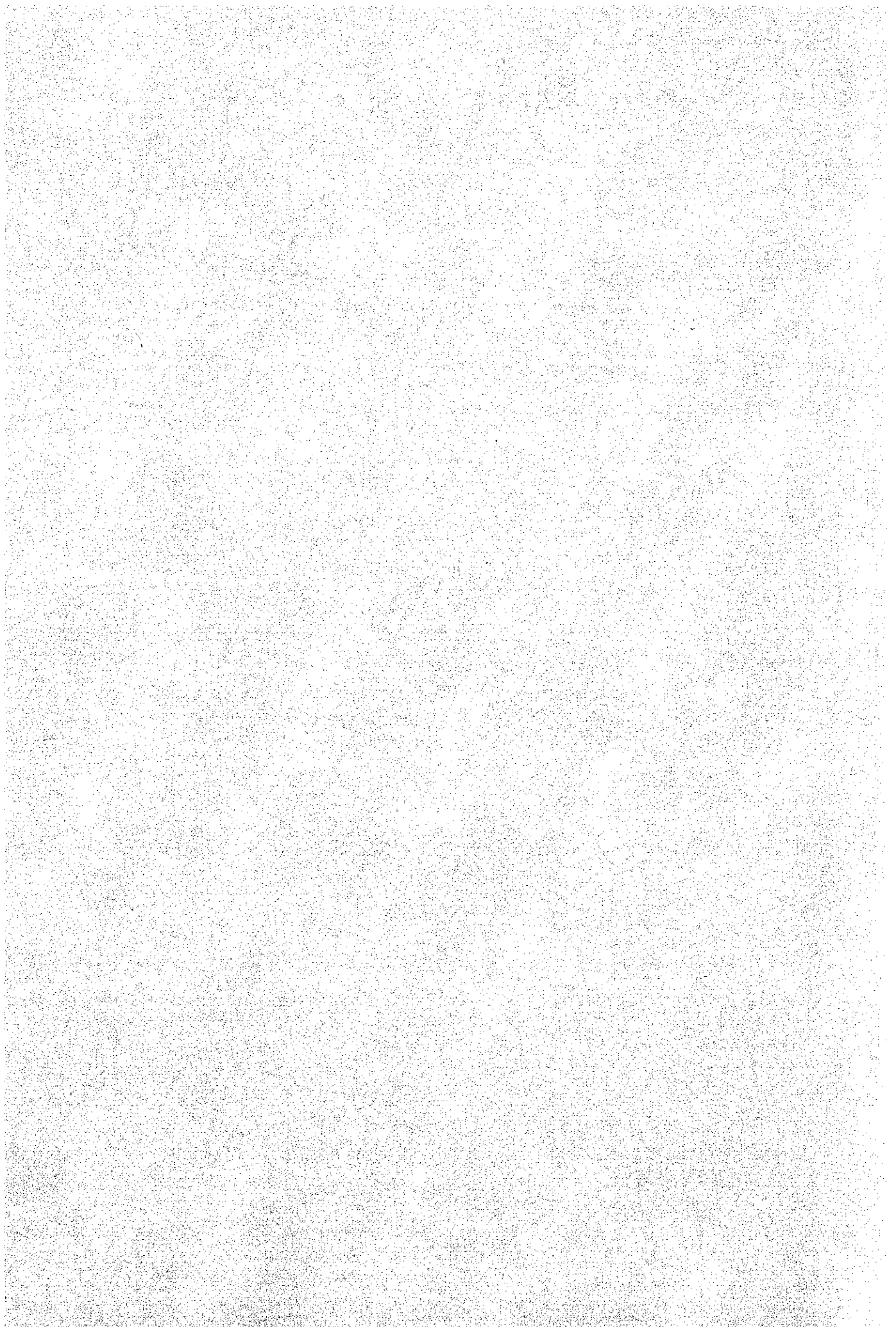


ANNEX 12 Meteorological data Kuamut (1969-1975)  
(Temperature, Humidity, Sunshine, Evaporation)



CLIMATOLOGICAL DATA METEOROLOGICAL DATA 1969-1975

Station Number 5274201 Station Name Kuamut

Year 1975

Climatic Element	Value Presented	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	
Temperature	Mean Daily Maximum	OF	84.4	83.5	84.3	88.4	88.3	86.1	86.8	87.2	85.5	86.4	85.4	82.2	85.7	
	Extreme Daily Maximum	"	88.0	88.0	90.0	92.0	90.0	89.0	90.0	90.0	88.0	89.0	88.0	87.0	72.0	
	Mean Daily Minimum	"	71.2	70.2	70.9	73.1	72.0	71.0	70.3	70.4	70.0	70.8	70.6	70.2	70.9	
	Extreme Daily Minimum	"	66.0	68.0	67.0	76.0	67.0	68.0	68.0	68.0	68.0	68.0	69.0	67.0	65.0	65.0
	Mean	"	75.7	75.2	76.2	78.8	77.6	76.8	76.3	76.3	76.5	75.3	76.2	75.9	74.8	76.3
Relative Humidity	Mean Daily Maximum	%	95.6	95.7	96.4	95.8	95.5	95.6	95.5	95.1	95.0	94.6	95.1	95.0	95.4	
	Extreme Daily Maximum	"	97.0	97.0	98.0	97.0	97.0	97.0	97.0	96.0	96.0	96.0	96.0	96.0	98.0	
	Mean Daily Minimum	"	55.7	55.7	53.2	49.3	49.7	50.8	49.6	50.4	52.8	51.4	52.1	57.2	52.3	
	Extreme Daily Minimum	"	47.0	45.0	46.0	40.0	45.0	42.0	39.0	39.0	50.0	45.0	44.0	44.0	40.0	
	Mean	"	81.5	83.8	82.6	81.0	81.2	80.9	81.3	81.3	81.2	82.6	81.3	82.3	84.5	82.0
Sun hine	Mean Daily Total	Hrs	4.97	5.77	5.51	6.63	6.42	6.30	6.14	5.57	5.76	6.16	6.64	4.83	5.89	
Evaporation	Total	mm	93.0	89.9	117.9	116.1	125.0	112.8	106.2	111.0	125.7	117.1	95.5	88.1	1298.2	
Rainfall	Total	mm														

## CLIMATOLOGICAL DATA

Station Number 5274201 Station Name Kuanut

Year 1974

Climatic Element	Value Presented	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	
Temperature	Mean Daily Maximum	OF	85.0	81.8	85.9	86.2	87.3	87.3	87.9	87.9	88.1	87.0	86.6	86.6	86.5	
	Extreme Daily Maximum	"	90.0	88.0	92.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	90.0	94.0	96.0	
	Mean Daily Minimum	"	71.4	70.8	71.1	72.1	72.0	71.0	70.1	71.0	71.5	71.9	71.8	72.0	71.4	
	Extreme Daily Minimum	"	67.0	69.0	68.0	70.0	69.0	66.0	66.0	66.0	68.0	68.0	68.0	68.0	69.0	66.0
	Mean	"	76.8	74.9	76.2	77.4	77.6	77.2	76.6	76.6	77.2	77.0	77.5	77.8	77.3	77.0
Relative Humidity	Mean Daily Maximum	%	94.7	96.1	96.1	95.6	96.2	96.2	93.5	95.9	94.0	93.9	95.4	95.9	95.5	
	Extreme Daily Maximum	"	98.0	98.0	98.0	98.0	98.0	98.0	99.0	98.0	97.0	99.0	98.0	97.0	99.0	
	Mean Daily Minimum	"	55.1	62.4	52.1	51.0	52.0	49.4	50.1	50.6	50.6	52.9	52.8	54.6	52.8	
	Extreme Daily Minimum	"	45.0	49.0	38.0	38.0	42.0	42.0	40.0	40.0	42.0	43.0	43.0	44.0	44.0	38.0
	Mean	"	83.6	87.5	81.9	82.6	82.5	81.9	82.5	82.5	83.8	82.6	82.7	84.0	83.2	
Sunshine	Mean Daily Total	Hrs	4.93	3.41	5.98	5.62	6.01	6.04	5.99	6.51	5.23	5.31	5.87	5.38	5.52	
Evaporation	Total	mm	111.5	105.9	114.1	133.1	135.1	126.2	124.2	129.3	119.9	110.0	113.8	103.1	1426.2	
Rainfall	Total	mm														

## CLIMATOLOGICAL DATA

Station Number 5274201 Station Name Kuamut

Year 1973

Climatic Element	Value Presented	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Temperature	Mean Daily Maximum	OF	86.5	88.2	88.	90.6	89.7	90.4	89.4	88.9	88.3	89.0	87.3	88.3	88.7
	Extreme Daily Maximum	"	90.0	93.0	93.0	95.0	93.0	94.0	93.0	92.0	90.0	91.0	92.0	91.0	95.0
	Mean Daily Minimum	"	71.6	72.4	72.1	73.6	73.6	72.8	72.1	72.5	73.2	72.4	72.1	72.7	72.6
	Extreme Daily Minimum	"	68.0	68.0	67.0	71.0	72.0	68.0	69.0	66.0	72.0	70.0	69.0	69.0	68.0
Relative Humidity	Mean	"	77.0	79.1	78.7	77.0	79.1	79.1	78.4	78.2	73.0	78.1	77.6	75.9	77.6
	Mean Daily Maximum	%	95.8	95.7	96.0	95.5	96.0	96.1	96.6	96.8	96.5	96.2	95.8	96.3	96.1
	Extreme Daily Maximum	"	98.0	98.0	99.0	98.0	98.0	97.0	98.0	99.0	98.0	98.0	97.0	98.0	99.0
	Mean Daily Minimum	"	51.6	47.0	51.2	49.6	51.5	50.4	52.1	50.9	51.8	51.5	52.7	50.4	50.9
	Extreme Daily Minimum	"	42.0	37.0	32.0	34.0	45.0	43.0	42.0	41.0	44.0	47.0	45.0	40.0	32.0
	Mean	"	82.0	78.2	80.0	81.7	83.2	82.1	82.7	83.1	84.1	83.2	82.1	82.1	82.0
Sunshine	Mean Daily Total	Hrs	6.81	7.46	5.65	6.40	6.18	6.38	5.68	5.36	5.17	5.63	5.57	5.96	6.02
Evaporation	Total	mm	131.1	126.5	139.5	160.5	145.3	126.8	123.5	119.4	140.0	160.0	116.8	127.8	1617.0
Rainfall	Total	mm													

CLIMATOLOGICAL DATA

Station Number 5274201 Station Name Kuamut

Year 1972

Climatic Element	Value Presented	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual	
Temperature	Mean Daily Maximum	OF	84.4	85.4	85.0	89.1	90.5	88.8	89.7	*87.5	*88.7	88.6	87.5	87.5	87.7	
	Extreme Daily Maximum	"	87.0	89.0	89.0	91.0	93.0	91.0	94.0	91.0	91.0	91.0	91.0	90.0	94	
	Mean Daily Minimum	"	71.5	72.4	71.6	72.6	73.0	73.0	71.9	71.7	72.3	72.2	72.2	73.2	72.3	
	Extreme Daily Minimum	"	68.0	69.0	69.0	70.0	71.0	69.0	69.0	69.0	69.0	69.0	69.0	70.0	71.0	71
Relative Humidity	Mean		75.9	76.7	76.3	78.6	79.8	78.4	78.9	77.3	75.3	77.7	77.5	78.0	77.5	
	Mean Daily Maximum	%	94.8	94.0	95.3	94.9	94.8	95.4	95.7	95.8	95.9	95.9	95.9	95.7	96.1	95.4
	Extreme Daily Maximum	"	94.0	95.0	97.0	96.0	96.0	98.0	98.0	95.0	98.0	98.0	98.0	98.0	98.0	98
	Mean Daily Minimum	"	563.3	54.5	56.2	48.9	48.5	49.7	50.6	55.5	53.4	53.0	52.7	54.3	52.8	
Sunshine	Extreme Daily Minimum	"	54.0	43.0	43.0	43.0	41.0	46.0	40.0	48.0	43.0	48.0	45.0	47.0	40	
	Mean	"	84.2	82.9	84.3	80.9	79.5	82.3	84.6	84.4	83.3	83.7	84.1	84.0	83.2	
	Mean Daily Total	"	4.70	5.31	4.71	7.08	7.25	6.32	6.46	5.96	6.23	6.66	6.04	6.50	6.10	
	Total	mm	107.2	117.4	110.0	158.0	157.2	135.4	142.0	145.8	166.6	154.9	136.2	117.6	1648.2	
Rainfall	Total	mm														

## CLIMATOLOGICAL DATA

Station Number 5274201 Station Name Kuamut

Year 1971

Climatic Element	Value Presented	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Temperature	Mean Daily Maximum	OF	33.8	81.3	85.3	89.1	89.1	86.8	88.3	87.6	89.0	88.6	86.9	85.3	86.8
	Extreme Daily Maximum	"	92	88.0	90.0	93.0	93.0	91.0	92.0	91.0	92.0	94.0	90	88.0	94.0
	Mean Daily Minimum	"	71.3	71.4	70.5	73.1	73.7	72.1	72.1	72.9	73.2	72.5	73.4	76.3	72.8
	Extreme Daily Minimum	"	67.0	70.0	68.0	70.0	70.0	70.0	70.0	69.0	71.0	68.0	71.0	69.0	67.0
Relative Humidity	Mean	"	75.5	74.8	77.5	79.4	78.8	75.1	78.3	78.3	78.6	78.5	78.1	76.3	77.4
	Mean Daily Maximum	%	92.3	92.1	94.5	93.5	93.8	93.6	91.5	88.9	91.7	85.3	95.4	95.1	92.3
	Extreme Daily Maximum	"	95.0	98.0	98	97.0	99.0	97.0	97	96.0	95.0	95.0	100.0	96.0	95
	Mean Daily Minimum	"	62.8	66.7	50.4	42.5	46.1	53.4	47.8	50.3	46.5	50.6	56.1	57.5	52.6
Sunshine	Extreme Daily Minimum	"	47.0	46.0	40.0	32.0	37.0	39.0	37.0	40.0	36.0	30.0	48.0	49.0	30
	Mean	"	83.8	85.5	80.6	75.9	79.0	80.7	78.2	78.2	78.4	70.4	84.1	85.1	80.1
	Mean Daily Total	Hrs	3.66	3.55	5.95	7.45	7.00	5.13	6.28	5.29	5.64	4.20	4.82	3.01	5.16
	Total	mm	92.0		131.6	155.2	143.5	113.8	131.6	137.2	128.8	124.5	113.0	129.3	
Rainfall	Total	mm													

