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DYE 2 POSITION AND TOPOGRAPHY 1986(U) COPENHAGEN UNIV  
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19. ABSTRACT (Continue on reverse if necessary and identify by block number) The main objective was to obtain a precise "fix", i.e., latitude, longitude and elevation at station Dye-2 on the Greenland ice cap. The site expedition established a benchmark 100 meters from Dye-2 and set up a Geociever with theodolite transportation to the site. Topographical data for the Geociever site is provided in this report.			
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## Dye 2 position and topography 1986.

### Purpose :

- (1) To provide a satellite based fixed point close to Dye 2 for position and elevation reference. By remeasurement of this point, the surface velocity can be calculated;
- (2) To measure the surface topography within 3 km from the station. Irregular ice flow should be accompanied by changes in surface slope, thus the surface topography can be used as an indicator for variations in surface strain.

### Equipment

The satellite receiver used is constructed by University of Copenhagen (UCPH). This receiver has demonstrated an accuracy of better than 1 meter in the horizontal plane, and better than 1.5 meter in elevation. The topography is performed with a Wild T16 theodolite equipped with a Wild DI200 distance meter. The theodolite has automatic vertical zero.

### Data processing

#### Satellite fix.

The satellite information is stored on tape in the field. In the lab., the information is transferred to the Sperry 1192 mainframe at the University Computing Center. Abnormal satellite passes are removed by a preprocessor, and the result checked manually. The data are then mixed with the precise satellite ephemeris (provided by DMATHC) and the position calculated by the DMATHC developed DOPPLR program. Thus, the position is compatible with any position calculated by DMATHC using the precise ephemeris. The estimated error is less than 1 meter in the horizontal plane, and less than 1.5 meter in elevation.

In order to reference the elevation to mean sea level in stead of the WGS72 ellipsoid, the estimated geoidheight is calculated from geoid data provided by Rapp, Ohio University. The estimated geoid height is 40 meter. As the measured antenna height above the ellipsoid is 2152.52 m, and the antenna was 1.05 m above the snow, the snow surface at the geociever site is 2111.5 meter above sea level.

#### Surface topography

The main elevation reference is the snow surface at the satellite fix. In order to provide this reference, an optical marker (prism) was mounted 0.5

meter from the satellite antenna. The terrain close to the station is very irregular due the snow removal operations, thus two observation posts had to be used, both west of the Dye station and close to the garage. The position of these points relative to the satellite site was calculated from the distance and azimuth to the marker prism at the satellite site. The true azimuth was calculated from sun shots. The position of the Dye station was determined from prisms at the corner legs. The main reference is the south side of the southwestern leg - that close to the entrance latter. The distance data from the DI2000 is corrected for barometric pressure, temperature and humidity in the distance meter itself. The elevation reading and the distance then give the elevation changes, corrected for refraction and earth curvature. This calculation was done at the lab using a Lotus 123 program (se enclosure 4).

The corrected elevation measurements were used as input to the "UNIRAS" program. Using the "Geopak" routines, and some degree of smoothing, the topography shown as enclosure 3 is obtained. All observed points are marked with a small dot. Due to the low data density in some areas, the topography have some anomalies. This is an artifact from the data processing.

Compared with the topography around Dye 3, the topography is relative regular. The surface undulations are not very strong. The ice flow is in direction 285 degree true.

#### Schedule

The team, consisting of N. Gundestrup and L. Riishøjgård arrived Dye 2 with 109'th TAG May 22. The same day, the satellite receiver was set up. Passes from May 23 to May 28 were used for the calculations. The measurements of the surface topography took place in the days May 24 to May 26. The main problems were obstacles due to snow drifts and periodic low visibility. May 26, the measurements had to stop because excessive snow drifts made measurements impossible. The team left Dye 2 for Sondre Stromfjord May 28 by 109'th TAG.

#### Enclosures:

1. Photo of reference at Dye 2 station
2. DMA sheet with satellite fix data.
3. Surface topography
4. Lotus sheet of elevation measurements



Enclosure 1, photo of reference at Dye 2.

The main reference at the Dye station is the column close to the entrance latter. On the photo, the prism, and the yellow target just below the prism is visible. The reference is 44 cm above the horizontal beam.

