An Overview of Baseflow in Adelaide River Catchment

Water Resources Division Technical Report 29/2024

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Cover image: Adelaide River gauging station G8170008 at downstream Daly River Road fed by groundwater discharge at downstream Daly River Road, October 2023. Photo courtesy of Kien Nguyen.

Acronyms

Acronyms	Full form
AHD	Australian Height Datum
BFI+	HydroOffice Baseflow program
BoM	Bureau of Meteorology
Crk	Creek
DEPWS	Department of Environment, Parks and Water Security
DLPE	Department of Lands, Planning and Environment
DFMs	Digital filter methods
D/S	Downstream
EWMA	exponentially weighted moving average
GHS	Graphical hydrograph separation
HESEP	Hydrograph-Separation program
Hwy	Highway
km	kilometres
MB	Mass balance
m	metres
ML	megalitres
NT	Northern Territory
NTG	Northern Territory Government
NTWAPF	Northern Territory Water Allocation Planning Framework
RDF	Recursive digital filter
RDF 1P/ 3P	Recursive digital filter one pass/ three pass
SRTM	Shuttle Radar Topographic Mission
U/S	Upstream
WAP	Water Allocation Plan
WHAT	Web Hydrograph Analysis Tool
WCD	Water Control District
WMZ	Water Management Zone

Glossary

Term	Definition
Aquifer	A geological unit, or an artificial fill, permeated or capable of being permeated permanently or intermittently with water
Aquifer (confined)	an aquifer bounded above and below by impermeable beds, or by beds of distinctly lower permeability than that of the aquifer itself and the upper water surface is the bottom of the upper confining bed
Aquifer (unconfined)	an aquifer that is not confined beneath relatively impermeable rocks; also referred to as a phreatic aquifer
Aquitard (confining layer)	a geological formation that may contain groundwater but is not capable of transmitting significant quantities of groundwater
Bore	A natural or constructed hole in the ground that is used, or could reasonably be used, for any of the following purposes: (a) taking groundwater; (b) investigating the behaviour, occurrence and availability of groundwater; (c) monitoring the condition of groundwater; (d) injecting water to recharge an aquifer; (e) disposing waste directly or indirectly into groundwater.
Catchment area, surface water	The extent of land where water from precipitation drains into a waterway.
Cumec (m^3/s)	A cubic metre per second, a unit of measurement used to describe flow in surface water systems; one cumec is equal to one thousand litres per second.
Discharge	The volume of water flowing in a stream or through an aquifer past a specific point in a given period of time (Fetter, 2001)
Dry season	The Dry season in the Top End of NT runs from May to October. The humidity is low and the average daily temperature is around 32°C.
Environmental Water Requirement	Descriptions of the water regimes needed to sustain the ecological values of aquatic ecosystems at a low level of risk. These descriptions are developed through the application of scientific methods and techniques or through the application of local knowledge based on many years of observation (ARMCANZ & ANZECC 1996, National principles for the provision of water for ecosystems, Sustainable Land and Water Resources Management Committee Subcommittee on Water Resources Occasional Paper SWR No 3)
Ephemeral stream	A waterway that does not flow all year round.
Fill and spill	A groundwater system with limited storage capacity that typically fills up in the wet season and overflows to the surface
Gauging station	Gauging stations collect water level, flow and rainfall data. They can also collect discrete water quality data
Groundwater	Water occurring or obtained from below the surface of the ground (other than water contained in works, not being in a bore, for the distribution, reticulation, transportation, storage or treatment of

Term	Definition
	water or waste) and includes water occurring in or obtained from a bore or aquifer
Groundwater dependent ecosystem	an ecosystem that requires access to groundwater to meet all or some of its water requirements
Groundwater flow system	A system that is hydrologically connected and described at the level desired for management purposes (e.g. sub-catchment, catchment, basin or drainage division, or groundwater management unit, sub-aquifer, aquifer, groundwater basin)
Hydrogeological conceptual model	Collections of hypotheses (both in written and diagrammatic form) describing the understanding of groundwater flow systems. They are used to inform and provide levels of uncertainty to groundwater flow and transport models. (Sometime called conceptual hydrogeological models).
Hydro-stratigraphic unit	A water-bearing geologic unit or units hydraulically connected or grouped together on the basis of similar hydraulic conductivity which can be reasonably monitored; several geologic formations or part of a geologic formation may be grouped into a single hydro-stratigraphic unit
In-stream flow requirement	The volume and timing of water flow required for proper functioning of an aquatic ecosystem
Low flow	The "flow of water in a stream during prolonged dry weather" (WMO)
Recharge	A hydrologic process whereby water moves from the Earth's surface to groundwater. The recharge value represents the amount of water that goes into the groundwater system and may be expressed in units of depth/time, e.g. mm/yr or volume/time, e.g. ML/yr.
Recharge (direct)	Water added to the groundwater reservoir in excess of soil-moisture deficits and evapotranspiration by direct vertical percolation through the vadose zone (de Vries & Simmers, 2002). E.g. recharge via precipitation from irrigation or rainfall.
Recharge (indirect)	Results from percolation to the water table following runoff, as ponding in low lying areas and lakes, or through beds of surface water courses
River catchment	The extent of land where water from precipitation drains into a waterway
Transmissivity	The rate at which water of a prevailing density and viscosity is transmitted through a unit width of an aquifer or confining bed under a unit hydraulic gradient (Fetter, 2001)
Water Allocation Plan	see Water Act 1992, section 22B
Water Control District	see Water Act 1992, section 22B
Wet season	The Wet Season in the Top End of NT runs from November and April. Cyclones can occur. Thunderstorms are frequent, the humidity can rise to 98 % and the temperature can reach over 40°C inland.
watertable	the water surface where water pressure head is equal to the atmospheric pressure. Or more easily conceptualised as the surface where rock or soil becomes fully saturated. Also known as the phreatic surface.

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Acknowledgement of Country

The Northern Territory Government respectfully and proudly acknowledges the Northern Territory's Aboriginal people and their rich cultures. We pay respect to Elders past and present. We acknowledge Aboriginal peoples as the traditional owners and custodians of the lands and waters that we rely on for our livelihoods. We recognise the intrinsic connection of traditional owners to Country and value their ongoing contribution to managing the lands and waters. We support the need for genuine and lasting partnerships with traditional owners to better understand cultural connections, and we will work to establish lasting partnerships to manage water together, now and into the future.

Executive Summary

The Top End of the Northern Territory lies within the wet/dry tropics, where it experiences seasonal monsoon rainfall followed by an extended dry period. During the dry season, streamflow typically ceases by mid- to late-season. This climatic polarity, coupled with limited surface storage features, ensures that any flow at the end of dry season is largely derived from groundwater discharges from local or regional scale aquifers.

The separation of baseflow from other components of streamflow is commonly used to assess the contribution of groundwater resources in sustaining ecological values and meeting other basic consumption needs, particularly during the recessional period. Understanding baseflow can inform management strategies to maintain minimum flows for environmental and cultural requirements. These may include regulating groundwater extraction, determining set back distances and limiting groundwater extraction rates.

Baseflow is often seen as a perennial flow that sustains rivers flowing throughout the year. In the context of the Adelaide River and its tributaries, this study aims to assess the contribution of baseflow, including its presence in non-perennial streams. The study focused on identifying groundwater sources of baseflow and characterizing baseflow across the Adelaide River catchment, examining twelve sub-catchments where streamflow discharges and/or water levels have been monitored.

Two qualitative methods - recessional analysis and flow duration curve (FDC) - were applied to assess the potential for groundwater contribution to baseflow. Following this, various baseflow separation methods were used to evaluate the contribution of baseflow to streamflow based on daily discharge data.

The recessional analysis, which focusses on the shape of the recession curve, helped identify sites with potential groundwater components even after streamflow ceased. This analysis was applied to 2 years of flow data which indicated that groundwater could be contributing to streamflow at non-perennial sites such as Acacia Creek (G8170085) and Burrell Creek (G8170062), though field confirmation is required. The FDC method is a statistically rigorous approach that utilized the entire daily streamflow record, estimating the proportion of streamflow originating from groundwater by calculating the ratio of daily discharge exceeded 90% of the time to that exceeded 50% of the time. For eight of the sites, this ratio was zero, implying no baseflow contribution, due to streamflow ceasing for several months each year. The method performed well for perennial streams but was less effective in assessing non-perennial streams.

The quantitative baseflow separation was carried out using three methods: the recursive digital filter three-pass (RDF 3) technique, the online Web-based Hydrograph Analysis Tool (WHAT) and Baseflow index program (BFI+). Continuous baseflow separation was conducted for the twelve sub-catchments of the Adelaide River using current and historic daily streamflow datasets. The results show that groundwater is the dominant source maintaining streamflow in sub-catchments where flow persists through the driest months (June–September). BFI values for sub-catchments with a high proportion of baseflow ranged from 80% to 97%. Hydrogeological analysis confirmed that streamflow during the dry season occurs in certain sub-catchments, including G8170002, G8170008, and G8170066, which are underlain by high-yielding aquifers including the Jinduckin Formation, Tindall Limestone Formation, and Coomalie Dolostone.

The findings of this study will inform decisions regarding which sub-catchments require further monitoring of both groundwater sources and streamflow, particularly in areas with a high density of extraction bores. Furthermore, this study provides a valuable framework of baseflow separation and analysis methodologies that can be applied to other river basins in the monsoonal Top End of the Northern Territory.

Introduction

1.1 Purpose

This study developed a daily baseflow dataset for the Adelaide River and its tributaries to support management strategies aimed at maintaining minimum instream flows for environmental and other purposes. The dataset also serves as a reference for hydrological modelling within the Adelaide River catchment. The baseflow separation method used in this study has broader implications beyond the Adelaide River catchment, providing a valuable tool for regions where hydrogeology and aquifer presence are poorly mapped. This method is especially useful for identifying low flows that may be masked by wet season rainfall and catchment rainfall, which can persist for months after rainfall ceases.

The study applies several techniques for separating baseflow from daily time-series data. These techniques are assessed through calibrated parameters and visual hydrograph evaluations. Recessional analysis and FDC were conducted to evaluate which sub-catchments have available groundwater sources that contribute to baseflow.

The report aims to evaluate existing methodologies to identify the most practical approaches for estimating baseflow in river basins of the monsoonal Top End of the Northern Territory, where stream hydrographs are dominated by extreme wet season flows. The daily baseflow datasets produced in this study are intended to support water management strategies, maintain minimum instream flows for environmental purposes, and inform hydrological modelling and water allocation planning within the Adelaide River catchment.

1.2 Baseflow and baseflow analyses

Streamflow typically comprises two components: direct flow and baseflow (Aksoy et al., 2009; Bayou et al., 2021), illustrated in Figure 1. Direct flow is associated with rainfall events and includes surface flow and interflow (Aksoy et al., 2009). It responds quickly to rainfall, typically over a short time frame. In contrast, baseflow is the longer-term, delayed flow originating from storage and often comes from groundwater discharging from aquifers. It can also be sourced from lakes, melting glaciers, wetland or springs, riverbanks, floodplains, interflow, return flow from irrigation and other delayed sources (Cartwright et al., 2014; Duncan, 2019; Eckhardt, 2008; Smakhtin, 2001).

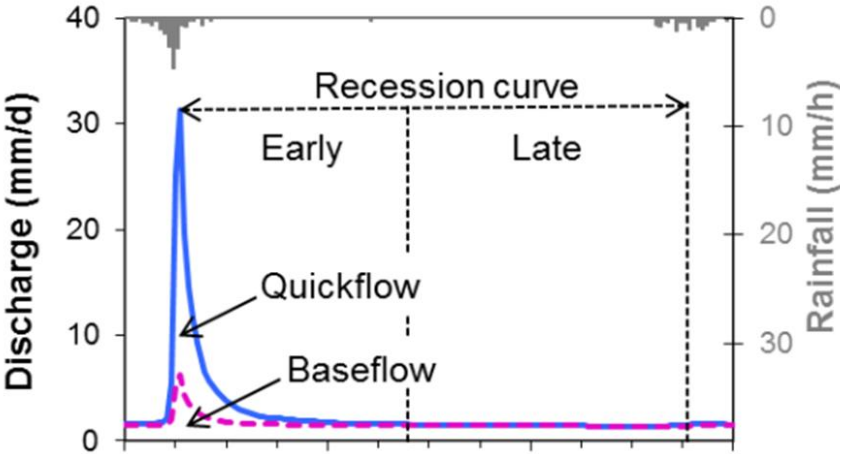

Figure 1. Quickflow and baseflow components of streamflow (modified from Steward, 2014)

Several methods exist for analysing the baseflow component of the stream hydrograph, with the most common being recession analysis, frequency analysis and baseflow separation. Despite extensive research on baseflow estimation, the precise outcome remains challenging to define (Duncan, 2019).

To quantify baseflow, various techniques have been developed, including graphical hydrograph separation (GHS) methods, which rely solely on-stream discharge data, tracer mass balance (MB) methods, which incorporate chemical constituents in the stream, stream discharge and concentrations of end-member constituents (runoff and baseflow) (Miller et al., 2015). GHS approaches include recession curve methods (RCMs) and digital filter methods (DFMs) (Gardner et al., 2010; Miller et al., 2015). RCMs tend to be more objective than DFMs because they identify a linear recession constant during the falling limb of the hydrograph, providing an integrated signal of basin hydrologic and geologic characteristics (Miller et al., 2015). DFMs, on the other hand, define baseflow as the line connecting the minima of streamflow (Wolock, 2003). The traditional hydrographical method for baseflow separation is the recession analysis based on the recession curve, which focuses on the receding limb of the flood hydrograph following the peak. This portion of the hydrograph represents streamflow that is, at least in part, maintained by discharge from watershed aquifer storage (Thomas et al., 2015). As quick flow decreases, the slope of the recession curve flattens, and baseflow becomes more dominant. Analysing the recession curve, particularly separating out the baseflow component, provides insight into the characteristics of the natural storages that feed the stream (Tallaksen, 1995). Traditionally, graphical methods were used to separate baseflow from the recession curve, often constructing a master recession curve (Toebes et. al., 1969 as cited in Tallaksen, 1995). More recently, the focus has shifted toward defining a mathematical model to describe recession segments of the hydrograph (Brodie and Hostler, 2005).

Another approach for assessing the groundwater contribution to streams is frequency analysis, which derives the relationship between the magnitude and frequency of streamflow discharges (Brodie and Hostler, 2005). A common application of this method is the flow duration curve (FDC), which helps determine whether baseflow constitutes a proportion of streamflow. This is done by using Q_{90} and Q_{50} statistical probabilities, representing flow exceedance for the 90^{th} and 50^{th} percentiles of flow, respectively (Bayou et al., 2021). While the FDC indicates whether baseflow contributes to streamflow, it cannot generate baseflow values as a time series.

Among the hydrograph analysis techniques that use measured streamflow data, recursive digital filter (RDF) methods are the most commonly employed for baseflow separation. These techniques were developed by Lyne and Hollick (1979), Boughton (1988), Nathan and McMahon (1990), Chapman (1991), and Eckhardt (2005). RDF methods are automated and typically do not have a direct hydrological basis; instead, they aim to provide an objective and repeatable estimation of baseflow (Nathan and McMahon, 1990). These methods apply a filter (algorithm) to the entire streamflow record to generate a baseflow hydrograph.

Ladson et al. (2013) proposed a standard approach to baseflow separation using the Lyne and Hollick filter, known as the RDF 3P. This method has been applied to the Bass River in Victoria, Australia. The technique involves reflecting the flow for 30 days at the beginning and end of the flow series to address "warm-up" issues and specifying initial values for each of the three passes. Duncan (2019) developed a two-step method to retain some physical relevance in baseflow estimation. This method includes a backward pass to fit a master baseflow recession curve, followed by a forward pass using the Lyne and Hollick filter to smooth the master recession. The method employs a visual assessment to select the best-fit parameter for the master recession curve and has been applied to three catchments in Victoria, where it provided a satisfactory representation of baseflow (Duncan, 2019).

Another baseflow separation method, developed by Tularam and Ilahee (2008), uses the exponentially weighted moving average (EWMA) model, which was applied to two catchments in Queensland. The local-minimum method, an automated technique introduced by Sloto and Crouse (1996), constructs a sequence of "local minima" - the lowest observed flow within an interval. Adjacent local minima are then connected by straight lines to create the baseflow hydrograph.

Many RDF methods have been developed and are readily available online. Streamflow data can be uploaded to various web-based tools and computer programs, which then apply baseflow separation methods and provide baseflow results. One example is the Web-based on Hydrograph Analysis Tool (WHAT) (Lim et al., 2005), which uses three techniques including local minimum, the Lyne and Hollick filter and the Eckhardt filter. WHAT has no limitations on the input time-series data (https://engineering.purdue.edu/mapserve/WHAT). Another tool, SepHydro, developed by four Canadian organizations, offers eleven methods of baseflow separation (https://sephydro.hydrotools.tech/pageMain.php). SepHydro, however, is limited to blocks of daily time-series datasets with a maximum length of 20 years. HydroOffice (BFI+) (https://hydrooffice.org) is a program providing eleven baseflow separation methods, similar to SepHydro, but without limitations on time-series datasets. The PART application, part of the U.S. Geological Survey Toolbox, applies the local-minimum method to estimate the mean value of baseflow over long time series of streamflow data (Chen and Teegavarapu, 2019).

In this study, recession analysis and the flow duration curve (FDC) methods were employed to assess the baseflow contribution to streamflow for each sub-catchment. Then, a selection of automated baseflow separation techniques, available through WHAT and BFI+, was applied to daily streamflow data to determine baseflow. The RDF 3P technique, developed by Ladson et al. (2013), was also applied using a spreadsheet. The resulting streamflow hydrographs, baseflow hydrographs, and baseflow index (BFI) values were then compared to identify the most suitable baseflow techniques for each sub-catchment.

1.3 Study area

In the ‘Top End’ of the Northern Territory, the distinct wet and dry seasons result in streamflow patterns dominated by direct flow during the wet season and baseflow during the dry season, when present. Baseflow, sourced from groundwater discharging from regional aquifers, controls dry season flows in several of the region's largest rivers. Baseflow can also originate from shallow, localized aquifers, temporary riverbank storage following high-flow events, and wetlands. As the dry season progresses, the proportion of total flow derived from groundwater increases, while residual flows from rainfall and interflow decrease, altering the characteristics of low flows from early to late in the dry season. Baseflow is often considered a perennial flow that maintains river flow throughout the year. In order to better understand and quantify the groundwater contribution to streamflow in the Adelaide River and its tributaries, this study will also examine non-perennial streamflow and baseflow.

The Adelaide River catchment is a large river system spanning 7,455 km^2 (Geofabric: Water Information: Bureau of Meteorology, http://www.bom.gov.au/), located in the Top End of the Northern Territory. Its headwaters originate in Litchfield National Park and Tipperary Station, about 19 km southwest of Adelaide River Town, and it discharges into the Timor Sea, approximately 50 km northeast of Darwin. The catchment lies within the wet/dry tropics, experiencing annual monsoon rainfall followed by 6-8 months of dry conditions, during which recessional streamflow typically ceases by the middle to end of the dry season.

The Adelaide River catchment is a part of the Darwin Rural and Adelaide River Water Control District (WCD), which manages water extraction from both groundwater and surface water sources to protect the resource, as well as environmental and cultural values. A water allocation plan (the ‘plan’) is being prepared for the Adelaide River catchment, with finalisation expected by mid-2026. The plan will regulate the use of surface water across the catchment. This study aims to provide baseflow information that may contribute to the development of the plan.

Surface water levels and discharge data are available from 60 locations within the Adelaide River catchment. Of these, twelve gauging stations were selected for baseflow analysis, as listed in Table

1, along with their corresponding catchment areas. These sites were chosen because they have time-series streamflow data suitable for baseflow separation and are located upstream from any tidal influences. Figure 2 illustrates the catchment and gauging station sites used in this report.

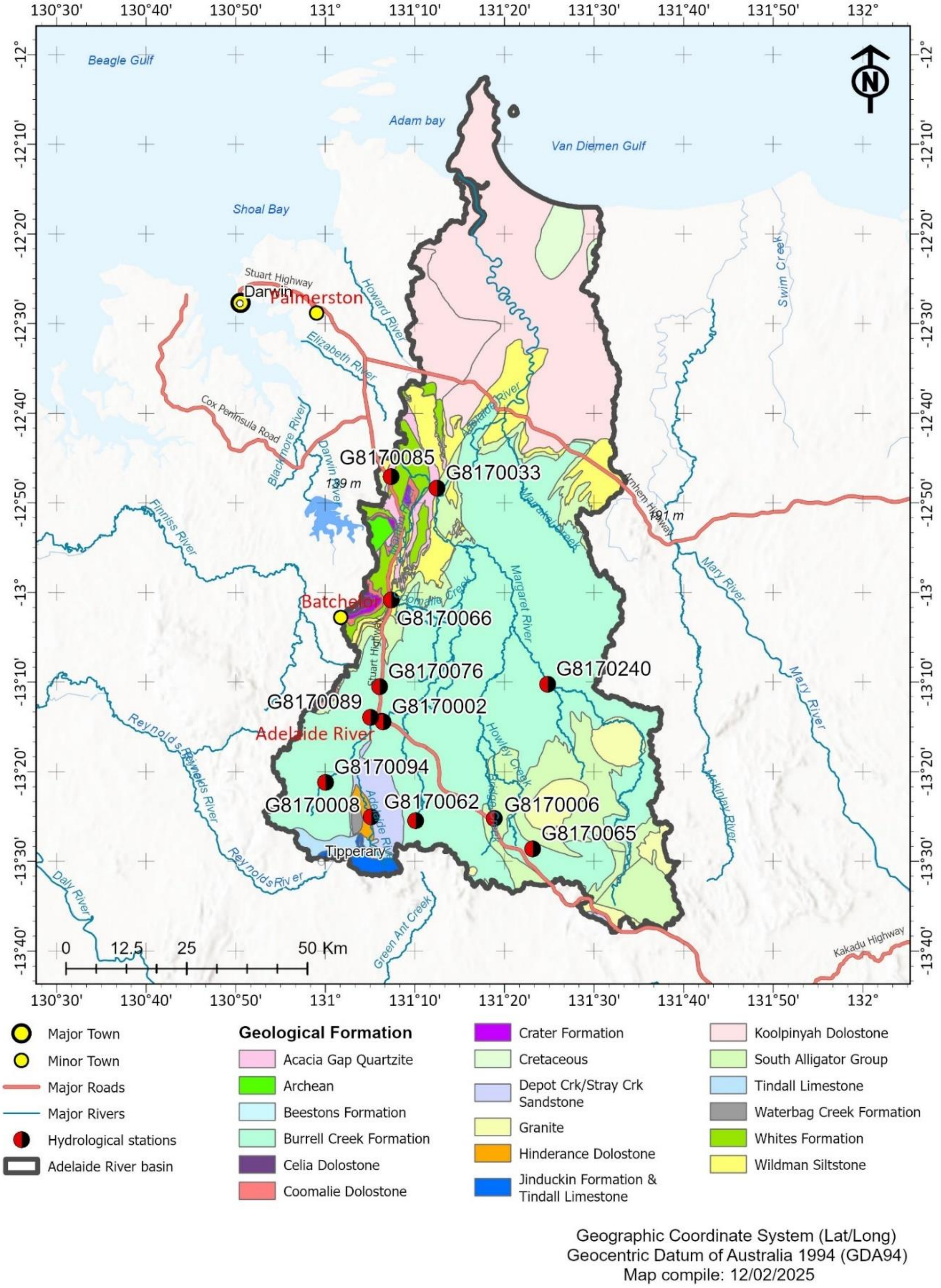

Figure 2. Adelaide River basin, the selected hydrological stations for baseflow separation and geology of the study area

2. Data

The site locations and sub-catchment areas of the surface water gauging stations analysed in this report are provided in Table 1. The geological formation within the study area is shown in Figure 2.

Table 1. Surface water monitoring sites referenced in this report (gauging stations)

Station ID	Site name [a]	Drainage area (km^2)	Longitude (WGS 84)[a]	Latitude (WGS 84)[a]
G8170002	Adelaide River - Railway Bridge	643.07	131.108642	13.24147
G8170006	Bridge Creek – U/S Railway	126.0	131.314394	13.420194
G8170008	Adelaide River - D/S Daly Road	117.95	131.084895	13.417125
G8170033	Manton River – Acacia Gap	222.0	131.20119	12.79858
G8170062	Burrell Creek – Eighty – Seven Mile Jump Up	36.8	131.168144	13.424347
G8170065	Howley Creek – D/S Brocks Creek Mine	110.0	131.385783	13.476726
G8170066	Coomalie Creek – Stuart Hwy	82.0	131.122868	13.013572
G8170076	Stapleton Creek – Stuart Hwy	50.0	131.101200	13.181908
G8170085	Acacia Creek – Stuart Hwy	11.0	131.122372	12.784630
G8170089	Snake Creek – Stuart Hwy	37.5	131.084535	13.231911
G8170094[b]	Adelaide River W Br - D/S Red Bank Crk	239.0	130.997388	13.355816
G8170240	Margaret River – Bobs Hill	896.0	131.413678	13.170703

[a]: The information was obtained from NTG AQUARIUS Time-series (https://ntg.aquaticinformatics.net/).

[b]: This site has time-series height data but no rating table due to lack of flow measurements. The rating data was provided in an unpublished technical report for Hydrological (Rainfall-Runoff) Modelling for Adelaide River Basin (Gautam, 2024), prepared by Water Resources Division (WRD).

2.1 G8170002

Gauging station G8170002, located on the Adelaide River at the railway bridge, has a catchment area of 643.07 km^2 (Figure 3). Established in May 1952, this station provides a long and reliable continuous water level record. Using rating tables, continuous flow data has been derived from this site, serving as the primary data sources for analysis.

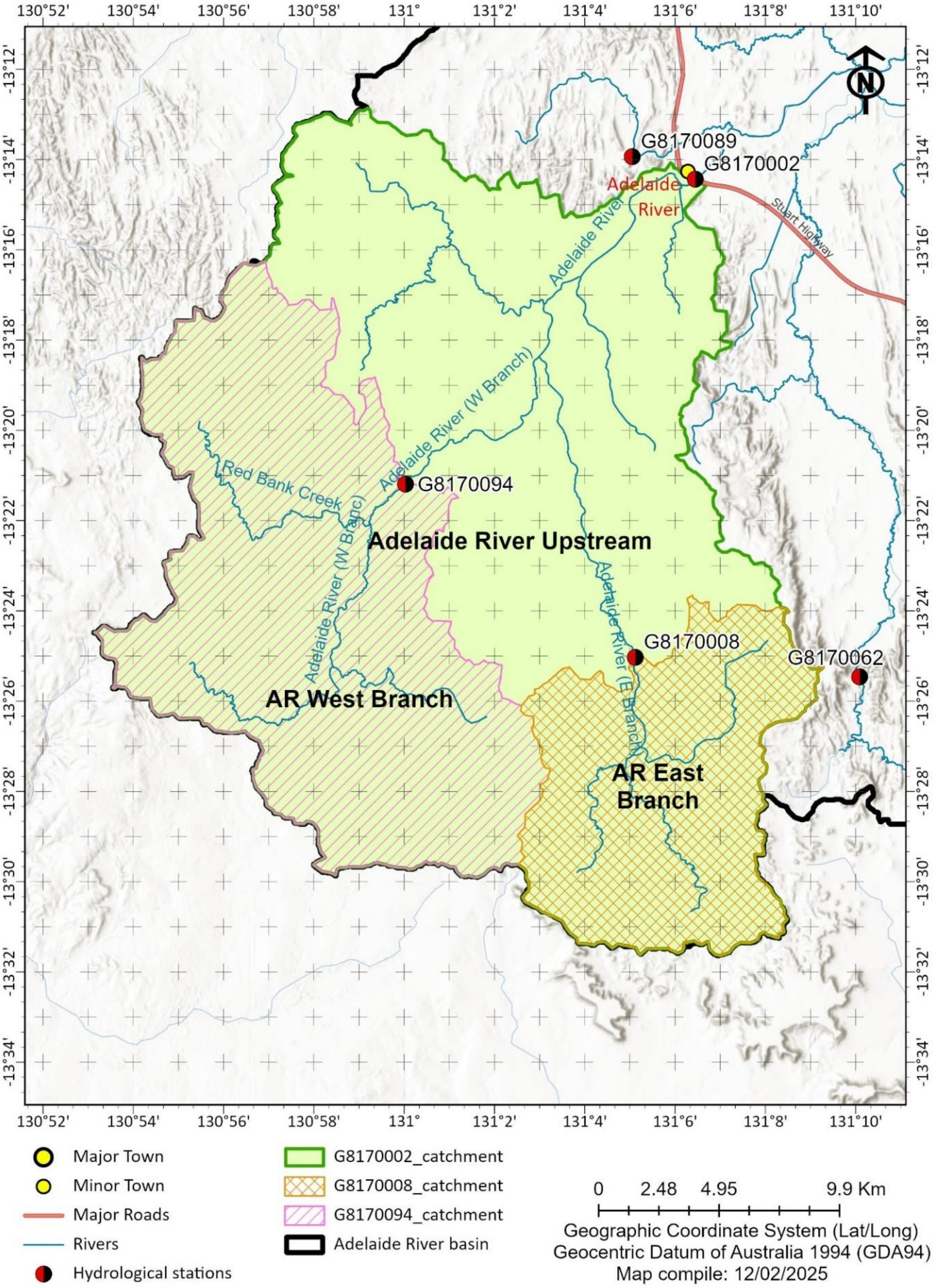

Figure 3. G8170002 catchment and sub-catchments of the upper stream Adelaide River basin

2.2 G8170006

Gauging station G8170006 is located on the Bridge Creek, upstream of the railway. Bridge Creek flows into Howley Creek before discharging into Margaret River (Figure 4). This station has historic streamflow records from 1966 to 2011.

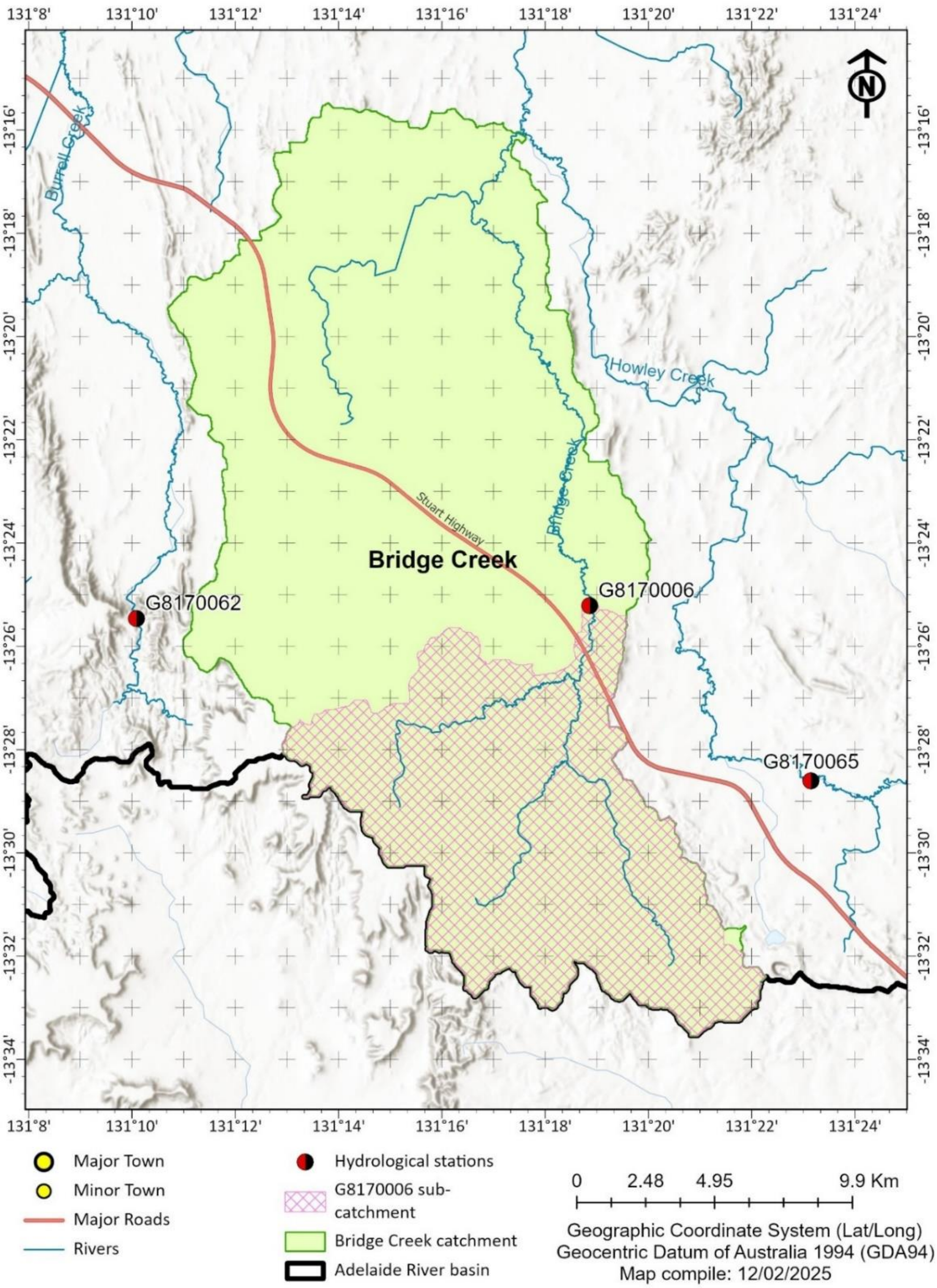

Figure 4. Bridge Creek catchment

2.3 G8170008

Gauging station G8170008, with a catchment area of 117.95 km², is located upstream of G8170002. Situated downstream of Daly River Road on the east branch of the Adelaide River (Figure 3), this station was established in July 1981 and has time-series data recorded since August 27, 1981. However, there was a significant gap in the data between 1993 and 2003. Baseflow separation at this station was determined from stream flow data and the relationship between streamflow and baseflow for both G8170008 and G817002.

2.4 G8170033

Gauging station G8170033 is located in Acacia Gap (Figure 5), near the confluence of Manton River and Adelaide River. This station has streamflow records from 1959 to 1986. The influence of Manton Dam on baseflow is not assessed in this report due to lack of necessary data.

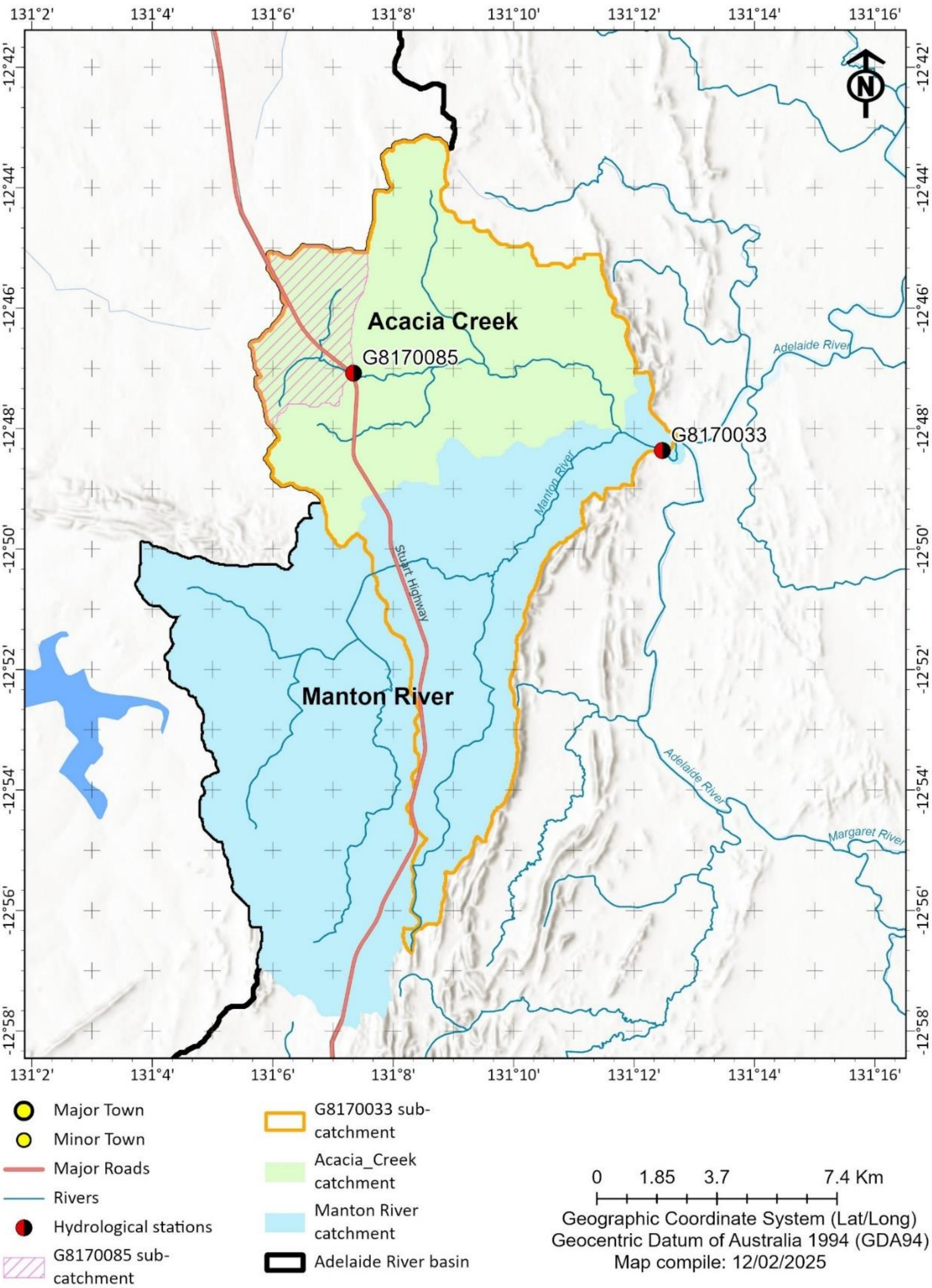

Figure 5. Manton River catchment and its tributary Acacia catchment

2.5 G8170062

Gauging station G8170062 is situated on Burrell Creek, approximately 2.7 km downstream of Dorat Road (Figure 6). This historic station has streamflow records from 1957 to 1986.

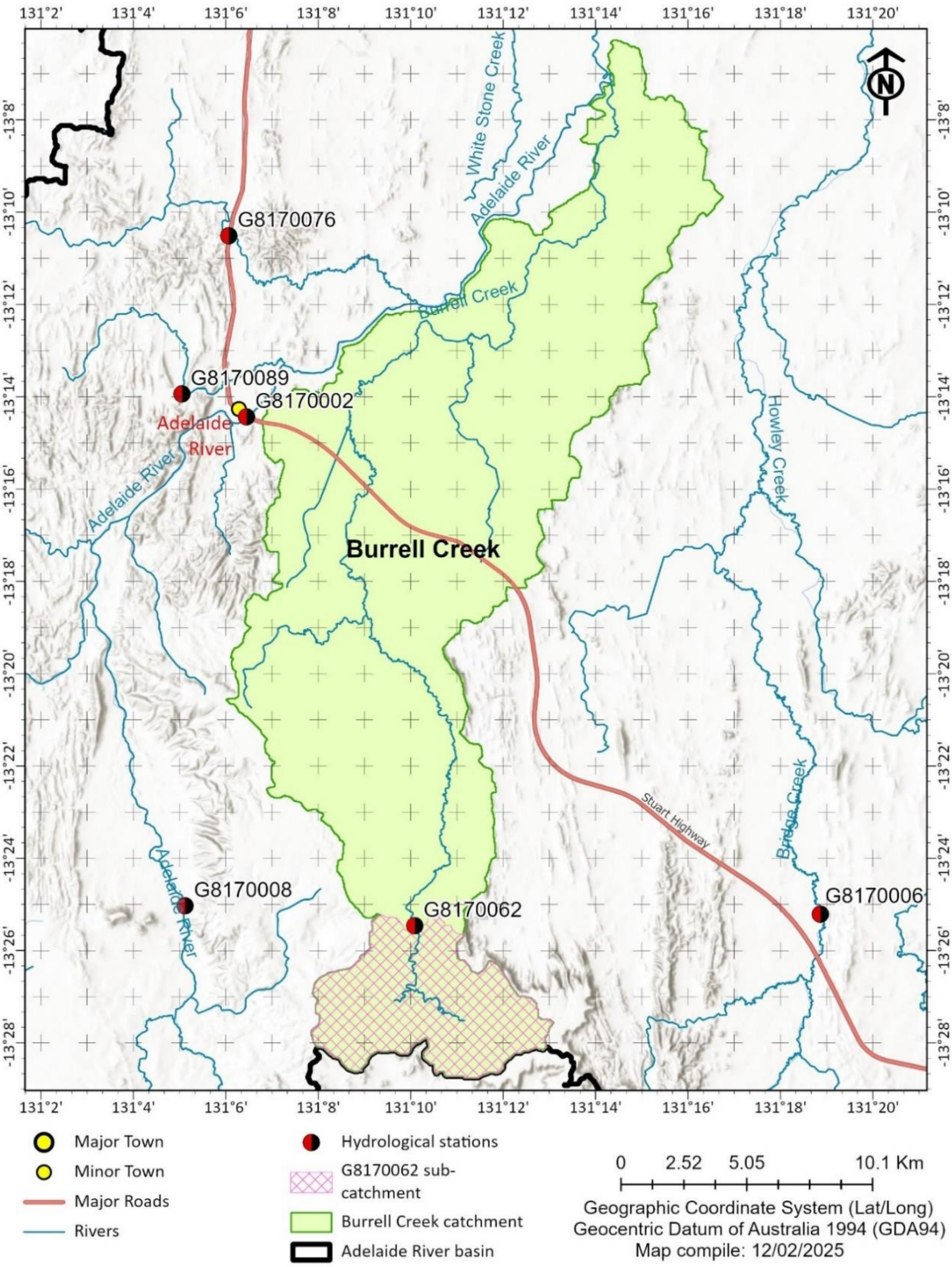

Figure 6. Burrell Creek catchment

2.6 G8170065

Gauging station G8170065 is situated on Howley Creek, downstream of Brocks Creek Mine and approximately 3.4 km downstream of Stuart Hwy (Figure 7). This station has historic streamflow records from 1997 to 2002.

