Annotations for

Monthly Discharge Data for Rivers and Streams of Russia and former Soviet Union [FSU] Republics Derived from NCAR ds553, ds552 and Other Sources

Byron A. Bodo
bodo@connection.com
Toronto, Canada
v1.2, March, 2000

Disclaimer

Users assume responsibility for errors in the river and stream discharge data, associated metadata [river names, gauge names, drainage areas, & geographic coordinates], and the annotations contained herein.

Until further information and data become available, this set of monthly discharges for 316 river and stream gauges in Russia and FSU republics and the associated metadata are about as clean and complete as can presently be obtained from freely available data sources.

No doubt errors and discrepancies remain in the metadata and discharge records. Anyone data set users who uncover further errors and other discrepancies are invited to report them to NCAR.

Preface

Work-up of river and stream discharge data for Russia and the republics of the former Soviet Union [FSU] contained in NCAR data sets 552 and 553 was undertaken in support of certain UNEP/WHO sponsored contract work [for anyone interested in environmental contamination in Russia by DDT, PCBs, dioxins & other organochlorines [see http://www.cciw.ca/gems/pops-rf.html].

The initial work was done in great haste during summer 1997. On obtaining some additional data sets in late 1998, I reworked the comparative analysis. This document was created as a record of changes, deletions, and optional choices made in the process of synthesizing available data into a coherent working data base.

This document was prepared for on-screen viewing, not printing !!!
Tables sprawl across page breaks, so printed output can be very messy.

This document is intended mainly as a look-up reference when concerns arise about particular gauge records. Users of the data set should read the introductory sections. Otherwise, the file can be searched for gauge name or code number for information on particular sites.

To ensure wide accessibility, this document was prepared as an MS Word 6 doc file. The www addresses are not active hyperlinks. They have to be copied and pasted into www browsers.

Clicking on a page number in the Table of Contents will jump the cursor to the beginning of that section of text [in the MS Word version, not the pdf file].

Revision 1.2 — What's New

1. metadata quality of river and gauge names and numerous location coordinates has improved appreciably
2. data were updated for an average gain of 9.5 net years (total months divided by 12) at 145 gauges

- a large set of discharge records for nominally 1,494 gauges in the Russian / FSU Arctic drainage basin is now available on ***R-arcticnet*** [**http://www.R-arcticnet.sr.unh.edu/]**
- see ***R-arcticnet*** sub-section

- see section on Version 1.2 Updates

Why this data set remains useful

1. good records are available for 178 gauges not readily available in other sources; most of these gauges are in non-Arctic drainage basins of Russia and the FSU
2. many of the 135 gauges common to R-ArcticNET have longer or more correct data than available in R-ArcticNET
3. the metadata are generally better than those in other sources; specifically, for most sites, the river and gauge names adhere reasonably to conventional English forms for Russian names; also most location coordinates should be within 15 km of the true gauge locations

Table of Contents

Distribution Files

Files in the distribution package are listed below:

Contents	File name
ascii description of distribution files & formats	**Readme**
Site catalogue & summary statistics	**fsu_q.cat (ascii)** **fsu_cat.xls (spreadsheet)**
Monthly discharge data	**fsu.q**
Annotations	**fsu_notes.doc [this file]**
Mappad file	**fsu_q.mpd**

Free viewers for MS Word doc files and MS Excel .xls files are available at:

http://officeupdate.microsoft.com/index.htm

Files ***fsu_q.cat*** (ascii) and ***fsu_cat.xls*** (MS Excel 8) contain the same gauge metadata and summary statistics. ***fsu_q.cat*** has FORTRAN format as listed below. See ***fsu_cat.xls*** for additional information. The essential metadata are: FSU gauge no., latitude, longitude, river name, gauge name, and drainage area. The summary statistics can be calculated directly from the data in file ***fsu.q***.

(i5,1x,a1,f8.3,f9.3,1x,a30,a35,a2,1x,a1,f10.1,f8.3,f7.1,2i5,f6.1,2(f8.3,i5,i3))

variable	format	width	1st col	last col
gauge no.	**I5**	**5**	**1**	**5**
blank	**1X**	**1**	**6**	**6**
data source code	**A1**	**1**	**7**	**7**
latitude	**F8.3**	**8**	**8**	**15**
longitude	**F9.3**	**9**	**16**	**24**
blank	**1X**	**1**	**25**	**25**
river name	**A30**	**30**	**26**	**55**
gauge name	**A35**	**35**	**56**	**90**
country code	**A2**	**2**	**91**	**92**
blank	**1X**	**1**	**93**	**93**
continent code	**A1**	**1**	**94**	**94**
drainage area	**F10.1**	**10**	**95**	**104**
mean annual discharge	**F8.3**	**8**	**105**	**112**
mean annual runoff	**F7.1**	**7**	**113**	**119**
1st year	**I5**	**5**	**120**	**124**
last year	**I5**	**5**	**125**	**129**
net years	**F6.1**	**5**	**130**	**134**
max 12 month discharge	**F8.3**	**8**	**135**	**142**
year	**I5**	**5**	**143**	**147**
month	**I3**	**3**	**148**	**150**
min 12 month discharge	**F8.3**	**8**	**151**	**158**
year	**I5**	**5**	**159**	**163**
month	**I3**	**3**	**164**	**166**

Mean monthly discharge rates in m^3/s for 316 FSU river and stream gauges are contained in file ***fsu.q*** with FORTRAN format (2i5,12f11.3).

Variable	Format
FSU gauge no.	**I5**
calendar year	**I5**
monthly discharges Jan-Dec	**12F11.3**

The suggested method for reading data is:

1. first read the FSU gauge no. and any other desired metadata into memory from file ***fsu_q.cat***,
2. then read data for desired sites from file ***fsu.q*** by keying on the gauge ID.

- ***fsu_q.mpd*** is a data file for viewing gauge locations and summary statistics with NOAA's Mappad software for MS Windows 3+ and NT. See Appendix B.

Monthly Discharge Data for Russia and republics of the former Soviet Union [FSU]

Seven data sets listed below were contrasted and ultimately synthesized into a single set with monthly discharge records for 316 river and stream gauges in Russia and 11 of the 14 other now-independent republics of the former Soviet Union [FSU]. (See site map)

1. **RUS** the main set of 26 files (series A*nn* & E*nn*) in the Russian-US exchange data set posted at NCAR [http://www.scd.ucar.edu/dss/datasets/ds553.0.html]

2. **X-file** the composite of the 3 extra files (*rwmo.sdf*, *rivdat1*, *rivdat2*) available with the Russian-US exchange data set at NCAR; *rivdat1* and *rivdat2* apparently originated via Battelle, while the origin of *rwmo.sdf* is unclear. As these files appear to have originated independently of the Russia-US exchange, they were treated jointly as a separate data set.

3. **IHD** the 84 FSU sites in the old UNESCO/IHD data set with discharges to 1972 [available at NCAR from the ds552 page]

4. **WMO** the 87 FSU sites in the NCAR data set ds552 attributed to WMO [http://www.scd.ucar.edu/dss/datasets/ds552.0.html]

5. **RIV** the 85 FSU sites in the RIVDIS data set from ORNL [http://www-eosdis.ornl.gov/daacpages/rivdis.html]

6. **O-file** a set of 25 FSU sites passed along by anonymous donor ***O*** —— 23 identical to WMO with almost perfectly concordant data on common months [including the same replication errors & typos] but some sites having longer records as in RUS; plus 2 other Russian sites with 1985–87 data.

7. **R-Arc** 1,494 gauges in the Russian / FSU Arctic drainage basin available on ***R-arcticnet*** [**http://www.R-arcticnet.sr.unh.edu/]**

8. **V-file** a set of 1000+, mostly non-Arctic drainage basin FSU gauges with records to 1985

Additional resources employed included:

- site catalogue files associated with ds553: ***fwmos.sdf***, ***ussr_riv.lst*** (aka Slack's list), & ***readmencar*** (Battelle list).

- GRDC site catalogue [http://www.bafg.de/html/internat/grdc/welcome_grdc.html] was used for cross comparing river & gauge names, geo coordinates, and drainage areas. GRDC site metadata are often no more reliable than other sources. Many site records in Rus & X or parts thereof are not available in the GRDC archive.

- geographic locations and site coordinates were checked and derived as available in the ***Times World Atlas*** and the ***Digital Chart of the World*** [DCW] gazetteer, but many gauge sites have no entries so coordinates remain as given. For v1.1, some remaining un-georeferenced or doubtful site locations were found using US ***NIMA's (National Imagery and Mapping Agency) GEOnet*** name-server / on-line gazetteer at http://164.214.2.59/gns/html/.

FSU–Russian Basin & Stream Gauge Coding System

- Rus-Am exchange data are identified by the FSU basin/gauge coding system numbers
- the system is summarized as best as can be ascertained from available info in Appendix A at the end of these notes
- the available catalogues gave gauge codes for more sites than had data
- FSU gauge code nos. were available for all but 4 sites in other data files; hence, the FSU codes were adapted for the merged data set
- the FSU republics may have adapted other coding systems since independence

Version 1.2 Updates

Metadata Corrections

- the quality of metadata for the present set of 316 gauges has improved appreciably by collating available gauge inventory lists with new information in ***R-ArcticNET***, ***V-file*** and other sources,

- most river and gauge names should be reasonably close to standard English forms, i.e., there is a good chance of finding them in gazetteers like NIMA GEOnet

- most location coordinates should be within 15 km of true gauge locations

- gauge coordinates have varied somewhat from one data set to another, so this may be as accurate as coordinates can be made without visiting each site with a GPS unit

R-arcticnet

- a large set of discharge records for nominally 1,494 gauges in the Russian / FSU Arctic drainage basin is now available on ***R-arcticnet*** [**http://www.R-arcticnet.sr.unh.edu/]**
- data at R-ArcticNET often have up to 5 years or more of additional data from 1986

- 135 of gauge records in this set are common to the records at R-ArcticNET

- data at R-ArcticNET were provided by Russia's State Hydrological Institute [SHI] in St. Petersburg
- some errata may have crept into discharge records as they were transferred from the Russian hydrological service headquartered in Obninsk to SHI in St. Petersburg to R-arcticnet at UNH (University of New Hampshire)
- a quick scan turned up several duplicate sites and some replicated records at nominally different sites, but on the whole the data look reasonably good

- spot checks show:

1. R-ArcticNET data for common sites still have some errata identified in this document

2. R-ArcticNET data report numerous missing values for Arctic streams that were identified as legitimate 0s according to the data qualifier codes supplied with ds553 which originated from the source agency at Obninsk; the false missing values can inflate long term mean annual discharge and specific runoff estimates, and lead to other distortions in time series modelling and analysis

3. due to rounding, data in R-ArcticNET have lower digital precision; data from ds553 have better digital precision, but this is only of limited consequence for low discharge streams with frequent monthly discharges < 1 m^3/s

4. the location coordinates given in R-ArcticNET metadata differ somewhat from those in the present set and the US-Russia exchange files; Kola Peninsula and White Sea drainage basin gauges and possibly other subsets of R-ArcticNET gauges have numerous bad location coordinates

5. numerous common sites in this set have records extending further back in time than those on R-ArcticNET, and at least one has some more recent data

6. river and gauge names are often given in unconventional English transliterations that bear little resemblance to the English names given in US or British sources; while R-ArcticNET metadata have Russia / FSU gauge code numbers, the only definitive way to determine which site records match those in other data sets that lack the Russia / FSU gauge code numbers is to run matching algorithms using correlations and other similarity measures

R-arcticnet – Data Retained

- for Version 1.2, the records for 135 common sites were re-constructed by superimposing R-ArcticNET on v1.1 data
- this preserves the corrections, higher digital precision on low discharges, and the correct interpretation of 0s and missing values available in the Rus-Am exchange files, and takes advantage of the post 1985 data in R-ArcticNET

- the 135 sites common to R-ArcticNET are identified in the catalogue spreadsheet "***fsu_cat.xls***"
- ***for anyone using R-ArcticNET, the 135 common sites can easily be replaced by data in this set to obtain more complete records***

- there were exceptions for the Severnaya Dvina @ Ust-Pinega and the Ob @ Salekhard both of which have records that appear to have been revised slightly in the more recent versions available at R-ArcticNET
- these records were built using R-ArcticNET as the base
- the Severnaya Dvina @ Ust-Pinega record was replaced by that in R-ArcticNET
- the Ob @ Salekhard record in v1.1 had several years not in R-ArcticNET; hence, v1.1 was superimposed on R-ArcticNET data to give a record with the most recent revisions plus the additional data in v1.1

- the v1.1 record for Khatanga @ Khatanga which had numerous false 0s was replaced by that in R-ArcticNET

V-file

- this is a collection of 1000+ mostly non-Arctic drainage basin gauges for the entire FSU with data to 1985; a few Russian sites have 1–2 years of post-1985 data
- end dates suggest that these data were likely processed after the Rus-Am exchange files (1995) and before R-ArcticNET (1999)
- these data are not presently available over the internet, but were part of larger global data set that accompanied draft documents being prepared for the Second World Water Forum, March 2000, Hague, Netherlands

Caveats:

- FSU code numbers were omitted or lost by the creators of this set

- metadata and discharges are somewhat muddled, e.g., some small streams have huge discharges and vice versa; many river and gauge names are given in English forms that are not easily recognizable [but closer to English norms for Russian names than R-ArcticNET]; some gauge data appear twice under different names, etc.

