

Flow Analysis Report



Project name:	Flow analysis example project
Project number:	2026-A01
Client:	Limitless Hydro
Designer:	Marco van Dijk
Station:	T3H006 - Tsitsa River @ Xonkonxa
Input file:	T3H006_Primary_data.txt
Data type:	HD
Record period:	1951-10-16 to 2026-05-18
Analysed period:	1951-10-16 to 2026-05-18
Date analysed:	2026-09-16 14:17:23
Project notes:	An example of the analysis of a historical flow record in the Tsitsa river

Included sections

1. Data quality assessment
2. Summary statistics
3. Time series analysis
4. Flow duration analysis
5. Volume analysis
6. Low and high flow analysis
7. Flood frequency analysis
8. Seasonality analysis
9. Stochastic flow generation

DISCLAIMER

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Data quality assessment



RECORD COVERAGE

Start date	: 1951-10-16
End date	: 2026-05-18
Calendar days	: 27244 days
Days represented	: 21967 days

GAP DETECTION

Number of gap periods	: 1025 periods
Total gap days	: 5279 days

CONSISTENCY CHECKS

Negative flow values	: 0 records
Potential duplicate records	: 0 records

OUTLIER DETECTION

Potential outliers beyond ± 3 SD	: 397 records
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CAPACITY CHECK

Status	: No valid capacity entered
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INFILLING

Status	: Placeholder only - no values are changed in this version
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Summary statistics

BASIC STATISTICS

Station	: T3H006 - Tsitsa River @ Xonkonxa
Data type	: HD
Analysis start	: 1951-10-16 date
Analysis end	: 2026-05-18 date
Number of valid records	: 21965 records
Average	: 26.99 m ³ /s
Median	: 9.77 m ³ /s
Highest	: 966.89 m ³ /s
Lowest	: 0.00 m ³ /s
Standard deviation	: 51.31 m ³ /s
Variance	: 2632.54 (m ³ /s) ²
Coefficient of variation	: 1.901
Skewness	: 6.107
Kurtosis	: 62.481

FLOW QUANTILES

Q10	: 69.02 m ³ /s	Q65	: 4.34 m ³ /s
Q20	: 37.94 m ³ /s	Q70	: 3.38 m ³ /s
Q30	: 23.81 m ³ /s	Q75	: 2.80 m ³ /s
Q40	: 15.08 m ³ /s	Q80	: 2.29 m ³ /s
Q50	: 9.77 m ³ /s	Q85	: 1.81 m ³ /s
Q55	: 7.66 m ³ /s	Q90	: 1.38 m ³ /s
Q60	: 5.79 m ³ /s	Q95	: 0.90 m ³ /s

RUNOFF VOLUMES

Total runoff volume	: 51225.09 million m ³
Average annual runoff volume	: 692.23 million m ³ /year
Average monthly runoff volume	: 62.55 million m ³ /month

TREND STATISTICS

Linear trend slope	: -0.001 m ³ /s/year
Linear trend intercept	: 27.03 m ³ /s
R ²	: 0.0000
Trend direction	: Decreasing

Time series analysis

DATA QUALITY ASSESSMENT : completed before this analysis.
Station : T3H006 - Tsitsa River @ Xonkonxa
Input file : T3H006_Primary_data.txt | Data type: HD
Analysis period : 1951-10-16 to 2026-05-18

DAILY HYDROGRAPH

Valid daily records : 21965
Mean flow : 26.99 m³/s
Median flow : 9.77 m³/s
Maximum flow : 966.89 m³/s
Minimum flow : 0.00 m³/s

MONTHLY HYDROGRAPH

Months analysed : 819
Highest monthly mean : 1976-03 = 238.54 m³/s
Lowest monthly mean : 1995-07 = 0.00 m³/s

ANNUAL HYDROGRAPH

Hydrological years analysed : 73
Highest mean annual flow : 1975/76 = 86.85 m³/s
Lowest mean annual flow : 1982/83 = 0.49 m³/s

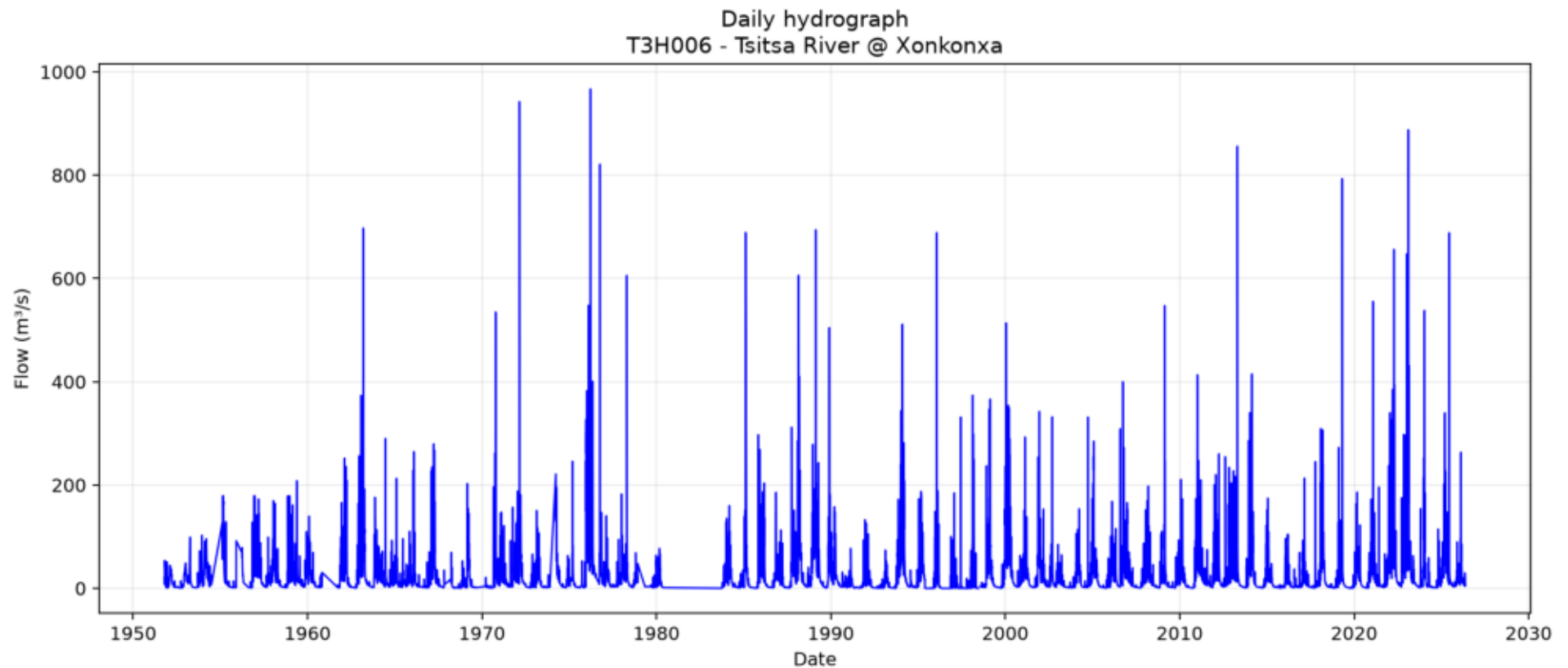
MOVING AVERAGES

Window : 30 days
Moving average maximum : 247.51 m³/s
Moving average minimum : 0.00 m³/s

