	+ 1725	+ 90	46,691
627	8.882	21.896	+ 77	— 31		+ 240	+ 71	.617
Ng	24.36	50.923	+ 306	— 181		......	+ 59	......
636	46.529	57.896	+ 55	— 6		+ 1873	+ 38	.665
191	9.991	6.411	+ 339	+ 63		......	+ 28	......
650	7.108	19.146	+ 63	+ 30		+ 1230	+ 9	.622
655	59.165	11.972	+ 73	+ 19		+ 462	0	.631
663	44.354	56.124	+ 60	+ 25		+ 1438	— 11	.710
675	19.518	39.279	+ 185	+ 20		......	— 33	......
681	8.484	19.148	+ 48	+ 14		+ 2618	— 52	.700
685	35.347	49.692	+ 97	— 7		— 1092	— 65	.714
694	2.683	16.073	+ 81	+ 22		— 37	— 80	.616

$a_1 = +4^s.577$, $a_2 = +4^s.600$, $a_3 = +4^s.697$, $a_m = +4^s.625$ — $46^s.663$

E = $17^h 30^m.8$. — 1.500

$45^s.163$

Tallinn. July 5-th, 1937.

*	a	t	cC	iI	p	aA	r	ΔT
	s	s						s
191	10.187	45.376	+ 339	+ 466	+ 44	......	+ 80	......
650	7.093	47.246	+ 63	— 160		+ 341	+ 64	19.495
655	59.141	39.506	+ 73	— 215		+ 152	+ 57	.524

⁎	a	t	cC	iI	p	aA	r	ΔT
663	44.346	24.417	+ 60	— 173		+ 393	+ 48	.557
675	19.410	1.685	+ 186	— 580		......	+ 30	......
681	8.500	48.309	+ 48	— 116		+ 685	+ 14	.516
685	35.329	16.178	+ 97	— 295		— 234	+ 4	.535
694	2.683	43.258	+ 81	— 245		+ 26	— 8	.527
700	52.017	34.586	+ 193	— 641		......	— 20	......
707	19.785	0.400	+ 82	— 276		+ 5	— 42	.572
713	38.663	18.614	+ 50	— 170		+ 631	— 50	.544
733	10.502	51.000	+ 67	— 242		+ 258	— 89	.464

$a_1 = +1^s.241$, $a_2 = +1^s.119$, $a_3 = +1^s.168$, $a_m = +1^s.176$ — $19^s.526$

$E = 18^h\,16^m.7$. — $-\ 1.500$

$18^s.026$

Tallinn. July 6-th, 1937.

⁎	a	t	cC	iI	p	aA	r	ΔT
650	s 7.088	s 48.698	+ 63	— 10	+ 40	+ 309	+ 61	s 17.927
655	59.133	40.890	+ 73	— 45		+ 137	+ 57	.981
663	44.344	25.858	+ 60	— 34		+ 356	+ 52	18.012
675	19.366	2.778	+ 186	— 199		......	+ 42	......
681	8.507	49.846	+ 48	— 45		+ 620	+ 32	17.966
742	3.832	45.559	+ 59	— 106		+ 376	— 40	.944
747	27.641	10.355	+ 123	— 232		— 579	— 44	.978
750	3.593	45.507	+ 68	— 122		+ 217	— 49	.932
759	7.490	51.244	+ 194	— 391		......	— 61	......
765	1.542	43.171	+ 55	— 94		+ 461	— 68	.977

$a_1 = +1^s.080$, $a_2 = +1^s.048$, $a_m = +1^s.064$ — $17^s.965$

$E = 18^h\,48^m.1$. — $-\ 1.500$

$16^s.465$

III. Time Signal Reception and Preliminary Longitudes.

The following tables show the measured preliminary longitudes in chronological order. "Nardin — Time Signal Moment" gives the difference: Chronometer Nardin 2451 minus moment of corresponding time signal. The moments of the time signals were taken from the "Bulletin Horaire" sub "Heures définitives des signaux horaires etc."; the velocity of transmission was also taken into account. The "Adjusted Mean" (of time signals) was graphically deduced for the epoch of observations, the rate of the chronometer being accepted as linear. Δs is the correction for the personal error of the reception of time signals [1]; ΔT gives the correction of the chronometer taken from Chapter II. λ_p is the deduced preliminary longitude, where λ_p = "Adjusted Mean" (of signals) + Δs + ΔT. In the tables, seconds are only given, while hours and minutes may be found in Chapter V.

Date	Nardin — Time Signal Moment.					Δs	ΔT	λ_p
	GBR	FYL	FLE	DFY	Adjust. mean.			
1935.					Tallinn.			
	s	s	s	s	s	s	s	s
28. 7.	59.280	59.381	59.563	59.652	59.552	—0.024	27.879	57.407
29. 7.	0.766	0.912	1.083	1.150	1.010	„	26.391	57.377
30. 7.	2.387	2.531	2.674		2.612	„	24.794	57.382
							Mean	*57.389* ± *0.009* (mean error)
1935.					Hummuli.			
	s	s	s	s	s	s	s	s
1. 8.	4.974	5.119	5.278	5.396	5.304	—0.024	4.299	9.579
2. 8.	6.367	6.510	6.708		6.611	„	2.980	9.567
4. 8.	9.294	9.458	9.653	9.772	9.549	„	0.050	9.575
							Mean	*9.574* ± *0.004*
1936.					Tallinn.			
	s	s	s	s	s	s	s	s
10. 6.	57.796	57.902	58.003	58.069	57.964	—0.024	29.419	57.359
1936.					Ebavere.			
	s	s	s	s	s	s	s	s
15. 6.	2.904	3.024	3.193	3.247	3.132	—0.024	50.146	53.254 [2]
17. 6.	21.998	22.068	22.114	22.163	22.100	„	31.219	53.295 [3]
18. 6.	22.510	22.547	22.628		22.574	„	30.729	53.279
19. 6.	23.054	23.123	23.192		23.132	„	30.200	53.308
						Weighted mean		*53.287* ± *0.011*
1936.					Emumäe.			
	s	s	s	s	s	s	s	s
25. 6.	25.574	25.641	[4]	[4]	25.664	—0.024	4.350	29.990 [5]
26. 6.	26.224	26.323	26.415		26.344	„	3.704	30.024

