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Reassessment of suspended sediment load of river Jökulsá á Dal at Hjarðarhagi

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Short abstract:
The objective of this study is to reassess the suspended sediment load of Jökulsá á Dal. The reassessment is based on improved sampling methodology and comparison with the older methodology. Mean suspended sediment load of Jökulsá á Dal at Hjarðarhagi for the interval 1970–99 is 5.8 million tons per year, but 6.7 million tons per year for the interval 1965–99. This is based on seasonal 5-year-period rating curves. The difference is caused by the surge in Brúarjökull 1963–64. During 1970–99 about 86% of the load was transported during the interval from July to September. Seventy-two percent of the sediment is classified within the 0.002–0.2 mm grain size range, and 18% coarser than 0.2 mm. According to the calculations the difference in suspended sediment load between Hjarðarhagi and the other sampling site at Brú fits well within the error associated with sediment sampling and discharge measurements. To fully evaluate the sediment transport in Jökulsá á Dal it is very important to continue bedload studies at Hjarðarhagi.

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1 Introduction

Jökulsá á Dal is one of the largest rivers in Iceland, with a watershed of 3700 km^2, thereof 3320 km^2 at Hjarðarhagi, and 1410 km^2 covered by glacier (Fig. 1). The annual mean discharge is about 180 m^3/s at the river mouth in the bay of Héraðsflói. The river is fed mainly by glacial water from Brúarjökull glacier, and to a lesser extent by direct runoff water from the adjoining highland. The Brúarjökull is a surging glacier with recorded surges in the early 17th and 18th century, in 1810, 1890, and in the fall of 1963 (Árni Snorrason 1985). Abnormal flows and high sediment concentration were recorded in the years following the 1963 surge, as evident from this report. The glacier origin of Jökulsá á Dal is reflected by the great amount of sediment the river transports to the ocean.

Figure 1: Map of the river basin of Jökulsá á Dal (Þórarinn Jóhannsson 2000).

Sediment samples have been obtained in Jökulsá á Dal since 1963; thus a long record of suspended sediment concentration and grain size, in combination with discharge data, are available for the river. The data has predominantly been collected for the purpose of possible future hydroelectric power development on the river, for which a sufficient record of past and present discharge and sediment data is essential (Svanur Pálsson et al. 1998).

Two main sampling sites have been used on river Jökulsá á Dal, i. e. at Hjarðarhagi and at Brú (Fig. 1). In a report published by Orkustofnun in 1996 on the glacial rivers north of Vatnajökull it was made clear that sediment sampling in Jökulsá á Dal has been subject to serious problems (Svanur Pálsson and Sigfinnur Snorrason 1995). Due to high discharge velocities and turbulence at Hjarðarhagi and Brú, the ordinary sampler did not reach the riverbed as required. A small intake nozzle had to be employed due to the same problem in order to avoid overfilling. Consequently, the calculated sediment load was underestimated by about 1 million tons annually of the coarser suspended sediment.

To evaluate the missing coarse sediment fraction, a supplementary sediment monitoring program was initiated for the two sampling locations in 1995 and 1996 (Svanur Pálsson 1996; Svanur Pálsson and Sigfinnur Snorrason 1996). Both ordinary S49 samples and so-called P61 samples, which were obtained with a heavier sampler that could be electronically opened and closed, were collected during these summers. The sampling program was, however, unsuccessful as the P61 sampler also failed to reach the riverbed. After a motorized cableway was built about 2 km downstream from the Hjarðarhagi bridge, it was possible to obtain sediment samples with the P61 sampler that collected sediment laden water through the whole water column. Such samples were obtained during the summers of 1998, 1999, and 2000 under the supervision of Ásgeir Gunnarson. These measurements were successful and their results were presented in reports of Orkustofnun, see Svanur Pálsson and Ásgeir Gunnarsson 1998 and 1999.

The current study involves reevaluation of the older suspended sediment and discharge data and includes recalculation of the sediment load using the reestablished values for sediment concentration and grain size distribution. The recalculations show that the mean sediment load is about 300 000 tons greater than earlier load calculations inferred, which is however only one-third of the sediment load increase that had been estimated by Haukur Tómasson et al. (1996). It is evident from these experiments that the sampling location at the cableway is better than at the bridge upstream, as the sampler reaches the riverbed and it is possible to use a larger intake nozzle. Still, because the water flow is less turbulent and at lower velocity at the cableway than at the older sampling site, less sediment is transported in suspension and more sediment is transported as bedload at the former site. These circumstances call for bedload measurements at the cableway location that have been impossible at the Hjarðarhagi bridge. Such experimental measurements were initiated in 2000 with good results, and should be continued if a more thorough understanding of the total sediment transport in Jökulsá á Dal is required.

2 Sampling and data analysis

2.1 Sample types and grain size classification

All river samples that are taken within the river sediment sampling program of the Hydrological Service are classified into two main groups, F and S samples. The classification depends on the sampling methods that were used in the field, as described below.

F-samples are sampled in bottles without the use of a sampler. They are almost always taken at one site close to the riverbank.

S-samples are sampled in about 400 ml flasks using a specific water sampler. The water flows into the flask through a valve on the sampler, while the air in the flask is sucked out through another valve on the side to minimize its effects on the incoming water. The suction is controlled by the water flowing across the air valve. The sampler is lowered into the river and lifted up at a constant rate, resulting in an integrated river sample from the river surface to the riverbed. Three types of samplers are used: 1) The hand sampler (DH48), which is fastened to a rod that is lowered into the river; 2) the S49 sampler, which is attached to a winch; and 3) the P61 sampler, which is heavier than S49 and has an electronic opening that is possible to open and close with a remote control, also attached to a winch.

The S-samples are further divided into three subcatagories, which are labeled S1, S2, and S3.

S1 samples are obtained from several (usually 3–5) locations on a river transect using the S49 and P61 samplers.

S2 samples are usually obtained from one location on the river transect, but occasionally from two locations. These samples are obtained with the S49 sampler and are comparable to S1 samples although they are taken from fewer locations on the river transect.

S3 samples are obtained from either riverbank and are always taken in the hand sampler, DH48.

This sample classification refers to the sampling method, but it can also be considered as a quality categorization.

F-samples are only taken when a sampler is not available. Most F-samples were taken more than 30 years ago before samplers were available, or were very few. Only occasional F-samples have been obtained since then. The F-samples are considered to be the lowest quality samples. They should represent the fine suspended sediment properly, but they are insufficient to represent the coarser suspended sediment. The coarser material is missing because the bottle is neither dipped deep enough nor into the main river current where the coarse material is concentrated. The F-bottle sampling is also affected by the direction the bottle is held at in relation to the stream flow. In most cases, the bottle is held nearly perpendicular to the river flow, but it should be held parallel to the stream flow so that inflowing water does not have to change its direction at the bottle aperture. Furthermore, the inflowing water is disturbed by the air escaping from the bottle as there is no ventilation valve.

S1 samples are considered to be the best quality samples, although S2 samples that are obtained from high discharge rivers in confined settings where turbulent flow occurs, should equal them in quality. S1 sampling is difficult in such settings as the sampler tends to advance into the main current.

The S3 samples are of less quality than S1 and S2 samples. They have the same problem as the F-samples being obtained close to the riverbank, although there is no rotation of stream flow at the bottle aperture or problem with outgoing air. S3 samples should be considered valid concerning fine suspended load, but they usually underrepresent coarse suspended load as is seen when S3 samples are compared with simultaneous S1 and S2 samples.

The different subsamples from the river transect are combined into one sample for grain size analysis, which is performed by a combination of sedimentation method ($<63\mu$m) and sieving ($\geq 63\mu$m). The sediment concentration (mg/l) of the sample is measured as well as its grain size distribution. In this study, a grain size curve is established for each sample and the curve divided into five grain size classes based on a modified Atterberg grain size division (see Table 1). The next size class above sand includes gravel according to the Atterberg grain size scale (2–20 mm); however, as only an insignificant part of the suspended sediment load is classified as gravel this grain class is included within the sand fraction. Due to problems translating the Icelandic names used for the different Atterberg size fractions without confusion with other grain size scales, the Icelandic names are hereafter used in this report. The near applicable grain size terms according to the widely used Udden Wentworth size scale are, however, included in Table 1 for comparison.

Table 1: Grain size classification used in the report.

Icelandic name used here	English name	Grain size (mm)
Sandur	"Coarse sand"	2-0.2
Grófmór	"Fine sand"	0.2-0.063
Fínmór	"Coarse silt"	0.063-0.02
Méla	"Fine silt"	0.02-0.002
Leir	"Clay"	<0.002

The coarser material is much more susceptible to variations due to sampling methods and conditions at the sampling site. Depending on the current velocity, the *sandur* is transported as bedload in some locations, whereas it is in suspension in other locations. Sediment coarser than *sandur* (2 mm) is mostly transported as bedload.

2.2 Rating curves

Rating curves are used to calculate the suspended sediment load (Fig. 2). The function is shown below, where q_s represents suspended sediment load in kg/s, Q equals discharge in m^3/s at the time of sediment sampling, k is the ratio coefficient and n the exponent:

$$q_s = k \times Q^n$$

Several rating curves are used in this study. Their main components, including the ratio coefficients, are shown in tables. All ratio coefficients in the tables have been multiplied with 10^6 to simplify comparison between rating curves. For example, the ratio exponent is written as 148 instead of 148×10^{-6}.

Several factors should be kept in mind when the quality of rating curves is considered:

- The quality of rating curves tends to be proportional to the number of samples they represent. Too few samples can bias the results; thus, the greater the number of samples the better the rating curve. The correlation between discharge and suspended sediment load is variable because many other factors than discharge affect the sediment load. The samples used for generating a rating curve should be obtained throughout the whole year, but should be especially well distributed over the time period when sediment discharge is greatest.

- Rating curves should include samples that are obtained over a broad discharge spectrum, and should include both samples obtained close to the highest daily mean discharge and samples obtained at much lower discharge.

- The correlation should be as high as possible. Good correlation is represented by r=0.90 or higher, r=0.95 or higher exhibits excellent correlation, while poor correlation is represented by r=0.80 or lower.

