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Reykjavík, 26th November, 1948.

The Icelandic Meteorological Office has been asked to give some explanation of the flood in Þjórsá on March 4-6th 1948, and in this report, an effort is made to do so. The report however, does not make the claim to be completely exhaustive. Moreover, the data at hand are too few for a complete treatment of the case and even when some numerical estimates are made, they should be regarded as qualitative rather than quantitative.

The weather during January and most of February was rather typical for the winter in southern Iceland. There were spells of frost with northerly wind and mostly fair weather, interrupted by days of southeast winds with rain or sleet. The mean sea level temperature in the southwest part of Iceland went only on very few occasions slightly above 5°C during these months.

Since the mean elevation of the Þjórsá watershed is about 850 m. and the normal lapse rate is about 0.4°C per 100 meters, the mean temperature of the watershed is some 3.4°C lower than the sea level temperature, or below 2°C. The assumption that a temperature of 3°C would be needed to make an extensive thaw makes it probable that most of the snow that fell in the drainage basin during January and February had not melted by the end of February. In view of what has just been said it is likely that the ground conditions just before and during the flood days were such, that high ground was mostly covered with snow, but at lower levels the ground was about half covered with snow and the snowfree

portion frozen to some depth, the surface thawing during frozenless periods, but the frozenearth farther down blocking the penetration of rain water to a great extent.

On February 27th there was a pronounced change in the weather in Iceland. A depression, which moved up the strait between Iceland and Greenland brought a current of warm and rather moist air over the country. The sea level temperature went up to about 8°C and at Hæll, (a meteorological station within the Þjórsá watershed, coordinates 64°04´N 20°13´W, elevation 130 m.) the temperature rose to about 7-8°C. The main flow of the warm current seems to have reached the country on February 29th when the temperature of the air at 1500 m. reached 4°C. The precipitation during these days was not very great however, mostly because of the stability of the warm air. The warm current was interrupted by a cold westerly flow few hours after noon on March 2nd.

The cold westerly current did not last for long. On March 3rd a new depression, following a track similar to the one before, brought a south and southwesterly current over the country. The air was a little warmer than on February 29th, moist and rather unstable, and as a result there was a tremenduous rainfall in south and western Iceland. The total amount of precipitation at Hæll between 09 GMT on March 3rd to 18 GMT on March 4th was 95 mm. In the evening of March 4th the depression, which now had moved to the north of Iceland, brought the cold westerly current again to the Þjórsá basin and the precipitation almost stopped at the same time.

The flood in Þjórsá seems to be caused primarily by the runoff of the rainwater. If the velocity of the water in Þjórsá is about 1 m.p.s. and the distance from the center of the watershed to the flood gage station is around 100 km., then the water can reach the

station in 27 hours' time. The collection time for the watershed can then be expected to be between 24 and 40 hours, which is in fairly good agreement with the time of the flood.

According to the flood gage measurements the total runoff between noon on the 3rd of March to noon of the 7th is estimated to be $6.6 \cdot 10^8 m^3$. About $1.7 \cdot 10^8 m^3$ are estimated to be normal runoff, leaving $4.9 \cdot 10^8 m^3$ as floodwater. The total precipitation at Hæll was 95 mm. during the rainstorm, and we will assume tentatively that this precipitation is representative for the whole watershed. Its area is about 7240 km^2 and then the total amount of rain falling in the drainage area during the rainstorm is $95 \cdot 10^{-3} \cdot 7{,}24 \cdot 10^9 = 6.9 \cdot 10^8 m^3$. It is almost certain, however, that the mean rainfall over the whole basin is greater then at Hæll. Unfortunately, there are no representative rainfall measurements available at this time for the Þjórsá basin, but on the basis of measurements made in Norway (O.H. Johnsson: The distribution at Rainfall in Norway, Geografiska Annaler, Stockholm 1937, h.1-2) the precipitation for the Þjórsá basin are estimated to be 1.5 times that for Hæll. The total rainfall then becomes $1.5 \cdot 6.9 \cdot 10^8 = 10.3 \cdot 10^8 m^3$. The ratio between the floodwater and the total precipitation then becomes 0.48 or in other words, the floodwater is about one half of the total precipitation.