[1] See "Longitude and Latitude Determinations in Estonia from 1930 to 1933", Publications from the Tallinn Institue of Technology, Series A, No. 1, 1937, p. 10.

[2] The contact of the chronometer works irregularly, especially when receiving FLE. Weight of λ_p 0.5.

[3] Weight of ΔT 0.5; weight of λ_p therefore also 0.5.

[4] FLE and DEY gave no signals. GBR received on June 26-th in the morning gave for "Nardin — Time signal moment" 26.043,

[5] Weight of λ_p 0.5.

Date	Nardin — Time Signal Moment. GBR	FYL	FLE	DFY	Adjust. mean.	Δs	ΔT	λ_p
	s	s	s		s		s	s
29. 6.	28.626	28.674	28.754		28.690	„	1.367	30.033 [1]
30. 6.	29.305	29.419	29.519		29.431	„	0.622	30.029
							Weighted mean	$30^s.022 \pm 0^s.010$
1936.					Tallinn.			
	s	s	s		s	s	s	s
3. 7.	33.606	33.594	33.607		33.604	—0.024	23.813	57.393
4. 7.	33.505	33.521	33.514		33.514	„	23.915	57.405
5. 7.	33.524	33.539	33.543		33.537	„	23.882	57.395
1937.					Tallinn.			
	s	s	s		s	s	s	s
12. 6.	45.429	45.676	45.968		45.803	—0.024	11.562	57.341
13. 6.	48.037	48.279	48.570		48.376	„	9.048	57.400
1937.					Vaivara.			
	s	s	s	s	s	s	s	s
17. 6.	58.648	58.876	59.180	59.359	59.209	—0.024	25.026	24.211
18. 6.	1.325	1.535	1.775		1.623	„	22.575	24.174
19. 6.	3.412	3.612	3.857		3.695	„	20.524	24.195
							Mean	$24^s.193 \pm 0^s.011$
1937.					Kaseküla.			
	s	s	s		s	s	s	s
28. 6.	22.873	23.112	23.415		23.252	—0.024	53.305	16.533
1. 7.	29.715	29.884	30.112		29.994	„	46.545	16.515
2. 7.	31.074	31.276	31.505		31.376	„	45.163	16.515
							Mean	$16^s.521 \pm 0^s.006$
1937.					Tallinn.			
	s	s	s	s	s	s	s	s
5. 7.	39.052	39.216	39.390	39.513	39.335	—0.024	18.026	57.337
6. 7.	40.749	40.836	40.949	41.014	40.931	„	16.465	57.372

IV. Latitude Determinations.

The following tables give the latitude determinations in chronological order. In the tables we denote by

1) ✻ — the number of the stars forming a pair in the old Boss [2]) catalogue;

[1]) Weight of ΔT 0.5; weight of λ_p therefore also 0.5.

[2]) Lewis Boss. Preliminary General Catalogue 1910.

2) $\frac{\delta_n + \delta_s}{2}$ — the mean declination of the pair in the new Boss[1]) system. This figure does not contain short period nutation terms;

3) m — the difference of the zenith distances of north and south star measured with the Talcott micrometer;

4) i — the correction for inclination given by the levels;

5) c — the correction for the curvature of the parallel;

6) r — the correction for differential refraction;

7) φ_p — the deduced preliminary latitude;

8) ☾ — the correction of the given night for short period nutation terms.

For each field-point, the mean φ_p is given with its mean error, where the effect of short period nutation terms has already been taken into account. The mean φ_p is computed from individual pairs (not nights).

Hummuli. August 6-th, 1935.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ′ ″
4782 — 4805	57 46 4.29	+ 7 6.95	— 0.16	+ 0.10	+ 0.13	57 53 11.31
4948 — 4994	57 52 52.82	+ 0 18.11	+ 0.15	+ 0.20	+ 0.01	11.29
4948 — 5014	57 49 58.50	+ 3 12.46	+ 0.50	+ 0.20	+ 0.06	11.72
5057 — 5083	58 1 19.16	— 8 8.35	+ 0.11	+ 0.10	— 0.14	10.88
5105 — 5162	57 59 15.90	— 6 5.30	+ 0.48	+ 0.18	— 0.10	11.16
						57 53 11.27
						☾ — 0.05
						57 53 11.22

Hummuli. August 8-th, 1935.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ′ ″
4671 — 4707	57 52 56.07	+ 0 15.42	— 0.90	+ 0.14	+ 0.00	57 53 10.73
4799 — 4829	57 54 7.20	— 0 56.29	+ 0.12	+ 0.20	— 0.01	11.22
4948 — 4994	57 52 53.44	+ 0 18.22	— 0.64	+ 0.10	+ 0.01	11.13
4948 — 5014	57 49 59.13	+ 3 12.77	— 0.61	+ 0.10	+ 0.06	11.45
5057 — 5083	58 1 19.87	— 8 9.40	+ 0.40	+ 0.08	— 0.14	10.81