PERIODICITY ANALYSIS

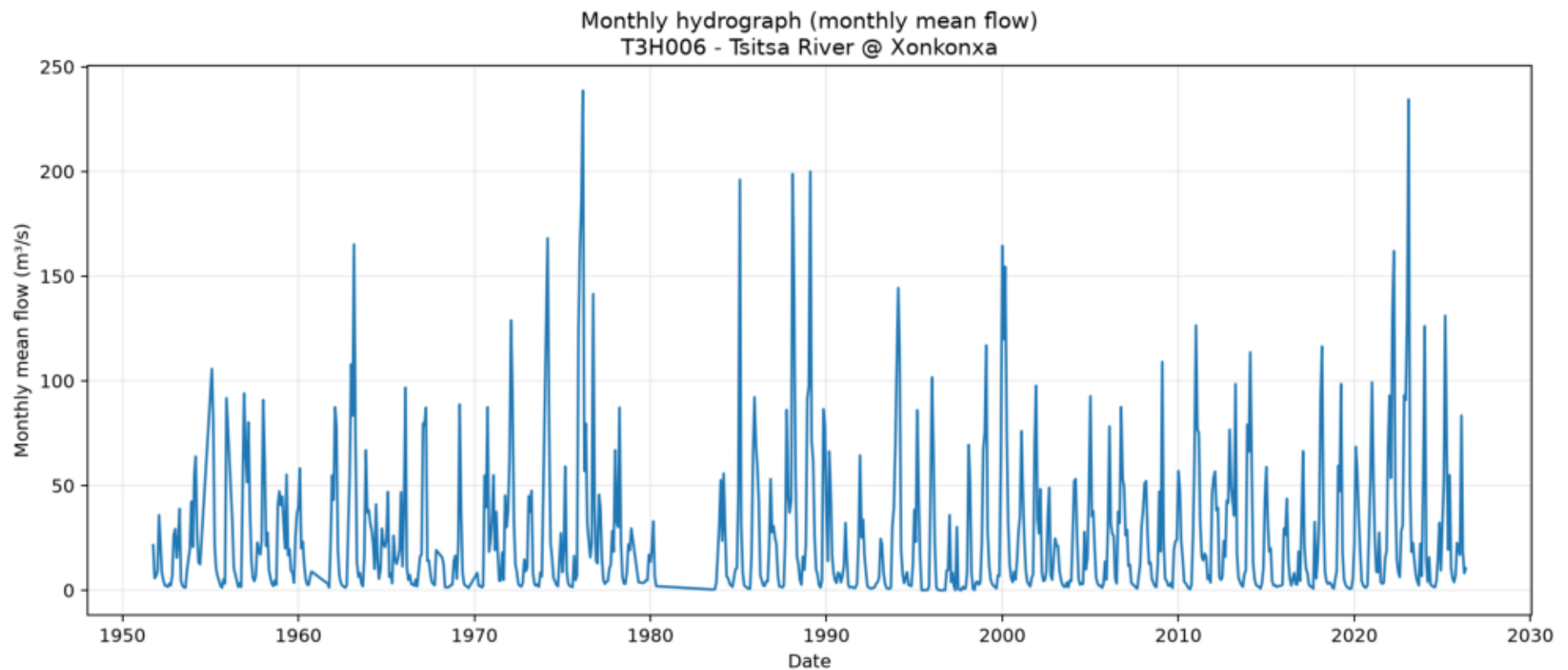
Highest climatological month : 2
Average summer mean flow : 41.16 m³/s
Average winter mean flow : 11.22 m³/s

Time series analysis



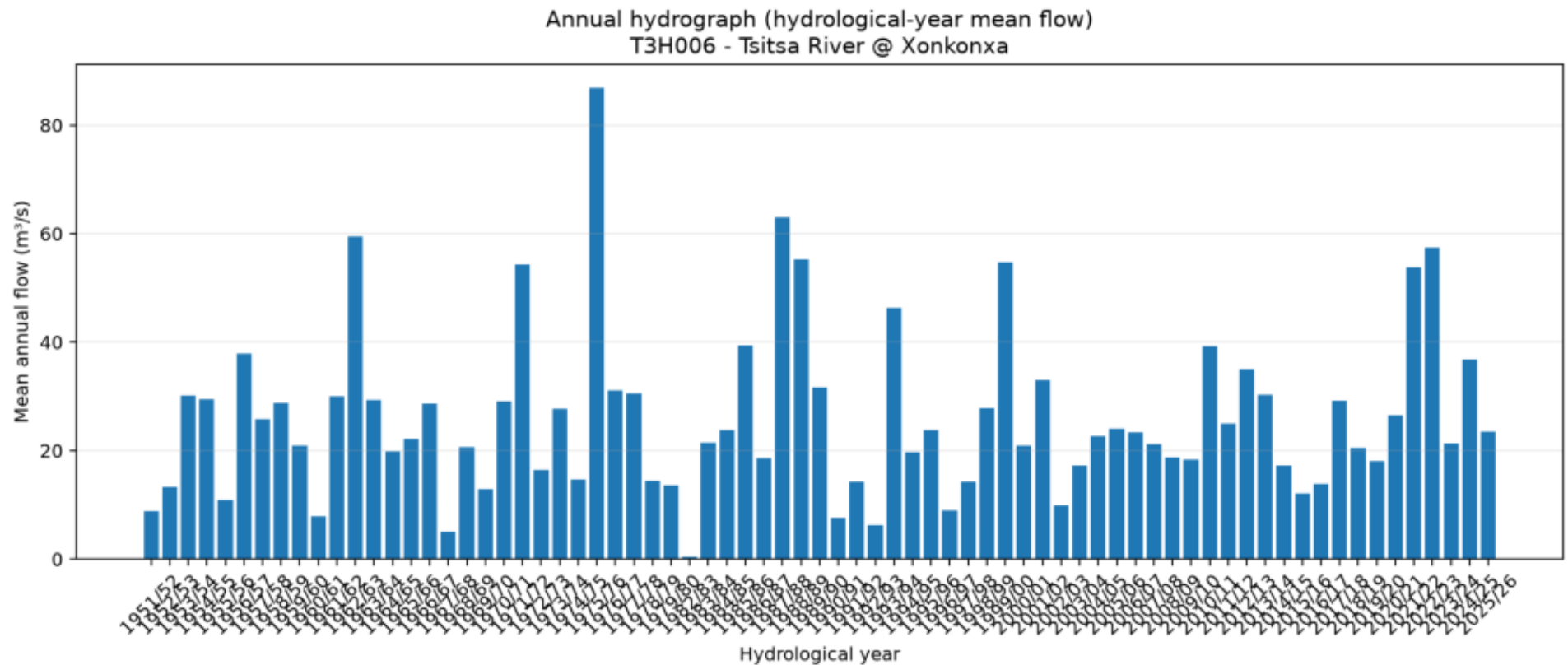
Input file: T3H006_Primary_data.txt | Data type: HD