- Rating curves with exponent greater than 3 are suspect as they tend to assign too high sediment load at high discharge and too low sediment load at low discharge. The exponent is close to 2 in good rating curves, but exponents from 1.5–3.0 are acceptable.

- It is unfavorable to include outliers within the rating curve dataset, especially if the curve is based upon few samples. Such outliers should be removed in some instances.

The rating curves are used to calculate the daily sediment load based upon the daily mean discharge. The daily mean discharge is used here as well as in older Orkustofnun reports because information on how sediment load varies during the daily discharge fluctuation is not available. Such information would, however, be very useful. The rating curves are, however, constructed from pairs of sediment concentration measurements and instantaneous discharge at the time of measurements. In some cases discharge is decreasing or increasing when the samples are taken. This increases the scatter of the rating curve since, in general, higher concentrations are observed on the rising limb of the hydrograph.

Rating curves that are based on samples representing the whole year are called annual rating curves. When the sample number is great it is sometimes possible to define seasonal rating curves. If the rating curves are satisfactory and the information on the mean discharge is well established, it should be possible to calculate the annual sediment load.

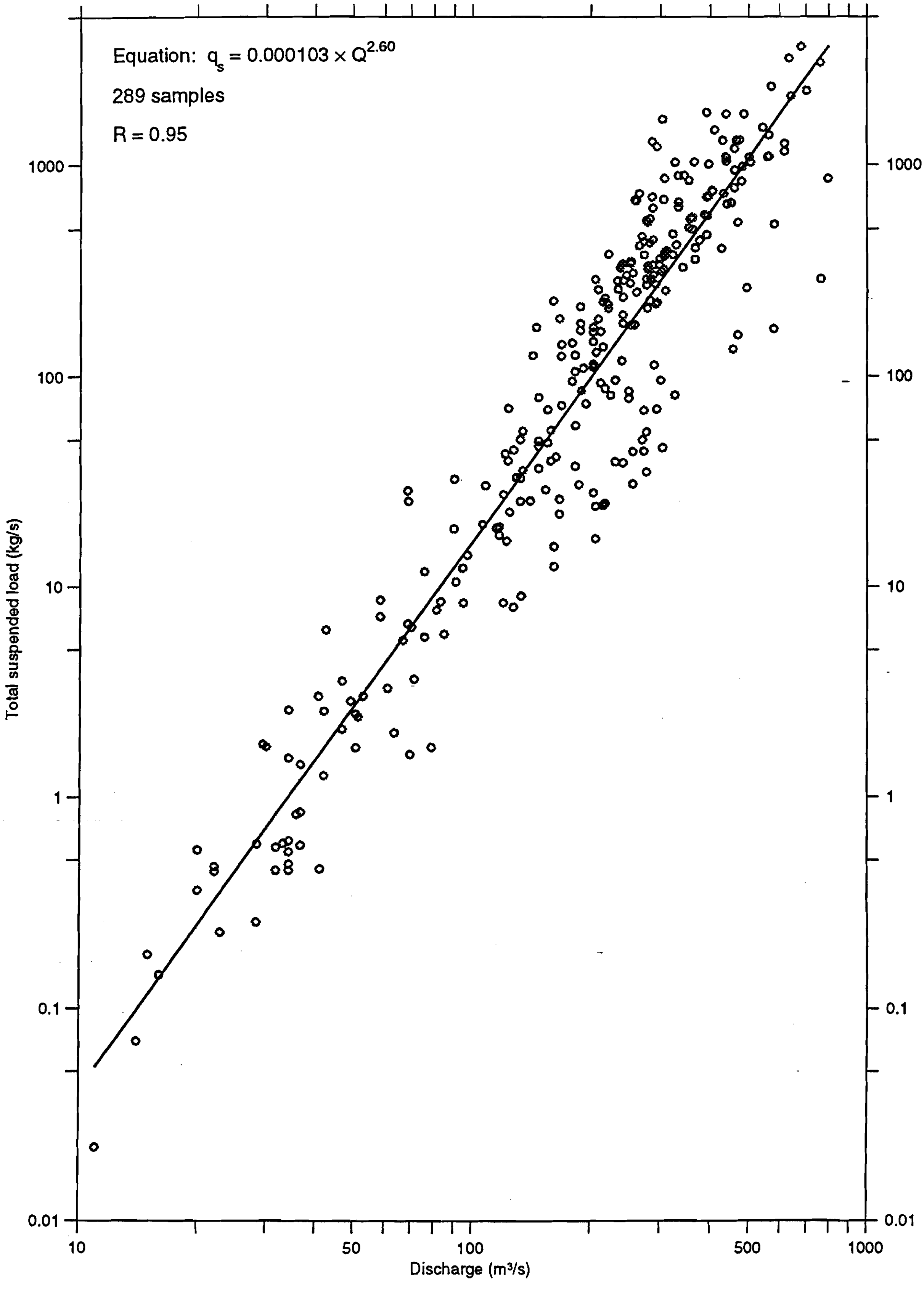


Figure 2: Jökulsá á Dal, Hjarðarhagi, annual rating curve 1970–99.

3 Data used in this study

Suspended sediment samples have been obtained at two locations in river Jökulsá á Dal; at Hjarðarhagi since 1963 and at Brú since 1970. Hjarðarhagi has been considered the main sampling site in Jökulsá á Dal and samples from that site are more numerous than from Brú. The first part of this study involves only samples from Hjarðarhagi, whereas samples from Brú are also used in Chapter 6.

Only so-called F-samples were obtained during the first two years of sampling (1963 and 1964). Those samples were very inaccurate regarding the coarsest suspended sediment, which is to a large extent lacking from F-samples. The first S-sample was retrieved in 1965. Figure 3 shows the distribution of S-samples obtained since 1965 using the S49 and DH48 samplers. It is apparent that the annual sampling has varied much during the 35 years of sampling. Sampling frequency was high before and around 1970, but was relatively low around 1990. Total of 384 S-samples from Hjarðarhagi are used in this study, including 10 S1 samples, 214 S2 samples, and 160 S3 samples. Most S3 samples, which are considered the poorest samples of the three sample types, were obtained during the initial years of sediment sampling, although occasional S3 samples have been taken since, especially in wintertime.

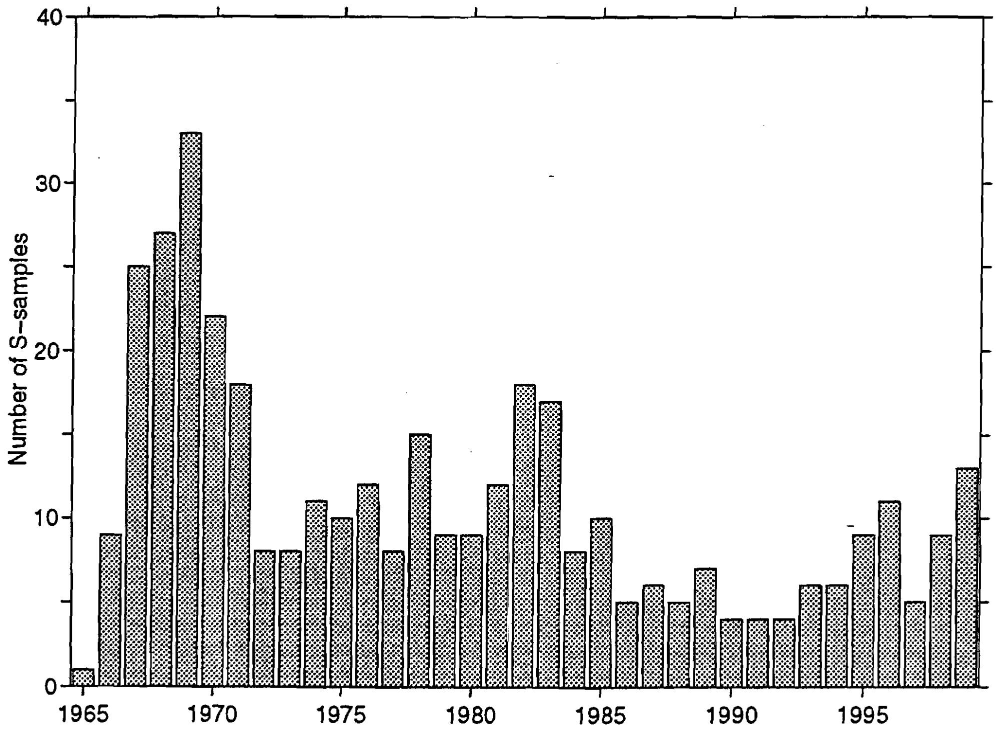


Figure 3: Jökulsá á Dal, Hjarðarhagi, number of S-samples per year.

Figure 4 shows the mean annual discharge at Hjarðarhagi between 1964 and 1999. In most years the discharge is around 150 m^3/s, with occasional deviations like in 1976, 1979, 1984, 1985, 1991 and 1997.

The monthly mean discharge is presented in Fig. 5, which shows that the highest discharges occur from May to October.

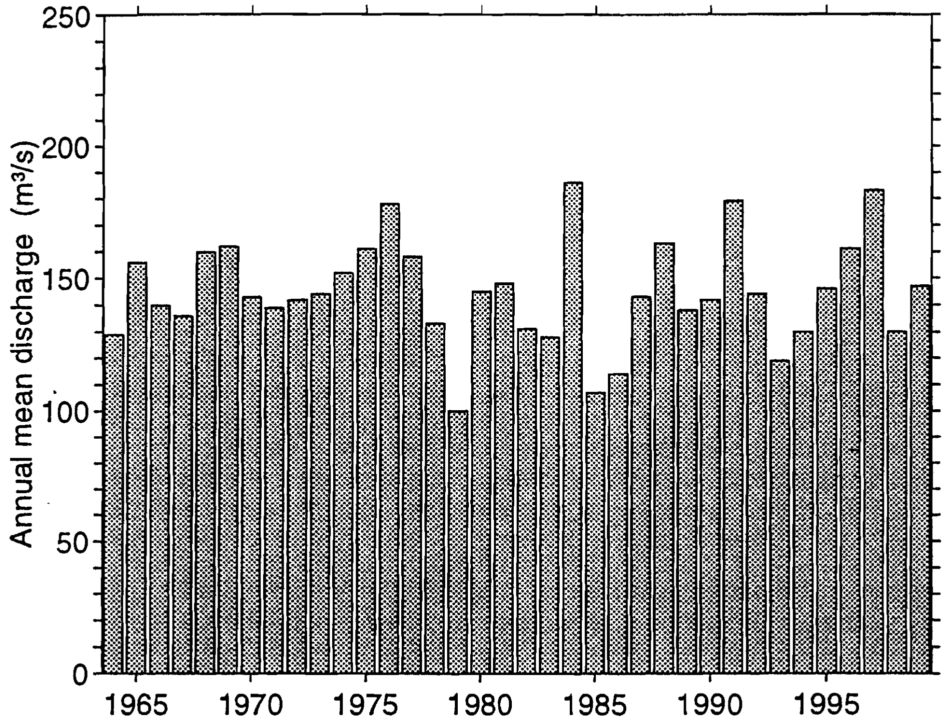


Figure 4: Jökulsá á Dal, Hjarðarhagi, annual mean discharge.

