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Report No. 15

Third Interim Report on the Arctic River Data Base (ARDB) for the Arctic Climate System Study (ACSYS): Plausibility Control and Data Corrections - Technical Report -

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1. Introduction

In accordance with the Initial Implementation Plan for the Arctic Climate System Study (ACSYS) the main objective of the GRDC is to compile the Arctic River Data Base (ARDB) for ACSYS. Initially, the main intention of this task has been to calculate freshwater fluxes into the Arctic Ocean. Prior to the recent calculations, there was a great bandwith in this estimation of about 50 % which is not acceptable for the needs of hydrological and climatological modelling.

In the meantime the database has grown up from 15 stations as stated in the ACSYS-Science Plan (1992) to 182 stations in 1995 and 235 stations in 1996 and up to now. Details of the structure and the development of the ARDB are described in the first and second Interim Reports on the Arctic River Database from 1995 and 1996 (GRDC-Reports Nos. 8, 12).

Meanwhile the calculation of the river runoff in the Arctic Ocean is possible, using the 35 largest rivers by area selected from the total of 235 stations of the ARDB. It could be demonstrated (GRDC-Report No. 12) that the use of 35 stations is sufficient for this calculation, because the greatest part of the arctic drainage area is covered by already 24 of the largest rivers (figure 1). For the purpose of surface water flux calculations, there is only a marginal advantage in using more than 35 stations especially when a monitoring component was considered in the ACSYS project. A catalog with some important metadata of these stations is attached as annex 1 to this report.

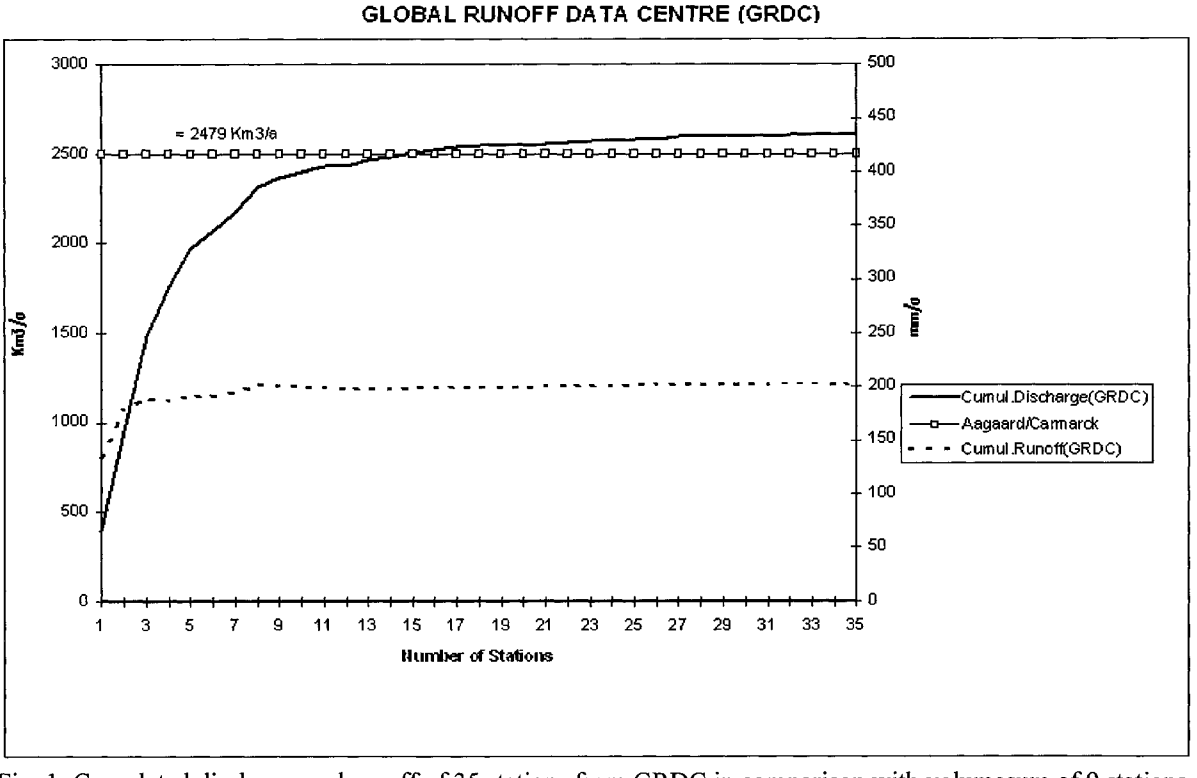


Fig. 1: Cumulated discharge and runoff of 35 stations from GRDC in comparison with volumesum of 9 stations from Aagaard and Carmack

2. Rationale for this report

Data quality is of overriding importance for modelling purposes. The responsibility for the quality of data lies with the data providers - usually national hydrological services. However, errors may occur during data transfer, typing, printing etc. at several points in the process which tend to slip usual precautionary measures of the services. For this reason, GRDC screened the station data for the 35 stations which have been used for the calculation of surface water fluxes to the Arctic Ocean. The selection of these stations has been made on the basis of first priority.

During the progress of the project, the need for more hydrological data has become evident. It is now clear, that ACSYS is growing far beyond the initial task for the GRDC to calculate surface water fluxes to the Arctic Ocean. Specifically, hydrological data are required from inland stations for the development of landsurface - atmosphere exchange models, tailored specifically to Arctic conditions. The GRDC is cognizant of the desire of the ACSYS science community to include more stations into the data quality screening process. GRDC therefore calls on ACSYS members to identify those stations which should have priority for further screening and to report these stations to GRDC.

3. Checking of data - general

A first data screening is performed before import of data to the GRDC database. For the purpose of ACSYS, the recently developed Plausibility Tool of the GRDC was applied to the 35 priority gauging stations data. The plausibility tool allows the graphical visualization of monthly and daily time series of discharge data, comparison with time series of other stations or time intervals and the correction of faulty values. Correction can be done using several methods including interpolation, regression, expert decisions. Corrected values are then stored in a corrected version of the database while the original values are maintained for reference purposes in backup files of the database system. Evident irregularities in the hydrographs of time series screening were printed and the critical values marked (see annex 3). After having finished screening the station, the values were corrected in the raw data.

Likewise, the plausibility tool allows the closure of data gaps using a variety of statistical methods. However, no data gaps were closed for the purpose of quality control of ARDB-data.

This screening method allows the checking of the plausibility of hydrological time-series. It does not allow to make any statement about the original accuracy or homogeinity of the time series. This would require extensive accessibility to further station information (e.g. cross-section chacteristics, rating curves, instruments used) and methods of primary data processing (primary quality control etc).

4. Checking of the data - 35 main stations

To keep efforts in a reasonable limit, first of all the 35 stations used for the computation of the freshwater fluxes into the Arctic Ocean were examined by using the plausibility tool. The results

of the plausibility control confirm the generally good quality of the data.

No plausibility errors in monthly data were detected. In the daily time series, some errors were recognized and corrected. Some examples are: wrong typed or transferred numbers (8 instead of 3), changed digits (981 instead of 198), digits forgotten or to much (123 instead of 1230). These errors could be manually corrected (see annex 2). For other errors the method of linear interpolation was used.

In the graphs, several variations of the effect of snow and ice and human influence (possible reservoir operation) on the hydrological regime could be recognized, partly with sudden changes or large variations in the discharge time series. Changes to the discharge values were made only where an error was beyond reasonable doubt.

5. Assessment of data quality

Concerning the plausibility of data of the examined 35 discharge stations the assumed good quality can be confirmed. No plausibility errors occured in monthly time series. In the daily series, about 636 station years with 228.000 values were examined. Here 48 daily values were corrected, corresponding to a rate of 0,02%. This error rate had most probably no effect on the ACSYS-studies of the past, because only a few single values were incorrect. However, calculations with a scope on high temporal and spatial resolution may be affected. The corrected data were stored in the ARDB, and in order to make the corrections comprehensible, the original values remain accessible, too.

6. Conclusion

A plausibility analysis for 35 stations of the Arctic River Data Base has been made with the result of a very low error rate. The ARDB has been updated with the corrected values. The annexes attached to this report give details about the stations used for plausibility control and observed errors.

ACSYS-scientists are requested to define stations which should be screened in a second priority phase of the data screening effort for ACSYS.

ANNEX

Annex 1: 35 GRDC stations for computing Freshwater Fluxes into the Arctic Ocean

River specification	Country	Coordinates	Catchment area [km²]	Monthly data from - to	Daily data from - to
GRDC-No. 2912600 River: Ob Station: Salekhard	RS	66.57N/66.53E	2949998	1/1930 - 12/1994	1/1978 - 12/1994
GRDC-No. 2903430 River: Lena Station: Stolb	RS	72.37N/126.80E	2460000	1/1978 - 12/1994	1/1978 - 12/1994
GRDC-No. 2909150 River: Yenisei Station: Igarka	RS	67.48N/86.50E	2440000	1/1936 - 12/1995	5/1978 - 12/1995
GRDC-No. 2903420 River: Lena Station: Kusur	RS	70.70N/127.65E	2430000	1/1935 - 12/1994	1/1978 - 12/1994
GRDC-No. 4208025 River: Mackenzie River Station: Arctic Red River	CN	67.46N/133.74W	1660000		8/1972 - 12/1992
GRDC-No. 4103200 River: Yukon Station: Pilot Station	US	61.93N/162.88W	831390		10/1975 - 9/1993
GRDC-No. 2998510 River: Kolyma Station: Kolymskaya	RS	68.73N/158.72E	526000	1/1978 - 12/1994	1/1978 - 12/1994
GRDC-No. 6970250 River: Northern Dvina(Severnaya Dvina) Station: Ust-Pinega	RS	64.10N/42.17E	348000	6/1881 - 12/1993	1/1883 - 12/1993
GRDC-No. 6970710 River: Pechora Station: Oksino	RS	67.63N/52.18E	312000	1/1989 - 12/1993	5/1980 - 12/1993

River specification	Country	Coordinates	Catchment area [km²]	Monthly data from - to	Daily data from - to
GRDC-No. 2998400 River: Indigirka Station: Vorontsovo	RS	69.58N/147.35E	305000	1/1937 - 12/1994	1/1978 - 12/1994
GRDC-No. 2998110 River: Yana Station: Ubileynaya	RS	70.75N/136.08E	224000	1/1978 - 12/1994	1/1978 - 12/1994
GRDC-No. 2999910 River: Olenek Station: 7.5km Downstream mouth River Pur	RS	72.12N/123.22E	198000	1/1965 - 12/1984	
GRDC-No. 2998150 River: Omoloy Station: Namu	RS	69.38N/134.62E	108000	1/1979 - 12/1993	1/1979 - 12/1993
GRDC-No. 2999250 River: Taz Station: Sidorovsk	RS	66.60N/82.28E	100000	1/1978 - 12/1994	1/1978 - 12/1994
GRDC-No. 4209800 River: Back Station: below Deep Rose Lake	CN	66.08N/96.50W	98200	1/1966 - 12/1984	
GRDC-No. 2999500 River: Pur Station: Samburg	RS	67.08N/78.15E	95100	1/1965 - 12/1990	1/1978 - 12/1990
GRDC-No. 6970500 River: Mezen Station: Malonisogorskaya	RS	64.95N/45.67E	56400	1/1965 - 12/1993	1/1978 - 12/1993
GRDC-No. 6970100 River: Onega Station: Porog	RS	63.80N/38.27E	55770	1/1965 - 10/1993	1/1978 - 10/1993
GRDC-No. 4209400 River: Coppermine River Station: Point Lake Outlet	CN	65.41N/114.00W	19300		7/1965 - 12/1992
GRDC-No. 4209550 River: Burnside River Station: near The mouth	CN	66.74N/108.82W	16800		9/1976 - 12/1992