- discharges are more crudely rounded than in RUS95 and R-ArcticNET

Data Retained

- because of the metadata problems, the only readily usable data are those that can be matched directly to records in other files
- scanning algorithms matched 252 records to sites in the present set of 316 gauges
- almost all were Russian gauges that had better (more digitally precise) or more recent data in the RUS95 or R-ArcticNET
- within rounding limits, 98 of the 252 records corroborate 98 non-Arctic Russian gauge records in RUS95

- V-file did have had longer and more precise data for 19 non-Russian records that were otherwise only available in UNESCO files
- UNESCO data (IHD / WMO / RIV) were generally confined to 1964–1984 or less, and crudely rounded; hence, these 19 gauges all benefit from the replacement or addition of V-file data

Net Data Base Improvement

- the combined updates from R-ArcticNET and V-file produced an average gain of 9.5 net years (total months divided by 12) at 145 gauges
- two gauges lost records due to corrections and revisions

- the net gain has been about 750 years of record

Caveats

- the 750 years of data added to V1.2 have not been scrutinized as rigorously as the core data set of V1.1
- a scan for extrema uncovered about 25 entries that were either extraneous numerical junk that had filled what were likely empty slots (missing months), and some obvious decimal shift typos
- more subtle and difficult to detect errata may remain in the data

RUS [Russia_American exchange] data set

The main Russian Exchange data set comprised 26 files in the A*nn* & E*nn* series that nominally correspond to Asian and European drainage divisions within the Russian Federation. These had a total of 280 geographically unique site records. These were compiled into a joint working set dubbed ***RUS*** *(also referred to as RUS95)*.

Three extra files — ***rivdat1***, ***rivdat2*** & ***rwmo*** — had 38 unique site records. These were compiled into a set dubbed ***X-file*** or simply ***X*** and compared against RUS.

After reduction/collation of records under non-unique gauge codes, the total ds553 set contained records for 289 unique gauges.

All but a few of the 289 sites are in the Russian Federation. The 3 non-Russian sites identified are:

Code	River	Gauge	Lat	Lon	Country	
19072 w	**Ural**	**Kushum**	**50.84**	**51.23**	**KZ**	**AS**
19195 w	**Ilek**	**Aktyubinsk**	**50.27**	**57.23**	**KZ**	**AS**
80131 w	**Desna**	**Chernigov**	**51.49**	**31.33**	**UA**	**EU**

These are national border area sites. There may be more non-Russian sites. My Soviet era digital map is coarse and lacks the political boundaries of the 15 now independent FSU republics.

In the early stages of processing, several issues concerning un-named records, and identical records under multiple site IDs were resolved:

3881 Alazeya @ Argakhtakh

code	river	gauge	Lat	Lon
3552	**Alazeya**	**Argakhtakh**	**68.50**	**153.42**
3881	**Alazeya**	**Argakhtakh**	**68.50**	**153.42**

- the RUS-Am files have data under code 3881, but the same data can be found under Russian codes 3552 and 3881 in R-ArcticNET
- code 3881 is retained in the present set
- data from R-ArcticNET have missing values for numerous winter freeze-up months when RUS-Am specifies 0s according to the qualifying codes

1492 / 1594 Amguema @ mouth of Shoumny Bk

code	river	gauge	Lat	Lon	area km2
1492	Amguema	mouth of Shoumny Bk (Ust'e Shumny)	67.46	178.22	26,700
1594	Amguema	U Mosta 174 km	67.42	178.40	26,400
			67.67	-178.70	

- it appears that the gauge was moved slightly upstream in 1976
- records for the two gauges have appeared under both codes, sometimes separately, sometimes composited into a single record
- for the present data set, the composited record is retained under ID 1594

- anyone feeling strongly about it, can split the two records out as 1492 [1944–1975] and 1594 [1976–1987], but the difference in drainage areas is so small these two records can be safely spliced

- variable location coordinates have been given for these gauges in every source including different Russian sources
- the coordinates supplied by SHI (R-ArcticNET) would place the gauges in the headwaters west of 180º; however, if the drainage areas are correct [total basin area is only ~30,000 km^2], the gauge has to be somewhere near the coordinates given on the bottom line of the table above which are near the coordinates given in the old IHD distribution, i.e., ***the site is almost surely east of 180º***

10251 / 10252 Tom @ Tomsk

code	river	gauge	Lat	Lon	area km^2
10251	Tom	Tomsk	56.54	84.90	57,000
10251	Tom	Tomsk	56.50	84.92	57,000
10252	Tom	Tomsk	56.50	84.92	57,800

- 10252 has data only for 1981–1985, but these are identical to 10251 for 1981–1984
- the joint record is retained under code 10251 with the coordinates and drainage area indicated on the first line (yellow-shading)

70801 Severnaya Dvina @ Ust Pinega

code	river	gauge
70801	Severnaya Dvina	Ust-Pinega

- records ***70085*** and ***70801*** in ***X-file*** were found to be versions of the same gauge record [***Severnaya Dvina @ Ust Pinega***].
- these were extracted and handled separately with site record 70801 from RUS, before merging with RUS.
- **70801** is the correct Russian code for this gauge

Pseudo FSU–Russian Gauge IDs

- For two sites in WMO & one in O-file not in the other sets, there were no FSU-Russian gauge nos. available. Hence, gauge numbers were faked using the appropriate basin code with suffix 999.

75999	**o**	**Volga**	**Yeltsy**	**RU**	**EU**
84999	**w**	**Kara Samur**	**Luchek**	**RU**	**EU**
85999	**w**	**Vorotan**	**Urut**	**AZ**	**EU**

Assignment of Unknown Sites

11 site records in the combined Rus-Am set had no directly corresponding names in the available catalogues. All but 2 were matched to catalogue sites as follows:

10127 Charysh @ Charyshskoye

code	river	gauge	Lat	Lon	area km^2
10127	**Charysh**	**Charyshskoye**	**51.40**	**83.57**	**7,180**
10134	**Charysh**	**Charyshsky**	**52.13**	**83.28**	**20,700**

- the available catalogue files give these identical coordinates, but ***Charyshskoye*** and ***Charyshsky*** are distinctly different places with the coordinates listed above
- record ***10127 Charysh @ Charyshskoye*** with drainage area 7,180 km^2 is available in the present set

71193 Umba @ Umba Lake outlet

code	river	gauge	Lat	Lon	area km^2
71193	**Umba**	**Umba L outlet**	**67.53**	**34.28**	**2,380**

- **71193** is identified in SHI metadata as **Umba @ efflux** which is interpreted here as **Umba @ Umba Lake outlet**

76229 Usva @ Usva

code	river	gauge	Lat	Lon	area km^2
76229	**Usva**	**Usva**	**58.68**	**57.57**	**2,170**

- un-named, un-georeferenced record **76229** is identified in SHI metadata as **Usva @ Usva**

76566 Vyatka @ Arkul

code	river	gauge	Lat	Lon	area km^2
76566	Vyatka	Arkul	57.27	50.02	96,900

- un-named **76566** is identified in SHI metadata as **Vyatka @ Arkul** not ***Vyatka*** @ **Akutkol'** as given in the catalogue files of ds553

78142 Khoper @ Novokhopersk

code	river	gauge	Lat	Lon	area km^2
78142	Khoper	Novokhopersk	51.08	41.65	34,800

- un-named, un-georeferenced record **78142** is identified in SHI metadata as **Khoper @ Novokhopersk**

75241 Kostroma @ Bui d/s Veksa

code	river	gauge	Lat	Lon	area km^2
75241	Kostroma	Bui d/s Veksa	58.33	41.50	8,870
			58.48	41.53	

- Un-named record **75241** is identified in SHI metadata as ***Kostroma @ Bui d/s Veksa***
- SHI gives different coordinates (blue) than Rus-Am catalogue files (yellow)
- take your pick

72450 Lovat @ Sel'tso

code	river	gauge	Lat	Lon	area km^2
72450	Lovat	Sel'tso	56.93	30.68	8,230
			56.83	30.67	

- un-named record **72450** is identified in SHI metadata as **Lovat @ Sel'tso**
- SHI gives different coordinates (blue) than Rus-Am catalogue files (yellow)
- take your pick

78011 Don @ Georgiu-Dezh (Liski)

code	river	gauge	Lat	Lon	area km^2
78011	Don	Georgiu-Dezh (Liski)	51.00	39.50	-
			50.83	39.50	

- un-named, un-georeferenced record **78011** is identified in SHI metadata as ***Don @ Georgiu-Dezh*** which seems to be also known as ***Liski***
- no drainage areas are given, the expected drainage area would be 75,000–82,000 km^2 for the given mean annual discharge.

Others

- un-named record ***5105*** matches WMO record ***Ussuri @ Kirovsky*** at approximately the same coordinates

- un-named record **75348** has coordinates that put it 10 km from Bolkhov. The Slack list has an un-georeferenced gauge called Nugr @ Bolkhov with area 1,010 km^2. At the prevailing regional specific runoff (139–165 mm/a), the probable area of the ^{2}. Thus it seems likely that Nugr @ Bolkhov are the stream and gauge names. Record 75348 is labelled **Nugr (likely) @ Bolkhov.**

- un-georeferenced record ***76355 Urshak @ Lyakhovo*** was assigned coordinates 54.4N, 55.7E. NIMA GEOnet returns several Lyakhovos. This one seems to be about where correlations with other sites suggest it should be (northwest of Ufa, near sites 76490, 76500, 76512), but there is another Lyakhovo not too far to the south that might be the correct location.

Finally, only 1 site remain un-named and un-located:

3411 -99 -999 unknown unknown RS AS -9

- Record 3411 is a small (50–500 km^2) catchment somewhere in the vastness of north central / northeastern Siberia. Russian basin codes of the 3000 series include the Lena, Indigirka, Alazeya, Yana, Omoloy and Olenek basins. Site 3411 will not likely correlate well with anything but similarly sized streams in near proximity. Correlations suggest that site 3411 is likely in the Vilyuy sub-basin of the Lena or the adjacent upper Olenek basin
- presently, these data are not useful, but it may be possible to identify the stream and gauge location as further Russian data become available; hence, they were left in the present collection

UNESCO/WMO files: IHD, WMO and RIV

- Nominally IHD has data for 84 FSU sites with discharges through 1972.
- WMO has data for 87 FSU sites with discharges to 1985.
- RIV has data for 85 FSU sites with discharges to 1985.

- as other sources such as R-ArcticNET have become available, data in these files are approaching obsolescence; however, for the present,
  - there remain 6 records that are presently unavailable in other readily available sources
  - scattered cases where the metadata from these files assist in resolving discrepancies in metadata from other sources
  - scattered cases where the discharge data appear to be more correct than those from other data sources (i.e., some data in Russian data bases appear to have become corrupted since the submission of data to UNESCO)

- data in RIV are the FSU subset of RIVDIS which is a compilation of data provided to UNESCO/WMO by Vorosmarti & associates

- data in WMO are nominally the same data that appear in RIV except that the compilation has been attributed to GRDC

- IHD is an early compilation, nominally of 84 of the 87 sites in WMO. Despite it's age, IHD was helpful for identifying some typos, mislabeled gauges, incorrect geographic coordinates & other discrepancies in the other data sets.

- The combined set has 87 geographically unique site records as summarized below. 62 sites are common to the Russia-US exchange files, while 25 sites are not. The set has 3 Russian sites not in the Russia-US exchange files. 25 sites are in FSU republics. Of these, 22 are not in the Russia-US exchange files.

Country	WMO	† Rus-Am	this set
Russia	**62**	**59**	**291**
Kazakhstan	**10**	**2**	**10**
Ukraine	**3**	**1**	**3**
Azerbaijan	**3**		**3**
Tajikistan	**2**		**2**
Belarus	**1**		**1**
Moldova	**1**		**1**
Estonia	**1**		**1**
Lithuania	**1**		**1**
Latvia	**1**		**1**
Georgia	**1**		**1**
Uzbekistan	**1**		**1**
totals	**87**	**62**	**316**

† sites in Rus_Am common to WMO

As data in IHD, WMO & RIV ostensibly originated from the same submissions to UNESCO, data for common months should be identical among sets, but common data in the 3 sets differ somewhat due to scattered data entry errors, crude rounding in IHD, & other discrepancies.

RIV compilers incorrectly reduced the 4 independent site records listed below into two composite records.