[1]) Benjamin Boss. General Catalogue of 33 342 Stars for the Epoch 1950. Washington 1937.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	″
5130 — 5162	57 47 36.77	+ 5 34.64	+ 0.10	+ 0.19	+ 0.09	11.79
5199 — 5249	57 52 29.57	+ 0 41.49	+ 0.02	+ 0.10	+ 0.11	11.19
5279 — 5312	57 56 59.78	— 3 48.86	+ 0.08	+ 0.07	— 0.07	11.00
5394 — 5412	57 54 50.77	— 1 40.17	+ 0.50	+ 0.19	— 0.02	11.27
5478 — 5525	57 53 1.12	+ 0 10.50	— 0.18	+ 0.10	+ 0.01	11.55
5495 — 5525	57 49 16.06	+ 3 55.73	— 0.16	+ 0.10	+ 0.07	11.80
5565 — 5593	57 50 29.87	+ 2 42.15	— 0.35	+ 0.18	+ 0.04	11.89
5650 — 5664	57 56 43.97	— 3 32.82	— 0.01	+ 0.10	— 0.06	11.18
5719 — 5742	57 54 34.89	— 1 24.17	+ 0.48	+ 0.18	— 0.02	11.36
5827 — 5856	57 53 30.62	— 0 19.12	— 0.10	+ 0.10	— 0.00	11.50
5943 — 5958	57 54 11.76	— 1 0.95	+ 0.62	+ 0.10	— 0.01	11.52
5943 — 5975	57 57 28.70	— 4 18.08	+ 0.85	+ 0.10	— 0.07	11.50
						° ′ ″
						57 53 11.35
						☾ — 0.02
						° ′ ″
						57 53 11.33

Hummuli. August 9-th, 1935.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ′ ″
4671 — 4707	57 52 56.30	+ 0 14.97	— 0.25	+ 0.18	+ 0.00	57 53 11.20
4782 — 4805	57 46 5.08	+ 7 6.26	+ 0.24	+ 0.10	+ 0.13	11.81
4948 — 4994	57 52 53.74	+ 0 17.51	+ 0.17	+ 0.10	+ 0.01	11.53
4948 — 5014	57 49 59.43	+ 3 12.02	+ 0.16	+ 0.10	+ 0.06	11.77
5057 — 5083	58 1 20.14	— 8 9.79	+ 0.20	+ 0.10	— 0.14	10.51
5105 — 5162	57 59 16.92	— 6 5.64	— 0.02	+ 0.20	— 0.10	11.36
5194 — 5218	57 49 15.88	+ 3 55.19	+ 0.24	+ 0.18	+ 0.07	11.56
						° ′ ″
						57 53 11.39
						☾ + 0.06
						° ′ ″
						57 53 11.45

Mean for Hummuli: $\varphi_p = 57° 53' 11.34'' \pm 0.06''$

Ebavere. June 19-th, 1936.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ′ ″
4707 — 4763	58 59 16.36	+ 7 0.50	— 0.16	+ 0.18	+ 0.13	59 6 17.01

Ebavere. June 20-th, 1936.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ″ ″
3930 — 3977	59 12 18.38	— 6 3.09	+ 0.60	+ 0.15	— 0.10	59 6 15.94[1])
4056 — 4157	59 3 37.18	+ 2 38.65	+ 0.60	+ 0.10	+ 0.04	16.57
4186 — 4209	59 10 42.37	— 4 26.23	+ 0.56	+ 0.10	— 0.08	16.76
4186 — 4242	59 9 18.45	— 3 1.79	+ 0.82	+ 0.10	— 0.03	17.55
4327 — 4358	59 4 52.55	+ 1 23.36	+ 0.95	+ 0.08	+ 0.02	16.96
4382 — 4458	59 5 13.81	+ 1 2.81	— 0.44	+ 0.19	+ 0.03	16.40
4382 — 4460	59 4 53.25	+ 1 23.38	— 0.44	+ 0.19	+ 0.03	16.41
4479 — 4504	59 6 35.95	— 0 19.03	— 0.39	+ 0.10	— 0.01	16.62
4479 — 4505	59 6 50.59	— 0 33.62	— 0.39	+ 0.12	— 0.01	16.69
4671 — 4688	59 8 4.13	— 1 48.41	+ 0.50	+ 0.18	— 0.03	16.37
4730 — 4745	58 58 14.85	+ 8 1.49	+ 0.20	+ 0.19	+ 0.14	16.87
4787 — 4829	59 1 54.01	+ 4 22.43	+ 0.34	+ 0.19	+ 0.08	17.05
4863 — 4870	59 8 13.44	— 1 57.06	— 0.15	+ 0.06	— 0.04	16.25
4890 — 4980	59 1 48.54	+ 4 27.88	+ 0.22	+ 0.20	+ 0.08	16.92
5013 — 5026	59 3 25.64	+ 2 51.22	— 0.27	+ 0.19	+ 0.05	16.83
						59° 6′ 16.70″
						☾ + 0.07
						59° 6′ 16.77″