CLIMATOLOGICAL DATA

Station Number 5274201 Station Name Kuamut

Year 1970

Climatic Element	Value Presented	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Temperature	Mean Daily Maximum	OF	87.5	86.9	91.1	90.4	91.1	91.2	89.9	89.1	88.9	89.4	85.8	87.7	89.1
	Extreme Daily Maximum	"	92.0	92	96.0	95.0	95.0	94.0	94.0	93.0	92.0	94.0	92.0	91.0	96.0
	Mean Daily Minimum	"	73.7	73.6	73.9	74.3	73.9	73.3	72.7	71.7	71.4	72.7	72.6	72.5	73.0
	Extreme Daily Minimum	"	71.0	72	71.0	69.0	71.0	72.0	70.0	70.0	70.0	69.0	69.0	70.0	69.0
	Mean	"	77.9	76.4	79.8	79.6	79.5	79.4	78.5	77.7	77.7	77.5	78.7	78.2	77.6
Relative Humidity	Mean Daily Maximum	%	87.2	89.0	89.9	88.2	86.7	94.1	95.3	95.7	95.4	95.4	95.2	93.6	92.2
	Extreme Daily Maximum	"	91.0	94	93.0	91.0	93.0	100.0	99.0	99.0	99.0	100.0	100.0	96.0	100.0
	Mean Daily Minimum	"	59.1	58.4	51.3	56.1	53.0	53.7	51.3	52.8	51.9	52.3	56.2	54.0	54.0
	Extreme Daily Minimum	"	49.0	47.0	44.0	49.0	40.0	46.0	40.0	39.0	43.0	38.0	38.0	46.0	46.0
	Mean	"	76.6	76.1	77.7	76.9	74.4	82.0	82.3	83.7	82.7	82.5	83.9	83.0	80.3
Sunshine	Mean Daily Total	Hrs	4.50	4.51	5.59	5.00	5.57	6.36	5.69	4.72	5.73	5.38	5.13	4.20	5.19
Evaporation	Total	mm	110.2	88.1	131.1	114.1	131.3	125.2	118.4	120.4	125.0	133.4	120.9	107.2	1424.2
Rainfall	Total	mm													

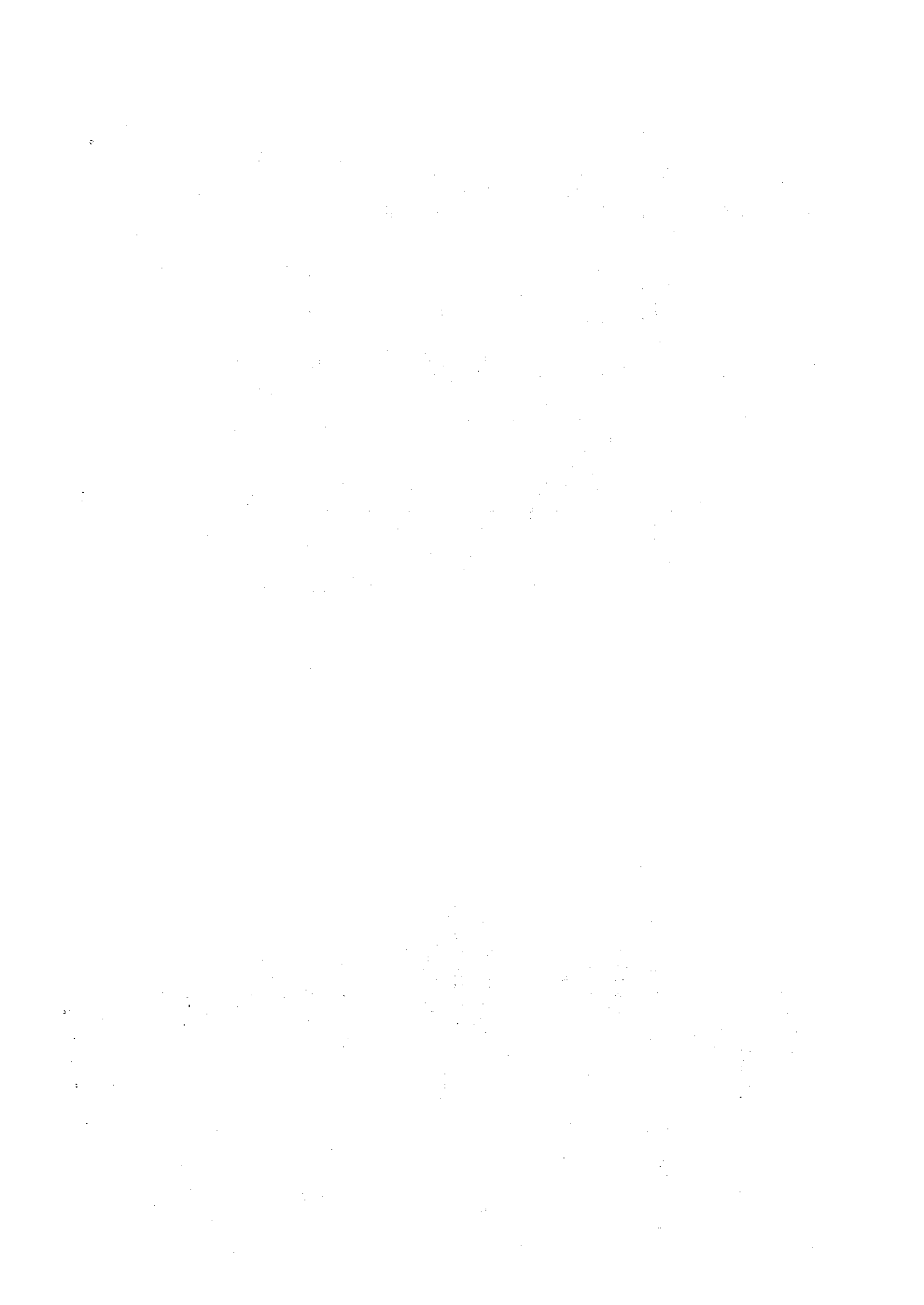


CLIMATOLOGICAL DATA

Station Number 5274201 Station Name Kuamut

Year 1969

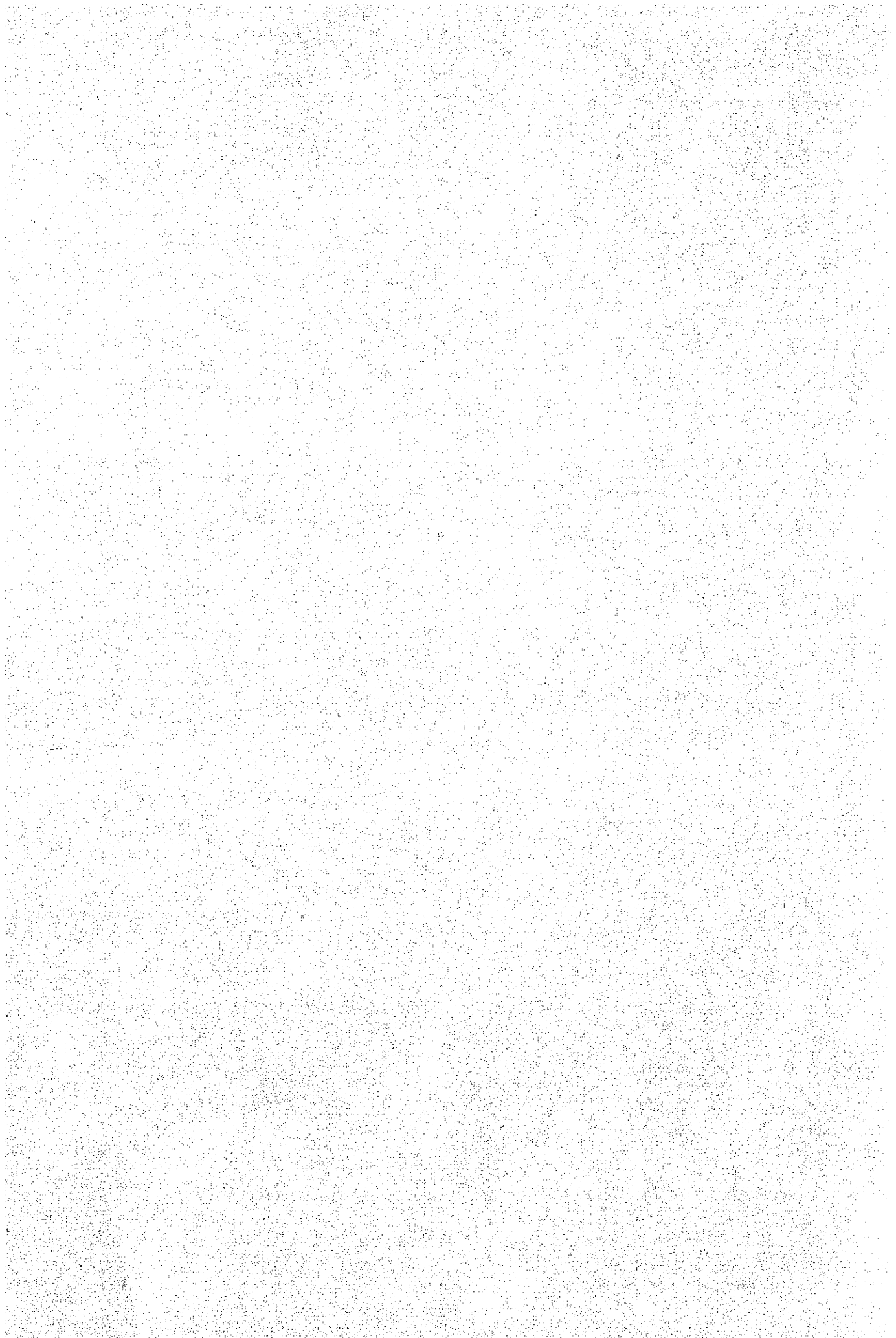
Climatic Element	Value Presented	Unit	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Annual
Temperature	Mean Daily Maximum	OF							88.9	90.5	89.1	90.1	89.0	87.6	89.2
	Extreme Daily Maximum	"							94.0	94.0	94.0	94.0	92.0	92.0	94.0
	Mean Daily Minimum	"							72.5	72.9	73.4	73.5	74.4	73.7	73.4
	Extreme Daily Minimum	"							68.0	70.0	71.0	71.0	72.0	72.0	68.0
	Mean								77.9	78.7	79.1	78.8	74.4	78.7	77.9
Relative Humidity	Mean Daily Maximum	%							93.9	93.7	93.5	91.5	84.2	88.2	90.8
	Extreme Daily Maximum	"							95.0	95.0	95.0	95.0	90.0	92.0	95.0
	Mean Daily Minimum	"							52.7	52.7	54.9	52.9	56.5	59.4	54.9
	Extreme Daily Minimum	"							46.0	46.0	42.0	46.0	48.0	52.0	42.0
	Mean	"							81.5	82.3	81.8	80.2	72.6	78.2	79.4
Sunshine	Mean Daily Total	Hrs													
Evaporation	Total	mm						132.6	132.3	133.4	118.1	131.8	117.4	116.8	
Rainfall	Total	mm													



ANNEX 13 Stage-Sischarge Table

Uku Kuamut

Tangklap



STAGE DISCHARGE TABLE  
 SG. KUAMUT AT ULE KUAMUT  
 STATION NUMBER 5074401  
 DATE APPLICABLE: 01/01/69-09/02/71

STAGE (IN. MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)
420	0	469	1353	522	1504	574	2406	627	3558		
677	3157	728	2656	783	3809	836	4310	890	4811		
943	5713	994	7467	1046	7969	1094	10525	1147	12078		
1199	13883	1253	14334	1307	15887	1357	18142	1405	20949		
1449	24758	1495	27715	1540	81524	1583	35233	1628	38691		
1670	42750	1713	46659	1754	51020	1837	59790	1923	67709		
1965	71868	2006	76379	2043	81691	2080	87054	2118	91965		
2155	97228	2192	102691	2230	107502	2270	112514	2309	117074		
2345	122687	2382	128050	2449	140025	2434	145651	2516	151956		
2582	164285	2620	169397	2654	175010	2690	180824	2754	193553		
2850	212798	2880	219564	2912	226080	2940	233296	2971	239812		
3001	246427	3038	251790	3067	258656	3099	264870	3182	286772		
3211	293788	3233	302158	3287	317043	3318	323808	3337	332579		
3412	356134	3438	363552	3460	372172	3484	380592	3525	398183		
3576	413819	3604	420836	3657	435971	3699	453512	3720	461431		
3744	470552	3837	503580	3856	512501	3901	529290	3920	538562		
3944	546931	4049	578906	4067	587075	4086	596247	4107	605017		
4144	623460	4168	631630	4252	667012	4343	700641	4420	737026		
4462	754367	4516	782583	4534	800926	4586	820622	4628	838113		
4677	854000	4738	880613	4778	898705	4845	937245	4880	956491		
4929	985609	4963	1005104	5059	1050812	5144	1099075	5173	1119272		
5269	1166382	5293	1186129	5329	1204973	5359	1225070	5425	1264412		
5455	1284409	5474	1293580	5487	1304105	5535	1333674	5593	1374369		
5630	1392863	5677	1422683	5693	1482706	5703	1443782	5736	1463378		
5799	1502871	5851	1531488	5925	1582156	6012	1643249	6115	1700534		
6199	1749047	6282	1811042	6468	1930322	6528	1970917	6675	2059174		
6726	2088192	6742	2109792	6925	2218798	6930	2260144	7085	2317178		
7142	2358174	7355	2485322	7527	2594327	7562	2613522	7600	2645247		
8134	2982587	8195	3023132	8266	3060970	8402	3151633	8647	3298377		
9019	3537587	9193	3645640								

STAGE DISCHARGE TABLE  
 SG. KUAMUT AT ULU KUAMUT  
 STATION NUMBER :  
 DATE APPLICABLE : 10/02/71 on wards

STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)
1400	0	1442	4164	1484	8127	1532	11187	1576	14999				
1469	18912	1663	22424	1705	26587	1749	30400	1791	34714				
1829	39731	1870	44045	1950	53225	1991	57589	2000	62255				
2069	67121	2111	71335	2185	82120	2335	102788	2375	107353				
2411	112871	2445	118590	2482	123908	2515	129777	2553	135044				
2591	139960	2658	152100	2689	158572	2724	164340	2757	170210				
2793	175323	2827	181698	2863	187866	2893	194138	2921	201312				
2956	207181	2988	213552	3021	219472	3053	225743	3088	231361				
3116	238334	3216	256594	3310	275807	3348	201676	3374	288449				
3433	302194	3497	314936	3590	334952	3715	360937	3802	382257				
3888	403728	3919	410249	3945	418025	4062	445515	4151	465932				
4237	487503	4297	501249	4349	516549	4435	537769	4488	552818				
4522	559189	4550	566313	4579	573185	4604	580860	4687	602933				
4710	611060	4737	618484	4869	657061	5002	694434	5121	735268				
5221	766072	5289	792005	5364	815733	5424	842471	5465	860430				
5489	868707	5510	877486	5535	885362	5576	902970	5646	927852				
5725	964121	5819	1010273	5853	1029886	5899	1046191	5973	1083163				
6050	1119733	6082	1139698	6105	1148126	6159	1176570	6215	1204211				
6282	1242938	6378	1288939	6414	1308153	6445	1320018	6619	1410589				
6698	1447059	6729	1467326	6770	1485185	6820	1514481	6859	1532691				
7093	1642151	7191	1687601	7643	1922020	7875	2032033	8854	2275033				
8787	2487833	8987	2590771	9308	2747637	9501	2839238	9741	2963246				
10333	3260624	10497	3345002	10597	3389950								