The rate of rainfall that caused this flood seems to be rather unusual for February and March. The precipitation measurements at Hæll began in 1933, and since then the rate of rainfall of 40 mm. or more in 24 hours in February has only been measured twice, in 1934, 66.7 and 1938, 40.0 mm. The maximum daily rate of precipitation in March has until this year always been less than 40 mm. in 24 hours.

The condition for maximum rainfall at Hæll, and in the Þjórsá

watershed, is strong southerly or rather southwesterly flow of moist air with satured adiabatic lapse rate. Southeast winds do not give so much rain, because of the sheltering effect of Mýrdalsjökull and the mountain range between Mýrdalsjökull and Vatnajökull. There may be consederable precipitation with NE wind in the northern part of the watershed. But in winter it would always be in form of snow and therefore hardly cause any floods in Þjórsá, not even during a thaw period later on. When it is noted that 20 grams of rain with a temperature of 4°C are required to melt 1 gram of snow at 0°C, the rainfall can be expected to be the chief contributor to the floods and not the thaw water, which on the other hand will probably supply most of the daily normal runoff.

Hlynur Sigtryggsson
(sign)

Monthly average temperature and departure from normal temperature

Oct. 1946 - May 1948.

	Reykjavík		Bolungarvík		Akureyri		Dalatangi		Vestmannaeyjar		Hæll	
1946	I	II	I	II	I	II	I	II	I	II	I	II
Oct.	7.6	3.4	7.5	4.5	7.9	5.4	7.5	3.7	7.6	2.8	6.5	3.1
Nov.	1.4	0.1	1.4	1.1	0.5	1.0	2.5	0.5	2.8	0.4	-0.0	-0.3
Dec.	2.9	3.0	2.7	2.9	2.0	3.9	3.7	2.9	4.2	2.8	1.7	2.6
1947												
Jan.	3.2	3.9	2.7	4.4	3.2	5.7	4.5	4.4	4.3	3.2	2.3	4.1
Feb.	-2.0	-1.7	-3.4	-1.7	-5.3	-3.3	-0.8	-1.1	0.8	-0.5	-3.4	-2.2
Mar.	-2.8	-3.2	-3.9	-2.7	-5.5	-3.9	-2.7	-2.4	0.0	-1.6	-4.0	-3.2
April	1.7	-0.8	-1.2	-1.6	-0.3	-1.1	1.2	0.8	3.2	0.2	1.0	-0.4
May	8.3	2.1	5.8	1.6	7.8	2.3	6.3	3.6	7.7	2.0	8.0	2.5
June	9,9	0.4	8.4	0.4	9.9	0.6	6.7	1.0	9.0	0.5	10.2	0.7
July	10.9	-0.3	10.5	0.8	11.6	0.7	9.0	1.4	10.3	0.1	11.1	-0.3
Aug.	11.0	0.5	11.8	3.4	13.2	4.0	11.1	3.5	10.5	0.9	10.6	0.7
Sept.	7.7	0.0	7.0	0.5	8.1	1.3	8.2	2.2	7.8	0.3	7.0	-0.1
Oct.	5.6	1.4	5. 0	2.0	4.5	2.0	6.2	2.4	6.1	1.3	4.3	0.9
Nov.	0.3	-1.0	-1.3	-1.6	-2.0	-1.5	0.6	-1.4	1.3	-1.1	-0.9	-1.2
Dec.	0.6	0.7	-1.0	-0.8	-1.3	0.6	0.5	-0.3	2.4	1.0	-0.4	0.5
1948												
Jan.	0.7	1.4	-0.4	1.3	-0.5	2.0	1.2	1.1	2.1	1.0	-0.5	1.3
Feb.	2.0	2.3	1.3	3.0	2.0	4.0	3.2	2.9	3.8	2.5	0.6	1.8
March	3.2	2.8	1.6	2.8	3.4	5.0	4.0	+.3	3.9	2.3	2.3	3.1
April	1.2	-1.3	-0.7	-1.1	0.4	-0.4	1.2	0.8	2.2	-0.8	0.3	-0.6
May	4.5	-1.7	3.3	-0.9	4.7	-0,3	3.3	0.6	4.9	-0.8	4.5	-1.0

Columns I: Monthly average temperature, °C

Columns II: Departure from normal temperature.

Monthly precipitation, mm.

October 1946 - May 1948.