Ebavere. June 21-st, 1936.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ′ ″
4123 — 4159	59 0 24.90	+ 5 49.87	+ 1.44	+ 0.18	+ 0.10	59 6 16.49
4223 — 4255	59 4 20.81	+ 1 55.17	+ 0.61	+ 0.12	+ 0.04	16.75
4327 — 4358	59 4 52.87	+ 1 23.79	+ 0.42	+ 0.08	+ 0.02	17.18
4382 — 4458	59 5 14.14	+ 1 1.78	+ 0.32	+ 0.19	+ 0.02	16.45
4382 — 4460	59 4 53.55	+ 1 22.55	+ 0.32	+ 0.19	+ 0.02	16.63
4479 — 4554	59 1 32.07	+ 4 44.55	+ 0.83	+ 0.10	+ 0.09	17.64
4624 — 4724	59 12 15.91	— 6 0.19	+ 0.31	+ 0.11	— 0.12	16.02
4727 — 4765	59 10 26.38	— 4 10.45	+ 0.32	+ 0.19	— 0.08	16.36
4788 — 4795	59 5 26.15	+ 0 50.04	+ 0.30	+ 0.10	+ 0.01	16.60
						59° 6′ 16.68″
						☾ + 0.01
						59° 6′ 16.69″

Mean for Ebavere: $\varphi_p = 59^\circ\, 6'\, 16.75'' \pm 0.07$

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[1]) Weight 0.5.

Emumäe. June 23-rd, 1936.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ′ ″
4021 — 4072	58 51 49.30	+ 4 29.69	+ 0.19	+ 0.19	+ 0.08	58 56 19.45
4123 — 4159	59 0 25.48	— 4 6.82	— 0.01	+ 0.18	— 0.07	18.76
4181 — 4201	58 57 45.79	— 1 26.39	— 0.20	+ 0.10	— 0.03	19.27
4327 — 4343	58 49 28.56	+ 6 50.61	+ 0.38	+ 0.08	+ 0.13	19.76
4382 — 4458	59 5 14.81	— 8 56.13	— 0.61	+ 0.19	— 0.14	18.12
4382 — 4460	59 4 54.21	— 8 35.46	— 0.61	+ 0.19	— 0.14	18.19
4504 — 4555	58 50 32.16	+ 5 47.34	— 0.31	+ 0.10	+ 0.10	19.39
4505 — 4555	58 50 46.65	+ 5 32.60	— 0.31	+ 0.11	+ 0.10	19.15
4634 — 4653	58 54 38.82	+ 1 39.40	+ 1.10	+ 0.11	+ 0.03	19.46
4686 — 4711	58 54 46.92	+ 1 32.36	— 0.15	+ 0.10	+ 0.03	19.26
4730 — 4745	58 58 15.91	— 1 57.92	+ 0.72	+ 0.18	— 0.03	18.86
4782 — 4814	58 56 11.76	+ 0 7.64	— 0.44	+ 0.10	+ 0.01	19.07
4870 — 4911	58 53 3.82	+ 3 15.38	— 0.25	+ 0.09	+ 0.06	19.10
4940 — 5012	58 53 41.70	+ 2 37.60	— 0.37	+ 0.09	+ 0.04	19.06
						58 56 19.06
						☾ — 0.06
						58 56 19.00

Emumäe. June 24-th, 1936.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ′ ″
4479 — 4554	59 1 33.12	— 5 14.82	— 0.80	+ 0.10	— 0.09	58 56 17.51
4634 — 4653	58 54 39.16	+ 1 40.06	— 0.54	+ 0.11	+ 0.03	18.82
4686 — 4711	58 54 47.30	+ 1 32.41	— 0.34	+ 0.19	+ 0.03	19.59
4730 — 4745	58 58 16.27	— 1 58.61	+ 0.70	+ 0.19	— 0.03	18.52
4825 — 4846	59 1 40.12	— 5 22.01	+ 0.50	+ 0.10	— 0.10	18.61
4890 — 4980	59 1 49.96	— 5 29.60	— 1.92	+ 0.10	— 0.09	18.45
5013 — 5026	59 3 27.12	— 7 6.43	— 1.40	+ 0.09	— 0.12	19.26
						58 56 18.68
						☾ — 0.07
						58 56 18.61

Mean for Emumäe: $\varphi_p = 58° 56' 18''.87 \pm 0''.12$

Vaivara. June 20-th, 1937.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ′ ″
4021 — 4047	59 24 13.68	— 1 36.44	+ 0.90	+ 0.19	— 0.03	59 22 38.30
4090 — 4159	59 19 15.32	+ 3 23.16	+ 0.23	+ 0.11	+ 0.06	38.88
4181 — 4220	59 14 3.74	+ 8 35.26	— 0.28	+ 0.10	+ 0.15	38.97

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	″
4293 — 4364	59 14 24.52	+ 8 14.29	— 0.56	+ 0.12	+ 0.15	38.52
1235 — 4400	59 28 44.76	— 6 6.98	+ 0.48	— 0.06	— 0.18	38.02
4464 — 4511	59 29 9.54	— 6 31.17	— 0.42	+ 0.10	— 0.11	37.94
4602 — 4614	59 22 37.94	+ 0 0.56	— 0.20	+ 0.12	+ 0.00	38.42
4603 — 4614	59 22 32.06	+ 0 6.35	— 0.20	+ 0.12	+ 0.00	38.33
4763 — 4822	59 21 23.06	+ 1 15.18	— 0.26	+ 0.20	+ 0.02	38.20
4923 — 4948	59 25 22.19	— 2 43.80	— 0.06	+ 0.11	— 0.04	38.40
5020 — 5083	59 9 55.14	+ 12 44.18	— 1.04	+ 0.10	+ 0.23	38.61
						59° 22′ 38.″42
						☾ + 0.04
						59° 22′ 38.″46