RIV #	RUS #	River	Gauge
1268	3811	Olenek	7.5 km d/s R Bur †
	3409	Olenek	8 km u/s R Bur
	85576	Vorotan	Eivazlar
228	85999	Vorotan	Vorotan (1973-75 Urut)

† identified as River Pur or River Buur in some sources, definitely not to confused with the much larger Pur River that drains to the Obskaya Gulf

11542 Severnaya Sosva @ Sosvinskaya Kultbaza

code	river	gauge	Lat	Lon	area km^2
11542	Severnaya Sos'va	Sos'vinskaya Kultbaza (Sos'va)	63.65	62.10	65,200

- the gauge location is variably known as ***Sos'vinskaya Kultbaza***, ***Sos'vinskaya***, or ***Sos'va*** (not to be confused with the other Sos'va of gauge 12434)

13005 Kara-Turgay (Qaratorghay) @ Akutkol

code	river	gauge		Lat	Lon
13005	Kara-Turgay (Qaratorghay)	Akutkol	KZ	50.12	65.57
				49.92	64.20

- the UNESCO files and V-file give different location coordinates for "Akutkol" which cannot be found in any readily available geographic name data bases or maps
- both sets of coordinates plot on the river channels about 100 km apart
- the UNESCO coordinates (2nd line) seem to be downstream on the Turgay River rather than upstream on the "Kara Turgay" tributary
- the V-file coordinates are retained for the present
- **Qaratorghay** seems to be the modern Kazakhstani name for the river

75309 Oka @ Orel (Kostamarovo)

code	river	gauge	
75309	**Oka**	**Orel (Kostamarovo)**	**RU**

- recent sources identify the gauge location as ***Orel***
- in the UNESCO files and other sources the gauge location was labelled "***Kostanarovo***" which was likely a mis-spelling of ***Kostamarovo*** a town near ***Orel***

82801 Rioni @ Zemochaladidi

code	river	gauge		Lat	Lon
82801	**Rioni**	**Zemochaladidi**	**GE**	**42.22**	**41.82**
		Sakochakidze		**42.18**	**41.68**

- in the UNESCO files, this site was identified as ***Sakochakidze*** which cannot be found in modern geographic name data bases and may be an old Russian name
- more recent sources give the gauge name as Zemochaladidi or Chaladidi with slightly different coordinates
- the older coordinates are closer to the Black Sea and may be more valid

Volga — lower Volga sites

- Rus-Am data has 2 sites. WMO record has a copy of the Volgograd record, but it has the higher drainage area attributed by RUS to downstream site 7801.
- Drainage areas may not be correct. The difference between the two sites seems to be too small.
- Discharge starts dropping below Volgograd as terrain becomes arid, local inflows decrease, & some waters may be diverted for irrigation.
- geo coordinates were also somewhat inconsistent

- as found

code	Lat	Lon	area	river	gauge
77090	**48.67**	**44.50**	**1,350,000**	**Volga**	**Volgograd powerplant**
wmo	**48.77**	**44.72**	**1,360,000**	**Volga**	**Volgograd powerplant**
77801	**46.67**	**47.67**	**1,360,000**	**Volga**	**Verkhne-Lebyazh'ye**

- after collating

code		Lat	Lon	area	river	gauge
77090	**w**	**48.67**	**44.50**	**1,350,000**	**Volga**	**Volgograd powerplant**
77801		**46.67**	**47.67**	**1,360,000**	**Volga**	**Verkhne-Lebyazh'ye**

Vorotan River, Azerbeijan sites

85576	**w**	**39.43**	**46.36**	**Vorotan**	**Eivazlar**	**2,020**
85999	**w**	**39.48**	**46.15**	**Vorotan - wmo**	**Vorotan (1973-75 Urut)**	**1,550**

- these 2 Azerbeijan sites are found ONLY in the IHD/WMO/RIV files
- data and metadata are muddled

- the main gauge appears to be near a place called ***Eyvazli*** in modern transliteration of Azerbeijan place names, or Eivazlar in all the old UNESCO files
- Eivazlar has ID 85576 in the Rus-Am site catalogues

- the 1973–1975 data come from an upstream gauge called Urut that is too obscure to be found on maps or gazetteers
- ID 85999 for Urut is a bogus ID devised for merging the site with Rus-Am data

- there does not appear to be a place or gauge called Vorotan

- the record for ***Eyvazli*** / Eivazlar was matched to a long record in an independent collection with data for 1927–1985 with several missing pieces including 1976–1980

- although the UNESCO records are muddled under two gauge names, data for 1965–1971 and 1981–1984 are unequivocally for ***Eyvazli***
- the 1973–1975 data are clearly for an upstream gauge, nominally Urut
- Urut has 77% ***Eyvazli*** drainage area, but for 1973–1975, averages 84% of ***Eyvazli*** discharge

- ***it is impossible to ascertain from available sources whether the 1976–1980 UNESCO discharges are for Urut or Eyvazli***
- these years have been ascribed to both gauges in different sources, but are missing from the independent record for ***Eyvazli***
- the 1976–1980 data are in the low range for ***Eyvazli*** data, but plausible for this site

Vorotan Data Retained

- the independent record is retained for ***Eyvazli*** with the 1976–1980 data from the UNESCO files under ID ***85576***

- the 1973–1975 data for ***Urut*** are retained under pseudo FSU gauge ID ***85999***
- the 1976–1980 data assigned to ***Eyvazli*** might be from ***Urut***

Drainage Area Discrepancies — Ob River Basin

- the largest discrepancies occur for certain main branch and large tributary gauges in the Ob River basin
- a large discrepancy of ca. 500,000 km^2 is often seen in the areas reported for the entire Ob basin and the main downstream gauge ***Ob @ Salekhard 11801***
- the disparity in drainage area estimates appears to originate mainly in estimates reported for the Irtysh tributary and its main affluents, the Tobol and the Ishym

- the differences of up to 530,000 km^2 in total Ob basin area are apparently due to inclusion/exclusion of closed drainage areas in the Irtysh system where some tributaries appear to wrap around closed drainage areas, and variable boundary definitions between the Irtysh system and the adjacent closed drainage areas of central Asia

- for the present metadata, the lower drainage areas have been accepted

Ob @ Salekhard 11801

- IHD gives area as **2,430,000** km^2 — this is widely used and accepted herein
- WMO, GRDC & new RUS files give area as **2,950,000** km^2
- a UNEP/SCOPE source gives total basin area as **2,550,000** km^2

Irtysh @ Omsk / Ust-Ishym / Tobolsk

- the discrepancies shown below, confirm that most of the differences in reported total Ob basin areas originate with variable areas reported for Irtysh River gauges

	River	Gauge		Lat	Lon	area km^2 R-Arctinet	area km^2 UNESCO
11048	Irtysh	Omsk	RU	55.02	73.30	321,000	769,000
11055	Irtysh	Ust-Ishim	RU	57.70	71.17	564,000	1,060,000
11056	Irtysh	Tobolsk	RU	58.20	68.23	969,000	1,490,000

Ishym @ Petropavlovsk 11410

- the IHD estimate is likely wrong

	River	Gauge		Lat	Lon	area km^2 IHD	WMO / RUS
11410	Ishym	Petropavlovsk	KZ	54.88	69.13	106,000	118,000

Tobol River gauges

- gauge ***12023 Tobol @ Lipovka / Lipovskoye*** is the only one in this set, but the other two are available in R-ArcticNET and the metadata have been reported in various inventory lists
- gauge ***12023*** is variably identified as ***Lipovka*** or ***Lipovskoye*** — take your pick

	River	Gauge		Lat	Lon	area km^2 R-Arctinet	UNESCO
12014	Tobol	Kurgan	RU	55.4	65.4	98,800	159,000
12018	Tobol	Yalutorovsk	RU	56.7	66.4	177,000	241,000
12023	Tobol	Lipovka / Lipovskoye	RU	57.8	67.4	359,000	423,000

Drainage Area Discrepancies — other sites

Kalaus @ Svetlograd 84009 — Kalaus @ Petrovskoye

- IHD, WMO, GRDC & RUS have site record **84009 Kalaus @ Svetlograd**, while Slack's list gives un-georeferenced site **Kalaus @ Petrovskoye** with the drainage area of 4,540 km^2 —— these may be the same entity

Kara Turgai @ Akutkol 13005

- IHD, WMO & GRDC give area as 14,700 km^2
- RUS gives area as 14,900 km^2
- using 14,900 km^2

Luga @ Tolmachevo 72577

- RUS area is 6,350 km^2
- WMO area is 5,990 km^2
- using 6,350 km^2

Nimelen @ Timchenko 5459

- RUS area is 9,950 km^2
- WMO area is missing
- using 9,950 km^2

Nura @ Sergipal'skoye 13066

- area given as 17,960 km^2 in RUS catalogue file
- site has data only in IHD & WMO files where area is given 12,300 km^2
- using 17,960 km^2

Oka @ Kaluga 75314

- RUS area is 54,900 km^2
- WMO area is 349,000 km^2
- using 54,900 km^2

Onega @ Porog 70842

- RUS area is 55,700 km^2
- WMO area is 55,770 km^2
- using 55,700 km^2

Pes' @ Yakhnovo 75156

- RUS-Am exchange files give area as 693 km^2
- R-ArcticNET gives 710 km^2
- using 693 km^2

Pyarnu @ Oorekula 41127

- IHD, WMO & GRDC give area as 5,180 km^2
- RUS gives area as 5,150 km^2
- using 5,150 km^2

Plotnikova @ Dalniy 2152

- RUS area is 642 km^2
- WMO area is 649 km^2
- using 642 km^2

Sosva @ Sosva 12434

code	river	gauge	Lat	Lon	area km2
12434	**Sosva**	**Sosva**	**59.17**	**61.92**	**22,100**

- record 12434 Sosva @ Sosva was identified in available catalogues with drainage area 65,200 km^2
- the drainage area according to SHI is 22,100 km^2
- the coordinates have been changed from previous releases

Geo Coordinate Corrections

- Geographic coordinates given for these sites are often rough.
- Sites having coordinates were checked against coordinates given in the Digital Chart of the World [DCW] gazetteer.
- DCW coordinates were substituted for 127 sites & some of the DCW coordinates were modified slightly if DCW plotted perceptibly off river.
- Many of these substitutions were done blindly as my digital map has blue line coverage only for larger rivers. In my experience, DCW has <1% perceptible errors & most of those are small. Generally, DCW points at towns or airports not stream gauges, but for 85-90% of about 25 sites checked manually, the DCW coordinates were better than the given coordinates which plotted perceptibly off river, at the wrong location on the river, or in some cases, on the wrong river altogether.

- for **Version 1.2**, coordinates were checked against the coordinates given in R-ArcticNET and V-file for 252 sites common to this set
- about 25 discrepancies >20 km were investigated and resolved
- most present location coordinates should be within 15 km of the true gauge locations

- ***for any work dependent on the precise geographic location of these gauges, the locations should be corroborated independently***

- The most significant error was site ***11524 Konda R @ Bolchary*** for which coordinates given in file A11 [59.67N, 49.00E] put the site 1,000 km west into Russian basin 76000.

- the next largest error was for ***13005 Kara-Turgay (Qaratorghay) @ Akutkol*** which UNESCO coordinates placed 100 km downstream on the Turgay River

- ***Akutkol*** cannot be found in any readily available geographic information sources, but the available coordinates from V-file do place the gauge on the Kara Turgay tributary so that any error cannot be too large

- Otherwise location changes were generally <100 km, mostly 5–30 km

Data Discrepancies

- in ***riv1dat***, the July 1950 entry at site 70850 was 345O which was assumed to be 3450 which is consistent with the typical July discharges observed at the site

- in the main file there were 2 completely identical copies of record 70180

Comparisons among Data Sets

- where possible discrepancies were evaluated by comparing RUS, X, and WMO/IHD/RIV
- X-file had data for 24 FSU [23 Russia, 1 Ukraine] sites in WMO/IHD/RIV

Discrepancies: non-WMO sites

- there were 229 sites that had not been reported in IHD/WMO/RIV
- only 8 of these had records in both RUS & X, and these records were essentially identical in RUS and X on common months
- data quality analysis relied on standard outlier scanning techniques but these are limited by the nearly dichotomous nature of much of the Arctic & arid region data, i.e., zero discharge during ice/dry season in most years, and perceptibly positive observations during warm/wet years [see next section]
- consequently, potential outliers tagged by standard scanning were evaluated by inspecting the site records vis-à-vis records of nearest neighbours both geographic and as determined by intersite correlations (generally Spearman's ρ on both raw & de-seasonalized data). This isn't too hard to do if the intersite distance and correlation matrices have been pre-determined and the outlier scanning software is set up to dump records in a format convenient for comparative visual inspection.

- the scans revealed some flagrant discrepancies shown below

- ***Some discrepancies were deleted, & some were left unchanged; you may want to revert to original data or substitute your own guess at the truth.***

Missing Values and Zeros

- sites in northeastern Siberia and southerly arid regions of central Asia may contain numerous zeros during the freeze-up months or dry season respectively
- in the Rus data files, each datum has qualifier codes that indicate amongst other things which data are to be interpreted as zeros rather than missing values.
- in the IHD/WMO/RIV files, many data that should have been interpreted as zeros, were reported as missing values
- the problem is most acute at ***1594 Amguema @ mouth of Shoumny Bk*** where most missing values reported in IHD/WMO/RIV sets are in fact zeros according to Rus files

- incorrectly interpreting zeros as missing values (or vice versa) can have significant repercussions for (a) time series modelling, and (b) the estimation of specific runoff
- in the latter case, regardless of how calculations are performed, the de facto exclusion of many zeros incorrectly identified as missing values and admitting mostly positive discharges that occur during the occasional warm winters, can significantly overestimate the specific runoff for the watershed which in turn leads to overestimation of surface runoff in regional water budgets and other extrapolations that are typically derived from specific runoff data

Documented Data Discrepancies:

1801 Kolyma @ Srednekolymsk

- in WMO & RIV, the 1981 record is replicated in 1982
- the RUS & x-file records appear legitimate

		RUS	x-file	WMO	RIV
1981	1	138.0	138.0	138.0	138.0
1981	2	120.0	120.0	120.0	120.0
1981	3	80.4	80.4	80.5	80.5
1981	4	95.3	95.3	95.5	95.5
1981	5	3990.0	3990.0	3990.0	3990.0
1981	6	5710.0	5710.0	5710.0	5710.0
1981	7	2600.0	2600.0	2600.0	2600.0
1981	8	3650.0	3650.0	3650.0	3650.0
1981	9	2260.0	2260.0	2260.0	2260.0
1981	10	1360.0	1360.0	1360.0	1360.0
1981	11	460.0	460.0	460.0	460.0
1981	12	238.0	238.0	238.0	238.0
1982	1	145.0	145.0	138.0	138.0
1982	2	104.0	104.0	120.0	120.0
1982	3	91.1	91.1	80.5	80.5
1982	4	78.2	78.2	95.5	95.5
1982	5	2850.0	2850.0	3990.0	3990.0
1982	6	7470.0	7470.0	5710.0	5710.0
1982	7	4150.0	4150.0	2600.0	2600.0
1982	8	4130.0	4130.0	3650.0	3650.0
1982	9	4570.0	4570.0	2260.0	2260.0
1982	10	864.0	864.0	1360.0	1360.0
1982	11	301.0	301.0	460.0	460.0
1982	12	327.0	327.0	238.0	238.0