STAGE-DISCHARGE TABLE  
 SG. MILIAN AT TANKULAP

STATION NUMBER 5373401

DATE APPLICABLE : 01/01/69 on wards

STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)	STAGE (MM)	DISCHARGE (LITRE/SEC)
121	0	190	4341	270	7838	354	11215	596	22028		
682	25364	765	28781	924	36218	1005	39795	1083	43694		
1312	55713	1383	60215	1457	64396	1599	73279	1669	77862		
1741	82163	1813	86424	1882	91127	1959	94945	2041	98603		
2545	125575	2613	130158	2686	134419	2754	139242	2887	149051		
2949	154236	3014	159140	3075	164446	3263	179962	3321	185670		
3386	190775	3445	196403	3508	201628	3567	207135	3750	223053		
3811	228681	3876	233665	4000	244076	4200	258587	4438	280535		
4750	307186	4818	312090	4993	328932	5060	333635	5430	365511		
5781	398795	6245	443896	6544	473199	6854	499649	7036	515688		
7451	553995	7651	568748	7879	591539	8204	627355	8453	653282		
8858	703046	9589	778174	9858	808282	10342	866085	10688	899891		
10860	917135	10956	930119	11058	942580	11414	975662	11652	1008423		
11798	1027717	11927	1044479	12605	1124512	12909	1162096	13258	1206795		
13520	1237626	13855	1280597	14557	1368950	15257	1451635	15874	1536813		
16244	1579748	16834	1660740	17303	1716292	17963	1809188	18417	1871573		
19099	1950922	19310	1975402	19567	2016886	19813	2048802	21004	2201872		
21203	2227196										





ANNEX 14 Monthly and Annual Rainfall Data

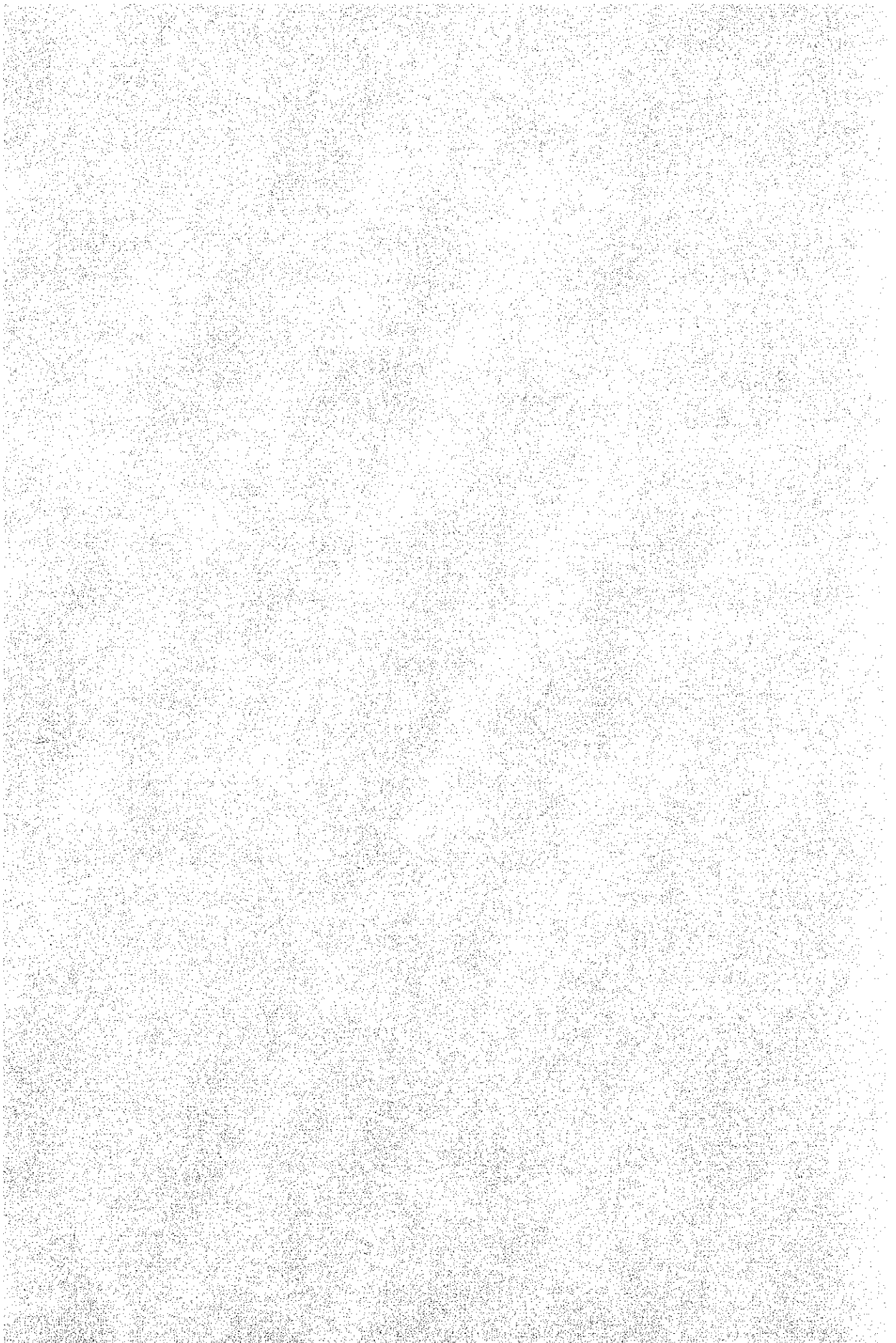
Sandakan 1947 - 1977

Kuamut 1969 - 1975

Lamag 1969 - 1975

Tangkulap 1969 - 1975

Ulu Kuamut 1969 - 1975



Station: Sandakan  
 Lat: 5° 54'N  
 Long: 118° 04'E

Ht. above M.S.L.: 12m.

Records of Monthly and Annual Rainfall  
 (Unit: mm)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Annual
1947	217.7	502.6	174.7	299.7	71.6	260.8	59.7	144.5	142.0	299.9	329.7	460.2	2963.1
1948	464.3	130.3	159.3	54.9	299.9	182.4	281.9	239.8	235.9	342.9	327.6	273.5	2942.7
1949	105.7	255.5	46.5	149.6	128.5	237.7	163.6	255.0	134.9	374.3	258.3	397.0	2506.6
1950	306.5	214.6	271.5	166.4	100.1	143.5	203.7	157.7	280.6	398.7	260.1	808.9	3112.3
1951	471.4	476.5	73.4	109.5	205.0	122.2	176.8	230.1	149.9	183.1	383.0	334.6	3115.5
1952	126.0	358.6	137.4	152.1	97.0	366.0	75.4	364.7	169.4	191.0	280.4	613.6	2931.6
1953	769.8	239.5	308.1	38.1	121.1	169.7	316.7	194.8	241.0	302.0	148.8	251.7	3101.3
1954	344.1	141.5	556.4	40.1	168.9	265.1	160.8	299.8	188.2	263.1	329.7	544.8	3262.5
1955	711.4	119.1	89.4	115.6	187.2	180.1	105.1	264.7	77.2	271.0	300.7	335.7	2757.2
1956	775.3	248.4	237.2	268.7	231.4	121.6	55.6	146.5	352.3	304.8	409.7	632.4	3793.9
1957	324.3	122.4	83.8	45.2	14.7	284.5	346.7	224.5	446.5	277.9	344.9	442.7	2958.1
1958	114.0	194.3	130.0	33.5	56.1	125.2	194.8	269.2	148.6	305.8	449.8	2457.6	2457.6
1959	260.8	177.0	254.7	86.4	143.0	160.8	260.8	188.2	317.7	222.7	358.9	363.9	2794.9
1960	415.2	286.0	109.0	124.7	101.1	193.0	154.9	249.9	328.1	385.8	403.1	480.3	3231.1
1961	218.4	111.0	101.6	128.8	366.0	163.1	104.4	261.6	174.7	430.2	269.5	561.5	2890.8
1962	640.3	185.1	231.6	93.5	60.7	200.1	133.3	319.5	333.5	252.5	221.5	692.1	3363.7
1963	1094.0	195.3	228.6	35.3	128.3	190.2	337.5	168.4	386.3	416.0	308.8	185.9	3674.6
1964	221.0	389.6	205.7	179.6	152.9	212.1	78.2	262.9	206.7	147.3	195.6	438.1	2689.7
1965	548.1	275.3	534.6	89.9	159.8	198.4	156.5	152.9	417.8	247.6	445.2	503.6	3729.7
1966	314.7	37.8	158.5	23.1	303.3	224.3	209.0	201.4	169.9	342.6	254.7	193.5	2432.8
1967	475.2	380.2	186.4	143.8	102.6	188.0	224.8	121.7	165.9	165.6	660.3	498.3	3252.8
1968	759.1	83.8	111.0	50.0	75.7	58.7	113.8	381.0	251.4	306.0	449.0	649.1	3288.6
1969	162.0	58.4	71.9	0.3	99.6	142.2	188.7	150.9	182.6	59.7	460.5	616.9	2193.7
1970	390.9	365.2	66.5	273.5	101.9	277.6	105.7	242.5	325.1	214.9	391.6	351.0	3106.4
1971	672.3	597.1	179.8	122.2	118.4	236.7	96.0	362.7	67.3	213.3	278.4	352.8	3297.0
1972	668.9	367.2	397.0	147.1	179.3	128.0	436.3	239.8	338.8	229.3	219.2	279.6	3610.5
1973	110.0	26.7	43.9	374.3	82.5	196.6	175.8	93.7	349.2	152.7	309.1	827.9	2742.4
1974	516.8	525.7	155.4	236.0	99.3	116.1	123.7	128.0	32.3	151.9	204.7	449.5	2759.4
1975	372.7	380.1	181.2	73.7	148.4	215.7	157.8	232.4	126.4	148.5	487.2	385.4	2909.5
1976	591.2	341.8	195.8	54.2	251.9	169.0	152.3	278.0	126.4	160.6	320.1	430.8	3072.1
1977	175.3	1079.3	243.6	47.1	62.7	156.1	216.2	265.0	182.5	233.8	243.2	480.5	3385.3
(1951-1977)	453.5	286.8	195.3	113.9	141.4	186.7	179.9	231.7	231.7	243.7	337.5	464.7	3066.8
(1947-1977)	1094.0	1079.3	556.4	374.3	366.0	366.0	436.3	381.0	446.5	430.2	660.3	827.9	3793.9
Highest	1963	1977	1954	1973	1961	1952	1972	1968	1957	1961	1967	1973	1956
Year of Highest	1963	1977	1954	1973	1961	1952	1972	1968	1957	1961	1967	1973	1956
Year of Highest	1949	1973	1973	1969	14.7	58.7	55.6	32.3	32.3	32.3	148.8	185.9	2193.7
Lowest	1949	1973	1973	1969	1956	1968	1973	1974	1974	1969	1953	1963	1969
Year of Lowest	1949	1973	1973	1969	1956	1968	1973	1974	1974	1969	1953	1963	1969
Year of Lowest	413.4	338.6	156.5	178.2	118.5	187.6	183.4	207.1	203.1	167.2	335.8	466.2	2949
Mean													
1967-1975													
Average													
2,949mm													

JABATAN PARIT DAN TALIAIR, MALAYSIA

MONTHLY AND ANNUAL RAINFALL DATA 1969-1975

STATION NUMBER: 5274201 STATION NAME: KUAMUT MET STATION

LATITUDE: 5°13'20" LONGITUDE: 117°29'10" ELEVATION: 20M

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL
1969	****	****	****	****	****	232	168	226	250	182	334	307	1699 *
	STATION OPENED				MAY 1969								MM
1970	344	303	181	220	148	248	177	168	144	389	273	310	2905
1971	332	616	165	52	270	341	221	301	106	224	388	371	3387
1972	304	242	223	2	463	181	157	334	329	255	223	151	2864
1973	96	21	136	190	123	94	96	50	168	22	22	254	1272
1974	132	534	137	296	220	156	221	174	113	172	248	141	2544
1975	263	286	333	148	92	136	238	192	281	183	201	340	2693
AVERAGE	245	334	196	151	219	198	183	206	199	204	241	268	2610 2644

JABATAN PARIT DAN TALIAIR, MALAYSIA  
MONTHLY AND ANNUAL RAINFALL DATA 1969-1975

STATION NUMBER: 5478001/2      STATION NAME: LAMAG & BUKIT GARAM      ELEVATION: 10M  
 LATITUDE: 5°28'40"      LONGITUDE: 117°49'10"

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL
1969	120	180	83*	23	3132	240	166	158	143	179	172	274	2 51*
1970	407	240	92	225	278	214*	273	290	222	345	314*	320	3220*
1971	487	635	190	94	267*	292	301	481	81	373	187	230	3618*
1972	361	293	273	98	69*	163	264	226	374	304	309	259	2993"
1973	38	0	69	346	281	222	381	278	296	331	295	200	2737
1974	227	113	230	310	222	186	344	190	147	295	283	396	3943
1975	439	521	150	198	187	155	270	272	429	516	133	384	3654
AVERAGE	297	426	167	185	256	210	286	271	242	335	230	295	3445 3200

JABATAN PARIT DAN TALIAIR, MALAYSIA

MONTHLY AND ANNUAL RAINFALL DATA 1969-1975

STATION NUMBER: 5372001  
 LATITUDE: 5°18'15"

STATION NAME: TANGKULAP  
 LONGITUDE: 117°16'40"

ELEVATION: 80 M

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL	
1969	****	****	****	***	****	****	***	94*	113	280	251	335	1073*	MM
1970	225	192*	116	293	111	330	172	236	235	315	528	296	3049*	MM
1971	235	69*	190	119	144	27	209	384	127	186	432	169*	2291*	MM
1972	143	51	137	55*	291	175	309	528	352	391	180	157	2768*	MM
1973	71	62	42*	209	142	168	376	160	301	187	244	386	2248*	MM
1974	250	389	172	217	404	49	225	185	108	130	193	216	2538	MM
1975	204	263	349	41	185	167	319	230	170	0	73	462	2463	MM
AVERAGE	188	191	193	176	213	153	268	287	201	213	272	292	2501 2647	MM