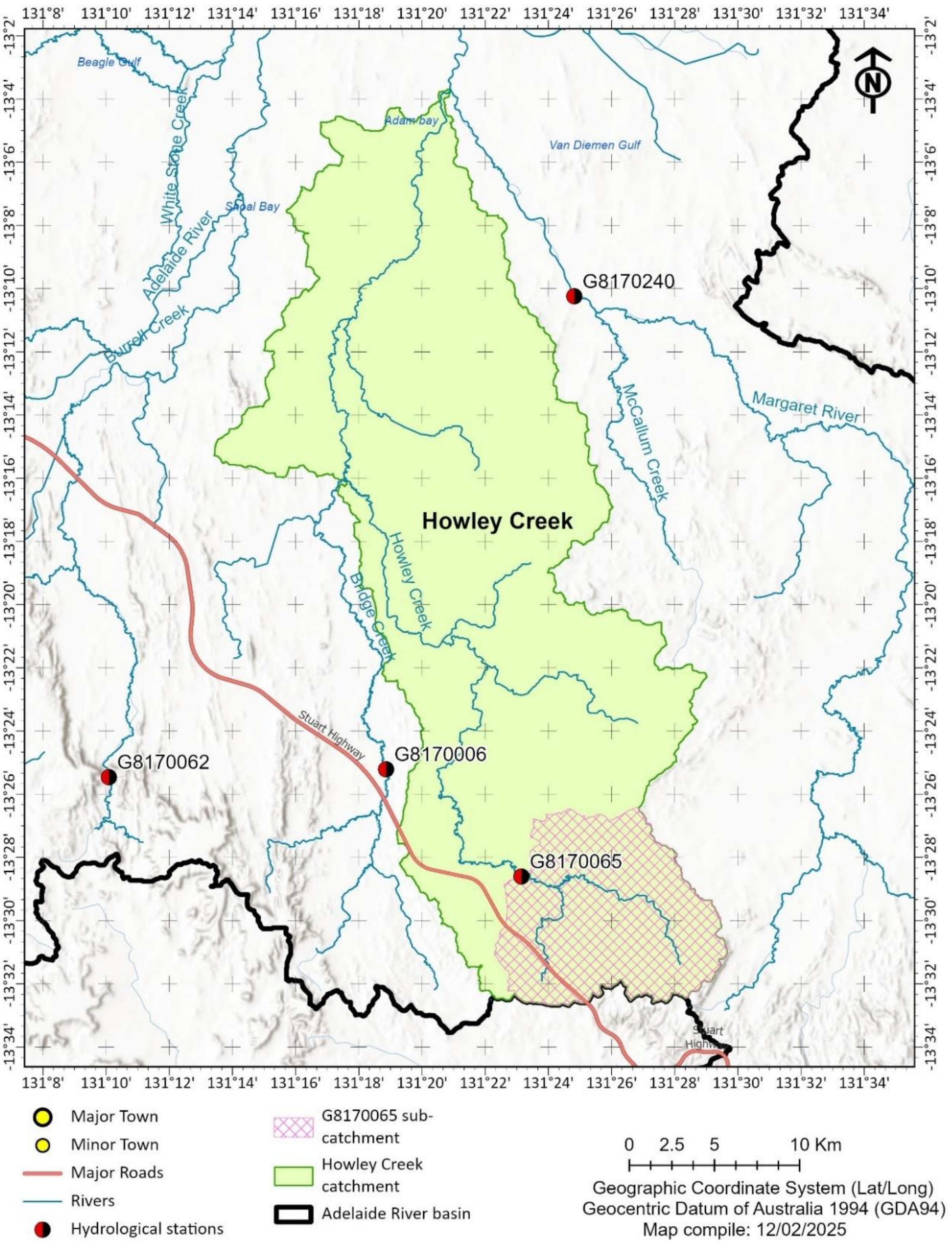

Figure 7. Howley Creek catchment

2.7 G8170066

Gauging station G8170066 is located on Coomalie Creek, on the eastern side of the Stuart Hwy approximately 72 km south-east of Darwin (Figure 8). Streamflow at Coomalie Creek generally persists throughout the dry season every year. Four time-series periods were selected at this station including between 1963-2001, 2001-2005, 2005-2009 and 2013-2024 due to data gaps.

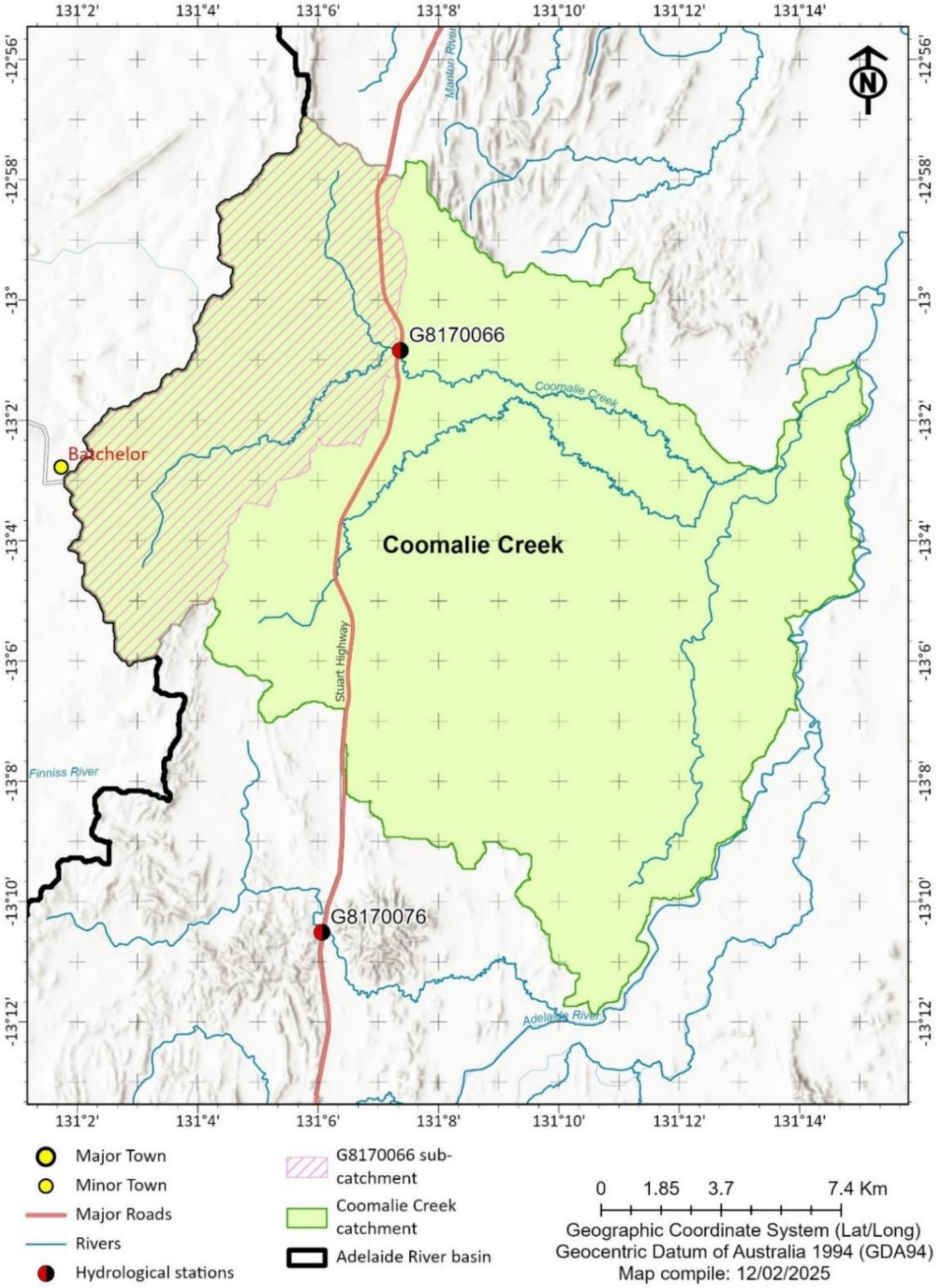

Figure 8. Coomalie Creek catchment

2.8 G8170076

Gauging station G8170076 is located on the Stapleton Creek, on the eastern side of Stuart Hwy, approximately 7 km north of Adelaide River Town (Figure 9). This station has continuous historic streamflow records from 1963 to 1981.

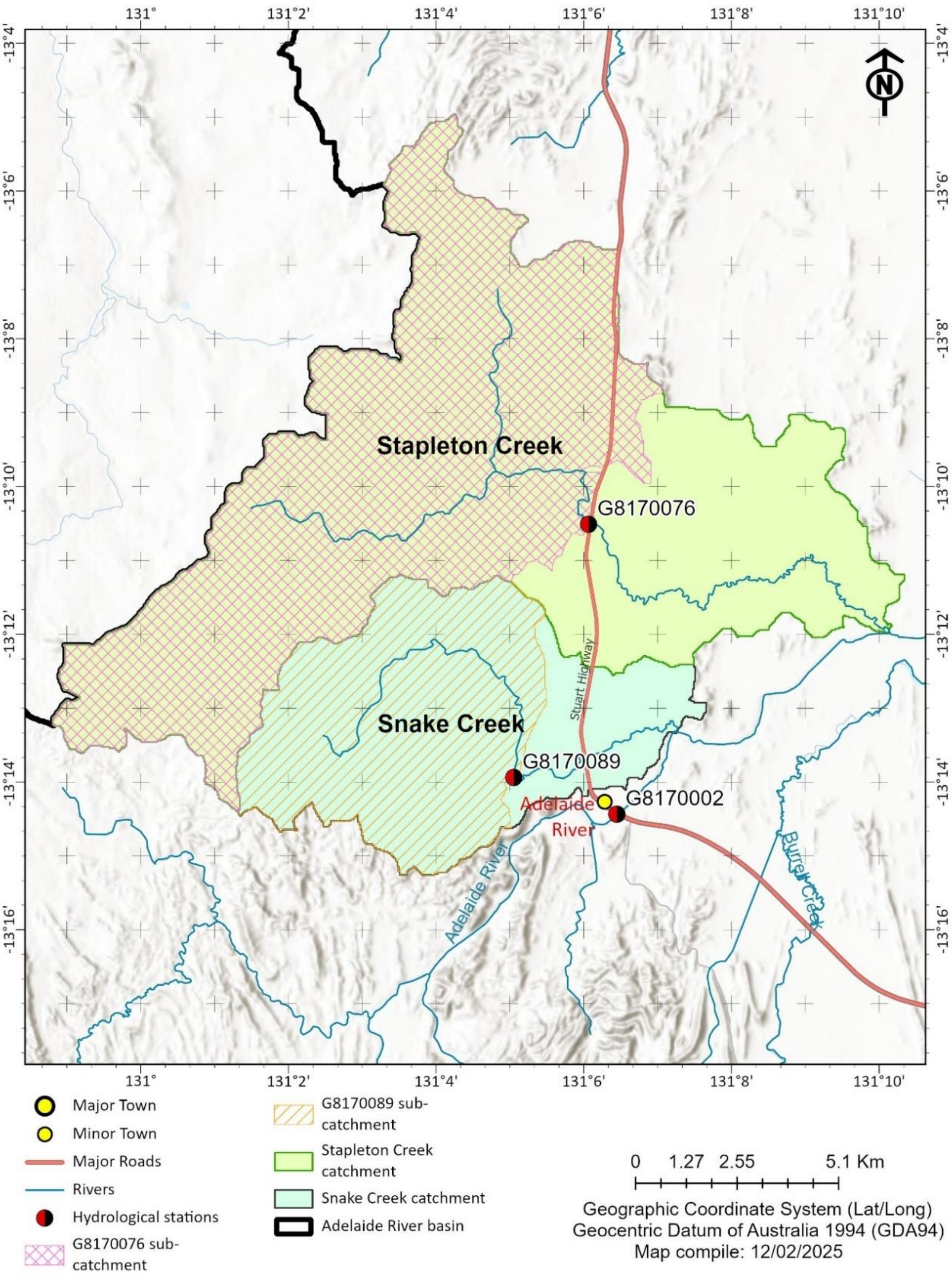

Figure 9. Stapleton and Snake Creek catchments

2.9 G8170085

Gauging station G8170085 is located on Acacia Creek, on the eastern side of Stuart Hwy, approximately 1.6 km north of Acacia Roadhouse (Figure 5). This station has streamflow records from 1963 to the present.

2.10 G8170089

Gauging station G8170089 is located on Snake Creek, and near Coach Road. The Snake Creek joins the Adelaide River approximately 2.5 kilometres northeast of Adelaide River Town (Figure 9). This station has continuous historic streamflow records for the years 1963 – 1969.

2.11 G8170094

Gauging station G8170094 is located on the Adelaide River West Branch, downstream of the Red Bank Creek (Figure 3). This station has water level data from 2023 to 2024, with some periods of missing data. The rating curves at this station has been developed by WRD based on an unpublished report on the hydrological model for Adelaide River catchment (Gautam, 2024).

The average daily water level at G8170094 from 30/11/2003 to 31/08/2024 was downloaded from NTG Time-series Data portal. A significant gap exists between 24/02/2004 – 10/11/2004, making interpolation challenging. Therefore, the selected daily water level from 11/11/2004 to 31/08/2023 along with the Q~H relationship data from the hydrological report (Gautam, 2024), were used to calculate discharge using the FORCAST formula in an Excel spreadsheet. Daily average streamflow then was generated from discharge by filling the missing data gaps.

2.12 G8170240

Gauging station G8170240 is located on the Margaret River at Bobs Hill. Margaret River is the largest tributary of Adelaide River basin (Figure 10), but it is an ephemeral river generally ceasing flow by the end of June. This station has historic streamflow records from 1967 to 1986.

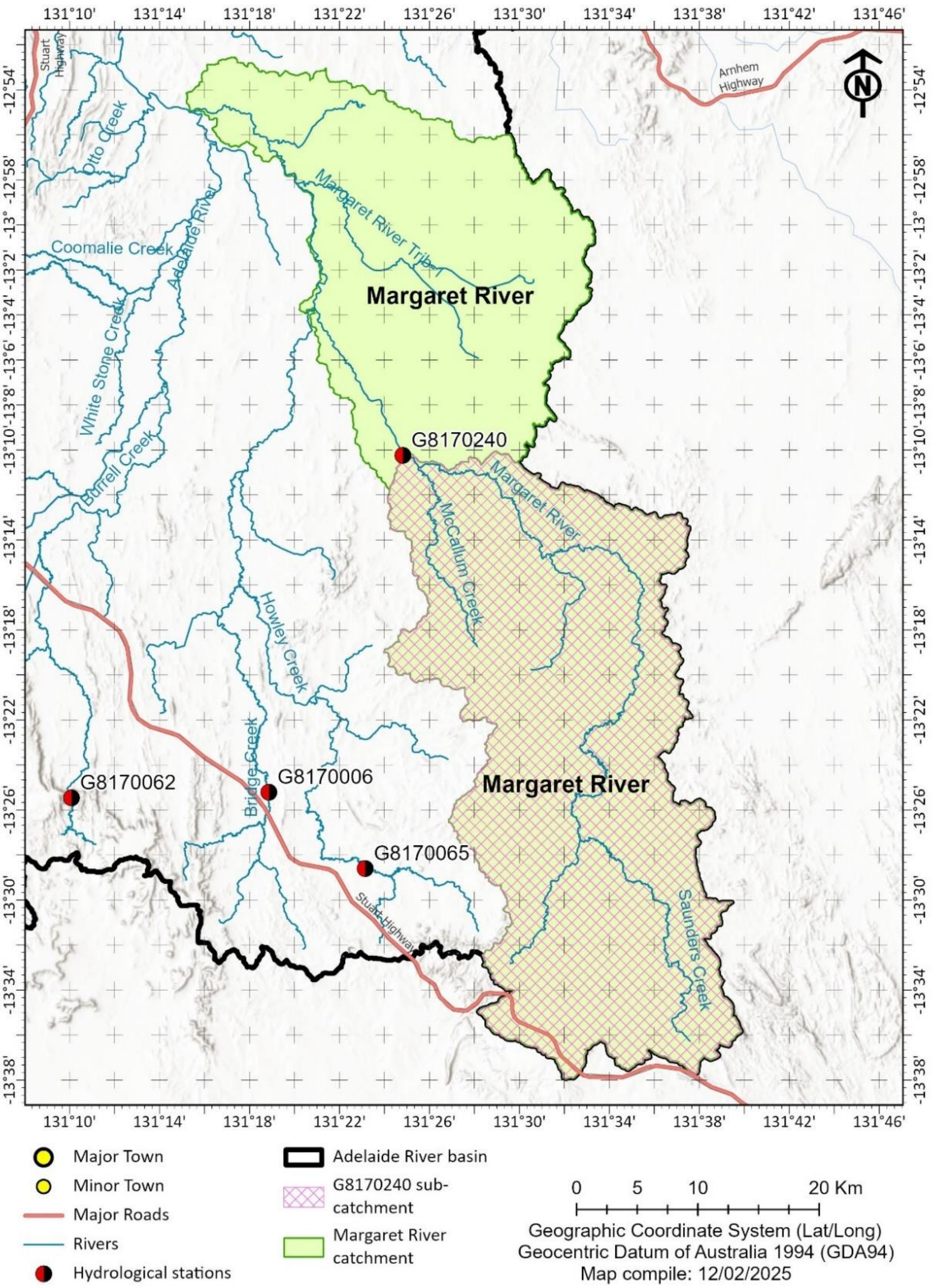

Figure 10. Margaret River catchment

2.13 Aquifers

The geological formations within the study area serve as potential sources of groundwater, which in turn contribute to baseflow. Groundwater can discharge into streams through seepage into streambeds or via localised springs that drain into waterways. The underlying geology of the Adelaide River catchment is illustrated in Figure 2, with the percentage of each geological formation within the sub-catchments presented in Table 2.

According to Tickell (2000) and Yin Foo (2004), the primary aquifers supplying water to the Acacia and Coomalie regions within the Adelaide River catchment include the Whites Formation, Coomalie Dolostone and Crater Formation.

Carbonate rocks in the Adelaide River catchment host moderate to significant aquifers, particularly those of the fractured and karstic types, which are likely contributors to baseflow. Key formations within this group include the Jinduckin Formation, Tindall Limestone, Hinderance Dolostone, Coomalie Dolostone, Koolpinyah Dolostone and Celia Dolostone. As reported from Tickell et al. (2023), the Coomalie Dolostone is one of the highest-yielding aquifers, with median values varying from 3 to 5 L/s and a maximum yield between 30 and 70 L/S.

Other aquifers in the study, such as the Burrell Creek Formation, Acacia Gap Quartzite, South Alligator Group, Whites Formation, and Wildman Siltstone, are classified as moderate-yielding groundwater sources. Median yields for these formations range from 1.5 to 3 L/s, with maximum yields varying from 10 to 50 L/s. The Depot Creek Sandstone is considered a minor groundwater resource, with median and maximum yield values of up to 1.5 L/s and 10 L/s, respectively.

Table 2. Areal extent of geological formations underlying each sub-catchment

Geology\ Sub-catchments	G8170002	G8170006	G8170008	G8170033	G8170062	G8170065	G8170066	G8170076	G8170085	G8170089	G8170094	G8170240
Acacia Gap Quartzite				19.8%			2.8%	0.2%	22.7%			
Archean							0.7%					
Beestone Formation							2.5%					
Burrell Creek Formation	58.2%	71.4%	1.3%		88.5%	68.0%		73.7%		100%	80.2%	37.9%
Celia Dolostone							10.3%					
Coomalie Dolostone				6.9%			16.2%	8.9%				
Crater Formation				3.3%			14.2%					
Depot Creek_Stray Creek Sandstone	16.3%		40.4%		11.5%						0.2%	0.8%
Granite		2.6%										17.1%
Hinderance Dolostone	3.2%		7.2%									
Jinduckin Formation & Tindall Limestone	8.6%		32.9%								1.7%	
South Alligator Group	0.2%	25.9%		7.0%		32.0%	1.0%	15.7%	47.1%			44.2%
Tindall Limestone	11.8%		14.1%								18.0%	
Waterbag Creek Formation	1.7%		4.1%									
Whites Formation				53.1%			37.6%		0.2%			
Wildman Siltstone				9.9%			14.7%	1.4%	30.0%			

3. Methodologies

3.1 Missing data

Missing streamflow data is a common issue at sites with long periods of flow records, often due to factors such as device failure, inadequate data management and lack of continuous maintenance. To address this, documented evidence, regression analysis, linear interpolation, and manual correction techniques were employed to fill the data gaps where possible. For sites that consistently ceased to flow during the dry season, gaps were filled with a zero value when missing data occurred during the dry season, and the last recorded flow as less than 0.020 m^3/s, until the flow resumed in the early wet season. The amended record was then used for analysis in this study. Table 3 and Figure 11 provide an overview of the missing data at the selected gauging stations.

Table 3. Details of recorded daily stream data

Hydrological stations ID	Selected periods	No of days in the period	No of days with data	No of days with missing data	% of missing data
G8170002	1953-1954, 1965-1971, 1971-2024	22,127	21,418	709	3.2%
G8170006	1966-2011	16,480	14,663	1,817	11.0%
G8170008	1981-1993, 2003-2004, 2005-2024	11,530	11,409	121	10.0%
G8170033	1959-1986	9,824	8,892	932	9.5%
G8170062	1957-1986	10,590	5,399	5,191	49.0%
G8170065	1997-2000, 2001-2002	1,069	853	216	20.2
G8170066	1963-2001, 2001-2005, 2005-2009, 2013-2024	20,392	19,757	635	3.1%
G8170067	1963-1981	6,364	2,761	3,603	56.6%
G8170085	1963-2024	22,397	21,043	1,354	6.0%
G8170089	1963-1969	387	304	83	21.4%
G8170094[c]	2004-2024	7,234	7,077	157	2.2%
G8170240	1967-1972, 1973-1976, 1977-1981, 1981-1986	4,889	4,579	310	6.3%

[c]: observed water levels

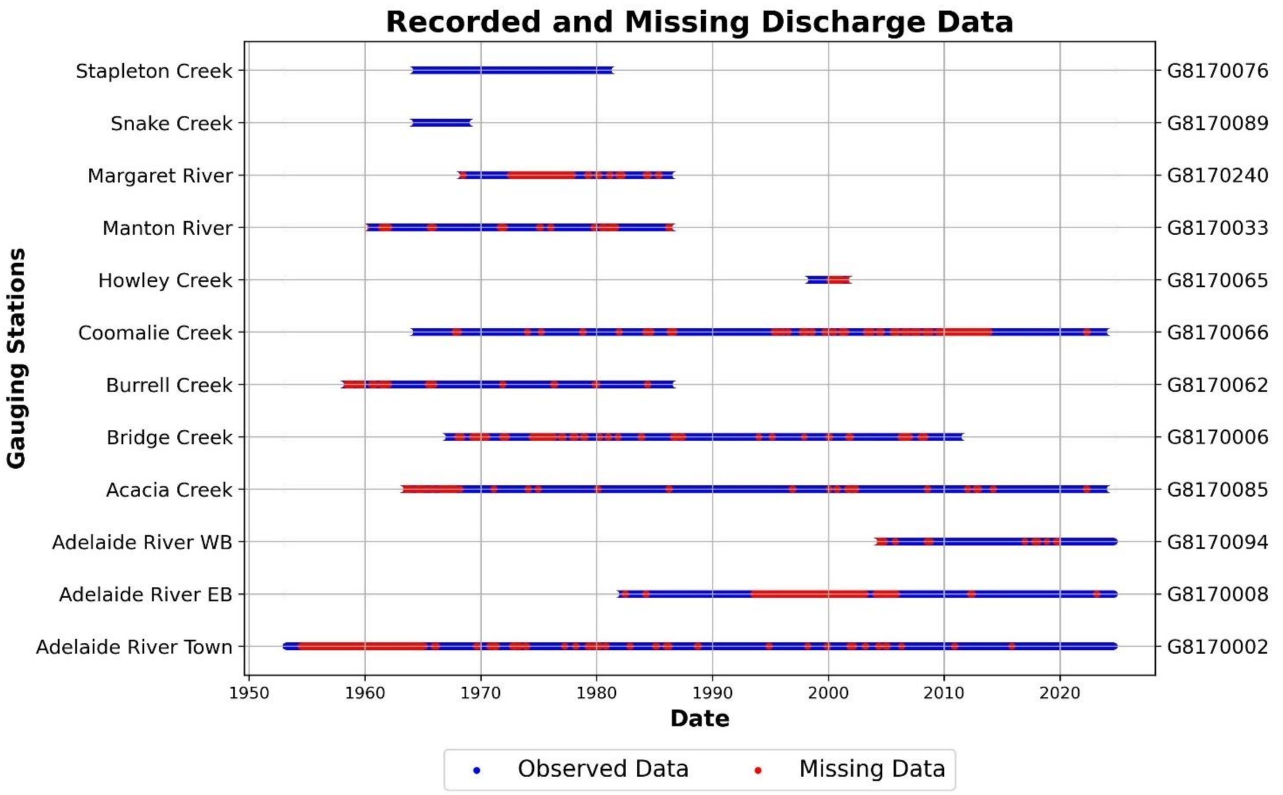

Figure 11. Overview of data record at selected gauging stations

3.2 Baseflow separation techniques and methods

This study employed several techniques, including recession analysis, FDC, RDF 3P, WHAT, BFI+ to evaluate the possible contribution of baseflow to streamflow and to determine the baseflow component at the selected gauging stations. A summary of baseflow assessment and separation methods is provided in Table 4.

Table 4. Summary of baseflow separation techniques and algorithms in this report

Filter name	Filter equation/ techniques	Sources (references)
Recession segment	$q_i = q_0 e^{-\alpha i}$ (1a) $q_i = q_0 k^i$ (1b)	Tallaksen (1994)
FDC	$P = 100 \frac{m}{(n+1)}$ (2)	Bayou et al. (2021)
RDF 3P	$q_{b_i} = q_i - q_{f_i}$ (3a) $q_{f_i} = \alpha q_{f_{(i-1)}} + \left(q_i - q_{(i-1)}\right)\frac{1+\alpha}{2}$ (3b) Lyne and Hollick (1979) method, standard approach developed by Ladson et al. (2013).	Ladson et al. (2013) Lyne and Hollick (1979)
WHAT one-para	Using Lyne and Hollick (1979) method (equations 3a and 3b)	Lim et al. (2025)
WHAT two-para	$q_{b_i} = \frac{\alpha q_{b_{i-1}}(1-BFI_{max})+(1-\alpha)BFI_{max}q_i}{1-\alpha BFI_{max}}$ (4)	Eckhardt (2005) Lim et al. (2025)
BFI+ local minimum	Lowest discharge in period 0.5(2N*-1) default parameters N = 5, and f = 0.9	Gregor (2010)

Filter name	Filter equation/ techniques	Sources (references)
		Sloto and Crouse (1996)
BFI+ RDF EWMA filter	$q_{b_i} = \alpha q_i + (1-\alpha) q_{b_{(i-1)}}$ (5) EWMA model	Gregor (2010) Tularam and Ilahee (2008)
BFI+ RDF one-para algorithm	$q_{b_i} = \frac{k1}{2-k1} q_{b_{(i-1)}} + \frac{1-k1}{2-k1} q_i$ (6) Chapman and Maxwell filter	Gregor (2010) Chapman and Maxwell (1996)
BFI+ RDF BFLOW	Lyne and Hollick (1979) method (equations 3a and 3b)	Gregor (2010) Nathan and McMahon (1990)
BFI+ RDF Chapman algorithm	$q_{b_i} = q_i - \frac{3\beta-1}{3-\beta} q_{f_{i-1}} + \frac{2}{3-\beta}(q_i - \beta q_{i-1})$ (7)	Chapman (1991) Gregor (2010)
BFI+ RDF Eckhardt algorithm	Eckhardt filter method (equation 4)	Eckhardt (2005) Gregor (2010)

where: q_0 is the initial streamflow at the start of the recession;
α is the constant coefficient, the term $e^{-\alpha i}$ can be replaced by k, called the recession constant;
P is the probability that a given flow will be equalled or exceeded (%);
m is the rank when flows arrange in descending order;
n is the total number of records (observed discharge);
q_{i-1} and q_i are the stream flows for the time i-1 and i;
$q_{f_{i-1}}$ and q_f are the filtered direct runoff for the time i-1 and i;
$q_{b_{i-1}}$ and b are the filtered baseflow response for the time i-1 and i;
k_1 is the filter parameter given by the recession constant;
β is the filter parameter;
BFI: is the maximum value of the baseflow index. BFI = 0.25 for perennial streams with hard rock aquifers (Eckhardt, 2008).

Klaasen and Pilgrim (1975), as cited in Nathan and McMahon (1990), identified different streamflow components based on daily recession constants: 0.2-0.8 for surface runoff, 0.7-0.94 for interflow, and 0.93-0.995 for baseflow.

The initial FDC assessment helps determine whether groundwater contributes to streamflow as baseflow. If the ratio Q_{90}/Q_{50} is higher than zero (0), baseflow is likely; if the ratio is equal to zero, baseflow is unlikely.

The baseflow separation methods used in this study include the online tools WHAT, BFI+ program, and the standard approach by Ladson et al. (2013). Ladson et al. (2013) outlined a detailed procedure for baseflow separation using the Lyne and Hollick filter (RDF 3P). They recommended an alpha (α) value of 0.925, based on its use in 186 catchments across southeastern Australia, and this value was also supported by Nathan and McMahon (1990). The Australian Rainfall and Runoff project (Murphy et al., 2010) found this alpha value to yield the most plausible results in eight case studies across Australia. However, an α value of 0.98 was found to produce better matches with baseflow index values compared to those derived from chemical tracers in nine Australian catchments. This value was adopted for baseflow assessments in the Murray-Darling Basin (Ladson et al., 2013). After preliminary screening, the selected α values for this report ranged between 0.95 and 0.995 for the comprehensive assessments.

The WHAT online tool was unable to provide results from the local minimum technique when long-term time-series data were input. As a result, the Lyne and Hollick (1979) one parameter and Eckhardt two parameter filters (Eckhardt, 2005) were applied instead. The WHAT tool requires input and output files to be uploaded and downloaded in .csv format. The output results were separated for each parameter value. Python's Matplotlib library was used to plot baseflow for the selected parameter values for each method. This facilitated easy examination of hydrographs, particularly the separated baseflow results during a recession or a flood event. To assess the suitability of the baseflow separation methods and selected parameters, the baseflow graphs (.html files) were inspected for accuracy of fit.

The BFI+ program, introduced by Gregor (2010), is an automated baseflow separation software. Version 3.0 of BFI+ was downloaded from the HydroOffice website (https://hydrooffice.org/Tool/BFI), and six of the eleven baseflow separation methods were selected for this study. They include Local minimum, One-parameter Chapman and Maxwell, RDF BFLOW (Lyne and Hollick filter), RDF Chapman (Chapman algorithm), RDF Eckhardt (Eckhardt algorithm) and RDF EWMA algorithm shown in Table 4. BFI+ requires input and output files in .txt format and provides output graphs for visual examination of the result for each year of selected method with the nominated parameters. However, in this study, all baseflow separation hydrographs were plotted in .html format by using Python's Matplotlib for detailed examination.

3.3 Base flow Index

The Baseflow Index (BFI) is defined as the ratio of long-term mean baseflow to total stream flow (Singh et al., 2019). It is commonly used to assess and characterise flow in a catchment and is valuable for comparing different catchments and regions. BFI serves as a benchmark for comparing the results obtained from different base flow separation methods (Aksoy et al. 2009). The BFI value is calculated using the following equation:

$$\mathrm{BFI} = \frac{\sum q_{b_i}}{\sum q_i} \tag{8}$$

where: q_{bi} and q_i are the baseflow and streamflow for the time step i (m^3/s).

BFI values in this study are calculated for monthly, dry season, annual time frames to facilitate comparisons within specific periods.

4. Results and discussions

4.1 Recession analysis method

Due to the variations in period of record, the streamflow data from 1969 and 1984 at selected sites were chosen to calculate the recession constants, which represent the flow types at each site. According to Nathan and McMahon (1990), overlapping ranges of daily recession constants indicate that multiple components may contribute to streamflow with k values of 0.7-0.94 representing interflow, and 0.93-0.995 representing baseflow. The k values for the selected year and sites are provided in Table 5.

Table 5. Recession constants (k) calculated for the late part of the recession curve.

Gauging stations	k value in 1969	Type of flow	k value in 1969	Type of flow
G8170008			0.99	Baseflow
G8170002	0.98	Baseflow	0.98	Baseflow
G8170066			0.97	Baseflow
G8170085	0.94	Baseflow/ Interflow	0.94	Baseflow/ Interflow
G8170033	0.94	Baseflow/ Interflow	0.94	Baseflow/ Interflow
G8170062	0.93	Baseflow/ Interflow		
G8170076	0.92	Interflow		
G8170240	0.905	Interflow		
G8170065	0.89 (in 1998)	Interflow		
G8170006	0.81	Interflow	0.86	Interflow
G8170089	068	Runoff		

The k values for three sub-catchments - G8170002, G8170008 and G8170066 - located in the upstream Adelaide River and in the Coomalie Creek range from 0.97 to 0.99, indicating that baseflow is the primary contributor to streamflow at these sites. At G8170008, part of the baseflow is likely sourced from the Jinduckin and Tindall Limestone aquifers. As a result, baseflow also serves as the main source of streamflow at G8170002, which is downstream of G8170008. For Coomalie Creek site (G8170066), baseflow is likely sourced from aquifers within several formations: primarily the Celia Dolostone, Coomalie Dolostone and Whites formation.

At sites G8170062, G8170085 andG8170033, the k values are lower ranging from 0.94 to 0.93, indicating that streamflow at these sites is derived from both interflow and groundwater. However, the flow often ceases during the dry season. Of these, G8170033 has the longest flow period, continuing until July. This delayed recession is due to groundwater discharge from the Coomalie Dolostone and the Whites Formation, as identified by Tickell (2000). For G8170062 and G8170085, the baseflow component is derived from the underlying aquifers including the Burrell Creek Formation (88.5%) at G8170062, Acacia Gap Quartzite (22.7%), South Alligator Group (47%) and Wildman Siltstone formation (30%) at G8170085 which are categorised to have moderate yields (Tickell et al., 2023).

At G8170006, G8170065, G8170076, and G8170240, the k-values range from 0.81 to 0.92, falling within the interflow range (Nathan and McMahon, 1990). This suggests that baseflow is unlikely to contribute significantly to streamflow at these sites. The dominant aquifers—Burrell Creek Formation and South Alligator Group—underlying these sub-catchments have moderate groundwater yield capacities.

The k-value at G8170089 in 1969 was 0.69, with flow ceasing in April (the late wet month). This suggests that streamflow at this site is primarily runoff.

However, selecting only two years (1969 and 1984) from over 30 to 50 years ago to calculate recession rates has limitations. It may not fully capture the mechanisms or behaviours affected by the preceding wet season and the prevailing groundwater levels resulting from longer-term recharge trends. Additionally, the high variation in recession behaviour - both within and between catchments - presents challenges in accurately analysing recession dynamics (Tallaksen, 1995). Therefore, this method should be viewed as a quick overview for assessing streamflow components based on recession segments.

4.2 FDC method

One of the simplest methods to estimate the contribution of groundwater to stream flow is FDC, which calculates the ratio between Q_{90} and Q_{50}. In this study, the Q_{90}/Q_{50} ratios for the sub-catchments are presented in Table 6.

The ratio values for G8170002, G8170008 and G8170066 ranged from 0.1 to 0.33, indicating that groundwater contributes to dry season streamflow in these sub-catchments. This aligns with the findings from the recession analysis. In contrast, the ratio value was zero (0) for sites G8170033 and G8170065, indicating that, by definition, groundwater does not contribute to streamflow in these sub-catchments. However, although the Q_{90} values were zero for these sites, the Q_{50} values were not, suggesting that groundwater does not provide perennial flows, it may still contribute to streamflow during certain periods.

For sites G8170006, G8170062, G8170076, G8170085, G8170089 and G8170240, both the Q_{50} and Q_{90} values were zero (0). This suggests that the gradient of the flow-duration curve for these catchments would be very steep, indicating flow is largely sourced from direct runoff (Searcy, 1959). The method effectively identifies baseflow in areas where flow is perennial or rarely ceases but falls short when streamflow regularly ceases.

Table 6. Streamflow statistic and Q_{90}/Q_{50} ratios results for all sub-catchments

Location	Period	Total no.	Mean (m^3/s)	Max (m^3/s)	Min (m^3/s)	Q_{50} (m^3/s)	Q_{90} (m^3/s)	Q_{90}/Q_{50}
G8170002	03/03/1953-24/6/1954 07/02/1965-26/01/1971 15/5/1971-31/08/2024	22,128	8.73	1227.66	0.00	0.47	0.06	0.14
G8170006	01/09/1966 – 04/10/2011	16,480	1.09	43.51	0.00	0.27	0.00	undefined
G8170008	29/8/1981-19/7/1993 9/3/2003-31/1/2004 2/11/2005 -31/08/2024	11,530	0.96	58.08	0.01	0.15	0.051	0.34
G8170033	05/12/1959-27/10/1986	9,824	2.46	38.81	0.00	1.98	0.00	0.00
G81700062	10/11/1957-7/11/1986	10,590	0.32	56.80	0.00	0.00	0.00	undefined
G81700065	19/12/1997-31/01/2000 05/04/2001-21/01/2002	1,066	2.74	82.80	0.00	0.009	0.00	0.00
G8170066	6/11/1963-11/02/2001 27/05/2001-27/08/2005 18/12/2005- 28/10/2009 21/11/2013-30/04/2024	20,392	0.86	72.40	0.00	0.117	0.019	0.16
G8170076	2/11/1963-27/08/1981	6,509	1.27	218.62	0.00	0.00	0.00	undefined
G8170085	5/1/1963-30/04/2024	22,397	0.22	35.00	0.00	0.00	0.00	Undefined
G8170089	02/11//1963-6/02/1969	2,007	0.42	72.95	0.00	0.00	0.00	undefined
G8170240	17/11/1967-31/07/1972 25/3/1973-30/11/1976 11/12/1977-21/11/1981 07/02/1982-30/10/1986	4889	5.13	57.09	0.00	0.003	0.00	undefined

4.3 Baseflow separation results

Baseflow separation was conducted for all the selected gauging sites using the methods outlined above. The Appendices provide selected streamflow and baseflow hydrographs, as well as the BFI values from each of the methods applied at the monitoring sites.

Although three of the programs use the Lyne and Hollick filter (see Table 4), there were variations in the results. Among these, the RDF 3P method produced the most accurate baseflow separation. The baseflow hydrograph generated using this method often closely matched the streamflow hydrograph around the inflection point of the recession curve, where streamflow is anticipated to consist solely of baseflow. Baseflow continued to account for the majority of the flow into the late recession period.

Figure 12 provides an example illustrating the baseflow separation results from different methods, each with varying parameters, for gauging station G8170008 during the 2007-2008 period. From these results, it is evident that when direct flow accounted for most of the streamflow, the baseflow hydograph from RDF 3P remained minimal, while many of other methods tended to overestimate baseflow.

The optimal α parameter values for all sub-catchment varied from 0.99 to 0.995. These values were higher than those found in previous studies across Australia (as noted by Ladson et al. (2013)), which used values of 0.925 or 0.98 for catchments in Victoria, New South Wales and Queensland. The higher values in this study may be due to the high intensity of rainfall during a few months of a year, followed by periods of little or no rain As a result, baseflow plays a significant role in streamflow during the middle and late dry seasons.

The WHAT one-parameter method, which also uses the Lyne and Hollick filter tended to overestimate baseflow when the recommended α values ranging from 0.90 to 0.995 were applied. However, when α was set to 0.999, good baseflow recession curves were obtained for several stations, as shown in Figure 12 and Appendices.

Both the WHAT two-parameter filter and BFI+ RDF Eckhardt filter, which share the same Eckhardt methodology (Table 4), yielded similar BFI values for the sites. However, the WHAT values were somewhat lower for the same parameter and provided a better fit. At each site, this filter was selected as providing a reasonable estimate of baseflow (Figure 12 and Appendices). In some cases, the filter overestimated baseflow, exhibiting sharp peaks during surface runoff events. The optimal parameters for the Eckhardt filter were BFI_{max} = 0.25 and the α values of 0.99 or 0.995.

The remaining BFI+ methods including Local minimum, RDF one parameter (Chapman and Maxwell algorithm), RDF Chapman and RDF EWMA generally overestimated baseflow for all stations.

The baseflow separation exercise highlighted the suitability of the RDF 3P method and the WHAT two-parameter (Eckhardt filter) for sub-catchments of the Adelaide River catchment. These methods are recommended for use across the Top End due to its contrasting wet and dry seasons.

Table 7 presents the baseflow resutls from the RDF 3P method, with the BFI shown as a percentage for ease of comparison. All the sites show an increase in monthly BFI between May and June, as expected, when rainfall diminishes and streamflow recedes. For sites G8170002, G8170008, G8170066 monthly BFI increases over the dry season until August or September since rainfall is rare, when interflow diminishes and baseflow becomes dominant.

The annual BFI for G8170008 and G8170066 are highest at 17% and 15%, respectively, and indicate these sites may generally have perennial flow from baseflow. For G8170002, which occasionally ceases to flow the annual BFI is 7.4% and for G8170085, G8170033, G8170062 and G8170240, which cease to flow every year, the annual BFI is 6.8% and 3.8%, respectively. It remains inconclusive whether groundwater discharge contributes to streamflow during the latter part of the dry season at these sites, and the low BFI values may reflect interflow rather than baseflow.

