

Nature Ref: 2002-11165A (Mudelsee et al.)

Supplementary Information (Part 2 from 4)

Oder flood record

Year	Month	Season [S, W]	n	Cause [I, S, C, R]	Maximum flood stage [cm] Krosno Eisenhüttenstadt	Runoff [m**3/s] Eisenhüttenstadt	Magnitude	CLIMDAT [+, -]
1269			1?				1	
1350		S?	1?				2	
1367		W?	1	S?			2	
1405		W?	1	S?			1	
1413		S?	1	R?			1	
1415	Apr	W	1				1	
1417	Apr	W	2				1	
1426	May	S	1?				1	
1444	Jun	S	1				1	
1445	Jun	S	2				1	
1454	Aug	S	1?				1	
1456	Feb	W	1				1	
1456	Aug	S	1	R?			2	
1464	Aug	S	7	R			1	
1468		S	1	R?			2	
1470	Sep	S	2	R			2	
1472	Feb	W	1				1	
1495	Jul	S	2				2	
1496	Jul-Aug	S	6	R?			3	
1501	Aug	S	5	R			3	+
1508		W	3				2	+
1514			1?				1	-
1515	Jul-Sep	S	8	R			3	+
1516	May	S	3				1	+
1520	Aug	S	1				1	-
1522	May	S	1?				1	+
1523	Jun	S	2	R?			1	+
1537	May	S	1	R?			2	+
1539	Sep	S	3	R?			1	-
1540	Dec!-Jan	W	2	I?			1	+
1542	Jul	S	4				1	+
1543	Mar	W	1?	I			1	+
1543	Aug	S	1				2	+

1548	Jun	S	1?	C		1	+
1549	Feb	W	3	I		1	+
1550	Jul	S	1	C		1	+
1550	Sep	S	1?	C		1	-
1551	Nov!	W	1?	C		1	+
1551	Mar	W	5	I, R		1	+
1556			1?	R		1	-
1564		S	1?			1	+
1565	Mar	W	6			3	+
1568			1			1	+
1570	May-Oct	S	3	R?		2	+
1572	Mar-Apr	W	1	S?, R		2	-
1578	Mar	W	1	I		1	+
1579		W?	1			1	-
1584		W?	1			1	-
1586	Mar	W	2			1	-
1591	Jun	S	1	R		2	+
1593	Mar	W	4	I		2	+
1593	Aug	S	1			2	+
1594			2			1	-
1595	Mar	W	2	I		1	-
1595	Jul	S	2	R	525	3	+
1598	Aug-Oct	S	2	R		2	-
1599	Mar	W	2	I		1	-
1605	Aug	S	2	R		2	+
1606	Jul	S	2	R		1	-
1612	Mar	W	1	I		1	-
1613		S?	1	R?		1	-
1614		W	1			1	-
1616		W?	1			1	-
1621	Aug	S	1?			1	-
1624		W?	1			1	-
1625	Jun-Jul	S	5			2	+
1628	Jul	S	1	R		1	-
1630			1?			1	-
1633		W?	1	R?		1	-
1634			1			1	-
1644			1?			1	-
1646		S?	2			1	-
1648		S?	1	R?		1	-
1651		W	2	S, R		1	-
1652		S?	1	R?		1	+

1654			1?			1	-
1655	Feb-Apr	W	5	I		2	+
1658	Apr	W	1	I		1	-
1659		S?	1			1	-
1662		S	1?			1	-
1663	Jul	S	1?			1	-
1664			2			1	-
1665	Mar	W	1			1	-
1665	Aug	S	1			1	+
1667	Jul	S	3			2	+
1672	Apr	W	1?			1	-
1674	Apr	W	1	I		1	-
1675	Jul	S	4	R?		3	+
1679		W?	2	I?		1	-
1680		W?	1			1	-
1681		W?	1	I?		1	-
1685	Jul	S	1?			1	-
1687	Sep	S	1?			1	-
1688	Oct	S	1?			1	-
1689		S?	1	C?		1	-
1692	Aug	S	2	R		2	-
1693		S?	1	R?		1	+
1694	Feb	W	6	S?, R?		2	+
1695	Jun	S	1?			1	+
1696		S?	1			1	-
1698	Mar-Apr	W	10		525	3	+
1699		W	1?			1	-
1706	May	S	1?			1	-
1708	Apr	W	1?			1	-
1709	Feb-Apr	W	5	I		3	+
1712	Apr	W	1?			1	-
1713		S?	2			2	-
1715	May-Jun	S	2			2	-
1718	Mar	W	2			1	+
1729	May	S	3	R	525	3	+
1730	Jul-Aug	S	1			1	+
1731		W	1			1	+
1736	Mar	W	1?	I		1	+
1736	Jun-Aug	S	23	R	512	3	+
1737	Dec!	W	1	R?		1	-
1737	Jan	W	2	I, R		2	+
1737	Jul	S	1?			1	+