# SUMMARY OF SATELLITE-OBSERVED STATION

STATION NAME/LOCAL NUMBER <b>Dye 2</b>	1986	LOCATION Pole 600 m south of station	DOPPLER NO.
STAMPING ON MARK			
AGENCY (CAST IN MARK)		TYPE OF STATION MARK 6 m glassfiber pole	

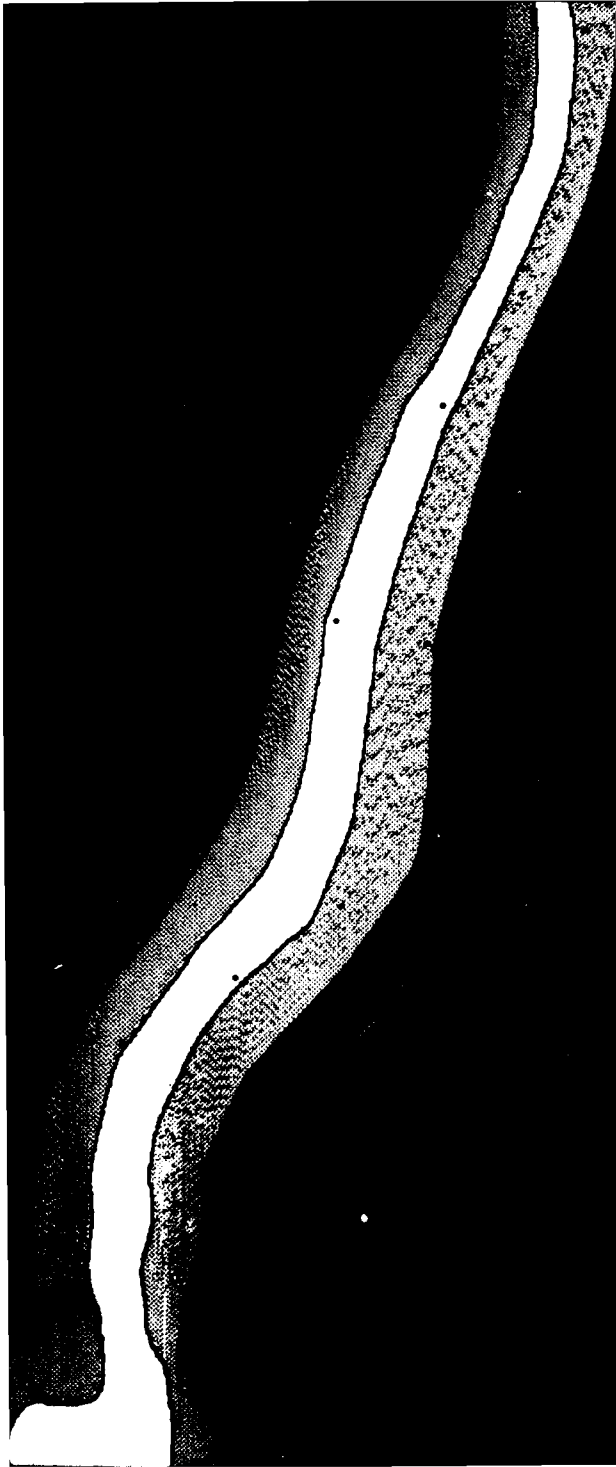
<b>DOPPLER OBSERVATIONS</b>		
EQUIPMENT/SERIAL NO. GIL, no. 2	HEIGHT OF TRACKING EQUIPMENT REFERENCE POINT ABOVE STATION MARK: 1.05 m above snow	TRACKING EQUIPMENT REFERENCE POINT
OBSERVED BY (AGENCY) GIL	SATELLITE(S) OBSERVED 20,50	PERIOD OF OCCUPATION 860523-860528, day 143

<b>SATELLITE-DERIVED COORDINATES</b>						
PASSES ACCEPTED 40	DEGREES OF FREEDOM: 742	RESIDUAL RMS 0.25	STATION SET NSWC 9Z-2	GRAVITY MODEL NSWC 10E-1	ELLIPSOID WGS-72	MINIMUM ELEV. ANGLE: 10
<i>(Satellite-derived coordinates referred to station mark)</i> antenna						
$\phi$ 66.485162 66 29 06.584	$\lambda$ 313.701451 313 42 05.222	$h$ 2152.52	ACCURACY (local)			
$x$ 1,763,759.74	$y$ -1,845,575.59	$z$ 5,827,715.02	0.229		0.217	
<i>(Satellite-derived coordinates of station mark transformed to local datum)</i>						
$\phi$	$\lambda$	$h$	DATUM			
$x$	$y$	$z$	ELLIPSOID			
$\Delta x$	$\Delta y$	$\Delta z$	DATE OF TRANSFORMATION			