Time series analysis



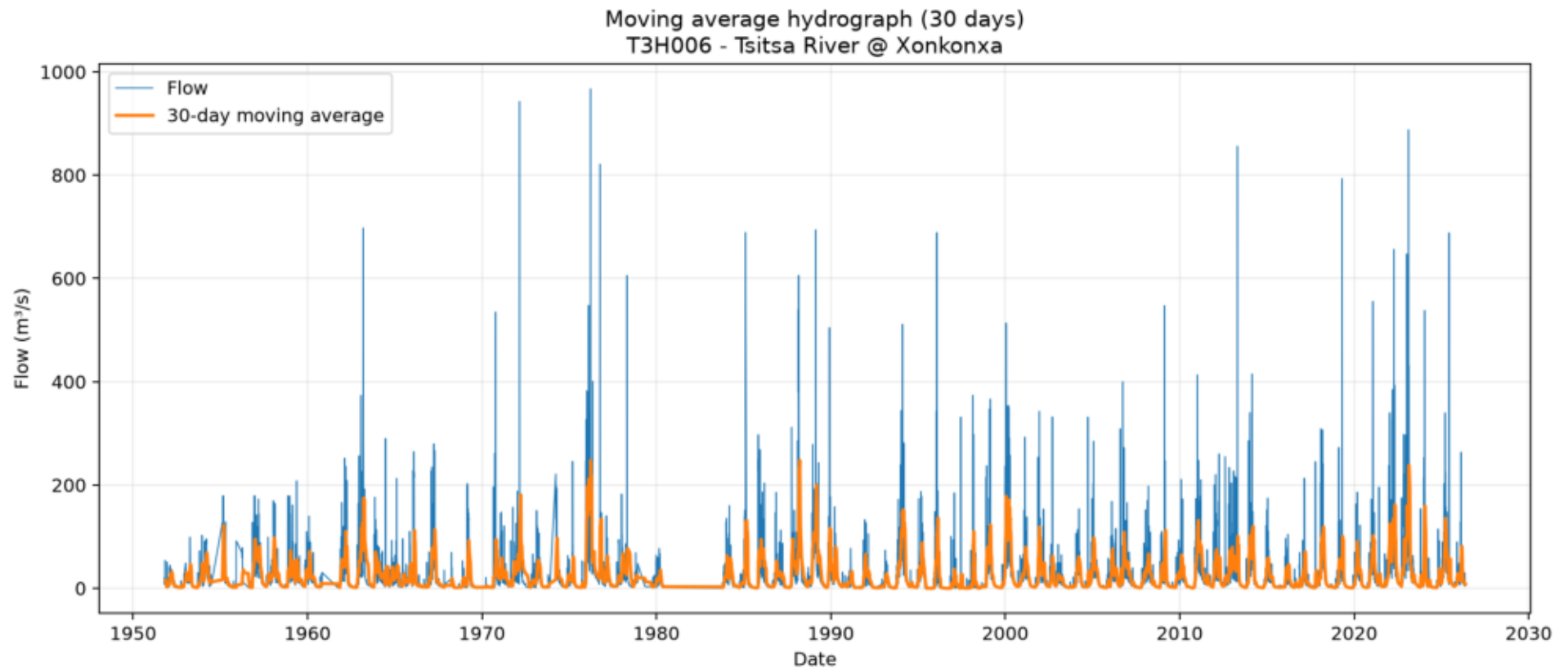
Input file: T3H006_Primary_data.txt | Data type: HD

Time series analysis



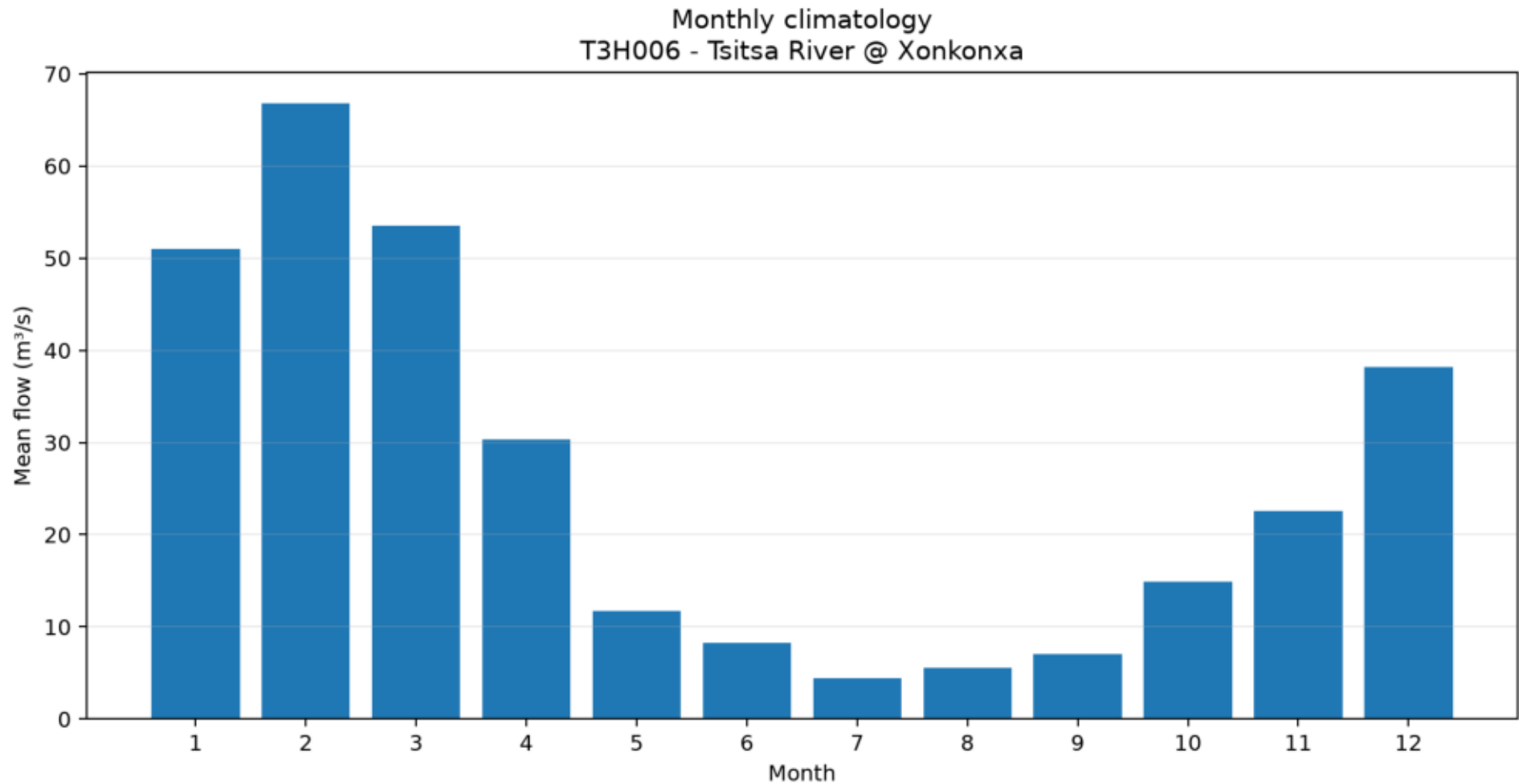
Input file: T3H006_Primary_data.txt | Data type: HD