Vaivara. June 21-st, 1937.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ′ ″
4021 — 4047	59 24 13.92	— 1 35.98	— 0.06	+ 0.19	— 0.03	59 22 38.04
4161 — 4223	59 28 47.38	— 6 9.29	— 0.26	+ 0.12	— 0.11	37.84
4293 — 4364	59 14 24.82	+ 8 14.32	— 0.64	+ 0.12	+ 0.15	38.77
1235 — 4400	59 28 44.91	— 6 5.39	— 1.26	— 0.05	— 0.18	38.03
4470 — 4531	59 24 10.87	— 1 32.10	— 0.30	+ 0.19	— 0.02	38.64
4609 — 4623	59 19 19.91	+ 3 18.60	+ 0.02	+ 0.10	+ 0.06	38.69
1673 — 4761	59 14 13.93	+ 8 24.78	— 0.46	— 0.05	+ 0.25	38.45
4829 — 4869	59 14 13.11	+ 8 25.49	0.00	+ 0.10	+ 0.14	38.84
						59° 22′ 38.″41
						☾ + 0.07
						59° 22′ 38.″48

Mean for Vaivara: $\varphi_p = 59^\circ 22' 38.''47 \pm 0.''08$

Kaseküla. June 26-th, 1937.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ′ ″
4255 — 4293	58 20 0.94	+ 10 53.70	— 0.59	+ 0.11	+ 0.22	58 30 54.38
4317 — 4354	58 22 39.03	+ 8 14.90	— 0.31	+ 0.18	+ 0.14	53.94
4458 — 4470	58 34 33.07	— 3 38.62	— 0.30	+ 0.18	— 0.06	54.27
4460 — 4470	58 34 12.47	— 3 18.02	— 0.30	+ 0.18	— 0.06	54.27
4591 — 4582	58 35 0.14	— 4 5.88	— 0.50	+ 0.09	— 0.09	53.76
4661 — 4724	58 29 12.38	+ 1 40.84	+ 0.13	+ 0.11	+ 0.04	53.50
4724 — 4749	58 31 25.84	— 0 31.02	— 0.61	+ 0.11	— 0.01	54.31
4790 — 4822	58 31 19.10	— 0 25.19	— 0.34	+ 0.18	— 0.01	53.74

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ′ ″
4948 — 4988	58 35 42.22	— 4 47.86	— 0.29	+ 0.10	— 0.08	54.09
5009 — 5085	58 39 43.82	— 8 48.86	— 1.14	+ 0.11	— 0.16	53.77
						58 30 54.00
						ℭ 0.00
						58 30 54.00

Kaseküla. June 27-th, 1937.

*	$\frac{\delta_n + \delta_s}{2}$	m	i	c	r	φ_p
	° ′ ″	′ ″	″	″	″	° ′ ″
4121 — 4161	58 24 42.19	+ 6 11.86	— 0.58	+ 0.10	+ 0.12	58 30 53.69
4184 — 4223	58 19 9.58	+ 11 44.81	+ 0.18	+ 0.12	+ 0.23	54.92
4255 — 4293	58 20 1.17	+ 10 53.36	+ 0.14	+ 0.11	+ 0.22	55.00
4317 — 4354	58 22 39.31	+ 8 16.02	— 1.08	+ 0.18	+ 0.14	54.57
4458 — 4470	58 34 33.34	— 3 38.49	— 0.57	+ 0.18	— 0.06	54.40
4460 — 4470	58 34 12.73	— 3 17.77	— 0.57	+ 0.18	— 0,06	54.51
4535 — 4602	58 37 39.31	— 6 45.05	— 0.96	+ 0.12	— 0.12	53.30
4535 — 4603	58 37 45.17	— 6 50.84	— 0.96	+ 0.12	— 0.12	53.37
4661 — 4724	58 29 12.70	+ 1 42.12	— 0.60	+ 0.11	+ 0.04	54.37
4724 — 4747	58 33 9.24	— 2 14.97	— 0.13	+ 0.11	— 0.04	54.21
4788 — 4805	58 26 31.80	+ 4 22.26	0.00	+ 0.10	+ 0.08	54.24
1871 — 4960	58 34 8.46	— 3 14.48	+ 0.67	— 0.01	— 0.06	54.58
5020 — 5031	58 25 16.94	+ 5 38.24	— 0.58	+ 0.10	+ 0.11	54.81
						58 30 54.31
						ℭ — 0.04
						58 30 54.27

Mean for Kaseküla: $\varphi_p = 58°\,30'\,54''.15 \pm 0''.10.$

V. Final Results.

The preliminary longitudes and latitudes given in Chapters III and IV need corrections for the variation of the terrestrial pole and for possible personal errors, as well as reductions to the geodetic centres.

The effect of the variation of the terrestrial pole on the eastern longitude was computed according to the formula

$$\Delta\lambda = \lambda_{\mathrm{mean}} - \lambda_{\mathrm{ins}} = \frac{1}{15}\,(x.\ \sin\lambda - y.\cos\lambda).\ \tan\varphi - \Delta\lambda',$$

where λ denotes the western longitude of the point in question, and $\Delta\lambda'$ the effect of the variation of the terrestrial pole on the so-called "mean observatory".

The effect of the variation of the terrestrial pole on latitudes is

$$\Delta\varphi = -(x.\cos\lambda + y.\sin\lambda),$$

where λ indicates the western longitude of the point in question.

x and y, the co-ordinates of the pole, and the quantity $\Delta\lambda'$, were taken from the "Bulletin Horaire" Nos. 93, 99, and 105.