River specification	Country	Coordinates	Catchment area [km²]	Monthly data from - to	Daily data from - to
GRDC-No. 6730500 River: Tana Station: Polmak	NO	70.07N/28.05E	14005	1/1912 - 12/1987	
GRDC-No. 6971600 River: Varzuga Station: Varzuga	RS	66.40N/36.63E	7940		1/1979 - 12/1988
GRDC-No. 6401120 River: Thjorsa Station: Urridafoss	IL	63.93N/20.60W	7200	4/1947 - 12/1993	1/1947 - 12/1993
GRDC-No. 6401700 River: Joekulsa a Fjollum Station: Dettifoss	IL	66.03N/16.45W	7000	9/1939 - 12/1984	1/1939 - 12/1984
GRDC-No. 6971150 River: Umba Station: Paialka	RS	66.64N/34.08E	6250		1/1979 - 12/1988
GRDC-No. 4209500 River: Tree River Station: near The mouth	CN	67.63N/111.88W	5960		12/1968 - 12/1992
GRDC-No. 6401090 River: Oelfusa Station: Selfoss	IL	63.94N/21.01W	5760	9/1950 - 12/1992	1/1950 - 12/1992
GRDC-No. 6731950 River: Altaelv Station: Masi	NO	69.42N/23.63E	5693	1/1978 - 12/1983	
GRDC-No. 6971100 River: Kola Oktiabrsky Station: Railway,km 1429	RS	68.88N/33.05E	3780	1/1965 - 12/1984	1/1979 - 12/1988
GRDC-No. 4209450 River: Big River Station: above Egg River	CN	72.48N/123.40W	3640		7/1975 - 12/1988
GRDC-No. 6401800 River: Lagarfljot Station: Lagarfoss	IL	65.50N/14.37W	2800	9/1949 - 9/1993	1/1949 - 12/1993

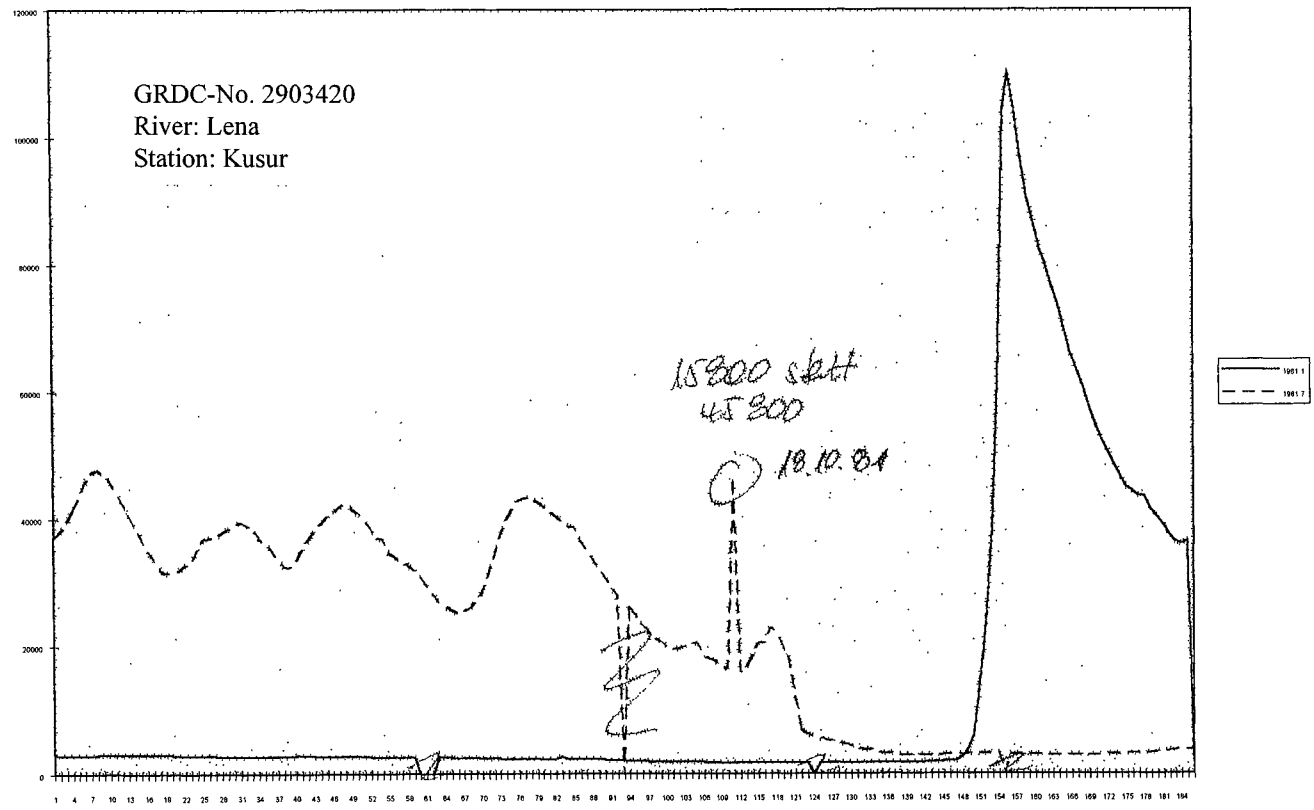
River specification	Country	Coordinates	Catchment area [km²]	Monthly data from - to	Daily data from - to
GRDC-No. 6970630 River: Pesha Station: Volokovaya	RS	66.50N/48.25E	2780	1/1989 - 12/1993	1/1978 - 12/1993
GRDC-No. 4209580 River: Gordon River Station: near The mouth	CN	66.81N/107.10W	1530		8/1977 - 12/1992
GRDC-No. 4209650 River: Freshwater Creek Station: near Cambridge Bay	CN	69.13N/104.99W	1490		7/1970 - 12/1992
GRDC-No. 6970200 River: Solza Station: Soukhie Porogui	RS	64.31N/39.48E	1190		1/1978 - 12/1987
GRDC-No. 4209600 River: Ellice River Station: near The mouth	CN	67.71N/104.14W			1/1971 - 12/1992

Annex 2: Corrections made to daily runoff values

Station	Date	Old Value [m³/s]	New Value [m³/s]	Correction method
2903420 River: Lena Station: Kusur	Oct 18, 1981 Aug 16, 1983 Aug 17, 1991 Aug 19, 1991	45800 21400 42620 42440	15800 31400 26000 23850	manual manual manual linear interpolation
GRDC-No. 2903430 River: Lena Station: Stolb	Jul 13, 1986	3270	32700	manual
GRDC-No. 2909150 River: Yenisei Station: Igarka	Oct 21, 1980 Jul 11, 1991 Sep 30, 1991	76200 92920 41400	7620 29120 14400	manual manual manual
GRDC-No. 2998400 River: Indigirka Station: Vorontsovo	Aug 10, 1989 Sep 16, 1989 Sep 21, 1989 Aug 02, 1990	2490 2930 2562 4660	4920 5930 5562 7660	manual manual manual manual
GRDC-No. 2998510 River: Kolyma Station: Kolymskaya	Aug 14, 1978	5590	8590	manual
GRDC-No. 2999250 River: Taz Station: Sidorovsk	Aug 01, 1981 Aug 02, 1981 Jul 21, 1983 Jul 07, 1986 Nov 08, 1986 Jun 04, 1986 Jul 08, 1993 Jun 09, 1993	5490 4240 2420 2470 514 2850 2600 3110	2490 2440 3420 3470 814 3850 4600 4640	manual manual manual manual manual manual manual linear interpolation

Station	Date	Old Value [m³/s]	New Value [m³/s]	Correction method
GRDC-No. 6970100 River: Onega Station: Porog	Oct 06, 1980	900	273	linear interpolation
	Oct 17, 1980	617	364	linear interpolation
	Oct 25, 1980	161	428	linear interpolation
	Nov 06, 1980	318	918	manual
	Nov 17, 1980	241	618	linear interpolation
	Aug 14, 1981	596	196	manual
	Sep 21, 1984	715	378	linear interpolation
	Nov 21, 1984	257	503	linear interpolation
	Jul 04, 1985	345	845	manual
	Jun 07, 1989	287	554	linear interpolation
	Jul 07, 1989	551	312	linear interpolation
	Sep 07, 1989	236	671	linear interpolation
	May 25, 1992	231	2310	manual
	May 26, 1992	206	2060	manual
	May 27, 1992	187	1870	manual
	May 28, 1992	168	1680	manual
	May 29, 1992	150	1500	manual
	May 30, 1992	132	1320	manual
	May 31, 1992	119	1190	manual
GRDC-No. 6970250 River: Northern Dvina (Severnaya Dvina) Station: Ust-Pinega	Apr 26, 1990	10800	19800	manual
GRDC-No. 6970710 River: Pechora Station: Oksino	Oct 23, 1989	493	4930	manual
	Oct 24, 1989	493	4930	manual
	Nov 03, 1991	506	5060	manual
	May 30, 1992	24400	29650	linear interpolation
	Sep 20, 1992	367	3670	manual
GRDC-No. 6971100 River: Kola Oktiabrsky Station: Railway,km 1429	Jun 01, 1980	3	410	linear interpolation
	Mar 26, 1988	111	11	manual