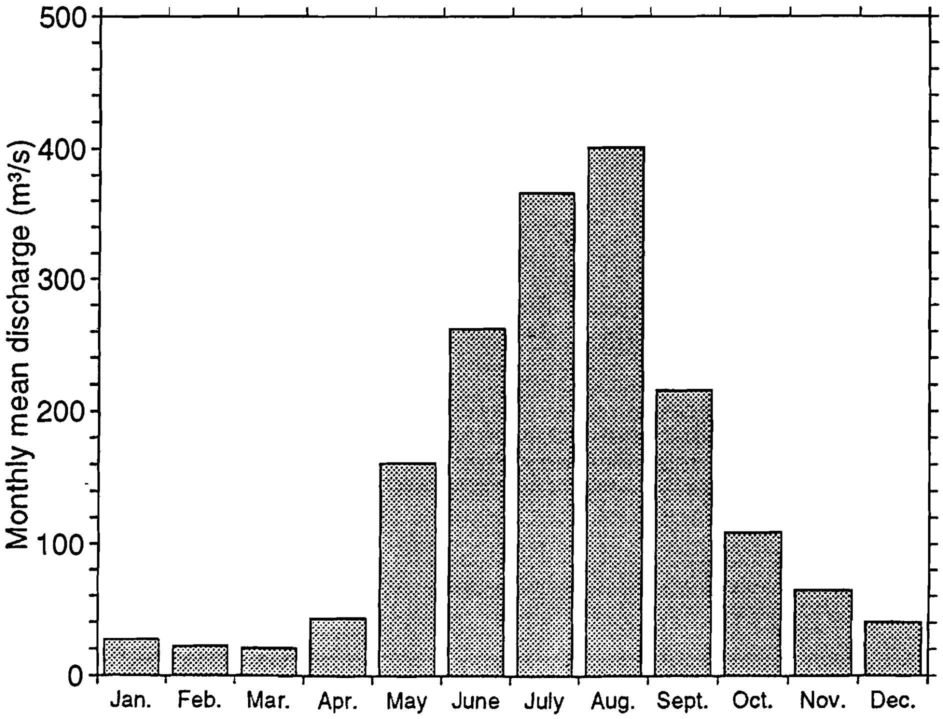
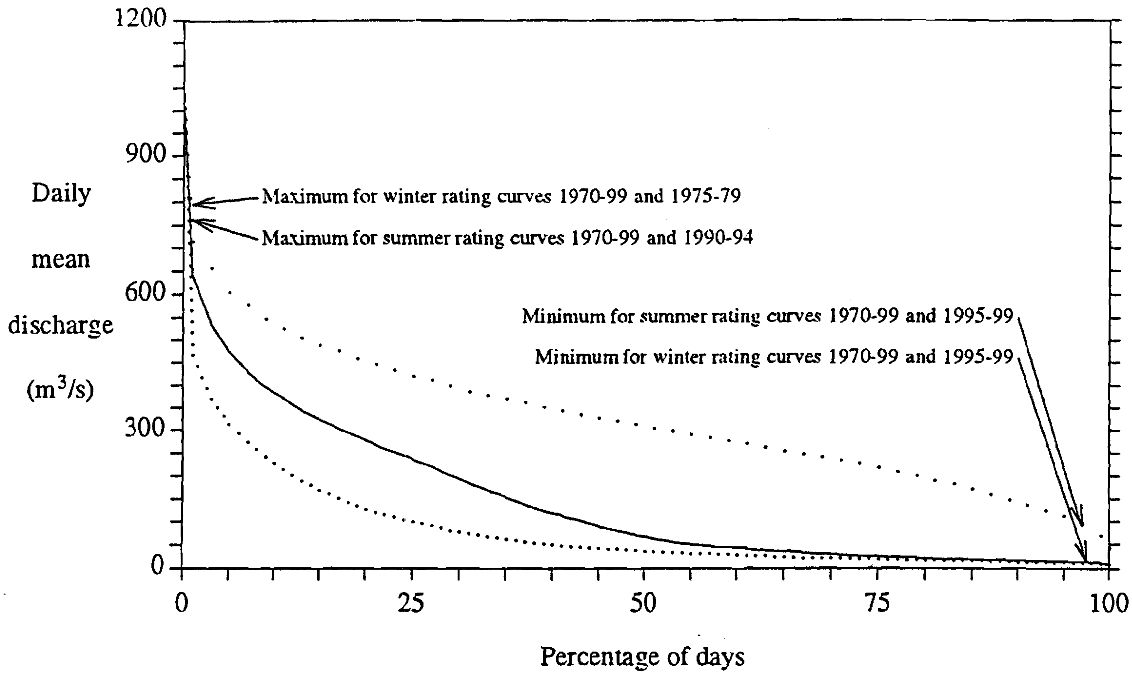


Figure 5: Jökulsá á Dal, Hjarðarhagi, monthly mean discharge.



Unbroken line: Whole year. Dotted line: July-September. Densely dotted line: October-June.

Figure 6: Jökulsá á Dal, Hjarðarhagi, flow duration 1965–99.

The flow duration at Hjarðarhagi 1965–99 is presented in Fig. 6, which shows large variations in discharge. Lower discharge values occur during winter, when glacial melting has finished and direct runoff is low. The occasional floods, when daily mean discharge reaches values higher than 500 m^3/s, are most common in July and August. Spring floods are also common, although they are usually smaller.

4 Processing of sediment data

The previous chapter portrayed the difference between the various sample types and how they were ranked based on quality, with S1 being the best quality sample, followed by S2, then S3, and finally F-samples. In a river such as Jökulsá á Dal, the difference between S1 and S2 samples is probably not so pronounced as the samples have been obtained where the river flow is turbulent, in a confined setting. However, special care has to be taken with the S3 samples, as they might underestimate the coarse sediment transported by the river.

Based on data from twenty S2 and S3 sample pairs obtained simultaneously from Jökulsá á Dal between 1981 and 1984, Haukur Tómasson et al. (1996) increased the sediment concentration in S3 samples by 17% to equal S2 sample concentrations.

A previous study concluded that the normal sampling method with a S49 sampler on a hydraulic winch underestimated the coarsest suspended sediment in both S1 and S2 samples (Svanur Pálsson and Sigfinnur Snorrason 1995). Two reasons were specified:

1. At normal summer discharge, the S49 sampler is unable to reach the riverbed from the sampling bridge at Hjarðarhagi because of high current velocity and turbulent flow. As the coarsest sediment is expected to lie close to the riverbed, it is probable that this sampling method undersamples the coarse sediment.
2. Due to the circumstances at the sampling site, it is necessary to use a small diameter intake nozzle, usually 2 mm in diameter, to avoid overfilling of the sampling bottles. So small diameter excludes the coarsest material from entering the bottle.

During the summers of 1995 and 1996, several samples were obtained from the bridges at Hjarðarhagi and Brú with a heavier sampler, P61, in addition to the normal S49 sampler, to try to compensate for the missing coarse sediment. Nevertheless, the P61 samper was unable to reach the riverbed at Hjarðarhagi and at Brú, as discussed in reports from Orkustofnun (Svanur Pálsson and Sigfinnur Snorrason 1996 and Svanur Pálsson 1996).

Following previous experiments at Hjarðarhagi and Brú, a new sampling program was initiated, by which, suspended sediment samples were obtained from a new motorized cableway 2 km downstream from the Hjarðarhagi bridge. The P61 sampler and an electric winch were used for this purpose during the summers of 1998, 1999, and 2000. The sampler reached the riverbed at all times and it was possible to use a 4.5 mm diameter nozzle for all samples. The sampling program included integrated samples from the river surface to the riverbed in addition to samples obtained at specific depths, which were used to investigate the change in sediment concentration with depth. Simultaneously, regular S2 samples were obtained from the Hjarðarhagi bridge using the S49 sampler. The conclusions from these experiments from 1998–2000 are available in reports published by Orkustofnun (Svanur Pálsson and Ásgeir Gunnarson 1998 and 1999 and Ásgeir Gunnarsson et al. 2001 in preparation).