- Through the 1940s & 1950s, WMO/IHD/RIV agree with RUS while there are numerous discrepancies between RUS & X, mostly on May-June discharges; for 1950–1957, X has identical data with the same discrepancies as WMO / IHD / RIV / RUS on May-Jun discharges
- May–Jun records would appear to have been retrospectively revised.
- From 1964 onward, X agrees with RUS while there are numerous discrepancies with WMO / IHD / RIV
- As reasons for the discrepancies are unclear, there is no particular reason for choosing the other records over RUS with the exception of some probable typos shown below:
- ***the June 1928 discharge is the lowest of 56 years by 300-fold and was changed to the O-file discharge***

- the May 1951 RUS value is within the range of reported values and may be valid; thus it was left as is; however, the WMO discharge of 2,650 is closer to the seasonal norm and may be the valid entry. X has 435.
- ***the May 1958 value would be the lowest ever by an order of magnitude and was changed to the X-file discharge***

			RUS	WMO	X-file	O-file	dif	seasonal	r1	r2	r3
1801	1928	6	10.2			10200.0	-10189.8	9732.0	-12.0	0.6	
1801	1951	5	265.0	2650.0	435.0		-2385.0	1981.0	-3.9	1.6	-3.5
1801	1958	5	10.9		109.0		-98.1	1799.0	-4.6		-4.4

† the *seasonal* is a robust iterated biweight that should be close to the median of the monthly values. And r1, r2, r3 are the respective outlier diagnostics for the monthly discharges in records 70801 and 70085 expressed as the ratio of difference between the value & the seasonal to the robust dispersion measure [an iterated biweight that should be close to 1/2 IQR or MAD]. By Mosteller–Tukey critera, ratios of 6–9 are taken to define "Far Out" points, but due to underlying trends in discharge, more conservative (bigger) limits should be used.

3153 Peledui @ Solezavod

- Jun 1938 discharge is probably a typo; 2nd lowest discharge in 30 yrs is 32
- this record correlates only poorly with nearest neighbours (ca. 300 km removed)
- from pre-/post- months, expected Jun discharge would be 48–178
- I suspect true Jun 1938 discharge is 120, but I left this one unchanged

	J	F	M	A	M	J	J	A	S	O	N	D
1936	23.2	19.2	15.6	16.4	112.0	142.0	63.3	39.2	31.3	25.0	27.7	23.7
1937	21.6	19.0	16.3	16.0	304.0	81.5	31.4	40.4	41.5	31.2	25.8	17.9
1938	15.1	13.0	11.8	47.4	330.0	12.0	50.4	34.2	25.2	23.7	20.9	15.5
1939	13.5	12.1	12.2	38.0	104.0	36.0	26.9	17.1	16.4	9.9	9.3	10.9
1940	9.9	9.2	7.6	10.0	143.0	40.1	21.8	17.3	16.4	15.2	10.3	11.5

3180 Chara @ Tokko

- Dec 1972 discharge (7.25) is too low; it would be 6-fold lower than the 2nd lowest Dec discharge in 52 years
- this site correlates well with ***3036 Lena @ Solyanka*** for which Dec discharge increases from Nov; but the latter stream is 10+ fold larger & not necessarily the best indicator
- at a comparably sized neighbour, ***3157 Bolshoi Patom @ Patom***, that correlates only moderately (Spearman = 0.5), Dec discharge drops by half from Nov, the typical decline
- evidence is a bit weak, but this looks like a typo & ***Dec discharge was set to 72.5***

- you may want to change it back or delete it

	J	F	M	A	M	J	J	A	S	O	N	D
1970	56.9	38.8	39.3	68.5	1070	2730	1250	777	1180	347	125.0	84.8
1971	62.8	48.1	39.5	54.6	1280	2320	2100	1250	1670	441	151.0	94.6
1972	74.7	63.1	41.5	37.4	659	1930	953	831	1240	255	90.4	7.3
1973	59.2	48.6	40.7	47.0	810	1720	1480	998	380	270	102.0	93.8
1974	62.9	43.8	41.4	44.6	469	2630	1690	764	379	261	99.7	77.7

3222 Aldan @ Ust-Mil'

- Apr 1971 discharge is a probable typo; downstream site 3225 had normal discharge
- ***Apr 1971 discharge was changed to 151*** which is about right vis-à-vis the downstream site

	J	F	M	A	M	J	J	A	S	O	N	D
1969	186	118	85	95	3910	12700	4800	1640	1970	717	294	250
1970	165	122	105	103	7270	14500	2320	2630	4000	1300	593	373
1971	256	188	137	1510	8340	6890	3630	3040	4330	1300	441	393
1972	243	193	151	195	5000	10000	8470	8970	5660	2700	491	353
1973	233	180	154	159	5070	6170	5320	7270	2130	1130	553	388

3291 Amga @ Buyaga

- Apr 1967 discharge is extreme & likely a typo
- ***the WMO/IHD/RIV value of 88.0 was substituted***
- site 3291 correlates only modestly with its somewhat remote nearest neighbours (3222 at 341 km to the east, & 3180 at 403 km to the west); discharges at both rise modestly in Apr to levels well below the May peak)

	J	F	M	A	M	J	J	A	S	O	N	D
1965	19.7	18.8	15.3	16.4	539.0	286.0	101.0	44.9	93.3	44.9	29.8	18.2
1966	14.5	13.4	11.4	8.8	569.0	258.0	67.1	50.1	86.2	51.8	30.4	20.6
1967	15.8	14.9	12.5	887.0	857.0	254.0	36.7	40.4	38.0	34.9	16.8	15.9
1968	14.9	11.0	10.6	114.0	746.0	164.0	58.6	56.2	103.0	39.0	18.8	15.8
1969	12.7	8.2	6.7	4.5	484.0	438.0	195.0	33.4	37.3	21.1	15.7	10.4

- Apr 1943 discharge also stands out as extreme; but this may be a case similar to 1968 where the spring flood arrived early
- this was left unchanged

	J	F	M	A	M	J	J	A	S	O	N	D
1941	10.9	10.0	8.8	10.2	543.0	206.0	23.9	20.7	19.7	17.3	5.6	3.4
1942	8.5	8.2	8.4	9.3	388.0	230.0	43.4	86.2	126.0	81.3	35.3	16.8
1943	11.4	8.9	7.9	182.0	535.0	85.5	118.0	222.0	245.0	129.0	62.5	31.7
1944	19.1	15.3	14.2	15.0	845.0	190.0	227.0	237.0	154.0	92.9	37.2	23.2
1945	17.0	15.2	14.6	16.3	673.0	306.0	216.0	53.8	63.7	42.5	24.5	14.1

3367 Markha @ Malykai

- there are 10 or so discrepancies between RUS and the others; the only one of these that seems likely to be a typo occurs in both RUS & WMO
- the RUS Aug 1988 value would tie the lowest Aug discharge reported for 42 yrs
- data for the upstream site, Markha @ Chumpuruk in R-ArcticNET also has very low discharge, so this appears to be legitimate
- X-file gives 133 which appears to be wrong

			RUS	WMO	X	dif	Seasonal
3367	1984	8	13.3	13.5	133.0	-119.7	281.1

3409 & 3811 — Olenek River Sites

- There are 2 gauge records for the lower Olenek River.
- RUS has record 3409 which extends from July 1951 to Dec 1963.
- X has record 3811 which extends from 1964–87.

Rus #	IHD #	RIV #	River	Gauge	Drainage area
3409	MH31		Olenek	8 km u/s R Pur	181,000
3811		1268	Olenek	7.5 km d/s R Pur	198,000

- IHD incorrectly gave a composite of record 3409 and 3811 for 1952–72 identified as site 3409
- RIV incorrectly gave the same composite for 1952–84 as IHD, but identified the site as 3811
- WMO correctly gave records 3409 for 1952–63 and 3811 for 1965–84.
- comparison of record 3409 from RUS & WMO shows only trivial rounding inconsistencies
- none of these records have data for 1964
- essentially RUS, IHD, RIV, and WMO are identical where they overlap and the only practical difference is in the metadata

- X-file has data for site 3811 for Jan 1964 – Dec 1987
- X & WMO have numerous discrepancies mainly over 1965–69 plus a few in 1979.

- X and R-ArcticNET have identical data for 1964–1985
- the whole 1964–1987 X-file record was accepted for site 3811

3821 Lena @ Kusur

- RUS & WMO/IHD/RIV agree except for a few typos in the latter
- Oct–Dec 1974 RUS discharges may be in error; WMO discharges are closer to seasonal norms; RUS records have been retained for the time being

		RUS	WMO	dif	Seasonal	r1	r1
1974	7	52,000	52,000		39,481	6.1	6.1
1974	8	38,300	38,300		27,291	8.0	8.0
1974	9	23,200	23,200		24,683	-1.0	-1.0
1974	10	16,700	13,600	3,100	13,811	3.3	-0.2
1974	11	6,190	4,050	2,140	3,280	15.5	4.1
1974	12	4,820	2,990	1,830	2,740	14.9	1.8
1975	1	2,360	2,360		2,600	-1.9	-1.9
1975	2	2,010	2,010		1,975	0.3	0.3
1975	3	1,600	1,600		1,425	2.0	2.0

3802 Khatanga @ Khatanga

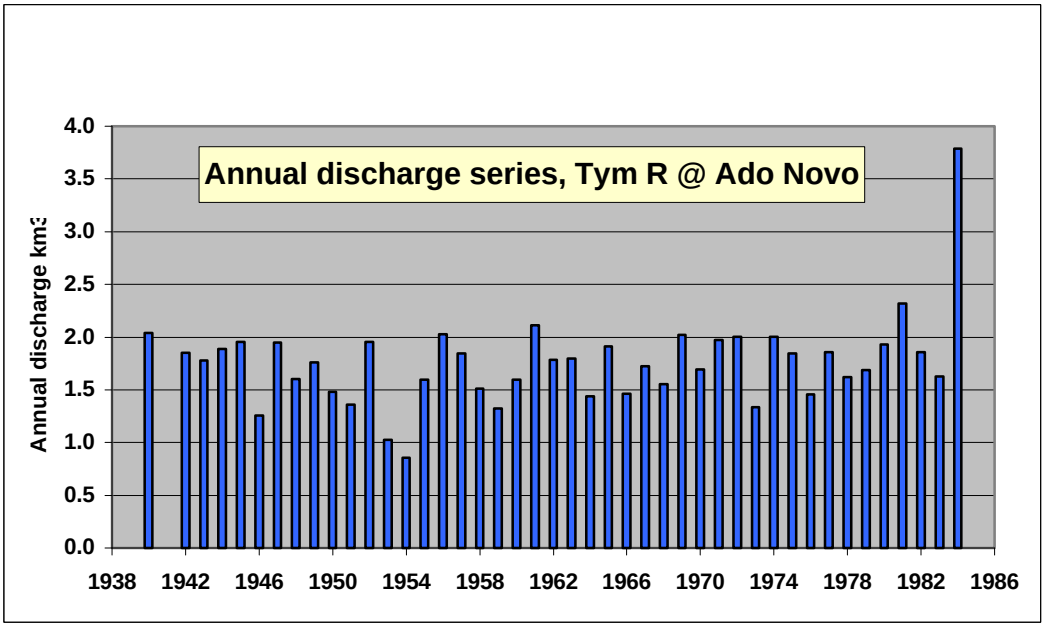
- the version given in v1.1 has been replaced by data from R-ArcticNET
- the version in v1.1 reported false 0s for winter freeze-up months
- R-ArcticNET record gives these as missing values

- it seems that this gauge only operates during open water months
- for several during the 1960s, the whole year was monitored
- winter discharges fall to <1000 m^3/s, but are unlikely to go to 0; this river is too big to freeze solid regardless of how cold it becomes in the region

4033 Tym @ Ado Tymovo

- 1984 discharges [last available year] are extraordinarily high
- this is the only Sakhalin Island stream in the set, so there are no other stream data to compare it to
- the plot of the annual discharge series confirms that 1984 data are highly abnormal
- analysis of data for 4 coastal precipitation gauges surrounding site 4033 which is in the centre of the island shows that 1984 was consistently near or below long term mean annual total precipitation at each gauge
- ***thus, 1984 was deleted***

	J	F	M	A	M	J	J	A	S	O	N	D
1980	13.5	11.5	11.0	13.0	273.0	184.0	26.0	14.5	59.0	75.5	28.0	17.0
1981	14.0	11.0	9.4	31.0	222.0	70.0	34.0	51.5	82.0	237.0	82.5	26.0
1982	18.5	15.0	13.0	43.5	207.0	159.0	40.5	17.0	28.5	92.5	42.0	21.5
1983	16.0	12.5	10.5	45.5	188.0	130.0	26.0	29.5	30.5	74.5	30.0	19.5
1984	80.0	89.0	92.0	101.0	245.0	136.0	99.0	107.0	94.0	143.0	120.0	96.0