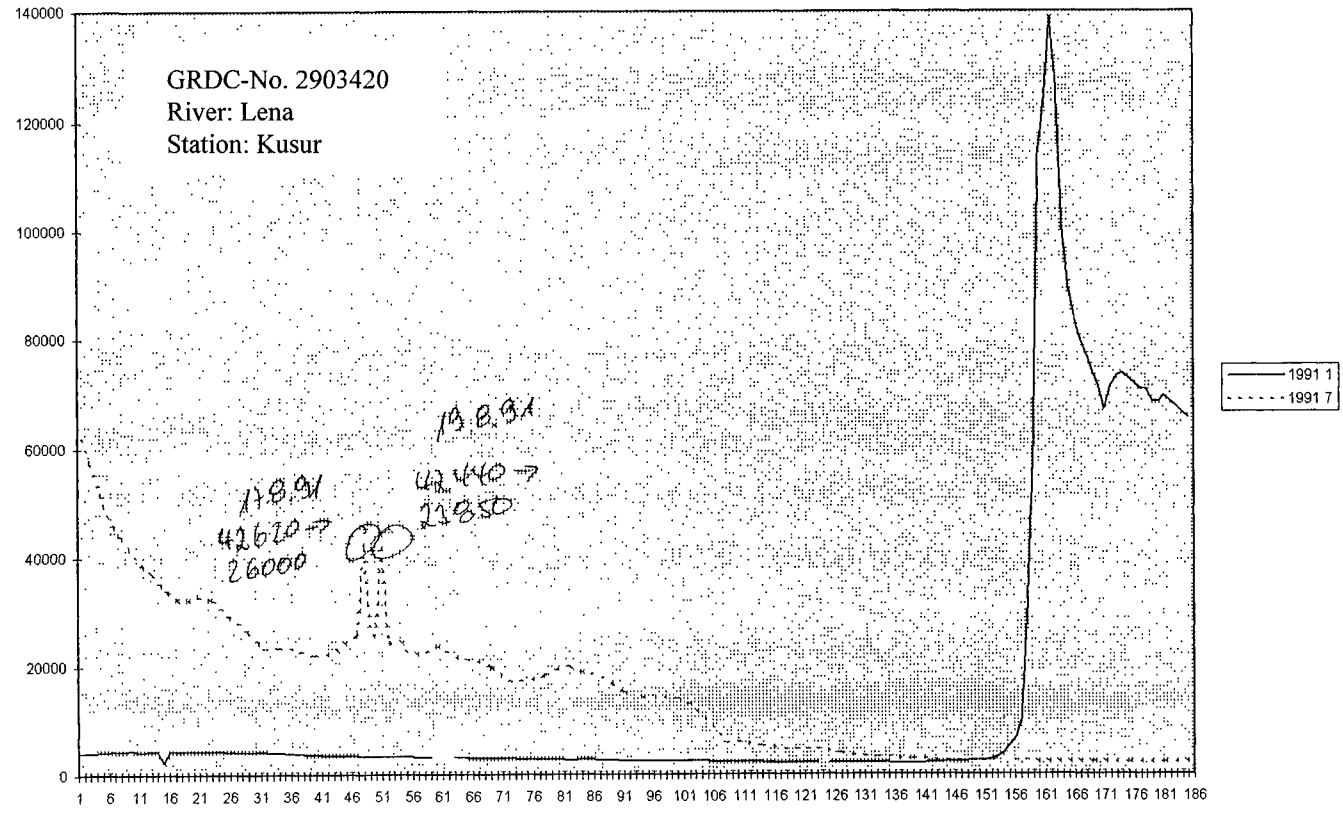
ANNEX 3: Plots of discharge time series



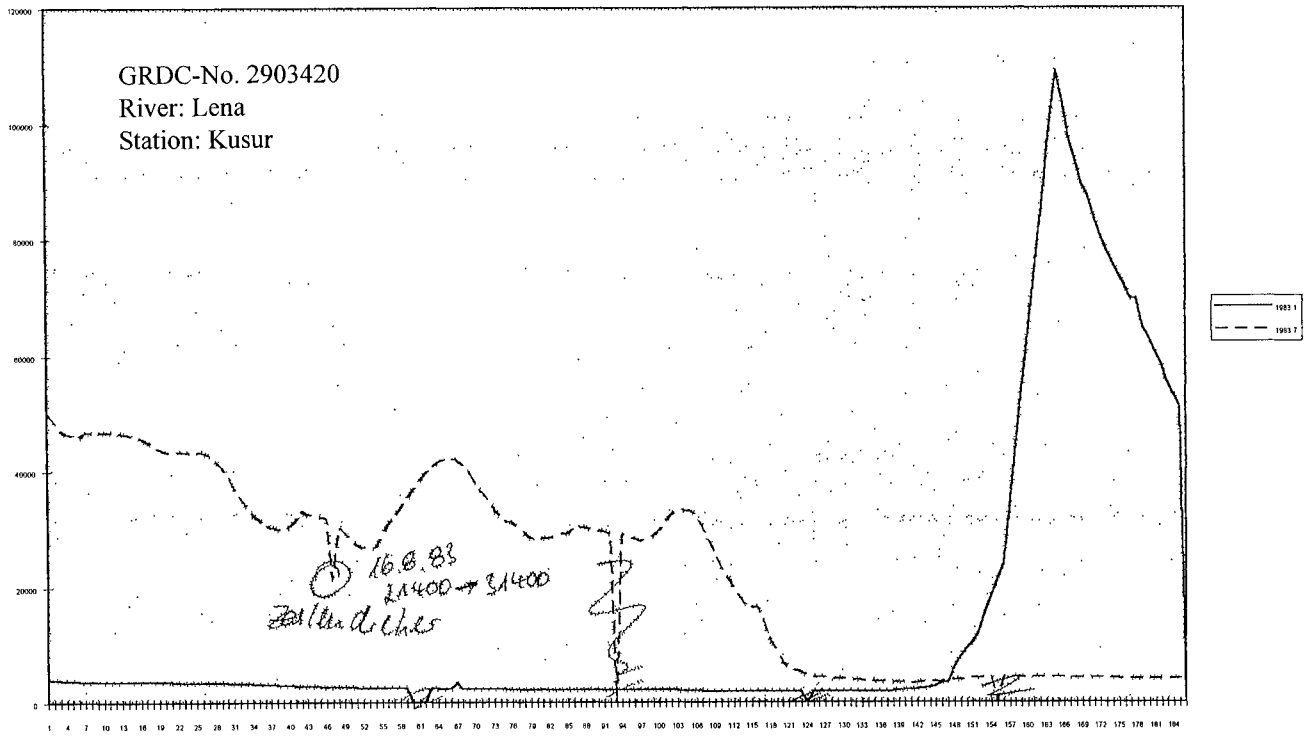
2903420

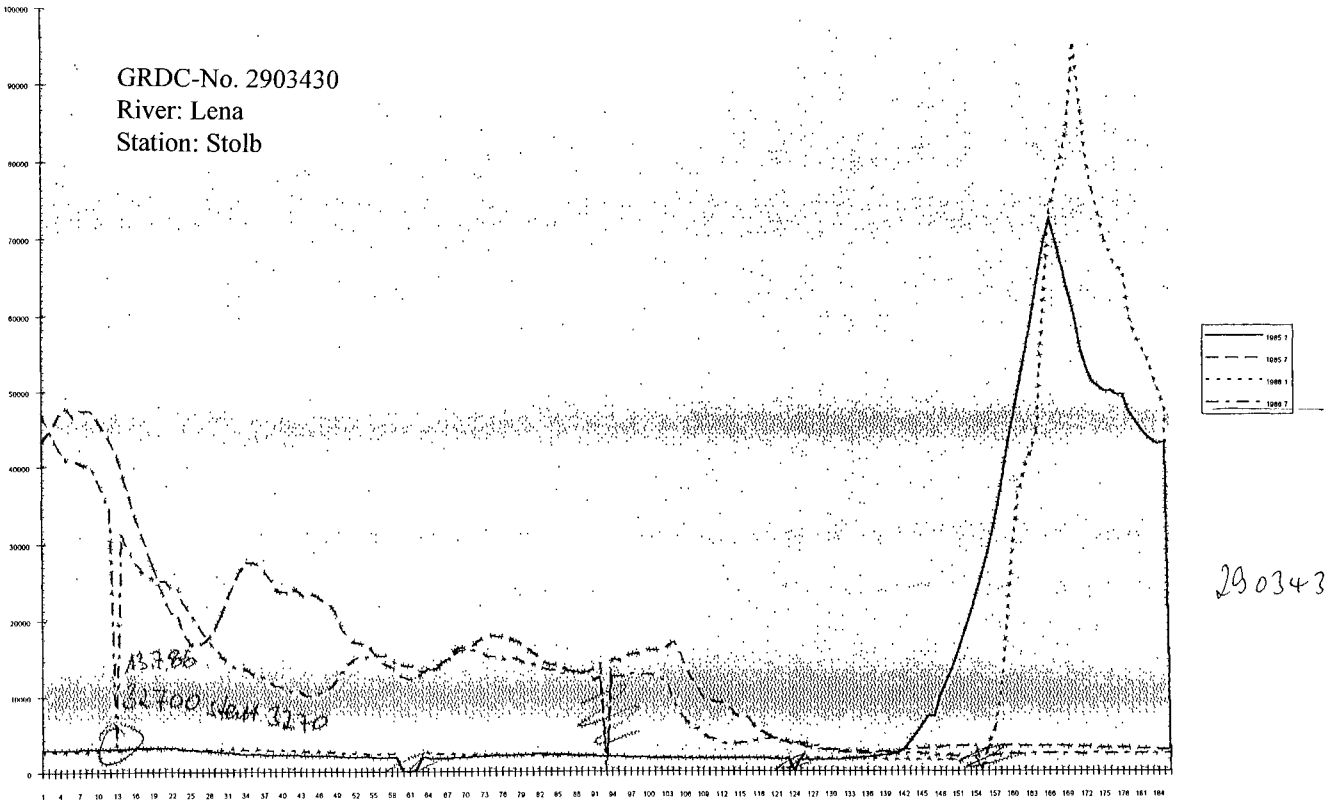
Tabelle1 Diagramm 1

2903420



2903420





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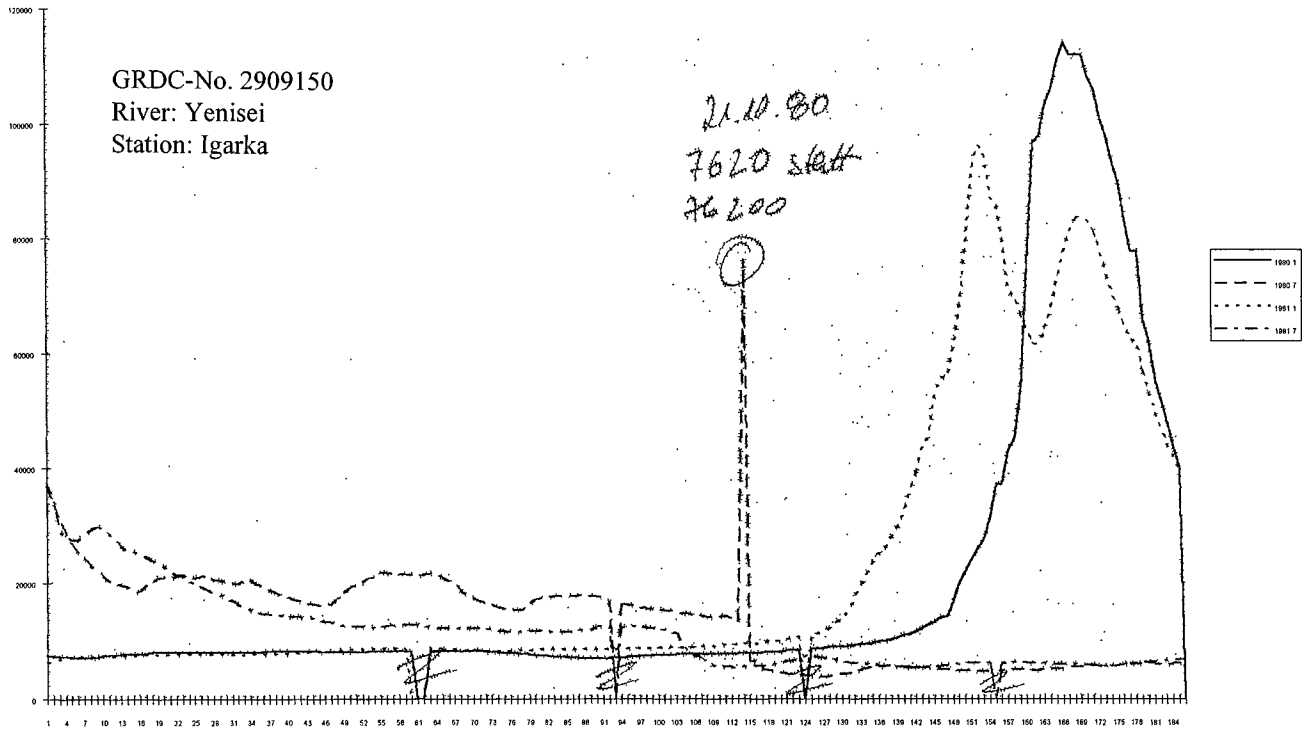
2909150