1749	Jan	W	1	I		1	-
1751	Mar	W	1			1	-
1770	Jan	W	3	I		2	-
1771	Mar	W	3			1	+
1775	Feb	W	2	I		1	-
1779	Aug	S	1?	R		1	-
1780	Mar	W	4	I		2	-
1780	May	S	4			1	-
1783	Jan	W	5	I, R		1	-
1784	Dec!	W	2			1	-
1785	Apr	W	23	I	479	3	+
1789		S?	2			1	-
1794	Feb-Mar	W	1	R		1	-
1798	Mar	W	1?	R		1	-
1799	Feb	W	1	I		1	-
1804	Mar	W	1	I		1	
1804	Jun	S	14	R		2	
1813	Aug-Sep	S	11	R	446	3	
1814	Apr	W	5		479	2	
1826	Mar	W	1?			1	
1826	May	S	3		386	2	
1827	Mar	W	1	I		1	
1829	May-Jun	S	13	R	430	2	
1830	Mar	W	16	I?	488	3	
1830	Sep	S	1?			1	
1831	Sep	S	11	R	475	3	
1833	Sep	S	3	R	339	1	
1838	Mar	W	11	I	524	3	
1839	May-Jun	S	2		322	1	
1845	Mar-Apr	W	4	I, R		2	
1847	Jun-Jul	S	6			2	
1847	Oct-Nov	S	2		383	1	
1850	Dec!-Feb	W	3	I	405	2	
1854	Aug	S			555	3	
1855	Apr	W			459	3	
1855	May	S			318	1	
1860	Jul	S			334	1	
1871		W?			447	3	
1876	Feb-Mar	W			505	3	
1879	Jun	S			330	1	
1880	Aug	S			369	2	
1883	Jun-Aug	S			382	2	

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1885	May-Jun	S		311			1
1886		W?		435			2
1888	Sep	S		323			1
1890	Sep	S		359			1
1891	Mar	W		467	1710		3
1891	Jul-Aug	S		417	1249		2
1894	Jun	S		310	762		1
1896	May	S		424			2
1897	May	S		410			2
1897	Aug	S		370			2
1899	May	S		422			2
1899	Sep	S		334			1
1902	Jun-Jul	S		373			2
1903	Jul	S		469	2110		3
1906	Sep-Oct	S		312			1
1909	Apr	W					2
1911	Feb-Mar	W		383	540		2
1911	May	S		359	499		1
1913	Aug	S		334	464		1
1915	Mar-Apr	W		352	488		1
1915	Oct	S		468	623		3
1916	Dec!-Jan	W		358	512		1
1917	Jan	W		364	506		1
1917	Mar-May	W		436	619		2
1918	Jan	W		318	498		1
1920	Dec!-Feb	W		410	551		2
1922	Oct	S		345	470	906	1 (-)
1923	Dec!-Feb	W		383	526	1314	2 (1)
1924	Mar-Apr	W		410	552	1546	2 (2)
1925	Aug	S		353	480	973	1 (-)
1926	Jun-Aug	S		437	596	1925	3 (2)
1927	Jan	W		340	488	1015	1 (1)
1927	Apr	W		349	496	1079	1 (-)
1931	Oct!-Dec!	W	NI	478	649	2500	3 (3)
1931	Mar-May	W	NI	317	456	809	1 (-)
1931	Oct	S		390	535	1390	2 (1)
1937	Mar	W	NI			938	1 (-)
1938	Jan-Feb	W	NI			1240	2 (1)
1938	Aug-Sep	S				1810	2 (2)
1939	Apr	W				1150	1 (1)
1939	May-Jun	S				1330	2 (1)
1939	Aug	S				1080	1 (-)