Owing to the lack of observational data, no personal errors were taken into account for the latitude determinations. For an estimate of the personal errors of the longitude determinations at field-points, we examine the longitude determinations at Tallinn. We get the following table.

Date	Observed longitude λ_p	$\Delta\lambda$	$\lambda_p + \Delta\lambda$	Yearly mean	Weight
1935. 7. 28.	$57^s.407$	$-0^s.001$	$57^s.406$		
7. 29.	57.377	„	57.376		
7. 30.	57.382	„	57.381	$57^s.388$	1
1936. 6. 10.	57.359	$-$0.004	57.355		
7. 3.	57.393	$-$0.004	57.389		
7. 4.	57.405	„	57.401		
7. 5.	57.395	„	57.391	57.384	1
1937. 6. 12.	57.341	$-$0.008	57.333		
6. 13.	57.400	„	57.392		
7. 5.	57.337	$-$0.007	57.330		
7. 6.	57.372	„	57.365	$57^s.355$	0.5

Weighted mean of yearly means $57^s.380 \pm 0^s.009$

The 9-th session of the Baltic Geodetic Commission adopted for the longitude of the astronomical pier at Tallinn $1^h\,38^m\,57^s.402$ east of Greenwich. [1]) When comparing this value with the longitudes determined by me at Tallinn in 1935, 1936, and 1937, we notice that the latter seem to contain considerable personal errors.

[1]) Comptes Rendus de la neuvième session de la Commission Géodésique Baltique, p. 44. Helsinki 1937.

The problem arises whether to deduce the personal errors separately for each year, or to compute a general mean value for all three years (from 1935 to 1937). When determining a separate error for each year, we obtain $+ 0\overset{s}{.}014 \pm 0\overset{s}{.}009$ for 1935, $+ 0\overset{s}{.}018 \pm 0\overset{s}{.}010$ for 1936, and $+ 0\overset{s}{.}047 \pm 0\overset{s}{.}015$ for 1937. The apparent personal error for 1937 ($+ 0\overset{s}{.}047 \pm 0\overset{s}{.}015$) is too large for a mean value for a longer period, and does not seem to be real for the present observations; the mean error is also comparatively large. Considering this, we compute for the personal error the weighted mean value for all three years (from 1935 to 1937), with the relative weight 1 for the years 1935 and 1936, and the relative weight 0.5 for 1937. We obtain for this mean value of the personal error

$$p = + 0\overset{s}{.}022 \pm 0\overset{s}{.}009$$

All longitudes determined at field-points, were corrected by this quantity.

The following table gives final longitudes for the years from 1935 to 1937. In the table we denote by

λ_p — the preliminary longitude of the astronomical pier, as given in Chapter III; beside them are their mean errors. These mean errors were deduced, however, only from the internal agreement of the observations and are, therefore, of no great importance;

$\Delta\lambda$ — the effect of the variation of the pole;

p — the correction for the personal error;

λ — the final longitude of the astronomical pier;

r — the reduction from the astronomical pier to the geodetic centre, the sub-surface mark of the trigonometric point;

λr — the final longitude of the geodetic centre.

At Tallinn, the longitude of the astronomical pier (the Landskrona tower) is given according to the resolution of the Baltic Geodetic Commission, as mentioned above. The geodetic centre (geodetic observation point) is in the steeple of the Tallinn Lutheran Cathedral (Tallinna Toomkirik).

At Tallinn and Hummuli, the reductions to the centres were made by the Topo-Hydrographic Section of the Army Staff, elsewhere these measurements were made by the author.

Final Longitudes.

	λ_p	$\Delta\lambda$	p	λ in time	λ in arc	r	λ_r
	h m s	s	s	h m s	° ′ ″	″	° ′ ″
Tallinn.				1 38 57.402	24 44 21.03	+ 3.05	24 44 24.08
Hummuli.	1 44 9.574 ± 0.004	— 0.001	+ 0.022	1 44 9.595	26 2 23.93	— 0.47	26 2 23.46
Ebavere.	1 44 53.287 ± 0.011	— 0.005	„	1 44 53.304	26 13 19.56	— 0.70	26 13 18.86
Emumäe.	1 45 30.022 ± 0.010	— 0.004	„	1 45 30.040	26 22 30.60	+ 1.16	26 22 31.76
Vaivara.	1 51 24.193 ± 0.011	— 0.008	„	1 51 24.207	27 51 3.10	— 2.07	27 51 1.03
Kaseküla.	1 39 16.521 ± 0.006	— 0.008	„	1 39 16.535	24 49 8.02	+ 4.88	24 49 12.90

The following table gives the final latitudes. In the table we denote by

φ_p — the preliminary latitude taken from Chapter IV;

$\Delta\varphi$ — the correction for the variation of the pole;

φ — the final latitude of the astronomical pier;

r — the reduction from the astronomical pier to the subsurface mark of the triangulation point;

φ_r — the final latitude of the geodetic centre;

Final Latitudes.