JABATAN PARIT DAN TALIAIR, MALAYSIA

MONTHLY AND ANNUAL RAINFALL DATA 1969-1975

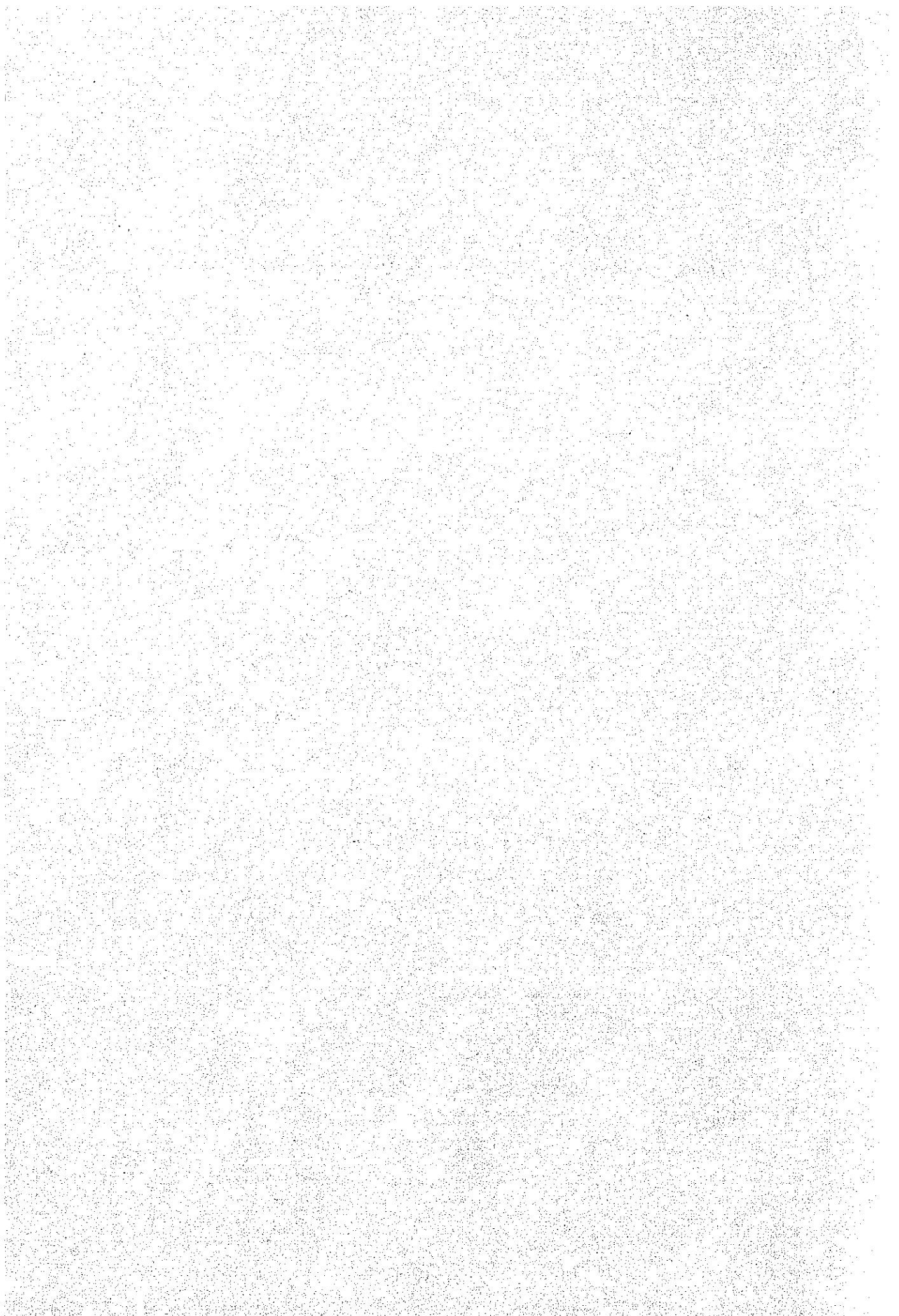
STATION NUMBER: 5074001      STATION NAME: ULU KUAMUT      ELEVATION: 40m  
 LATITUDE: 5°04'55"      LONGITUDE: 117°26'30"

YEAR	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL	
1969	****	****	****	****	****	****	****	****	****	32*	47	77	157*	MM
1970	57	26	18	36	26	53	32	44	51	70	56	63*	532*	MM
1971	49*	117	34	29	45	59	43	20*	****	****	****	****	396*	MM
1972	****	****	****	****	****	****	****	****	****	****	****	****		MM
1973	****	****	****	****	****	****	****	****	105*	400	324	217	1046*	MM
1974	88	378	140	382	196	243	192	247	183	135	311	225	2720	MM
1975	224	279	359	86	255	146	323	270	460	298	145	312	3157	MM
AVERAGE	123	200	138	133	131	125	148	187	231	226	177	208	2939 2027	MM





ANNEX 15 Progress Report - Kinabatangan and Labuk Flood  
Warning Systems of May 1977 Dr. Rudolf Chlemutz



Pengarah,  
Jabatan Parit dan Taliair,  
Kota Kinabalu.

Hydrology Section,  
Jabatan Parit dan Taliair, K. Kinabalu  
20th May 1977

Progress Report

Kinabatangan and Labuk Flood Warning Systems

After having visited the Labuk and Kinabatangan basins three weeks ago I have now finished a preliminary analysis of the data from the East Coast Region. This report contains the findings from this analysis and a strategy for further investigations.

- 1) Preliminary analysis of streamflow records
- 1.1.) Kinabatangan

The data from the Kinabatangan River System are of poor quality. Since the three stations in this area were established in 1969 there were two major floods: 1971 and 1977. There is no complete record available for either of the two.

Out of the available record I selected 38 medium sized floods for a rough correlation. The Kinabatangan River has two main tributaries, the Kuamut and the Milian. Floods originate mainly from the Milian, there are, however, floods recorded on the Kinabatangan which do not show up on the record of the Kuamut or the Milian.

For the 38 flood events I singled out for analysis the following conclusions can be drawn:

- 1.1.1.) A flood peak on the Kuamut or the Milian causes a peak of roughly the same gauge level on the Kinabatangan. For floods recorded on the Kuamut and the Milian it is the higher of the two that will be roughly equivalent to the maximum on the Kinabatangan.
- 1.1.2.) The travel time of the peaks from the Milian or the Kuamut to the Kinabatangan varies a great deal. The values for the Milian (34 floods) range from 6 to 87 hrs. with the average at 34 hrs. After eliminating 4 extreme values the range is 9 to 62 hrs. and the average 32 hrs. For the Kuamut (76 floods) the travel time is between 3 and 85 hrs, average 43 hrs. Disregarding 4 extreme values the range is from 23 to 72 hrs with the average being 42 hrs.
- 1.1.3.) There seems to be a vague pattern in that a peak flow shows up in the Kuamut first, the next day in the Milian and one day later in

the Kinabatangan.

The preliminary analysis suggests that a 24 hrs warning could be given for flood peaks to reach Bukit Garam.

#### 1.2.) Labuk

The data basis for the Labuk basin is much more sound and allows a more detailed analysis. 154 flood events could be selected for a correlation. Unfortunately here again the record of the large floods in 1971, 1974 and 1977 is incomplete. The peaks can be traced very early as they travel from the Tomboloi to the Porog Station. The following conclusions can be drawn:

1.2.1.) The peaks are attenuating to varying degrees as they travel downstream. Generally attenuation is very slight and in some rare instances the downstream peak is higher than the upstream peak, suggesting that the flood mainly originated from the lower parts of the basin.

1.2.2.) The analysis of all 154 flood events yields an average travel time of 10 hrs for the peak. The maximum is 24 hrs and the minimum is 2 hrs, but the standard deviation is only 3 hrs 15 min, which means that most of the values are pretty close to the average.

1.2.3.) The 17 highest floods out of the 154 show slightly different results. The average travel time is 11 hrs 40 min, maximum 17 hrs 40 min, minimum 6 hrs 40 min., and standard deviation 3 hrs 20 min. I have not yet found a plausible explanation why higher peaks should take longer to travel downstream. The preliminary Hood analysis already provides the basis for a reliable warning system.

#### 2.) Further investigations

The data for the entire East Coast Region have now been sent to KL for digitising and any further analysis will be done when the printout is received.

##### 2.1.) Kinabatangan

The Kinabatangan basin has 4 rainfall stations which could yield more conclusive information about the nature of the floods. I also hope to build up a better data basis with the new Kinabatangan at Balat Station.

##### 2.2.) Labuk

There is only one rainfall station in the Labuk basin and it is located in the lower section (Trusan Sapi base camp). Ranau is in the upper corner of the basin and I do not expect the data from there to be very relevant for the

Labuk. There will be a new rainfall station in the middle of the catchment at Tampias.

Fortunately the streamflow records are usable and sufficient for a flood analysis. Tomboloi Station will be shifted upstream to Tampias, but I do expect a very easy correlation between the two stations. I will also try to trace the flood peaks as far at upstream as the Liwagu at Bedukan Station.

### 3.) Instruments

Analysis is only one part of a Flood Warning System, to operate it telemetric equipment is needed. There are two instruments which fullfill our requirements, the Telemark from leupold & Stevens and the Remote-controlled Water Level Recorder-Transmitter from Ott. Both instruments can transmit the river level continuously, on demand or automatically initiated when an alarm-condition is reached. We are presently waiting for some detailed information on the instruments.

I would suggest that one instrument should be purchased and installed in the Tampias Station with the receiver in the Trusan Sapi base camp. After the instrument has been tested for the Labuk Flood Warning System two more sets can be purchased for the Kinabatangan Flood Warning System.

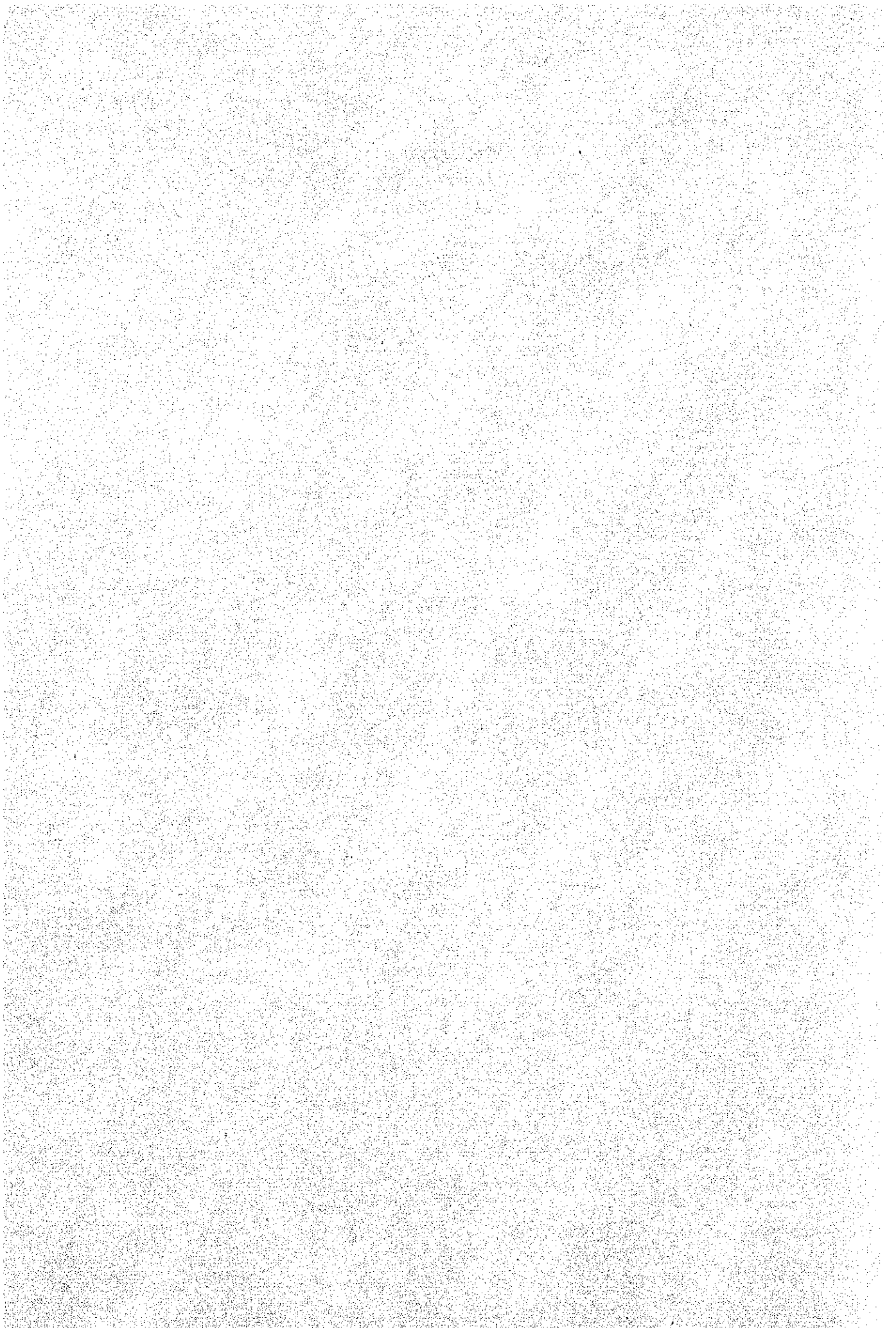


(Dr. Rudolf Ohlemutz)

RO/gg.