7024 Barguzin @ Barguzin

- Jul–Dec 1971 discharges are up to 10-fold too low; Jul-Dec discharges at 3 regional sites (3096, 7072, 7098) which correlate only modestly with site 7024, all have normal Jul-Dec discharges
- ***Jul-Dec 1971 discharges are implausibly low***
- a scan of R-ArcticNET data shows that ***these data belong to a small upstream tributary not the Barguzin***

- May 1972 discharge is extremely low; the 2nd lowest May discharge in 51 yrs is 77
- **R-ArcticNET data for an upstream gauge (Barguzin @ Mogoi'to) indicate that May 1972 for Barguzin @ Barguzin should be near 121 and discharge was changed accordingly**

	J	F	M	A	M	J	J	A	S	O	N	D
1969	33.2	27.2	22.0	42.0	144.0	243.0	169.0	223.0	207.0	85.5	48.5	41.8
1970	33.6	28.0	24.6	51.2	141.0	282.0	331.0	200.0	169.0	101.0	48.0	34.5
1971	27.3	24.5	20.9	56.3	155.0	250.0	9.8	8.9	5.5	3.7	2.8	1.8
1972	39.2	29.4	28.7	63.4	12.1	135.0	200.0	203.0	103.0	70.1	42.7	39.6
1973	35.5	28.4	23.6	40.3	158.6	287.0	360.0	653.0	359.0	137.0	58.6	49.2
1974	42.9	35.4	20.5	58.5	101.0	334.0	201.0	161.0	110.0	95.8	46.1	32.8

7047 Selenga @ Novoselenginsk

- Dec 1950 discharge is a probable typo; this would be the highest Dec discharge in 54 yrs record by two fold
- correlations with Russian neighbours are only modest, but Russian sites show no December rise, so any rise in discharge at site 7047 would have to have originated upstream in Mongolia
- based on the historical Dec record and other Russian sites, the Dec 1950 discharge at site 7047 should be <170 and >92.8
- **R-ArcticNET data for the downstream gauge (Selenga @ Mostovoy) give a Dec 1950 discharge or 203 which is about 2/3 of the Nov discharge**
- as the precise value isn't obvious, ***Dec 1950 discharge was deleted***

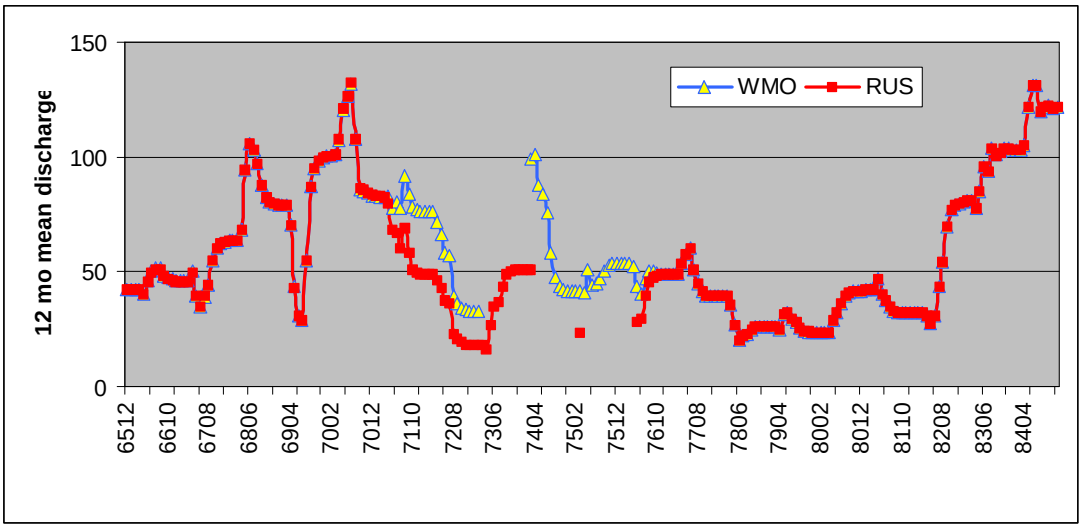
	J	F	M	A	M	J	J	A	S	O	N	D
1948	60.6	50.5	58.2	640	743	1240	1130	1330	1630	882	235	127
1949	71.4	60.3	69.3	453	874	710	1010	1370	1390	773	230	118
1950	60.1	43.0	48.9	275	1060	949	1930	2020	1630	879	170	766
1951	92.8	76.8	78.0	171	2240	1240	932	1240	1140	781	260	121
1952	74.8	66.7	62.3	262	1290	1420	1970	2670	1580	920	204	142

7098 Khilok @ Maleta

- from 1971-1975 the two records (RUS & WMO/RIV) are appreciably different, but both records are within the plausible range for this gauge
- below is the plot of 12 month running means with breaks due to some missing months during 1971–1975 in each series

- a check against R-ArcticNET data shows that presently in the Russian archives (both Rus-Am and R-ArcticNET) the 1971–1975 data for ***Khilok @ Maleta*** are identical to an upstream gauge ***Khilok @ Khilok*** with about 60% of the drainage area
- R-ArcticNET has another gauge ***Khilok @ Kunalei'*** not far downstream from Maleta

- the 1971–1975 data in WMO/RIV are consistent with the expected differences between upstream and downstream gauges; hence, the data given in Rus-Am and R-ArcticNET for 1971–1975 at ***Khilok* @ *Maleta*** are almost surely for ***Khilok* @ *Khilok***
- data from R-ArcticNET were retained with 1971–1975 from WMO/RIV



7168 Khara-Murin @ Murino

- Nov and Dec 1947 discharges stand out as abnormally low and high respectively

	J	F	M	A	M	J	J	A	S	O	N	D
1945	2.99	2.11	1.47	10.00	39.8	39.4	65.3	51.1	95.1	24.0	9.26	6.30
1946	6.27	4.81	2.84	8.49	45.5	48.1	39.8	41.1	26.9	20.2	9.42	4.38
1947	4.02	3.04	1.71	8.71	43.1	55.2	52.8	65.1	34.2	22.5	1.09	69.70
1948	5.66	3.76	3.31	8.32	39.0	91.0	72.0	80.6	55.3	21.8	7.66	5.21
1949	3.94	3.90	3.32	7.53	34.3	51.8	43.4	40.3	40.4	13.9	7.55	5.17

- the adjacent site, ***7167 Snezhnaya* @ *Vydrino,*** which correlates strongly with 7168, has a different pattern; typically site 7168 discharges are 50–70% of those at 7167; hence, the 7168 discharges are likely in error
- ***thus Nov–Dec discharges are site 7168 were deleted***

9340 Kan @ Podporog

- Jan 1976 discharge is too low (7.29); an upstream site 9335 & neighbour 8334, both of which correlate strongly with 9340, have normal Jan discharges 70-80% of the antecedent Dec discharges
- ***Jan 1976 discharge at site 9340 was changed to 72.9***

	J	F	M	A	M	J	J	A	S	O	N	D
1974	42.2	30.8	24.6	286.0	605	532	282	160	194	158	73.2	56.1
1975	41.9	41.7	33.3	188.0	856	876	461	369	433	247	108.0	92.3
1976	7.3	39.3	42.1	94.1	546	472	420	519	326	156	55.6	29.7
1977	21.0	22.3	23.9	313.0	956	746	455	320	306	261	121.0	51.2
1978	59.4	46.8	37.8	173.0	890	758	321	322	177	138	80.8	43.3

9455 Norilka @ Valek

- Sep 1961 discharge is extreme — the highest on record in 43 yrs for Sep by 6-fold
- R-ArcticNET data for this site give 670
- ***Sep 1961 was changed accordingly***

	J	F	M	A	M	J	J	A	S	O	N	D
1959	86.2	58.8	47.6	41.7	47.5	1470	1480	517	262	252	180	111.0
1960	85.0	48.9	33.8	29.6	103.0	806	575	294	236	171	118	82.2
1961	-9.0	-9.0	-9.0	-9.0	53.4	588	2230	1170	6700	428	232	142.0
1962	94.2	65.5	50.9	50.6	60.9	889	2390	1100	639	372	206	149.0
1963	103.0	74.0	46.7	43.3	49.7	994	1940	995	466	363	196	155.0

9803 Yenesei @ Igarka

- For this site, there are 118 significant discrepancies between the RUS record and the IHD/WMO/RIV records (which concur perfectly).
- Most discrepancies [ca. 115 of the 118] occur regularly on the 3 high discharge months (May-July) from 1936–1978.
- As viewed below, differences between the mean monthly discharges of RUS and WMO/RIV for 1936–1978 seem to suggest systematic adjustment.

	RUS	WMO/RIV	dif
May	27177	30551	-3374
June	82530	76756	5774
July	27967	27326	642

- It seems plausible that RUS records 1936–1978 have been retrospectively adjusted/corrected at high discharges some time since data were submitted to WMO and before preparation of the Rus-Am exchange file.

- Considering X-file muddies the waters a bit. Usually X-file agrees with RUS, but at this site, X-file concurs 90+% with WMO/RIV.

- Oct 1969 discharge in the RUS file is typo
- **R-ArcticNET gives 9810**

	J	F	M	A	M	J	J	A	S	O	N	D
1968	4940	5320	6040	6440	20600	66300	38300	15800	14200	11400	4790	5080
1969	6700	6800	6600	6900	11600	99700	21900	16800	15600	98100	5500	5100
1970	6200	7210	6630	8050	11200	71600	35300	18100	16700	11400	6690	6320

10117 Peschanaya @ Tochil'noye

- Oct 1944 discharge is clearly in error, the 2nd highest Oct discharge is only 66.6
- ***this was deleted***

	J	F	M	A	M	J	J	A	S	O	N	D
1943	7.01	4.73	6.3	85.9	58.7	50.1	28.5	18.0	15.9	13.1	5.9	8.92
1944	5.03	3.94	15.8	74.0	77.5	32.8	53.5	36.8	23.7	1814.0	11.2	7.76
1945	6.14	3.13	5.1	125.0	35.8	17.0	13.5	12.2	12.7	12.0	10.3	6.44

10240 Tom @ Novokuznetsk

- Mar 1973 discharge is a typo
- the site is below the confluence of 2 rivers, each with sites (10259 & 10277) not far upstream
- based on summation & prorating of upstream sites, ***the Mar 1970 discharge is likely 103 and was changed accordingly***

	J	F	M	A	M	J	J	A	S	O	N	D
1968	77.0	60.1	171.0	1540	1890	362	283	308	192	179	118	88.5
1969	67.7	63.9	64.1	882	5030	2490	364	374	520	889	265	121.0
1970	106.0	93.0	10.3	1550	3260	1730	338	438	272	624	208	117.0
1971	98.1	81.9	82.3	1610	3160	1150	434	252	174	167	143	102.0
1972	86.0	72.0	109.0	1510	1860	856	878	461	389	513	308	169.0

10441 Andarma @ Panychevo

- Jan 1963 discharge is too high; 2nd highest Jan discharge in 34 yrs is only 2.3
- some neighbouring sites [10548, 11309] that correlate with this one show normal discharge for Dec 62 and Jan 63
- ***this was changed to 1.87*** which is about what average ratios suggest it should be

	J	F	M	A	M	J	J	A	S	O	N	D
1962	1.73	1.56	1.56	9.76	28.30	7.00	2.96	2.84	2.09	3.00	2.02	1.67
1963	18.70	1.26	1.31	3.00	42.90	11.70	1.22	1.70	2.93	2.45	4.07	2.26
1964	1.59	1.35	1.26	2.97	64.70	11.90	3.18	2.47	2.81	3.93	3.02	1.82

11056 Irtysh @ Tobolsk

- Mar 1979 discharge is a typo; 2nd highest Mar discharge for 94 yrs is only 938
- Mar discharge of 599 is confirmed by R-ArcticNET data

	J	F	M	A	M	J	J	A	S	O	N	D
1978	505	567	561	1900	4620	3790	3040	2960	2290	2430	1720	1020
1979	758	632	599000	648	6120	7930	6250	3530	2650	2090	1300	1210
1980	952	771	842	1280	6320	5610	3000	1970	1730	1480	1180	713

11414 Ishym @ Vikulovo

- ***Mar 1981 discharge is 7.27***

	J	F	M	A	M	J	J	A	S	O	N	D
1980	9.5	7.6	8.0	110.0	500.0	266.0	58.0	37.7	17.3	13.6	12.1	9.1
1981	7.5	7.7	727.0	136.0	250.0	110.0	47.5	18.4	11.8	10.3	8.0	6.9
1982	6.8	6.9	7.7	60.4	74.1	40.4	15.2	9.6	10.5	8.7	5.9	5.5

11801 Ob @ Salekhard

- data from R-ArcticNET were substituted when available
- 1930–1935 and 1976–1977 were retained from v1.1

V1.1 notes

Before running comparisons, the following problems with replicated records in WMO & RIV were addressed.