Time series analysis



Input file: T3H006_Primary_data.txt | Data type: HD

Time series analysis



Input file: T3H006_Primary_data.txt | Data type: HD

Flow duration analysis



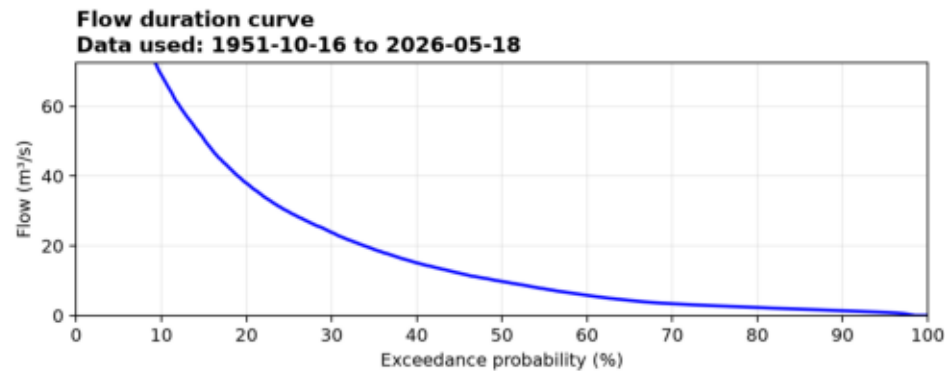
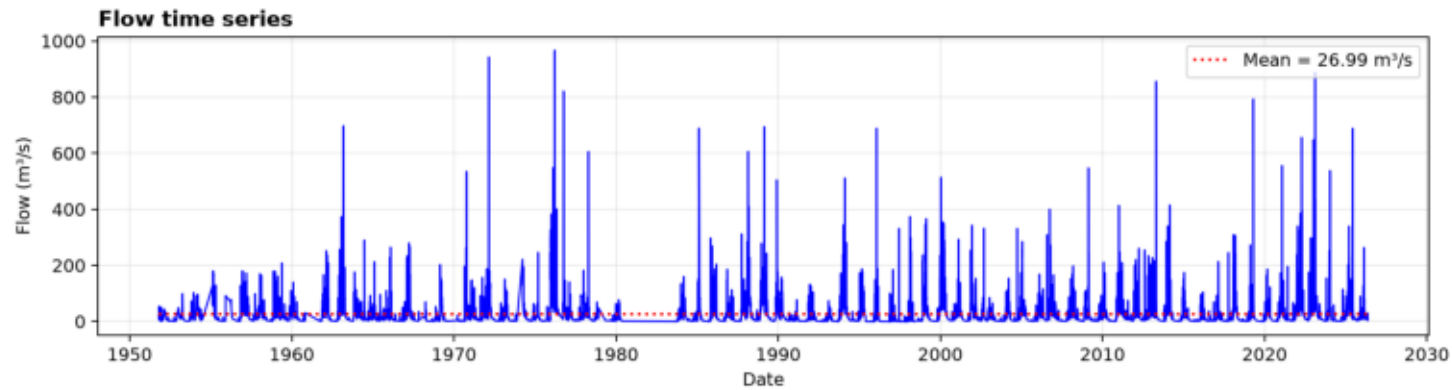
FLOW DURATION CURVE (FDC)

Exceedance probability	Standard	Ann min	Ann max	Summer	Winter	Mon min	Mon max
(%)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m³/s)	(m³/s)
Q10	69.02	14.96	226.83	96.48	26.19	9.15	144.05
Q20	37.94	3.18	123.45	60.93	13.66	5.27	88.85
Q30	23.81	2.03	76.91	41.28	9.11	3.59	68.04
Q40	15.08	1.03	61.19	29.42	5.97	2.89	52.82
Q50	9.77	0.43	42.6	21.5	3.97	2.29	41.45
Q55	7.66	0.17	35.7	18.08	3.4	2.01	37.36
Q60	5.79	0.01	33.63	15.03	3	1.73	31.89
Q65	4.34	0	31.34	12.24	2.67	1.5	27.91
Q70	3.38	0	27.91	9.62	2.34	1.3	25.07
Q75	2.8	0	25.73	6.97	2.02	1.15	21.42
Q80	2.29	0	21.6	4.49	1.72	1	17.77
Q85	1.81	0	14.99	2.96	1.44	0.85	14.95
Q90	1.38	0	12.27	1.96	1.14	0.66	11.49
Q95	0.9	0	8.97	1.16	0.71	0.39	7.98

Flow duration analysis

Daily Flow Analysis T3H006 - Tsitsa River @ Xonkonxa

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Exceedance probability (%)	Flow (m³/s)
Q10	69.02
Q20	37.94
Q30	23.81
Q40	15.08
Q50	9.77
Q55	7.66
Q60	5.79
Q65	4.34
Q70	3.38
Q75	2.80
Q80	2.29
Q85	1.81
Q90	1.38
Q95	0.90

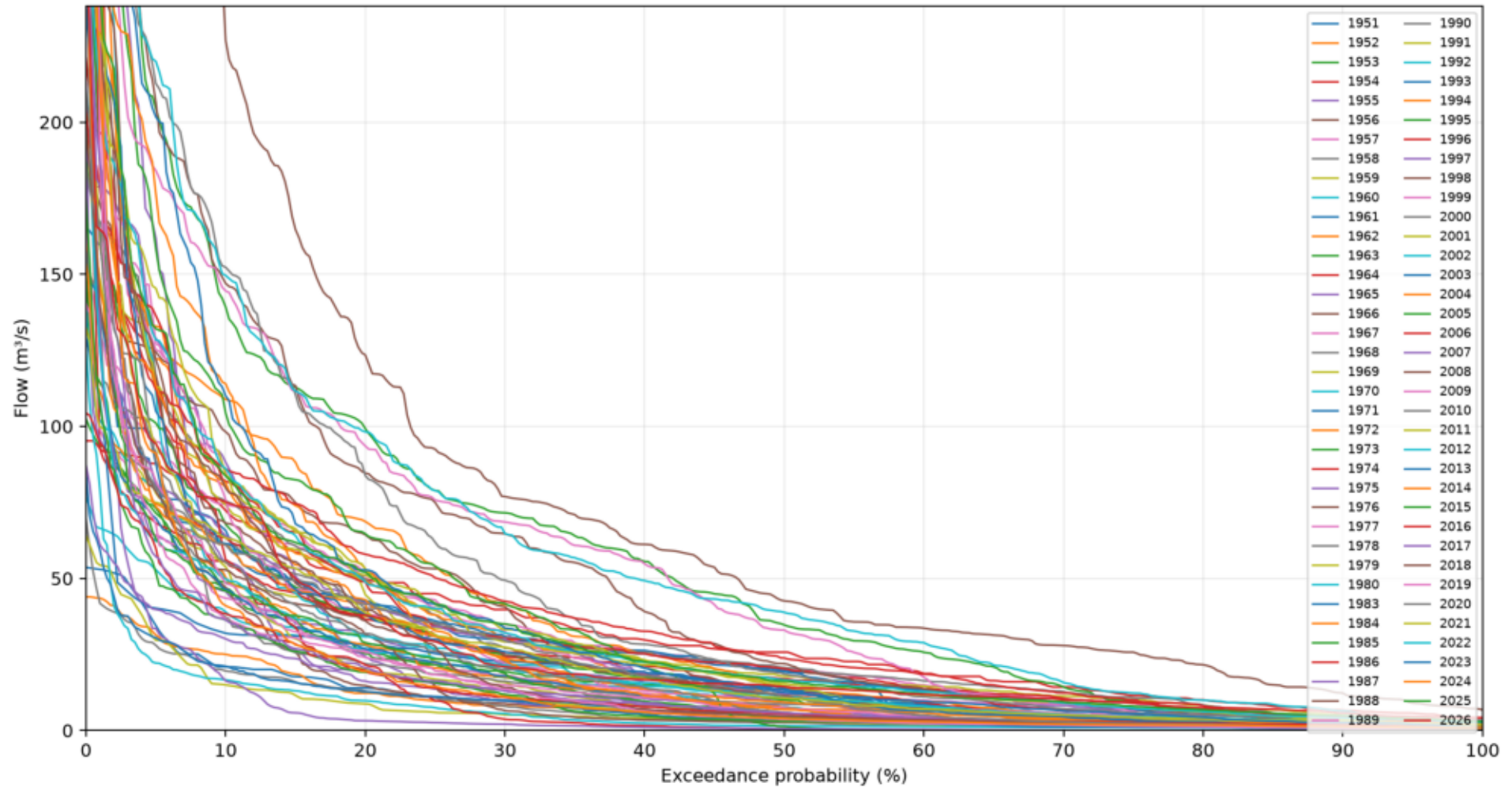
Statistics
Record start: 1951-10-16 | Record end: 2026-05-18 | Record length: 21967 days | Valid flow records used: 21965 days | Good flow records: 21965 days | Missing or excluded records: 2 days | Average flow: 26.99 m³/s | Median flow: 9.77 m³/s | Standard deviation: 51.31 m³/s | Coefficient of variation: 1.901 | Highest flow: 966.89 m³/s | Lowest flow: 0.00 m³/s | Trend slope: -0.0009 m³/s/year | Total runoff volume: 51225.09 million m³ | Average annual runoff volume: 692.23 million m³/year | Average monthly runoff volume: 62.55 million m³/month