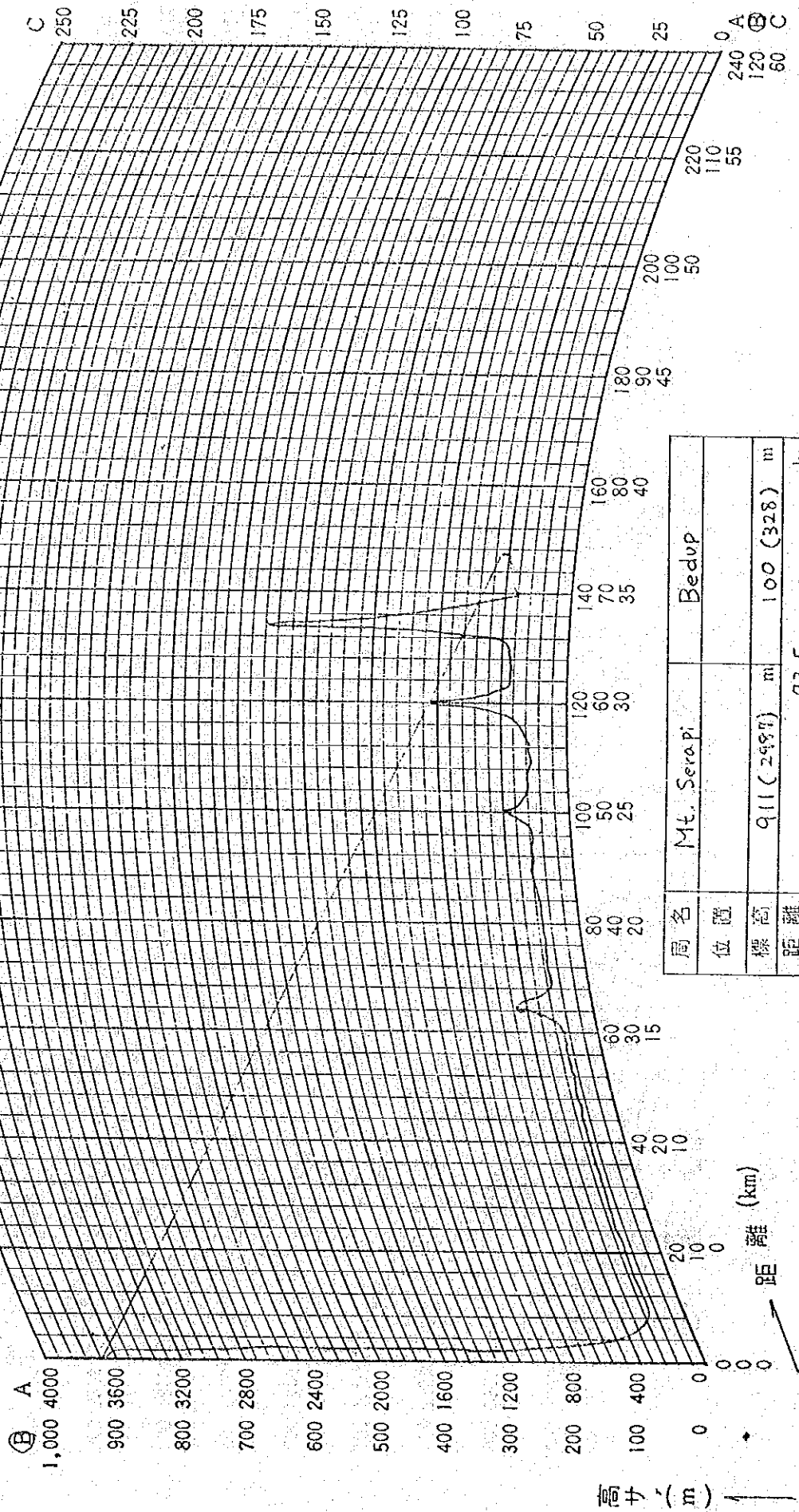


ANNEX 16 Profile Map

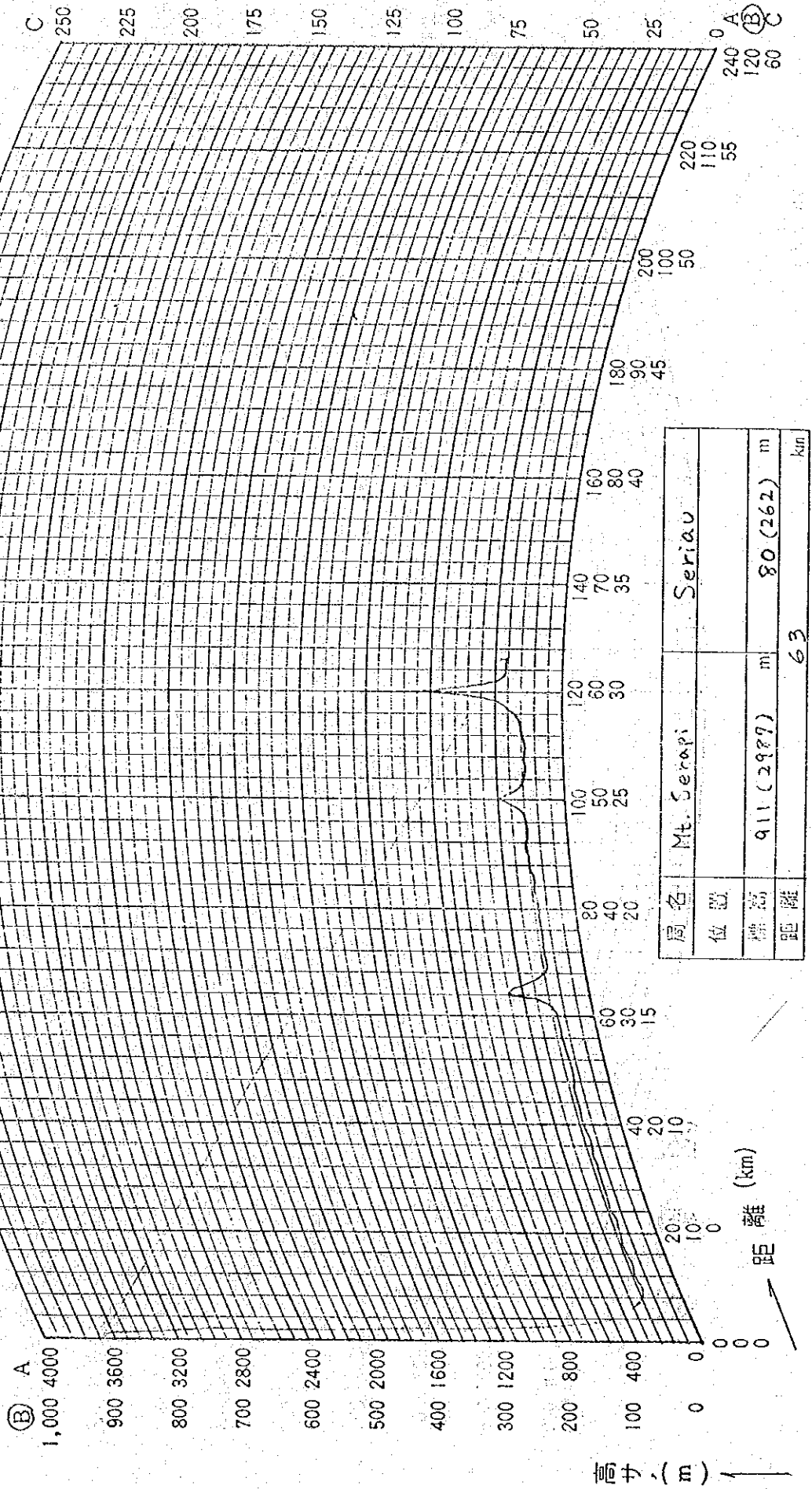




見通図



見通図



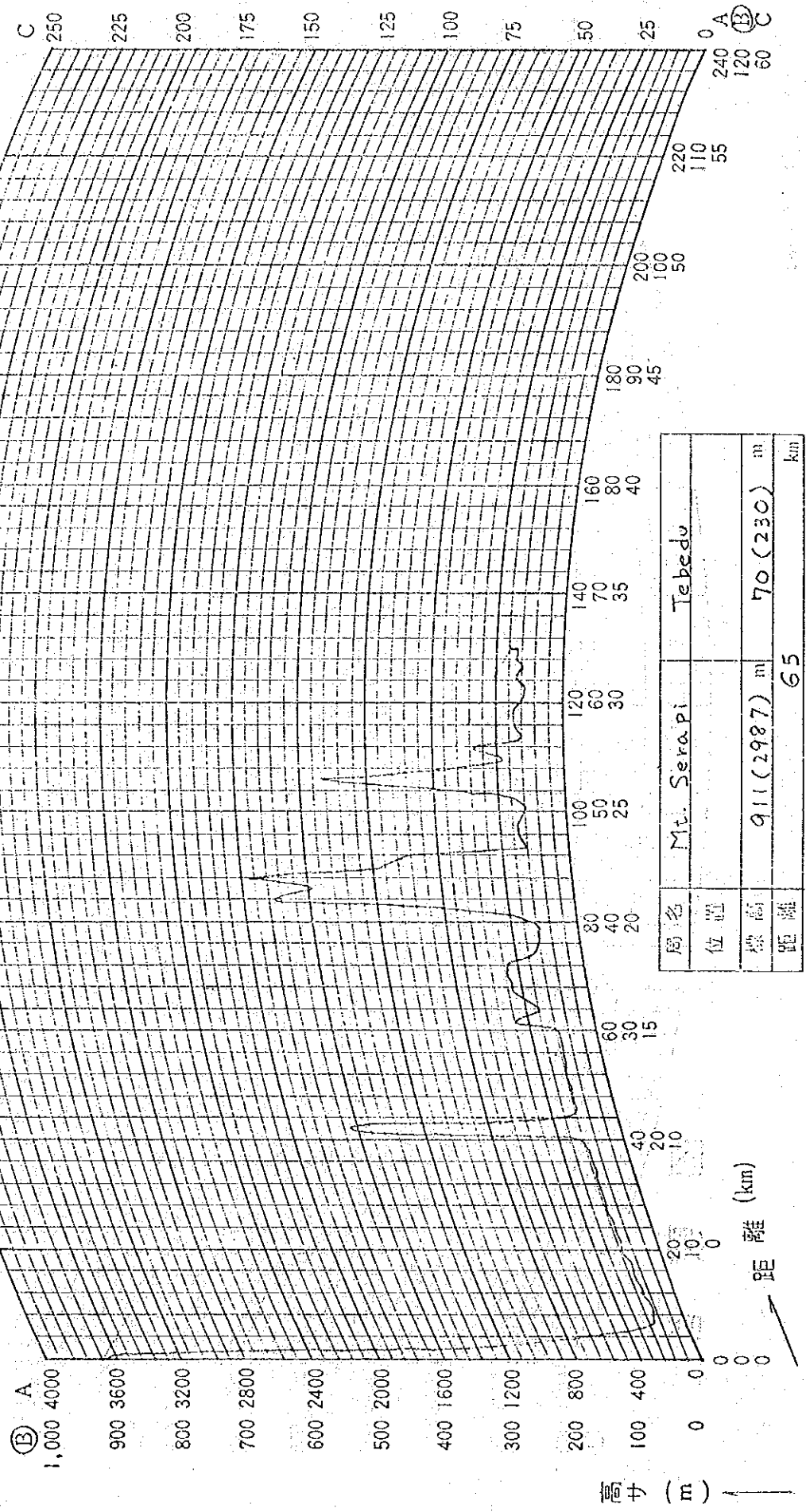




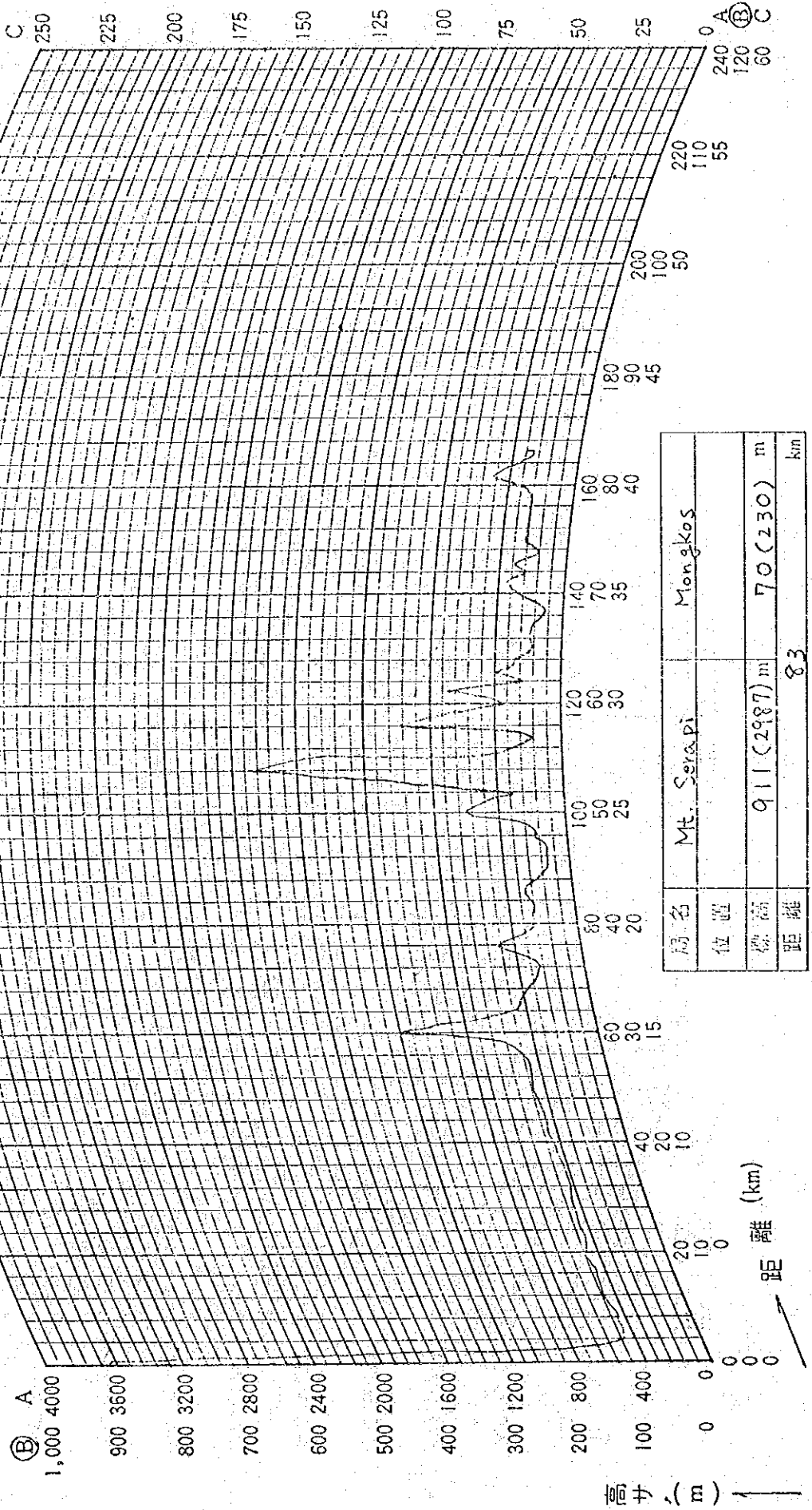


(Sedong River Basin)