The moderate annual BFI at G8170094 (6.4%) may be due to overestimation of streamflow, as the rating data was derived from the hydrological model rather than from field measurement. The remaining gauging sites, G8170065, G8170076 and G8170089, have annual BFI values less than 2.5% and their streamflows usually cease in the late dry season. This suggests that BFI values at these sites may reflect runoff or interflow during early dry season rather than baseflow.

Average monthly baseflow separation results at each gauging sites are provided in Appendix A: Baseflow separation results using RDF 3P technique

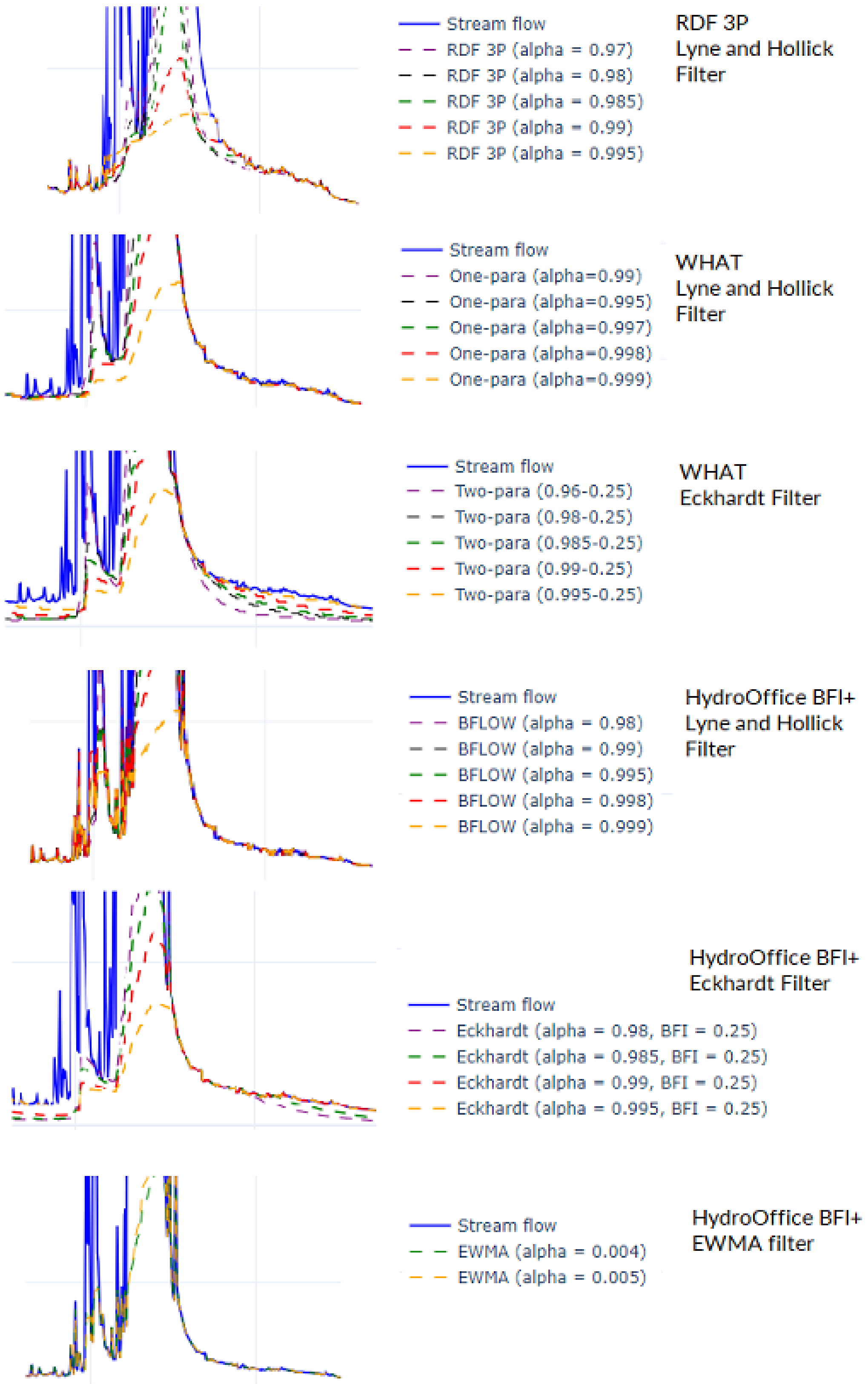

Figure 12. Baseflow hydrographs form various methods for G8170008 for years 2007-2008

Table 7. Summary of mean daily streamflow and baseflow for the dry season months (ML/d) and calculated BFI using the RDF 3P filter

Location ID	Flow/BFI	May	Jun	Jul	Aug	Sep	Oct	BFI (dry season)	BFI (Jun-Sep)	BFI (annual)
G8170002	Streamflow	100.3	41.6	26.8	18.1	12.4	28.1			
	Baseflow	69.1	39.7	26.4	17.8	11.1	14.2			
	BFI	68.9%	95.5%	98.2%	98.5%	89.8%	50.6%	78.3%	96.1%	7.4%
G8170006	Streamflow	22.0	6.1	2.1	1.5	0.7	1.6			
	Baseflow	6.0	3.7	2.1	1.4	0.3	0.6			
	BFI	27.0%	60.2%	95.7%	96.7%	49.4%	35.1%	41.1%	72.2%	5.1%
G8170008	Streamflow	25.0	19.1	16.6	12.3	8.1	7.8			
	Baseflow	16.3	14.5	12.5	10.2	7.8	7.0			
	BFI	65.4%	76.1%	75.3%	82.4%	96.6%	90.0%	76.7%	80.0%	17.1%
G8170033	Streamflow	31.7	4.2	2.0	0.9	0.7	1.7			
	Baseflow	10.5	3.9	1.8	0.7	0.5	0.8			
	BFI	33.2%	93.6%	91.7%	73.0%	73.4%	47.0%	44.1%	88.9%	3.8%
G8170062	Streamflow	9.5	0.6	0.06	0.02	0.021	0.59			
	Baseflow	1.1	0.3	0.06	0.02	0.017	0.04			
	BFI	11.6%	45.6%	100%	100%	79.4%	6.6%	14.0%	53.0%	3.8%
G8170065	Streamflow	4.3	1.3	0.5	0.0	0.0	0.0			
	Baseflow	4.1	1.3	0.5	0.0	0.0	0.0			
	BFI	95.7%	100%	100%	0%	0%	0%	96.9%	100%	2.2%
G8170066	Streamflow	24.5	13.2	8.9	6.3	5.0	4.1			
	Baseflow	13.7	10.5	8.1	6.0	4.5	3.8			
	BFI	55.8%	80.0%	91.4%	96.4%	88.8%	92.1%	75.2%	87.5%	15.0%
G8170076	Streamflow	14.4	1.5	6.3	0.0	0.0	0.3			
	Baseflow	2.6	1.2	1.4	0.0	0.0	0.1			
	BFI	18.3%	81.2%	22.5%	0%	0%	50.8%	24.0%	33.6%	2.7%
G8170085	Streamflow	5.4	1.0	0.09	0.00	0.02	0.06			
	Baseflow	2.4	0.8	0.09	0.00	0.01	0.04			
	BFI	44.8%	86.8%	99.9%	0%	49.7%	74.5%	51.8%	87.4%	6.8%
G8170089	Streamflow	92.8	27.4	0.01	0.01	0.00	0.00			
	Baseflow	0.4	0.3	0.01	0.01	0.00	0.00			
	BFI	0.4%	0.9%	100%	100%	0%	0%	0.5%	1.0%	0.6%
G8170094	Streamflow	35.3	18.4	11.0	6.1	3.4	5.4			
	Baseflow	24.7	16.4	10.4	5.8	3.4	3.5			
	BFI	70.0%	89.2%	94.3%	96.0%	100%	64.0%	83.3%	96.5%	6.4%
G8170240	Streamflow	101.9	12.9	0.4	0.0	0.1	3.4			
	Baseflow	20.0	4.3	0.3	0.0	0.1	0.9			
	BFI	19.6%	33.3%	81.7%	0%	100%	26.0%	21.5%	35.1%	3.9%

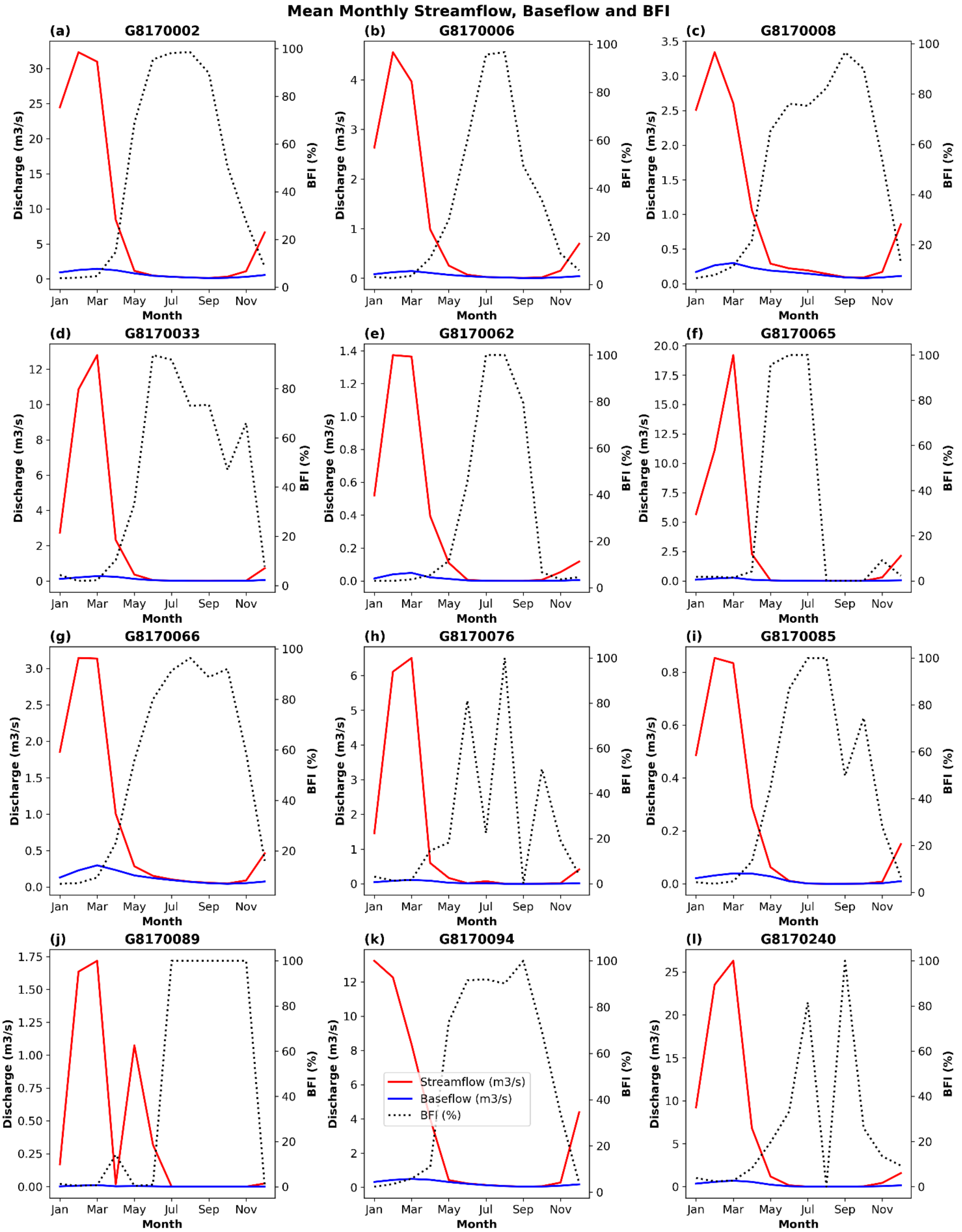

Figure 13. Monthly baseflow separation for 12 sub-catchments from RDF 3P method

4.3.1. Baseflow separation at G8170002

Table 8 presents BFI values from the selected methods, including RDF 3P (α = 0.995), WHAT one-para (α = 0.999), WHAT two-para (BFI_{max} = 0.25, C = 0.995) and BFI+ RDF Eckhardt (α = 0.995, BFI_{max} = 0.25), with BFI values ranging from 2.93% to 12.71%. Other BFI+ algorithms, including RDF one parameter, RDF BFLOW and RDF Chapman (with their parameters were set at 0.999), also provided a good fit for the baseflow hydrographs. Baseflow hydrographs for station G8170002 from all methods are shown in Appendix B.

Table 8. BFI values calculated from selected baseflow separation methods for G8170002

No.	Hydrograph separation method	BFI values			Notes
		1953-54	1965-71	1971-2024	
I	**RDF 3P**				
1	α = 0.99	4.72%	5.93%	9.01%	Not selected
2	α = 0.995	2.93%	4.80%	7.73%	Selected
II	**WHAT**				
1	One-para (α = 0.995)	9.29%	15.30%	18.70%	Not selected
2	One-para (α = 0.999)	5.57%	6.43%	8.45%	Selected
3	Two-para (BFI_{max} = 0.25, C = 0.995)	6.35%	8.12%	10.16%	Selected
III	**BFI+**				
1	RDF One-para (α = 0.995)	14.59%	18.56%	22.15%	Not selected
2	RDF One-para (α = 0.999)	9.57%	12.86%	17.47%	Selected
3	Local minimum	5.92%	25.33%	24.11%	Not selected
4	RDF EWMA (α = 0.005)	16.80%	24.44%	29.57%	Not selected
5	RDF BFLOW (α = 0.995)	16.59%	24.25%	29.39%	Not selected
6	RDF BFLOW (α = 0.999)	10.60%	16.20%	25.75%	Selected
7	RDF Chapman (α = 0.995)	12.51%	18.40%	22.00%	Not selected
8	RDF Chapman (α = 0.999)	9.53%	12.82%	17.43%	Selected
9	RDF Eckhardt (α = 0.995, BFI_{max} = 0.25)	8.53%	10.43%	12.71%	Selected

4.3.2. Baseflow separation at G8170006

Table 9 presents BFI values from selected methods, including RDF 3P (α = 0.995), WHAT one-para (α = 0.999), WHAT two-para (BFI_{max} = 0.25, C = 0.995) and BFI+ RDF Eckhardt (α = 0.995, BFI_{max} = 0.25), with BFI values ranging from 5.15% to 10.61%. Baseflow hydrographs for station G8170006 from all methods are shown in Appendix C.

Table 9. BFI values calculated from selected baseflow separation methods for G8170006

No.	Hydrograph separation method	BFI values 1966-2011	Notes
I	**RDF 3P**		
1	α = 0.99	6.65%	Not selected
2	α = 0.995	5.15%	Selected
II	**WHAT**		
1	One-para (α= 0.995)	15.75%	Not selected
2	One-para (α= 0.999)	6.38%	Selected
3	Two-para (BFI_{max} = 0.25, C = 0.995)	8.10%	Selected
III	**BFI+**		
1	RDF one-para (α = 0.999)	14.00%	Not selected
2	Local minimum	21.35%	Not selected
3	RDF EWMA (α = 0.004)	25.06%	Not selected
4	RDF BFLOW (α = 0.999)	20.77%	Not selected
5	RDF Chapman (α = 0.999)	13.97%	Not selected
6	RDF Eckhardt (α = 0.995, BFI_{max} = 0.25)	10.61%	Selected

4.3.3. Baseflow Separation for G8170008

Table 10 presents BFI values from the selected methods, including RDF 3P (α = 0.99 and 0.995), WHAT one-para (α = 0.999), WHAT two-para (BFI_{max} = 0.25, C = 0.995) and BFI+ RDF Eckhardt (α = 0.995, BFI_{max} = 0.25), with BFI values ranging from 8.70% to 22.06%. Baseflow hydrographs for station G8170008 from all methods are shown in Appendix D.

Table 10. BFI values calculated from selected baseflow separation methods for G8170008

No.	Hydrograph separation method	BFI values			Notes
		1981-93	2003-04	2005-23	
I	**RDF 3P**				
1	α = 0.99	15.53%	14.74%	17.58%	Selected
2	α = 0.995	14.15%	9.63%	15.43%	Selected
II	**WHAT**				
1	One-para (α = 0.995)	24.45%	31.65%	28.43%	Not selected
2	One-para (α = 0.999)	15.47%	22.72%	16.25%	Selected
3	Two-para (BFI_{max} = 0.25, C = 0.995)	15.86%	22.06%	16.59%	Selected

No.	Hydrograph separation method	BFI values			Notes
		1981-93	2003-04	2005-23	
III	**BFI+**				
1	RDF one-para (α = 0.999)	22.00%	7.46%	23.21%	Not selected
2	Local minimum	26.96%	64.50%	32.08%	Not selected
3	RDF EWMA (α = 0.004)	33.48%	23.83%	36.81%	Not selected
4	RDF BFLOW (α = 0.999)	26.31%	8.17%	30.04%	Not selected
5	RDF Chapman (α = 0.999)	21.94%	7.42%	23.17%	Not selected
6	Eckhardt (α = 0.995, BFI_{max} = 0.25)	19.94%	8.70%	18.98%	Selected

4.3.4. Baseflow separation for G8170033

Table 11 presents BFI values from the selected methods. The RDF 3P method (α = 0.995), providing the BFI value of 3.80%, was chosen for this station, as other methods did not produce satisfactory hydrographs. Baseflow hydrographs for station G8170033 from all methods are shown in Appendix E.

Table 11. BFI values calculated from selected baseflow separation methods for G8170033

No.	Hydrograph separation method	BFI values	Notes
		1959-86	
I	**RDF 3P**		
1	α = 0.99	5.09%	Not selected
2	α = 0.995	3.80%	Selected
II	**WHAT**		
1	One-para (α= 0.995)	15.55%	Not selected
2	One-para (α= 0.999)	5.26%	Not selected
3	Two-para (BFI_{max} = 0.25, C = 0.995)	6.90%	Not selected
III	**BFI+ 3.0**		
1	RDF one-para (α = 0.999)	13.00%	Not selected
2	Local minimum	35.03%	Not selected
3	RDF EWMA (α = 0.004)	23.60%	Not selected
4	RDF BFLOW (α = 0.999)	20.14%	Not selected
5	RDF Chapman (α = 0.999)	13.00%	Not selected
6	RDF Eckhardt (α = 0.995, BFI_{max} = 0.25)	9.37%	Not selected

4.3.5. Baseflow separation for G8170062

Table 12 presents BFI values from the selected methods, including RDF 3P (α = 0.995), WHAT one-para (α = 0.999), WHAT two-para (BFI_{max} = 0.25, C = 0.995) and BFI+ RDF Eckhardt (α = 0.995, BFI_{max} = 0.25), with BFI values ranging from 2.88% to 8.43%. Baseflow hydrographs for station G8170062 from all methods are shown in Appendix F.

Table 12. BFI values calculated from selected baseflow separation methods for G8170062

No.	Hydrograph separation method	BFI values 1957-86	Notes
I	**RDF 3P**		
1	α = 0.99	3.85%	Not selected
2	α = 0.995	2.88%	Selected
II	**WHAT**		
1	One-para (α = 0.995)	12.48%	Not selected
2	One-para (α = 0.998)	4.67%	Selected
3	Two-para (BFI_{max} = 0.25, C = 0.995)	6.07%	Selected
III	**BFI+**		
1	RDF one-para (α = 0.999)	11.77%	Not selected
2	Local minimum	16.42%	Not selected
3	RDF EWMA (α = 0.004)	20.66%	Not selected
4	RDF BFLOW (α = 0.999)	17.76%	Not selected
5	RDF Chapman (α = 0.999)	11.73%	Not selected
6	Eckhardt (α = 0.995, BFI_{max} = 0.25)	8.43%	Selected

4.3.6. Baseflow separation for G8170065

Table 13 presents BFI values from the selected methods. The RDF 3P method (α = 0.995) provided the best fit hydrograph, with BFI values of 2.18% and 0.28% for this station. Baseflow hydrographs for station G8170065 from all methods are shown in Appendix G.

Table 13. BFI values calculated from selected baseflow separation methods for G8170065

No.	Hydrograph separation method	BFI values 1997-2000	BFI values 2001-02	Notes
I	**RDF 3P**			
1	α = 0.99	3.41%	0.79%	Not selected
2	α = 0.995	2.18%	0.28%	Selected
II	**WHAT**			
1	One-para (α = 0.995)	18.83%	40.59%	Not selected

No.	Hydrograph separation method	BFI values		Notes
		1997-2000	2001-02	
2	One-para (α = 0.999)	9.19%	39.53%	No selected
3	Two-para (BFI_{max} = 0.25, C = 0.995)	11.37%	39.66%	Not selected
III	**BFI+**			
1	RDF one-para (α = 0.999)	7.20%	2.14%	Not selected
2	Local minimum	8.28%	0.00%	Not selected
3	RDF EWMA (α = 0.004)	15.45%	6.35%	Not selected
4	RDF BFLOW (α = 0.999)	8.08%	2.22%	Not selected
5	RDF Chapman (α = 0.999)	7.16%	2.08%	Not selected
6	Eckhardt (α = 0.995, BFI_{max} = 0.25)	7.31%	2.73%	Not selected

4.3.7. Baseflow separation for G8170066

Table 14 presents BFI values from the selected methods, including RDF 3P (α = 0.99 and 0.995), WHAT one-para (α = 0.998), WHAT two-para (BFI_{max} = 0.25, C = 0.995) and BFI+ RDF Eckhardt (α = 0.995, BFI_{max} = 0.25), with BFI values ranging from 7.08% to 22.62%. Baseflow hydrographs for station G8170066 from all methods are shown in Appendix H.

Table 14. BFI values calculated from selected baseflow separation methods for G8170066

No.	Hydrograph separation method	BFI values				Notes
		1963-2001	2001-05	2005-09	2013-24	
I	**RDF 3P**					
1	α = 0.985	11.80%	23.61%	14.79%	13.85%	Not selected
2	α = 0.99	10.16%	20.81%	12.39%	10.93%	Selected
3	α = 0.995	7.08%	15.21%	9.13%	7.71%	Selected
II	**WHAT**					
1	One-para (α = 0.995)	27.13%	28.47%	26.22%	27.50%	Not selected
2	One-para (α = 0.998)	13.20%	22.62%	13.41%	12.29%	Selected
3	Two-para (BFI_{max} = 0.25, C = 0.99)	14.41%	18.79%	14.96%	14.22%	Selected
III	**BFI+**					
1	RDF one-para (α = 0.999)	23.20%	17.73%	18.82%	19.89%	Not selected
2	Local minimum	37.16%	35.91%	36.60%	33.54%	Not selected
3	RDF EWMA (α = 0.004)	36.34%	32.33%	32.20%	34.37%	Not selected

No.	Hydrograph separation method	BFI values				Notes
		1963-2001	2001-05	2005-09	2013-24	
4	RDF BFLOW (α = 0.999)	32.02%	20.55%	21.92%	26.84%	Not selected
5	RDF Chapman (α = 0.999)	23.17%	17.70%	18.79%	19.90%	Not selected
6	Eckhardt (α = 0.99, BFI_{max} = 0.25)	17.07%	16.18%	16.61%	16.16%	Selected

4.3.8. Baseflow separation for G8170076

Table 15 presents BFI values from the selected methods, including RDF 3P (α = 0.995), WHAT one-para (α = 0.999), WHAT two-para (BFI_{max} = 0.25, C = 0.995) and BFI+ RDF Eckhardt (α = 0.995, BFI_{max} = 0.25), with BFI values ranging from 0.78% to 8.19%. Baseflow hydrographs for station G8170076 from all methods are shown in Appendix I.

Table 15. BFI values calculated from selected baseflow separation methods for G8170076

No.	Hydrograph separation method	BFI values	Notes
		1963-81	
I	**RDF 3P**		
1	α = 0.99	1.46%	Not selected
2	α = 0.995	0.78%	Selected
II	**WHAT**		
1	One-para (α = 0.995)	11.65%	Not selected
2	One-para (α = 0.999)	4.41%	Selected
3	Two-para (BFI_{max} = 0.25, C = 0.995)	5.91%	Selected
III	**BFI+**		
1	RDF one-para (α = 0.999)	11.15%	Not selected
2	Local minimum	15.02%	Not selected
3	RDF EWMA (α = 0.004)	20.86%	Not selected
4	RDF BFLOW (α = 0.999)	16.50%	Not selected
5	RDF Chapman (α = 0.999)	11.11%	Not selected
6	Eckhardt (α = 0.995, BFI_{max} = 0.25)	8.19%	Selected

4.3.9. Baseflow separation for G8170085

Table 16 presents BFI values from the selected methods, including RDF 3P (α = 0.99 and 0.995), WHAT one-para (α = 0.999), WHAT two-para (BFI_{max} = 0.25, C = 0.995) and BFI+ RDF Eckhardt (α

= 0.995, BFI_{max} = 0.25), with BFI values ranging from 3.72% to 11.96%. Baseflow hydrographs for station G8170085 from all methods are shown in Appendix J.

Table 16. BFI values calculated from selected baseflow separation methods for G8170085

No.	Hydrograph separation method	BFI values 1963-2024	Notes
I	**RDF 3P**		
1	α = 0.99	5.71%	Selected
2	α = 0.995	3.72%	Selected
II	**WHAT**		
1	One-para (α = 0.995)	22.14%	Not selected
2	One-para (α = 0.999)	7.94%	Selected
3	Two-para (BFI_{max} = 0.25, C = 0.995)	10.11%	Selected
III	**BFI+**		
1	RDF one-para (α = 0.999)	16.28%	Not selected
2	Local minimum	31.94%	Not selected
3	RDF EWMA (α = 0.005)	30.76%	Not selected
4	RDF BFLOW (α = 0.999)	24.63%	Not selected
5	RDF Chapman (α = 0.999)	16.24%	Not selected
6	Eckhardt (α = 0.995, BFI_{max} = 0.25)	11.96%	Selected

4.3.10. Baseflow Separation for G8170089

Table 17 presents BFI values from the selected methods. The RDF 3P methods (α = 0.995) provided the best fit hydrograph, with a BFI value of 0.6% for this station. Baseflow hydrographs for station G8170089 from all methods are shown in Appendix K.

Table 17. BFI values calculated from selected baseflow separation methods for G8170089

No.	Hydrograph separation method	BFI values 1963-1969	Note
I	**RDF 3P**		
1	α = 0.99	1.46%	Not selected
2	α = 0.995	0.60%	Selected
II	**WHAT**		
1	One-para (α = 0.995)	6.95%	Not selected
2	One-para (α = 0.998)	2.15%	Not selected
3	Two-para (BFI_{max} = 0.25, C = 0.995)	3.04%	Not selected

No.	Hydrograph separation method	BFI values 1963-1969	Note
III	**BFI+**		
1	RDF one-para (α = 0.999)	4.68%	Not selected
2	Local minimum	14.24%	Not selected
3	RDF EWMA (α = 0.004)	11.44%	Not selected
4	RDF BFLOW (α = 0.999)	5.77%	Not selected
5	RDF Chapman (α = 0.999)	4.63%	Not selected
6	Eckhardt (α = 0.995, BFI_{max} = 0.25)	4.81%	Not selected

4.3.11. Baseflow Separation for Gauging Station G8170094

Table 18 presents BFI values from the selected methods, including RDF 3P (α = 0.995), WHAT one-para (α = 0.999), WHAT two-para (BFI_{max} = 0.25, C = 0.995) and BFI+ RDF Eckhardt (α = 0.995, BFI_{max} = 0.25), with BFI values ranging from 5.68% to 12.01%. Baseflow hydrographs for station G8170094 from all methods are shown in Appendix L.

Table 18. BFI values calculated from selected baseflow separation methods for G8170094

No.	Hydrograph separation method	BFI values 2004 - 24	Notes
I	**RDF 3P**		
1	α = 0.99	6.68%	Not selected
2	α = 0.995	5.68%	Selected
II	**WHAT**		
1	One-para (α = 0.995)	14.51%	Not selected
2	One-para (α = 0.999)	8.07%	Selected
3	Two-para (BFI_{max} = 0.25, C = 0.995)	9.32%	Selected
III	**BFI+**		
1	RDF one-para (α = 0.999)	15.39%	Not selected
2	Local minimum	14.40%	Not selected
3	RDF EWMA (α = 0.004)	24.06%	Not selected
4	RDF BFLOW (α = 0.999)	20.84%	Not selected
5	RDF Chapman (α = 0.999)	15.36%	Not selected
6	Eckhardt (α = 0.995, BFI_{max} = 0.25)	12.01%	Selected

4.3.12. Baseflow separation for gauging G8170240

Table 19 presents BFI values from the selected methods, including RDF 3P (α = 0.995), WHAT one-para (α = 0.999), WHAT two-para (BFI_{max} = 0.25, C = 0.995) and BFI+ RDF Eckhardt (α = 0.995, BFI_{max} = 0.25), with BFI values ranging from 2.71% to 16.44%. Baseflow hydrographs for station G8170240 from all methods are shown in Appendix M.

Table 19. BFI values calculated from selected baseflow separation methods for G8170240

No.	Hydrograph separation method	BFI values				Notes
		1967-72	1973-76	1977-81	1982-86	
I	**RDF 3P**					
1	α = 0.99	4.13%	6.46%	7.52%	7.47%	Not selected
2	α = 0.995	2.71%	3.94%	4.52%	4.51%	Selected
II	**WHAT**					
1	One-para (α = 0.995)	13.55%	17.82%	21.24%	28.92%	Not selected
2	One-para (α = 0.999)	4.35%	6.44%	6.66%	15.49%	Selected
3	Two-para (BFI_{max} = 0.25, C = 0.995)	5.93%	8.23%	8.62%	16.44%	Selected
III	**BFI+**					
1	RDF one-para (α = 0.999)	10.82%	11.15%	12.74%	13.02%	Not selected
2	Local minimum	37.23%	56.64%	52.05%	43.14%	Not selected
3	RDF EWMA (α = 0.004)	21.29%	24.27%	28.85%	27.18%	Not selected
4	RDF BFLOW (α = 0.999)	14.42%	13.57%	16.27%	16.67%	Not selected
5	RDF Chapman (α = 0.999)	10.78%	11.11%	12.71%	12.99%	Not selected
6	Eckhardt (α = 0.995, BFI_{max} = 0.25)	8.47%	9.71%	10.45%	10.57%	Selected

4.4 Baseflow at G8170002

Streamflow at G8170002 Adelaide River railway bridge occasionally ceases to flow, while further upstream at G8170008, flow is perennial. This site, is located on the Adelaide River mainstream, represents the uppermost perennial source of flow to the river. Therefore, to better understand the perennial sources and characteristics of flow in the upper Adelaide River, an analysis of streamflow in the G8170002 catchment follows.

For the dry season months (June-October), mean monthly streamflow at G8170008 contributed from 42.6% to 76.2% of mean monthly streamflow at G8170002, while mean monthly baseflow at G8170008 contributed between 37.2% and 70.6% of mean monthly baseflow at G8170002 over the period of 2006-2024, when the datasets from both station were available (Table 20). This suggests that baseflow from G8170008 likely contributes significantly to the flow at G8170002. However, it cannot be assumed that all the flow at G8170008 contributes directly to the flow at G8170002. From the G8170008 monitoring site, it is approximately 15 km downstream to the confluence with the West branch of the Adelaide River and another 12 km to G8170002. The exact variation in baseflow between these sites remains unclear, as there could be significant losses, such as evapotranspiration, or gains along the way. Based on the hydrogeology between the sites notably the Tindall Limestone and Jinduckin Formation, it is anticipated that further groundwater input to the stream occurs.

Upstream from the confluence with the west branch, the Adelaide River east branch is underlain by Hinderance Dolostone and Depot Creek Sandstone, formations that likely hold aquifers. In the very upper reaches the river is underlain by Tindall Limestone and the Jinduckin Formation, and south of the Daly River Road there are springs emerging from the aquifers within these formations which contribute to the flow at G8170008. Ancillary to this is Sybil springs, G8170109 (Figure 14), which discharges from a fault in the Depot Creek Sandstone underlying these carbonate formations. The spring has an average flow of 47.5 L/s based on 35 observations from April to November between 1965 and 2004 (NTG AQUARIUS Time-series). The characteristics suggest that this stretch of the river is a gaining stream.

Downstream of the confluence with the west branch, groundwater sourced from the Depot Creek Sandstone could be contributing to flow of the Adelaide River via tributaries. This is supported by data from the G8170260 site, located on a tributary in this area (Figure 14). Although only a few flow measurements are available, showing an average flow of 22.9 L/s from 5 observations between July 1986 and June 1988 (NTG AQUARIUS Time-series), this indicates that further baseflow contributions to the river may occur downstream of the confluence.

The monitoring site G8170094, located on the Adelaide River west branch approximately 10 km upstream of the confluence with the Adelaide River mainstream (Figure 14), has a continuous water level record. However, streamflow data is unavailable due to lack of a rating table for flow gauging. To gain a better understanding of baseflow in the upper Adelaide River catchment, it is recommended that flow surveys be conducted from the upper reaches of the G8170008 and G8170094 sub-catchments, extending along the river to G8170002. Further flow gauging at G8170094 is also needed to develop a rating table.

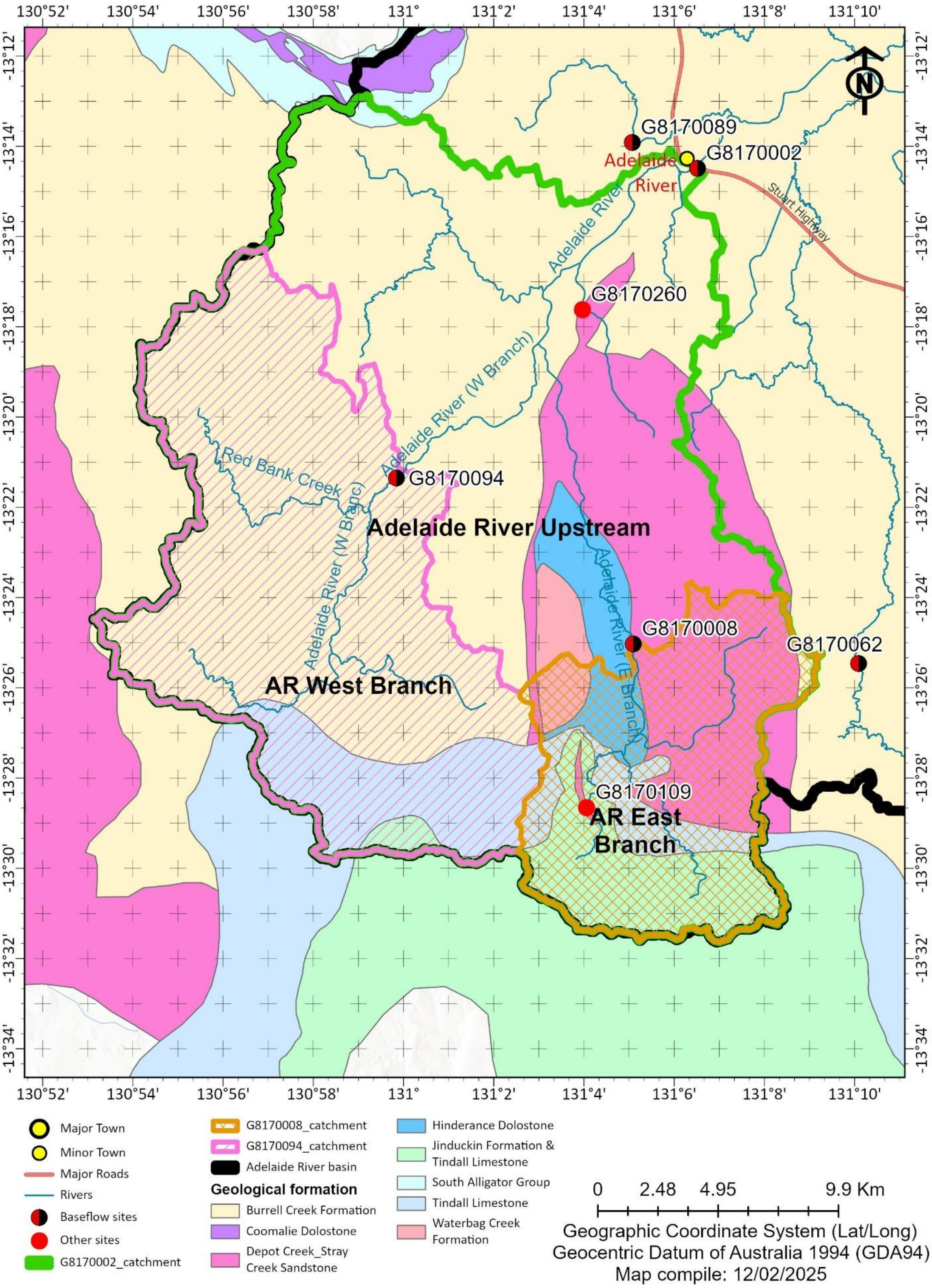

Figure 14. Geological formations within Adelaide River upstream sub-catchments

Table 20. Mean monthly streamflow and baseflow at G8170008 and G8170002, and as a percentage of G8170002

Month	G8170008 (ML/month)	G8170002 (ML/month)	G8170008/ G8170002 (%)
Stream flow			
January	9352.8	102154.2	9.2%
February	10120.8	101933.3	9.9%
March	8393.9	72761.1	11.5%
April	3556.3	33023.4	10.8%
May	1036.3	4323.0	24.0%
June	774.8	1629.5	47.5%
July	695.8	1013.7	68.6%
August	496.4	651.8	76.2%
September	308.5	429.8	71.8%
October	288.7	677.1	42.6%
November	471.6	3287.4	14.3%
December	2708.6	32127.0	8.4%
Baseflow from RDF 3 between 2006 – 2024			
January	586.86	3321.1	17.7%
February	864.03	4208.8	20.5%
March	1070.29	5206.7	20.6%
April	784.12	4280.8	18.3%
May	673.64	2807.3	24.0%
June	582.87	1567.5	37.2%
July	504.54	983.9	51.3%
August	393.11	631.2	62.3%
September	303.40	429.8	70.6%
October	281.42	502.5	56.0%
November	308.45	1035.0	29.8%
December	398.14	1923.5	20.7%

5. Conclusions and Recommendations

5.1 Conclusion

This study employed various hydrograph analysis methods and techniques commonly used to distinguish or separate baseflow from streamflow data.

Recession analysis, which focussed on the shape of the recession curves and delivers recession constants, identified that three monitoring sites (G8170002, G8170008 and G8170066) had a definite baseflow component. In contrast, three sites (G8170085, G8170033 and G8170062) exhibited a potential baseflow component, though their streamflow ceased in the dry season.

The FDC method, which analysed the Q_{90}/Q_{50} ratio through streamflow frequency analysis to estimate the proportion of streamflow originating from groundwater, provided values for perennial streams but proved less effective for non-perennial streams (with Q_{90}=0). Only three of the eleven sites had a ratio greater than zero, ranging from 0.14 to 0.33. The same three sites – G8170002, G8170008 and G8170066 - were identified through recessional analysis as having a definite baseflow component.

When referencing the geology of the Adelaide River catchment, it was found that catchments underlain by moderate to high yielding aquifers (G8170002, G8170008, G8170066 and G8170033) demonstrated groundwater-sourced baseflow. For the other two sites identified by recessional analysis with a potential baseflow component (G8170062, G8170085), fieldwork is needed to confirm whether groundwater discharges contribute to streamflow or if the observed delayed flow is due to an alternative source.

Baseflow separation, wherein the baseflow component is separated from streamflow, was performed using various recursive digital filters. Of these, a variation of the Lyne and Hollick filter as developed by Ladson et al. (2013) provided a good estimate of baseflow overall, though the Eckhardt filter also performed well. The average annual BFI ranged from 0.6% to 17.1%, indicating that baseflow is generally limited in the Adelaide River catchment.

The three baseflow analysis methods implemented by this study, combined with an examination of the underlying geology, has preliminarily identified groundwater sources contributing to baseflow in the Adelaide River catchment. This study serves as a valuable reference for assessing baseflow in other catchments in the Northern Territory.

5.2 Limitations and Recommendations

- Maintain monitoring of groundwater-influenced streamflow gauging stations: Continue to monitor flow at gauging stations where groundwater contributes to streamflow such as G8170008, G8170002 and G8170066. Consider reinstating monitoring at G8170033 or explore alternative options to monitor spring discharges in this area.
- Undertake flow gauging at G8170094: Establish a flow gauging station a G8170094 and generate a rating curve for the site.
- Examine available groundwater monitoring records: Reviewing groundwater monitoring data from bores within sub-catchments to assess the relationship between groundwater levels in aquifer-bearing formations and baseflow at nearby surface water gauging stations. This analysis should focus on sub-catchments where groundwater-sourced baseflow has been confirmed.
- Undertake flow surveys within the upper reaches: Conduct flow surveys along the upper reaches of the G8170008 and G8170094 sub-catchments, extending down to G8170002. This will help pinpoint the locations and quantities of groundwater discharges to the streams. Coupled with water quality sampling, this will aid in identifying groundwater sources contributing to flow at G8170002. A similar investigation should be conducted for the Coomalie Creek gauging site, G8170066.