	φ_p	$\Delta\varphi$	φ	r	φ_r
	° ′ ″	″	° ′ ″	″	° ′ ″
Hummuli.	57 53 11.34 ± 0.06	+ 0.02	57 53 11.36	+ 0,04	57 53 11.40
Ebavere.	59 6 16.75 ± 0.07	0.00	59 6 16.75	+ 0.22	59 6 16.97
Emumäe.	58 56 18.87 ± 0.12	— 0.02	58 56 18.85	— 0.02	58 56 18.83
Vaivara.	59 22 38.47 ± 0.08	+ 0.01	59 22 38.48	+ 0.04	59 22 38.52
Kaseküla.	58 30 54.15 ± 0.10	— 0.01	58 30 54.14	+ 1.24	58 30 55.38

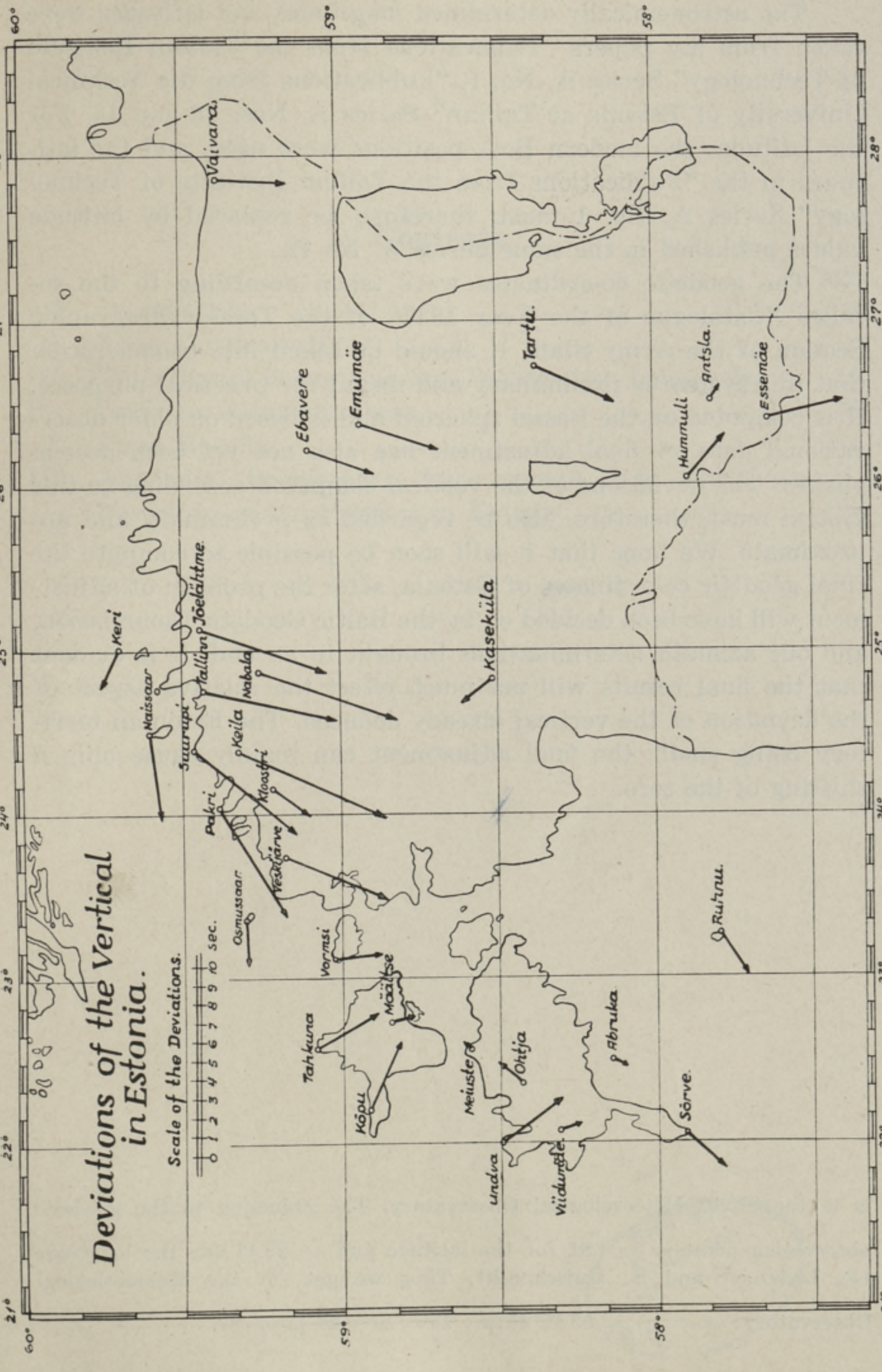
VI. Appendix. Preliminary Approximate Data about the Deviation of the Vertical in Estonia.

It is of some interest to compare the astronomically determined longitudes and latitudes with the geodetic co-ordinates of the same points. The following table shows the data referred to. The same data are represented graphically.

In the table we indicate by $\lambda_a = \lambda_r$ the astronomically determined longitude and by $\varphi_a = \varphi_r$ the astronomically determined latitude; λ_g denotes the geodetic longitude, and φ_g the geodetic latitude; $\xi = \varphi_a - \varphi_g$; $\eta = (\lambda_a - \lambda_g)$. cos φ.