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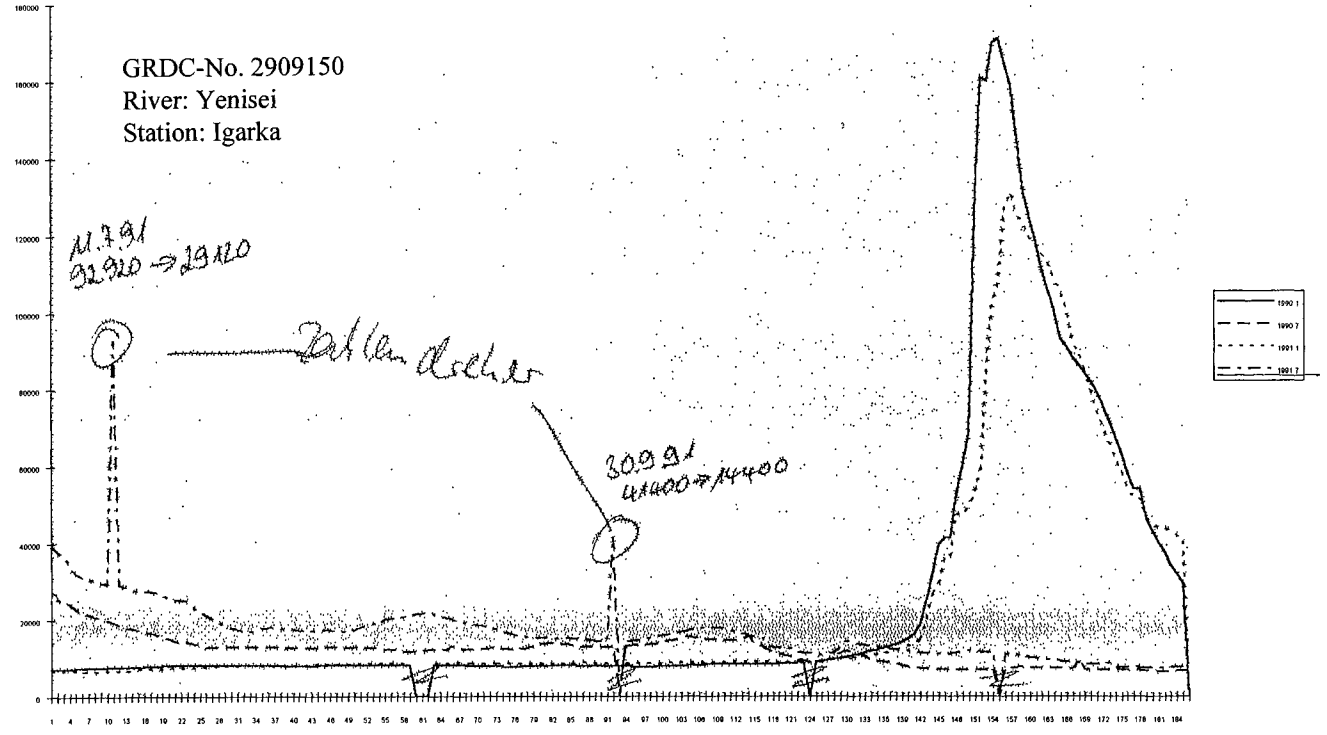
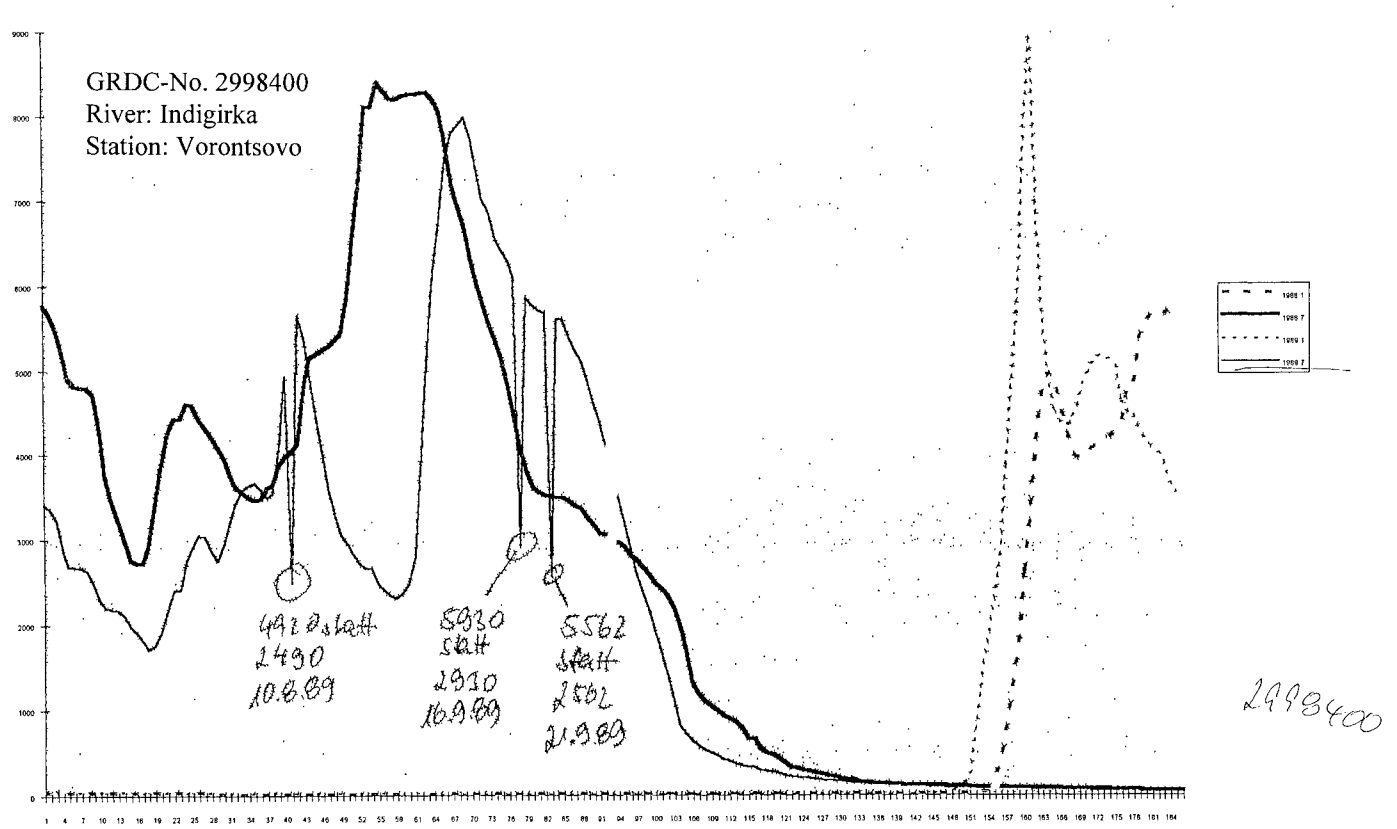
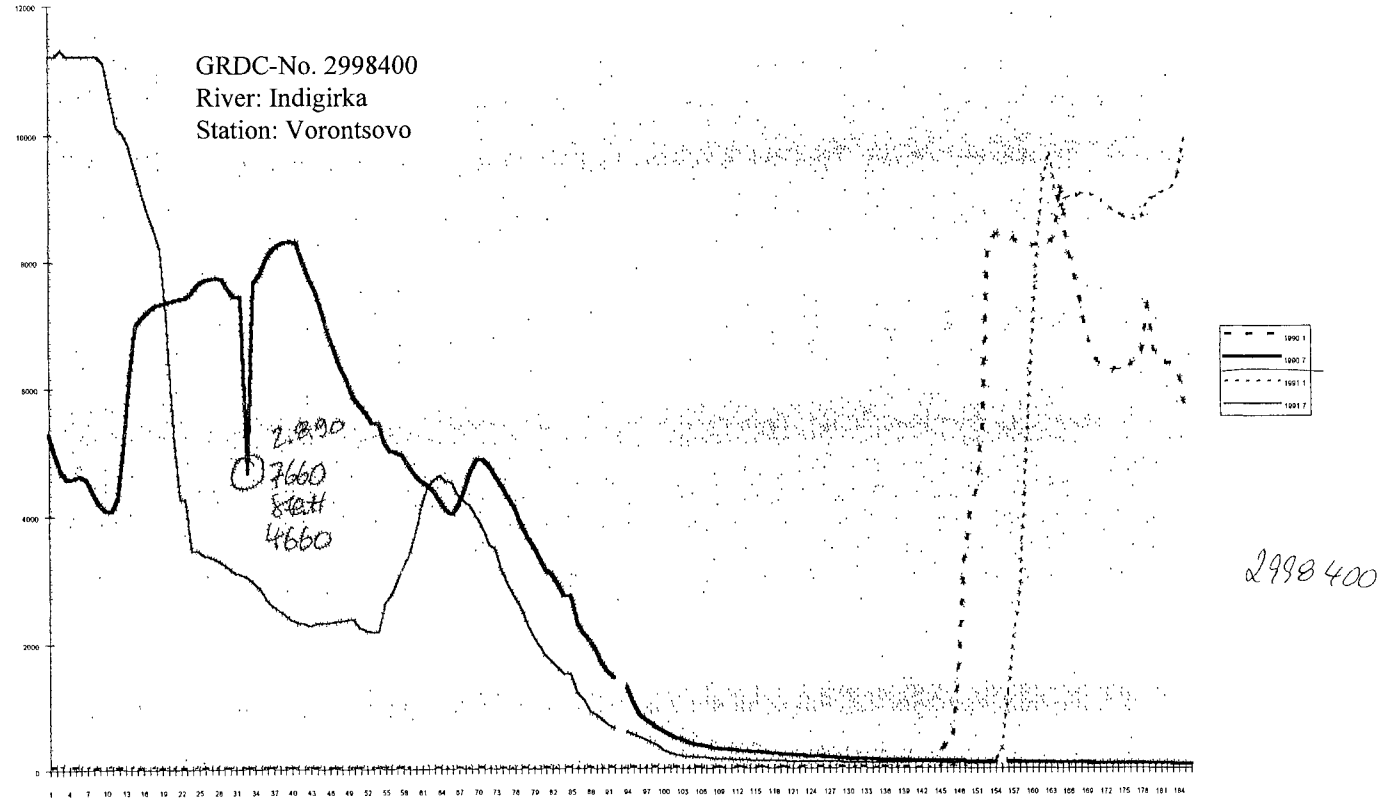



GRDC-No. 2998400
River: Indigirka
Station: Vorontsovo
4912 statt 1490 10.6.89
5930 statt 2910 16.9.89
5562 statt 2552 21.9.89
2998400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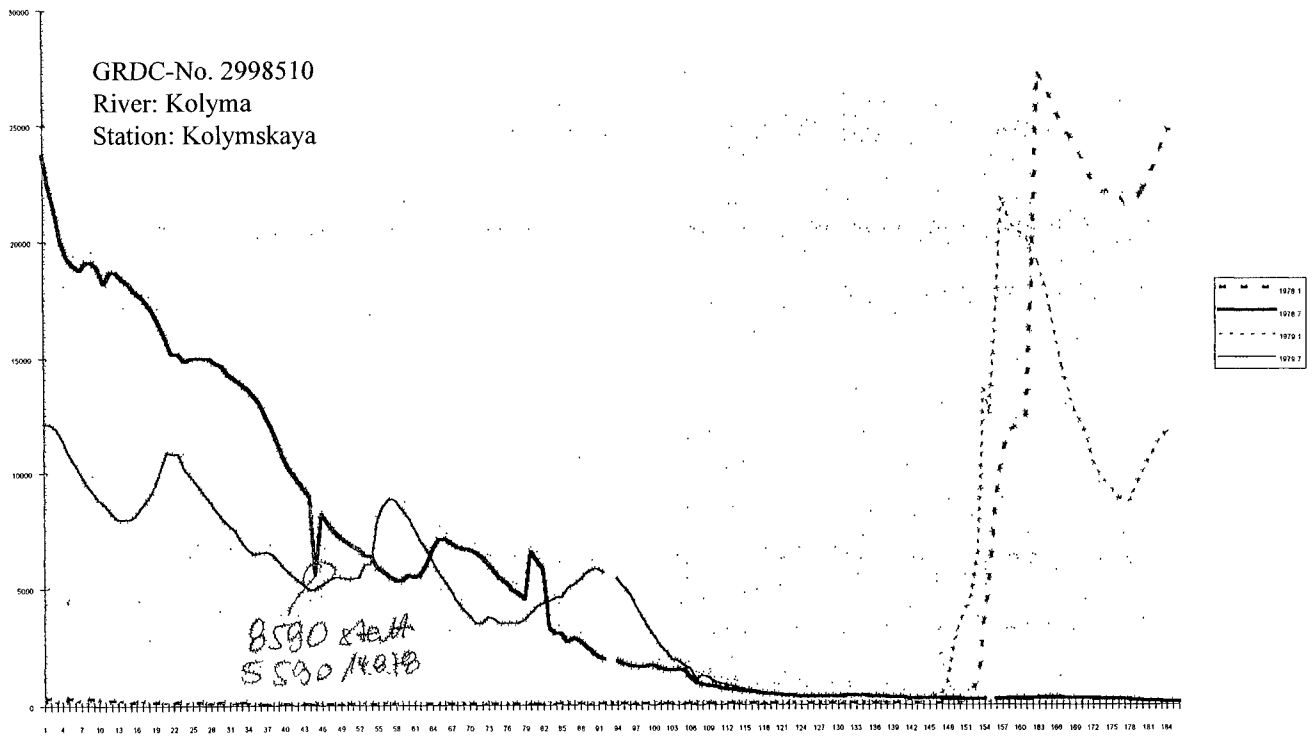
River: Indigirka
Station: Vorontsovo
2.890
7660 statt 4660
2998400