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Appendix A: Baseflow separation results using RDF 3P technique

Average monthly baseflow (ML/d) for G8170002 using RDF 3P method

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1953			3.12	7.94	11.33	6.73	5.90	5.85	3.76	2.55	5.35	11.76	6.46
1954	15.57	21.79	27.13	28.98	20.54	13.23							21.47
1965		4.87	13.75	27.98	32.78	21.69	12.26	7.57	3.41	0.22	0.54	15.80	13.02
1966	40.11	66.34	78.01	52.75	22.77	16.02	8.48	4.04	1.69	5.35	11.54	34.03	28.20
1967	48.24	72.50	87.80	79.28	32.97	16.88	10.49	7.06	3.58	4.02	2.66	25.48	32.33
1968	36.57	72.05	97.03	95.00	94.52	66.23	33.89	22.18	11.76	7.60	8.80	25.05	47.45
1969	55.58	91.24	105.59	48.49	37.44	28.00	17.61	11.89	7.24	8.99	22.47	22.23	37.75
1970	28.14	38.27	20.51	14.12	10.33	4.96	7.58	0.41	0.00	0.00	6.65	13.34	11.87
1971	8.33				0.47	1.19	2.22	2.94	2.45	3.61	4.82	10.06	4.13
1972	33.32	53.25	77.82	89.51	64.65	31.66	22.26	17.64	9.93	7.28	14.93	15.03	36.35
1973	47.32	92.85	120.30	132.17	67.56	42.59	22.96	12.93	8.20	15.38	25.25	38.92	51.87
1974	102.02	164.31	206.35	198.01	149.26	75.36	42.72	33.15	25.85	37.30	76.23	67.40	97.67
1975	125.42	121.96	168.54	179.60	106.90	51.07	34.61	22.76	23.43	45.20	36.46	84.08	83.14
1976	133.87	176.51	206.51	175.30	114.38	57.09	37.92	27.10	20.00	16.06	25.13	76.68	88.61
1977	101.94	144.75	175.88	136.28	110.99	55.80	54.14	48.14	10.95	8.54	21.45	62.53	77.30
1978	73.81	106.04	90.31	60.06	29.41	21.79	16.27	11.93	8.42	10.00	31.54	42.11	41.40
1979	58.86	70.33	78.18	80.65	51.06	15.89	11.78	7.99	4.41	12.14	9.49	36.85	36.29
1980	55.26	79.50	94.88	95.52	47.16	2.22	1.74	1.75	0.87	0.79	24.68	37.24	36.63
1981	61.38	85.51	93.38	76.54	46.32	31.70	25.00	17.46	14.72	16.65	30.95	56.80	46.13
1982	55.54	74.48	69.46	48.31	26.02	15.82	11.92	7.67	5.52	0.98	7.96	26.04	28.88
1983	22.14	34.09	50.19	60.05	27.56	11.43	6.68	3.35	1.31	13.47	19.16	25.20	22.79
1984	47.90	83.10	108.78	81.97	61.04	40.19	24.88	17.20	17.71	8.06	6.41	34.58	44.19
1985	39.02	46.21	60.55	57.13	45.07	24.63	17.74	10.66	6.24	12.74	21.31	22.30	30.20
1986	37.67	46.53	52.18	51.44	31.54	16.17	11.20	7.01	4.88	18.67	19.88	20.87	26.38
1987	33.50	45.35	47.93	26.60	14.70	9.15	5.91	2.80	0.47	0.00	22.63	29.04	19.69

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1988	36.03	45.52	49.10	39.04	10.98	4.23	2.13	0.18	0.00	4.56	28.46	50.46	22.48
1989	75.82	93.31	104.67	77.60	57.38	28.42	17.53	12.14	6.29	13.60	17.89	18.92	43.34
1990	41.88	47.10	60.07	36.03	42.20	16.55	9.37	4.91	1.23	0.00	17.00	41.80	26.44
1991	61.39	88.79	99.47	70.76	47.06	28.01	17.42	11.67	6.78	0.45	24.98	23.50	39.70
1992	36.34	46.46	46.41	17.30	8.11	3.94	1.49	0.10	1.20	3.36	15.82	21.32	16.74
1993	30.21	48.64	59.93	51.24	30.84	13.37	7.84	3.92	1.11	7.03	12.98	23.36	24.05
1994	53.24	62.53	80.49	78.00	32.10	17.17	10.51	5.64	2.11	0.12	6.28	39.32	32.11
1995	58.70	93.11	113.29	107.89	70.53	31.63	18.84	12.56	7.77	20.09	43.94	57.41	52.71
1996	77.18	96.26	109.05	108.09	43.65	21.68	16.01	11.86	4.11	23.21	18.47	48.12	47.99
1997	104.87	160.43	185.03	161.61	88.49	41.78	26.05	20.60	13.83	31.88	27.44	93.50	79.16
1998	145.98	184.34	186.88	147.73	64.48	34.58	22.73	16.32	12.82	32.23	63.40	95.30	83.29
1999	136.12	172.80	200.60	214.35	180.00	89.74	57.46	34.36	26.62	34.25	45.94	63.41	104.19
2000	142.89	190.27	232.46	251.01	208.68	112.91	68.03	46.33	28.35	50.71	31.45	126.15	123.94
2001	159.93	216.10	243.36	148.67	110.05	88.83	55.89	39.98	27.32	24.71	31.18	86.31	102.08
2002	110.76	104.67	108.41	82.97	50.08	37.92	28.29	20.16	16.47	14.91	23.12	35.63	52.50
2003	45.38	66.43	88.25	92.80	50.95	30.07	20.44	16.77	12.22	7.22	12.02	45.69	40.52
2004	101.73	154.53	183.44	167.09	141.35	161.94	161.46	118.68	36.39	16.06	34.32	45.37	110.07
2005	118.76	133.49	142.15	87.94	39.01	25.13	17.12	11.91	6.58	19.61	44.22	67.66	59.06
2006	101.09	149.31	184.19	218.55	211.25	150.61	89.80	50.08	27.97	20.07	29.05	32.12	104.97
2007	123.66	158.34	187.93	193.29	108.41	56.93	40.81	28.07	19.12	20.79	54.20	75.40	88.43
2008	143.03	195.38	232.70	210.40	106.41	58.52	39.79	25.66	18.33	12.48	43.00	102.98	98.71
2009	171.66	207.69	214.01	142.74	59.08	37.82	25.75	19.38	14.99	9.92	11.06	79.41	82.11
2010	149.29	201.15	229.02	226.24	179.33	109.93	46.02	27.82	21.06	49.16	26.60	93.70	112.74
2011	192.82	293.69	360.38	313.98	212.08	131.15	72.94	46.27	28.96	25.73	111.46	126.96	158.75
2012	133.14	209.57	216.32	135.17	111.28	73.22	46.98	31.76	20.89	21.21	30.99	70.00	91.36
2013	72.01	94.28	121.54	128.99	84.77	44.44	25.15	17.83	12.56	23.18	48.81	91.92	63.59

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2014	101.18	145.16	148.01	127.98	78.26	44.33	29.90	20.00	15.63	9.40	7.71	57.73	64.97
2015	92.66	112.71	118.02	76.81	37.82	23.22	15.88	10.99	6.77	5.17	15.52	55.67	47.26
2016	86.56	110.11	123.68	83.80	47.77	20.54	15.12	9.94	14.94	5.61	22.32	52.15	49.20
2017	112.77	163.71	193.92	189.50	130.84	56.09	32.34	20.03	13.14	13.82	30.97	39.65	82.52
2018	93.63	143.50	138.80	89.52	70.77	41.78	27.50	18.86	13.03	9.82	38.89	35.06	59.57
2019	59.87	77.25	77.91	59.16	36.15	19.17	15.59	10.84	5.03	2.10	8.00	19.56	32.29
2020	40.12	53.76	66.89	69.31	25.33	11.05	6.72	5.28	1.19	12.56	19.81	42.97	29.50
2021	71.18	98.77	117.25	118.06	70.24	33.57	18.27	11.32	5.80	11.04	25.76	29.82	50.59
2022	78.63	104.41	119.77	107.83	50.87	26.40	23.28	13.01	7.60	31.62	56.84	65.26	56.82
2023	124.87	162.56	182.63	178.09	84.36	44.84	25.77	16.57	10.87	8.10	39.99	46.53	76.49
2024	87.37	149.00	158.21	41.71	15.58	9.14	5.46	3.14					58.23

Average monthly baseflow (ML/d) for G8170006 using RDF 3P method

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1966									0.00	0.00	0.00	0.00	0.00
1967	0.02	0.06	0.26	0.56	0.89	1.31	0.46	0.00	0.00	0.00	0.00	0.12	0.31
1968	1.41	5.79	9.65	11.27	11.46	8.70	0.02	0.00	0.00	4.42	5.92	1.95	5.03
1969	3.84	8.68	7.93	1.01	0.00	0.00	0.00	0.00	0.00	0.47	4.02	2.79	2.36
1970	1.90	4.14	0.83	0.70	0.00	0.00	0.00	0.00	0.17	0.00	0.40	0.64	0.71
1971	1.50	2.54	3.34	3.64	1.20	0.73	0.25	0.00	0.00	0.15	0.05	2.37	1.31
1972	3.29	2.13	4.28	1.21	0.00	0.00	0.00	0.00	0.00	0.00	0.74	0.23	0.99
1973	1.92	4.06	5.74	0.90	0.00	0.00	0.00	0.00	0.00	0.25	3.36	5.42	1.79
1974	9.76	14.53	16.73	8.55	1.09	0.00	0.00	0.00	0.00	0.00	0.03	1.04	4.25
1975	2.98	3.92	8.05	7.80	0.00	0.00	0.00	0.00	0.00	2.66	7.04	10.09	3.54
1976	12.94	14.79	15.53	9.63	1.39	0.00	0.00	0.00	0.00	0.36	1.19	7.43	5.25
1977	10.03	10.66	12.23	7.45	3.05	0.12	0.01	0.00	0.00	0.00	0.45	5.45	4.09
1978	6.91	7.69	6.45	2.97	0.40	0.00	0.00	0.00	0.00	0.00	0.36	2.28	2.23
1979	4.56	7.11	8.02	0.72	0.36	0.06	0.00	0.00	0.00	0.67	1.95	3.60	2.23
1980	7.75	12.66	14.85	8.43	0.28	0.01	0.00	0.00	0.00	0.00	0.23	3.10	3.91
1981	4.49	8.06	7.70	0.05	0.00	0.00	0.00	0.00	0.00	0.54	1.52	4.69	2.23
1982	5.74	7.26	6.21	2.13	0.23	0.00	0.00	0.00	0.00	0.00	0.00	1.07	1.86
1983	1.52	2.25	2.58	3.51	1.63	0.00	0.00	0.00	0.00	0.13	0.00	0.29	0.98
1984	1.90	4.96	7.81	4.47	0.52	0.00	0.00	0.00	0.00	0.00	0.64	0.19	1.69
1985	1.01	2.24	2.57	1.58	0.57	0.00	0.00	0.00	0.00	0.00	0.28	0.20	0.69
1986	1.11	1.03	0.44	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.18	0.27
1987	0.39	1.32	1.11	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.50	0.27
1988	0.83	0.82	1.01	0.35	0.00	0.00	0.00	0.00	0.11	0.05	0.20	1.29	0.39
1989	1.77	2.98	3.76	3.84	0.90	0.04	0.09	0.39	0.29	0.00	0.00	0.17	1.17
1990	0.97	1.30	2.52	0.98	0.78	0.04	0.09	0.00	0.00	0.00	0.25	0.83	0.64

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1991	2.63	5.38	4.42	1.99	0.00	1.27	0.46	0.14	0.00	0.00	0.36	0.20	1.38
1992	1.71	1.99	2.67	0.18	0.09	0.00	0.00	0.00	0.00	0.00	0.17	1.11	0.66
1993	2.21	4.74	5.80	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.94	1.14
1994	4.44	5.07	7.80	2.49	0.01	0.00	0.00	0.00	0.00	0.00	0.01	2.33	1.83
1995	5.22	11.99	14.64	8.02	1.17	0.06	0.00	0.00	0.00	0.00	0.24	1.08	3.48
1996	2.51	3.65	3.97	1.89	0.00	0.00	0.00	0.00	0.00	0.11	0.16	1.62	1.15
1997	8.14	16.23	20.30	7.97	0.43	0.00	0.00	0.00	0.00	0.00	1.01	7.51	5.07
1998	18.32	25.49	28.89	28.20	19.56	11.00	0.16	0.00	0.00	0.00	6.87	18.58	13.00
1999	26.04	33.66	40.58	43.75	41.66	30.11	26.55	20.83	0.62	6.83	25.28	18.84	26.18
2000	34.89	42.21	47.51	45.51	33.66	24.60	18.05	14.69	10.88	6.42	2.17	15.59	24.63
2001	23.53	30.75	30.80	15.67	11.96	6.04	5.06	1.59	0.29	0.00	0.40	2.92	10.64
2002	7.28	9.53	11.49	8.15	3.39	1.55	0.62	0.08	0.00	0.00	0.15	0.32	3.51
2003	0.44	3.09	7.21	4.15	0.65	0.10	0.00	0.00	0.00	0.00	0.00	2.39	1.49
2004	12.99	24.03	30.14	28.57	26.29	24.36	23.70	19.38	1.85	0.00	6.27	2.87	16.68
2005	17.79	20.50	21.56	20.25	14.27	10.04	0.00	0.00	0.00	0.00	2.21	5.62	9.27
2006	8.42	15.87	20.85	29.32	33.71	13.70	0.00	0.00	0.00	0.00	0.00	0.00	10.10
2007	4.86	13.16	17.11	18.97	17.52	11.27	7.34	3.57	0.00	0.00	0.45	4.09	8.16
2008	9.66	12.72	19.03	21.03	12.97	8.70	5.89	3.04	0.47	0.00	0.57	6.14	8.34
2009	12.05	16.18	17.39	8.53	3.17	1.54	0.42	0.00	0.00	0.00	0.00	3.07	5.14
2010	10.69	16.74	20.70	18.27	17.12	8.53	1.95	0.32	0.00	2.58	1.29	9.06	8.89
2011	19.24	32.55	40.97	25.07	5.71	2.45	1.47	1.09	0.74	0.48			13.55

Average monthly baseflow (ML/d) for G8170008 using RDF 3P method

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1981								0.24	0.45	0.97	1.40	3.86	1.65
1982	7.22	12.67	13.98	8.70	7.72	7.62	7.17	6.77	5.56	3.80	4.55	5.58	7.58
1983	4.68	5.43	7.18	8.78	8.19	6.33	5.50	5.10	4.10	5.27	4.54	4.59	5.81
1984	7.21	17.92	33.35	27.12	16.86	14.16	13.07	11.01	9.92	6.56	6.59	7.52	14.25
1985	7.85	11.37	16.31	17.00	11.65	9.87	8.76	6.85	5.44	6.31	7.73	6.79	9.64
1986	9.33	11.76	12.49	11.89	10.01	9.37	8.30	6.19	5.12	5.65	5.96	6.35	8.51
1987	7.55	10.54	9.06	7.14	6.45	6.20	5.75	4.77	4.33	2.96	3.46	3.36	5.93
1988	5.79	6.91	7.66	7.56	5.20	4.33	3.78	3.19	2.53	2.51	3.85	6.71	5.00
1989	12.38	16.62	20.30	13.19	9.43	8.32	8.19	7.61	5.32	4.89	4.89	5.41	9.67
1990	6.74	7.64	8.29	6.69	6.50	4.59	4.40	3.84	3.36	2.87	2.59	4.30	5.14
1991	7.62	16.48	17.14	11.35	8.22	6.64	5.40	4.86	3.45	1.75	2.78	2.17	7.26
1992	3.88	5.14	5.97	5.84	4.75	3.90	2.98	2.18	1.51	2.03	2.68	3.31	3.68
1993	3.77	8.08	9.73	6.47	4.68	3.19	2.11						5.60
2003			4.29	8.05	10.44	11.62	12.39	12.67	9.69	8.33	9.82	14.73	10.37
2004	25.11												25.11
2005											0.94	1.67	1.51
2006	4.34	15.63	30.07	50.54	67.59	76.85	62.41	36.22	20.95	11.10	12.16	10.75	33.29
2007	24.53	33.24	40.33	27.16	23.04	18.02	15.39	14.47	12.55	11.97	12.70	15.19	20.65
2008	22.53	31.57	42.39	27.20	23.05	18.94	16.52	14.82	12.52	9.02	10.57	18.56	20.62
2009	31.98	40.65	27.79	21.87	18.33	14.90	13.48	12.19	11.20	11.06	11.06	11.06	18.66
2010	15.14	31.32	42.86	48.07	51.03	48.30	32.93	22.39	10.35	12.68	9.79	16.80	28.44
2011	33.34	75.35	105.21	67.07	32.38	28.22	23.33	19.07	16.38	14.79	24.53	26.65	38.61
2012	29.01	42.43	51.83	36.65	22.65	18.25	16.22	14.37	12.33	13.30	15.45	19.55	24.28
2013	18.36	21.31	25.51	26.75	22.65	18.32	16.83	15.00	12.53	11.16	14.02	17.91	18.34
2014	22.47	39.53	31.92	23.31	19.59	16.79	15.07	12.73	11.47	9.87	9.00	15.31	18.79

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2015	21.97	28.32	20.80	14.85	12.98	11.21	10.29	9.40	8.34	7.46	8.62	11.62	13.74
2016	17.13	19.80	18.74	15.30	13.03	10.93	9.13	6.61	6.40	4.83	4.97	7.03	11.13
2017	19.40	36.78	42.48	25.02	18.27	12.98	10.55	9.24	7.75	8.09	8.72	9.96	17.32
2018	14.38	29.56	28.28	15.85	12.56	11.88	11.51	9.86	8.48	7.43	8.51	8.88	13.83
2019	10.69	13.31	11.66	9.16	8.15	7.69	7.45	7.03	4.90	3.85	4.22	4.59	7.69
2020	6.36	8.11	9.66	9.56	7.93	7.35	6.36	4.82	3.48	4.43	3.99	5.62	6.47
2021	8.72	14.65	20.33	14.86	12.41	11.22	9.55	7.87	6.25	6.29	7.33	8.37	10.63
2022	13.43	18.14	20.06	19.22	13.86	11.31	10.96	8.78	7.24	8.32	10.04	12.65	12.80
2023	28.22	39.27	37.62	25.72	20.88	16.09	13.64	11.11	8.93	7.74	9.39	10.68	18.99
2024	17.70	42.21	48.43	18.43	12.49	9.88	7.61	4.97					20.09

Average monthly baseflow (ML/d) for G8170033 using RDF 3P method

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1959												0.16	0.16
1960	3.48	11.58	19.82	19.16	8.73	2.22	0.01	0.01	0.01	0.01	0.01	0.01	5.39
1961	1.38	5.62	6.57	3.71	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.42
1962	0.22	5.22	6.35	0.10	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.97
1963	0.94	6.21	11.51	13.52	1.46	0.01	0.01	0.01	0.01	0.01	0.01	0.57	2.82
1964	2.84	7.55	9.68	13.82	4.21	0.29	0.01	0.01	0.01	0.01	0.59	6.05	3.74
1965	15.50	18.16	24.68	27.91	10.22	1.23	0.11	0.00	0.00	0.00	0.00	8.50	8.80
1966	17.77	25.90	28.54	14.02	0.60	0.02	0.01	0.01	0.01	0.01	0.01	8.27	7.83
1967	10.81	22.61	31.47	27.59	3.48	0.47	0.04	0.01	0.01	0.01	1.19	0.13	8.04
1968	5.69	22.10	34.30	25.88	34.97	27.19	7.80	2.03	0.27	0.01	0.01	8.66	14.04
1969	15.60	24.86	26.76	6.64	3.86	0.93	0.30	0.01	0.01	0.01	0.01	0.98	6.57
1970	1.49	5.83	6.79	1.34	0.17	0.01	0.01	0.01	0.01	0.01	0.01	3.06	1.54
1971	1.62	6.43	12.71	16.74	15.31	3.04	0.34	0.01	0.00	0.00	0.00	0.00	4.67
1972	3.70	7.53	13.85	19.01	10.39	1.56	0.04	0.01	0.01	0.01	0.01	0.01	4.66
1973	4.91	16.34	28.90	36.56	14.45	3.55	0.72	0.01	0.01	0.01	1.70	1.86	9.01
1974	23.32	46.26	63.68	63.80	30.05	4.19	1.84	0.41	0.06	1.89	1.91	21.78	21.44
1975	40.71	48.60	60.36	47.32	15.49	5.74	3.22	1.91	0.22	1.71	5.84	15.01	20.34
1976	22.08	31.56	42.77	36.37	12.72	4.27	2.52	1.83	0.10	3.02	0.35	4.52	13.45
1977	15.97	27.72	37.46	32.75	20.49	6.09	2.43	0.59	0.01	0.01	1.18	8.40	12.67
1978	11.67	21.12	24.36	16.22	5.37	1.67	3.41	0.02	0.01	0.01	0.01	1.18	7.00
1979	8.37	12.46	15.90	10.95	1.62	0.12	0.01	0.01	3.22	9.82	10.93	6.69	6.63
1980	11.65	20.40	28.85	31.74	19.34	5.54	3.87	2.48	1.11	0.07	2.85	7.51	11.25
1981	10.05	21.00	29.06	32.86	34.65	33.16	20.64	6.74	0.01	3.52	1.44	19.84	17.73
1982	24.73	34.16	29.93	14.16	9.61	1.14	0.16	1.85	7.31	0.50	0.01	0.02	10.15
1983	8.49	0.30	7.84	15.02	9.25	0.47	0.01	0.01	0.01	0.01	0.01	1.07	3.56

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1984	3.90	14.14	25.23	18.82	10.00	2.19	0.53	0.01	0.55	0.25	0.01	1.17	6.37
1985	2.92	10.22	13.20	12.69	5.69	0.70	0.02	0.01	0.01	0.01	0.01	5.06	4.17
1986	6.33	9.43	9.97	5.27	1.86	0.49	0.88	0.60	0.24	0.29			3.54

Average monthly baseflow (ML/d) for G8170062 using RDF 3P method

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1957											0.57	0.87	0.75
1958	1.86	3.04	2.59	1.40	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.73
1959	0.23	0.83	0.41	6.26	12.96	1.05	0.00	0.00	0.00	0.00	0.93	1.09	1.99
1960	1.91	5.21	5.58	3.57	1.50	0.87	0.12	0.00	0.00	0.00	0.08	0.80	1.62
1961	0.78	2.24	2.18	1.01	0.17	0.00	0.00	0.00	0.00	0.00	0.44	1.47	0.68
1962	1.65	4.12	1.05	0.15	0.01	0.01	0.01	0.00	0.00	0.00	0.42	0.50	0.64
1963	0.65	1.11	1.41	0.70	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.32
1964	0.19	0.31	0.74	0.53	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.42	0.19
1965	0.67	0.06	1.57	1.86	0.09	0.00	0.00	0.00	0.00	0.00	0.00	0.24	0.37
1966	3.30	7.79	3.60	0.90	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.28	1.29
1967	1.67	3.46	4.06	1.61	1.09	0.93	0.77	0.61	0.44	0.28	0.12	0.34	1.27
1968	1.08	5.86	7.64	2.55	3.83	1.78	0.30	0.00	0.00	0.00	0.00	0.06	1.91
1969	0.62	3.91	7.14	1.10	0.42	0.10	0.00	0.00	0.00	0.00	0.00	0.26	1.12
1970	0.57	0.68	0.18	0.10	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.14	0.14
1971	0.68	1.10	2.06	1.99	0.43	0.00	0.00	0.00	0.03	0.16	0.21	0.92	0.63
1972	1.46	2.02	3.73	1.93	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.80
1973	0.42	2.99	4.85	2.87	0.51	0.15	0.00	0.00	0.00	0.08	1.30	1.44	1.21
1974	5.24	13.38	15.57	3.43	1.93	0.82	0.16	0.00	0.00	0.38	0.32	0.80	3.45
1975	2.43	4.01	8.09	3.91	1.58	0.78	0.17	0.00	0.00	0.20	0.10	0.68	1.82
1976	3.10	7.16	11.21	4.38	2.05	0.61	0.11	0.00	0.00	0.00	0.00	0.27	2.39
1977	2.10	4.96	7.82	2.88	1.69	0.74	0.13	0.00	0.00	0.00	0.10	1.13	1.78
1978	1.88	3.98	2.20	0.24	0.00	0.00	0.00	0.00	0.00	0.00	0.22	0.17	0.70
1979	0.26	0.82	1.39	0.15	0.13	0.00	0.00	0.00	0.00	0.03	0.00	0.16	0.24
1980	0.95	5.42	6.89	2.89	1.18	0.21	0.00	0.00	0.00	0.00	0.00	0.52	1.49
1981	1.80	5.53	4.78	1.14	0.20	0.00	0.00	0.00	0.00	0.00	0.10	0.54	1.15

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1982	0.80	2.83	2.19	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.49
1983	0.22	0.44	1.13	1.14	0.12	0.00	0.00	0.00	0.00	0.00	0.12	0.20	0.28
1984	0.78	5.01	9.44	2.77	0.95	0.05	0.00	0.00	0.00	0.00	0.00	0.11	1.58
1985	0.85	1.79	3.43	2.04	0.36	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.70
1986	0.10	0.64	0.36	0.25	0.01	0.00	0.00	0.00	0.00	0.01	0.02		0.13

Average monthly baseflow (ML/d) for G8170065 using RDF 3P method

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1997												3.70	3.70
1998	8.51	15.17	17.36	5.38	2.67	2.69	1.51	0.00	0.00	0.00	2.70	8.88	5.36
1999	13.30	21.10	29.80	18.57	9.73	1.09	0.06	0.00	0.00	0.00	4.60	4.25	8.47
2000	11.78												11.78
2001				0.10	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02
2002	0.06												0.06

Average monthly baseflow (ML/d) for G8170066 using RDF 3P method

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1963											0.14	0.31	0.23
1964	0.71	2.43	4.99	6.54	4.99	5.38	1.67	2.63	1.78	1.60	3.05	5.71	3.46
1965	8.32	7.83	11.26	11.76	8.44	6.54	4.84	3.87	2.99	2.34	0.90	2.91	5.99
1966	5.95	12.11	15.01	9.95	7.33	5.48	4.99	3.78	3.25	4.12	2.11	4.38	6.51
1967	5.78	9.88	20.61	20.70	15.33	11.47	7.44	6.22	5.33	3.12	1.85	7.31	9.58
1968	10.05	20.35	33.61	36.44	29.57	19.65	17.62	12.40	7.59	5.33	4.55	4.94	16.82
1969	10.88	17.57	25.87	14.97	9.65	7.32	6.24	5.11	4.33	2.88	4.93	5.07	9.52
1970	4.47	7.21	6.20	4.76	4.20	3.65	1.31	1.00	0.97	1.17	0.84	1.53	3.08
1971	1.79	3.97	10.19	13.44	9.37	7.28	5.14	3.48	2.47	1.68	2.79	5.73	5.61
1972	9.27	7.42	15.17	17.71	11.67	9.88	6.15	4.21	3.36	2.11	1.66	3.35	7.66
1973	4.87	11.62	20.32	22.73	16.25	14.98	8.18	5.27	3.81	3.04	6.14	7.42	10.36
1974	13.85	37.38	60.62	43.64	25.89	21.85	15.59	10.99	9.29	9.46	9.78	14.43	22.63
1975	23.07	30.47	43.50	36.77	27.83	23.97	14.33	9.63	5.92	10.29	13.87	21.92	21.74
1976	29.85	47.56	58.82	33.36	22.13	18.82	14.92	10.51	7.61	5.71	6.09	8.90	21.94
1977	13.71	22.15	34.37	30.18	18.07	14.68	11.99	9.50	7.50	4.70	5.53	10.19	15.17
1978	12.52	19.76	19.60	10.23	6.65	5.82	5.27	4.39	3.03	0.35	3.85	4.50	7.93
1979	5.46	6.63	6.95	4.75	3.75	2.43	1.67	1.28	0.78	1.08	0.93	0.92	3.03
1980	1.86	5.80	11.74	10.26	6.72	4.87	3.52	2.55	1.22	0.95	1.41	2.14	4.41
1981	3.76	9.96	19.31	14.82	10.57	6.64	4.70	3.56	2.72	3.57	3.58	10.92	7.84
1982	13.18	19.56	14.81	5.55	3.68	3.23	2.91	2.03	1.48	0.75	0.65	2.31	5.77
1983	1.64	2.52	3.65	5.22	4.58	1.96	1.21	1.13	0.78	0.86	1.05	1.65	2.18
1984	2.14	10.02	21.84	15.39	8.38	6.36	4.79	3.79	2.81	1.18	1.39	1.93	6.65
1985	4.20	8.28	14.50	21.12	25.84	27.90	29.67	30.19	29.11	27.23	26.38	23.02	22.36
1986	26.82	29.46	26.88	23.14	18.14	17.03	16.72	15.70	14.72	15.88	14.26	11.51	19.12
1987	13.54	16.65	15.92	13.55	12.82	12.08	11.47	10.29	7.85	7.80	10.64	10.93	11.93

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1988	12.21	13.02	12.73	10.37	8.80	6.61	7.18	4.22	2.70	3.15	5.22	7.41	7.79
1989	11.83	17.82	23.45	17.60	8.61	5.50	4.47	3.54	2.41	2.38	2.90	4.58	8.70
1990	5.11	6.32	6.96	6.45	6.68	3.76	2.57	1.73	1.05	0.52	1.93	3.62	3.88
1991	9.64	22.10	23.89	12.61	7.31	6.13	5.54	3.77	3.34	1.72	3.53	3.94	8.54
1992	5.72	7.41	9.08	8.19	6.52	4.62	3.12	1.08	0.70	0.56	0.64	1.76	4.10
1993	2.66	8.45	12.46	6.78	4.92	4.00	2.77	1.45	0.96	0.47	0.62	2.59	3.98
1994	4.97	6.83	9.96	9.23	6.53	4.37	2.08	1.04	0.60	0.41	0.52	1.95	4.02
1995	4.14	13.37	21.42	18.31	10.35	7.63	5.30	3.23	1.58	5.49	4.45	7.19	8.50
1996	9.65	14.03	18.99	20.83	18.65	8.17	5.15	3.89	1.21	2.69	4.06	7.47	9.55
1997	27.99	59.37	51.83	23.13	17.13	14.67	12.37	8.44	3.88				17.98
1998	0.39	15.27	27.68	26.81	20.44	14.33	9.38	7.45	5.65	4.44	9.82	14.66	13.00
1999	24.29	39.23	56.64	52.93	30.03	24.49	16.63	10.28	7.34	7.19	16.86	14.03	24.87
2000	29.67	43.34	58.06	53.33	25.83	19.13	16.91	11.19	7.28	6.91	6.71	15.91	24.45
2001	20.12	24.24			0.97	2.21	4.51	6.01	5.41	3.58	5.86	6.78	7.46
2002	8.91	11.14	12.93	9.49	7.93	7.32	6.73	5.08	4.00	2.17	3.10	2.70	6.76
2003	3.86	5.81	9.61	10.13	5.87	2.95	1.97	1.29	1.45	0.90	1.48	4.15	4.11
2004	19.63	40.81	48.81	23.60	16.15	13.39	10.28	7.07	4.65	2.50	3.69	6.03	16.31
2005	14.43	20.97	20.02	8.38	4.57	3.08	1.98	1.23				2.52	8.97
2006	6.13	24.23	37.62	49.43	32.52	21.26	18.88	14.27	8.44	5.80	5.26	7.36	19.21
2007	14.61	17.73	26.10	25.08	20.05	14.45	9.45	7.09	5.09	4.16	6.46	6.85	13.06
2008	17.29	29.66	44.66	30.27	22.34	18.86	15.66	9.16	5.99	4.46	4.74	10.45	17.76
2009	18.58	27.11	21.67	10.05	6.68	4.70	3.46	2.41	1.64	1.04			9.69
2013											1.17	2.67	2.30
2014	7.78	25.98	31.13	21.65	16.21	14.55	11.70	8.29	6.14	3.91	3.62	5.87	12.98
2015	12.79	21.00	19.99	10.43	7.84	6.50	5.03	3.51	2.28	1.39	1.38	3.35	7.88
2016	9.48	13.99	15.39	10.59	7.57	3.63	2.68	1.88	1.54	0.99	1.61	3.04	6.01

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2017	10.68	25.66	36.89	28.75	19.41	12.26	8.06	5.68	3.29	2.97	5.36	5.42	13.62
2018	11.45	31.69	37.41	21.53	13.21	11.00	9.11	6.94	5.01	3.10	7.31	8.46	13.73
2019	9.74	14.56	16.58	14.25	9.94	7.83	6.73	4.67	2.42	1.28	1.64	3.81	7.74
2020	5.25	8.32	16.22	21.17	18.44	14.90	9.59	6.45	4.06	3.35	1.72	6.51	9.66
2021	17.34	32.22	41.86	24.84	16.40	14.36	9.47	6.50	3.90	2.28	2.94	3.40	14.52
2022	12.80	24.93	30.89	23.62	17.72	11.03	8.56	6.09	4.14	4.73	5.54	6.63	12.98
2023	27.53	53.47	66.73	47.51	27.10	23.39	15.77	9.44	6.40	4.70	3.43	7.06	24.18
2024	12.47	36.68	52.83	37.37									34.79

Average monthly baseflow (ML/d) for G8170076 using RDF 3P method

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1963											0.00	0.00	0.00
1964	0.04	0.91	1.79	2.35	1.61	0.00	0.00	0.00	0.00	0.00	0.07	0.83	0.63
1965	0.99	0.52	2.09	1.21	0.49	0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.46
1966	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.10	4.05	8.99	8.23	9.13	7.45	1.73	0.20	0.00	0.00	0.00	0.12	3.32
1969	0.89	6.10	8.51	3.83	0.63	0.00	0.00	0.00	0.00	0.00	0.00	0.39	1.67
1970	0.74	3.27	2.27	0.80	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.61	0.62
1971	0.96	4.19	7.37	8.17	3.54	0.33	0.00	0.00	0.00	0.00	0.00	2.32	2.23
1972	4.55	4.12	8.99	8.82	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.27
1973	2.95	8.32	12.84	10.36	1.45	1.13	0.00	0.00	0.00	0.00	3.51	1.90	3.50
1974	11.97	24.19	33.07	34.03	9.69	3.27	21.54	0.69	0.00	0.00	0.00	1.56	11.59
1975	14.02	20.05	26.27	23.47	6.60	3.26	1.18	0.00	0.00	2.43	1.69	10.80	9.08
1976	16.08	21.42	22.76	10.80	4.08	2.34	1.23	0.00	0.00	0.00	0.00	0.88	6.59
1977	3.56	9.15	12.66	9.60	4.29	2.29	0.00	0.00	0.00	0.00	0.00	2.31	3.62
1978	4.43	7.89	6.52	3.09	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.33	1.83
1979	2.36	4.42	5.77	3.20	0.71	0.00	0.00	0.00	0.00	0.00	0.00	1.30	1.46
1980	2.79	6.36	8.57	7.60	4.43	1.20	0.00	0.00	0.00	0.00	0.00	1.61	2.70
1981	5.03	8.87	6.44	0.50	0.05	0.00	0.00	0.00					2.60

Average monthly baseflow (ML/d) for G8170085 using RDF 3P method

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1963	0.14	0.84	2.15	2.55	0.71	0.13	0.00	0.00	0.00	0.00	0.02	0.11	0.55
1964	0.26	0.39	0.59	1.14	0.46	0.01	0.00	0.00	0.00	0.00	0.05	0.34	0.27
1965	0.52	0.40	1.62	2.83	1.95	0.16	0.00	0.00	0.00	0.00	0.00	0.48	0.66
1966	2.88	5.17	2.98	0.48	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.95
1967	0.07	0.00	0.00	0.04	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03
1968	0.06	2.42	5.84	5.43	4.92	3.03	0.59	0.00	0.00	0.00	0.00	0.13	1.86
1969	1.44	4.37	7.13	2.23	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.27
1970	0.07	0.33	0.37	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.08	1.14	0.17
1971	0.72	3.14	6.52	7.17	3.12	1.39	0.00	0.00	0.00	0.00	0.10	2.00	2.00
1972	3.39	3.60	5.64	4.53	2.00	0.87	0.01	0.00	0.00	0.00	0.00	0.01	1.66
1973	0.34	2.49	5.08	4.39	2.04	0.72	0.00	0.00	0.00	0.00	0.00	0.07	1.25
1974	2.03	3.46	7.43	5.68	3.11	0.85	0.04	0.00	0.00	0.00	0.12	1.65	2.02
1975	5.38	8.96	12.02	5.31	2.83	1.47	0.05	0.00	0.00	0.04	0.31	0.95	3.08
1976	2.78	6.41	8.80	4.24	2.21	0.77	0.01	0.00	0.00	0.00	0.00	0.13	2.10
1977	1.22	3.30	6.63	6.15	3.04	1.45	0.00	0.00	0.00	0.00	0.14	1.27	1.92
1978	1.70	4.12	5.72	3.29	0.73	0.06	0.00	0.00	0.00	0.00	0.26	0.17	1.32
1979	0.45	0.72	1.06	0.68	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.24
1980	0.29	1.09	2.83	3.48	1.92	0.72	0.00	0.00	0.00	0.00	0.02	0.36	0.89
1981	0.72	2.64	4.79	2.53	1.18	0.10	0.00	0.00	0.00	0.09	0.03	0.74	1.06
1982	1.20	3.52	3.85	0.82	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.78
1983	0.00	0.00	0.19	0.67	0.40	0.00	0.00	0.00	0.00	0.00	0.04	0.12	0.12
1984	0.18	1.24	4.04	2.68	0.45	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.72
1985	0.05	0.35	0.69	0.57	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.06	0.17
1986	0.21	1.07	1.28	0.63	0.01	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.26
1987	0.13	1.11	1.86	0.85	0.11	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.34
1988	0.84	1.78	2.70	2.66	0.95	0.00	0.00	0.00	0.00	0.02	0.03	0.84	0.81

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1989	2.13	4.26	6.73	5.22	1.47	0.43	0.14	0.00	0.00	0.02	0.00	0.11	1.69
1990	0.58	0.32	0.43	0.51	0.55	0.01	0.00	0.00	0.00	0.00	0.01	0.19	0.22
1991	1.20	4.20	5.27	2.12	0.39	0.04	0.00	0.00	0.00	0.00	0.00	0.00	1.08
1992	0.05	0.10	0.27	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05
1993	0.02	0.93	1.85	0.90	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.32
1994	0.71	1.75	2.85	2.16	0.20	0.00	0.00	0.00	0.00	0.00	0.02	0.32	0.66
1995	2.59	7.90	10.69	5.87	2.87	1.22	0.00	0.00	0.00	0.00	0.14	1.60	2.71
1996	3.98	6.58	8.60	7.88	5.30	2.16	0.00	0.00	0.00	0.06	0.13	0.80	2.94
1997	6.36	12.42	8.43	3.40	2.53	0.29	0.00	0.00	0.00	0.00	0.02	0.83	2.80
1998	2.69	5.83	6.73	4.58	1.73	0.01	0.00	0.00	0.00	0.15	0.29	2.45	2.02
1999	9.31	15.20	18.01	10.49	4.94	3.81	0.41	0.00	0.00	0.00	0.90	2.16	5.37
2000	4.44	8.36	12.64	10.84	4.62	3.40	0.85	0.01	0.00	0.01	0.28	2.35	3.96
2001	3.83	6.97	9.56	6.31	3.41	1.48	0.01	0.00	0.00	0.00	0.77	1.79	2.82
2002	2.54	3.99	8.17	8.26	1.81	0.01	0.00	0.00	0.00	0.00	0.00	0.46	2.09
2003	1.65	5.03	6.31	3.80	2.36	0.00	0.00	0.00	0.00	0.00	0.30	1.23	1.71
2004	6.24	11.47	13.35	5.85	3.05	1.31	0.03	0.00	0.00	0.03	0.00	0.28	3.44
2005	2.79	4.81	4.78	2.60	0.79	0.00	0.00	0.00	0.00	0.00	0.03	0.36	1.33
2006	1.21	5.01	8.72	12.18	5.92	3.44	1.90	0.00	0.00	0.00	0.00	0.14	3.19
2007	0.72	2.40	5.99	8.15	4.63	0.54	0.00	0.00	0.00	0.17	0.85	0.57	1.99
2008	3.44	7.17	9.60	4.73	2.53	0.51	0.00	0.00	0.00	0.12	0.08	1.50	2.46
2009	3.63	6.07	5.16	2.33	1.38	0.03	0.00	0.00	0.02	0.00	0.02	0.83	1.60
2010	3.07	5.47	6.17	4.64	3.22	0.08	0.00	0.00	0.00	0.30	0.23	0.94	1.99
2011	2.50	9.24	16.22	10.93	3.81	2.78	0.54	0.05	0.00	0.23	0.64	1.18	3.97
2012	2.92	5.59	7.46	3.52	1.51	0.81	0.12	0.01	0.00	0.00	0.00	0.25	1.84
2013	0.89	1.53	2.73	3.46	2.76	0.46	0.00	0.00	0.00	0.04	0.29	0.32	1.04
2014	1.34	5.36	6.46	4.68	2.45	1.29	0.01	0.00	0.00	0.00	0.07	0.11	1.79
2015	1.60	3.81	5.11	3.30	1.50	0.21	0.00	0.00	0.00	0.00	0.03	0.69	1.34

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2016	3.06	5.20	5.91	3.82	2.66	0.06	0.21	0.00	0.37	0.29	0.52	1.06	1.92
2017	4.52	9.17	11.82	6.63	3.12	1.43	0.10	0.00	0.00	0.00	0.41	0.60	3.11
2018	1.90	5.34	5.21	1.46	0.47	0.06	0.00	0.00	0.00	0.00	0.18	0.33	1.22
2019	0.76	1.78	2.39	1.65	0.36	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.57
2020	0.22	0.76	2.11	2.38	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.54
2021	1.73	5.60	8.51	4.34	2.36	0.21	0.00	0.00	0.00	0.00	0.24	0.54	1.94
2022	3.17	7.01	8.50	4.80	2.83	0.34	0.01	0.00	0.00	0.79	0.90	1.78	2.49
2023	5.78	9.85	11.99	7.67	3.89	1.61	0.05	0.00	0.00	0.00	0.28	1.74	3.53
2024	3.19	8.87	11.73	6.32									7.52