Thirty-five sample pairs were available following the sampling program in 1998–2000, including 1) an integrated sample taken from the cableway at Hjarðarhagi obtained

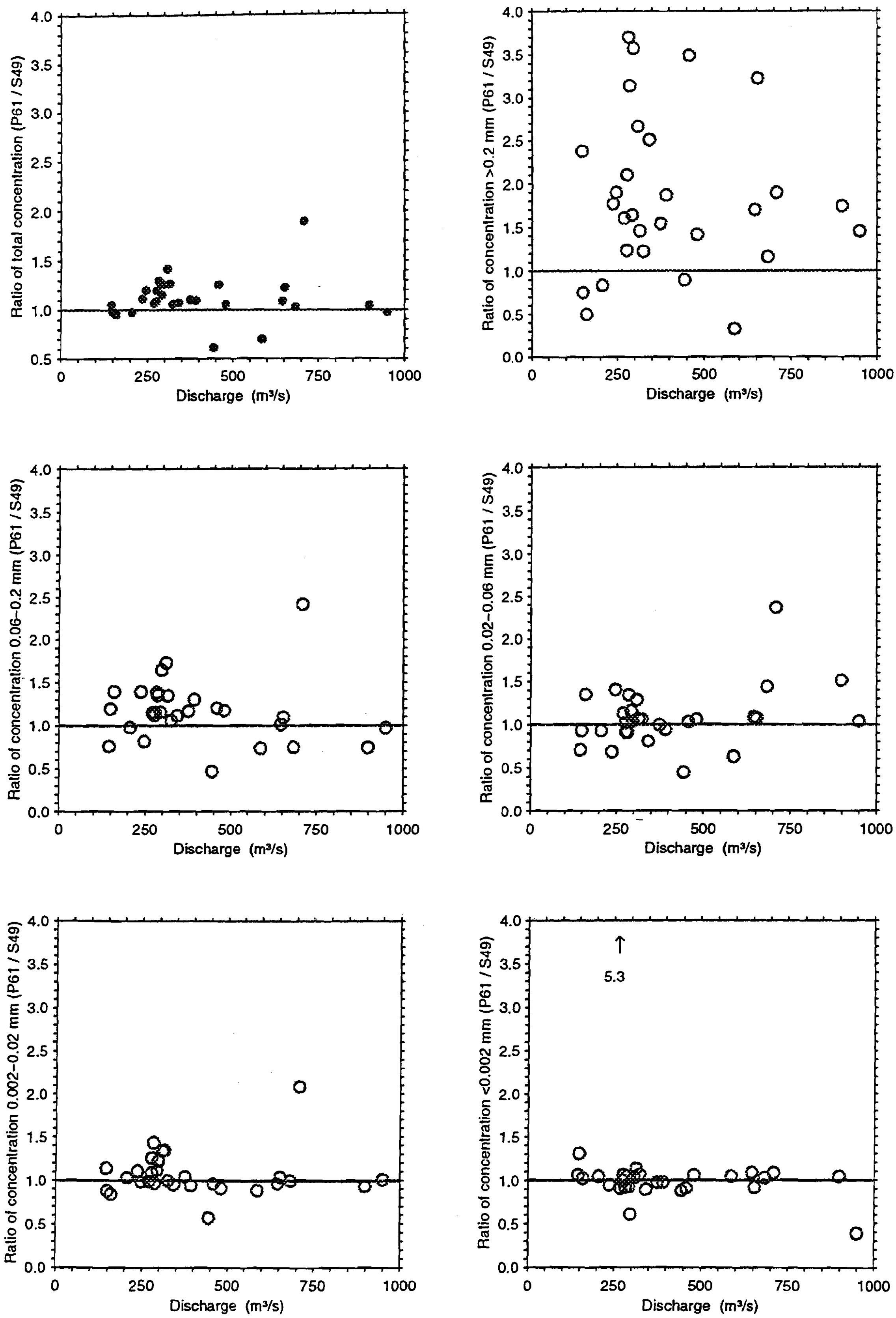


Figure 7: Ratio of sediment concentration in P61 vs. S49 samples.

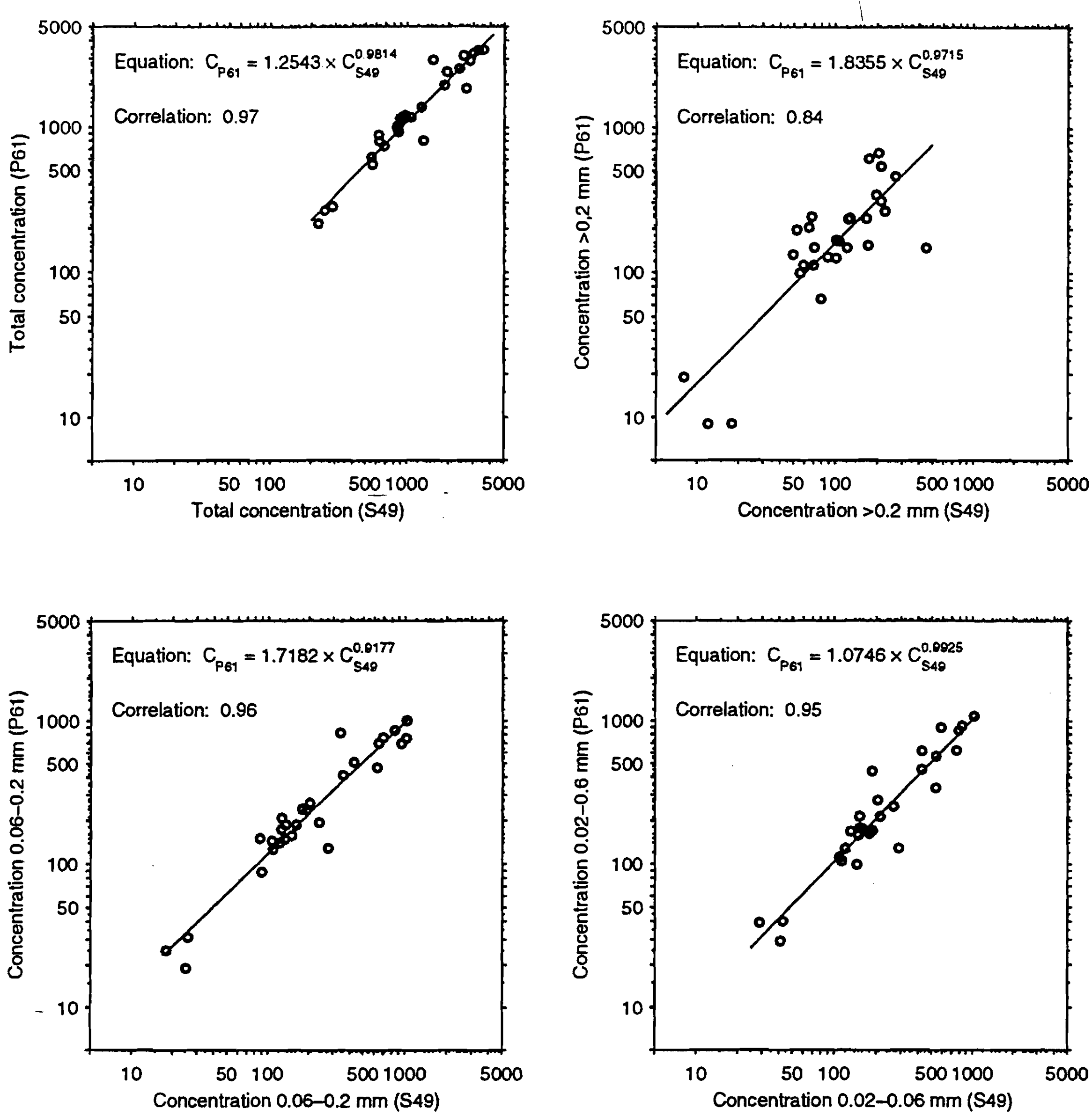


Figure 8: Sediment concentration of total and three coarsest grain size groups (P61/S49).

at several locations on the river transect using the P61 sampler and a 4.5 mm nozzle, and 2) a regular S49 sample normally with a 2 mm nozzle taken from one location at the bridge at Hjarðarhagi where the current is greatest. These sample pairs were used to reevaluate the sediment concentration in regular S-samples from Hjarðarhagi in relation to the concentration of P61 samples taken from the cableway downstream.

When the sediment load in Jökulsá á Dal is calculated, the year is divided in two seasons. The former represents the glacial melting period from July to September, which is called *summer*, and the following season, which includes the remainder of the year, and is classified as *winter*.

In this study, the initial step in the reevaluation of the sediment load in Jökulsá á Dal was to examine the ratio between sediment concentration in samples obtained by the S49 vs. the P61 samplers. Ratios for both total sediment concentration and for sediment concentration in specific grain size classes were studied. One sample taken in October 2000 was excluded from the sample pool due to an anomalous grain size distribution. Hence only five sample pairs obtained during late July and October were used for the *winter* season. The ratio for sediment concentration in these five sample pairs was close to 1.0; thus no revision of older *winter* samples in relation to P61 samples was deemed necessary.

Figure 7 shows the sediment ratio between S49 and P61 samples in the remaining 29 *summer* sample pairs vs. the discharge. The plots show both the total concentration and the individual grain size classes vs. discharge.

The next procedure in the sediment load evaluation was to estimate by how much the older S49 samples needed to be corrected to show sediment concentration equivalent to the P61 samples. The mean of the P61/S49 vs. discharge ratio was calculated from the samples for each size fraction as well as for the total sediment concentration. The total sediment concentration increased by 12%, *sandur* by 85%, *grófmór* by 16%, *fínmór* by 8%, *méla* by 3%, and *leir* decreased by 2%, but one sample was omitted when calculating the change in *méla* and *leir*.

Another procedure was also used by calculating the relationship

$$\mathrm{C_{P61}} = \mathrm{k} \times \mathrm{C}_{S49}^{n} \quad \text{or} \quad \log \mathrm{C_{P61}} = \log \mathrm{k} + \mathrm{n} \times \log \mathrm{C}_{S49}$$

using the least squares regression method. $\mathrm{C_{S49}}$ represents the concentration for S49 samples and $\mathrm{C_{P61}}$ equals the concentration for P61 samples.

The results are shown in Fig. 8, which also includes the values for k, n, and the calculated correlation coefficient, which is good for all size classes except *sandur*. The relationship was not calculated for *méla* and *leir* because the P61/S49 ratio was almost equal to 1 for these size fractions.

The least squares regression method was preferred for the reevaluation of sediment concentration, especially for the *sandur* fraction. This method resulted in a correction of total sediment concentration by 5–10%, *sandur* by 50–70%, *grófmór* by -5 to +10%, and *fínmór* by 0–5%.

As was discussed earlier the sediment concentration in the S3 samples was increased by 17% based on earlier calculations of the mean ratio of sediment concentrations in individual sample pairs. It was then evaluated whether the method of least squares was more suitable for this computation of S3 samples, but that was not the case due to the irregular amount of *sandur* in the samples. Therefore the older method was used on all S3 samples and the total sediment concentration was increased by 17%. Subsequently, the total sediment concentration was reevaluated in all samples obtained from July to September using the least squares method and new sediment rating curves calculated.

S3 samples, although not ideal, were included in the calculation because 5-year-period rating curves were made back to the surge in the Brúarjökull glacier in 1963–4, when almost all samples were of the S3 type.