Name	φ_a	φ_g	λ_a	λ_g	ξ	η
	° ′ ″	″	° ′ ″	″	″	″
Undva	58 29 31.64	28.44	21 59 47,04	51.76	+ 3.20	— 2.47
Sõrve	57 54 35.39	33.26	22 3 22.84	19.02	+ 2.13	+ 2.03
Viidumäe	58 18 27.99	26.78	22 4 21.53	22.26	+ 1.21	— 0,38
Kõpu	58 54 58.50	56.83	22 11 51.80	59.01	+ 1.67	— 3.72
Ohtja	58 25 41.01	42.32	22 21 58.86	0.93	— 1.31	— 1,08
Abruka	58 8 24.66	23.84	22 30 8.19	7.52	+ 0.82	+ 0,35
Meiuste	58 35 53.10	53.57	22 34 43.05	43.80	— 0.47	— 0.39
Tahkuna	59 5 31.84	28.55	22 35 7.08	10.67	+ 3.29	— 1,84
Määltse	58 50 50.92	49.70	22 44 33.94	34.38	+ 1.22	— 0.23
Vormsi	59 1 41.52	38.90	23 7 2.77	3.21	+ 2.62	— 0.23
Ruhnu	57 48 5.34	3.85	23 15 41.47	36.89	+ 1.49	+ 2,44
Osmussaare	59 18 11.51	11.40	23 21 46.17	41.39	+ 0.11	+ 2.44
Veskijärve	59 10 46.82	41.48	23 44 25.77	21.12	+ 5.34	+ 2.38
Pakri	59 23 17.94	14.31	24 2 28.36	16.86	+ 3.63	+ 5.85
Kloostri	59 13 12.82	10.75	24 9 3.47	0.70	+ 2.07	+ 1,42
Suurupi	59 27 53.79	48.46	24 22 58.84	50.20	+ 5.33	+ 4.39
Keila	59 19 20.80	13.09	24 23 9.98	3.11	+ 7.71	+ 3,51
Naissaare	59 36 15.40	14.77	24 30 53.72	44.34	+ 0.63	+ 4.75
Tallinn	59 26 20.23	13.11	24 44 24.08	20.82	+ 7.12	+ 1.66
Kaseküla	58 30 55.38	56.96	24 49 12.90	10.53	— 1.58	+ 1.24
Nabala	59 15 40.71	33.38	24 51 45.46	40.34	+ 7.33	+ 2.62
Keri	59 41 54,24	55.16	25 1 27.14	23.02	— 0.92	+ 2.08
Jõelähtme	59 26 51.45	44.74	25 7 32.21	27.46	+ 6.71	+ 2.41
Hummuli	57 53 11.40	9.34	26 2 23.46	27.80	+ 2.06	— 2.31
Ebavere	59 6 16.97	13.48	26 13 18.86	16.48	+ 3.49	+ 1.22
Emumäe	58 56 18.83	14.66	26 22 31.76	29.15	+ 4.17	+ 1.35
Essemäe	57 38 19.93	15.84	26 23 41.10	43.09	+ 4.09	— 1.07
Antsla	57 48 47.79	47.23	26 30 14.52	15.94	+ 0.56	— 0.76
Tartu [1])	58 22 45.35	41.11	26 42 54.27	50.61	+ 4.24	+ 1.92
Vaivara	59 22 38.52	34.80	27 51 1.03	0.64	+ 3.72	+ 0.20

[1]) At Tartu, the longitude and latitude are determined astronomically for the Astronomical Observatory of the University. The data for the latitude are given in the Publications of the Tartu Astronomical Observatory, Vol. XXIV, Part I, page 3; the data for the longitude are given in the same publications, Vol. XXVII, No. 3, page 76. The latitude of the meridian circle of the observatory is 58° 22′ 47.16″ (E. Schönberg) and its longitude 1ʰ 46ᵐ 53.180ˢ = 26° 43′ 17.70″ (R. Livländer). The geodetic observation point (pier)


Deviations of the Vertical
in Estonia.
Scale of the Deviations.
0 1 2 3 4 5 6 7 8 9 10 sec.
Vaivara
Tartu
Antsla
Essemäe
Hummuli
Emumäe
Ebavere
Kasekula
Keri
Naissaar
Tallinn
Jöelähtme
Nabala
Saarupi
Keila
Kloostri
Pakri
Vesijärve
Osmussaar
Vormsi
Määltse
Tahkuna
Kõpu
Ruhnu
Abruka
Ohtja
Neiuste
Undva
Viidumäe
Sõrve
21°
22°
23°
24°
25°
26°
27°
28°
58°
59°
60°

The astronomically determined longitudes and latitudes were taken from my papers "Publications from the Tallinn Institute of Technology" Series A, No. 1, "Publications from the Technical University of Estonia at Tallinn" Series A, Nos. 12 and 13. For the latitudes the modern Boss positions were used, and the latitudes in the "Publications from the Tallinn Institute of Technology" Series A, No. 1 must, therefore, be replaced by latitude values published in the same Series A, No 12.

The geodetic co-ordinates were taken according to the so-called "Catalogue of the Year 1937" of the Topo-Hydrographic Section of the Army Staff. It should be taken into consideration that this system is preliminary and meant for practical purposes. It is computed on the Bessel spheroid and is based on older observational data. A final adjustment has also not yet been accomplished. The deviations of the vertical computed according to this system must, therefore, also be regarded as preliminary and approximate. We hope that it will soon be possible to compute the final geodetic co-ordinates of Estonia, after the problem of adjustment will have been decided on by the Baltic Geodetic Commission, and our azimuth determinations brought to an end. It is evident that the final results will not much effect the relative aspect of the deviation of the vertical already deduced. The Estonian territory being small, the final adjustment can mainly cause only a shifting of the zero.

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is in the Tartu Meteorological Observatory. The reduction to the geodetic observation point is — $1''.81$ for the latitude and — $23''.43$ for the longitude (R. Livländer and H. Muischneek). Thus we get for the Meteorological Observatory: $\varphi_a = \varphi_r = 58^\circ 22' 45''.35$; $\lambda_a = \lambda_r = 26^\circ 42' 54''.27$.

Contents.