1940	Nov!-Dec!	W	NI		1190	1 (1)
1940	Mar-Apr	W	I		1810	2 (2)
1940	May-Jun	S			1370	2 (1)
1941	Feb-Jun	W	NI		1670	2 (2)
1942	Dec!	W	NI		824	1 (-)
1942	Mar-Apr	W	I		1420	2 (1)
1942	May	S			1280	2 (1)
1944	Apr	W	NI		824	1 (-)
1946	Feb-Mar	W	NI		1320	2 (1)
1947	Mar-Apr	W	I	638	2020	3 (2)
1948	Jan-Mar	W	NI		956	1 (1)
1949	Jul	S			915	1 (-)
1951	May	S			1050	1 (-)
1952	Apr	W	NI		824	1 (-)
1953	Feb-Mar	W	NI		1280	2 (1)
1956	Mar	W	NI		927	1 (-)
1958	Jul	S			1690	2 (2)
1960	Aug	S			840	1 (-)
1962	May	S			994	1 (1)
1963	Mar	W	NI		1040	1 (1)
1965	Mar	W	NI		1050	1 (1)
1965	Jun	S			1640	2 (2)
1966	Aug	S			1100	1 (1)
1967	Feb	W	NI		920	1 (-)
1968	Jun	S			1510	2 (2)
1970	Mar-Apr	W	NI		828	1 (-)
1971	Jan-Feb	W			986	1 (1)
1971	Jul	S			1030	1 (1)
1974	Oct	S			828	1 (-)
1975	Dec!-Jan	W			1170	1 (1)
1976	Jan	W			880	1 (1)
1977	Feb-Mar	W			966	1 (1)
1977	Aug-Sep	S			1754	2 (2)
1979	Mar	W			1117	1 (1)
1980	Apr-May	S			861	1 (1)
1980	Jul-Aug	S			1104	1 (1)
1981	Mar	W			894	1 (1)
1981	Jul-Aug	S			1310	2 (1)
1982	Jan	W			965	1 (1)
1985	Aug	S			1355	2 (2)
1987	Jan-Apr	W			1255	2 (2)
1992	Apr	W			925	1 (1)

1994	Apr	W		853	1 (1)
1996	May	S		912	1 (1)
1997	Jul-Aug	S	717	2490	3 (3)
1999	Mar	W		1020	1 (1)
2000	Mar	W		856	1 (1)
2001	Aug	S	519		2 (2)
2001	Sep	S	459		1 (1)
2002	Feb-Mar	W	479		1 (1)

Notes:

(1) Year

Year A.D. (Gregorian calendar).

(2) Month

! : Alerts when month = Nov or Dec and season = W (see Note (3)).

(3) Season

W : Winter, from November of preceding year to April of year.

S : Summer, from May to October of year.

Separated flood events are listed when an influence of the first on the second event can be excluded, otherwise they are counted as one event.

? : indirect information (from nearby region, tributary, etc.).

(4) n

For the interval up to 1850:

Number of different sources reporting Oder flood event between Racibórz and before Kostrzyn.

? : doubtful flood event (possibly misrecorded, or of only local extent): n = 1, the source is non-contemporary and no indirect support (from nearby region, tributary, etc.) exists.

(5) Cause

For the interval up to 1850:

C : cloudburst,

R : long rain,

I : ice and thawing,

S : snow and thawing (not I),

? : indirect information (from nearby region, tributary, etc.).

For the interval 1930 to 1970:

I : ice and thawing,
NI : not I.

(6) Flood stages

Eisenhüttenstadt (former Fürstenberg) zero stage set to recent value (<http://www.wsa-egerswalde.de>), that is, the stage used by Bureau (1896) and Oderstrombauverwaltung (1907, 1930ff), increased by 198 cm.

(7) Runoff

Runoff values (flood peaks), as provided by GRDC, were inferred via measured water stage and determined stage-runoff relations. These relations were established using explicit measurements of runoff (by means of velocity measurements across the river cross-section). The accuracy of a flood record at a particular station depends on (1) the accuracy of the stage-runoff relation at upper (flood) values, (2) how frequent relations were updated and (3) how stable stage-runoff relations are over time.

In case of the Oder, it seems that for various reasons (war, divided responsibilities, etc.) the degree as to which above accuracy requirements are fulfilled, is unknown (Grünewald et al. 1998). Systematic errors in inferred runoff cannot be excluded therefore. Note that, taking into account the widths of magnitude classes (see Mudelsee et al.), this had a reduced effect on the reconstructed Oder flood magnitude record.

(8) Magnitude

1 : minor flood event,
2 : strong flood event,
3 : exceptionally strong flood event.