- in WMO, Mar–Dec 1944 data were replicated in Mar–Dec 1943
- IHD, RIV & RUS are identical and appear to have the correct data
- the 1944 WMO record is OK

		WMO	IHD	RIV	RUS	x-file
1943	1	6,010	6010	6,010	6,010	5,958
1943	2	3,790	3790	3,790	3,790	3,885
1943	3	2,720	2870	2,870	2,870	2,921
1943	4	2,850	3220	3,220	3,220	3,110
1943	5	21,400	20900	20,900	20,900	13,580
1943	6	32,600	28000	28,000	28,000	28,363
1943	7	28,000	26000	26,000	26,000	26,103
1943	8	18,400	18000	18,000	18,000	18,310
1943	9	12,400	11400	11,400	11,400	11,363
1943	10	11,000	10500	10,500	10,500	10,299
1943	11	5,850	5620	5,620	5,620	5,599
1943	12	3,930	4060	4,060	4,060	4,563
1944	1	3640				
1944	2	3190				
1944	3	2720				
1944	4	2850				
1944	5	21400				
1944	6	32600				
1944	7	28000				
1944	8	18400				
1944	9	12400				
1944	10	11000				
1944	11	5850				
1944	12	3930				

- in WMO, the 1961 record was replicated in 1962
- the other 4 sets agree & appear to have the correct 1962 data

		WMO	IHD	RIV	RUS	x-file
1961	1	5,500	5,500	5,500	5500	5500
1961	2	4,770	4,770	4,770	4770	4770
1961	3	4,050	4,050	4,050	4050	4050
1961	4	5,020	5,020	5,020	5020	5022
1961	5	14,800	14,800	14,800	14800	14536
1961	6	36,900	36,900	36,900	36900	37087
1961	7	34,200	34,200	34,200	34200	34266
1961	8	20,400	20,400	20,400	20400	20635
1961	9	10,700	10,700	10,700	10700	10740
1961	10	9,680	9,680	9,680	9850	9850
1961	11	6,230	6,230	6,230	6240	6240
1961	12	5,690	5,690	5,690	5690	5690
1962	1	5,500	4,840	4,840	4,840	4,840
1962	2	4,770	3,980	3,980	3,980	3,980
1962	3	4,050	3,930	3,930	3,930	3,930
1962	4	5,020	4,560	4,560	4,560	4,562
1962	5	14,800	23,200	23,200	23,200	22,666
1962	6	36,900	30,500	30,500	30,200	30,407
1962	7	34,200	27,500	27,500	27,300	27,548
1962	8	20,400	15,300	15,300	16,100	15,391
1962	9	10,700	11,100	11,100	11,900	11,087
1962	10	9,680	9,570	9,570	10,100	9,570
1962	11	6,230	7,010	7,010	7,010	7,010
1962	12	5,690	5,670	5,670	5,670	5,670

After fixing the replicates and an obvious typo in IHD, IHD, WMO & RIV were all in agreement. Both RUS & X-file had data, so a 3-way comparison was run among RUS, X-file and WMO records:

- X-file disagrees with RUS consistently to 1964; much of it is reported to 4–5 digits, so it may have been derived without rounding from a set of dailies from somewhere back in time
- after 64, X-file is mostly identical to RUS except for a few typos.
- in contrast to X-file, WMO is nearly identical to RUS before 1962 and disagrees frequently with RUS post-62. Most discrepancies are minor, but some in the 1960s are potentially significant (>10%).
- From 1970–84, WMO is reported to 4–5 digits, so it may have been derived from a set of daily discharges without rounding.
- RUS has no obvious typos and is missing 1976–1980 which both WMO & X have, but X appears to have some typos for May–June 1979. X has 1986–88 which the

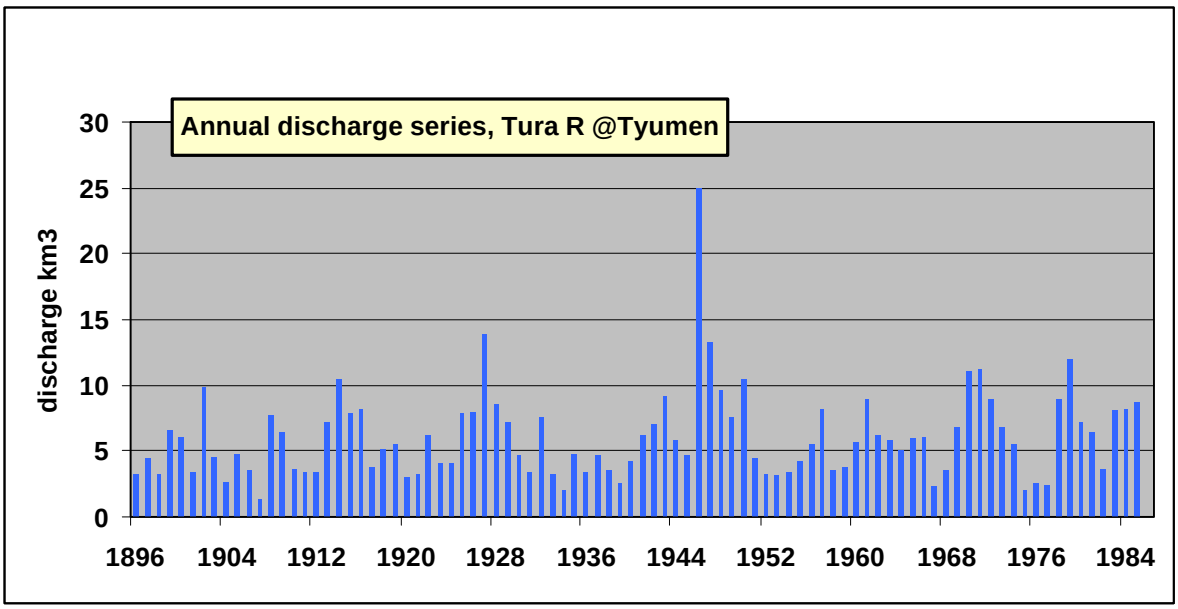
To build a complete record from 1930–88, RUS was used as the base, 1976–80 were filled in from WMO, and finally 1986–88 were added from X.

12244 Tura @ Tyumen'

- June 1946 discharge is extreme; the 2nd highest June discharge for 90 yrs is 1590 m^3/s
- the annual discharge volume plot shows that this single dubious datum produces an annual discharge 2-fold higher than any other in 90 yrs; moreover, the 90-yr mean annual discharge is raised 50% from 4 to 6 km^3/s

- **R-ArcticNET gives the same suspect discharge**
- **an upstream gauge (Tura @ Turinsk) suggests that the discharge should be in the range 500–750 m^3/s; hence, the actual discharge at Tyumen was likely 681**
- **Jun 1946 discharge was changed accordingly**

	J	F	M	A	M	J	J	A	S	O	N	D
1944	20.1	22.4	27.5	526.0	707.0	235.0	273.0	170.0	90.8	63.9	29.5	18.7
1946	26.1	30.4	42.0	355.0	1750.0	6810.0	80.0	51.5	53.8	158.0	147.0	57.0
1947	37.4	33.8	37.4	926.0	1270.0	1190.0	478.0	490.0	222.0	127.0	116.0	66.8



12517 Lobva @ Lobva

- RUS generally agrees with IHD/WMO/RIV except for minor discrepancies due to differences in reporting precision. X has no data.
- There is one significant discrepancy (below). Neither RUS nor WMO are near the seasonal, but not so far out as to be physically implausible. The RUS value is the highest reported May discharge on record, the WMO value is the 3rd lowest.

			RUS	WMO	dif
12517	1979	5	157.0	15.5	141.5

- kept RUS for the time being.

13066 Nura @ Sergipal'skoye

- 1971 discharges at this site are too high; except for Mar & Apr, 1971 discharges are 1 order higher than the 2nd highest discharge in the available 20 yrs record
- **an alternative version of this record with data extending from 1936–1985 gives typical data for 1971**
- the WMO / RIV / IHD version was replaced with the alternate record

	J	F	M	A	M	J	J	A	S	O	N	D
1969	0.0	0.0	0.0	52.0	1.9	0.3	0.3	0.2	0.2	0.8	0.7	0.3
1970	0.1	0.1	11.0	38.0	1.1	0.2	0.1	0.1	1.1	0.5	0.3	0.0
1971	33.0	32.0	15.8	133.0	155.0	238.0	134.0	41.0	35.5	61.5	64.0	57.0
1972	0.0	0.0	0.0	52.0	17.0	2.4	3.2	1.1	1.1	1.2	1.1	0.5
1973	0.1	-9.0	-9.0	52.0	12.0	1.6	0.7	0.7	0.6	4.4	15.0	4.7

14414 Karatal @ Ushtobe

- 1971 in UNESCO sources (WMO, IHD, RIV) clearly does not belong to this site
- the entire record was replaced with a longer and more recent record from V-file

	J	F	M	A	M	J	J	A	S	O	N	D
1968	36.0	33.0	68.0	92.0	133.0	61.0	36.0	11.0	23.0	48.0	55.0	45.0
1969	28.0	36.0	173.0	118.0	253.0	306.0	188.0	74.5	58.0	78.5	-9.0	-9.0
1970	33.5	71.5	77.5	95.5	79.5	78.5	55.0	42.5	44.0	53.0	59.0	44.5
1971	0.0	0.0	0.3	11.0	8.4	1.3	1.3	2.5	1.6	2.0	1.9	0.5
1972	31.5	25.0	60.0	128.0	178.0	142.0	106.0	68.0	56.0	78.5	88.0	76.0
1973	47.0	46.5	77.0	121.0	130.0	212.0	142.0	26.0	70.0	93.5	82.0	64.0
1974	30.0	20.5	64.0	76.5	43.5	12.0	9.3	9.6	17.5	39.0	45.5	29.1

17026 Amu Darya @ Chatly

- given the history of this river [much of the re-engineering of the system that contributed to destruction of the Aral Sea occurred during the 1960s], weird discharge patterns are expected & the record has been left as is
- nonetheless, if occasion arises, you might want to make inquiries about the scattering of apparently anomalous discharges over 1966–1973 [1973 is end of available record]

	J	F	M	A	M	J	J	A	S	O	N	D
1964	416.0	607.0	265.0	996.0	1620	1900	3400	2100	1390	991	650	502
1965	453.0	413.0	243.0	319.0	959	1580	1500	1280	917	776	703	521
1966	496.0	132.0	41.0	449.0	1440	2500	2890	2120	1410	904	714	509
1967	430.0	294.0	88.0	3.0	994	1750	2220	1970	1220	897	758	516
1968	251.0	144.0	21.0	198.0	1180	2480	3080	2520	1210	884	620	552
1969	318.0	498.0	914.0	2190.0	2560	4800	5360	4720	2250	1310	1220	779
1970	711.0	458.0	9.3	270.0	930	1790	2100	1330	2290	957	727	652
1971	447.0	137.0	0.8	3.7	240	1330	1300	1450	1460	771	529	167
1972	0.0	28.5	163.0	202.0	1360	1400	2380	1130	1130	762	423	302
1973	307.0	158.0	4.2	1130.0	1830	3670	3710	2110	1820	991	527	279

17050 Gunt @ Khorog

- Sep 1977 discharge is a probable typo
- site 17050 correlates modestly with site 17288 where there is no increased Sep discharge
- ratios suggest that the Sep 1977 discharge at site 17050 should be about 112; hence, ***discharge was changed to 112***

	J	F	M	A	M	J	J	A	S	O	N	D
1975	29	25	24	26	36	232	313	267	112	61	42	32.0
1976	27	25	24	26	71	170	338	238	123	58	42	33.5
1977	30	26	26	27	46	260	349	233	412	64	42	33.0
1978	29	25	25	35	86	416	470	277	149	76	50	38.0
1979	33	29	28	30	39	282	437	263	107	64	44	35.5

19072 Ural @ Kushum

- available in RUS, V-file, and UNESCO files WMO/IHD/RIV
- UNESCO sources have some potentially significant typos.
- Rus records were retained.

			RUS	WMO	dif
19072	1967	5	166.0	66.0	100.0
19072	1970	12	93.1	192.0	-98.9
19072	1975	4	468.0	45.0	423.0
19072	1975	5	280.0	28.0	252.0
19072	1975	6	126.0	12.5	113.5
19072	1975	12	29.3	49.5	-20.2
19072	1983	1	64.9	50.0	14.9
19072	1984	4	225.0	22.5	202.5

49036 Kem @ Yushkozero

- 1965 data in WMO/IHD/RIV are from a different site than those in RUS.
- The total annual discharge volume calculated from 1965 WMO data exceeds the 12 month maximum for the entire 1928–85 RUS record, so WMO is likely in error. The 1965 WMO/IHD/RIV data are likely for a downstream gauge (there's one near the Kem outlet to the Onega Gulf). — **confirmed by data from R-ArcticNET**

			RUS	WMO	dif
49036	1965	1	92.9	113.0	-20.1
49036	1965	2	72.2	89.0	-16.8
49036	1965	3	76.1	91.0	-14.9
49036	1965	4	77.4	140.0	-62.6
49036	1965	5	215.0	365.0	-150.0
49036	1965	6	278.0	371.0	-93.0
49036	1965	7	284.0	407.0	-123.0
49036	1965	8	289.0	427.0	-138.0
49036	1965	9	257.0	377.0	-120.0
49036	1965	10	363.0	497.0	-134.0
49036	1965	11	322.0	413.0	-91.0
49036	1965	12	248.0	336.0	-88.0

70801 Severnaya Dvina @ Ust-Pinega

- the entire record in v1.1 was replaced with data from R-ArcticNET
- through the late 1970s and 1980s, v1.1 data differed slightly from the current R-ArcticNET version

72818 Neva @ Novosaratovka

- ***1 significant typo in RUS was replaced with the WMO discharge***
- as the Neva is just a short outlet channel for Lake Ladoga, discharges are naturally very stable & the RUS datum is almost surely in error when contrasted against other data in the series

			RUS	WMO	dif
72818	1975	1	183.0	1830.0	-1647.0

75287 Unzha @ Makariev

- there's one probable typo in RUS; the Jun 1974 discharge would be the lowest of 90 available years while the previous months discharge was the 4th highest on record
- ***this was changed to the WMO value***