Average monthly baseflow (ML/d) for G8170089 using RDF 3P method

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1963											0.00	0.00	0.00
1964	0.05	0.33	0.80	0.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.14
1965	0.15	0.05	0.45	0.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.06
1966	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1967	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1968	0.06	1.11	2.19	0.63	1.88	1.27	0.04	0.03	0.02	0.02	0.01	0.00	0.60
1969	0.84	2.38	2.77	0.15									1.52

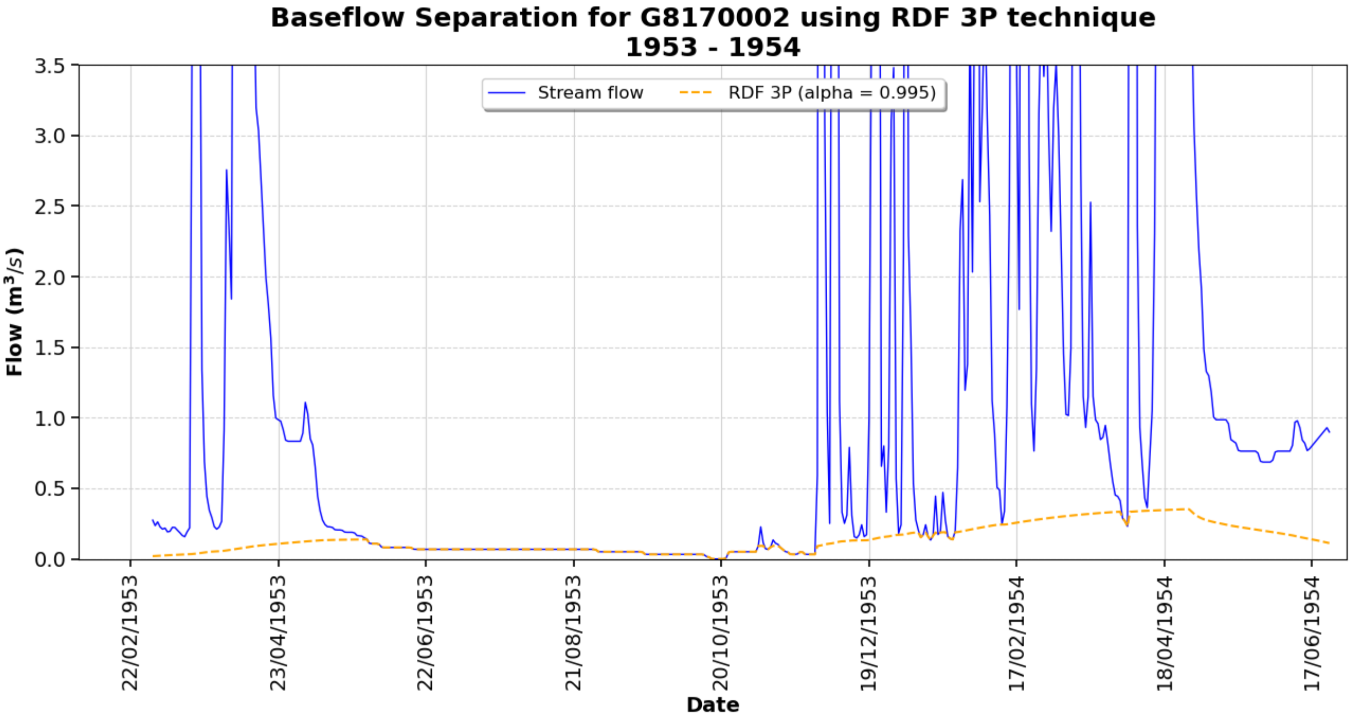
Average monthly baseflow (ML/d) for G8170094 using RDF 3P method

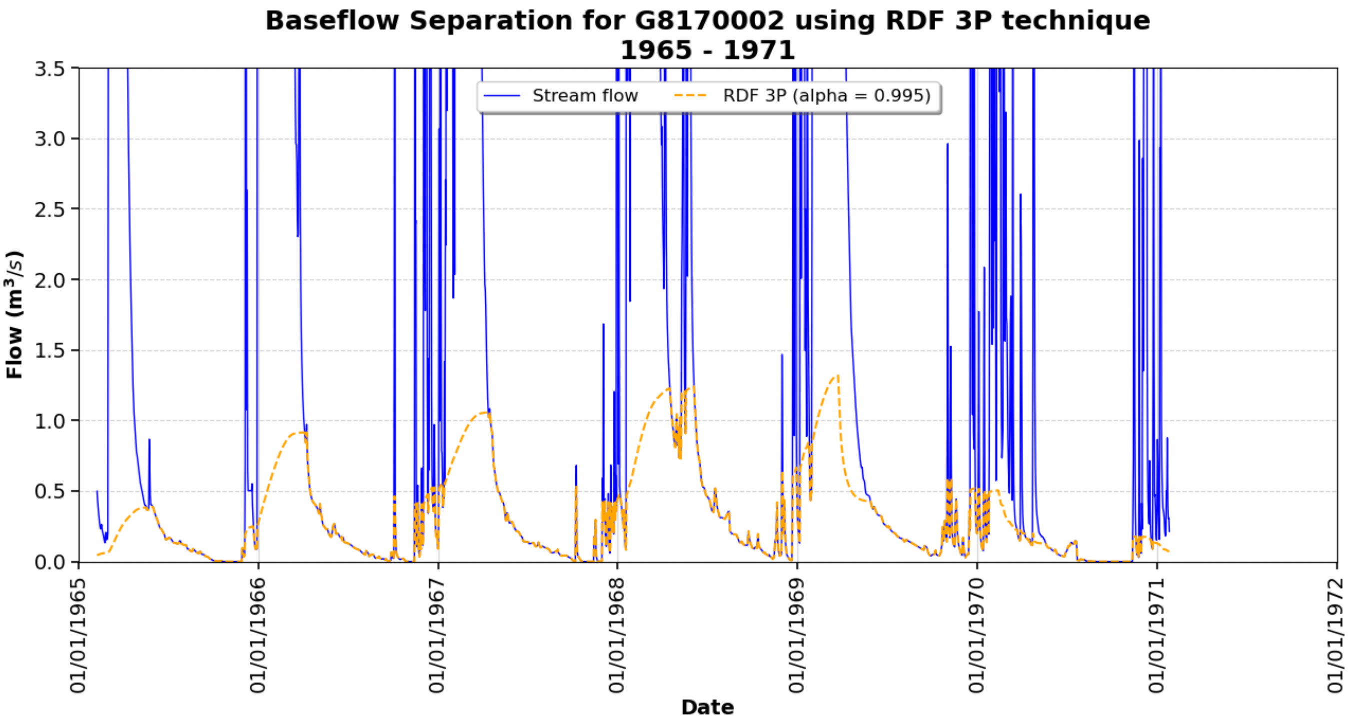
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
2004											0.17	0.42	0.32
2005	5.10	12.72	18.43	21.41	19.55	12.91	8.30	2.69	1.37	3.89	13.09	16.72	11.33
2006	23.36	35.98	45.53	55.88	60.00	55.53	40.33	26.34	17.07	4.69	3.14	8.44	31.30
2007	36.29	46.16	56.18	57.06	26.81	13.27	6.34	2.47	1.51	1.41	4.27	15.31	22.10
2008	36.62	50.05	60.69	44.08	17.29	6.63	2.28	1.59	1.28	0.96	1.71	15.92	19.83
2009	35.78	45.78	48.38	37.40	17.57	10.94	6.56	3.89	1.46	1.01	1.66	17.31	18.82
2010	32.31	42.78	48.57	49.89	39.03	24.89	10.43	4.95	0.54	1.02	0.65	10.33	21.98
2011	37.72	55.15	67.62	51.09	19.38	5.40	2.01	1.42	1.14	0.94	7.57	2.54	20.77
2012	9.78	30.04	36.78	38.16	29.81	25.78	23.29	21.09	19.77	21.32	23.33	29.19	25.66
2013	30.10	34.77	40.52	43.88	44.14	29.00	15.89	12.91	5.16	4.88	23.16	34.24	26.50
2014	37.67	46.11	38.35	32.65	18.11	9.58	5.81	3.02	1.91	1.17	0.98	15.58	17.41
2015	25.77	31.72	34.72	32.42	21.08	14.88	9.70	2.15	0.97	0.76	7.27	17.85	16.51
2016	28.25	36.59	41.68	38.66	24.54	12.28	8.38	3.05	2.44	1.17	10.65	26.56	19.47
2017	40.73	52.93	58.53	52.73	37.21	20.96	16.19	9.18	2.66	1.54	2.49	10.77	25.33
2018	26.15	39.18	38.59	27.19	24.41	20.56	9.64	2.84	1.41	0.92	9.97	10.81	17.49
2019	19.32	22.37	23.25	20.29	17.55	15.02	3.81	0.89	0.00	0.14	4.06	6.32	11.01
2020	12.85	16.33	19.74	21.90	20.78	13.59	3.59	0.72	0.98	11.64	8.93	18.48	12.45
2021	25.19	31.15	34.62	30.60	23.00	12.57	5.19	1.66	0.97	0.95	4.92	7.53	14.76
2022	20.27	26.67	30.82	32.45	21.13	12.19	9.97	3.00	1.17	11.95	18.30	18.82	17.17
2023	33.44	43.28	49.48	51.94	38.26	27.97	21.27	11.29	1.80	1.08	13.16	16.86	25.70
2024	28.75	46.85	52.63	23.43	14.06	9.04	5.57	3.14					22.79

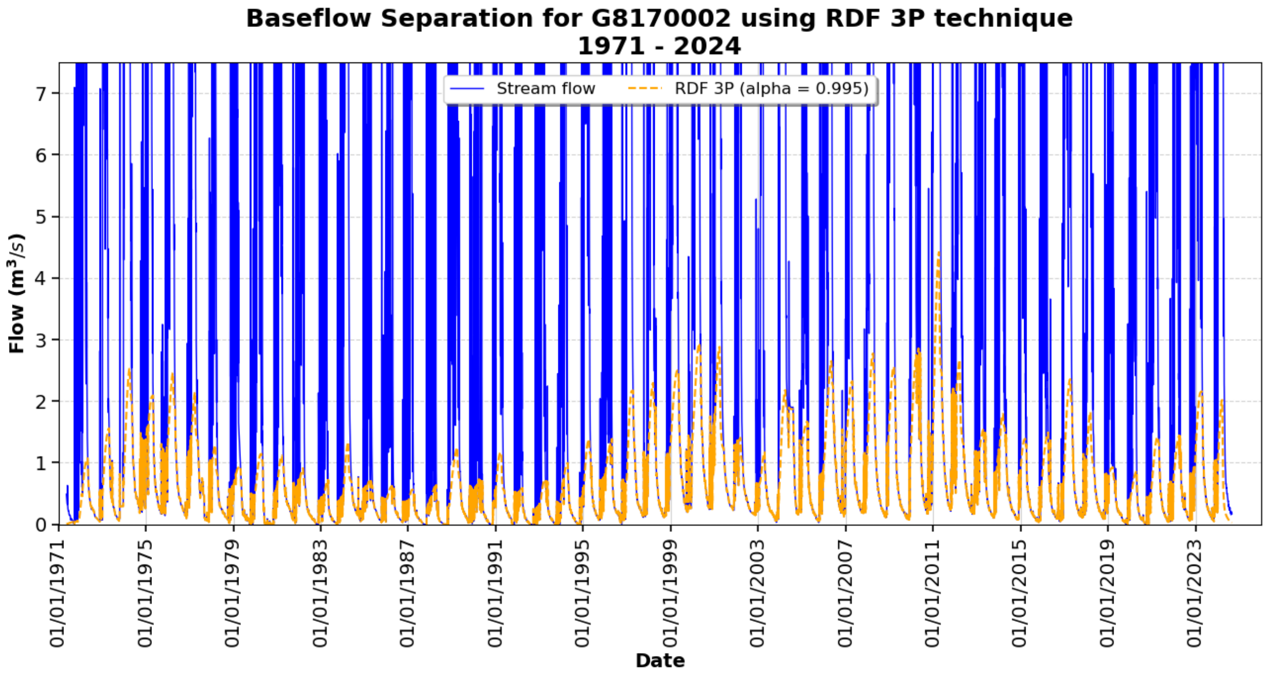
Average monthly baseflow (ML/d) for G8170240 using RDF 3P method

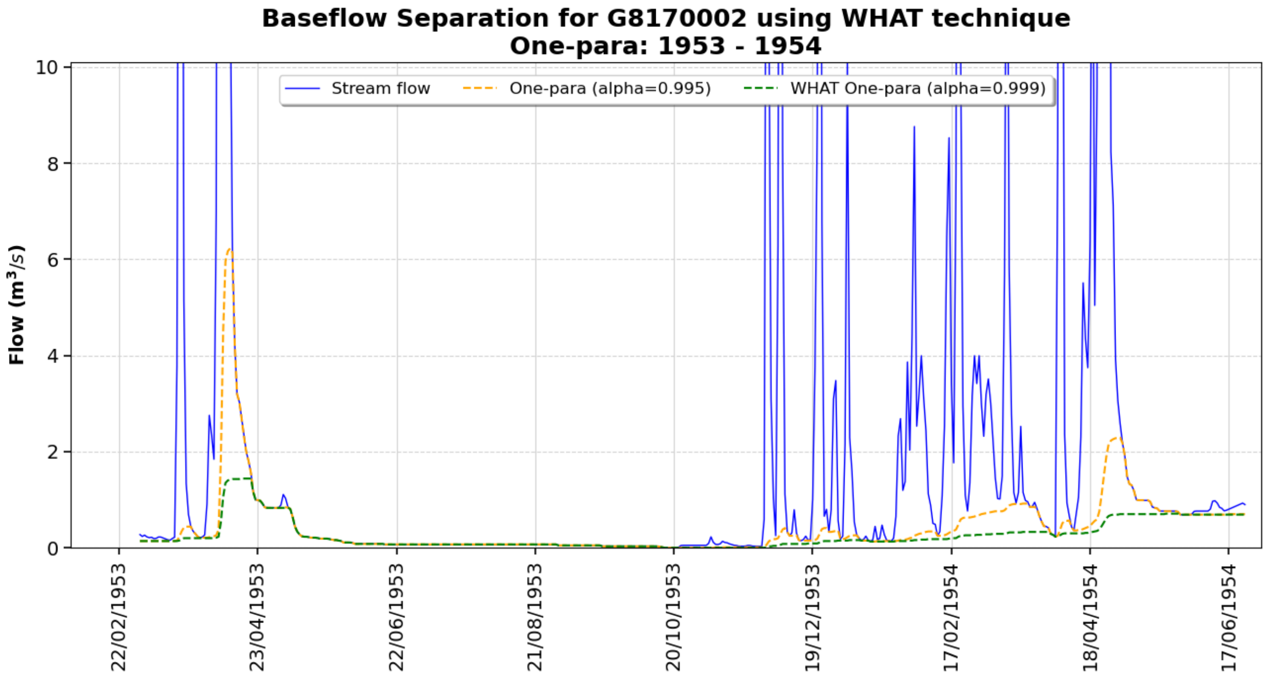
Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1967											0.02	0.03	0.03
1968	0.12	11.24	27.52	12.21	27.88	19.20	3.09	0.00	0.00	0.00	0.51	6.31	9.01
1969	14.50	33.23	47.68	33.37	7.59	0.01	0.00	0.00	0.00	2.36	1.66	6.45	12.10
1970	13.66	26.45	24.42	16.32	3.61	0.00	0.00	0.00	0.00	0.00	7.78	14.51	8.78
1971	15.80	34.80	49.47	54.47	9.24	0.19	0.07	0.00	0.00	0.00	2.47	18.77	15.29
1972	29.42	30.51	45.32	22.64	1.45	0.03	0.00						18.44
1973			1.67	4.70	3.97	0.09	0.00	0.00	0.00	0.43	3.34	6.26	2.08
1974	17.73	53.36	86.55	99.45	53.67	12.93	1.72	0.00	0.88	7.63	12.75	22.48	30.57
1975	63.71	75.90	100.45	103.14	24.17	7.39	0.98	0.00	0.00	4.37	24.19	39.93	36.74
1976	77.46	99.43	102.18	21.26	4.80	1.60	0.30	0.00	0.00	0.15	0.06		27.77
1977												5.19	5.19
1978	13.69	31.89	46.67	28.83	3.14	0.07	0.00	0.00	0.00	0.00	16.86	27.06	13.90
1979	54.92	96.92	127.65	125.66	26.62	0.00	0.00	0.00	0.00	0.00	0.00	5.64	36.01
1980	56.80	78.09	87.87	67.52	26.60	1.41	0.00	0.00	0.00	0.00	0.00	17.01	27.79
1981	33.55	47.18	38.95	4.03	0.69	0.00	0.00	0.00	0.00	0.00	0.34		11.41
1982		35.86	54.01	48.29	14.84	0.12	0.00	0.00	0.00	0.00	0.00	9.77	14.26
1983	14.08	28.22	42.41	47.86	17.16	0.05	0.00	0.00	0.00	0.00	0.93	2.86	12.68
1984	21.13	52.92	97.18	125.80	103.31	33.64	0.00	0.00	0.00	0.00	0.00	13.23	37.15
1985	37.05	50.54	46.83	37.64	31.31	0.69	0.00	0.00	0.00	0.00	11.79	3.98	18.12
1986	22.98	25.96	11.46	6.02	0.05	0.00	0.00	0.00	0.00	0.00			6.52

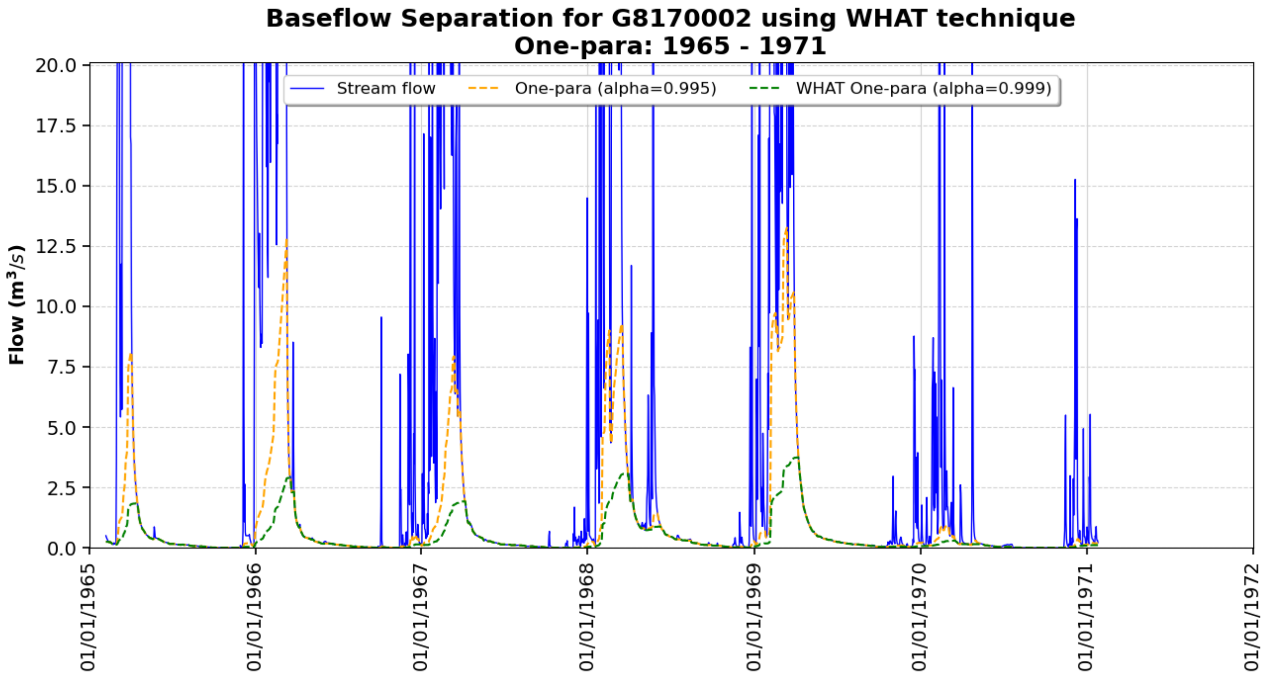
Appendix B: Baseflow separation hydrographs for G8170002

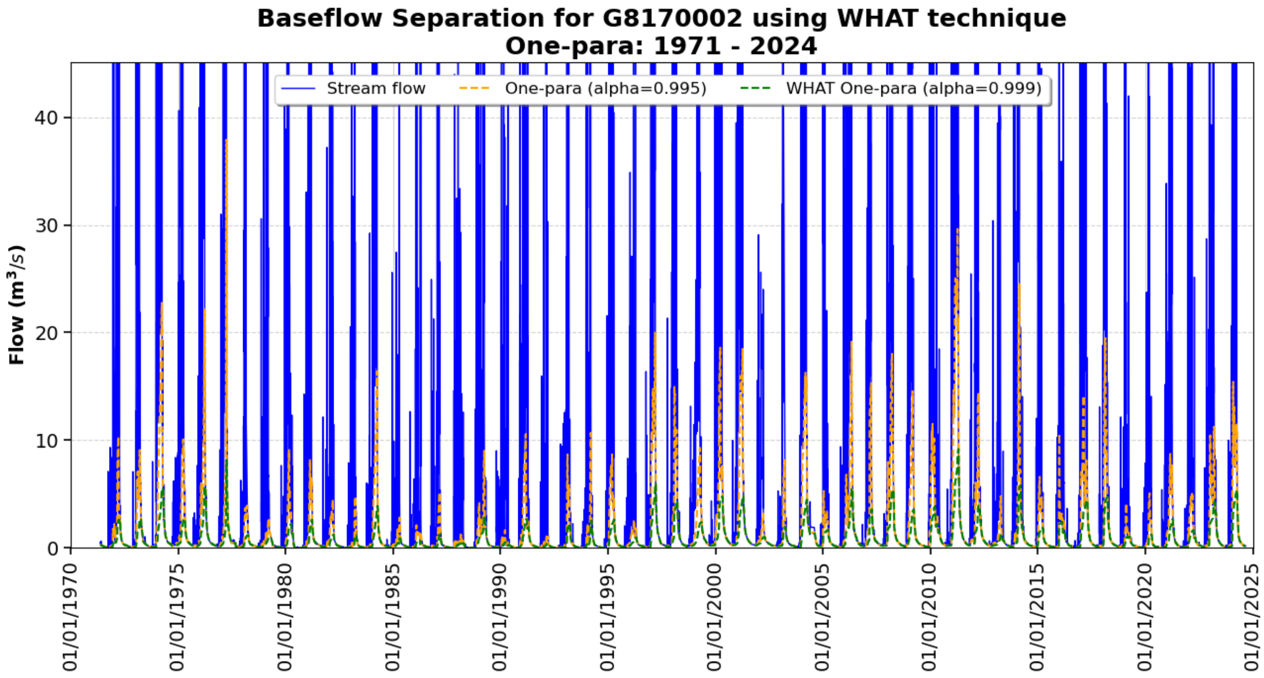


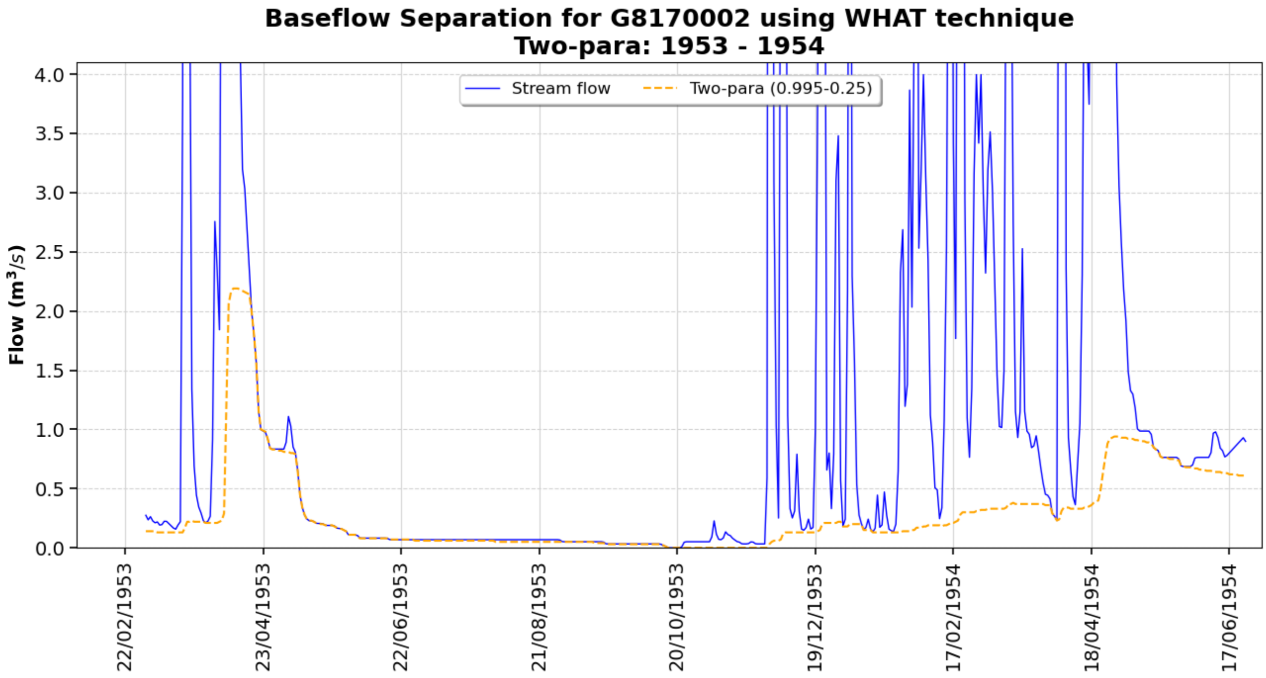


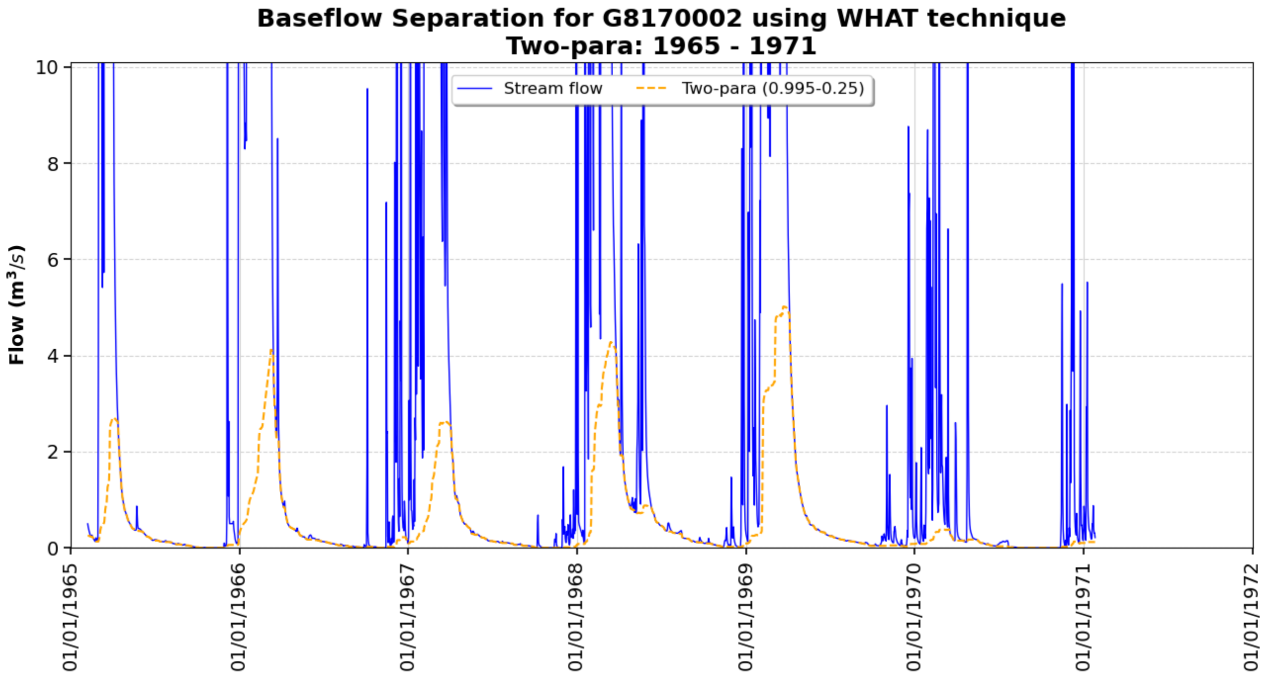

Baseflow Separation for G8170002 using RDF 3P technique
1971 - 2024
Stream flow
RDF 3P (alpha = 0.995)
Flow (m³/s)
Date
01/01/1971
01/01/1975
01/01/1979
01/01/1983
01/01/1987
01/01/1991
01/01/1995
01/01/1999
01/01/2003
01/01/2007
01/01/2011
01/01/2015
01/01/2019
01/01/2023

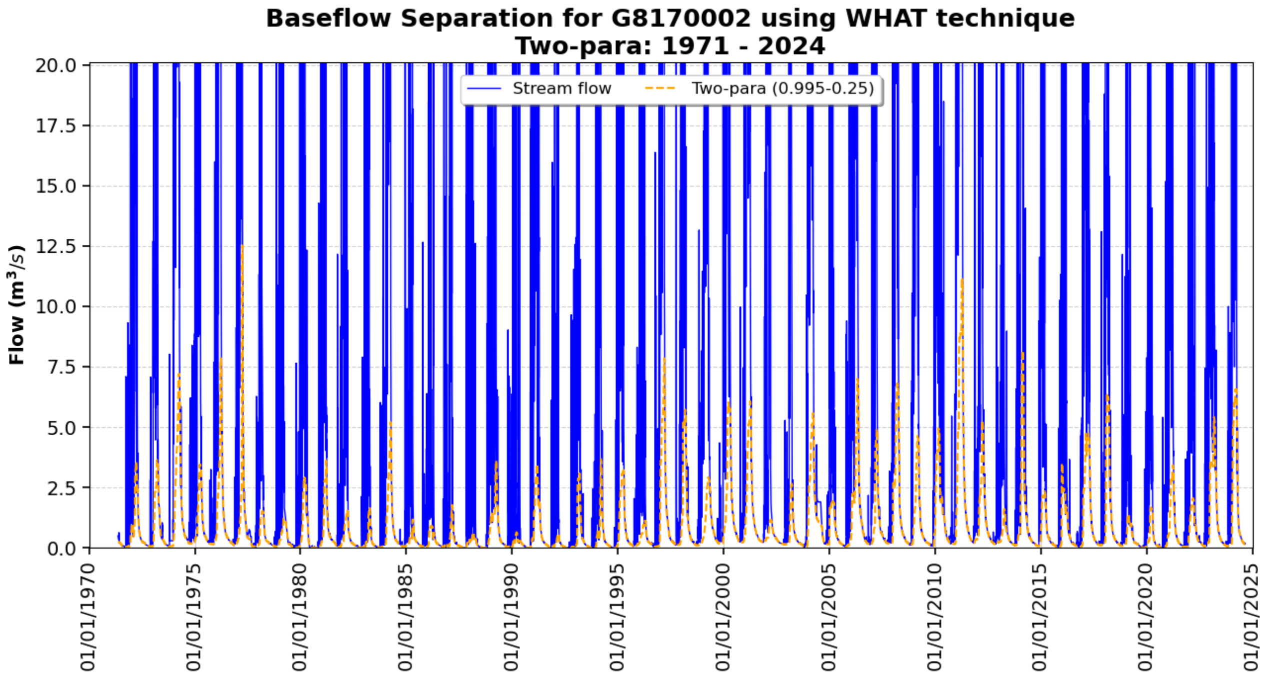

Baseflow Separation for G8170002 using WHAT technique
One-para: 1953 - 1954
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.999)
Flow (m³/s)
22/02/1953
23/04/1953
22/06/1953
21/08/1953
20/10/1953
19/12/1953
17/02/1954
18/04/1954
17/06/1954

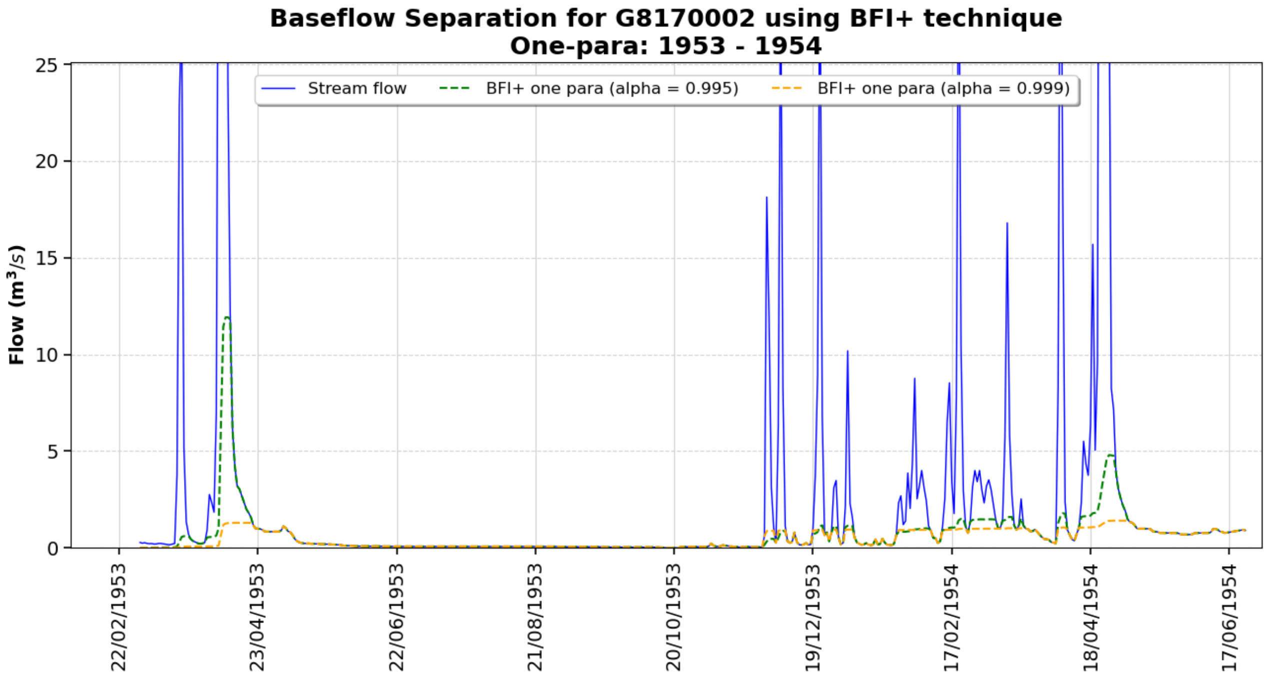

Baseflow Separation for G8170002 using WHAT technique
One-para: 1965 - 1971
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.999)
Flow (m³/s)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972

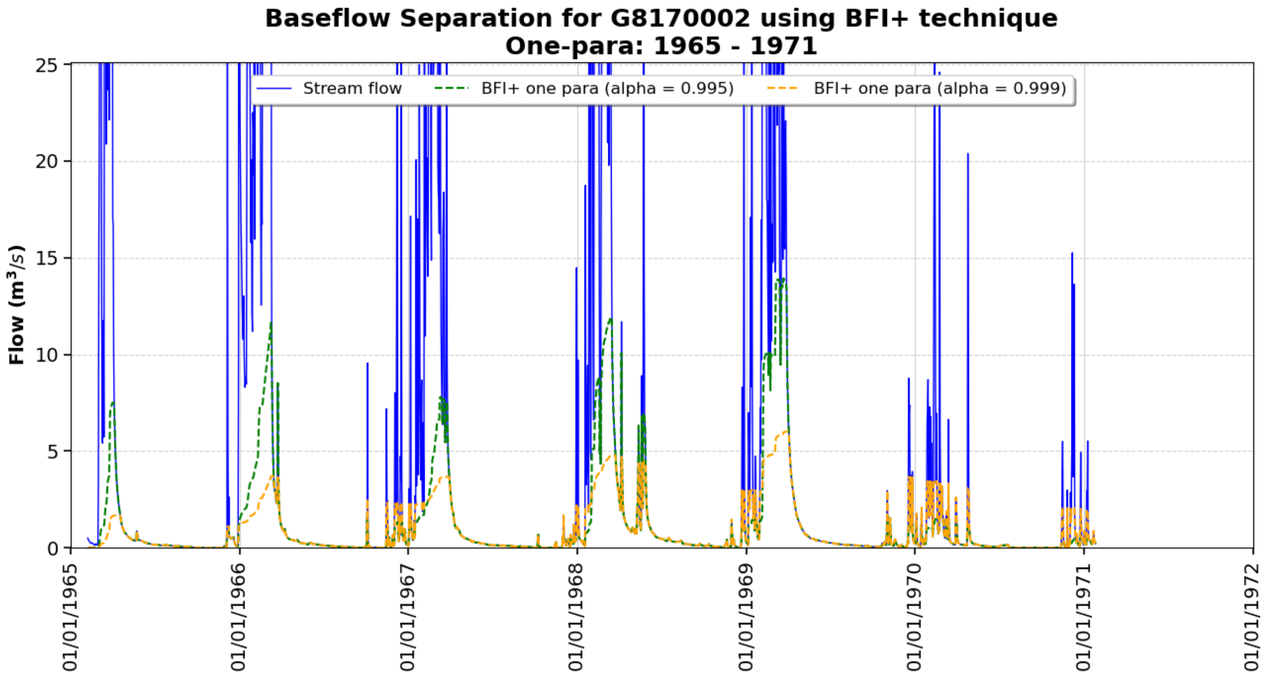

Baseflow Separation for G8170002 using WHAT technique
One-para: 1971 - 2024
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.999)
Flow (m³/s)
0
10
20
30
40
01/01/1970
01/01/1975
01/01/1980
01/01/1985
01/01/1990
01/01/1995
01/01/2000
01/01/2005
01/01/2010
01/01/2015
01/01/2020
01/01/2025

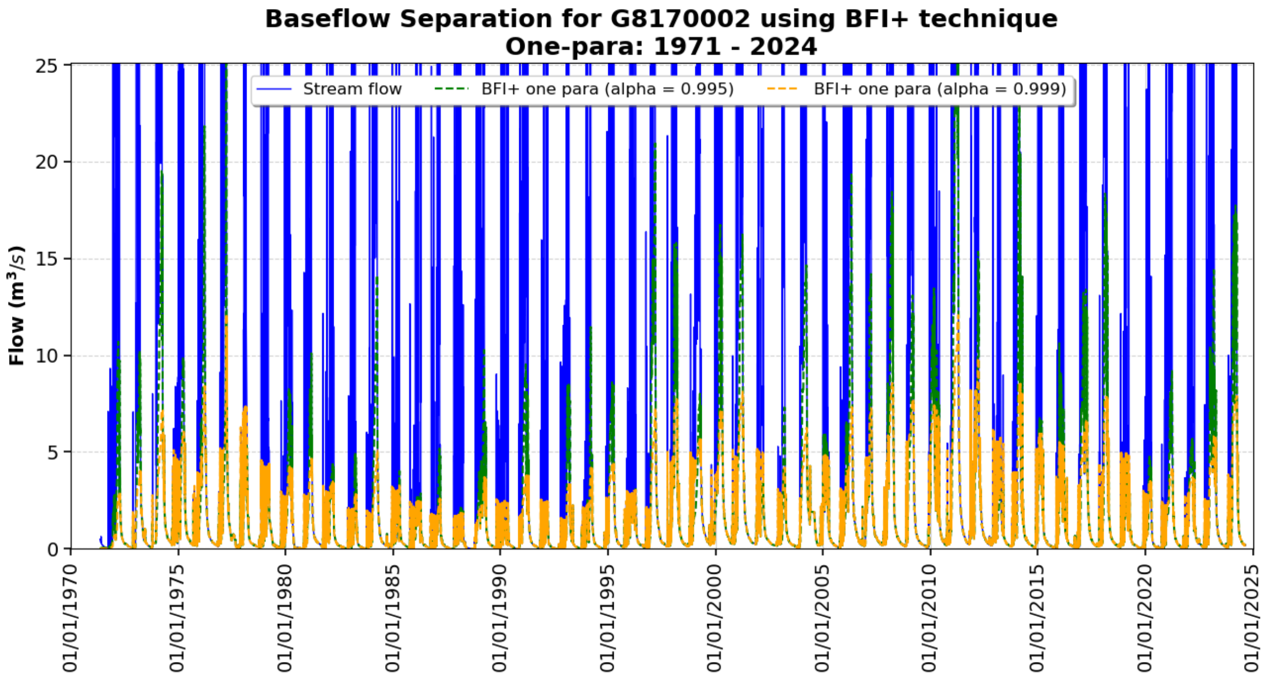

Baseflow Separation for G8170002 using WHAT technique
Two-para: 1953 - 1954
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
22/02/1953
23/04/1953
22/06/1953
21/08/1953
20/10/1953
19/12/1953
17/02/1954
18/04/1954
17/06/1954