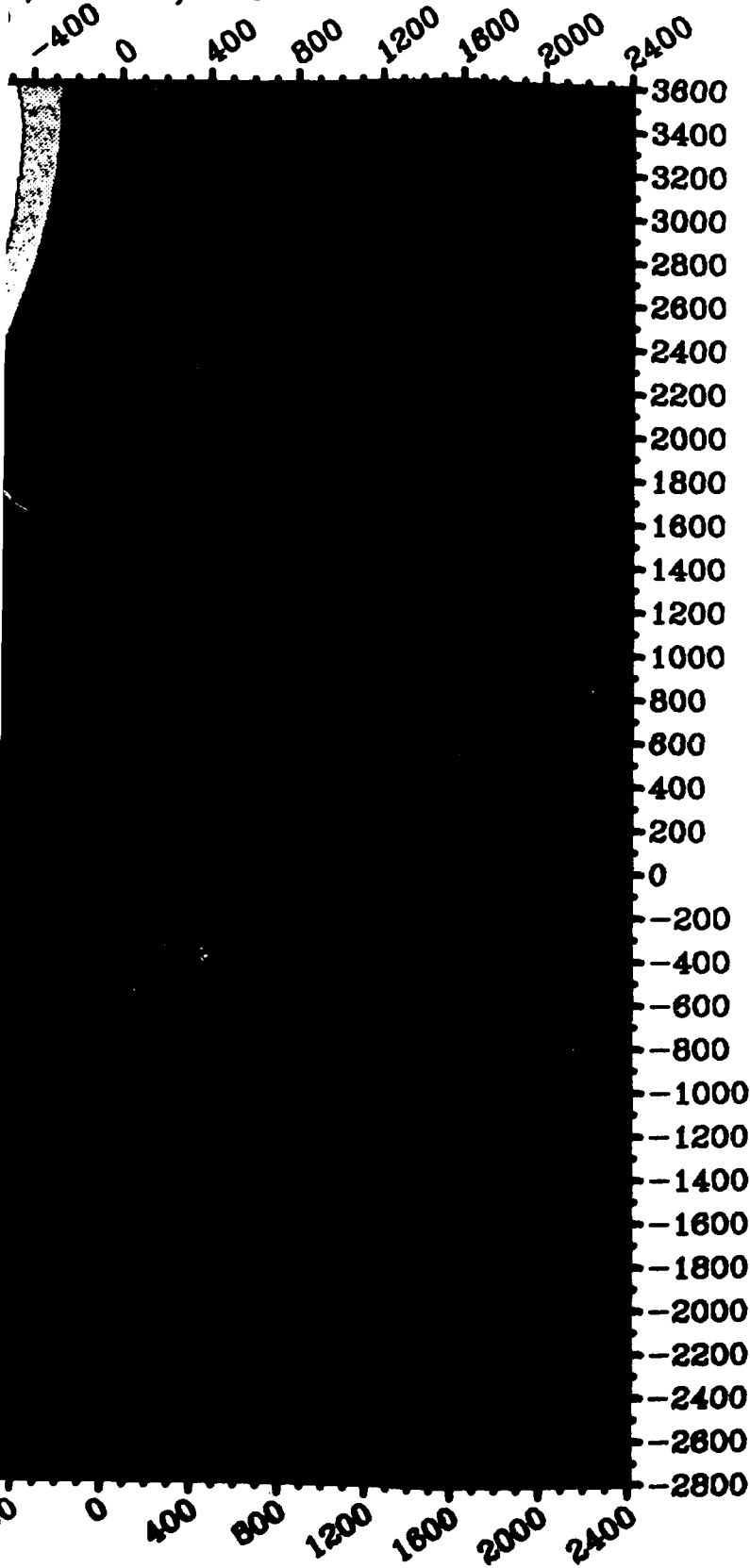
<b>GROUND SURVEY COORDINATES OF STATION MARK</b>						
$\phi$	$\lambda$	DATUM (HORIZONTAL)		ELLIPSOID		
DATE OF ADJUSTMENT	ORDER	SURVEY BY (AGENCY)	DATE	LOCATION OF SURVEY DATA		
ELEVATION (M)	DATUM (VERTICAL)		GEOID HEIGHT (M) 40 m	ELLIPSOID HEIGHT (M)		
ORDER (ELEV.)	ESTABLISHED BY (AGENCY)	DATE	SOURCE OF (M)			