Input file: T3H006_Primary_data.txt | Data type: HD

Flow duration analysis

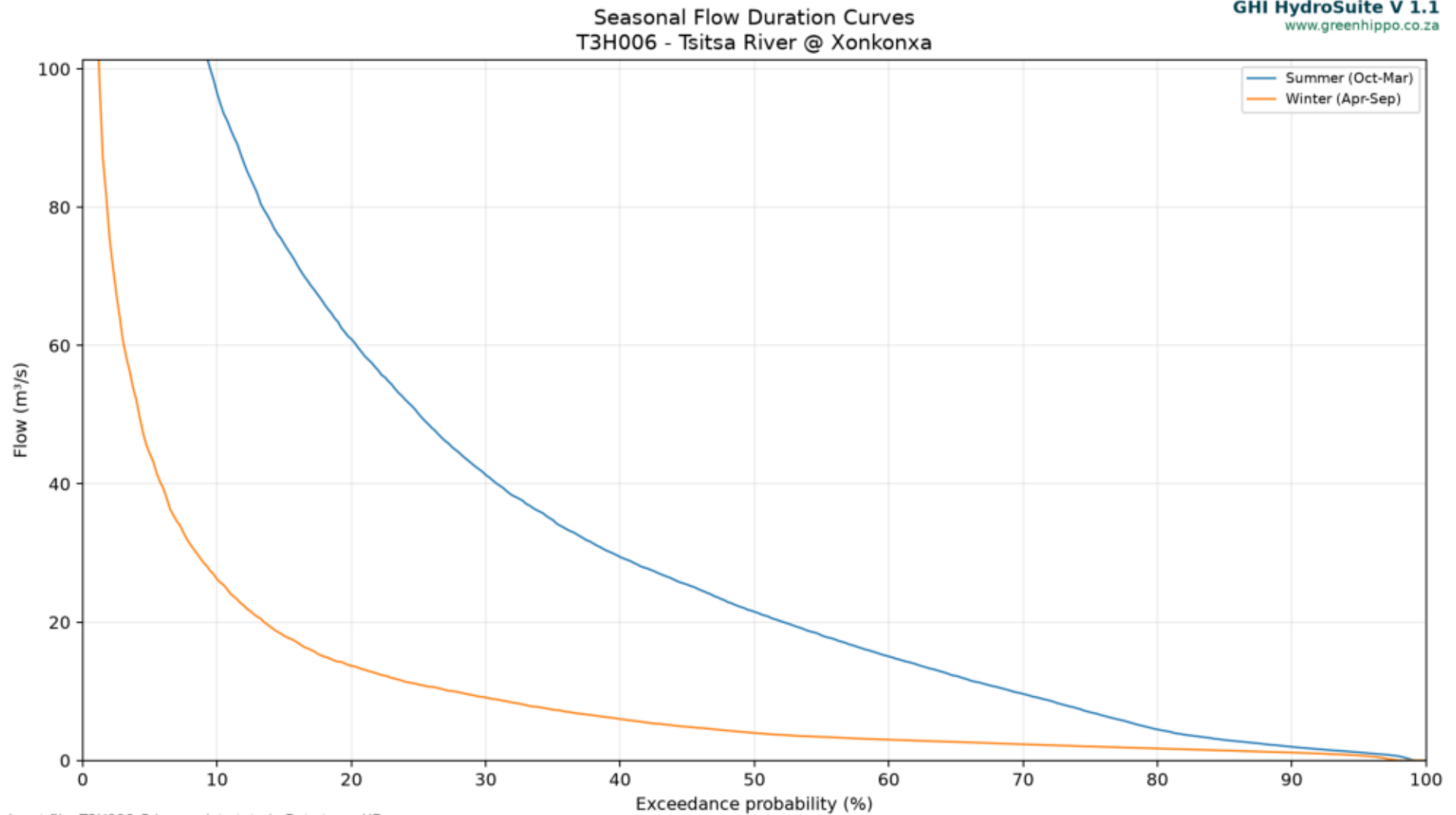
GHI HydroSuite V 1.1
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Annual Flow Duration Curves
T3H006 - Tsitsa River @ Xonkonxa

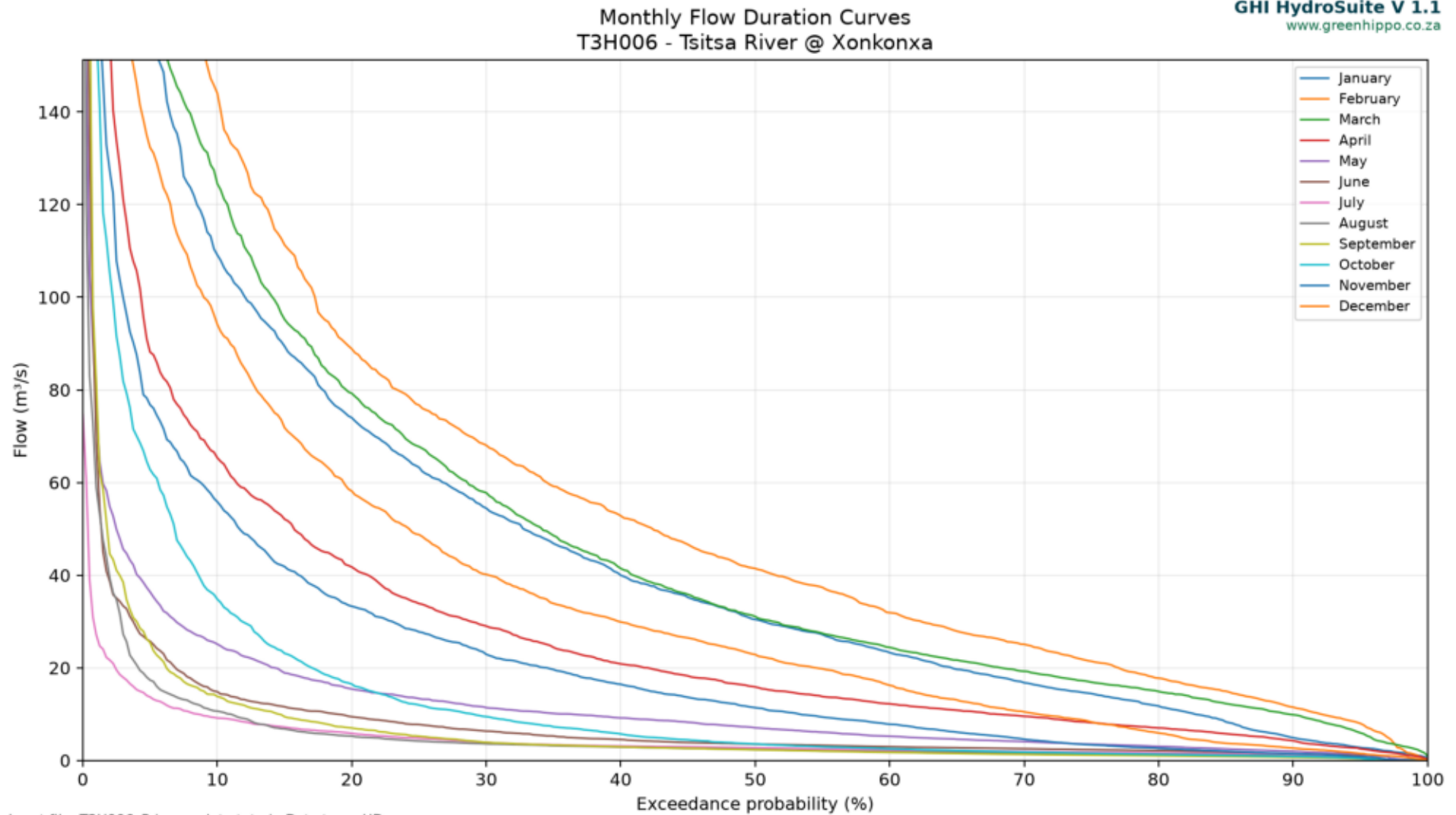


Flow duration analysis

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Flow duration analysis



Volume analysis



DATA QUALITY ASSESSMENT : completed before this analysis.