5 Calculation of suspended load

Both annual and seasonal rating curves were made for the interval 1970–1999, as well as for each 5-year-period from 1965 to 1999. Table 2 shows an overview of the rating curve values that were used to calculate the suspended sediment load in Table 3.

Table 2: Jökulsá á Dal, Hjarðarhagi, rating for total suspended load.

The rating curves are presented by the equation: $q_s = k \times Q^n$
q_s: suspended sediment load (kg/s), k: ratio coefficient, Q: discharge (m^3/s), n: exponent
Max. Q. r.: maximum discharge for rating curve, Min. Q. r.: minimum discharge for rating curve
Max. dmQ.: maximum daily mean discharge for rating curve used
P. a. max. Q. r.: percentage load above maximum discharge of the rating curve
S samples were used. Values for S3 samples were increased by 17%
Summer values were reevaluated based on comparison with P61 samples

Inter-val	Max. Q. r. m^3/s	Max. dmQ. m^3/s	Min. Q. r. m^3/s	P. a. max. Q. r. %	Sample number	Correlation R	Ratio coeff. $k \times 10^6$	Exponent n
Whole year								
1965-69	645	714	26.3	12.7	95	0.98	30	2.95
1970-74	486	590	28.3	1.9	67	0.96	14	3.07
1975-79	795	733	20.0	0.0	54	0.94	214	2.48
1980-84	617	762	16.0	18.7	64	0.96	189	2.46
1985-89	468	962	14.0	40.3	33	0.96	38	2.75
1990-94	762	997	97.1	7.7	24	0.85	214	2.43
1995-99	762	1030	11.0	9.3	47	0.96	194	2.46
1970-99	795	1030	11.0	3.5	289	0.95	103	2.60
Summer								
1965-69	645	714	120	11.2	54	0.91	6620	2.03
1970-74	486	538	127	1.3	33	0.93	19	3.04
1975-79	679	733	147	9.9	25	0.96	561	2.37
1980-84	617	762	117	23.4	27	0.95	332	2.43
1985-89	468	696	123	32.5	17	0.95	213	2.48
1990-94	762	997	127	12.9	15	0.94	41	2.76
1995-99	702	817	89.9	18.4	30	0.97	316	2.42
S1 and S2 samples								
1970-99	762	997	89.9	3.2	119	0.92	266	2.48
Winter								
1965-69	512	563	26.3	7.3	41	0.96	15	3.09
1970-74	409	590	28.3	17.4	34	0.95	33	2.84
1975-79	795	673	20.0	0.0	29	0.93	597	2.21
1980-84	431	667	16.0	22.6	37	0.95	676	2.11
1985-89	241	962	14.0	79.2	16	0.94	123	2.44
1990-94	493	708	97.1	10.4	9	0.74	6180	1.75
1995-99	762	1030	11.0	18.1	17	0.94	420	2.22
S1 and S2 samples								
1970-99	762	1030	14.0	5.1	74	0.90	452	2.26

Sediment load increases exponentially with discharge, which is represented by the exponent 2–3 in the rating curves for Jökulsá á Dal. Daily sediment load was calculated from the daily mean discharge, which should be valid as an approximation, although sediment load is by far the greatest during the daily maximum discharge.

Table 3: Jökulsá á Dal, Hjarðarhagi, total suspended load, millions of tons per year.
F samples for 1963-64, values for S3 samples were increased by 17%
Summer values were reevaluated based on comparison with P61 samples

Year	Daily mean discharge m^3/s	Suspended load using rating curves for 5-year-intervals: Summer	Winter	Summer + winter	Annual rating	Valid interval for rating-curve	Suspended load using annual rating curve 1970-99
1964	129				18	1963-64	3.0
1965	156	9.6	3.3	12.9	15.6	1965-69	6.4
1966	140	8.7	1.8	10.5	12.2		5.1
1967	136	5.4	4.6	10.0	9.0		4.0
1968	160	10.3	2.4	12.7	15.4		6.4
1969	162	11.7	3.4	15.1	19.3		7.7
Total 1965-69		45.7	15.5	61.2	71.5		29.6
Mean 1965-69	151	9.1	3.1	12.2	14.3		5.9
1970	143	3.1	2.8	5.9	7.2	1970-74	3.6
1971	139	6.7	0.8	7.5	6.9		3.5
1972	142	5.4	1.4	6.8	6.7		3.4
1973	144	6.1	1.1	7.2	6.7		3.5
1974	152	4.6	1.9	6.5	6.6		3.5
1975	161	7.0	0.9	7.9	6.7	1975-79	6.7
1976	178	8.3	0.8	9.1	7.6		7.6
1977	158	8.2	1.1	9.3	8.2		8.4
1978	133	5.0	0.5	5.5	4.4		4.4
1979	100	1.5	0.8	2.3	2.4		2.3
1980	145	4.1	0.6	4.7	4.1	1980-84	5.2
1981	148	5.3	0.3	5.6	4.3		5.4
1982	131	4.7	0.4	5.1	4.1		5.3
1983	128	3.9	0.6	4.5	4.1		5.3
1984	186	9.9	0.7	10.6	8.2		10.8
1985	107	1.3	0.3	1.6	1.6	1985-89	1.8
1986	114	2.0	0.5	2.5	2.6		2.9
1987	143	3.2	0.7	3.9	4.2		4.6
1988	163	4.9	0.8	5.7	6.2		6.7
1989	138	3.2	1.2	4.4	5.7		6.0
1990	142	4.4	0.6	5.0	4.1	1990-94	5.4
1991	179	10.6	0.6	11.2	7.6		10.7
1992	144	2.9	0.9	3.8	3.8		5.1
1993	119	1.2	0.6	1.8	1.9		2.3
1994	130	3.3	0.5	3.8	3.1		4.1
1995	146	5.1	1.1	6.2	6.5	1995-99	8.4
1996	161	4.8	0.5	5.3	4.6		5.7
1997	183	10.2	0.4	10.6	8.8		11.4
1998	130	4.1	0.3	4.4	3.6		4.5
1999	147	4.1	0.5	4.6	4.2		5.1
Total 1970-99		149.1	24.2	173.3	156.7		163.6
Mean 1970-99	144	5.0	0.8	5.8	5.2		5.5
S1 and S2 samples		5.0	0.8	5.8			

It is discernible that the values on which the rating curves are based are unequally distributed regarding discharge. High discharge values are predominantly lacking, especially for winter rating curves. Also, the winter rating curves from 1990–1994 are short of low discharge values, but only 9 samples are available for this interval. The winter rating curves for this period are by far the poorest rating curves. This, however, does not greatly affect the total sediment load because the sediment load is low during the wintertime. Most curves include exponents that are considered appropriate for good rating curves.

Suspended sediment load has varied in Jökulsá á Dal since river sediment sampling began in 1963 (Fig. 9). The main reason is the glacier surge in Brúarjökull, which started in mid-October 1963 and continued until 1964. Subsequently, the sediment load in Jökulsá á Dal increased substantially.

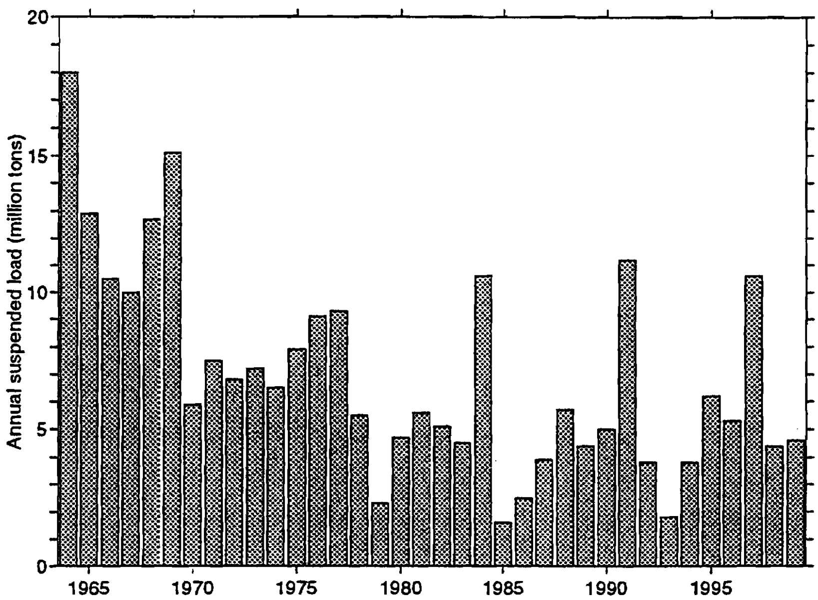


Figure 9: Jökulsá á Dal, Hjarðarhagi, annual suspended load.

Only one sample had been obtained before the surge, in June 1963. Another sample was taken in November 1963 and 11 samples in 1964. A total of 12 samples, which were all F-samples, was obtained during the surge period. Using a rating curve based on these samples, the total suspended sediment load in Jökulsá á Dal was about 17 million tons in 1964. In the samples most of the *sandur* is lacking, but the calculations should approximate well the sediment load in other size classes. To accommodate for the lacking *sandur*, the correct *sandur* content was evaluated from the rating curves for *sandur*. *Sandur*-sized suspended sediment appears not to increase substantially during surging conditions, but is more related to the river discharge. An annual rating curve was calculated including the corrected *sandur* content of the twelve samples collected during the surge in Brúarjökull. The rating curve suggests that the total suspended sediment load in Jökulsá á Dal in 1964 was approximately 18 million tons, but this number is very inaccurate due to few and poor samples.

The aftermath of a glacier surge is probably seen in the environment for several years following the initial surge, especially in the case of a great surge such as in the Brúarjökull glacier in 1963–64. The sampling period that includes S-samples has been divided into 5-year-intervals to evaluate whether the consequences of the surge are observed in the sediment load of Jökulsá. The first interval starts in 1965. Both annual and seasonal rating curves were made for each interval and these are listed in Table 2. Due to the fact that the rating curves for the interval 1965–69 (total 95 samples) are only based on 1 sample from 1965 and 9 samples from 1966 (Fig. 3), the suspended sediment load is surely too low.

Table 3 includes the daily mean discharge for each year and shows, for comparison, the sediment load calculated from rating curves using data from the period 1970–1999. Mean rating curves for both the period 1965–1969 and the period 1970–1999 are included to separate the interval affected by the Brúarjökull surge.