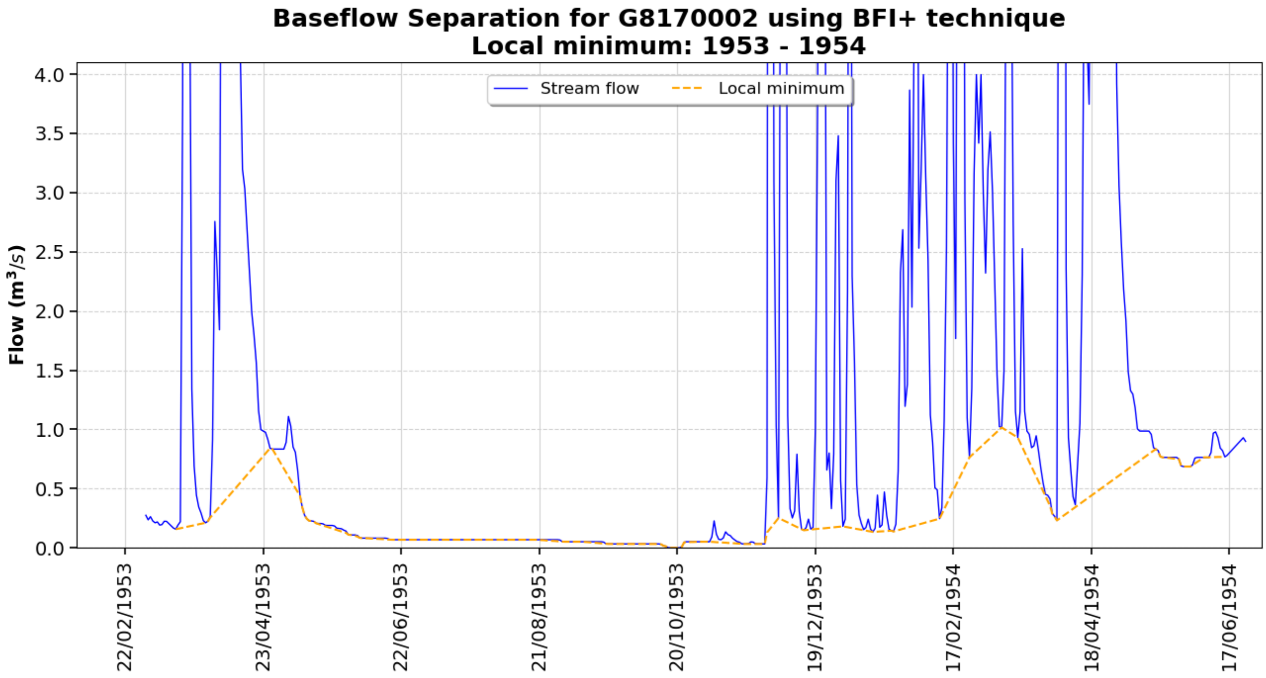

Baseflow Separation for G8170002 using WHAT technique
Two-para: 1965 - 1971
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
10
8
6
4
2
0
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972

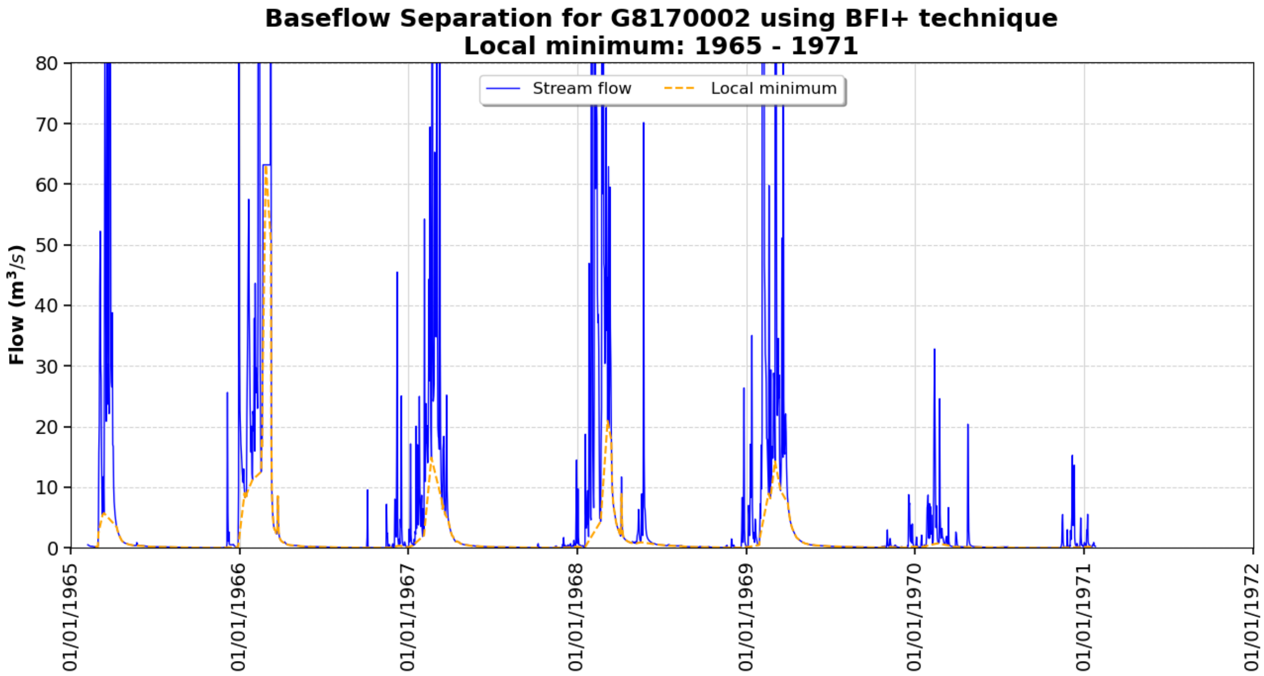

Baseflow Separation for G8170002 using WHAT technique
Two-para: 1971 - 2024
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1970
01/01/1975
01/01/1980
01/01/1985
01/01/1990
01/01/1995
01/01/2000
01/01/2005
01/01/2010
01/01/2015
01/01/2020
01/01/2025

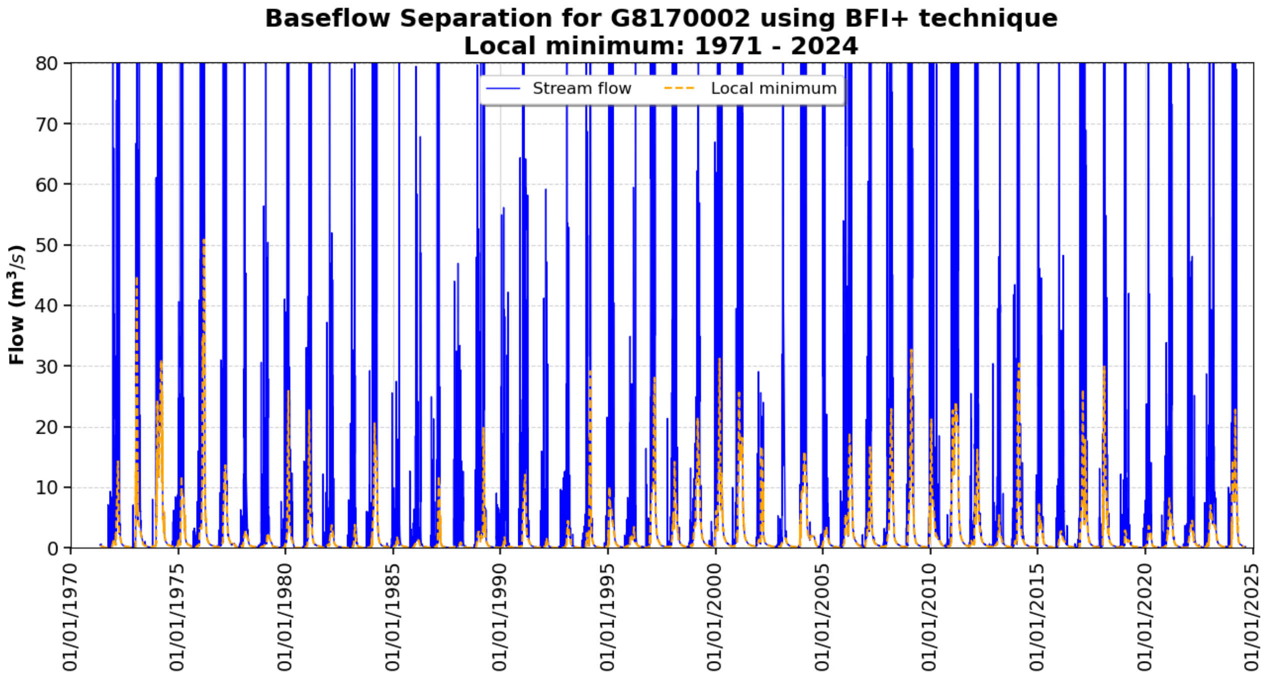

Baseflow Separation for G8170002 using BFI+ technique
One-para: 1953 - 1954
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
25
20
15
10
5
0
22/02/1953
23/04/1953
22/06/1953
21/08/1953
20/10/1953
19/12/1953
17/02/1954
18/04/1954
17/06/1954

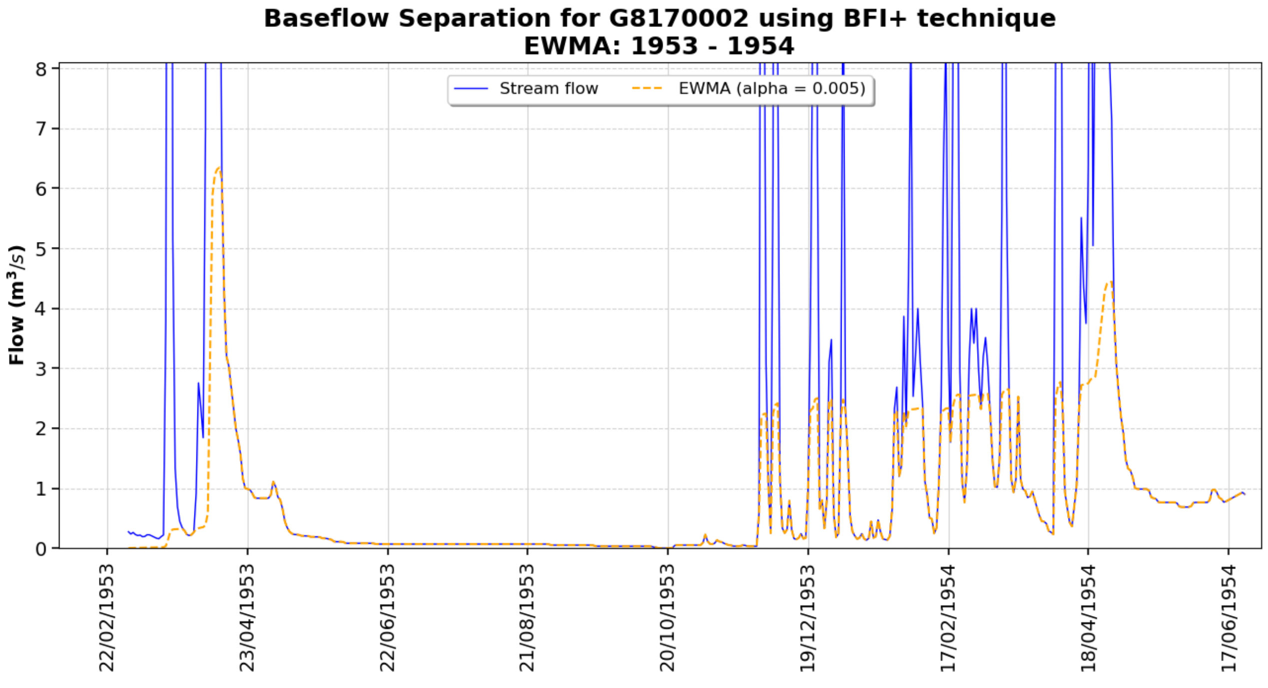

Baseflow Separation for G8170002 using BFI+ technique
One-para: 1965 - 1971
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
0
5
10
15
20
25
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972

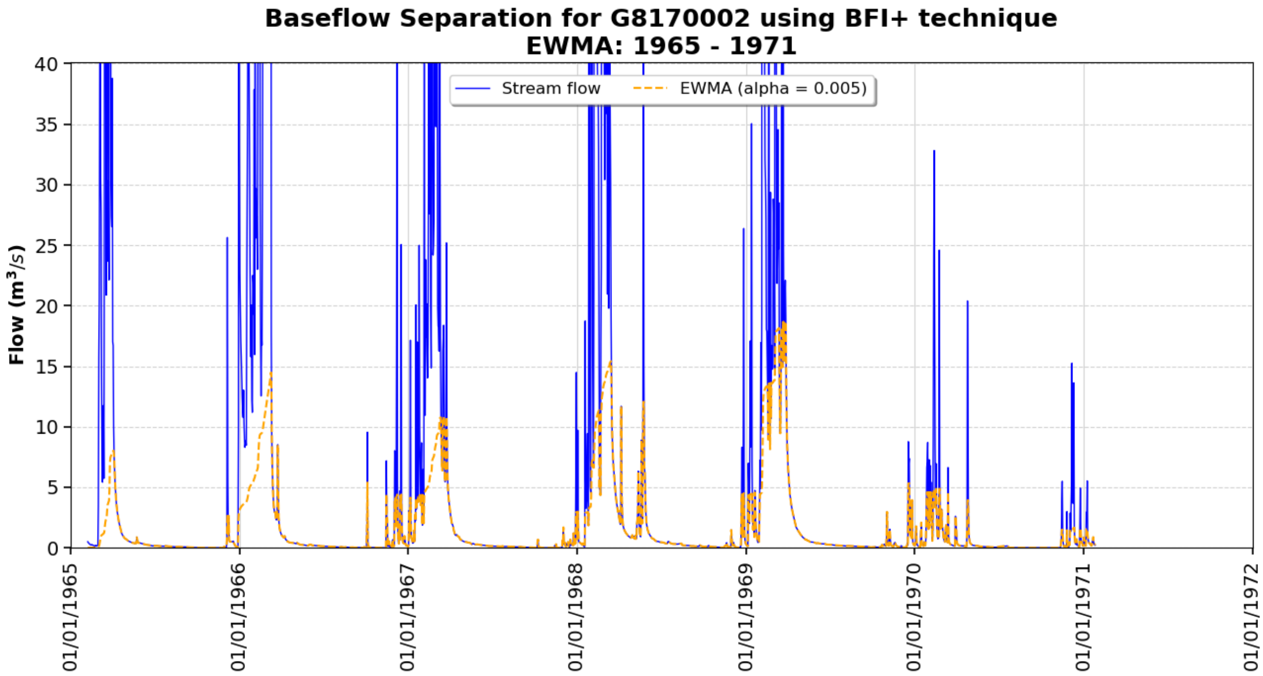

Baseflow Separation for G8170002 using BFI+ technique
One-para: 1971 - 2024
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
0
5
10
15
20
25
01/01/1970
01/01/1975
01/01/1980
01/01/1985
01/01/1990
01/01/1995
01/01/2000
01/01/2005
01/01/2010
01/01/2015
01/01/2020
01/01/2025

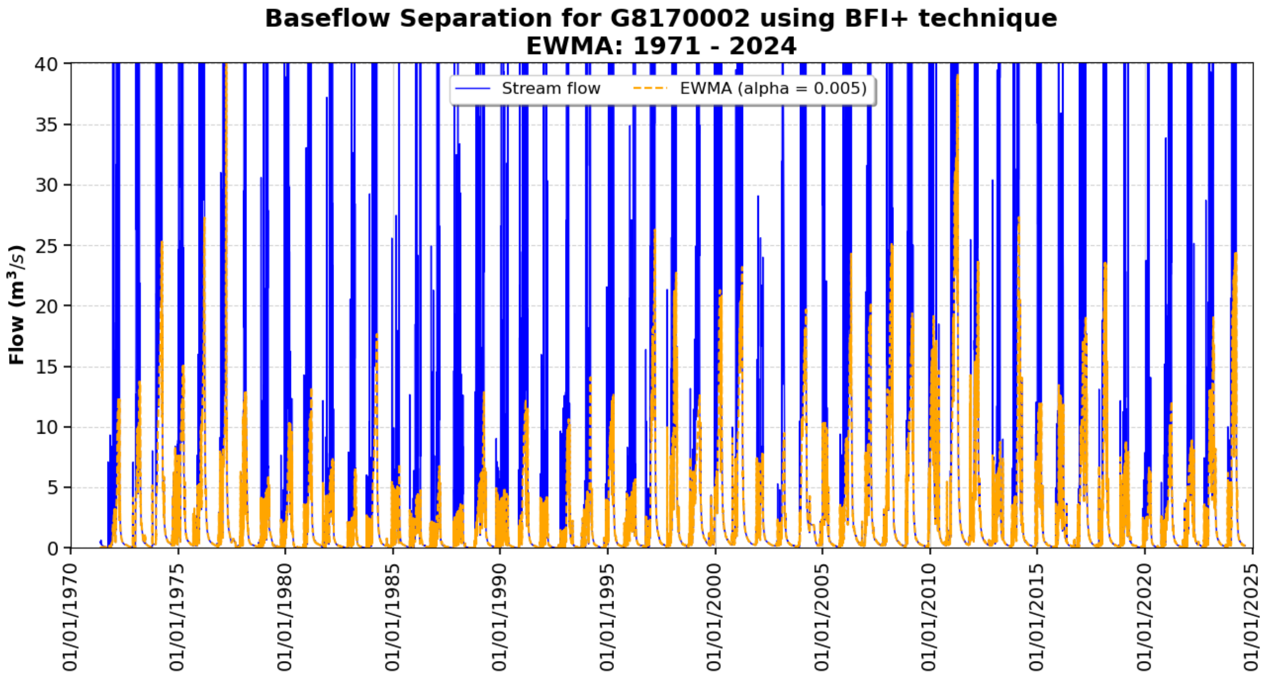

Baseflow Separation for G8170002 using BFI+ technique
Local minimum: 1953 - 1954
Flow (m³/s)
Stream flow
Local minimum
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
22/02/1953
23/04/1953
22/06/1953
21/08/1953
20/10/1953
19/12/1953
17/02/1954
18/04/1954
17/06/1954

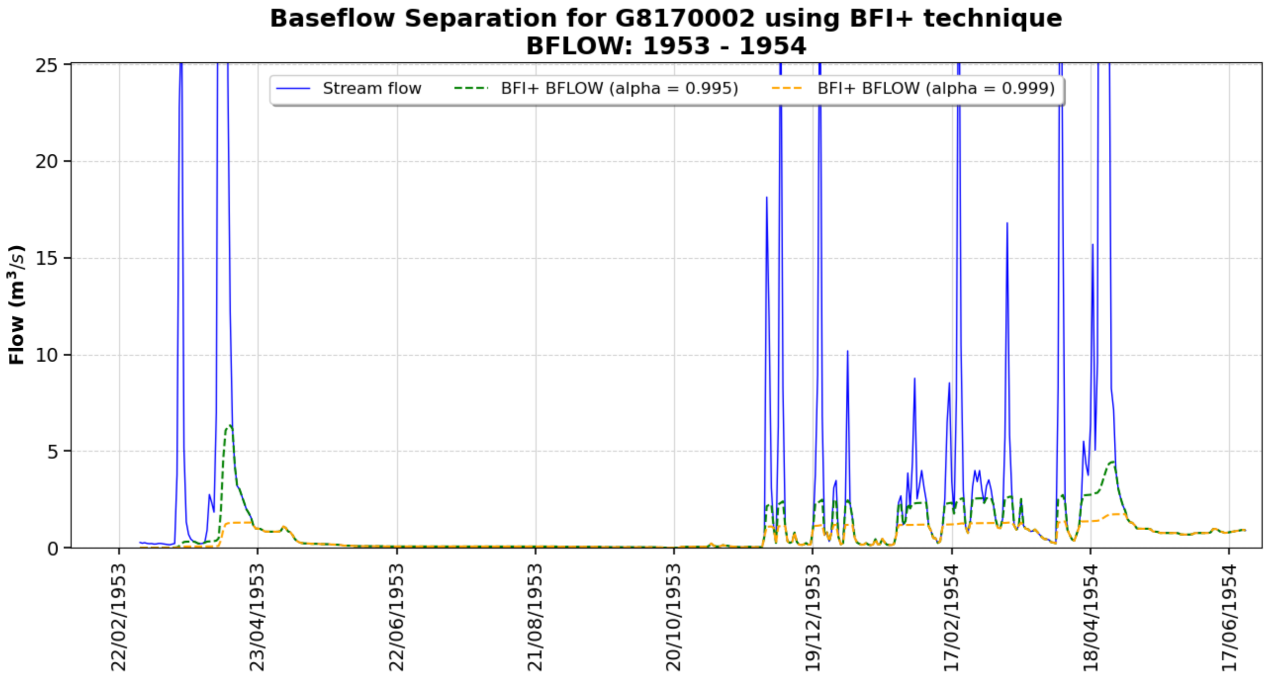

Baseflow Separation for G8170002 using BFI+ technique
Local minimum: 1965 - 1971
Flow (m³/s)
Stream flow
Local minimum
0
10
20
30
40
50
60
70
80
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972

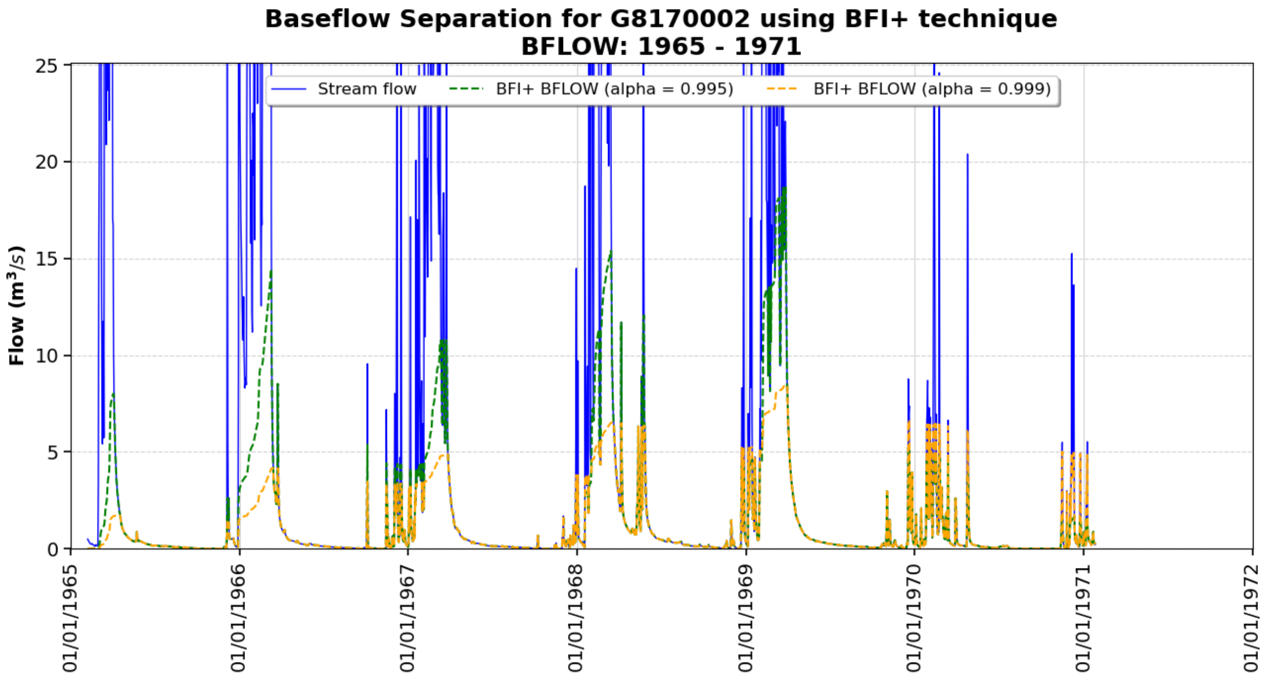

Baseflow Separation for G8170002 using BFI+ technique
Local minimum: 1971 - 2024
Stream flow
Local minimum
Flow (m³/s)
0
10
20
30
40
50
60
70
80
01/01/1970
01/01/1975
01/01/1980
01/01/1985
01/01/1990
01/01/1995
01/01/2000
01/01/2005
01/01/2010
01/01/2015
01/01/2020
01/01/2025

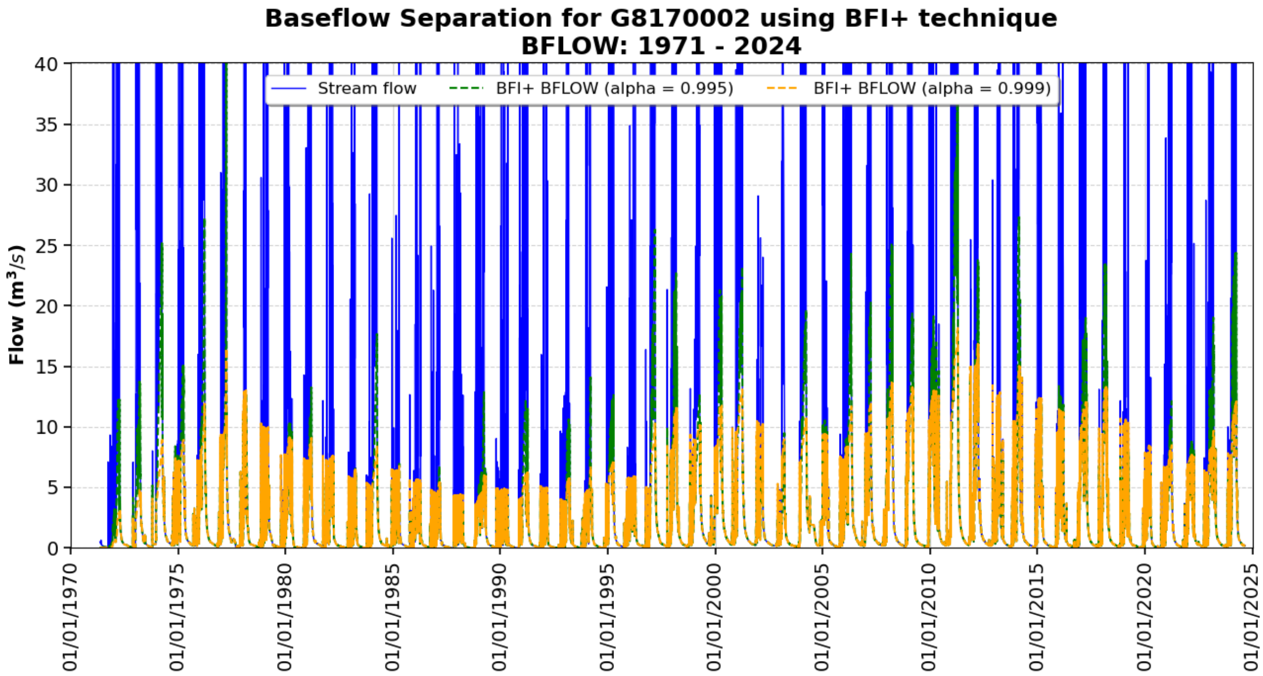

Baseflow Separation for G8170002 using BFI+ technique
EWMA: 1953 - 1954
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0
1
2
3
4
5
6
7
8
22/02/1953
23/04/1953
22/06/1953
21/08/1953
20/10/1953
19/12/1953
17/02/1954
18/04/1954
17/06/1954

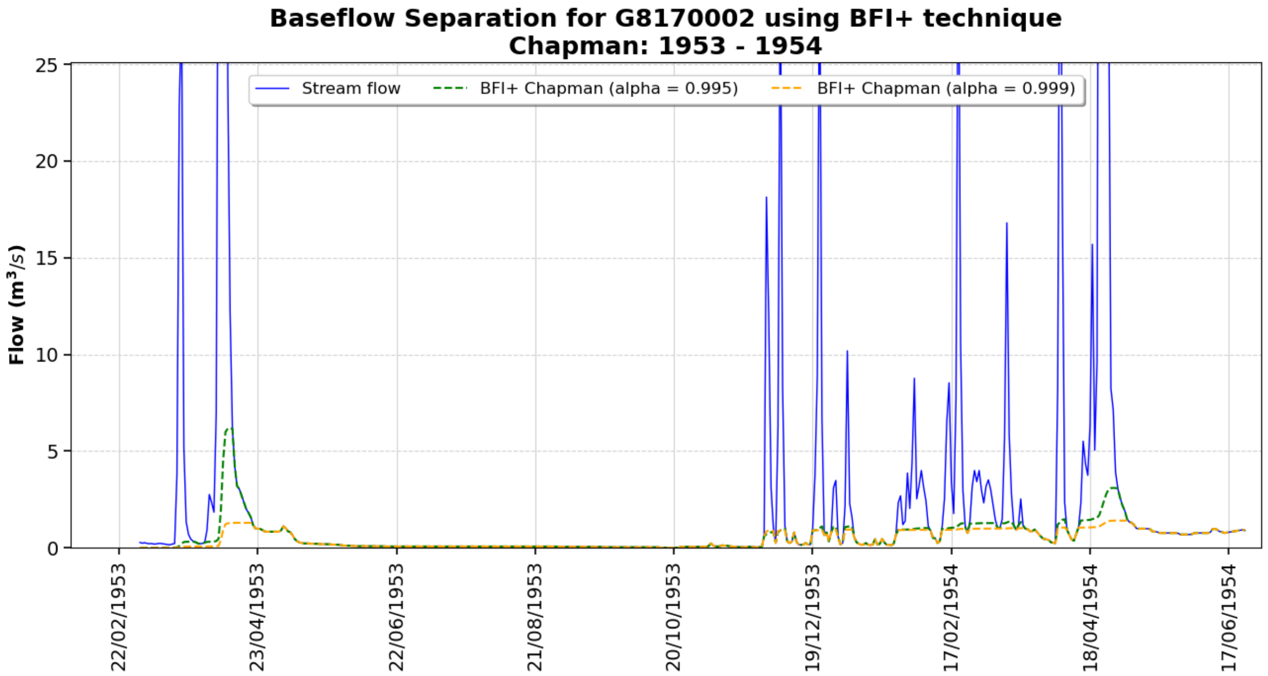

Baseflow Separation for G8170002 using BFI+ technique
EWMA: 1965 - 1971
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0
5
10
15
20
25
30
35
40
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972

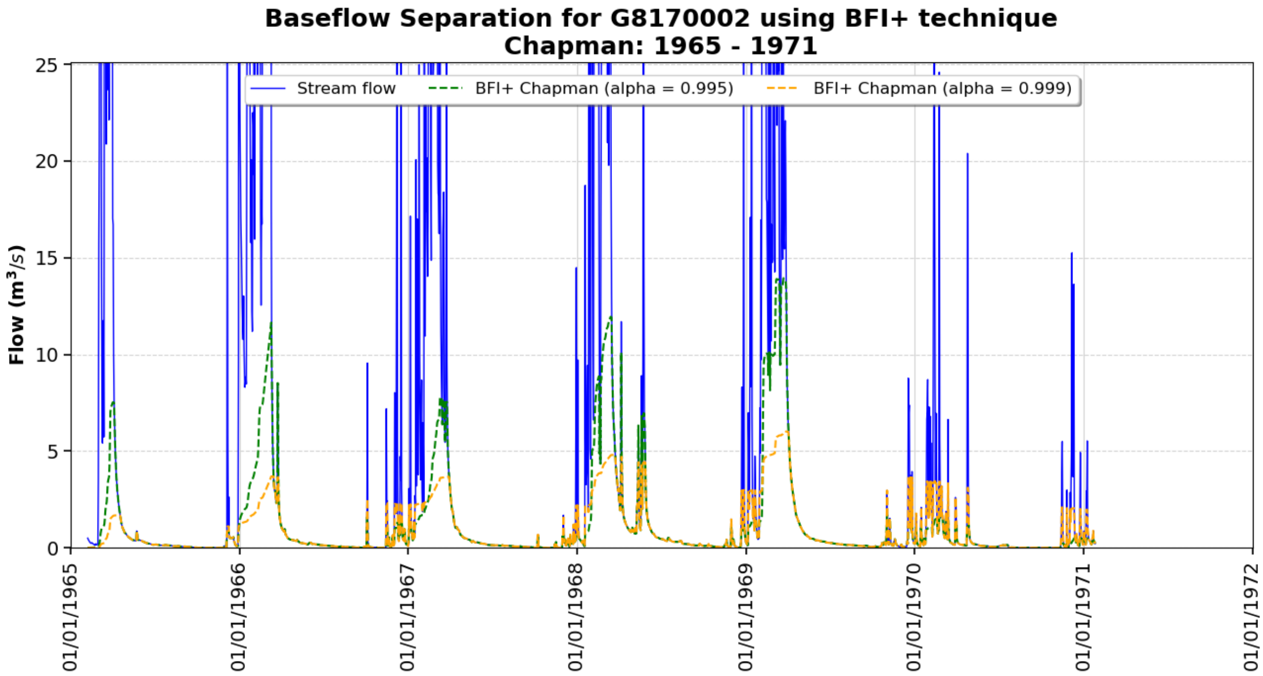

Baseflow Separation for G8170002 using BFI+ technique
EWMA: 1971 - 2024
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0
5
10
15
20
25
30
35
40
01/01/1970
01/01/1975
01/01/1980
01/01/1985
01/01/1990
01/01/1995
01/01/2000
01/01/2005
01/01/2010
01/01/2015
01/01/2020
01/01/2025

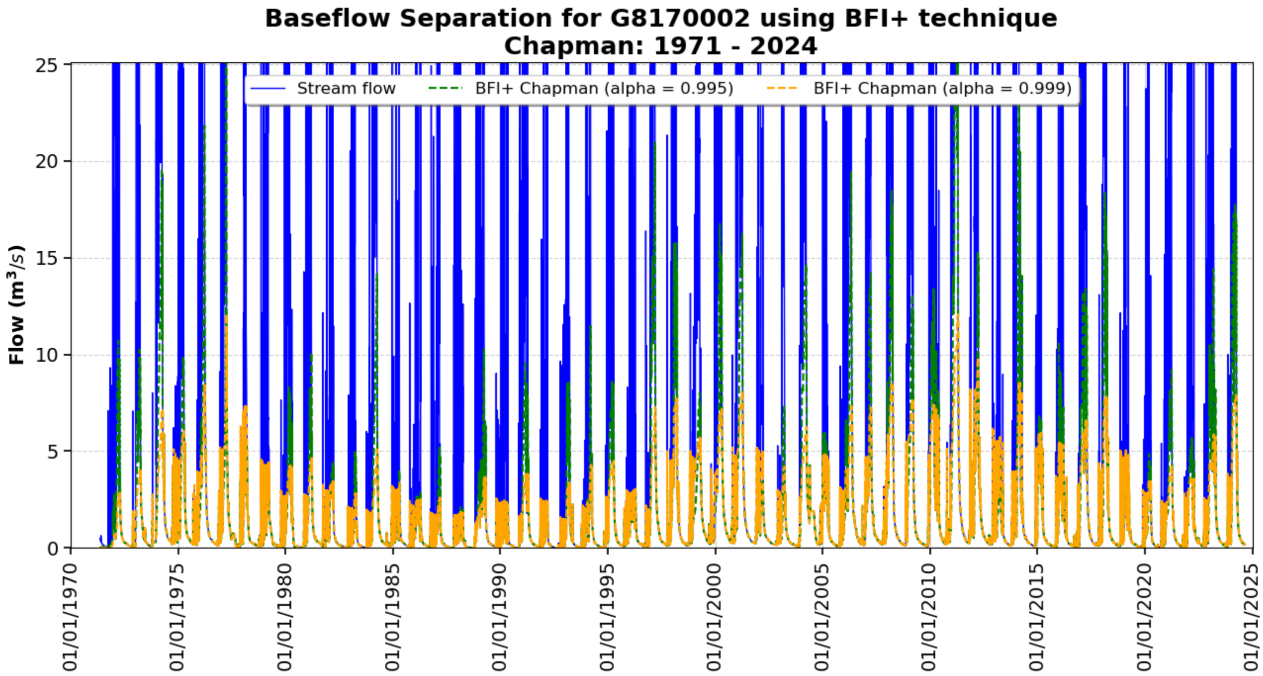

Baseflow Separation for G8170002 using BFI+ technique
BFLOW: 1953 - 1954
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0
5
10
15
20
25
22/02/1953
23/04/1953
22/06/1953
21/08/1953
20/10/1953
19/12/1953
17/02/1954
18/04/1954
17/06/1954

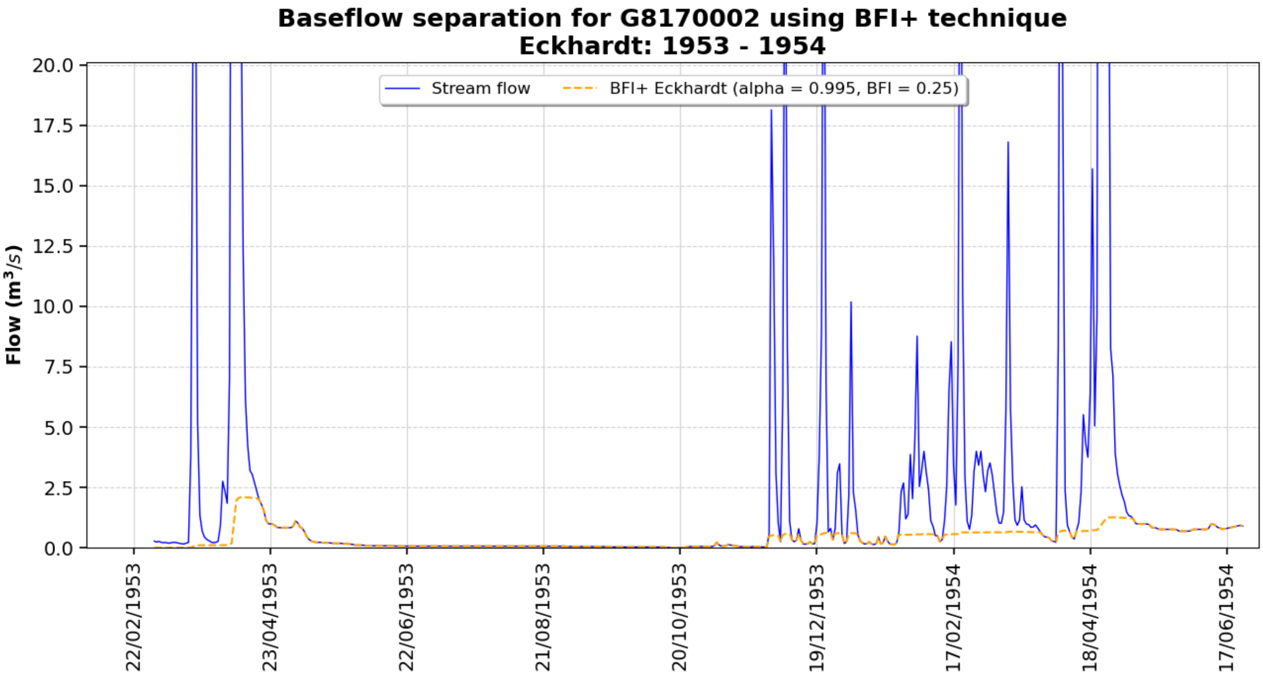

Baseflow Separation for G8170002 using BFI+ technique
BFLOW: 1965 - 1971
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0
5
10
15
20
25
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972

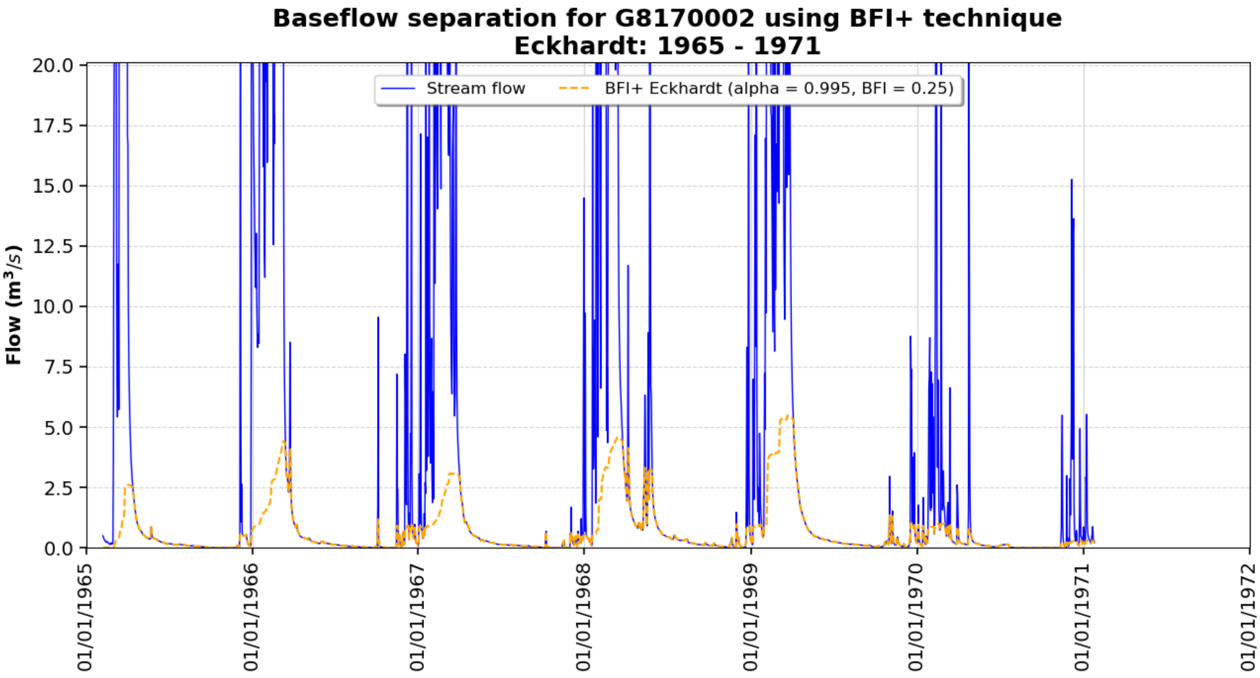

Baseflow Separation for G8170002 using BFI+ technique
BFLOW: 1971 - 2024
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0
5
10
15
20
25
30
35
40
01/01/1970
01/01/1975
01/01/1980
01/01/1985
01/01/1990
01/01/1995
01/01/2000
01/01/2005
01/01/2010
01/01/2015
01/01/2020
01/01/2025