見通図



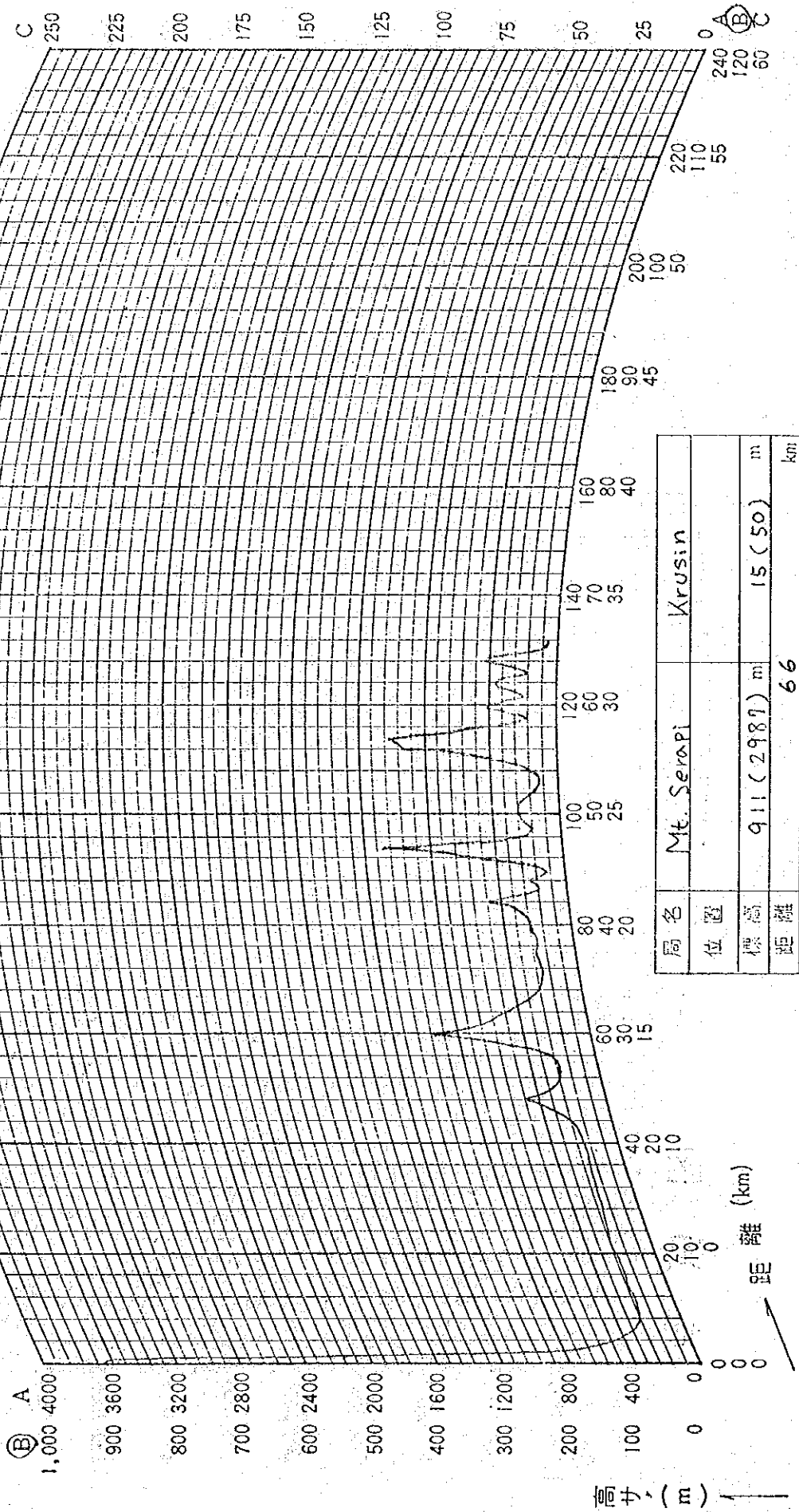
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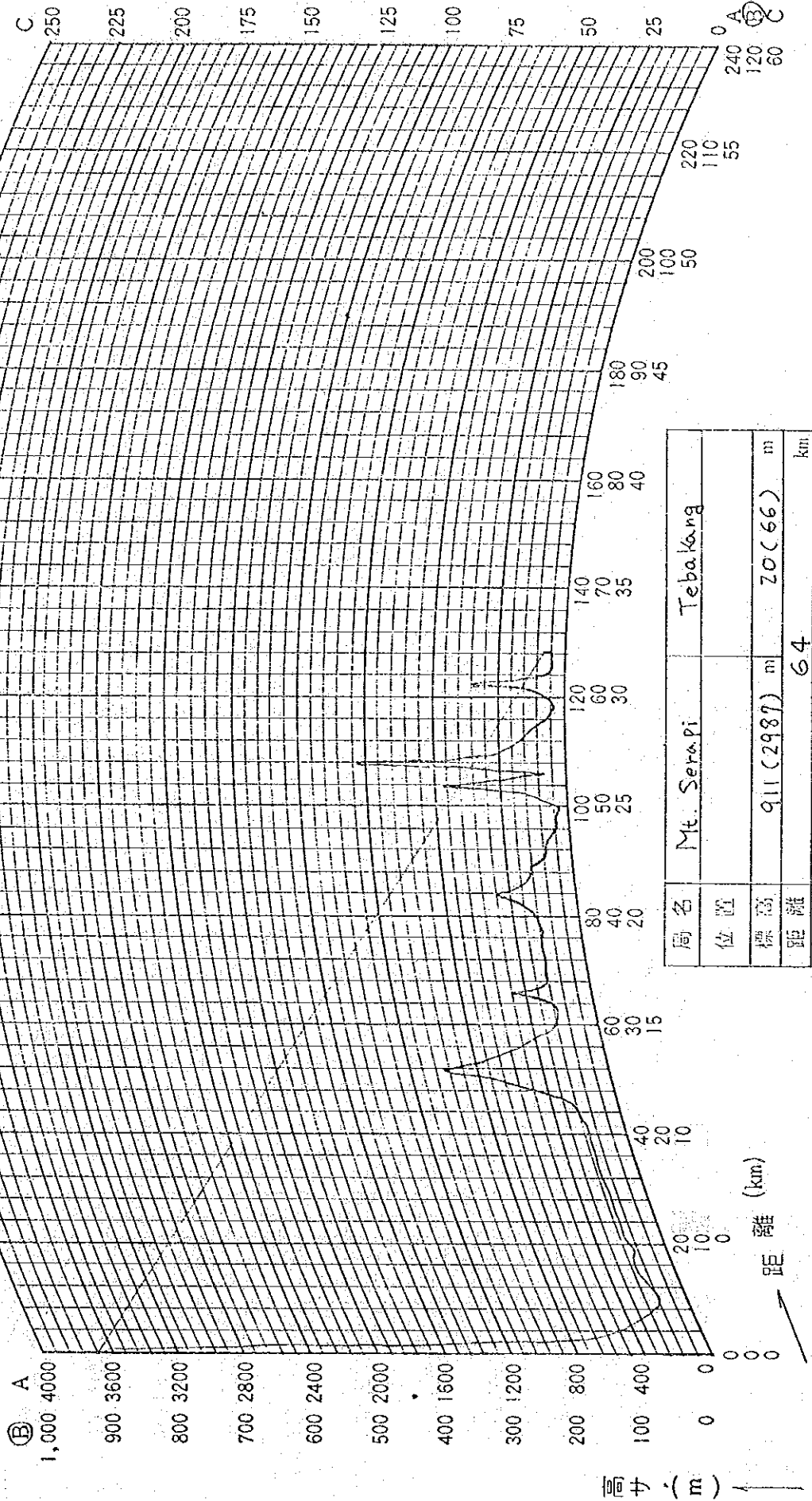
(Sadong River Basin)