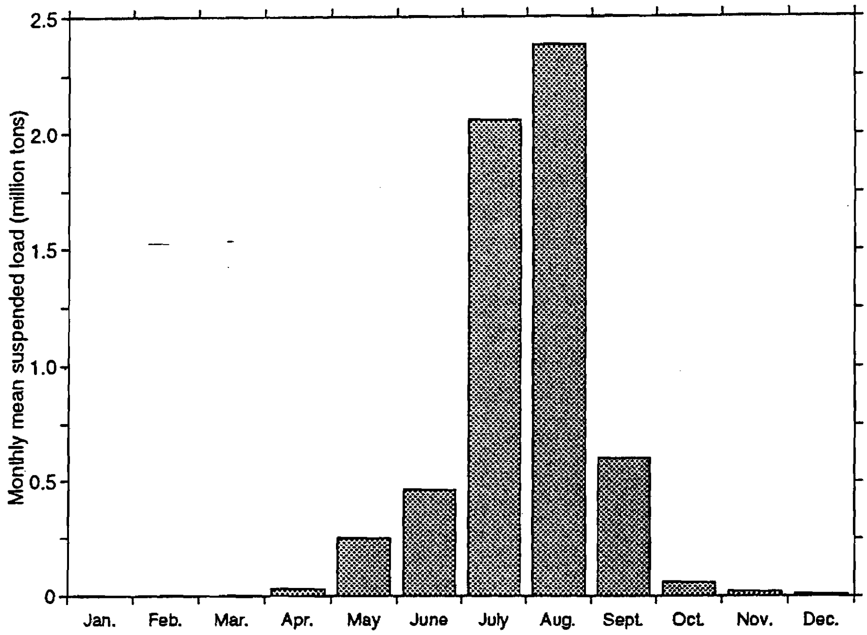


Figure 10: Jökulsá á Dal, Hjarðarhagi, monthly mean suspended load 1970–99.

Table 3 shows the total suspended annual load for the period 1965–1999 calculated by three different means:

1. The sum of winter and summer suspended sediment load as it is calculated based on the seasonal rating curves for each 5-year-period.
2. The suspended sediment load calculated by using the annual rating curves for each 5-year-period.
3. The suspended sediment load calculated by using the 1970–1999 rating curve.

There is insignificant difference between the mean values for the period 1970–1999, after the influence of the Brúarjökull surge has ceased. The mean for the total suspended sediment load using the sum of summer and winter rating curves is, however, most accurate, or 5.8 million tons for 1970–1999. The suspended sediment load increases to 6.7 million tons if the period for 1965–1969 is included, showing that the Brúarjökull surge has significantly influenced the sediment load in Jökulsá á Dal during the years following the surge. Mean suspended load for the period 1970–1999, as calculated by seasonal rating curves for the whole period based on S1 and S2 samples only, is also shown in Table 3 (bottom row) for comparison. These values compare well with the mean values calculated with the seasonal rating curves for the 5-year-periods, which include the S3 samples corrected for 17% increase in total suspended sediment concentration.

The annual sediment load for the period from 1964 to 1999 is shown in Fig. 9. The seasonal 5-year-period rating curves are used for all years except 1964 when the annual rating curve is used (Table 2). Figure 9 shows that sediment load was significantly higher during the first years following the glacier surge in Brúarjökull. Using the 1965–1969 rating curve, the sediment load is about 2.5 times higher for the first 5-year-period after the surge than for the following years which are calculated using the 1970–1999 rating curve. Good and poor hydrological years are easily identified from the figure, especially after 1975 when the effect of the surge has diminished. It should be borne in mind, that the results for 1964 are very inaccurate and too low for the interval 1965–69.

Figure 10 shows the monthly distribution of sediment load during the period 1970–99 based on seasonal 5-year-period ratings. It is evident that the greatest part, or 77%, of the annual load is transported in July and August.

Table 4: Suspended load, grain size groups, millions of tons per year.

Mean load for 1970-99 using annual rating curves for same interval
Only S1 and S2 samples were used

Grain size Classification	Limits mm	Summer	Winter	Summer + Winter	Percentage
Sandur	>0.2	0.86	0.15	1.01	18
Grófmór	0.06-0.2	1.11	0.15	1.26	22
Fínmór	0.02-0.06	1.14	0.15	1.29	22
Méla	0.02-0.002	1.34	0.26	1.60	28
Leir	<0.002	0.51	0.07	0.58	10
Total		4.96	0.78	5.74	100

Table 5: Rating curve values for total suspended load of individual size groups.

Only S1 and S2 samples were used. See Table 3 for explanation of abbreviations

Grain size	Season	Max. Q. r. m^3/s	Max. dmQ. m^3/s	Min. Q. r. m^3/s	P. a. max. Q. r. %	Sample number	Correlation R	Ratio coeff. $k \times 10^6$	Exponent n
Sandur	Summer	762	997	89.9	3.7	119	0.88	14	2.67
	Winter	762	1030	14.0	11.6	74	0.93	0.4	3.15
Grófmór	Summer	762	997	89.9	4.4	119	0.92	2.9	2.97
	Winter	762	1030	14.0	8.4	74	0.90	4.2	2.77
Fínmór	Summer	762	997	89.9	4.3	119	0.91	3.8	2.93
	Winter	762	1030	14.0	7.0	74	0.87	13	2.58
Méla	Summer	762	997	89.9	2.7	119	0.91	367	2.21
	Winter	762	1030	14.0	3.9	74	0.87	561	2.02
Leir	Summer	762	997	89.9	2.5	119	0.86	330	2.07
	Winter	762	1030	14.0	3.4	74	0.68	322	1.89

Table 4 depicts the division of the suspended sediment into grain size classes. The seasonal rating curves based on S1 and S2 samples for the interval 1970-99 were used to find the mean grain size division for the same period. The sum of the suspended load in individual size classes, 5.74 million tons per year, agrees well with total suspended sediment load in Table 3.

The values of the rating curves, which are used to calculate the suspended load in individual size classes, are shown in Table 5. The samples are numerous and are distributed across variable discharge values. Correlation is good or fair except for *leir* during the wintertime and the exponent in the *sandur* rating curve is relatively high. All rating curves, except the *leir* curve for winter, are classified as good or fair.

Values in Table 4 were used to evaluate the distribution of suspended sediment into size classes, which is shown in Fig. 11. Greatest part of the sediment is classified as *mór* and *méla*, and the *mór* can be divided approximately equally into *grófmór* and *fínmór*.

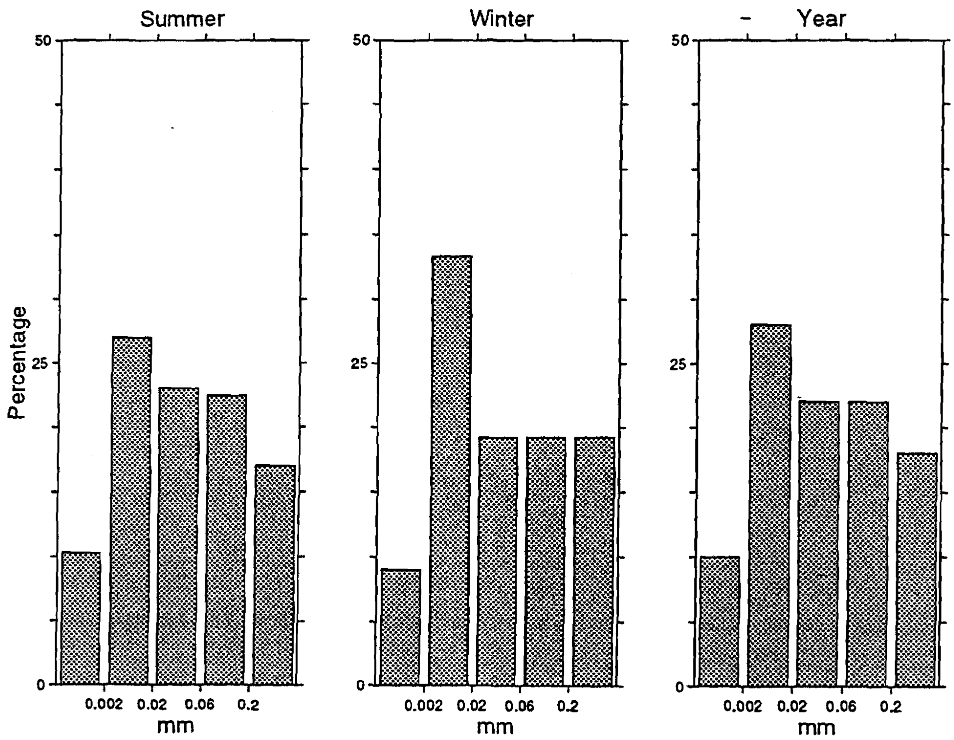


Figure 11: Jökulsá á Dal, Hjarðarhagi, grain size distribution (percentage).

Figure 12 displays how the suspended sediment load in each size class is distributed by percentage into winter vs. summer seasons using values in Table 4. It is clear from Fig. 12 that the suspended sediment load is greatest during the summertime.

Figure 13 shows the percentage difference of total suspended load between the annual rating curves for each 5-year-period and the annual rating curve for the period 1970–99. Before 1975 the suspended load calculated from the 5-year-period rating curves is substantially higher than what is calculated based on the rating curve for the 1970–99 interval, whereas there is no difference between the different calculations for the interval from 1975–79. Conversely, since 1980 the values according to the 5-year-period curves are always less than the values calculated based on the 1970–99 rating curve. Therefore it is concluded that the influence of the Brúarjökull surge on the suspended sediment load in Jökulsá á Dal had ceased by 1975.