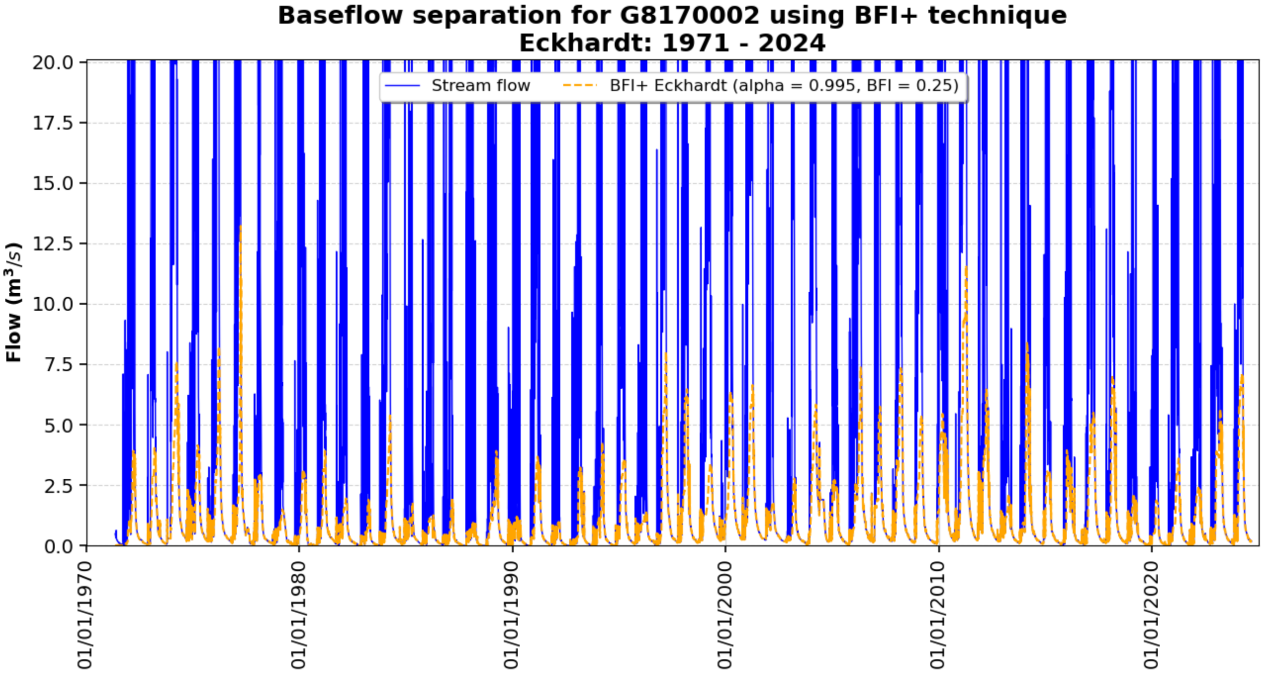

Baseflow Separation for G8170002 using BFI+ technique
Chapman: 1953 - 1954
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0
5
10
15
20
25
22/02/1953
23/04/1953
22/06/1953
21/08/1953
20/10/1953
19/12/1953
17/02/1954
18/04/1954
17/06/1954


Baseflow Separation for G8170002 using BFI+ technique
Chapman: 1965 - 1971
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0
5
10
15
20
25
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972

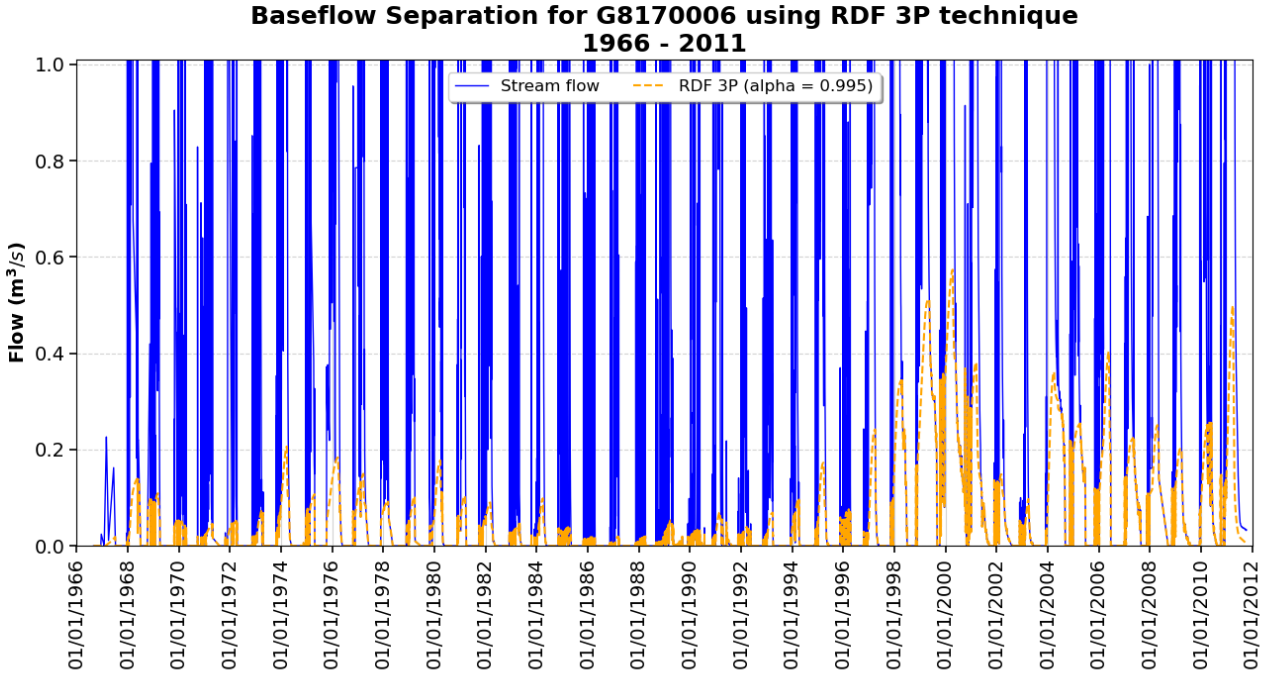

Baseflow Separation for G8170002 using BFI+ technique
Chapman: 1971 - 2024
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0
5
10
15
20
25
01/01/1970
01/01/1975
01/01/1980
01/01/1985
01/01/1990
01/01/1995
01/01/2000
01/01/2005
01/01/2010
01/01/2015
01/01/2020
01/01/2025

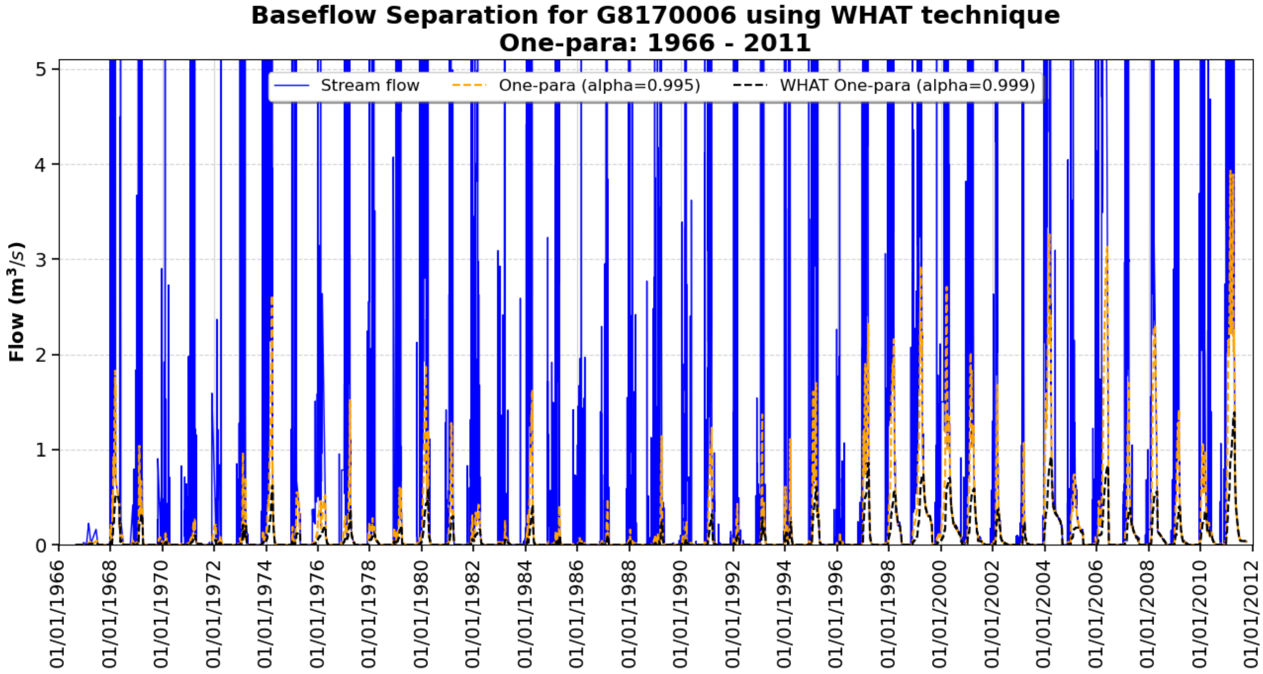

Baseflow separation for G8170002 using BFI+ technique
Eckhardt: 1953 - 1954
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
22/02/1953
23/04/1953
22/06/1953
21/08/1953
20/10/1953
19/12/1953
17/02/1954
18/04/1954
17/06/1954

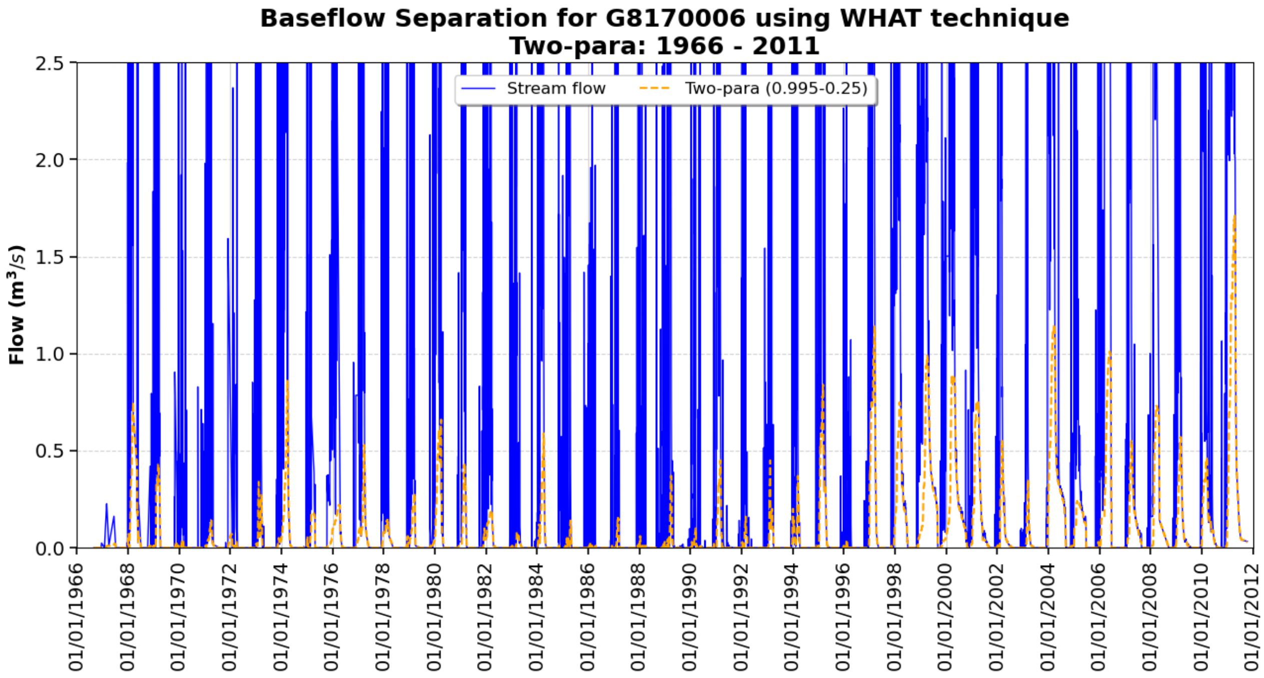

Baseflow separation for G8170002 using BFI+ technique
Eckhardt: 1965 - 1971
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972

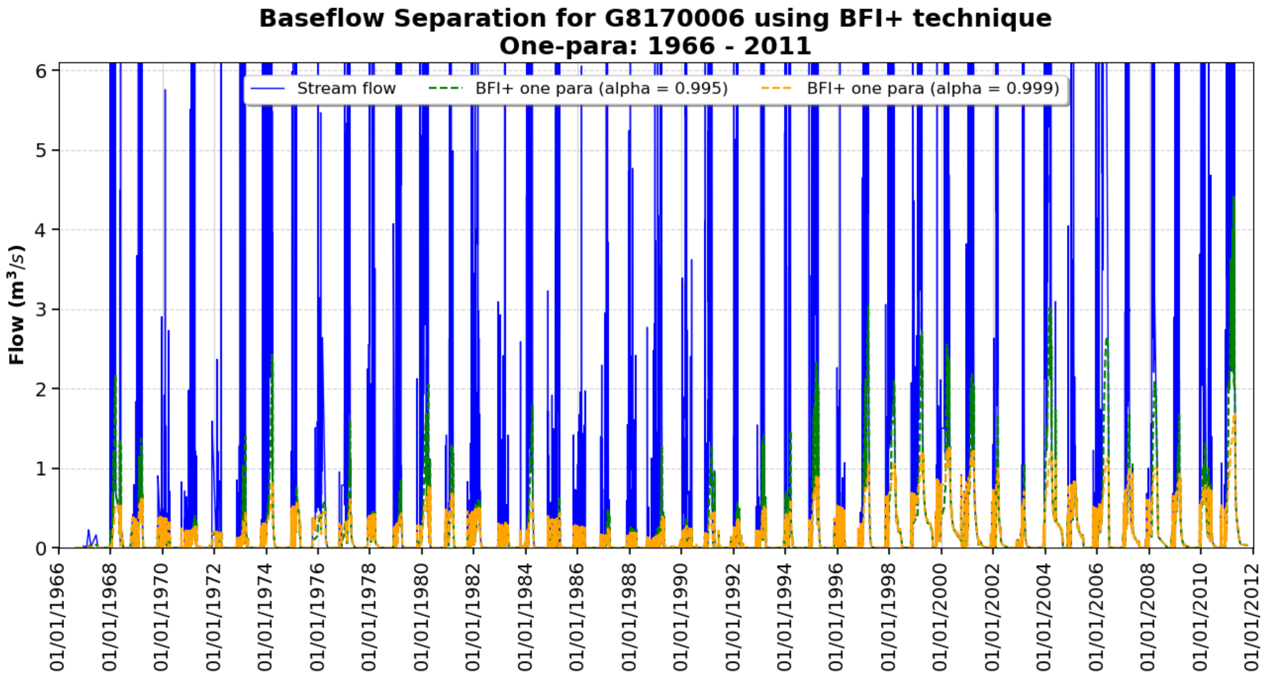

Baseflow separation for G8170002 using BFI+ technique
Eckhardt: 1971 - 2024
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1970
01/01/1980
01/01/1990
01/01/2000
01/01/2010
01/01/2020

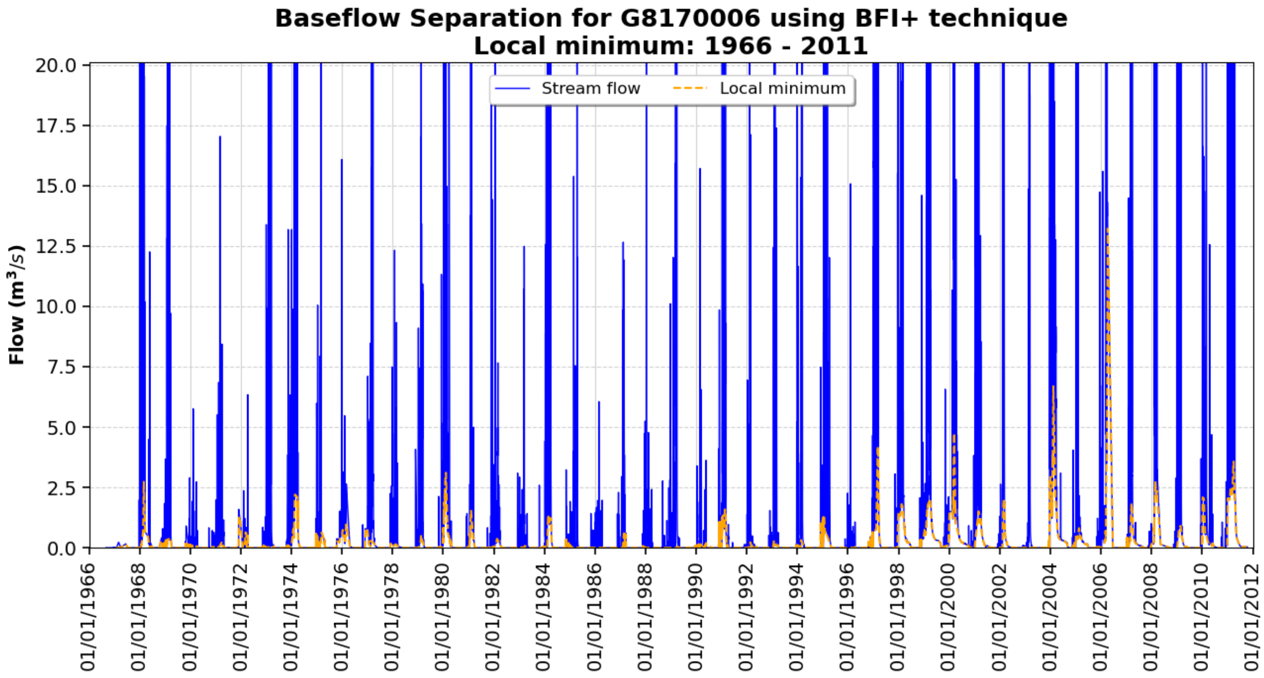
Appendix C: Baseflow separation hydrographs for G8170006

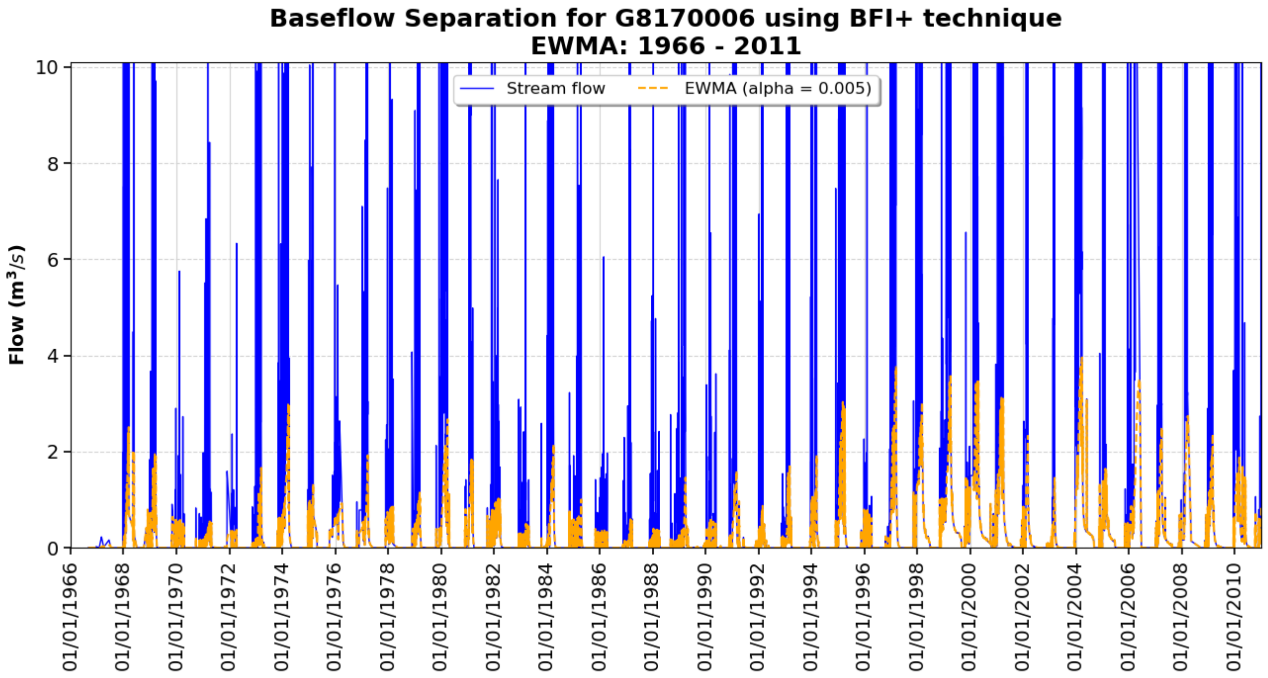


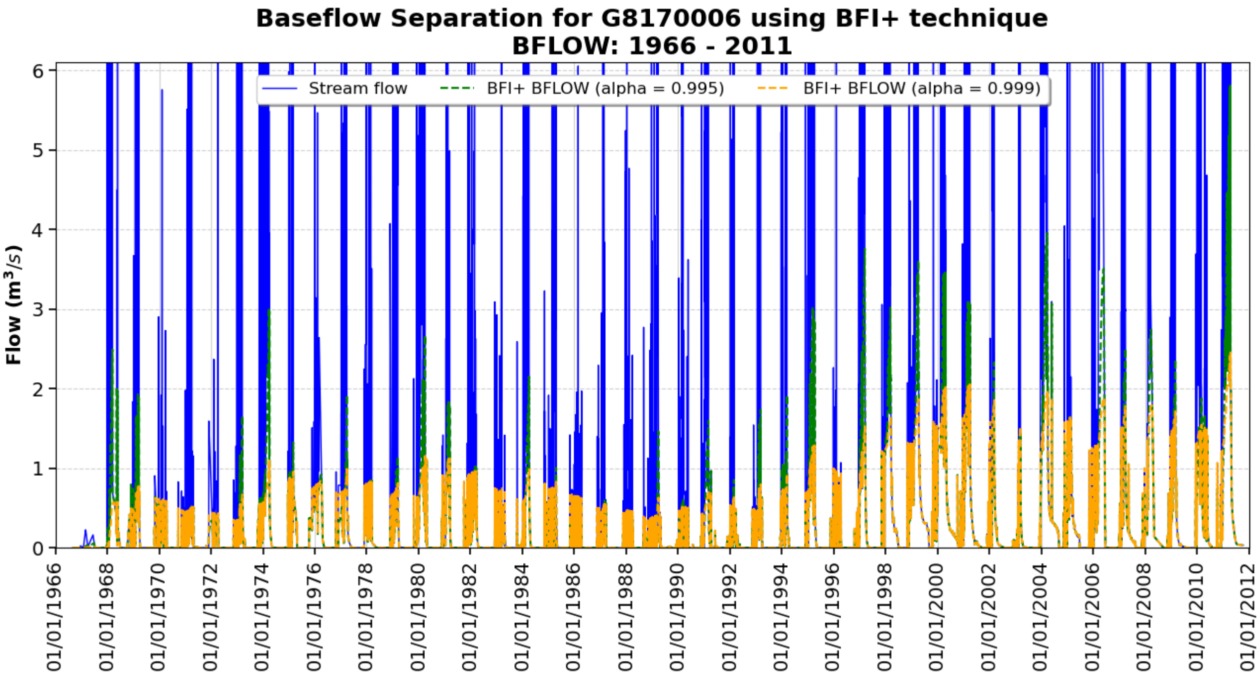


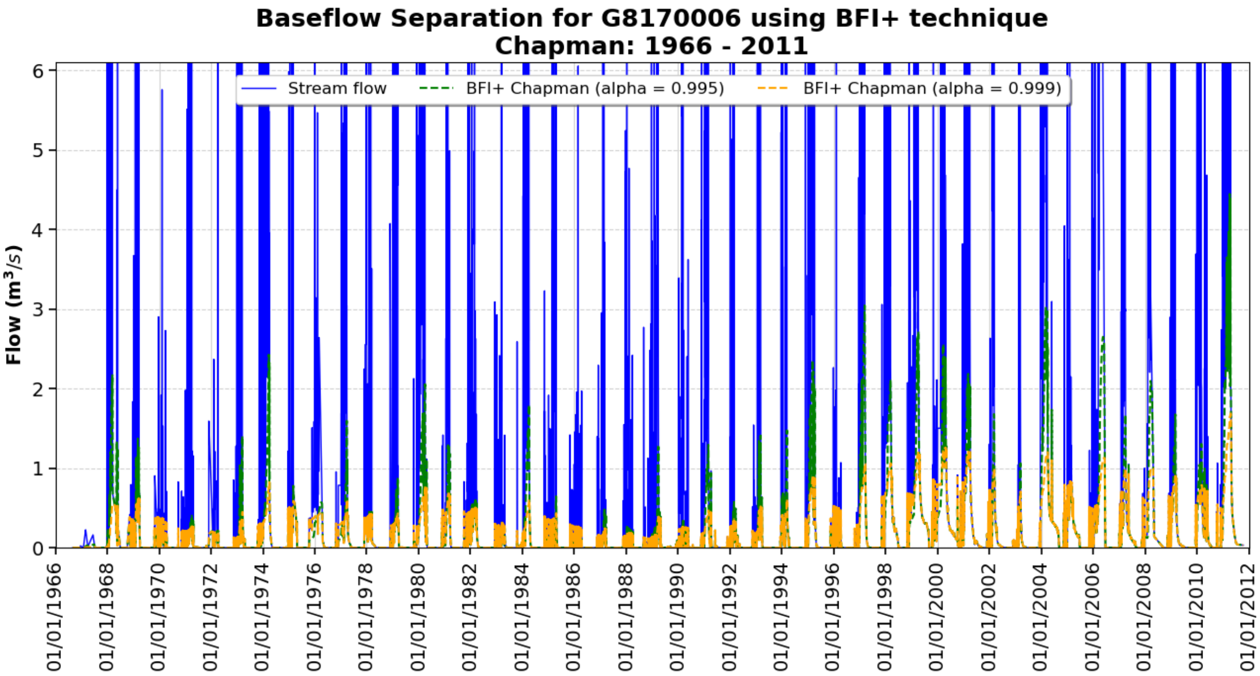

Baseflow Separation for G8170006 using WHAT technique
Two-para: 1966 - 2011
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)

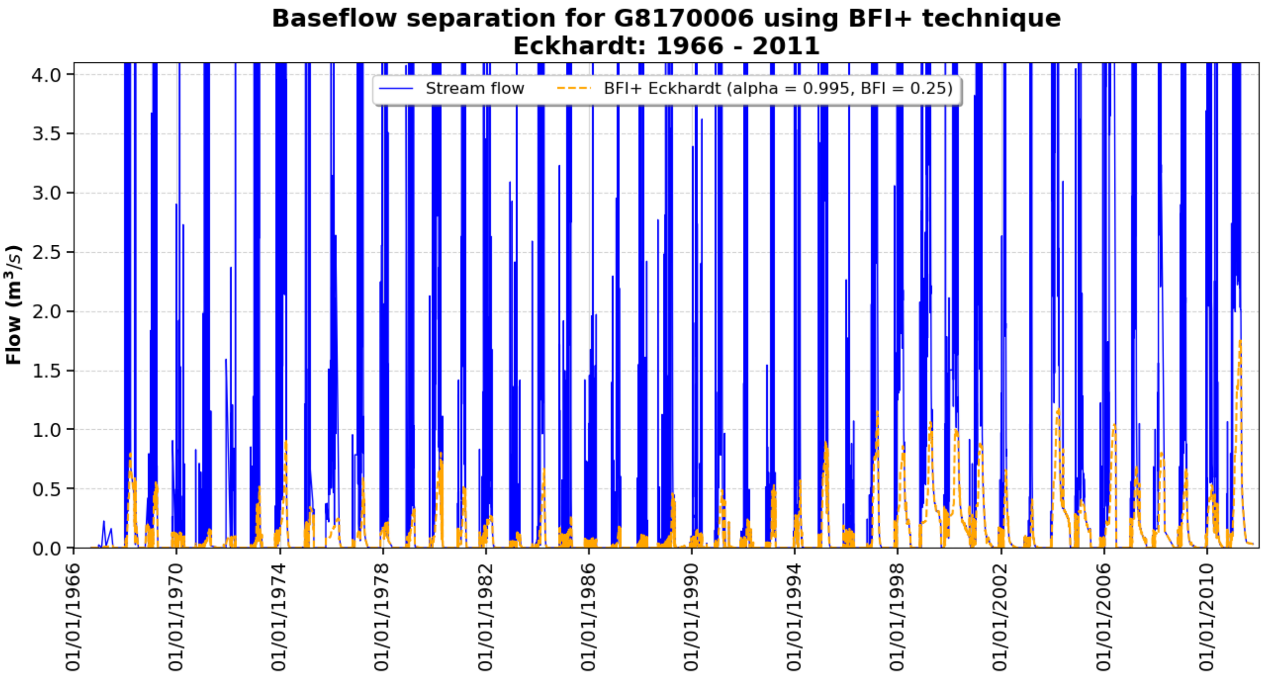

Baseflow Separation for G8170006 using BFI+ technique
One-para: 1966 - 2011
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)


Baseflow Separation for G8170006 using BFI+ technique
Local minimum: 1966 - 2011
Stream flow
Local minimum
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1966
01/01/1968
01/01/1970
01/01/1972
01/01/1974
01/01/1976
01/01/1978
01/01/1980
01/01/1982
01/01/1984
01/01/1986
01/01/1988
01/01/1990
01/01/1992
01/01/1994
01/01/1996
01/01/1998
01/01/2000
01/01/2002
01/01/2004
01/01/2006
01/01/2008
01/01/2010
01/01/2012

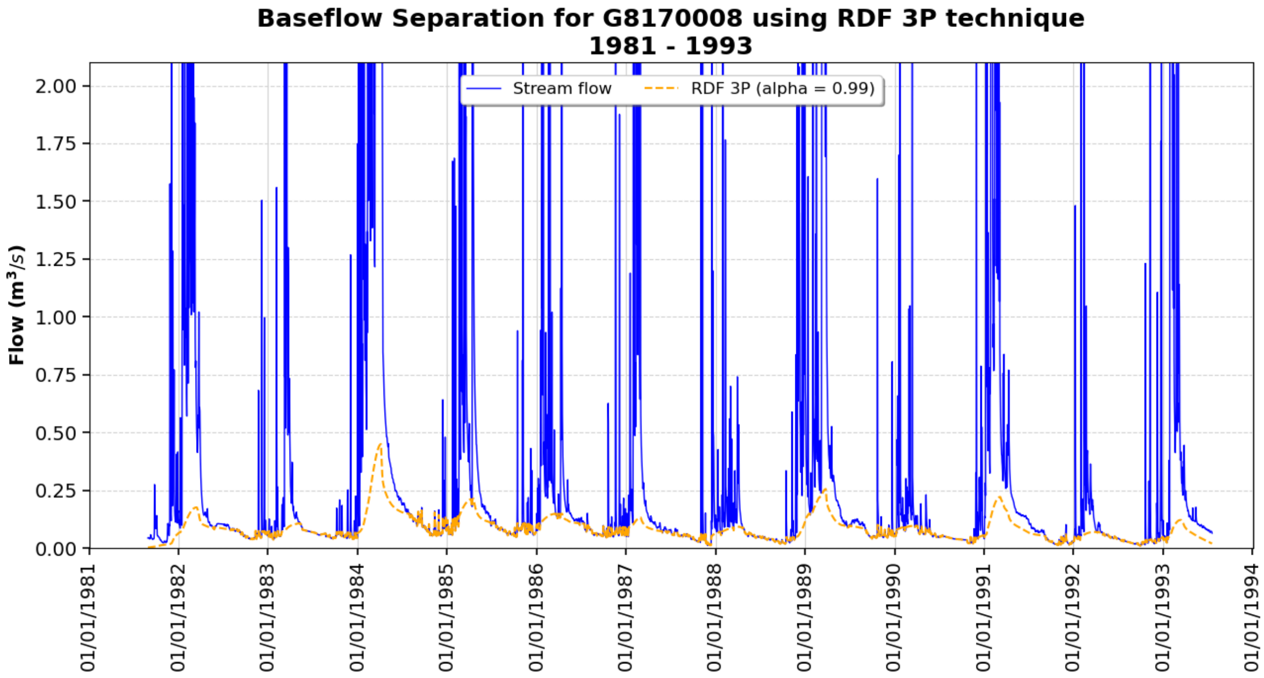

Baseflow Separation for G8170006 using BFI+ technique
EWMA: 1966 - 2011
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
10
8
6
4
2
0
01/01/1966
01/01/1968
01/01/1970
01/01/1972
01/01/1974
01/01/1976
01/01/1978
01/01/1980
01/01/1982
01/01/1984
01/01/1986
01/01/1988
01/01/1990
01/01/1992
01/01/1994
01/01/1996
01/01/1998
01/01/2000
01/01/2002
01/01/2004
01/01/2006
01/01/2008
01/01/2010

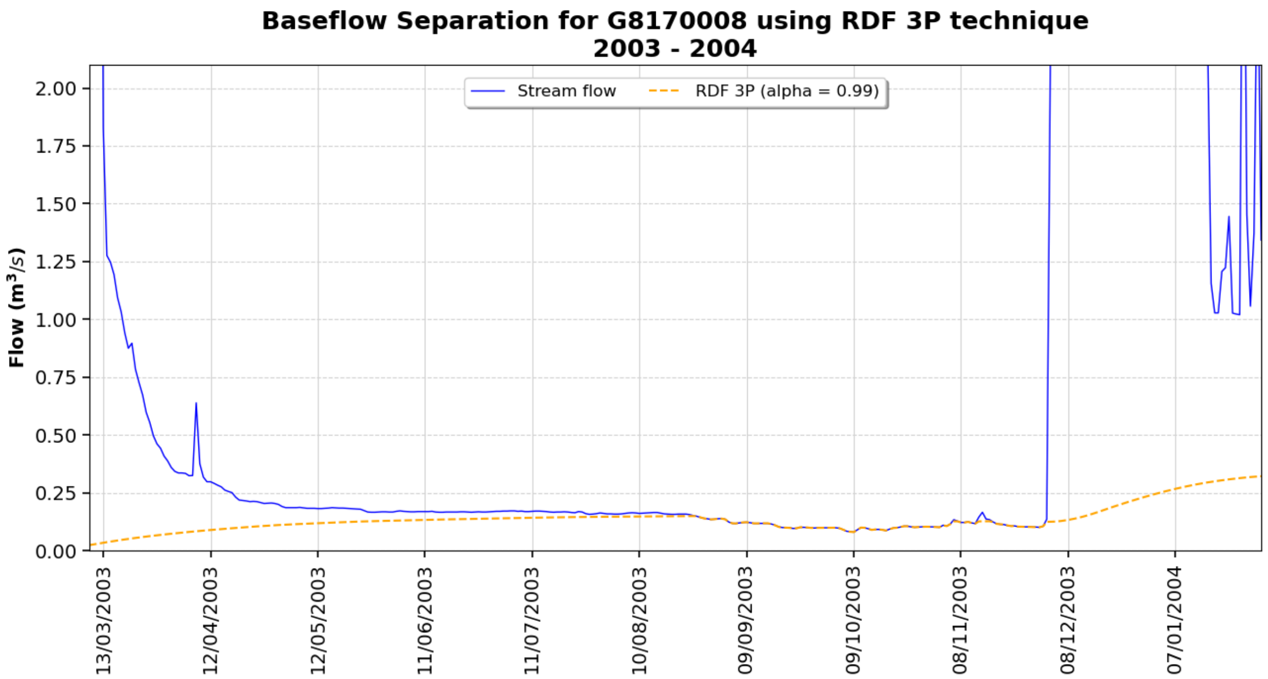

Baseflow Separation for G8170006 using BFI+ technique
BFLOW: 1966 - 2011
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0
1
2
3
4
5
6
01/01/1966
01/01/1968
01/01/1970
01/01/1972
01/01/1974
01/01/1976
01/01/1978
01/01/1980
01/01/1982
01/01/1984
01/01/1986
01/01/1988
01/01/1990
01/01/1992
01/01/1994
01/01/1996
01/01/1998
01/01/2000
01/01/2002
01/01/2004
01/01/2006
01/01/2008
01/01/2010
01/01/2012

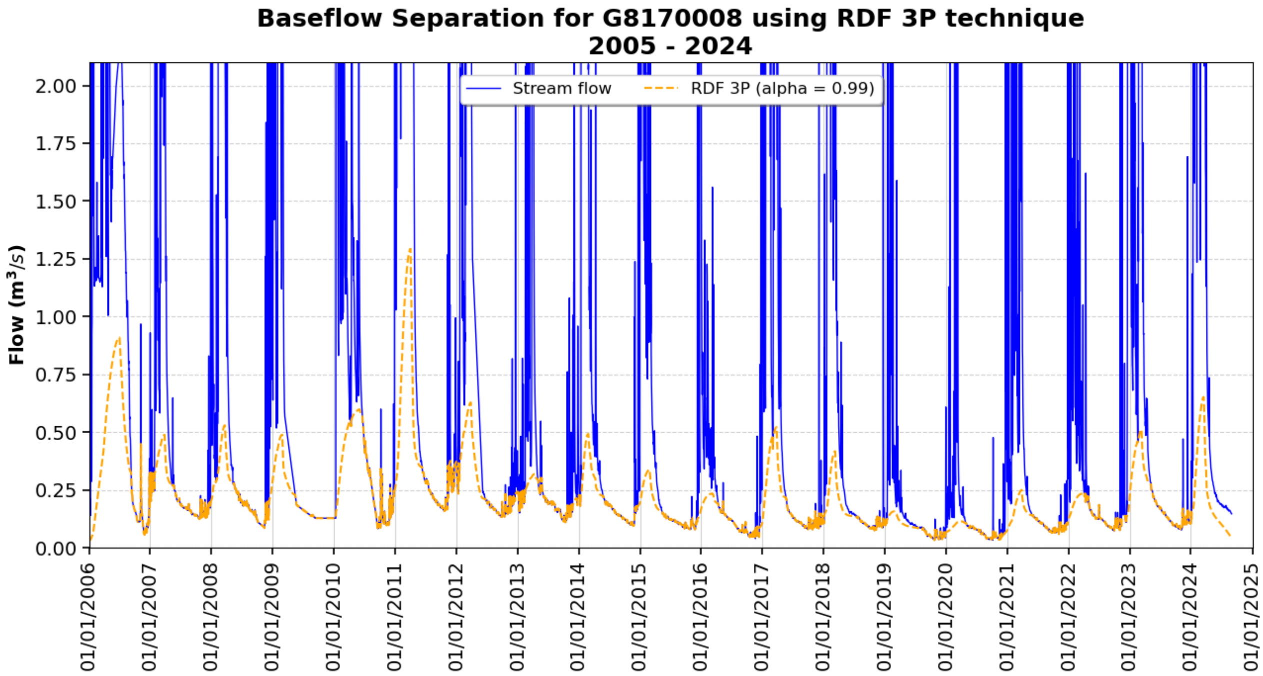

Baseflow Separation for G8170006 using BFI+ technique
Chapman: 1966 - 2011
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0
1
2
3
4
5
6
01/01/1966
01/01/1968
01/01/1970
01/01/1972
01/01/1974
01/01/1976
01/01/1978
01/01/1980
01/01/1982
01/01/1984
01/01/1986
01/01/1988
01/01/1990
01/01/1992
01/01/1994
01/01/1996
01/01/1998
01/01/2000
01/01/2002
01/01/2004
01/01/2006
01/01/2008
01/01/2010
01/01/2012

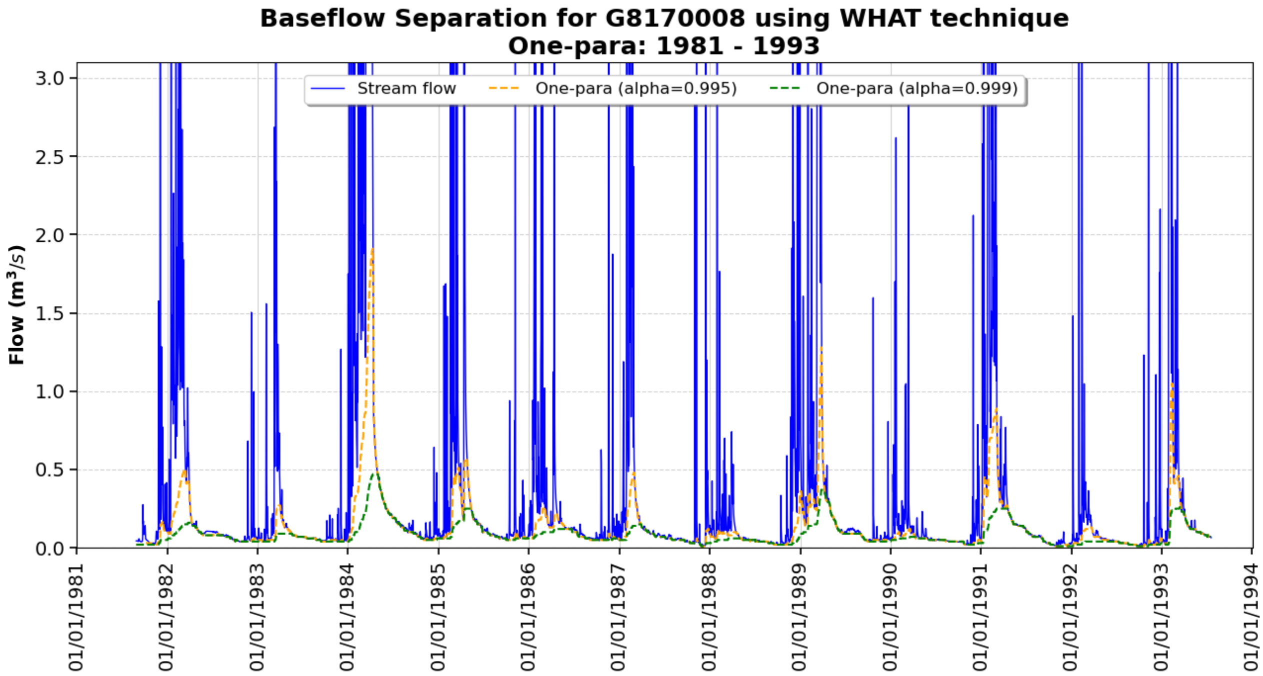

Baseflow separation for G8170006 using BFI+ technique
Eckhardt: 1966 - 2011
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/1966
01/01/1970
01/01/1974
01/01/1978
01/01/1982
01/01/1986
01/01/1990
01/01/1994
01/01/1998
01/01/2002
01/01/2006
01/01/2010