			RUS	WMO	dif
75287	1974	6	32.2	322.0	-289.8

75006 Volga @ Staritsa

- WMO file had a 2nd 1985 record that appears incorrect; May discharge is far too high; hence, 1st wmo record was kept & wmo file was changed

	J	F	M	A	M	J	J	A	S	O	N	D
1982	107.0	121.0	91.4	586	198	174	147	171	71.0	65.0	73.2	97.5
1983	59.5	88.9	248.0	407	146	116	148	118	45.4	101.0	71.9	85.8
1984	59.7	45.2	38.3	271	136	158	192	128	153.0	177.0	130.0	50.3
1985	39.9	60.6	140.0	406	261	220	171	138	139.0	160.0	257.0	76.4
1985	156.0	168.0	171.0	968	1030	267	281	224	229.0	324.0	264.0	209.0

75591 Lukh @ Lukh

- Apr 1962 discharge is a probable typo; 2 neighbours (75303, 75576) that correlate well with 75591 have normal discharges
- ***Apr 1962 discharge was changed to 21.7***

	J	F	M	A	M	J	J	A	S	O	N	D
1960	0.70	0.61	0.45	30.80	2.08	0.90	0.57	0.53	0.88	1.33	1.40	1.76
1961	1.64	1.22	1.28	38.40	2.70	0.83	0.83	0.57	0.76	0.99	1.13	1.11
1962	0.75	0.88	1.01	2.17	3.04	1.08	5.31	4.73	6.94	4.40	3.02	2.00
1963	1.15	0.92	1.08	28.80	2.90	0.61	0.53	0.43	0.67	0.83	1.38	1.21
1964	1.12	0.96	0.92	11.50	1.88	0.65	0.32	0.61	0.68	0.79	1.19	1.21

- Mar 1983 discharge is unusually high; discharges were also above normal at regional sites, but ratios suggest the Mar 1983 discharge at 75591 should have been in the 3.3–6.6 range so 6.1 may be the correct value
- evidence is a bit weak, so this was left unchanged for the time being

	J	F	M	A	M	J	J	A	S	O	N	D
1981	2.41	2.42	2.16	45.60	13.60	0.85	0.70	0.69	1.35	1.66	1.75	1.77
1982	1.84	1.62	1.52	27.90	5.07	1.76	1.19	0.77	1.10	3.30	6.18	5.37
1983	4.07	2.20	16.10	21.00	1.91	2.09	2.07	1.83	1.56	2.88	2.61	5.81
1984	1.93	1.26	1.21	17.10	1.75	1.03	0.92	1.12	1.84	5.28	4.27	1.44
1985	1.50	1.52	1.27	40.20	14.20	17.40	5.41	4.02	2.07	3.53	13.60	1.96

75623 Sura @ Kadyshev

- July 1960 discharge (4.26) is a probable typo; the upstream site 75620 has normal discharge
- ***this was changed to 42.6***

	J	F	M	A	M	J	J	A	S	O	N	D
1958	46.1	42.1	45.7	485.0	151.0	75.2	63.4	57.8	56.3	54.7	49.5	51.8
1959	39.5	42.8	45.6	662.0	105.0	67.6	55.3	53.6	46.8	48.7	37.0	32.3
1960	32.8	39.3	57.8	648.0	82.0	50.1	4.3	38.0	36.4	38.2	30.4	59.8
1961	36.7	36.9	82.7	890.0	103.0	62.8	55.1	45.5	45.6	44.0	42.3	38.7
1962	36.3	42.7	99.2	400.0	100.0	74.2	61.6	57.7	53.6	51.0	52.4	41.3

75674 Vetluga @ Mikhailovitsy

- Oct 1976 discharge is a probable typo; 2 neighbours (76619, 75682) that correlate very strongly have Oct discharges slightly lower than Sep & slightly higher than Nov
- ***Oct 1976 discharge at site 75674 was changed to 19***

	J	F	M	A	M	J	J	A	S	O	N	D
1974	28.8	22.0	19.6	128.0	1130.0	212.0	25.2	21.8	16.3	16.6	28.6	29.6
1975	19.2	19.2	18.5	423.0	78.8	29.4	13.8	12.7	13.0	12.3	13.5	12.6
1976	12.0	11.2	11.7	114.0	555.0	241.0	89.6	26.7	21.7	0.2	18.1	15.5
1977	14.8	14.0	12.3	210.0	125.0	26.4	15.5	11.4	10.5	28.9	99.4	86.4
1978	23.7	16.4	19.0	389.0	300.0	295.0	230.0	208.0	129.0	230.0	163.0	54.6

76518 Dymka @ Tatarskaya Dymskaya

- Jan 1962 discharge is a probable typo; discharges at 2 neighbours (76512, 77231) that correlate very strongly with 76518, lie between Dec 61 & Feb 62 discharges
- ***Jan 1962 discharge at site 76518 was changed to 0.75***

- May 1962 discharge is too low & a probable typo; the neighbours have May discharge 20–25% of Apr discharge suggesting that May discharge at site 76518

- ***May 1962 discharge was deleted*** as the legitimate value was unclear

	J	F	M	A	M	J	J	A	S	O	N	D
1960	1.2	1.0	1.2	16.1	1.8	1.4	1.3	1.2	1.2	1.3	1.1	1.4
1961	0.9	0.9	11.0	8.6	1.6	1.4	1.1	1.0	1.1	1.1	0.8	0.6
1962	7.5	0.1	1.4	11.0	0.1	1.5	1.2	1.2	1.3	1.4	1.3	1.1
1963	1.0	1.1	1.0	22.7	2.8	1.6	1.4	1.3	1.2	1.3	1.4	1.2
1964	0.8	1.1	1.0	13.4	3.6	2.0	1.9	1.6	1.5	1.5	1.4	1.0

- Apr 1971 discharge is a probable typo; the neighbours have Apr discharges about 16-fold higher than Mar which suggests a Apr discharge of 23 for site 76518
- ***discharge was changed to 14.5*** which seems like what was intended; this catchment is smaller & more prone to local variation

	J	F	M	A	M	J	J	A	S	O	N	D
1969	1.36	1.53	1.08	14.40	1.85	1.13	1.86	1.35	1.15	1.34	1.35	1.02
1970	1.05	1.05	1.06	16.50	2.34	1.67	1.50	1.54	1.48	1.43	1.87	1.34
1971	1.21	1.36	1.44	1.45	4.70	2.79	2.30	2.02	1.73	2.00	2.08	2.00
1972	1.85	1.34	1.68	20.40	2.59	1.95	1.51	1.31	1.45	1.48	1.57	1.49
1973	1.48	1.33	1.42	7.80	2.41	1.71	1.77	1.70	1.86	1.96	2.19	1.47

76553 Vyatka @ Usatevskaya

- May 1945 discharge is a probable typo; nearest neighbour 76593 & downstream Vyatka sites correlate very strongly & all have significant May 1945 discharge
- ***May 1945 discharge was changed to 631*** which gives about the same May/Apr ratio as at nearest neighbour 76593

	J	F	M	A	M	J	J	A	S	O	N	D
1943	17.6	16.4	27.2	361.0	759.0	142.0	86.1	115.0	111.0	181.0	79.6	40.2
1944	33.2	32.0	35.5	79.6	1080.0	283.0	199.0	158.0	153.0	150.0	68.9	37.6
1945	26.1	21.3	21.3	31.0	63.1	222.0	91.1	36.1	43.5	90.4	110.0	39.7
1946	27.2	26.8	29.5	71.0	858.0	86.1	54.8	35.3	140.0	148.0	107.0	47.4
1947	30.3	23.0	24.8	302.0	1120.0	295.0	89.6	80.8	58.0	117.0	78.1	45.1

76556 Vyatka @ Kirov

- there Is a data entry error at July 1974 RUS
- ***this was changed to the WMO value***
- July discharges don't go to 0 at this site, and the discharges of pre-/post- months are far too high to consider 0 discharge as a plausible possibility

			RUS	WMO	dif
76556	1974	7	0.0	214.0	-214.0

76566 Vyatka @ Arkul

- Jun 1973 discharge is a probable typo; all the Vyakta sites & neighbours have appreciably higher discharges relative to May and July discharges
- ***Jun 1973 discharge was changed to 260*** which is about what the neighbouring sites suggest it should be

	J	F	M	A	M	J	J	A	S	O	N	D
1971	201	183	153	1310	2820	1150	793	413	299	348	630	700
1972	389	221	213	1820	3450	1060	338	188	169	232	247	220
1973	203	156	170	1720	1310	26	191	216	256	439	384	287
1974	250	200	204	1560	5460	2200	535	322	278	249	275	294
1975	216	206	220	2400	929	356	214	179	180	191	192	152

77801 Volga @ Verkhne-Lebyazh'ye

- May 1962 discharge is a typo; discharge at Volgograd (site ***77090***) upstream was normal (20,600)
- ***May 1962 discharge was changed to 19600***

	J	F	M	A	M	J	J	A	S	O	N	D
1960	6280	5970	6000	7490	14000	12700	4760	4490	4290	4190	4200	3910
1961	3740	4280	5040	9060	19900	14500	6260	5000	4700	4450	5040	5220
1962	4260	5940	6360	7570	1960	7590	5740	6680	6520	6510	6250	6050
1963	6040	7090	7880	8240	19100	16300	6580	5830	5550	5590	5230	5550
1964	5470	6710	6240	6020	13500	9190	6300	5700	5580	5540	5450	5370

78011 Don @ Georgiu-Dezh

- in the main file, at site 78011, Mar–Dec of 1910 and 1911 were identical
- though discharge patterns at sites 78011 & 78013 are closely related, it's not clear from 1911–12 discharges at neighbouring gauges whether the Mar-Dec data at site 78011 are for 1910 or 1911
- for operational purposes (to avoid biasing annual & monthly means), ***Mar–Dec 1911 were deleted***

	J	F	M	A	M	J	J	A	S	O	N	D
1909	60.6	87.8	81.4	592.0	273.0	146.0	144.0	92.4	85.3	83.1	92.9	77.2
1910	64.3	78.8	98.2	1160.0	204.0	121.0	133.0	107.0	92.6	92.9	98.3	65.0
1911	91.3	74.4	98.2	1160.0	204.0	121.0	133.0	107.0	92.6	92.9	98.3	65.0
1912	63.7	71.7	161.0	1460.0	244.0	162.0	145.0	104.0	101.0	112.0	92.5	78.0

- the Aug 1903 discharge is another highly probable typo
- ***this was deleted***

	J	F	M	A	M	J	J	A	S	O	N	D
1901	69.2	104.0	679.0	1970.0	245.0	127.0	102.0	89.3	97.5	98.5	98.1	76.0
1902	135.0	246.0	367.0	1480.0	252.0	147.0	129.0	106.0	97.6	107.0	82.5	71.0
1903	72.0	85.0	500.0	795.0	163.0	179.0	120.0	1.0	93.3	98.4	115.0	98.5
1904	72.0	140.0	116.0	1460.0	590.0	121.0	118.0	101.0	92.2	99.1	120.0	129.0
1905	94.6	75.0	87.0	1190.0	195.0	99.4	85.3	80.1	92.5	114.0	132.0	124.0

- Sep 1981 discharge is a typo; discharge downstream at site 78013 was normal
- Sep 1981 discharge was changed to 158

	J	F	M	A	M	J	J	A	S	O	N	D
1979	133.0	309.0	325.0	3010.0	339.0	151.0	148.0	141.0	138.0	151.0	166.0	177.0
1980	126.0	131.0	128.0	1100.0	311.0	210.0	191.0	181.0	194.0	210.0	234.0	303.0
1981	341.0	300.0	577.0	1750.0	372.0	195.0	145.0	132.0	15.8	198.0	227.0	233.0
1982	227.0	170.0	278.0	483.0	287.0	176.0	212.0	181.0	157.0	211.0	237.0	228.0
1983	234.0	261.0	965.0	910.0	276.0	197.0	169.0	165.0	161.0	187.0	182.0	190.0

78054 Sosna @ Elets

- Jun 1981 discharge (6.23) is a typo
- neighbouring (75309) and downstream (78011 above) sites have normal discharge
- ***Jun 1981 discharge was changed to 62***

	J	F	M	A	M	J	J	A	S	O	N	D
1979	36.7	106.0	166.0	556.0	63.5	40.2	46.8	41.3	42.0	43.3	46.0	39.0
1980	32.8	33.0	34.0	336.0	66.4	52.8	62.1	57.5	52.8	53.5	69.2	83.9
1981	69.2	83.9	353.0	183.0	86.4	6.2	50.3	49.0	52.8	56.8	62.9	80.7
1982	65.8	61.0	173.0	147.0	83.6	66.6	72.1	61.8	53.7	67.3	62.3	64.1
1983	65.9	76.8	243.0	98.3	75.2	60.0	55.4	53.0	51.2	60.3	62.4	59.4

78202 Medveditsa @ Archedinskaya

- mean discharges drop >10 fold in RUS for 1981–84
- the WMO record appears good & was substituted

	J	F	M	A	M	J	J	A	S	O	N	D
1979	23.2	24.1	70.7	664.0	446.0	54.3	31.9	24.4	20.8	21.6	24.2	22.8
1980	20.4	21.0	18.8	238.0	160.0	41.6	27.7	22.1	20.7	22.8	24.3	32.0
1981	4.7	1.9	37.8	19.3	3.6	1.1	0.8	0.7	0.5	1.0	1.1	1.4
1982	1.8	1.3	3.0	11.6	4.6	1.1	0.9	0.8	0.8	1.0	1.6	2.2
1983	2.2	3.6	33.5	8.8	3.7	1.3	0.3	0.5	0.4	0.4	0.5	0.6
1984	0.5	0.5	0.5	11.4	0.8	0.1	0.0	0.0	0.0	0.0	0.1	0.4
1985	21.0	19.7	21.6	206.0	72.9	28.6	33.5	20.1	18.2	21.2	23.2	28.5