見通図

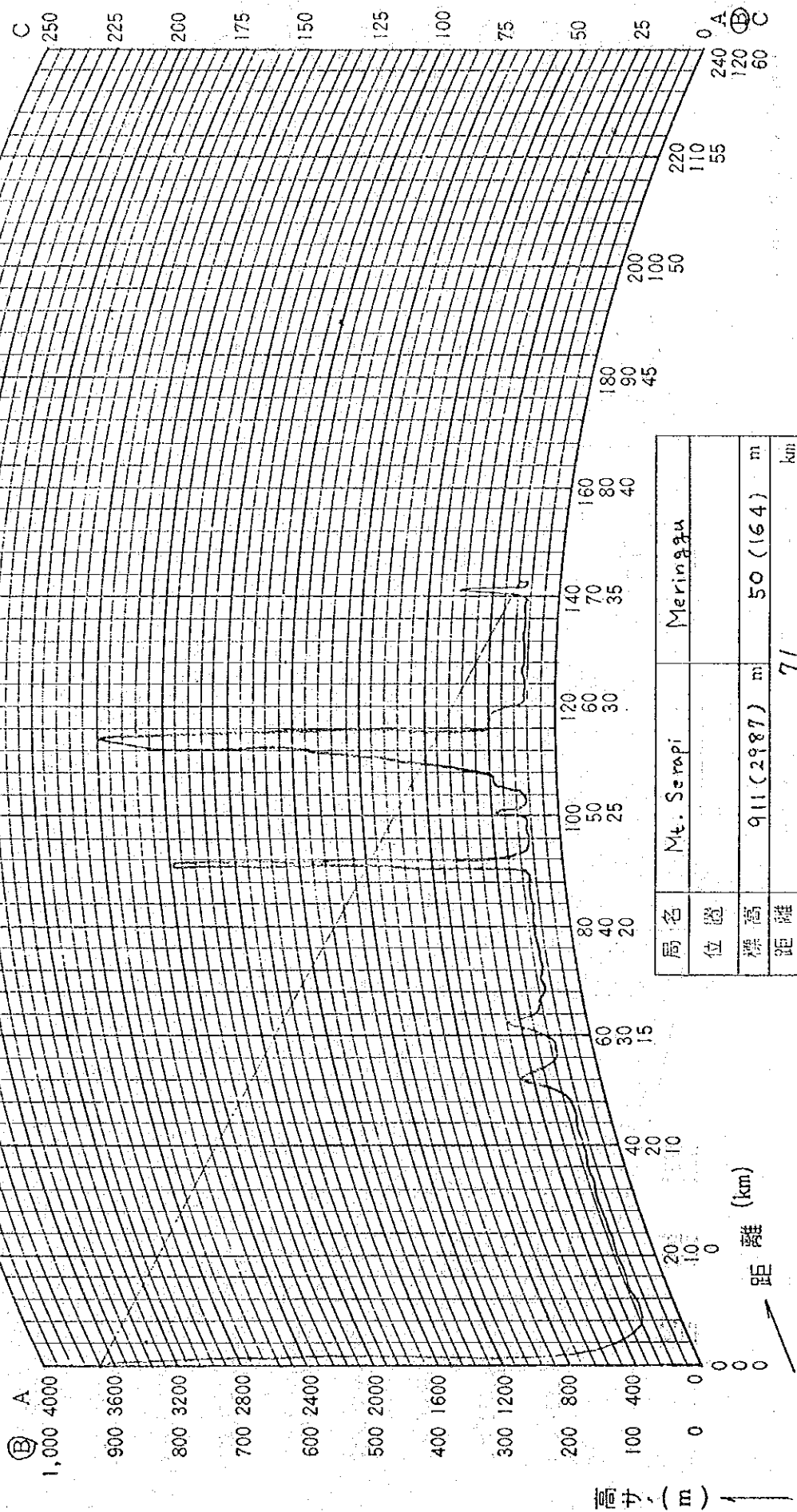




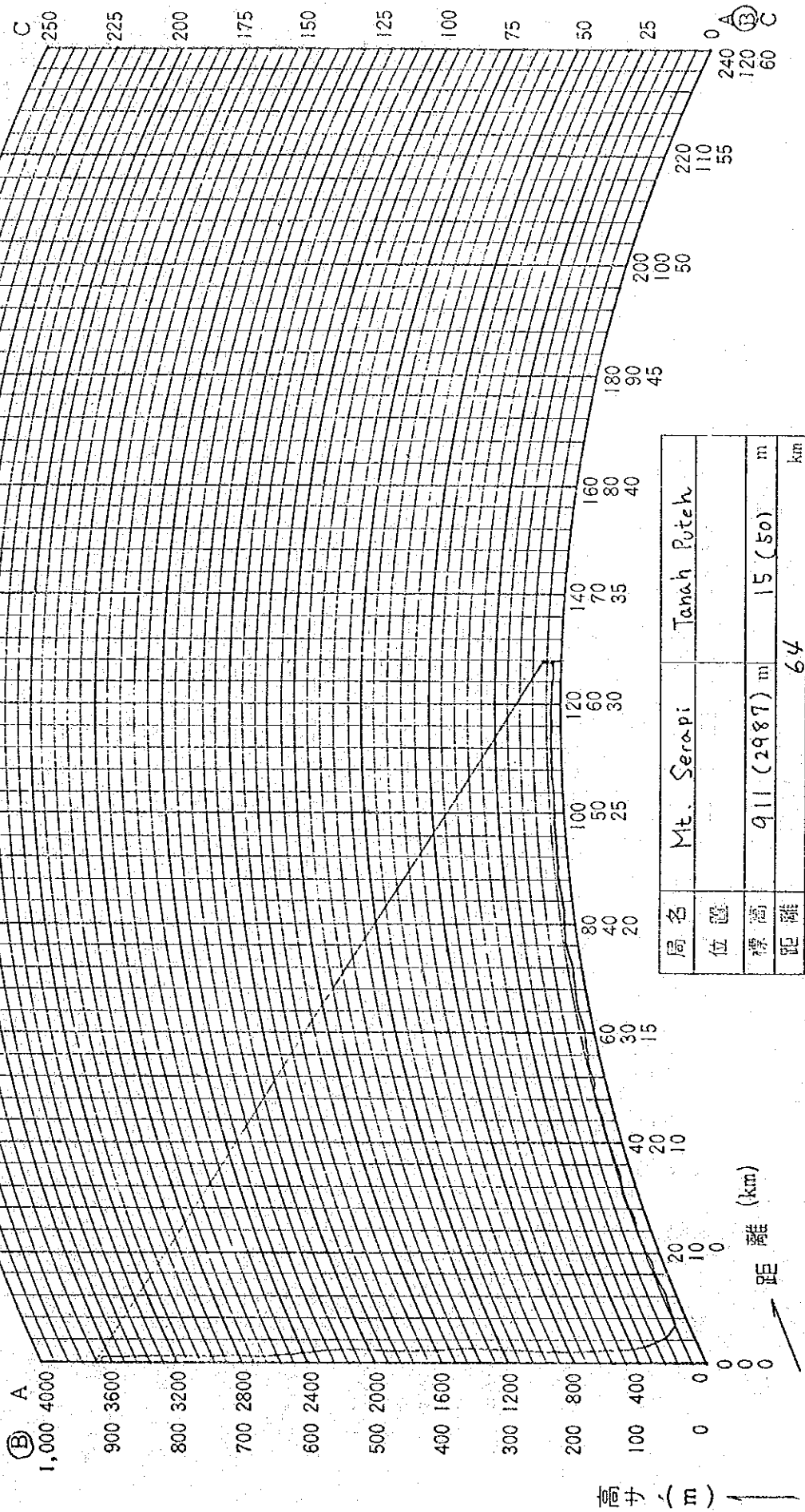
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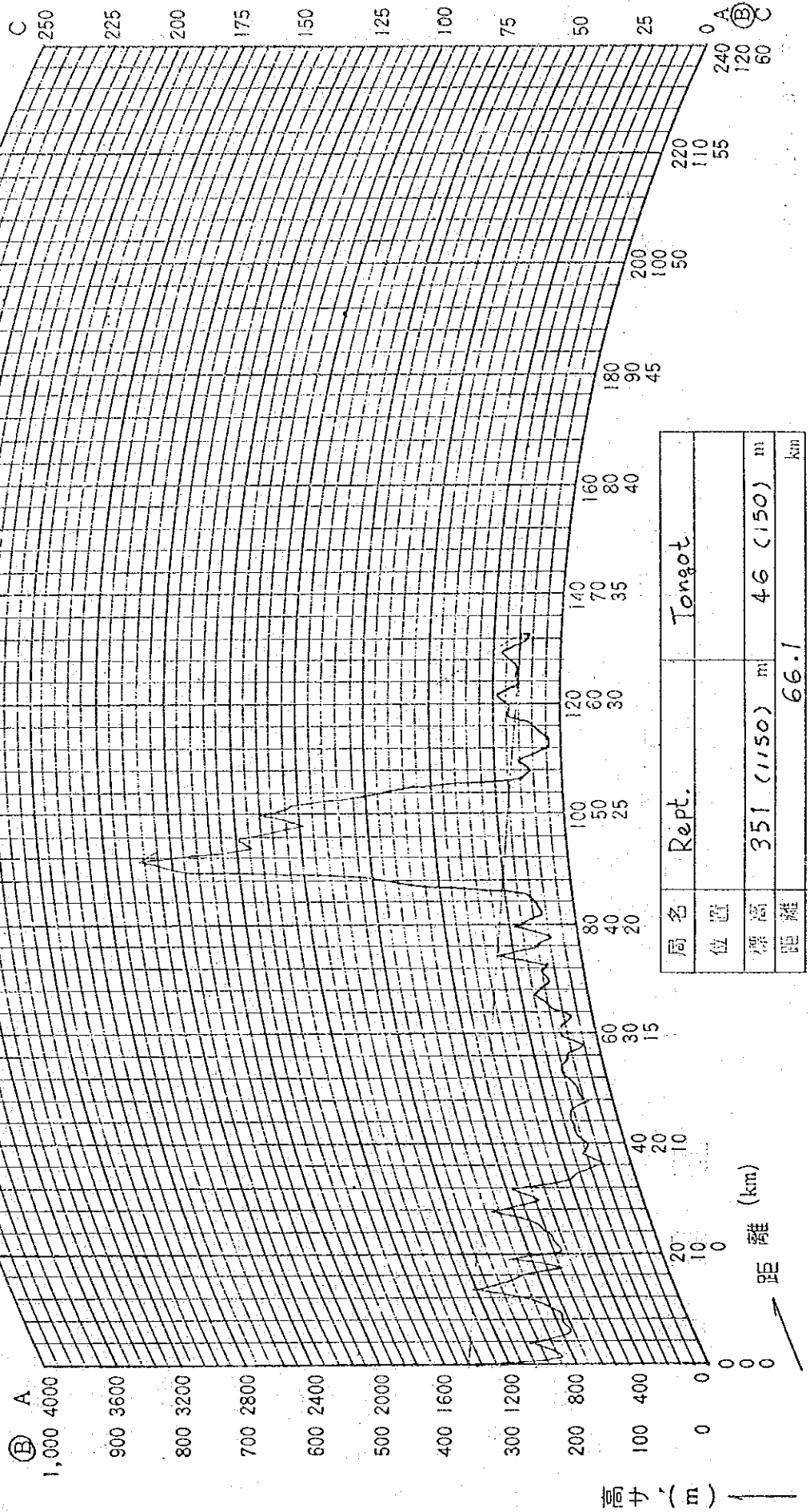
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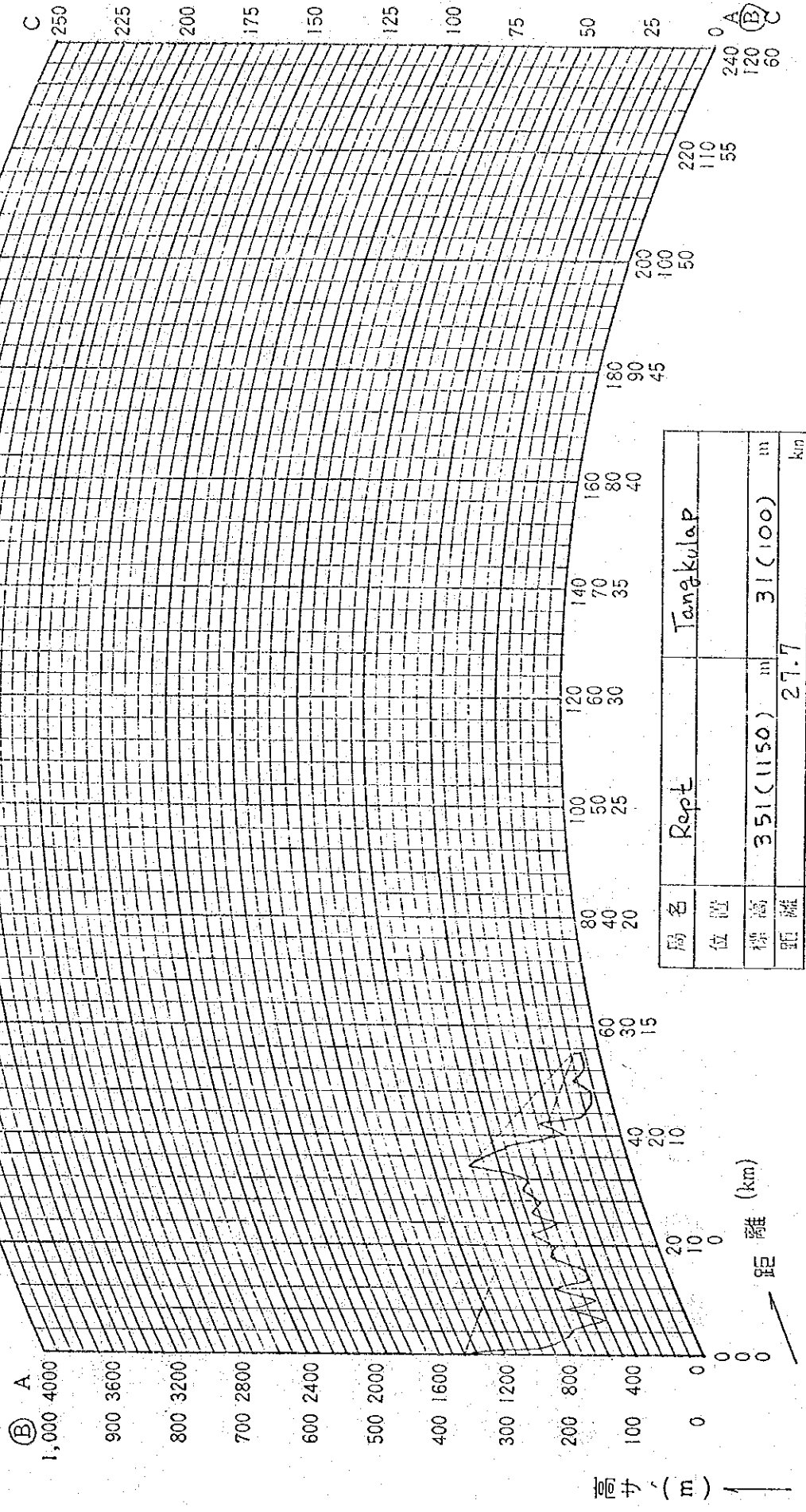
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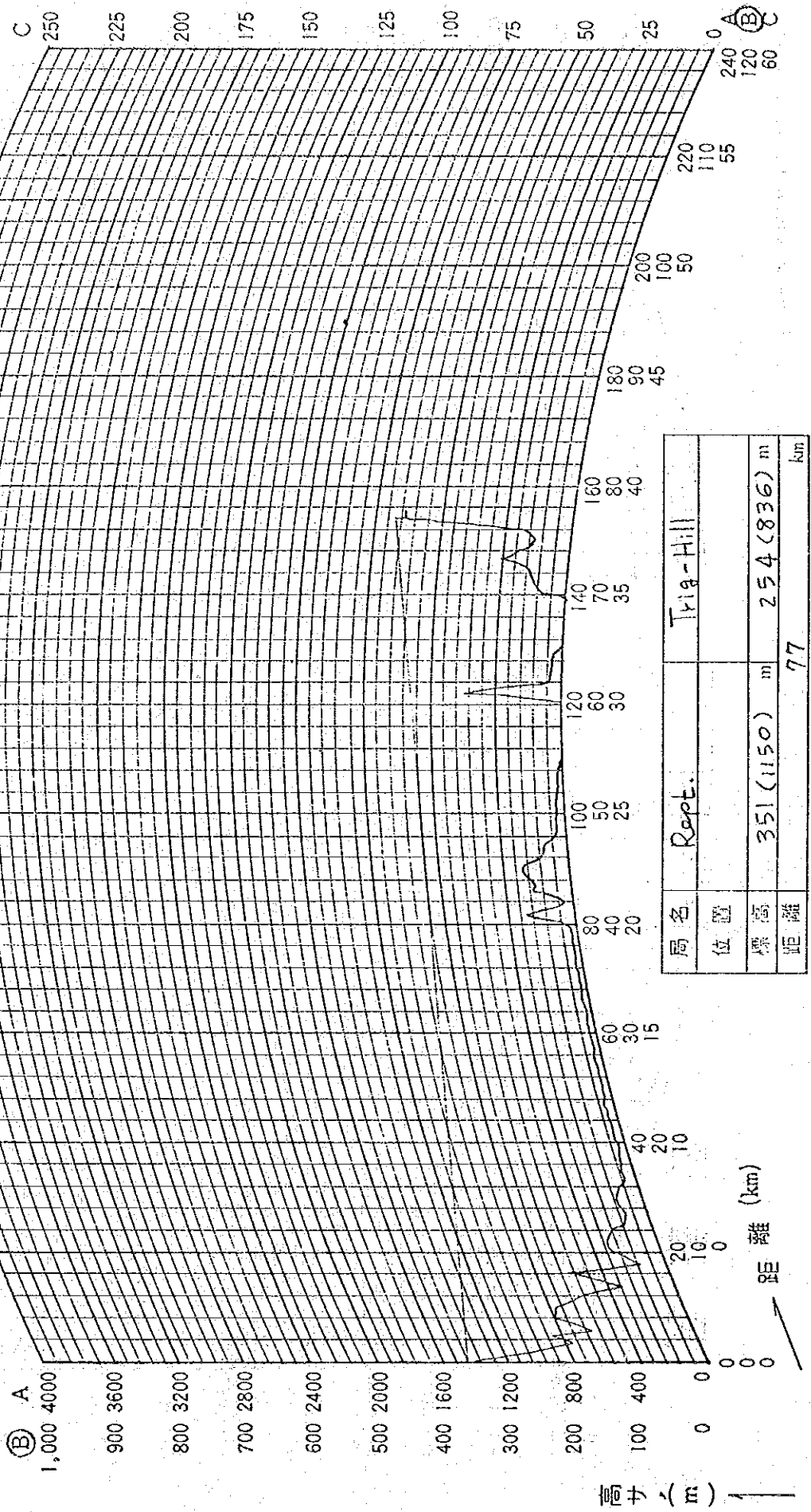
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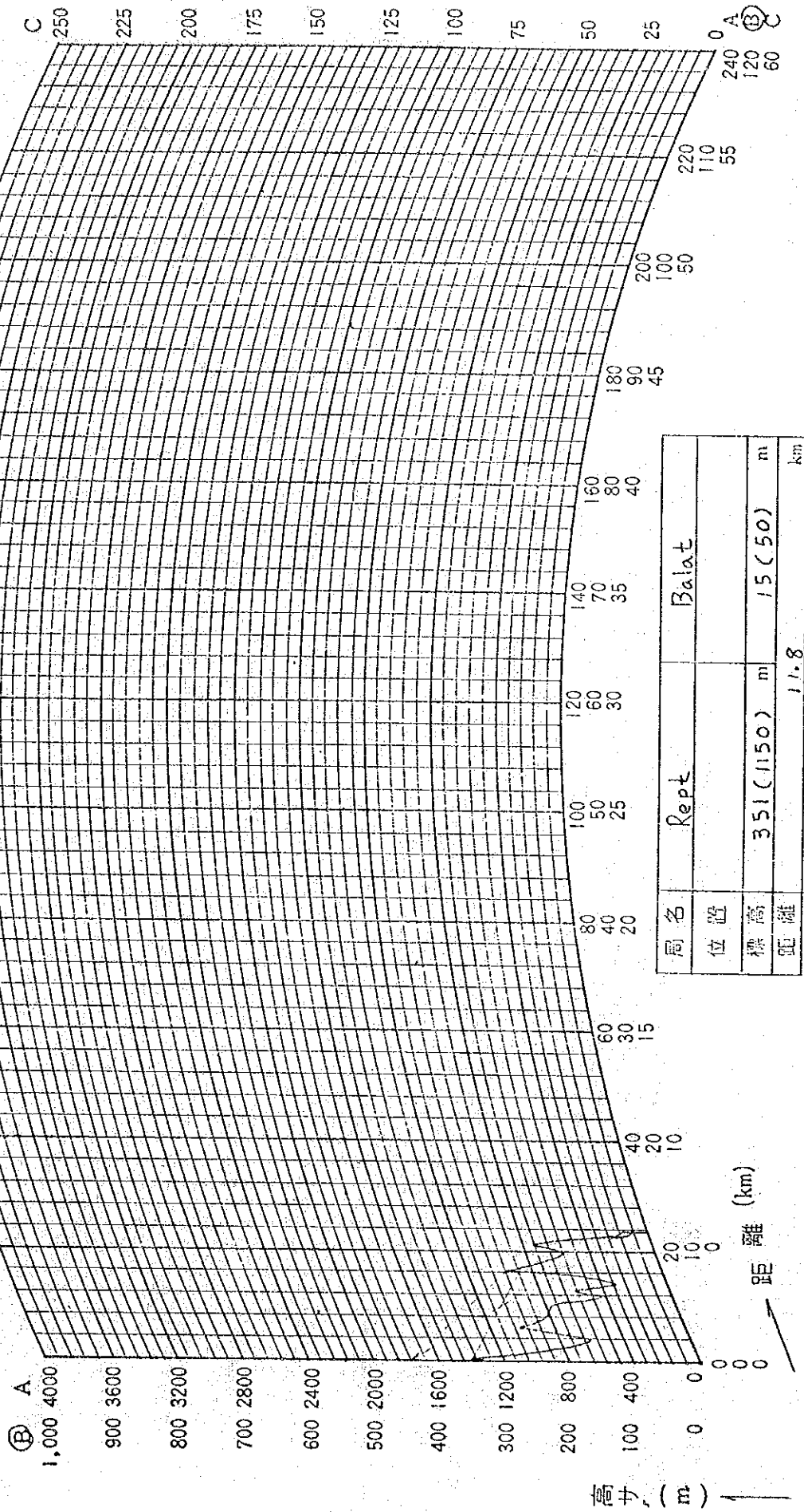
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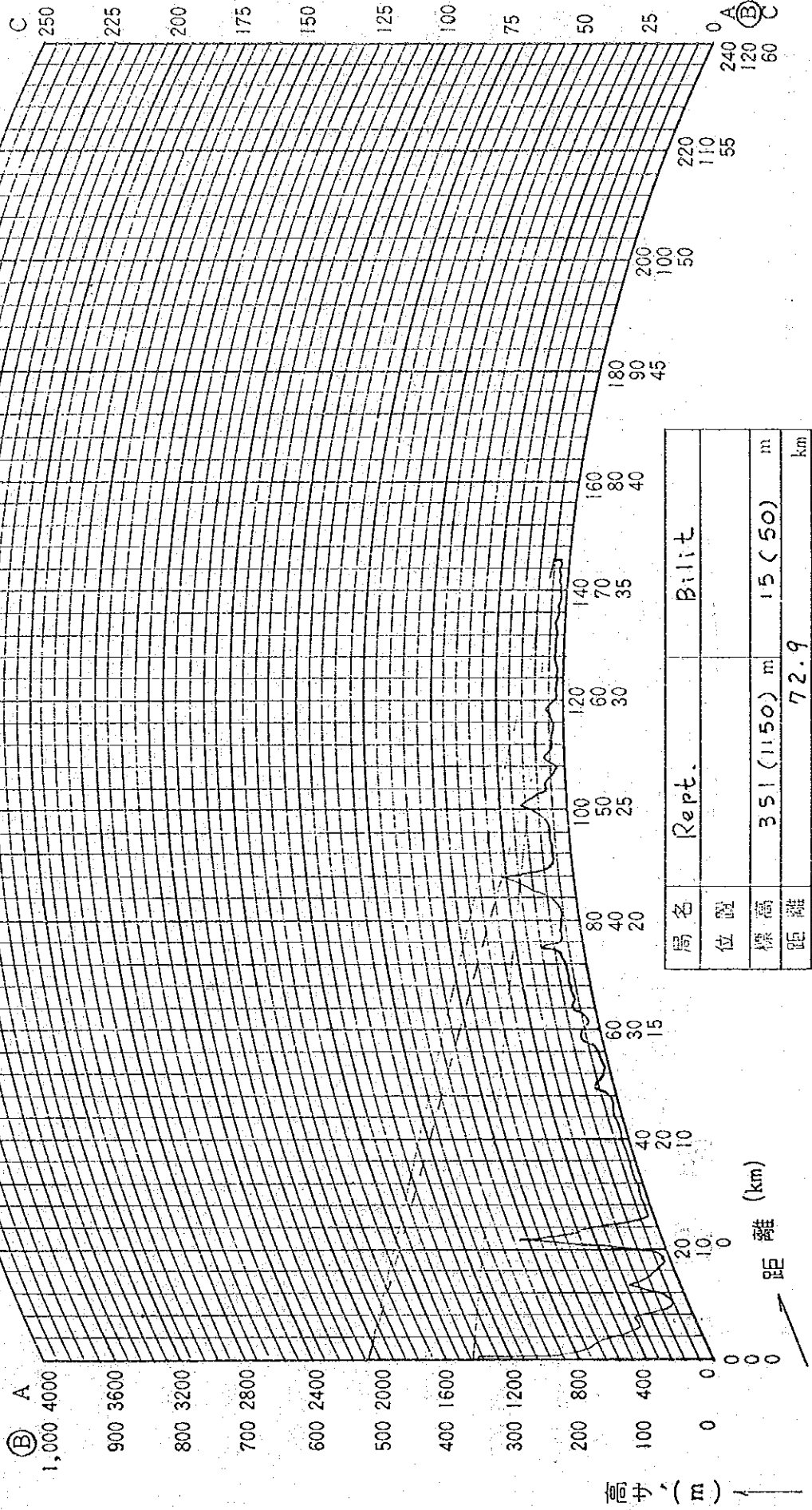
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見通図