CONNECTION TO LOCAL CONTROL			
FROM	TO	( ) AZ FROM NORTH	DISTANCE

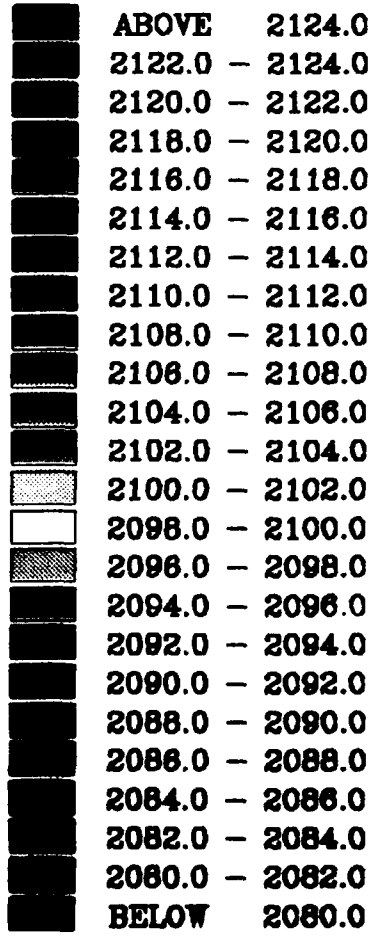
<b>REMARKS</b>  Dopplr Program Prec. ephemeris Oscillator drift $1.55 \times 10^{-10}$ per day Delay 0.731	<b>OTHER RELATED DATA FOR THIS STATION</b>		
	DATA	AVAIL.	LOCATION/REMARKS
	STATION OCCUPATION REPORT		
	GEODETIC INFORMATION REPORT		
	STATION DESCRIPTION		
	SURVEY DIAGRAM		
	STATION SITE SKETCH		
	PHOTOIDENTIFICATION		
	ASTRONOMIC COORDINATES		
	STATION PHOTOS		
PREPARED BY/DATE NG 870514	CHECKED BY/DATE NG 870514	REVISED BY/DATE	CHECKED BY/DATE



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NORTH



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Dye2, surface elevation measurements

Sight from garage: Elevation reference: snow at geociever site

rot	dN	dE	dH	dH1	deg		
-39.55	507.338	-54.532	-2.09	6.978	0.017453		
Dist	Az	Elev	Az, korr	N	E	H	
510.75	213.415	-0.768	173.865	-0.49	0.05	-0.00	pole
56.41	90.535	-0.537	50.985	542.85	-10.70	4.91	D2, SW cor
1448.65	145.372	0.323	105.322	112.36	1339.23	13.20	runway
1398.99	148.620	0.298	109.070	50.26	1267.68	12.30	runway
1814.81	145.837	0.298	106.287	-1.62	1687.45	14.55	
91.38	31.370	0.230	42.320	574.90	6.99	5.26	D2, NW co
81.59	118.590	0.217	79.930	522.83	25.37	5.20	D2, SE co
				554.88	43.06	5.20	D2, NE co

Sight from garage, raw azimuth offset

rot	dN	dE	dH	dH1	deg		
0.00	507.338	-54.532	-2.09	6.98	0.02		
Dist	Az	Elev	Az, korr	N	E	H	
510.75	173.865	-0.768	173.865	-0.49	0.05	-0.00	pole
917.52	177.672	-0.312	177.672	-409.43	-17.26	-0.05	
1501.24	179.468	-0.150	179.468	-993.84	-40.59	1.11	
2198.76	179.848	-0.033	179.848	-1691.41	-48.70	3.95	
2642.65	180.375	0.025	180.375	-2135.25	-71.83	6.52	
3122.67	180.622	0.068	180.622	-2615.15	-88.43	9.26	
2599.91	132.752	0.282	132.752	-1257.55	1854.58	18.15	
2191.11	132.108	0.300	132.108	-961.86	1571.01	16.69	
1679.79	131.648	0.282	131.648	-608.97	1200.68	13.35	
1234.23	130.715	0.217	130.715	-297.75	980.97	9.67	
873.41	129.452	0.108	129.452	-47.65	619.88	6.59	
103.31	330.615	2.152	330.615	597.36	-105.22	8.77	