78801 Don @ Razdorskaya

- there are 45 or so perceptible discrepancies between RUS & WMO that are not obvious typos which suggests that the record may have been retrospectively revised between submission of data to WMO & preparation of the Russia_US exchange file

81068 Dnestr @ Bendery

- 1969 & 1970 records in WMO file were identical
- IHD & RIV had different 1970 data that appear to be correct

84108 Terek @ Ordzhonikidze

- July 1931 discharge is a probable typo; the lowest July discharge in 62 yrs record
- V-file gives the same dubious discharge, but has other gauges in the area which indicate that discharge rose from Jun to Jul and that discharge at this gauge should be >100 m^3/s
- ***hence, July 1931 discharge was changed to 126***

	J	F	M	A	M	J	J	A	S	O	N	D
1930	10.8	11.4	10.7	13.2	25.5	53.6	84.9	68.3	37.9	24.6	17.7	12.8
1931	11.3	10.1	11.2	15.3	32.7	79.7	12.6	69.5	44.6	22.9	20.5	15.7
1932	12.9	12.3	14.3	23.7	58.0	98.5	77.5	66.3	50.1	28.2	18.3	15.0

- Rus-Am and V-files were missing 1973 for this gauge
- the UNESCO files give the following data for 1973
- these data are very typical for this gauge
- these data are retained for the present, but ***may be for another gauge in the Terek basin***

	J	F	M	A	M	J	J	A	S	O	N	D
1973	12.5	13.5	12.5	21.0	39.5	58.0	72.0	56.0	27.0	15.0	12.0	10.5

Appendix A — Russia–FSU Basin/Gauge Codes

- geographic summary of basin/gauge codes found in NCAR Russian data set are given in the table below
- this is not the most hydrologically rational system that might have been devised
- generally, the basin / hydrologic unit number is the integer left after dividing the gauge code by 1000
- by the Russian/FSU system, units 1–17 are considered Asia, and units 18–85 are considered Europe

Code	Watershed	Rivers	Receiving Waters
1000-1999	NE Siberia	Kolyma, Anadyr, Amguema	Arctic Ocean, East Siberian Sea, Chukchi Sea, Pacific Ocean, Sea of Okhotsk
2000-2999	Kamchatka	Kamchatka, Penzhina	Pacific Ocean, Sea of Okhotsk, Bering Sea
3000-3999	NE Siberia	Lena, Indigirka, Olenek, Omoloy, Yana, Anabar, Alazeya, Khatanga	Arctic Ocean, E Siberian Sea, Laptev Sea
4000-4999	Sakhalin Island	Tym	Sea of Okhotsk
5000-5999	lower Amur & independent drainage to Japan Sea from Primorsky Kray	Amur, Ussuri, Amgun, Nimelen, Razdol'naya	Japan Sea, Pacific Ocean
6000-6999	upper Amur	Amur, Shilka, Ingoda, Selemdzha, Bureya, Zeya	Pacific Ocean
7000-7999	Lake Baikal	Selenga, Barguzin, Chikoi, Khilok	Baikal > Angara > Yenesei > Kara Sea > Arctic Ocean
8000-8999	Angara d/s Baikal	Irkut, Iya, Biryusa	Angara > Yenesei > Kara Sea > Arctic Ocean
9000-9999	Yenesei excluding Angara–Baikal, may include independent Kara Sea drainage	Kan, Tuba, Norilka, Abakan, Podkamennaya-Tunguska, Nizhnyaya-Tunguska; may include Pyasina, Taymra & other independent Kara Sea drainage	Yenesei > Kara Sea > Arctic Ocean

10000-10999	Ob - u/s of Irtysh confluence, presumably to Ob source	Tom, Tym, Bia, Bolshoi Yugan, Charysh, Chulym, Kiya	lower Ob > Obskaya Gulf > Kara Sea > Arctic Ocean
11000-11999	Obskaya Gulf	lower Ob, Severnaya Sos'va, Irtysh (except Tobol), Ishym, Konda, Om, plus Nadym, Taz, Pur & likely other small Obskaya Gulf drainage independent of the Ob proper	lower Ob > Obskaya Gulf > Kara Sea > Arctic Ocean
12000-12999	Tobol trib of Irtysh trib of Ob	Tobol, Lobva, Sosva, Tura, Uy, Nitsa, Pyshma	Irtysh > lower Ob > Obskaya Gulf > Kara Sea > Arctic Ocean
13000-13999	Turgai & L Tengiz	Turgai, Kara Turgai, Nura	Lake Tengiz; Kazakhstan closed basin
14000-14999	Lake Balkash	Sharyn, Lepsy, Karatal, Ili	Lake Balkash; Kazakhstan closed basin
15000-15999	Lake Issyk Kul	Chu	Lake Issyk Kul; Kyrgyzstan closed basin
16000-16999	Syr Darya	Syr Darya, Naryn, Arys	Aral Sea closed basin
17000-17999	Amu Darya	Amu Darya, Gunt, Vakhsh, Zeravshan	Aral Sea closed basin
19000-19999	Ural	Ural, Maly Uzen, Ilek	Caspian Sea, closed basin
41000-41999	Pyarnu	Pyarnu	Gulf of Riga > Baltic > Atlantic Ocean
48000-48999	Lake Onega ?	Suna	Lake Onega > Lake Ladoga > Neva > Baltic > Atlantic
49000-49999	Gulf of Onega	Kem, Kovda, Vyg	Gulf of Onega > White Sea > Barents Sea > Arctic Ocean
70000-70999	White Sea — Pechora Sea	Onega, Severnaya Dvina, Mezen, Pechora, Kuloy	White Sea, Pechora Sea Barents Sea > Arctic Ocean
71000-71999	Kola Peninsula	Ura, Pecha, Kola, Kitsa, Ponoy, Umba, Kolvitsa	White Sea, Barents Sea > Arctic Ocean
72000-72999	Gulf of Finland	Neva, Lake Ladoga (excluding Lake Onega), Narva, Luga	Gulf of Finland > Baltic > Atlantic
73000-73999	Gulf of Riga excluding Pyarnu	Gauja (Gauya), Daugava	Gulf of Riga > Baltic > Atlantic Ocean
74000-74999	Baltic Proper	Neman, small tribs, likely	Baltic > Atlantic

		Pregolya	
75000-75999	upper Volga; roughly above Kazan / Kuybyshev reservoir	Klyaz'ma, Moksha, Mologa, Oka, Sura, Ugra, Unzha Vetluga	lower Volga > Caspian Sea, closed basin
76000-76999	upper Volga – NE tribs affluent to Kuybyshev reservoir	Vyatka, Belaya, Kama, Vishera, Chepsta, Ai, Ufa, Dema, Ik	lower Volga > Caspian Sea, closed basin
77000-77999	mid & lower Volga; roughly from Kuybyshev reservoir to Caspian Sea	Samura, Bolshoi Kinel & mostly small tribs	lower Volga > Caspian Sea, closed basin
78000-78999	Don	Don, Khoper, Severskiy Donets, Medveditsa	Sea of Azov > Black Sea > Mediterranean Sea > Atlantic
79000-79999	upper Dnepr; u/s Kiev res., mostly in Belarus & Russia	Dnepr, Pripyat, Vyazma	Black Sea > Mediterranean Sea > Atlantic
80000-80999	lower Dnepr; d/s top of Kiev reservoir	Dnepr, Desna, Seym,	Black Sea > Mediterranean Sea > Atlantic
81000-81999	Black Sea northwest coast	Dnestr, Yuzhny Bug	Black Sea > Mediterranean Sea > Atlantic
82000-82999	Black Sea east coast	Rioni, likely other tribs entering from Georgia	Black Sea > Mediterranean Sea > Atlantic
83000-83999	Kuban	Kuban	Sea of Azov > Black Sea > Mediterranean Sea > Atlantic
84000-84999	Caspian Sea northwest	drainage north of Caucasus divide including Kalaus, Terek, Samur	Caspian Sea, closed basin
85000-85999	Caspian Sea southwest	drainage south of Caucasus divide including Kura, Aras (Arax), L Yerevan, from lands of Azerbaijan, Armenia, Iran, Turkey	Caspian Sea, closed basin

Appendix B — Mappad File FSU_Q.MPD

Mappad

The file FSU_Q.MPD is a data file prepared for viewing the geographic locations of the Russia/FSU stream gauges with ***Mappad***, an elementary program created by NOAA for viewing and keeping notes on point data sets. Mappad runs on computers using MS Windows 3+ and NT operating systems.

Mappad and numerous digital maps are freely available from:

http://www.ngdc.noaa.gov/paleo/mappad.html.

FSU_Q.MPD

The file FSU_Q.MPD is a Mappad data file prepared for viewing the geographic locations of the Russia/FSU stream gauges.

FSU_Q.MPD contains point information for the following:

1. 87 FSU stream gauges in the WMO file including those common to the Russia_US exchange files [magenta circles labelled WMO on the legend]

2. 229 mostly Russian stream gauges, all but 2 from the Russia_US exchange files [red squares labelled RUS on the legend]

To view FSU_Q.MPD:

1. Download Mappad and the digital map of Russia.
2. Install mappad into a directory of your choice
3. Copy the digital map file (Russia.mpm) into the same directory.
4. Open FSU_Q.MPD in an ascii text editor, e.g., notepad, and change the path statement in the 4th line [*Mapfile: f:\mpd\russia.mpm*] to point to the directory containing mappad & Russia.mpm.
5. Start Mappad & from the ***File, Open File*** dialog box choose FSU_Q.MPD. Having opened FSU_Q.MPD with an appropriate map, Mappad displays the gauge sites overlaid on the map as below. Clicking on a point opens a notepad that displays the information & summary statistics available for that particular gauge.

The magenta dots are sites in WMO (including ones common to RUS); the red squares are RUS sites and the 2 other sites (Volga @ Yeltsy & Khatanga @ Khatanga). [**return to introduction**]

A typical data summary is shown below:

```
FSU gauge # = 70801
River = Severnaya Dvina
Gauge = Ust Pinega
Country = RU
drainage area = 348000.00 km2

mean annual discharge 106.52977 cu km
 min 12 mon Q 46.38922 cu km in yr from May 1937
 max 12 mon Q 186.42139 cu km in yr from Jun 1923

mean annual runoff = 306.1 mm
```

```
 records span        1881  1993
 net record length    112.3 yr

Dry month= Mar has       1941.4574 mcm
Wet month= May has      37124.9688 mcm

Monthly Summary: Qin mcm(million cu. m)
 Jan          2769.80029       2.6 %
 Feb          2955.71411       2.8 %
 Mar          1941.45740       1.8 %
 Apr          6196.96289       5.8 %
 May         37124.96880      34.8 %
 Jun         18158.70310      17.0 %
 Jul          7903.46045       7.4 %
 Aug          5819.14404       5.5 %
 Sep          6053.51270       5.7 %
 Oct          7808.30127       7.3 %
 Nov          6065.46533       5.7 %
 Dec          3732.27856       3.5 %
```

N.B. The notepad in MAPPAD has no option to set a fixed-format ascii font so the text looks rather messy on screen.

The full Russia/FSU map is rather coarse. Other maps from the NOAA site that give better regional detail of Russia/FSU areas are: FSU_east, FSU_central, FSU_west, Baikal, North Pole, Beringia, Baltic Sea, Scandinavia, Black Sea. From MAPPAD, the underlying digital map can be changed from the ***File, Modify DataFile*** dialog.

Under the ***Options, Map*** dialog, the symbol legend and point size can be controlled.

Appendix C — Some Tips for Interpreting Russian River and Gauge Names

- ***Bolshoy***, ***Bol'shoy***, ***Bol'shaya***, ***Bolshi'ye*** and other variants mean ***big*** or ***great***
- ***Maly***, ***Malyy***, ***Malaya*** and other variants mean ***small*** or ***little***
- ***Nizhne***, ***Nizhny***, ***Nizhnyaya*** and other variants seem to mean ***lower***
- ***Verkhne***, ***Verkhny***, ***Verkhnyaya*** and other variants seem to mean ***upper***
- ***porog*** appears to mean ***falls***, ***cataracts***, or ***rapids***
- ***ust'e***, ***ustie***, ***ust'ya*** and other variants mean ***mouth*** or ***outlet***
- most of the places named ***Ust***-xxx or ***Ust'***-xxx seem to be located at river mouths, e.g., ***Ust-Pinega*** on the Severnaya Dvina is at the confluence of the Pinega and the Severnaya Dvina
- Russians often translate outlet into english as "***offing***" [more common with river or stream outlets] or "***efflux***" [more common with lake outlets]
- the ***Uch*** commonly seen in river and gauges names of the "stan" republics of central Asia, e.g., Uch-Terek, may be the local variant of ***ust'e***
- ***Severnaya*** means ***north*** or ***northern***, e.g., Severanaya Dvina
- ***Zapadnaya*** means ***western***, e.g, Zapadnaya Dvina
- ***Yuzhny*** means southern, e.g, ***Yuzhny*** Bug
- ***GES*** is likely an abbreviation for hydroelectric station
- ***most*** or ***mosta*** may mean bridge