2998510



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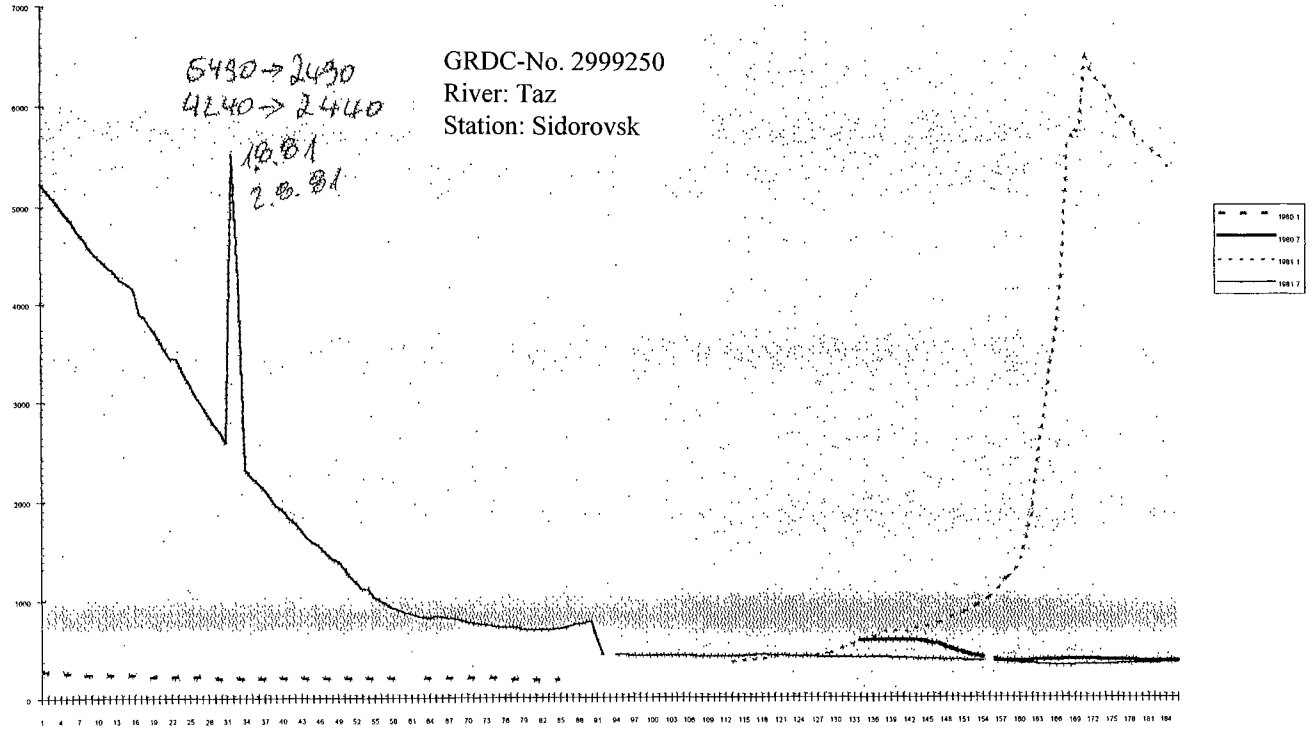

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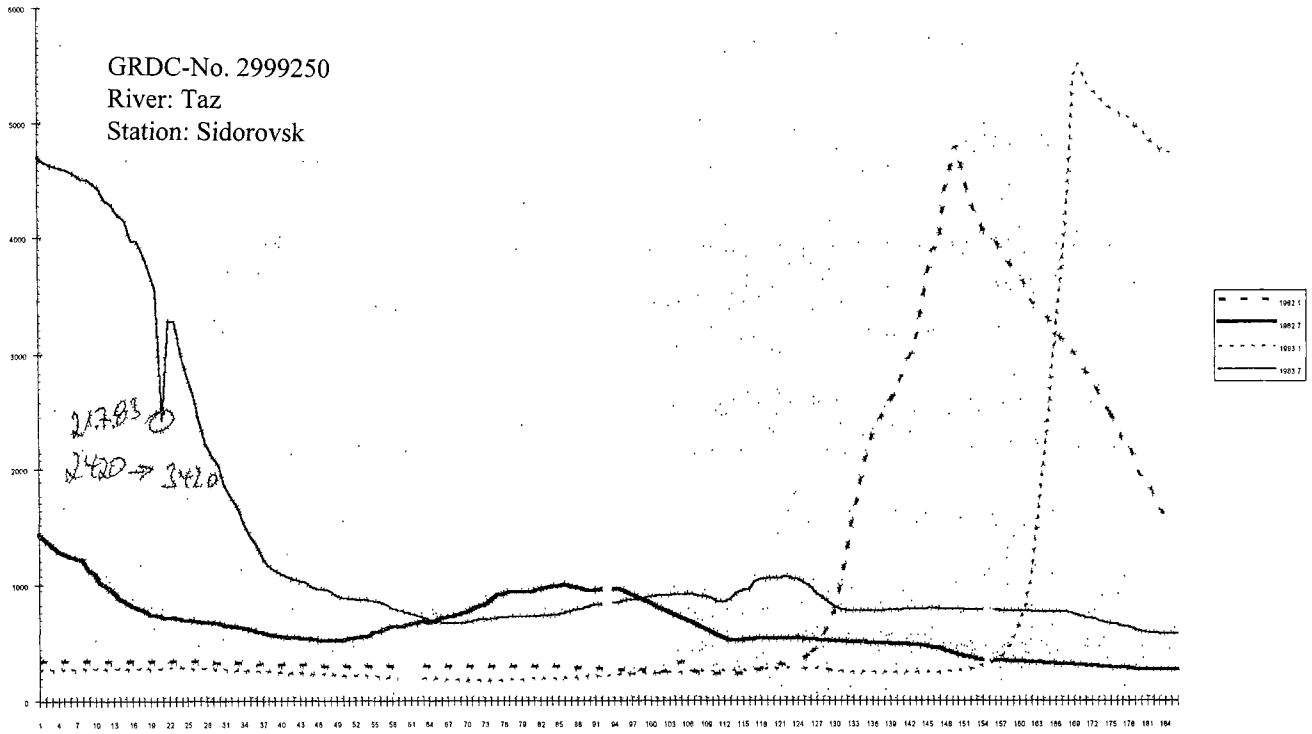

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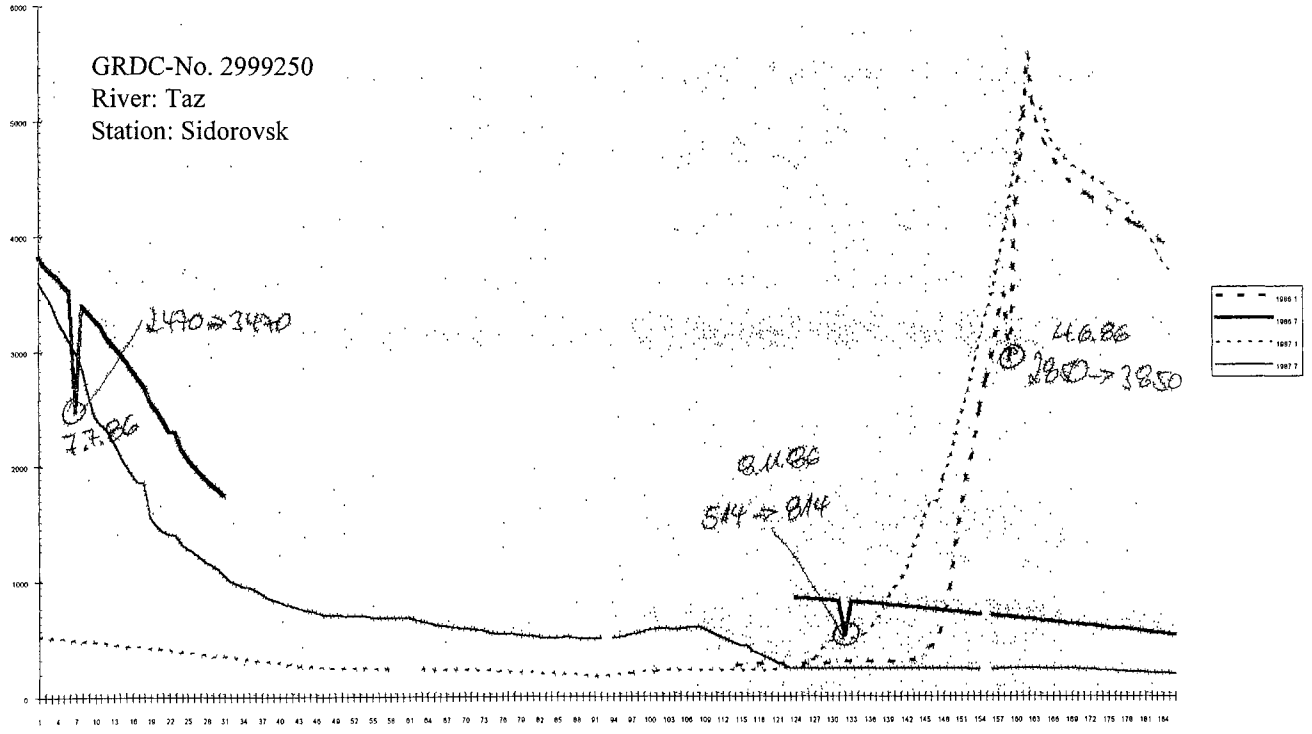

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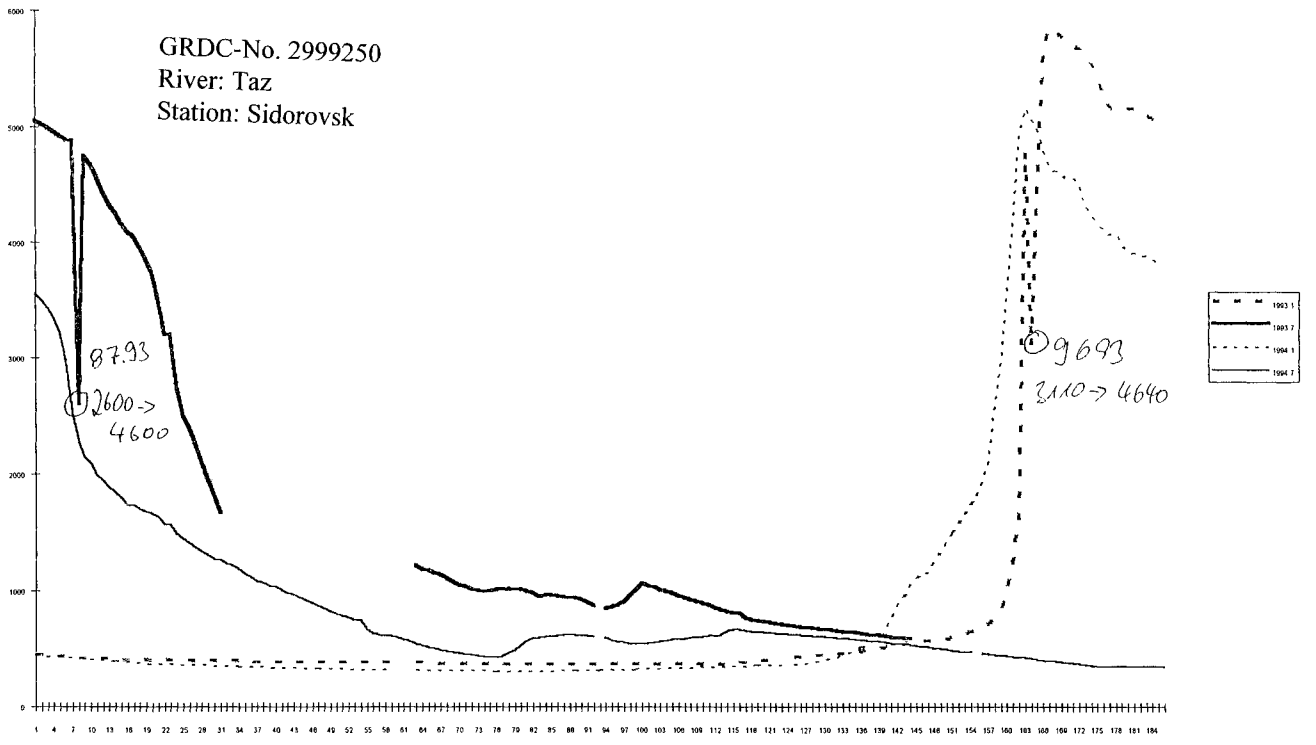