	Akur-eyri	Fagur-hólsm.	Kirkju-bæjarkl.	Vík í Mýrdal	Vestmanna-eyjar	Sáms-staðir	Hæll	Eyrar-bakki	Ljósa-foss	Þing-vellir
1946										
Oct.	8.2	231.9	264.3	283.4	193.5	217.3	253.6	217.2	388.6	252.o
Nov.	41,9	109.3	121.9	149.6	92.1	55.7	45,8	132.o	107.8	83.o
Dec.	19.1	309.6	240.5	341.6	262.2	131.3	93.9	143.8	137.7	153.o
1947										
Jan.	40.6	211.6	264.1	212.5	222.9	165.4	128.2	220.6	302.1	256.o
Feb.	60,6	42.o	18.9	69.6	46.3	13.o	3.6	32.1	28.o	39.o
March	36.3	0,3	0.o	15.5	7,6	10.5	1.7	22.6	8.4	9.o
April	24.7	158.8	130.5	169.5	66.o	51.4	37.9	94.5	85.8	71.o
May	9.7	144.1	179.4	185.6	121.3	55.o	54.1	136.8	151.7	142.o
June	12.8	253.3	221.2	191.5	79.4	39.6	80.9	69.4	85.9	65.o
July	31.7	150.9	196.4	284.9	177.8	85.4	120.7	123.7	160.2	104.o
Aug.	13.9	152.6	210.3	268.8	137.5	122.3	110.5	156.2	169.9	172.o
Sept.	9.6	135.4	202.o	195.6	135.7	138.4	129.2	166.1	211.7	166.o
Oct.	20.7	167.5	179.3	206.4	144.1	180.4	145.7	157.3	202.5	133.o
Nc	83.9	103.8	66.8	141.o	69.1	20.7	28.5	46.6	48.4	20.o
Dec.	56.9	73.3	116.9	210.o	141.8	114.8	130.6	148.1	152.9	146.o
1948										
Jan.	48.6	223.9	146.1	300.o	163.2	86.4	42.8	132.1	70.8	63.o
Feb.	38.6	138.2	127.5	142.3	148.5	102.4	92.2	147.9	202.2	161.o
March	28.7	249.7	279.3	201.4	153.6	162.1	249.o	193.2	446.8	258.o
April	19.6	79.o	72.7	109.9	85.o	51.8	43.o	67.5	67.o	54.o
May	15.o	82.5	140.9	148.2	86.4	38.7	61.o	80.2	127.3	98.o

Percentage of normal precipitation

October 1946 - May 1948.

	Akureyri	Hagurhólsmýri	Vík í Mýrdal	Vestmanneyjar	Þámsstaðir	Eyrarbakki
1946						
Oct.	15	141	138	150	207	180
Nóv.	91	64	76	78	57	116
Dec.	34	160	153	201	128	139
1947						
Jan.	94	112	96	159	167	203
Feb.	176	23	35	41	16	38
March	102	0,2	8	7	14	23
April	81	122	121	76	79	127
May	44	118	137	166	93	185
June	54	230	152	109	63	85
July	90	145	239	251	133	156
Aug.	34	143	225	198	184	203
Sept.	25	74	91	107	130	134
Oct.	37	102	101	112	172	131
Nov.	183	61	72	58	21	41
Dec.	100	40	94	109	112	143
1948						
Jan.	112	119	135	116	87	122
Feb.	112	77	72	130	123	174
March	81	144	106	147	210	237
April	64	61	76	98	79	91
May	68	67	109	111	65	108

List of stations.

Station	Lat. N	Long. W	Elevation, mete above MSL.
Akureyri	65° 41′	18° 05′	4,5
Bolungarvík	66° 10′	23° 15′	5
Dalatangi	65° 16′	13° 35′	9
Eyrarbakki	63° 52′	21° 09′	7,4
Fagurhólsmýri	63° 53′	16° 39′	40
Hæll	64° 04′	20° 15′	130
Kirkjubæjarklaustur	63° 47′	18° 04′	16
Ljósafoss	64° 06′	21° 01′	72
Reykjavík	64° 08′	21° 54′	50,7
Sámsstaðir	63° 44′	20° 07′	90
Vestmannaeyjar	63° 24′	20° 17′	122
Vík í Mýrdal	63° 25′	19° 01′	20
Þingvellir	64° 15′	21° 07′	105

Legend

Rain in mm at Hæll.

Temperature in °C at 300 m above M.S.L.

Water transport of þjórsá $m^3 sec^{-1}$.