Station : T3H006 - Tsitsa River @ Xonkonxa

Input file : T3H006_Primary_data.txt | Data type: HD

Duration : 1 day

Rolling windows analysed : 72324

Maximum rolling volume : 72.4171 Mm³ (72,417,136 m³)

Median rolling volume : 5.7717 Mm³

VOLUME DURATION VALUES

Rolling windows excluded because of 478600 gaps

Station : T3H006 - Tsitsa River @ Xonkonxa

Input file : T3H006_Primary_data.txt | Data type: HD

Duration : 12 hours

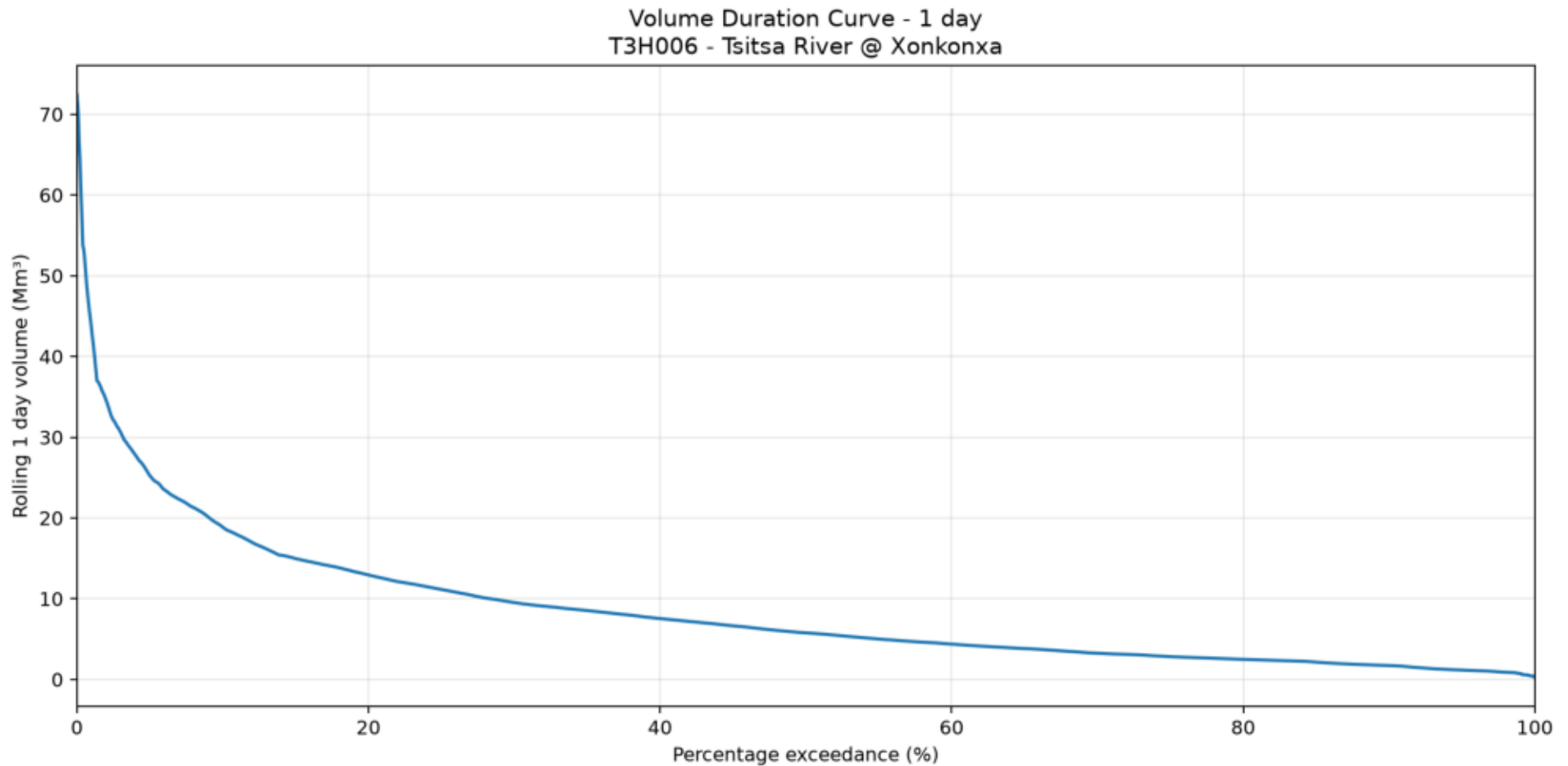
Annual maximum volume values: 28

Plotting position : Cunnane (A=0.4, B=0.2)