Tabelle1 Diagramm 2

6970100

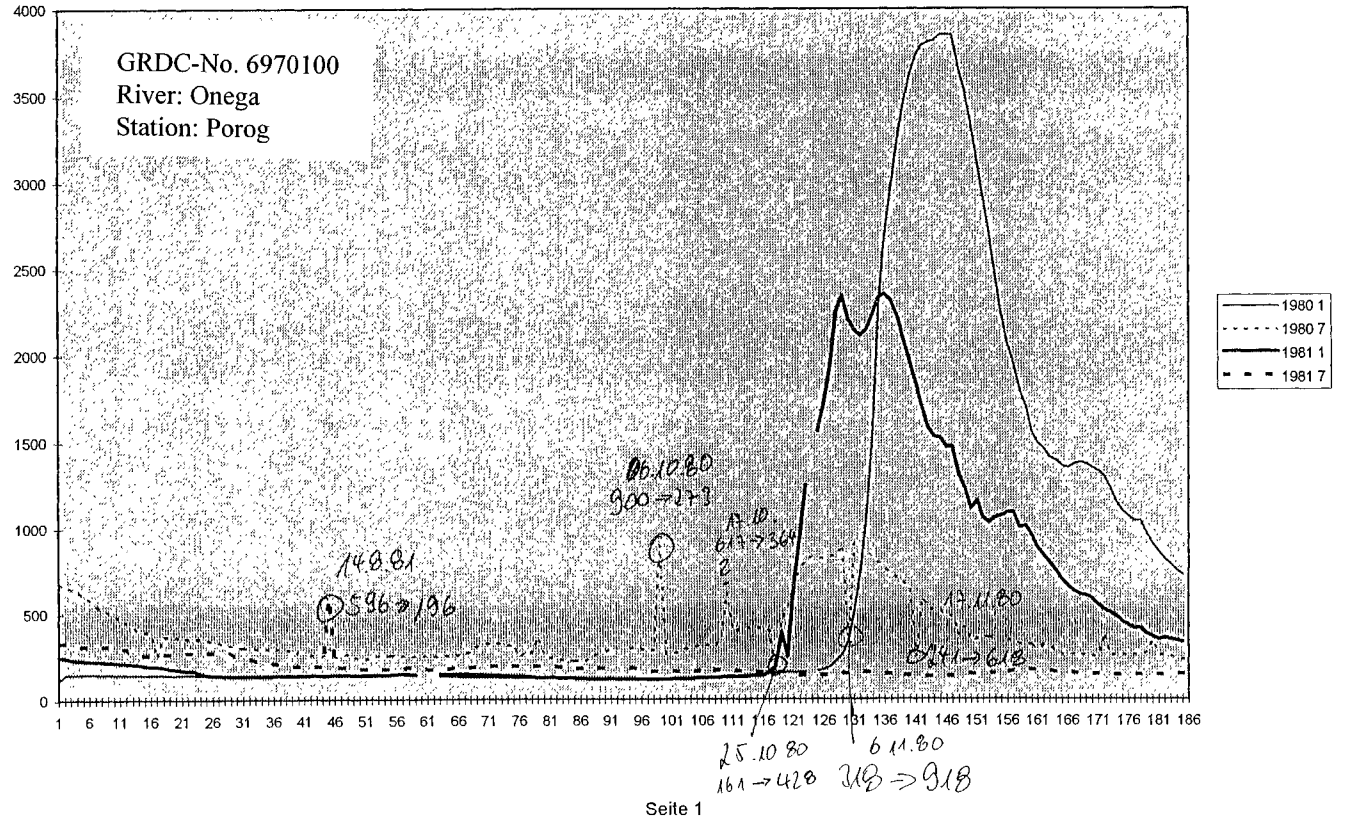


Tabelle1 Diagramm 4

6970100

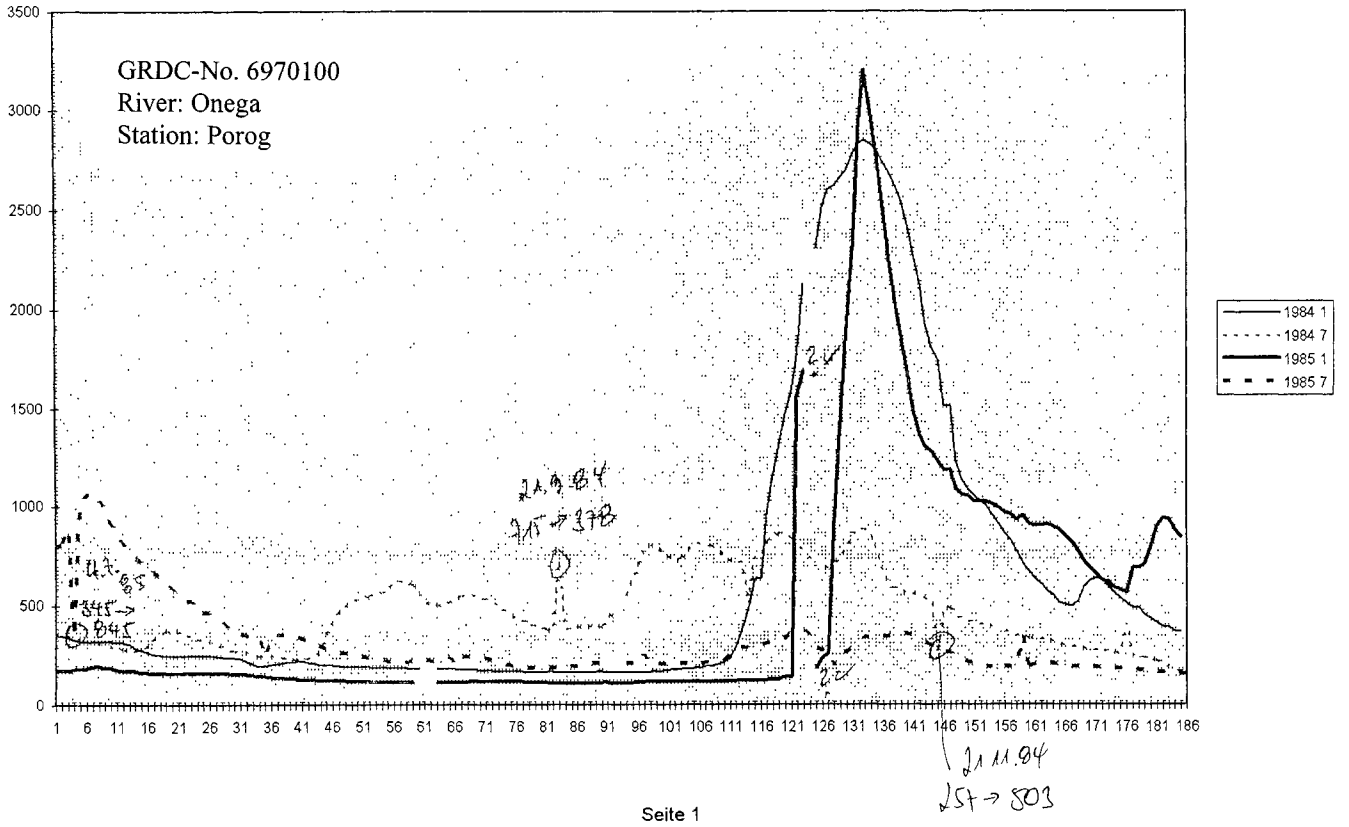


Tabelle1 Diagramm 6

6970100

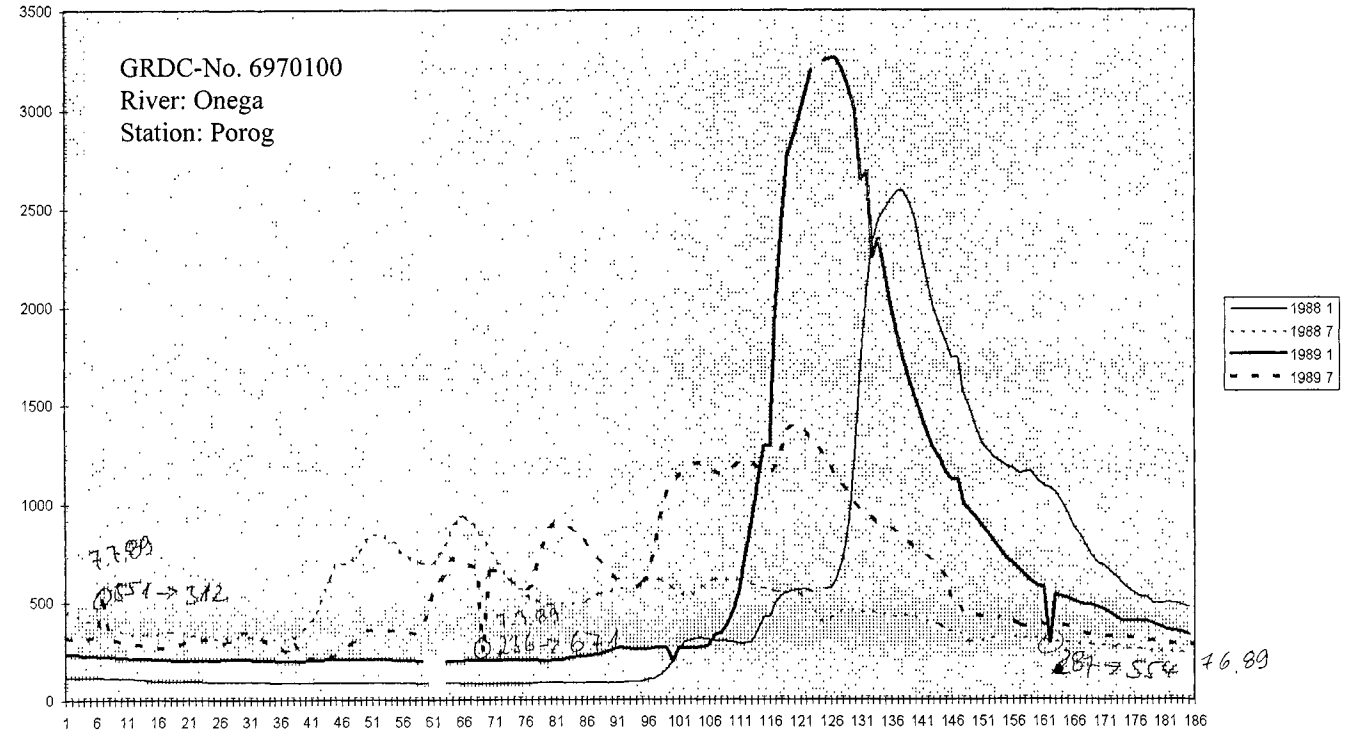
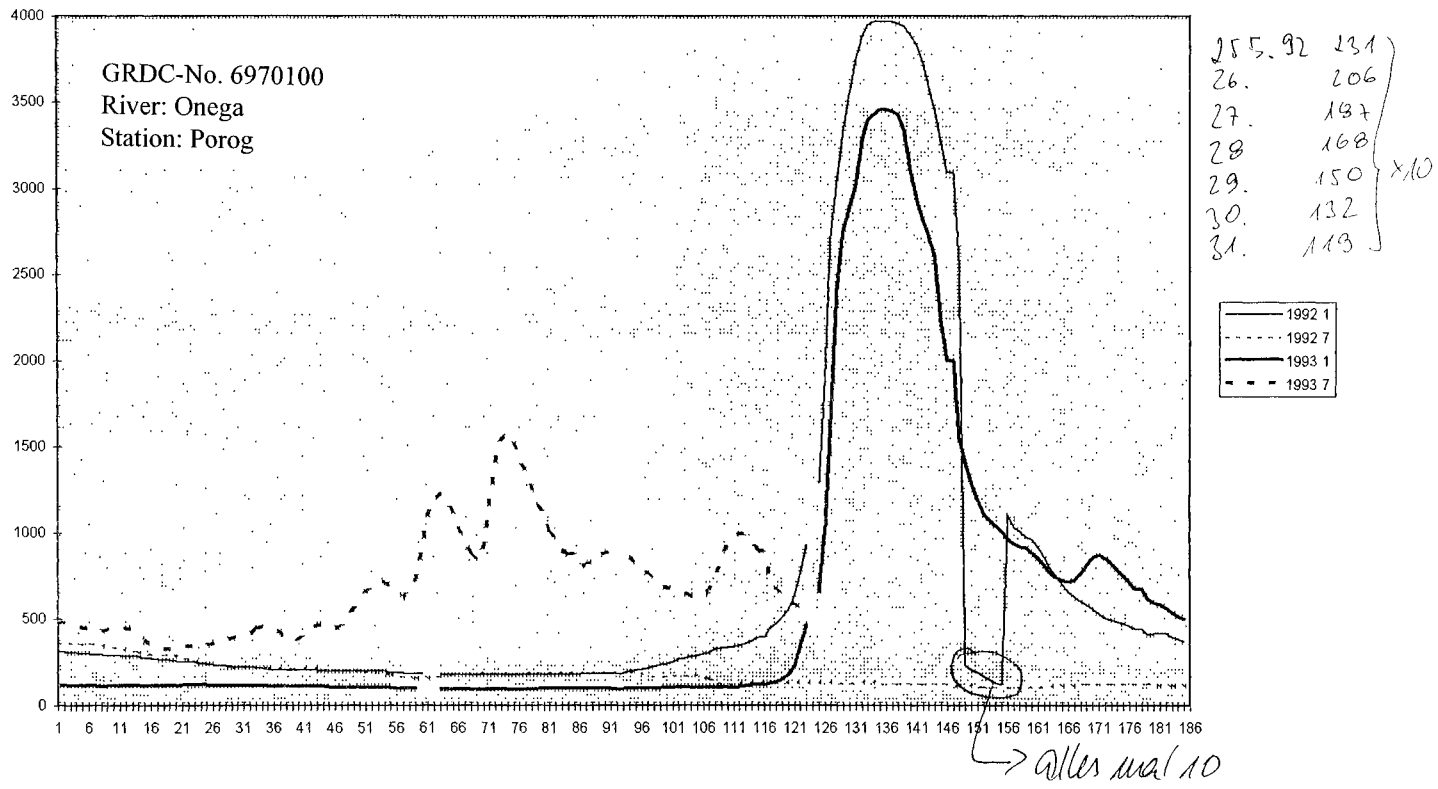