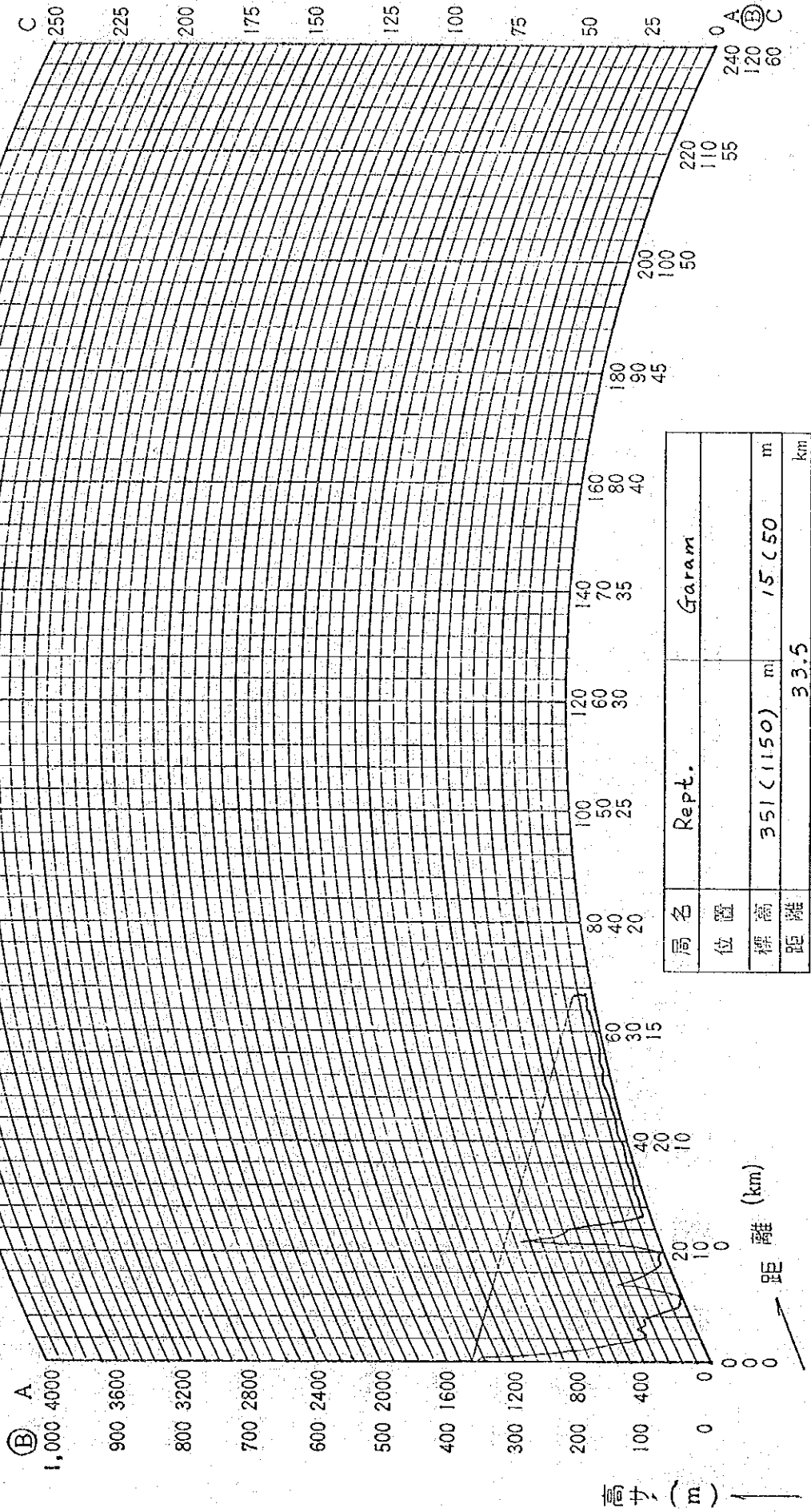


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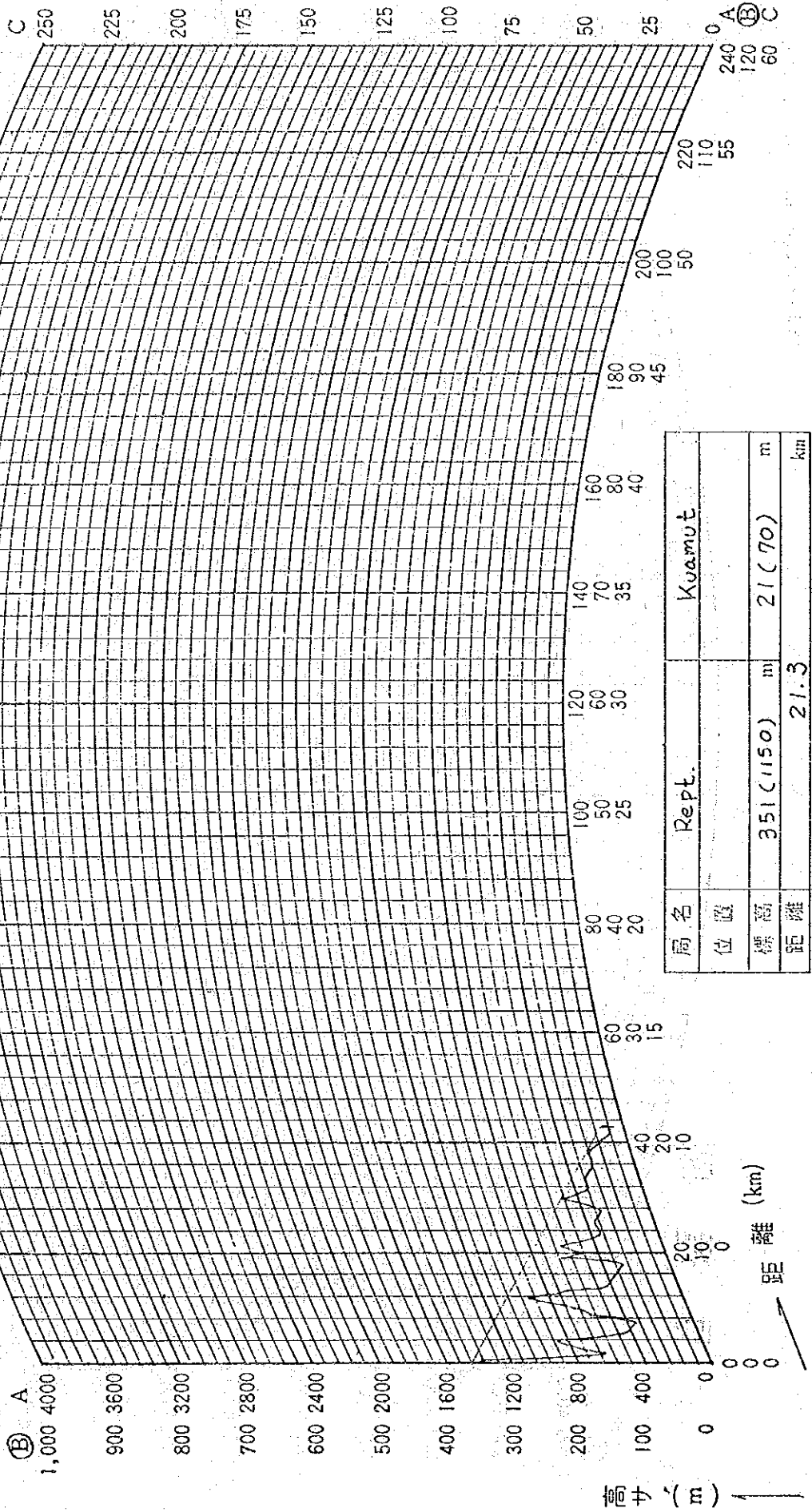




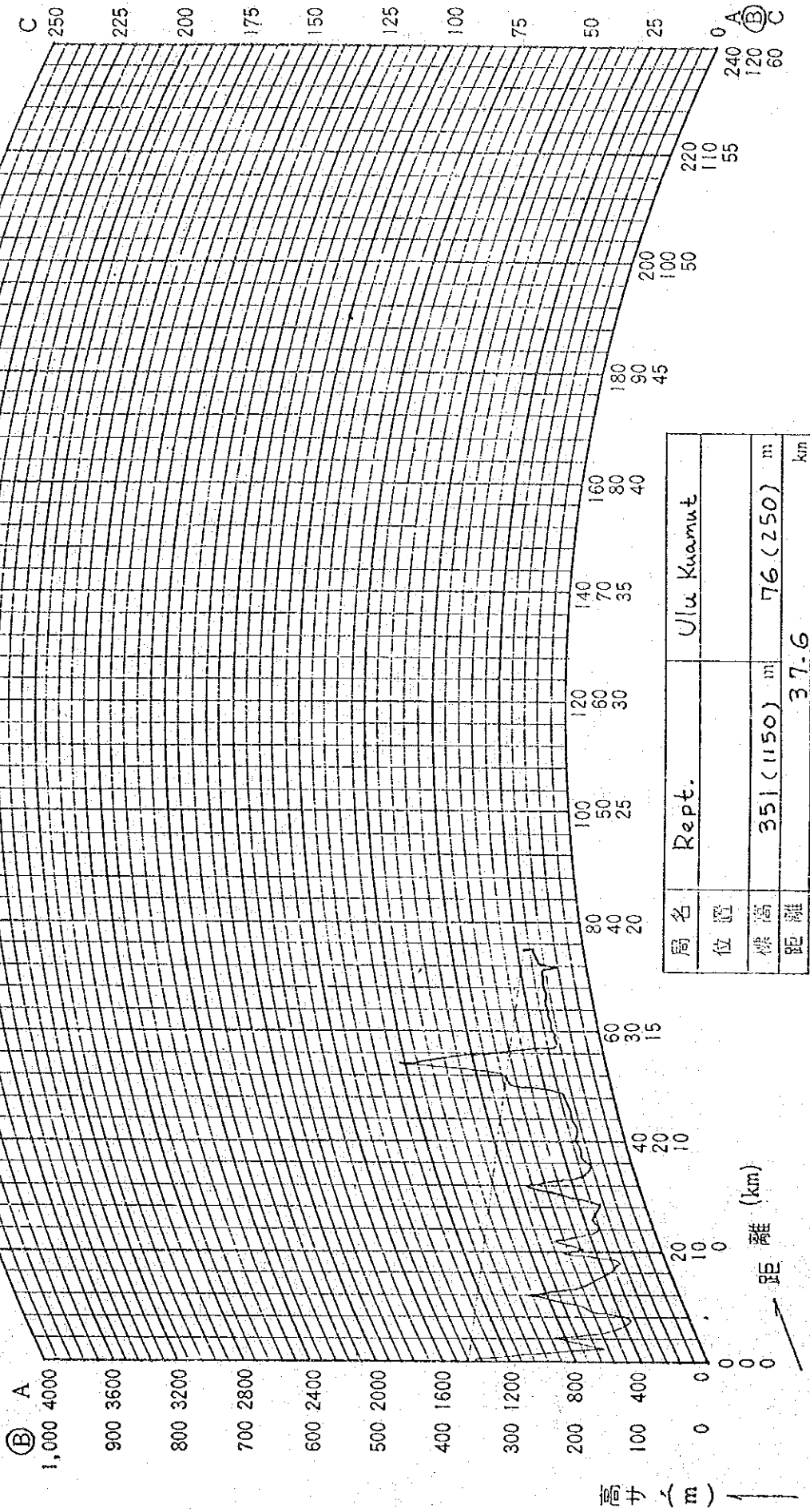
見通図



見通図



見通図







JICA