For the interval 1921 to 2002, the resulting magnitude is also given when assuming a constant reservoir size at present level (in parentheses, '-' denoting 'no flood event'). The time-dependent total size of the reservoirs is listed in Table 8.1 below. The difference in size at a time point, relative to the present, is subtracted from the flood peak (integrated runoff). See Mudelsee et al. for further details.

(8.1) Reservoir size

Year Total manageable reservoir size (above Eisenhüttenstadt) (Grünewald et al. 1998)

winter/summer
V (10**6 m**3)

1906	0.70
1907	1.83
1908	9.19
1909	19.59
1910	23.02
1911	24.62
1912	51.46
1913	54.47
1917	56.07
1930	57.03
1933	72.33
1938	75.13
1948	78.13
1955	85.63
1958	91.43
1961	91.53
1962	96.03
1964	102.53
1965	107.93
1969	123.53
1972	131.43
1974	132.03
1976	132.63
1986	140.13
1987	140.73

(9) CLIMDAT

Cross-check with documentary database CLIMDAT of Militzer (1998). This compilation is based mainly on original sources. Geographical focus is central and eastern Germany, Poland and the Czech Republic. It covers the time interval 1500 to 1799. CLIMDAT was constructed at the Historical Institute, University of Leipzig, Germany.

+ : agreement, that means, CLIMDAT mentions flood constructed from Weikinn's records
- : no agreement.

CLIMDAT lists following Oder floods not contained in the Weikinn source texts:
April 1548, August 1552, April 1557, July 1565, August 1567, June 1569, February 1571,
1609, August 1679 and October 1736, all assessed here as of magnitude 1, as well as
January 1682, assessed here as of magnitude 1 or 2.

(10) Observation intervals, data sources and data types

For measured data, the gauge station is given in brackets.

Thereby, 'MOST' means most of the relevant stations which include:

Racibórz, Koźle, Opole, Ujście Nysy, Brzeg, Wrocław, Brzeg Dolny, Malczyce, Ścinawa, Głogow, Nowa Sól, Cigacice, Połęcko, Frankfurt an der Oder, Słubice, Kostrzyn, Gozdowice and Schwedt - but not Krosno or Eisenhüttenstadt, which are listed separately.

Interval	Source	Data type
ca. 1269 to Dec 1850	Weikinn (1958-2002)	documentary, flood stage [Krosno]
ca. 1400 to 1903	Gimmler (1928)	documentary
ca. 1400 to 1911	Schmidt (1922)	documentary
1445 to 1903	Partsch (1896-1911)	documentary
ca. 1550 to 1903	Schulz (1926-1961)	documentary
1595 to 1903	Fischer (1907)	documentary, flood stage [MOST, Krosno, Eisenhüttenstadt]
1595 to 1894	Bureau (1896)	documentary, flood stage and flood runoff [MOST, Krosno, Eisenhüttenstadt]
1850 to 1920	Mengel (1930-1934)	documentary
1901 to 1997	Kocinski (1997)	documentary
1854 to 1904	Oderstrombauverwaltung (1907)	yearly maximum water stage [MOST, Krosno]
1905 to 1906	Oderstrombauverwaltung (1907)	monthly maximum water stage [MOST, Krosno]
1911 to 1936	Oderstrombauverwaltung (1930ff)	monthly maximum water stage [MOST, Krosno, Eisenhüttenstadt]
1903	Grünwald et al. (1998)	flood runoff [Eisenhüttenstadt]
1906 to 1998	Grünwald et al. (1998)	total reservoir size [above Eisenhüttenstadt]
1947 and 1997	http://www.wsa-eberswalde.de	flood stage [Eisenhüttenstadt]
1901 to 1984	UNESCO (1969-1993)	monthly and yearly maximum runoff [Gozdowice]
Nov 1920 to Oct 2000	GRDC (2001)	daily runoff [Eisenhüttenstadt]
Jan 1946 to Dec 1987	GRDC (2002)	monthly runoff [Polecko]
1930 to 1970	Preußische Landesanstalt für Gewässerkunde und Hauptnivellements (1933-1938); Landesanstalt für Gewässerkunde und Hauptnivellements (1940-1942); Forschungsanstalt für Schifffahrt, Gewässer- und Bodenkunde (1949, 1950-1951);	ice conditions

Meteorologischer und
hydrologischer Dienst der
Deutschen Demokratischen
Republik (1952-1957,
1962, 1963);
Institut für Wasserwirtschaft
(1964-1979)

Nov 2000 to Sep 2002 <http://www.wetteronline.de> daily water stage [Eisenhüttenstadt]

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