Sight from north of garage, west of station

rot	dN	dE	dH	dH1	deg		
235.82	597.356	-105.224	-2.09	8.86	0.02		
Dist	Az	Elev	Az, korr	N	E	H	
606.93	294.197	-0.825	170.020	-0.39	-0.04	0.00	
621.11	354.046	-1.175	229.871	197.04	-580.12	-5.94	
1107.09	358.732	-0.832	234.555	-44.67	-1007.14	-9.22	
1617.43	358.950	-0.643	234.773	-335.61	-1426.46	-11.20	
2174.13	359.280	-0.493	235.103	-646.47	-1886.41	-11.61	
2733.58	0.108	-0.413	235.931	-933.98	-2369.63	-12.42	
3248.77	1.080	-0.435	236.903	-1176.67	-2826.88	-17.17	
3293.69	9.315	-0.468	245.138	-787.43	-3093.68	-19.39	
3313.66	18.080	-0.520	253.903	-321.41	-3288.98	-22.55	
3405.87	27.183	-0.595	263.006	182.64	-3485.77	-27.80	
3373.27	37.233	-0.663	273.676	813.63	-3471.57	-31.78	
3276.99	46.510	-0.705	282.330	1297.30	-3306.61	-32.81	
2845.61	46.937	-0.713	282.760	1225.91	-2880.77	-28.09	
2346.69	47.000	-0.718	282.823	1110.18	-2393.40	-22.26	
1883.20	46.960	-0.752	282.783	1014.03	-1941.76	-17.70	
1384.11	46.850	-0.832	282.673	901.01	-1455.62	-13.19	
978.99	46.572	-0.963	282.395	807.50	-1061.40	-9.61	
526.95	47.042	-1.383	282.865	714.68	-618.95	-5.93	
593.68	100.150	-1.167	335.973	1139.60	-346.95	-5.29	
1022.26	90.472	-0.818	326.295	1447.78	-672.49	-7.75	
1530.61	88.330	-0.710	324.153	1838.05	-1001.59	-12.03	
2066.25	88.953	-0.708	324.776	2285.29	-1296.99	-18.47	

2689.27	89.750	-0.690	325.573	2315.60	-1625.63	-25.12	
3141.07	89.970	-0.652	325.793	3195.07	-1871.09	-28.30	
3087.72	98.398	-0.583	334.221	3377.79	-1448.08	-23.99	
2951.21	107.308	-0.492	343.131	3421.59	-961.62	-17.97	
2881.77	118.153	-0.367	353.976	3463.22	-407.65	-11.12	
2971.04	128.980	-0.258	4.803	3557.97	143.54	-6.00	
2980.69	140.283	-0.197	16.106	3461.06	721.67	-2.87	
2625.97	141.303	-0.183	17.126	3106.89	668.06	-1.14	
2122.12	142.157	-0.168	17.990	2615.73	550.20	0.86	
1671.75	143.437	-0.180	19.260	2175.54	446.21	1.71	
1152.92	146.118	-0.257	21.941	1666.77	325.57	1.69	
897.79	147.993	-0.363	23.816	1418.70	257.30	1.14	
933.43	135.835	-0.333	11.658	1511.53	83.39	1.41	runway
861.66	132.015	-0.435	7.838	1450.97	12.28	0.28	runway
606.92	294.200	-0.818	170.023	-0.39	-0.07	0.07	Pole

Sight from north of garage, west of station

rot	dN	dE	dH	dH1	deg	
0.00	597.356	-105.224	-2.09	8.86	0.02	
Dist	Az	Elev	Az, korr	N	E	H
606.93	170.022	-0.818	170.022	-0.39	-0.06	0.07
893.94	52.848	-0.218	52.848	1137.23	607.28	3.43
1324.72	52.643	-0.032	52.643	1401.17	947.76	6.15
1959.97	52.350	-0.002	52.350	1794.58	1446.60	6.97
2585.57	51.688	-0.035	51.688	2200.26	1923.54	5.65
2595.52	62.158	0.045	62.158	1809.55	2189.83	9.27
2601.43	71.548	0.072	71.548	1420.73	2362.46	10.51