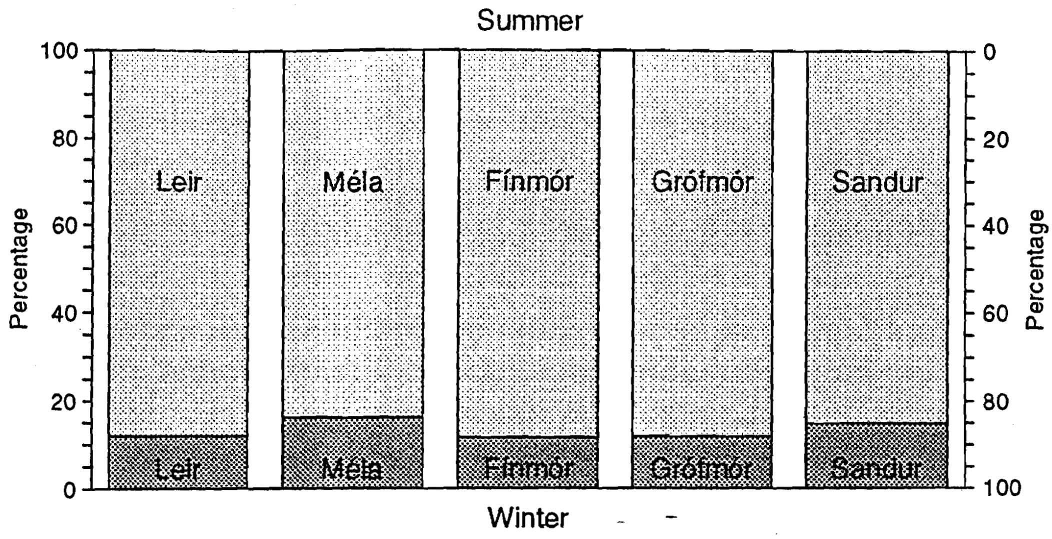


Figure 12: Jökulsá á Dal, Hjarðarhagi, seasonal distribution of grain size groups.

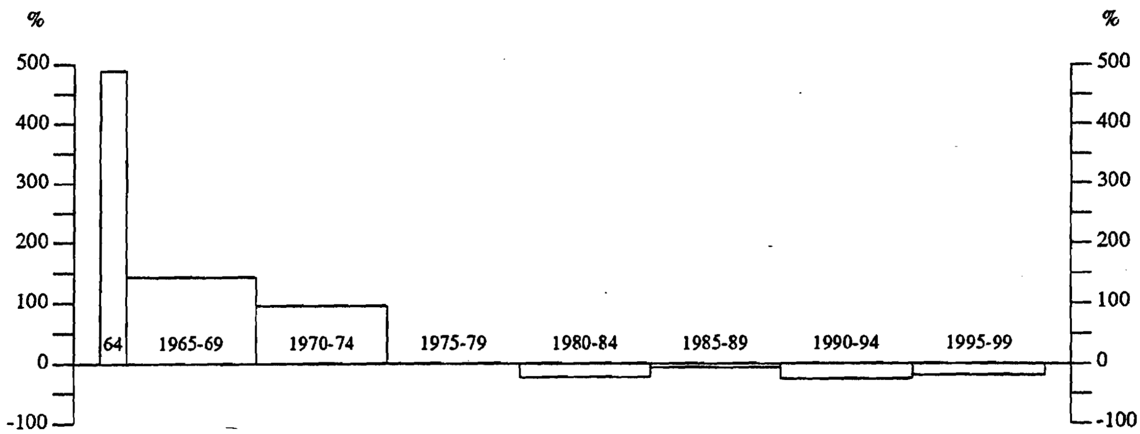


Figure 13: Difference of total suspended load between annual rating curves using 5-year-periods vs. the 1970–99 period.

6 Comparison of suspended load at Hjarðarhagi and Brú

Suspended sediment load and concentration was compared in 29 sample pairs obtained between 1970 and 2000 at the Hjarðarhagi and Brú bridges. All samples were S2 samples taken between May and November from the regular sampling locations on the bridges. The samples are comparable, although both sampling locations are subject to similar sampling problems as were introduced earlier for Hjarðarhagi.

Brú is located more upstream (Fig. 1) and it takes the maximum discharge peak at that location about 3–5 hours to travel downstream to Hjarðarhagi. Only sample pairs when the Brú sample was obtained about 3–5 hours earlier than the sample at Hjarðarhagi were included in the calculation, except when samples were obtained on days with small discharge variation.

The results from this comparison are shown in Fig. 14.

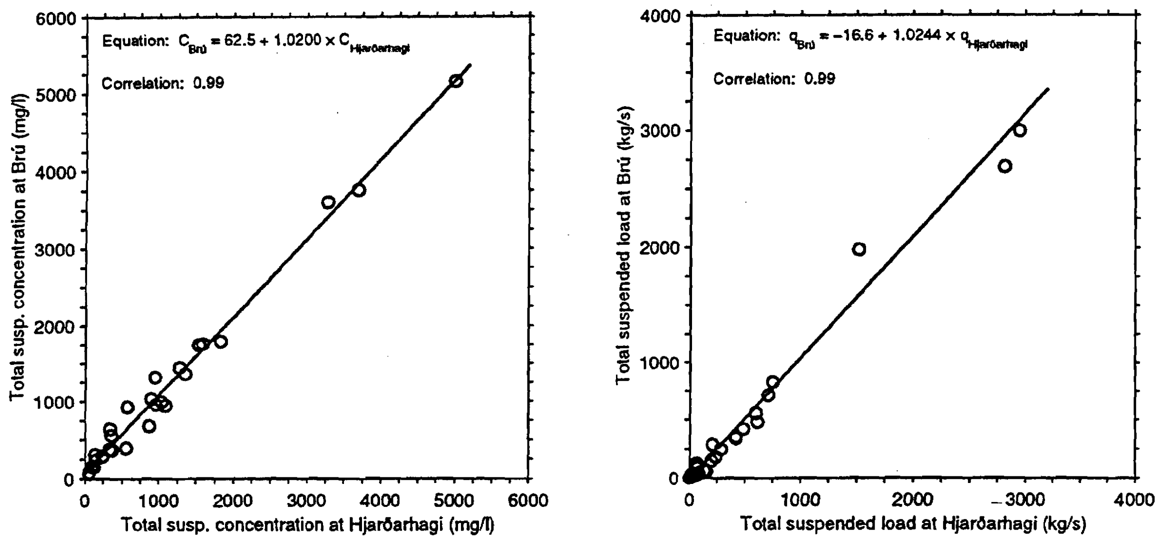


Figure 14: Total suspended concentration and total suspended load (Brú/Hjarðarhagi).

Using the 29 sample pairs, the correlation for both sediment concentration and sediment load for the two locations is very high, or 0.99. Similarly, the sediment concentration and load are about 2% greater at Brú than at Hjarðarhagi. The results published in this report agree well with the results from Haukur Tómasson et al. (1996), who calculated the sediment load to be about 4% higher at Brú than at Hjarðarhagi, by using the seasonal rating curves for 5-year-periods during the interval 1970–1993. Moreover, insignificant amounts of sediment are eroded or deposited between the two sampling sites in Jökulsá á Dal, which agrees well with the result published here, i.e. that similar amounts of sediment are transported at each location. The 2–4% difference between the locations fits well within the error associated with sediment sampling and discharge measurements.

7 Conclusions

The objective of this study is to reassess the suspended sediment load of Jökulsá á Dal. Supplementary sediment sampling with a P61 sampler from a cableway 2 km downstream of the standard sampling site at Hjarðarhagi has made such reassessment possible. The sediment concentration in the standard S49 samples was reevaluated based on the ratio between sediment concentrations in 29 pairs of samples obtained with the S49 sampler from the Hjarðarhagi bridge and with the P61 sampler on a cableway downstream. All these samples were obtained during the *summer* season (July–September).

Three types of rating curves were used to calculate the suspended sediment load:

1. Seasonal rating curves based on samples from 5-year-periods since 1965.
2. Annual rating curves based on the same 5-year-periods.
3. Annual rating curve based on samples 1970–99.

Calculations using the seasonal rating curves over 5-year-periods are considered to give the best results, whereas the annual rating curve for the period 1970-99 should be the least accurate.

The results from the calculations are as follows:

- Mean suspended sediment load for the interval 1970–99 using the seasonal 5-year-period rating curve was 5.8 million tons per year. For the same time interval the annual rating curves over 5-year-periods show sediment load to be 5.2 million tons per year, whereas the annual rating curve for 1970–99 infers the load to be 5.5 million tons per year.

- During 1970–99 about 86% of the suspended sediment load was transported during the interval from July to September, and seventy-seven percent of the sediment load was transported in July and August.

- Suspended sediment load for the years 1965–99 was calculated to be 6.7 million tons using the seasonal 5-year-period rating curves, 6.5 million tons per year using the annual 5-year-period rating curves, but only 5.5 million tons per year using the annual rating curve for 1970–99. The reason for the much lower estimate using the last rating curve is the high sediment load in river Jökulsá á Dal in 1965–69 due to the surge in Brúarjökull in 1963–64. Furthermore it must be borne in mind, that the suspended load in 1965–69 is too low due to uneven distribution of samples during that interval.

- Seventy-two percent of the sediment is classified within the 0.002–0.2 mm grain size range (*méla* and *mór*), and 18% coarser than 0.2 mm. The sum of the mean annual sediment load for each grain size class in the years 1970–99 equals 5.74 million tons per year when using seasonal rating curves for the whole period. This number agrees well with the suspended sediment load calculated using seasonal rating curves for 5-year-periods.

The main conclusions, using the most appropriate rating curves, are:

- Mean annual suspended sediment load during 1970–99 is 5.8 million tons, but 6.7 million tons if the interval from 1965–69 is included.
- Results from the 1996 report showed that the annual sediment load using seasonal rating curves for 5-year-periods from 1970–93 was 5.5 million tons (Haukur Tómasson et al. 1996). Contrarily, the annual rating curves for 5-year-periods estimated the annual suspended load to be 4.9 million tons for the 1970–93 interval, and to be 5.1 million tons using the annual rating curve for the 1970–94 period. Using the seasonal 5-year rating curves, the sediment load increased to 6.6 million tons per year when the post-surge years 1965–69 were added to the time interval. After recalculation of the data to accommodate for corrections following an improvement in sampling strategy, the mean annual suspended sediment load increases by over 300 000 tons per year. This necessary correction in the sediment load had been estimated to be about 1 million tons in the previous report (Haukur Tómasson et al. 1996).

Table 6 shows the main conclusions both from the present calculations and the calculations presented in the report of 1996. The results, which are concidered to be the most reliable, are boldfaced.

Table 6: Main conclusions, annual suspended sediment load (million tons per year).