ANNUAL MAXIMUM VOLUME SERIES

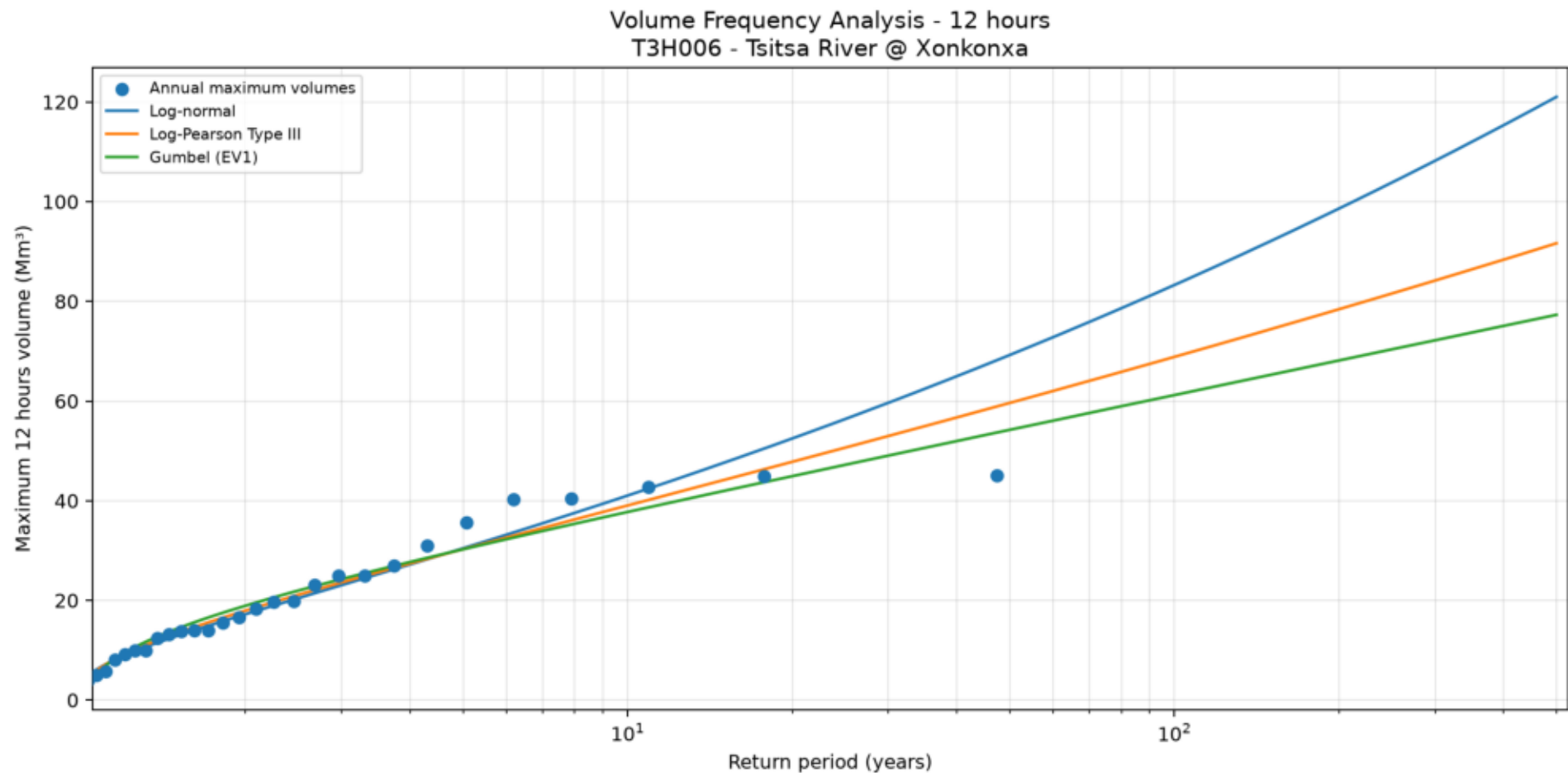
1998/99	1999-02-21 12	: 48	8.1383
1999/00	2000-03-16 12	: 00	23.0762
2000/01	2001-02-25 05	: 00	5.7137
2001/02	2002-09-11 01	: 30	24.9079
2002/03	2003-01-11 19	: 24	3.9448
2003/04	2004-09-26 13	: 18	16.5532
2004/05	2005-01-23 17	: 06	15.5104
2005/06	2006-09-27 09	: 54	24.9666
2006/07	2006-10-20 12	: 42	13.9222
2007/08	2008-03-12 07	: 36	13.1954
2008/09	2009-02-16 05	: 30	30.9246
2009/10	2010-01-27 22	: 18	9.1879
2010/11	2011-01-06 08	: 06	19.6814
2011/12	2012-08-08 17	: 06	13.9330
2012/13	2013-04-21 16	: 18	42.6784
2013/14	2014-01-10 07	: 48	18.2933
2014/15	2015-01-16 13	: 36	9.9871
2015/16	2016-03-14 03	: 06	4.9995
2016/17	2017-02-21 07	: 18	9.9123
2017/18	2017-10-11 02	: 30	19.8973
2018/19	2019-04-23 20	: 36	40.4160
2019/20	2020-03-03 05	: 12	12.4774
2020/21	2021-01-28 21	: 00	26.9580
2021/22	2022-04-13 06	: 00	45.0988
2022/23	2023-02-10 02	: 00	40.3083
2023/24	2024-01-12 08	: 48	35.6120

Volume analysis



Input file: T3H006_Primary_data.txt | Data type: HD

Volume analysis



Input file: T3H006_Primary_data.txt | Data type: HD

Low and high flow analysis

GENERAL

DATA QUALITY ASSESSMENT : completed before this analysis.
Daily values used for low-flow duration analyses : 21965
High-definition observations used for peak analyses : 550932

7-DAY MINIMUM FLOW

Minimum 7-day mean : 0 m³/s
Window end date : 1995-07-03

30-DAY MINIMUM FLOW

Minimum 30-day mean : 0 m³/s
Window end date : 1995-07-28

ANNUAL MINIMUM

Lowest hydrological-year daily mean : 0 m³/s
Hydrological year / date : 1994/95 / 1995-06-13

MONTHLY MINIMUM

Lowest monthly daily mean : 0 m³/s
Year-month / date : 1995-06 / 1995-06-13

ZERO-FLOW FREQUENCY

Zero-flow days : 312 days
Zero-flow frequency : 1.42 %

DURATION BELOW THRESHOLD

Threshold : 0 m³/s
Days below threshold : 312 days

DROUGHT DURATION

Longest duration below threshold : 44 days
Longest period : 1996-09-23 to 1996-11-05

ANNUAL MAXIMUM SERIES

Maximum instantaneous peak : 1048.7 m³/s
Hydrological year / date : 2012/13 / 2013-04-21