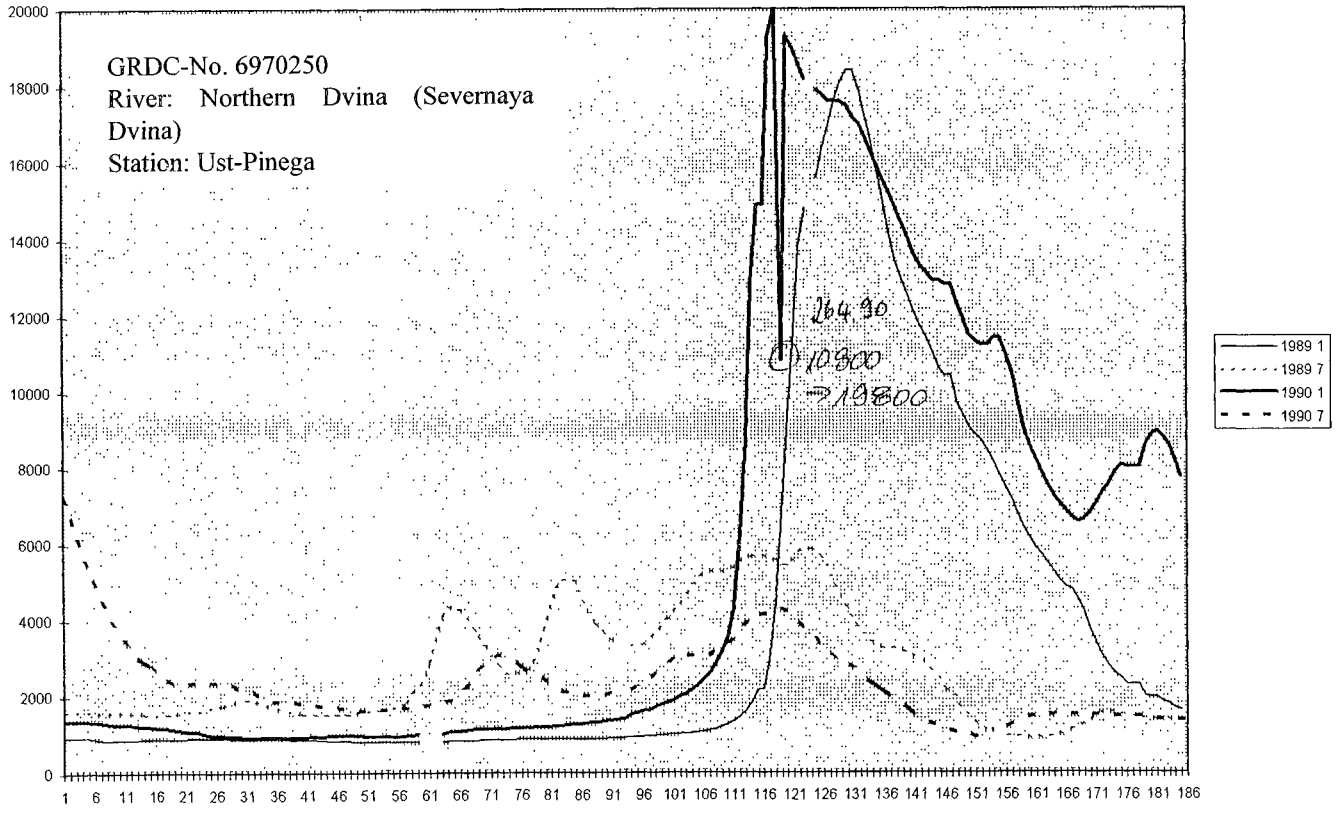
Tabelle1 Diagramm 8

6970100



Seite 1

Tabelle1 Diagramm 7 6970250



Seite 1

Tabelle1 Diagramm 5

6970710

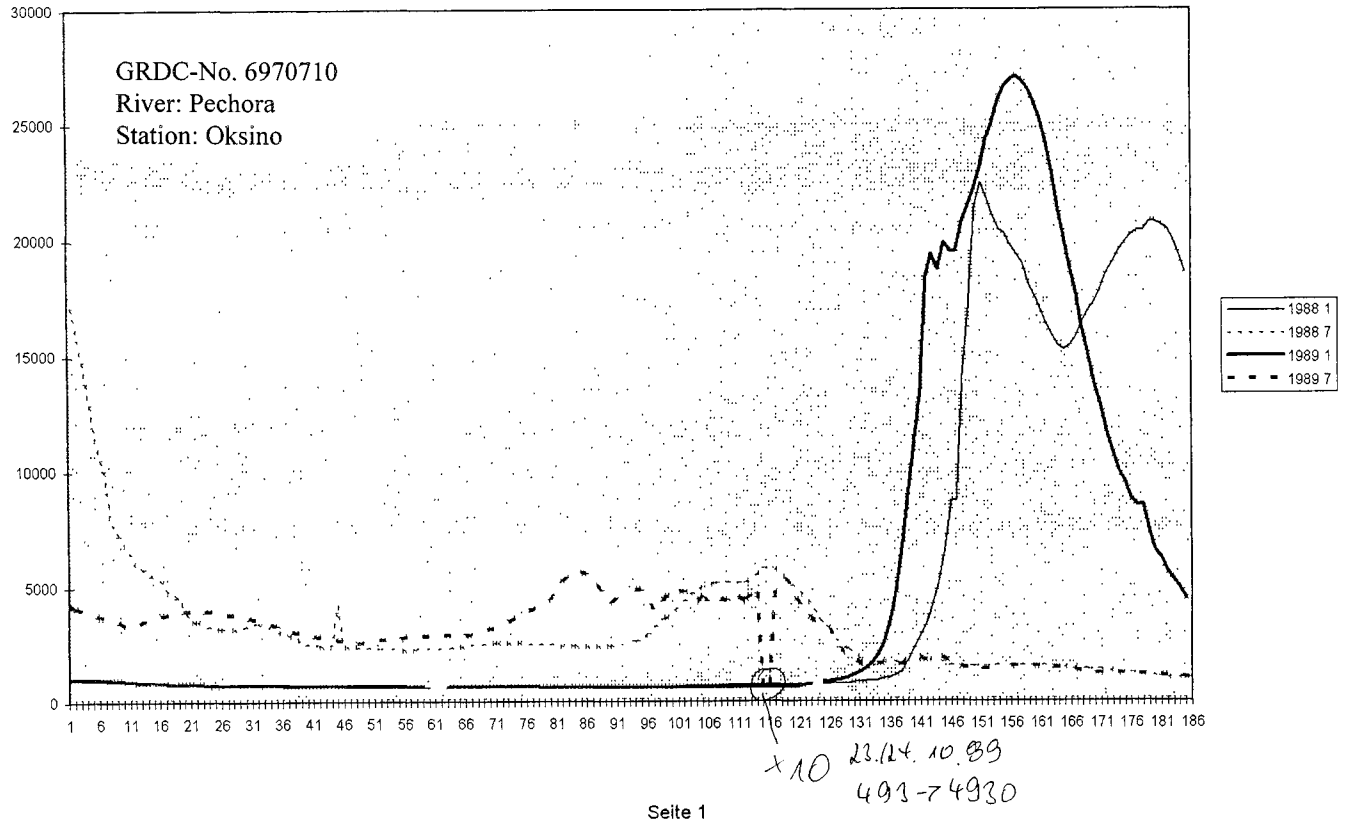


Tabelle1 Diagramm 6

6970710

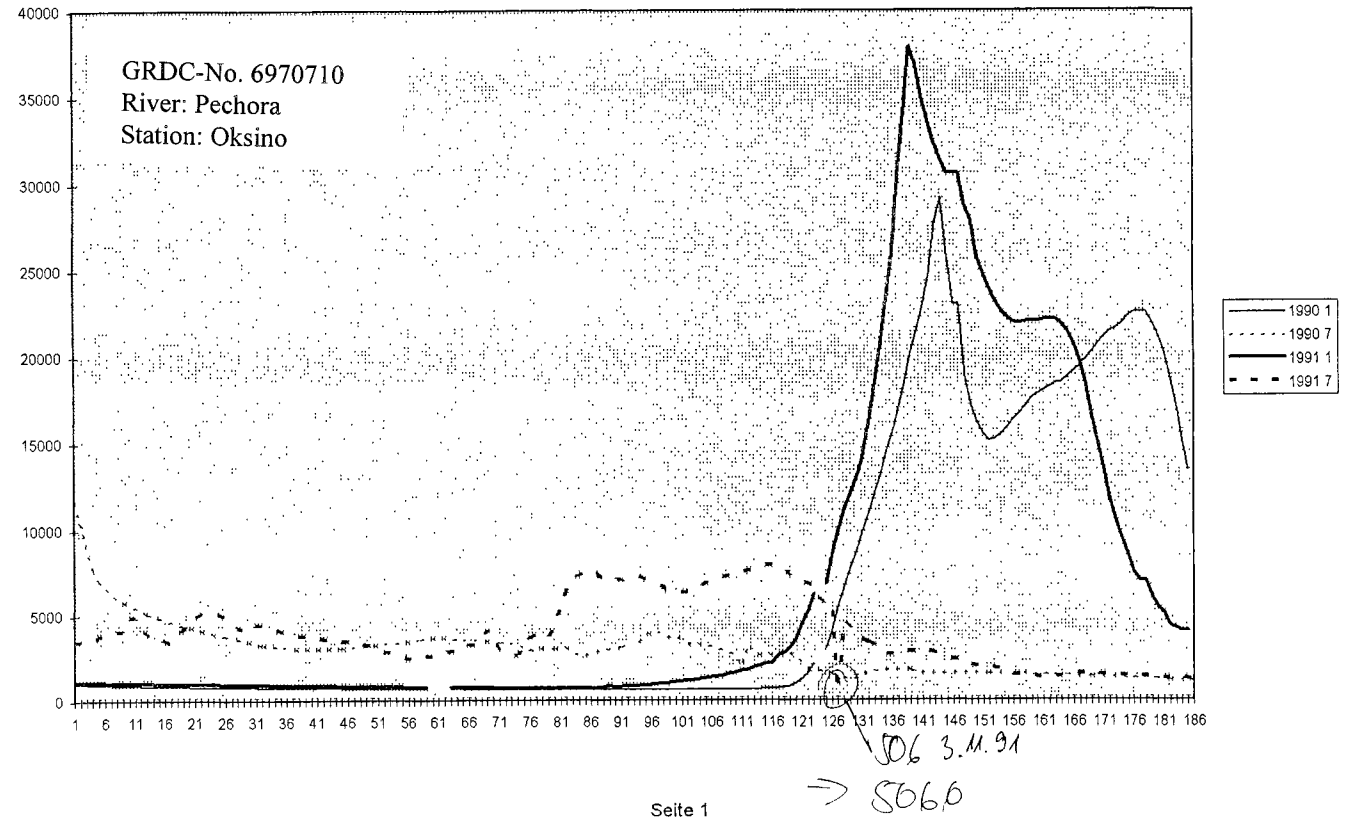


Tabelle1 Diagramm 7

6970710