Types of rating curves	Calculated suspended sediment load Present calculations	 Report of 1996
	1970-99	1970-93
Seasonal 5-year-periods	**5.8**	**5.5**
Annual 5-year-periods	5.2	4.9
Annual whole period	5.5	5.1
	1965-99	1965-93
Seasonal 5-year-periods	**6.7**	**6.6**
Annual 5-year-periods	6.5	6.3

However, it must be clear that the sediment pairs used for reevaluation of the standard samples obtained from the bridge at Hjarðarhagi reflect the different sampling sites, as well as the difference in sampling techniques. The river flow is more turbulent at the Hjarðarhagi bridge than at the cableway downstream which should cause higher suspended sediment concentration at the former site. On the contrary, the turbulent conditions at the Hjarðarhagi bridge hinder the S49 sampler reaching down to the riverbed; thus the difference between the samples in each pair is relatively small.

To get satisfactory information on the total sediment transport in Jökulsá á Dal, which is necessary for estimating the sediment accumulation in a reservoir for hydroelectric power plant, it is essential to study the transport of bedload at the same sampling site as used for obtaining the suspended sediment samples. Such study is possible at the cableway at Hjarðarhagi, but not at the bridge.

Comparison of suspended sediment load at the two sampling locations in Jökulsá á Dal, Hjarðarhagi and Brú, indicates that the difference between the two locations fits well within the error associated with sediment sampling and discharge measurements.

8 References

Árni Snorrason 1985: Analysis of River Flow Data From a Glaciated Basin in Iceland. In: *Multivariate Analysis of Hydrological Processes, Proceedings of Fourth International Hydrology Symposium 1985.* Eds. H. W. Shen, J. Obeysekera, V. Yevjevich, and D. Decoursey. Colorado State University, Colorado, USA, pp. 651–663.

Ásgeir Gunnarsson, Jórunn Harðardóttir, Árni Snorrason, and Svanur Pálsson 2001: *Mælingar á rennsli og svifaur í Jökulsá á Dal árið 2000.* Orkustofnun, report in preparation.

Haukur Tómasson, Svanur Pálsson, and Guðmundur H. Vigfússon 1996: *Framburður svifaurs í Jökulsánum norðan Vatnajökuls.* Orkusofnun, report OS–96024/VOD–02.

Orkustofnun Hydrological Service 2000: *Data base on river discharge.*

Svanur Pálsson 1996: *Samanburður aðferða við töku svifaurssýna í Jökulsá á Dal og Jökulsá í Fljótsdal 1995 og 1996.* Orkustofnun, report OS–96070/VOD-13 B.

Svanur Pálsson and Sigfinnur Snorrason 1996: *Samanburður aðferða við töku svifaurssýna í Jökulsá á Dal og Jökulsá í Fljótsdal 1995.* Orkustofnun, report OS–96002/VOD-01 B.

Svanur Pálsson and Guðmundur H. Vigfússon 1996: *Gagnasafn aurburðarmælinga 1963–1995.* Orkustofnun, report OS–96032/VOD–05 B.

Svanur Pálsson, Árni Snorrason, Hákon Aðalsteinsson, and Haukur Tómasson 1998: Discharge and Sediment Transport from the Glaciated River Basin of Jökulsá á Dal. In: *XX. Nordic Hydrological Conference.* Ed. Juha Kajander. Nordic Association for Hydrology, Helsinki, Finland, pp. 365–366.

Svanur Pálsson and Ásgeir Gunnarsson 1998: *Samanburðarmælingar á svifaur í Jökulsá á Dal 1998.* Orkustofnun, preliminary report.

Svanur Pálsson and Ásgeir Gunnarsson 1999: *Samanburðarmælingar á svifaur í Jökulsá á Dal 1999.* Orkustofnun, preliminary report.

9 Ágrip

Í skýrslu þessari er fjallað um endurreikninga á framburði svifaurs í Jökulsá á Dal við Hjarðarhaga. Í skýrslu Orkustofnunar frá 1996 um framburð svifaurs í Jökulsánum norðan Vatnajökuls kom fram, að framburðurinn væri vanreiknaður í Jökulsá á Dal bæði við Hjarðarhaga og Brú vegna þess, að venjulegur sýnataki, S49, kemst ekki niður að botni vegna straumhraða og iðukasta. Af sömu ástæðu varð að notast við tiltölulega þröngan inntaksstút í sýnatakanum. Því varð að gera ráð fyrir, að eitthvað af grófum svifaur vantaði í sýnin og var í skýrslunni sett fram sú ágiskun, að framburðurinn væri af þeim sökum vanreiknaður um 1 milljón tonna á ári að meðaltali.

Forsendurnar fyrir því, að unnt sé að endurreikna framburðinn, eru þær, að tekin höfðu verið sýni af svifaur með sýnataka P61, sem kemst niður að árbotni við rennslismæliklát um 2 km neðan brúarinnar, en þar hefur verið hefðbundinn sýnatökustaður. Sá sýnataki var ennfremur með víðari inntaksstút en unnt var að nota í sýnataka S49. Aurstyrkurinn í hefðbundnum sýnum í gagnasafni Orkustofnunar teknum frá brúnni með sýnataka S49 var endurmetinn út frá hlutfallinu milli styrks í sýnum teknum með sýnataka P61 og sýnataka S49 í 29 pörum teknum á þeim tíma, sem hér er skilgreindur sem sumar, þ. e. júlí–september.

Við útreikninga á framburði svifaurs voru notaðir þrenns konar svifaurslyklar:

1. Árstíðalyklar byggðir á sýnum frá fimm ára tímabilum, 1965–99.
2. Árslyklar byggðir á sýnum frá sömu fimm ára tímabilum.
3. Árslykill byggður á sýnum frá 1970–99.

Reikningar samkvæmt árstíðalyklum fimm ára tímabila eru taldir gefa áreiðanlegustu niðurstöðurnar, en árslykillinn fyrir tímabilið 1970–99 ætti hins vegar að gefa óáreiðanlegustu niðurstöðurnar.

Niðurstöður reikninganna eru þessar:

- Meðalframburður á árabilinu 1970-99 samkvæmt árstíðalyklum fimm ára tímabila reiknast 5,8 milljónir tonna á ári. Fyrir sama tímabil gefa árslyklar tímabila 5,2 milljónir tonna og árslykillinn 1970–99 5,5 milljónir.
- Um 86% svifaursins berast fram á sumrin, þar af berast um 77% fram í mánuðunum júlí og ágúst. Hér er miðað við tímabilið 1970–99.
- Sé miðað við tímabilið 1965–99 reiknast framburðurinn samkvæmt árstíðalyklum fimm ára tímabila 6,7 milljónir tonna á ári, samkvæmt árslyklum fimm ára tímabila 6,5 milljónir tonna og samkvæmt árslykli 1970–99 5,5 milljónir. Ástæðan fyrir því, að árslykillinn 1970–99 gefur miklu lægri niðurstöðu en hinir, er sú, að vegna framhlaups í Brúarjökli 1963–64 var framburður miklu meiri á árunum 1965–69 en á öðrum fimm ára tímabilum frá 1965–99, og þessi aukning kemur ekki fram í árslyklinum 1970–99. Vert er að geta þess, að framburður á tímabilinu 1965–69 er vafalaust vanreiknaður vegna þess, að hlutfallslega mjög fá sýni voru tekin á tveimur fyrstu árum tímabilsins.

- Summan af meðalframburði svifaurs af einstökum kornastærðarflokkum á ári á tímabilinu 1970–99 reiknast 5,74 milljónir tonna á ári. Byggt var á árstíðalyklum fyrir allt tímabilið. Þetta kemur vel heim við niðurstöðuna 5,8 milljónir tonna byggða á árstíðalyklum fimm ára tímabila.

Á grundvelli þeirra svifaurslykla, sem áreiðanlegastir eru taldir, fást þessar megin-niðurstöður.

Meðalframburður svifaurs á tímabilinu 1970–99 reiknast 5,8 milljónir tonna á ári, en hann reiknast 6,7 milljónir, ef tímabilið 1965–69 er tekið með. Munurinn liggur í stórauknum framburði fyrstu árin eftir framhlaup Brúarjökuls.

Reikniniðurstöðurnar í skýrslunni frá 1996 voru þær, að framburðurinn samkvæmt árstíðalyklum tímabila 1970-93 reiknaðist 5,5 milljónir tonna á ári. Fyrir sama tímabil gáfu árslyklar tímabila 4,9 milljónir tonna og árslykillinn 1970–94 5,1 milljón. Fyrir tímabilið 1965-93 reiknaðist framburðurinn að meðaltali 6,6 milljónir tonna samkvæmt árstíðalyklum fimm ára tímabila. Niðurstöðurnar nú, þegar tekið er tillit til endurbættrar sýnatökuaðferðar, sýna aukningu á meðalframburði á ári um 300 000 tonn. Í fyrrnefndri skýrslu var giskað á, að framburður væri vanreiknaður um 1 milljón tonna á ári að meðaltali.

Því verður að bæta við, að sýnapörin, sem lögð voru til grundvallar endurmati á mæligildum hefðbundinna sýna, sem tekin voru frá brúnni á Jökulsá, endurspegla ekki einungis tvær sýnatökuaðferðir, heldur tvo sýnatökustaði. Við brúna er aurinn vafalítið betur upphrærður en við kláfinn, þ. e. hlutfallslega meira berst fram sem svifaur á fyrrtalda staðnum. Hins vegar virðist oft skorta töluvert á, að sýnatakinn komist til botns við brúna. Hið fyrrtalda getur skýrt það, að ekki er meiri munur á aurstyrk milli sýnanna í pörunum en raun ber vitni.

Til þess að fá viðunandi upplýsingar um heildaraurframburð með tilliti til aurfyllingar í miðlunarlóni er nauðsynlegt að kanna einnig framburð skriðaurs á sama sýnatökustað og svifaurssýnin eru tekin. Það er einnig unnt að gera við kláfinn, en alls ekki við brúna.

Mælingar á sýnapörum teknum á hefðbundinn hátt við brýrnar við Hjarðarhaga og Brú sýna engan marktækan mun á svifaursframburði á þessum tveimur stöðum, og ber því saman við niðurstöður útreikninga á framburði í fyrri skýrslu.