MONTHLY PEAKS

Maximum monthly peak : 1048.7 m³/s
Year-month / date : 2013-04 / 2013-04-21

SEASONAL PEAKS

Seasonal peak records : 145 records

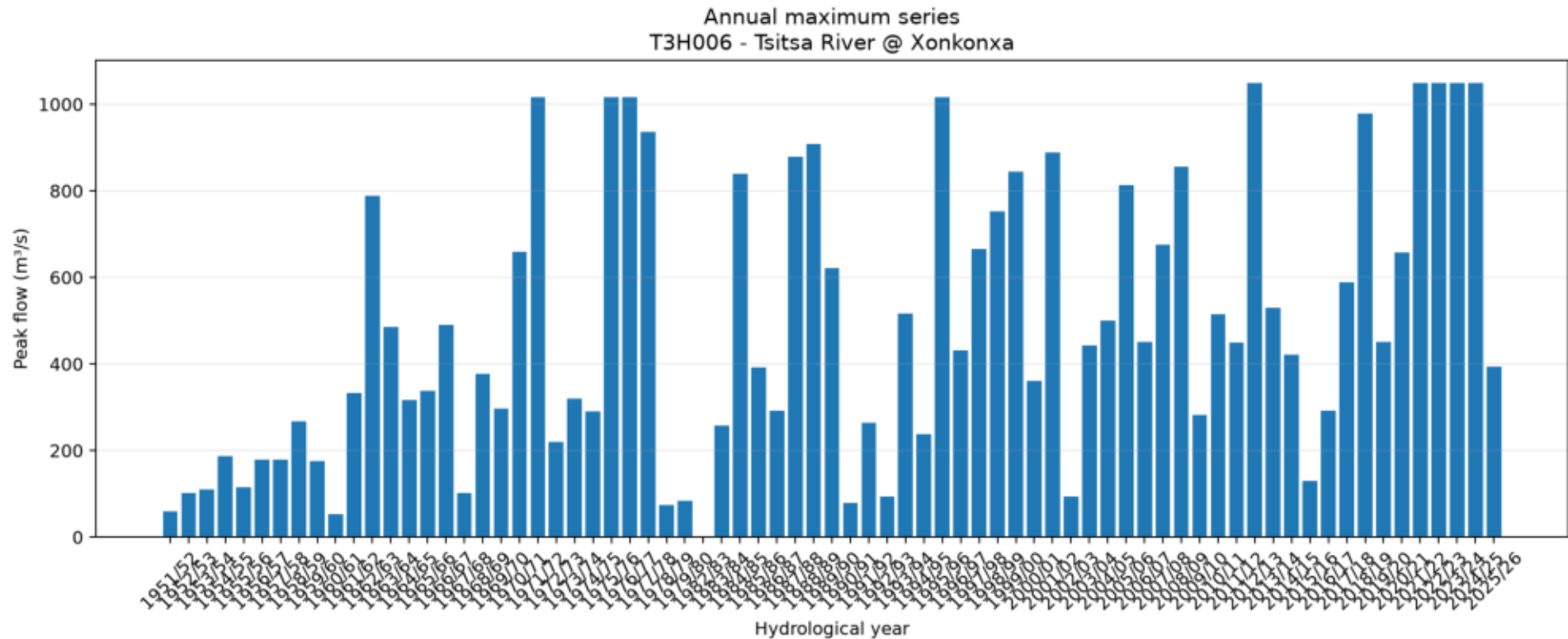
PEAK-OVER-THRESHOLD ANALYSIS

Threshold : 183.646 m³/s
Observations above threshold : 27628 observations

BASEFLOW INDEX

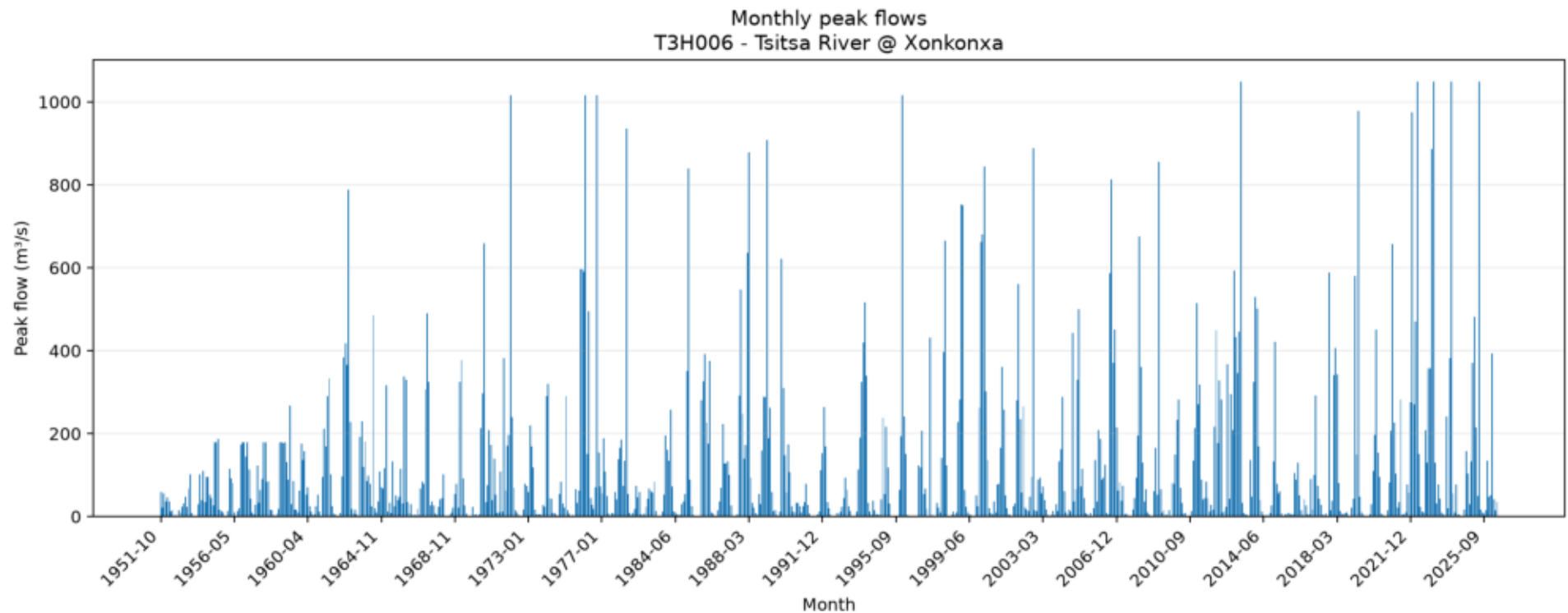
Status : Placeholder - digital filtering method to be selected in a later version

Low and high flow analysis



Input file: T3H006_Primary_data.txt | Data type: HD

Low and high flow analysis



Input file: T3H006_Primary_data.txt | Data type: HD

Flood frequency analysis



ANALYSIS SETTINGS AND SUMMARY

DATA QUALITY ASSESSMENT	: completed before this analysis.
Station	: T3H006 - Tsitsa River @ Xonkonxa
Input file	: T3H006_Primary_data.txt Data type: HD
Series	: Annual maximum series
Plotting position	: Cunnane (A=0.4, B=0.2)
Log transformation	: applied automatically for log-distributions
Flood peak values extracted	: 73
Maximum flood peak	: 967 m ³ /s
Maximum peak date	: 1976-03-21 (1975/76)
Annual maximum values	: 73
Mean (Qave)	: 343.584 m ³ /s
Standard deviation (SD)	: 245.569 m ³ /s
SD excluding maximum (SD*)	: 235.808 m ³ /s
Minimum / maximum	: 1.032 / 966.890 m ³ /s
Minimum / maximum Z-score	: -1.395 / 2.538
Log-skewness	: -2.304

Flood frequency analysis

FLOOD PEAK SERIES

Hydrological year	Peak date	Peak flow (m ³ /s)
1951/52	1951-10-27	54
1952/53	1953-04-06	99
1953/54	1953-12-13	102
1954/55	1955-02-20	179
1955/56	1955-12-01	92
1956/57	1956-12-09	179
1957/58	1958-01-14	169
1958/59	1959-05-20	208
1959/60	1960-02-01	139
1960/61	1960-10-31	30
1961/62	1962-02-15	252
1962/63	1963-03-11	697
1963/64	1964-06-20	290
1964/65	1965-02-08	213
1965/66	1966-02-02	264
1966/67	1967-03-28	280
1967/68	1968-04-01	69
1968/69	1969-02-27	203
1969/70	1970-09-30	262
1970/71	1970-10-13	535
1971/72	1972-02-25	942
1972/73	1973-02-19	150
1973/74	1974-03-27	221
1974/75	1975-03-12	246
1975/76	1976-03-21	967
1976/77	1976-10-05	821
1977/78	1978-04-22	606
1978/79	1978-10-26	69
1979/80	1980-03-02	77
1982/83	1983-09-26	1
1983/84	1984-03-07	160
1984/85	1985-02-10	689
1985/86	1985-11-03	297
1986/87	1986-11-09	186
1987/88	1988-02-25	606
1988/89	1989-02-17	694
1989/90	1989-11-29	504
1990/91	1991-02-20	77
1991/92	1991-12-14	133
1992/93	1993-02-13	74
1993/94	1994-02-07	511
1994/95	1995-03-03	187
1995/96	1996-01-27	689
1996/97	1997-06-13	331
1997/98	1998-02-18	374
1998/99	1999-02-20	366
1999/00	2000-01-17	513
2000/01	2001-02-15	293
2001/02	2001-12-14	342
2002/03	2003-01-11	85
2003/04	2004-09-26	331
2004/05	2005-01-23	285
2005/06	2006-09-27	400
2006/07	2006-10-20	272
2007/08	2008-03-12	198
2008/09	2009-02-16	547
2009/10	2010-01-28	211
2010/11	2011-01-05	413
2011/12	2012-04-01	260
2012/13	2013-04-21	856
2013/14	2014-02-21	415
2014/15	2015-01-16	174
2015/16	2016-03-12	104
2016/17	2017-02-21	213
2017/18	2018-02-01	309
2018/19	2019-04-23	793
2019/20	2020-03-03	186
2020/21	2021-01-28	555
2021/22	2022-04-13	656
2022/23	2023-02-10	888
2023/24	2024-01-12	538
2024/25	2025-06-10	688
2025/26	2026-02-14	263