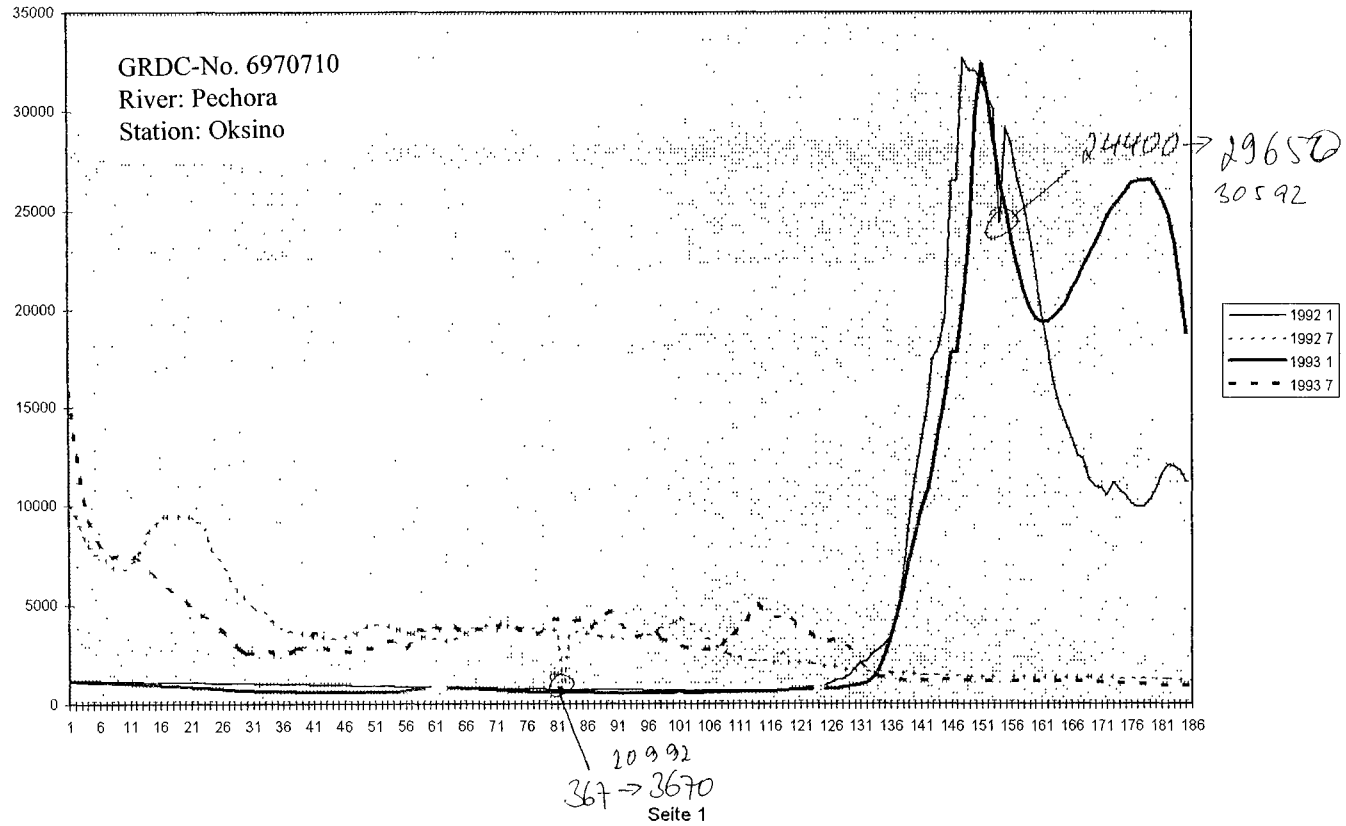


Tabelle1 Diagramm 1

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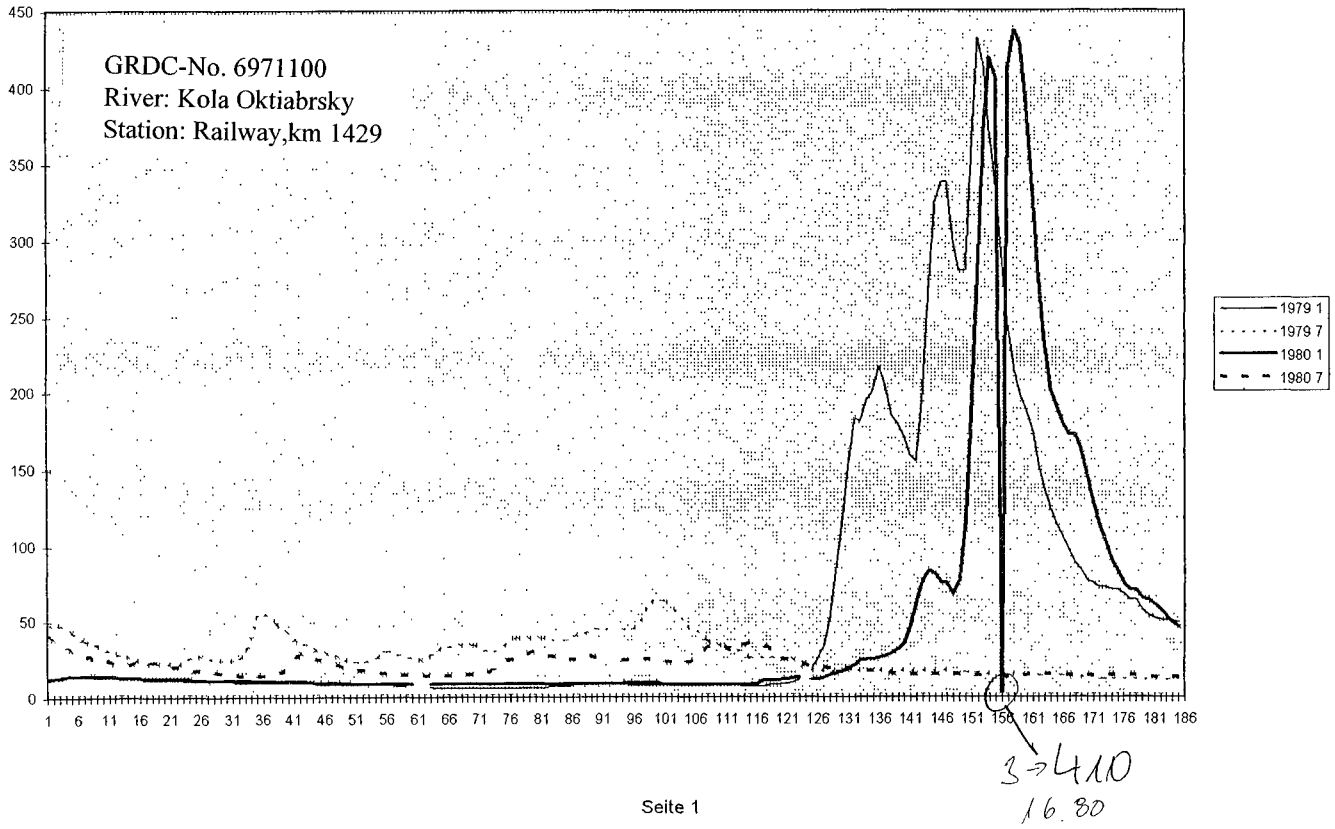
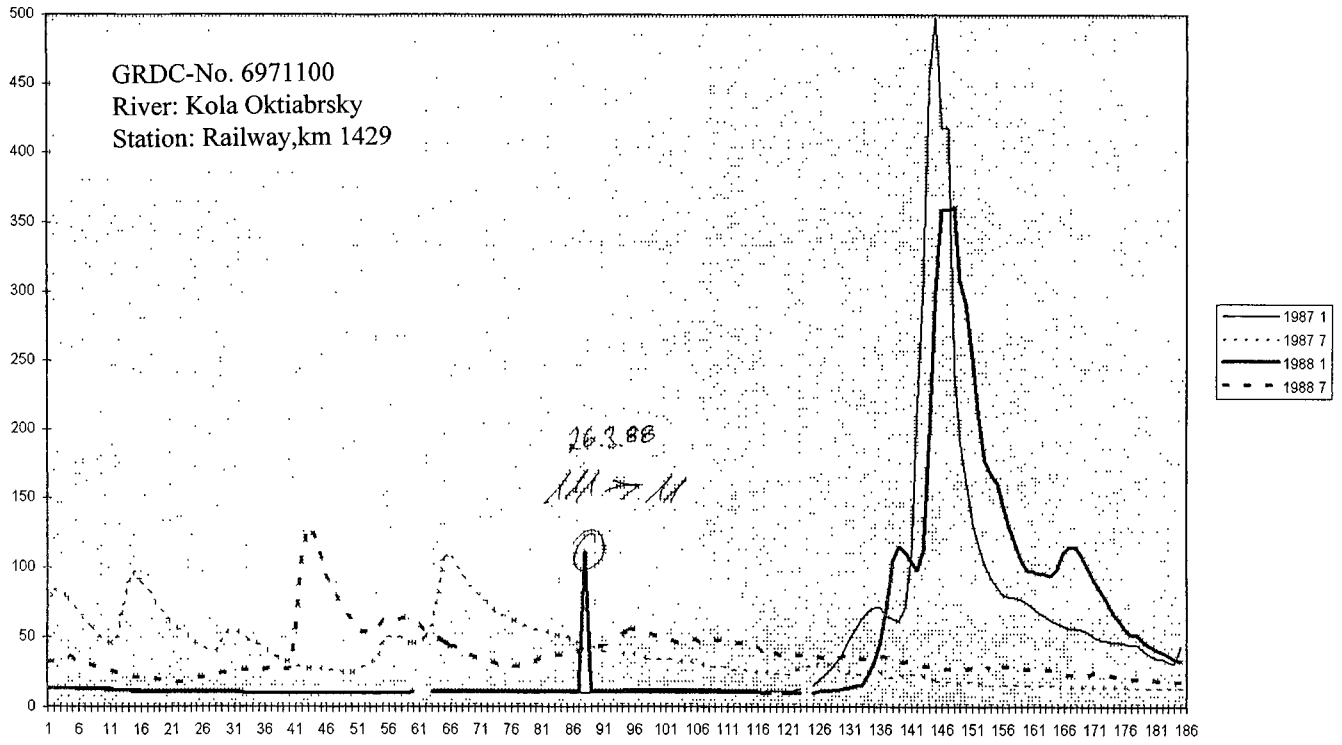


6971100


GRDC-No. 6971100
River: Kola Oktiabrsky
Station: Railway,km 1429
26.3.88
1987 1
1987 7
1988 1
1988 7