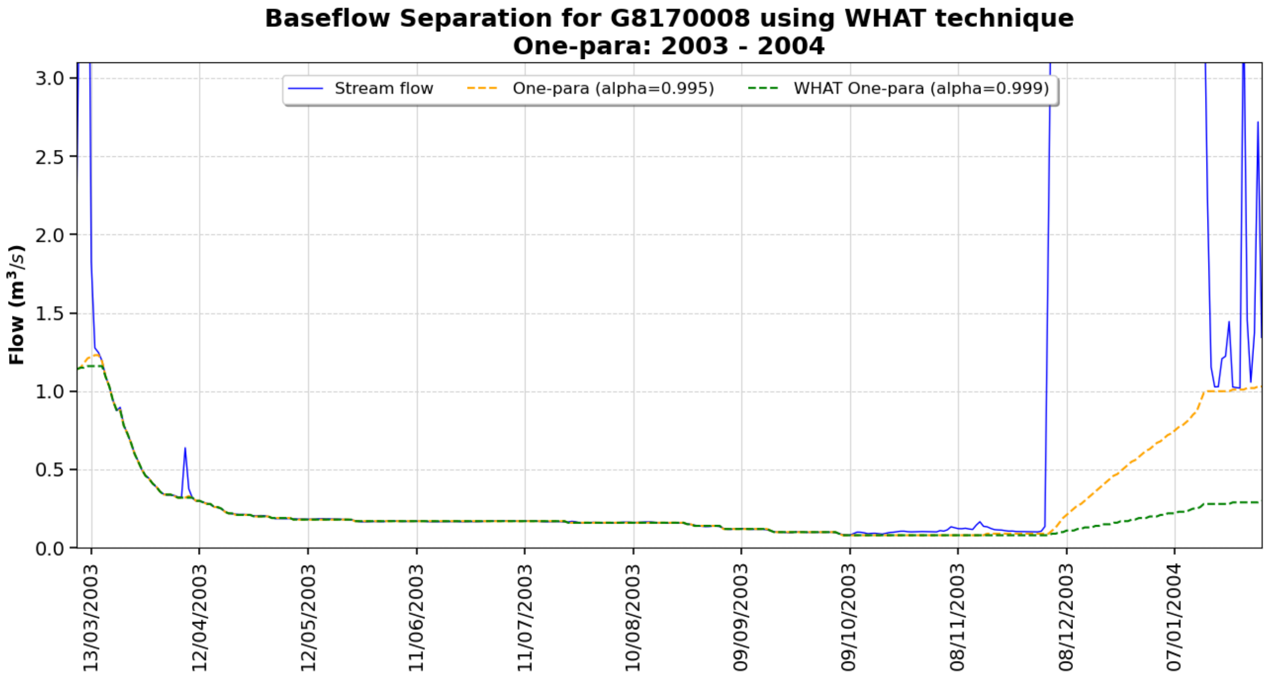
Appendix D: Baseflow separation hydrographs for G8170008

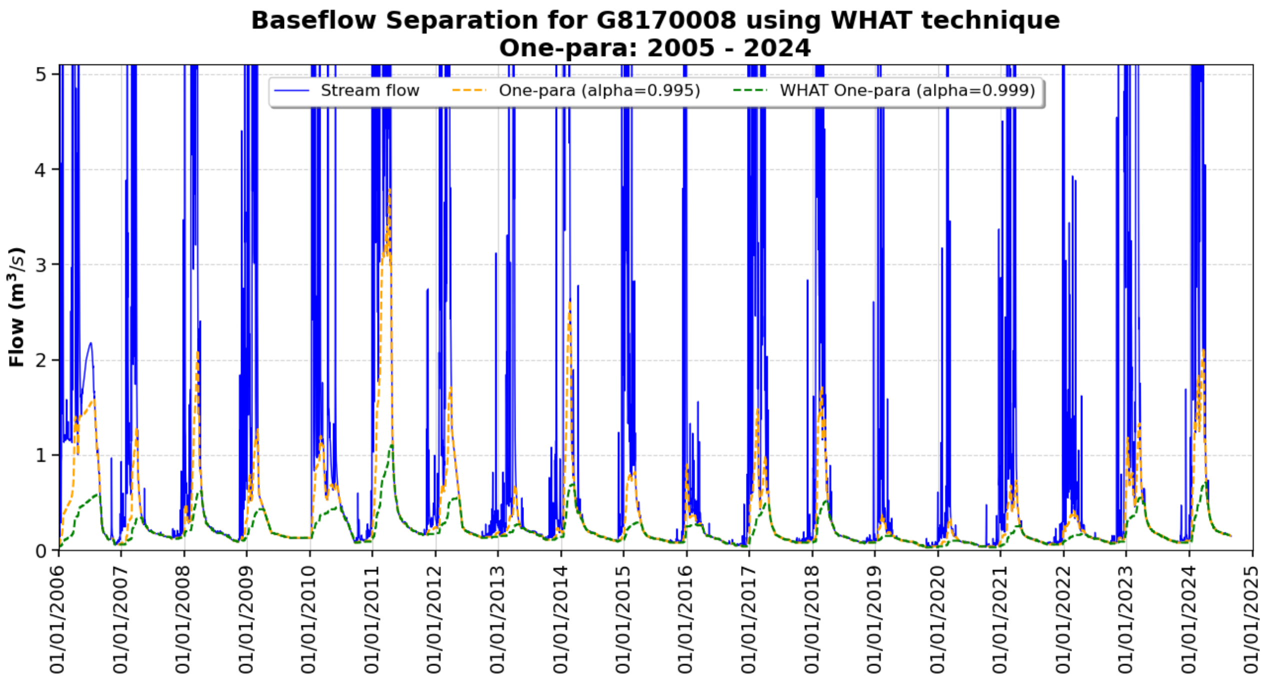


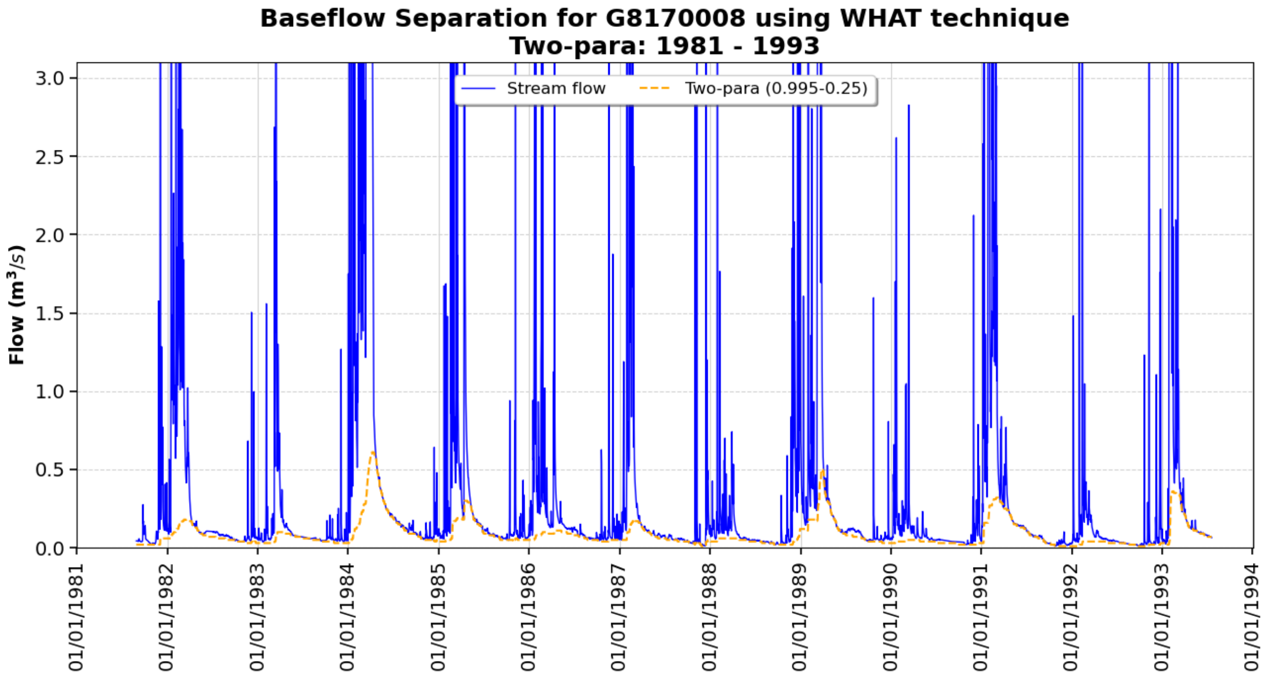


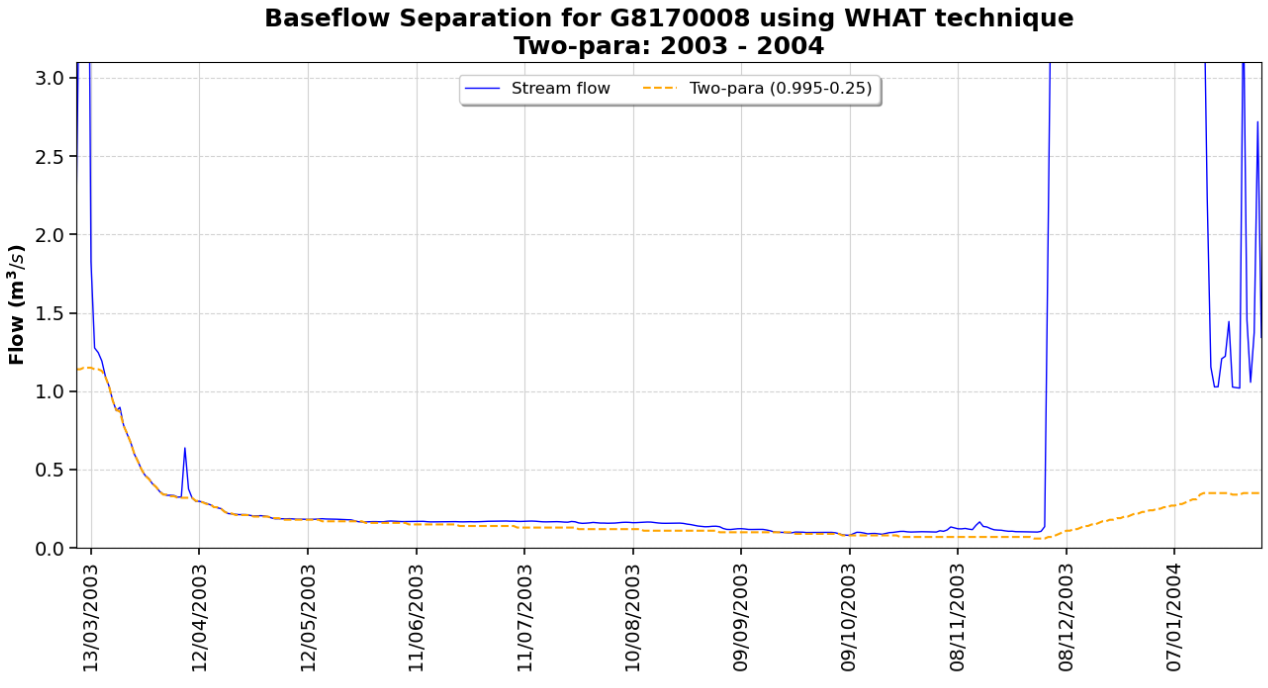

Baseflow Separation for G8170008 using RDF 3P technique
2005 - 2024
Stream flow
RDF 3P (alpha = 0.99)
Flow (m³/s)
0.00
0.25
0.50
0.75
1.00
1.25
1.50
1.75
2.00
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

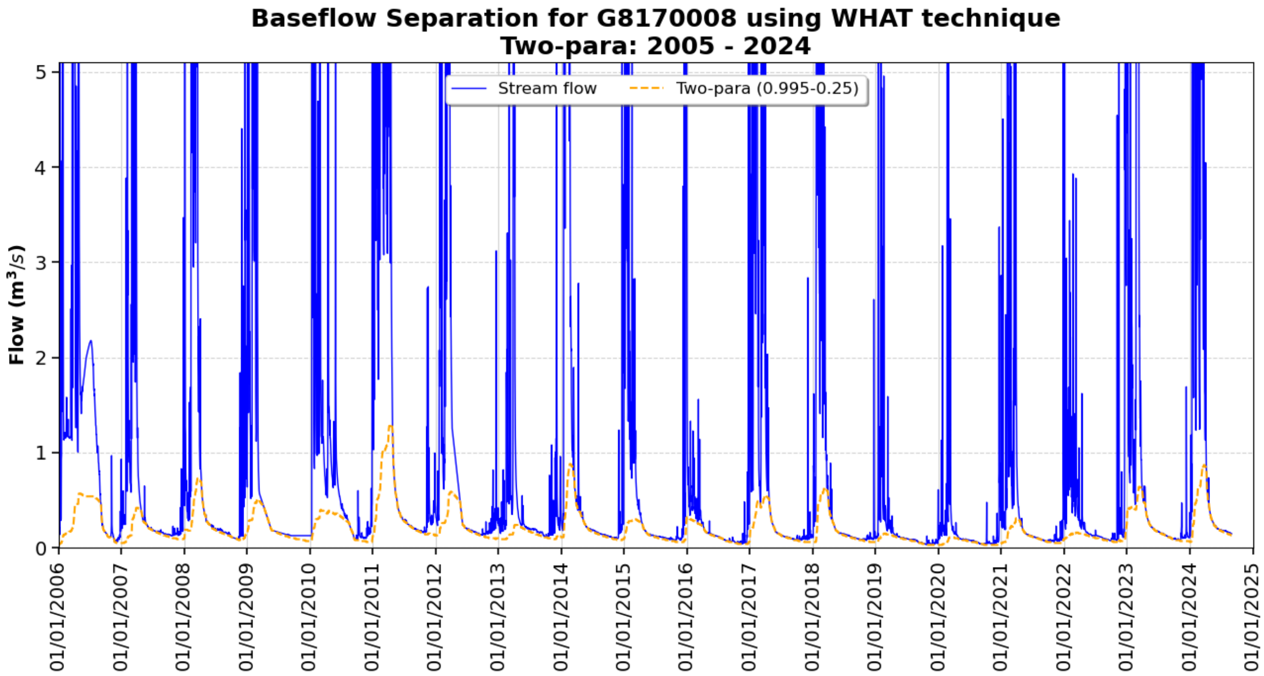

Baseflow Separation for G8170008 using WHAT technique
One-para: 1981 - 1993
Stream flow
One-para (alpha=0.995)
One-para (alpha=0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/1981
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987
01/01/1988
01/01/1989
01/01/1990
01/01/1991
01/01/1992
01/01/1993
01/01/1994

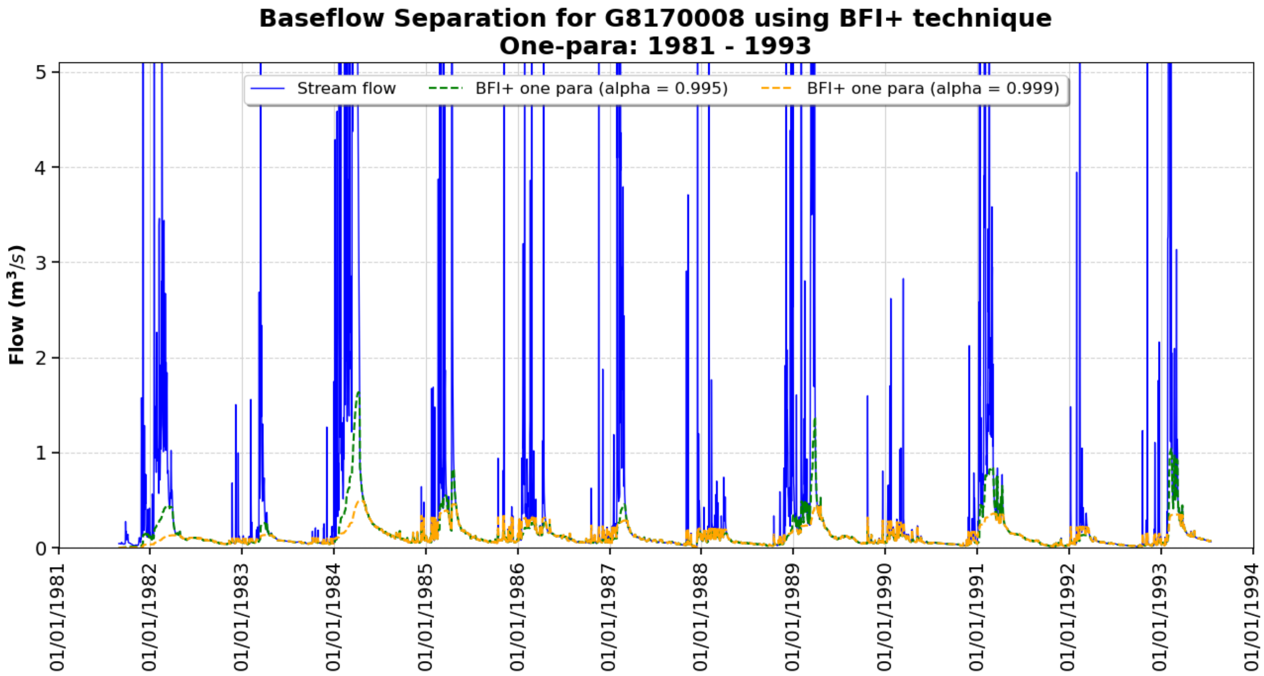

Baseflow Separation for G8170008 using WHAT technique
One-para: 2003 - 2004
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
13/03/2003
12/04/2003
12/05/2003
11/06/2003
11/07/2003
10/08/2003
09/09/2003
09/10/2003
08/11/2003
08/12/2003
07/01/2004

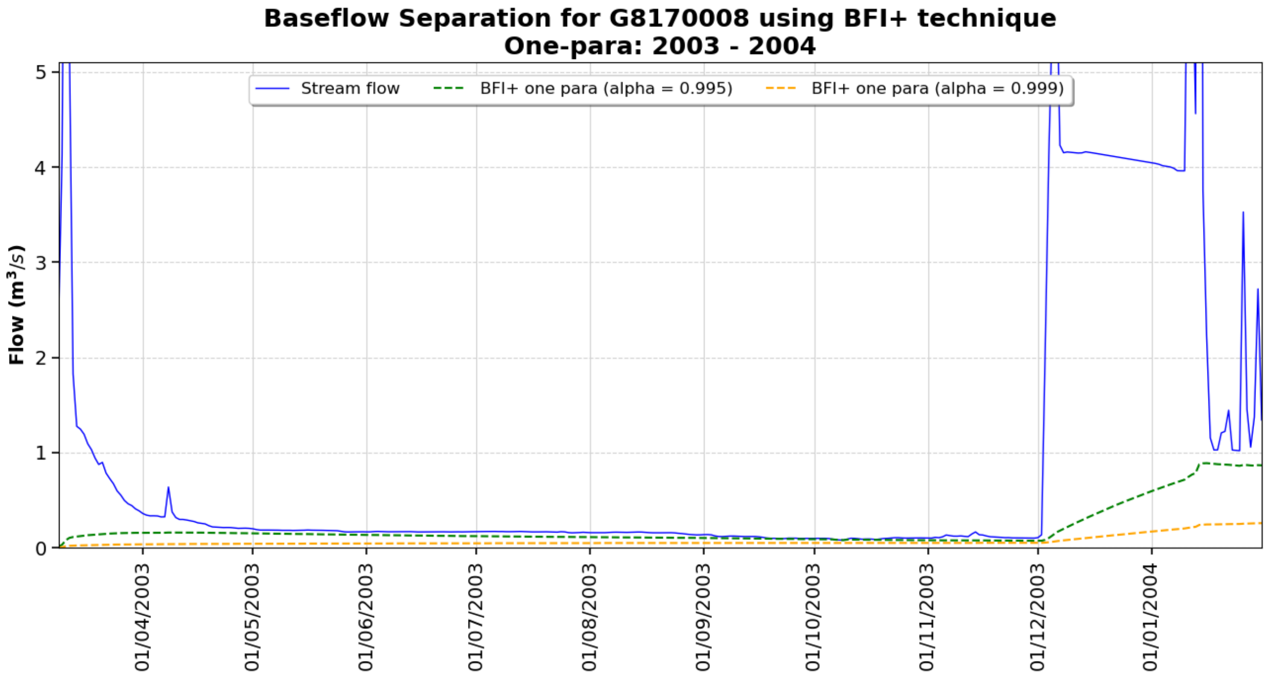

Baseflow Separation for G8170008 using WHAT technique
One-para: 2005 - 2024
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.999)
Flow (m³/s)
0
1
2
3
4
5
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

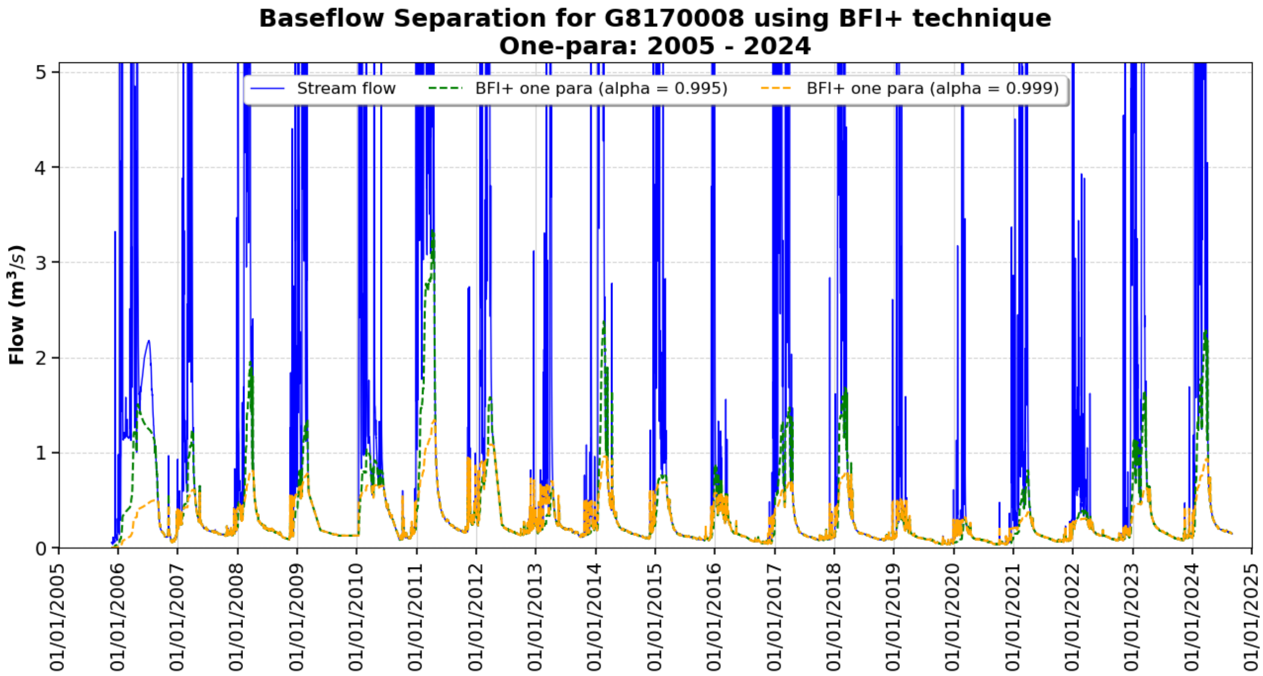

Baseflow Separation for G8170008 using WHAT technique
Two-para: 1981 - 1993
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/1981
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987
01/01/1988
01/01/1989
01/01/1990
01/01/1991
01/01/1992
01/01/1993
01/01/1994

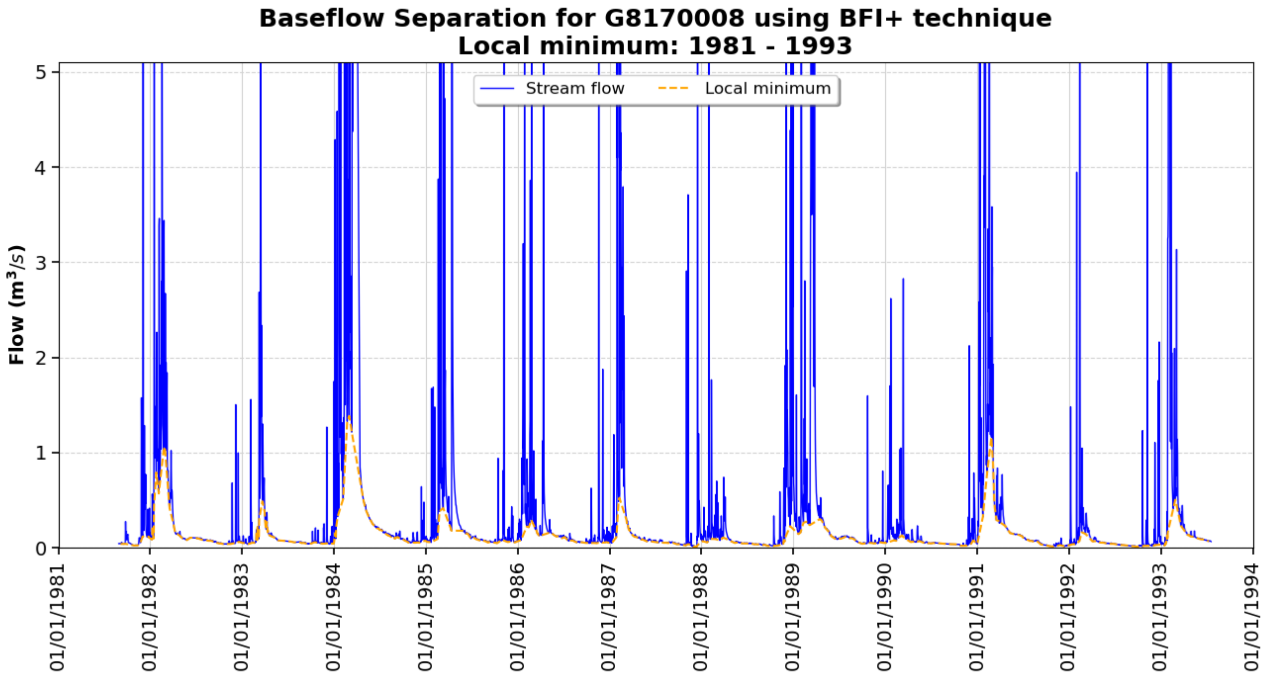

Baseflow Separation for G8170008 using WHAT technique
Two-para: 2003 - 2004
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
13/03/2003
12/04/2003
12/05/2003
11/06/2003
11/07/2003
10/08/2003
09/09/2003
09/10/2003
08/11/2003
08/12/2003
07/01/2004

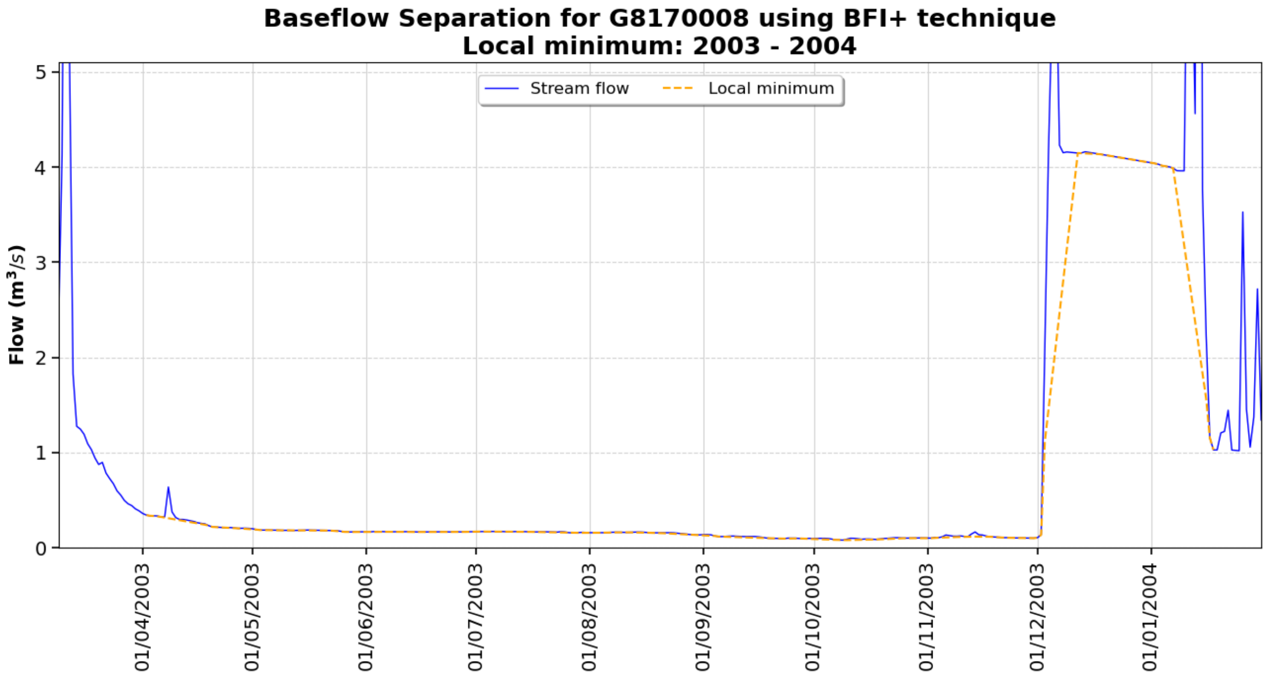

Baseflow Separation for G8170008 using WHAT technique
Two-para: 2005 - 2024
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0
1
2
3
4
5
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

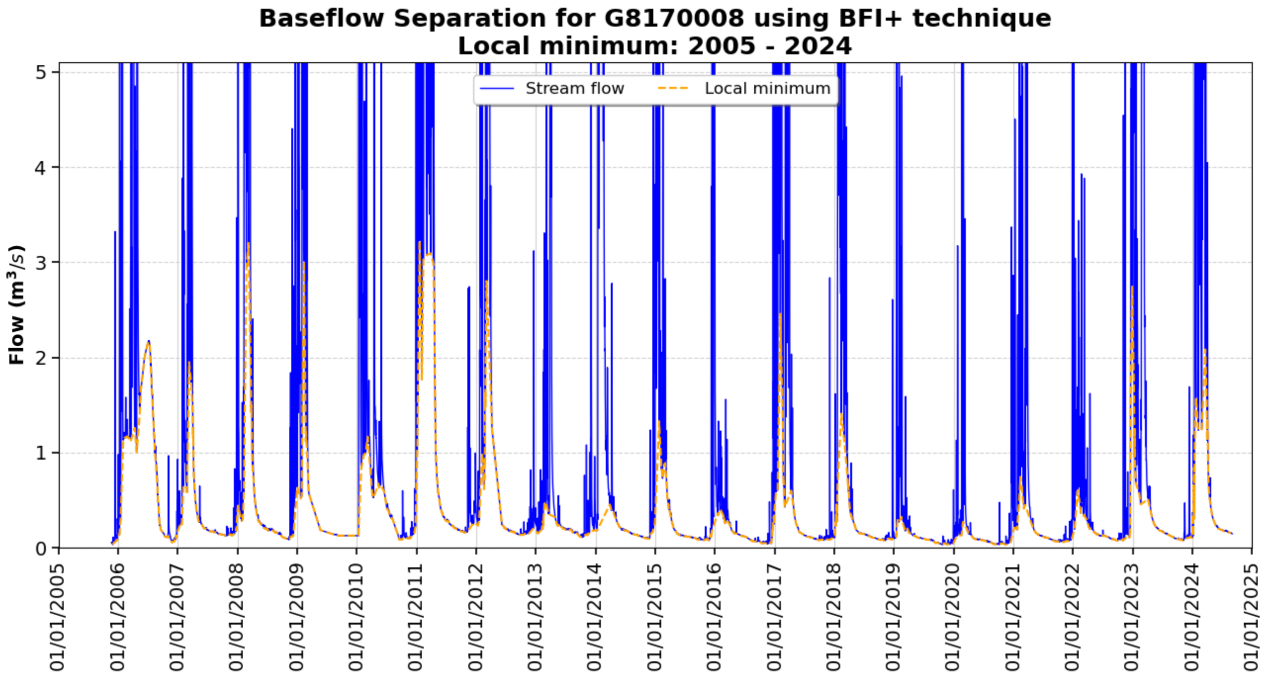

Baseflow Separation for G8170008 using BFI+ technique
One-para: 1981 - 1993
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
0
1
2
3
4
5
01/01/1981
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987
01/01/1988
01/01/1989
01/01/1990
01/01/1991
01/01/1992
01/01/1993
01/01/1994

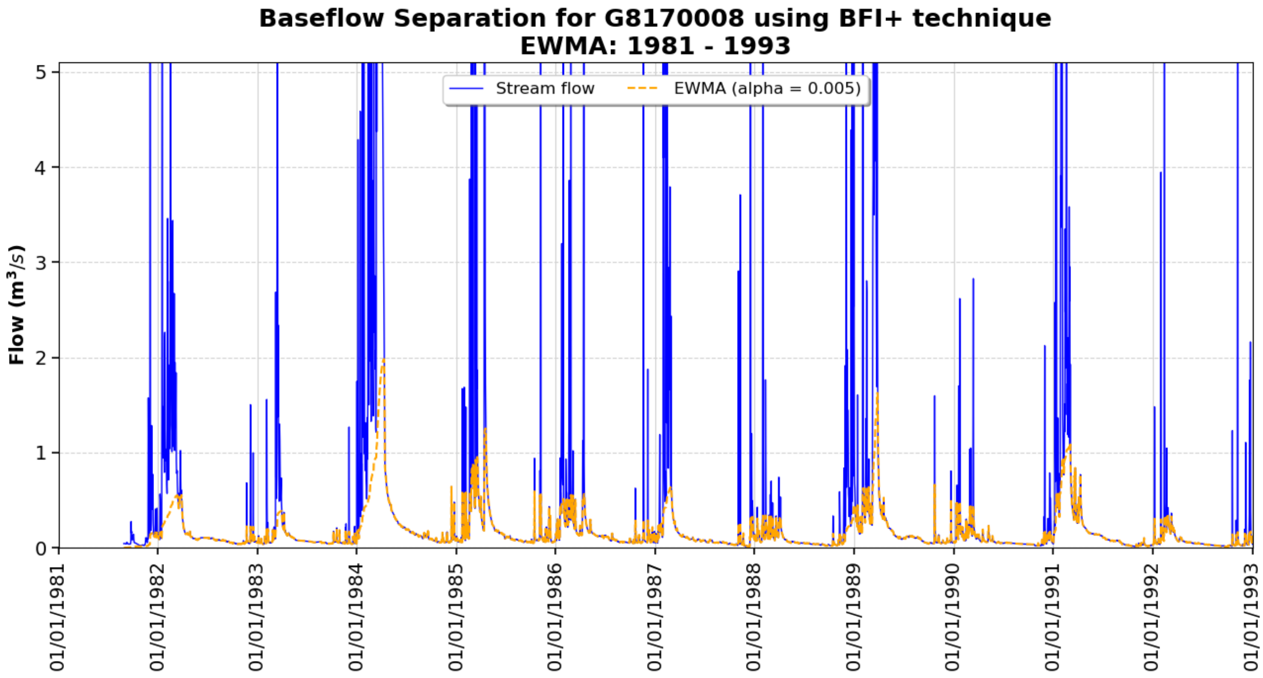

Baseflow Separation for G8170008 using BFI+ technique
One-para: 2003 - 2004
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
01/04/2003
01/05/2003
01/06/2003
01/07/2003
01/08/2003
01/09/2003
01/10/2003
01/11/2003
01/12/2003
01/01/2004

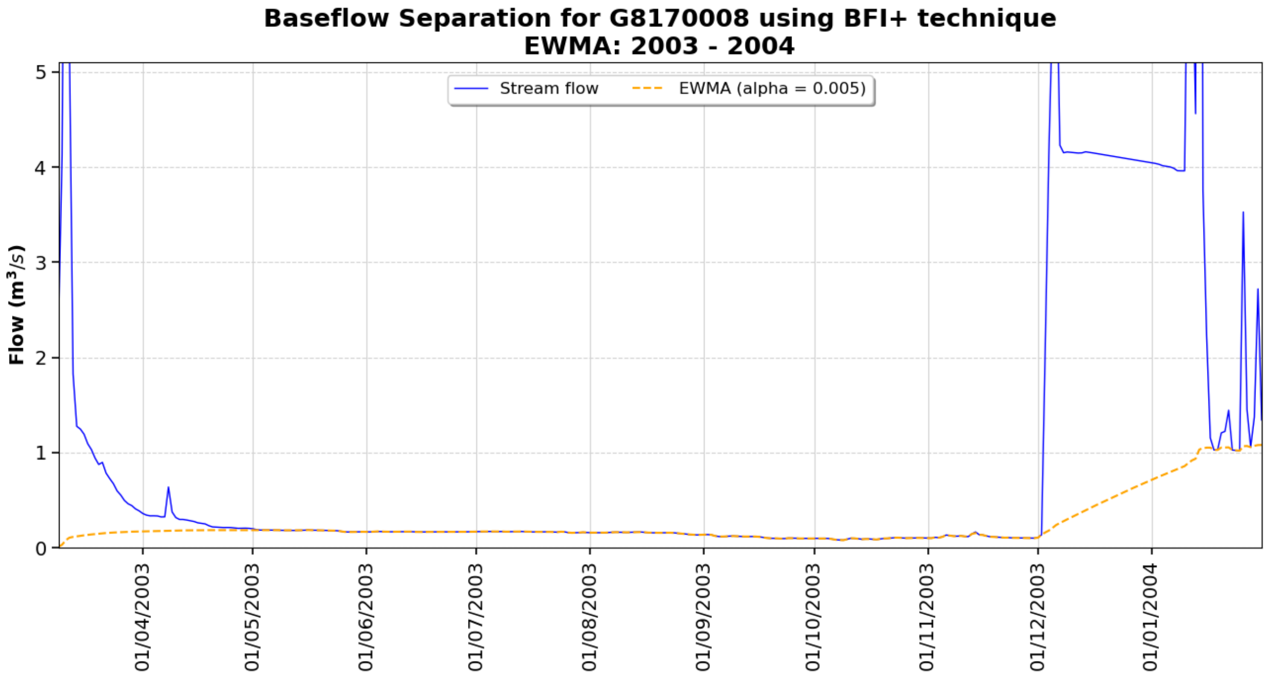

Baseflow Separation for G8170008 using BFI+ technique
One-para: 2005 - 2024
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

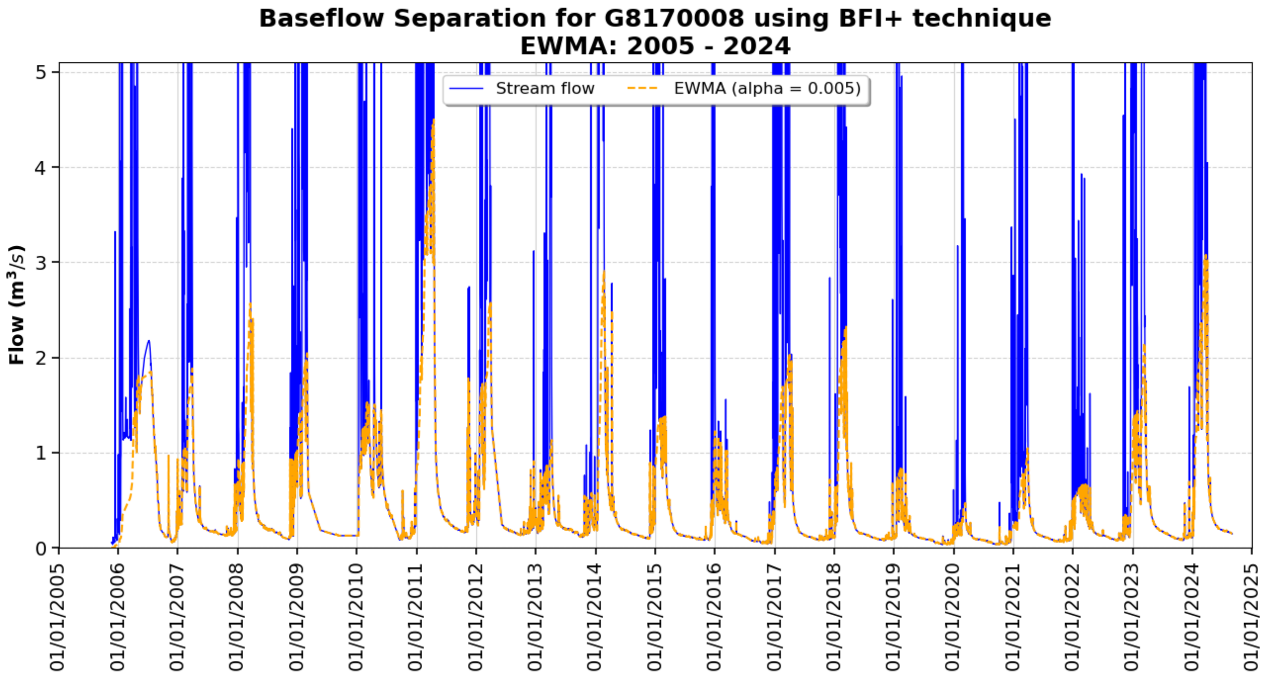

Baseflow Separation for G8170008 using BFI+ technique
Local minimum: 1981 - 1993
Stream flow
Local minimum
Flow (m³/s)
0
1
2
3
4
5
01/01/1981
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987
01/01/1988
01/01/1989
01/01/1990
01/01/1991
01/01/1992
01/01/1993
01/01/1994

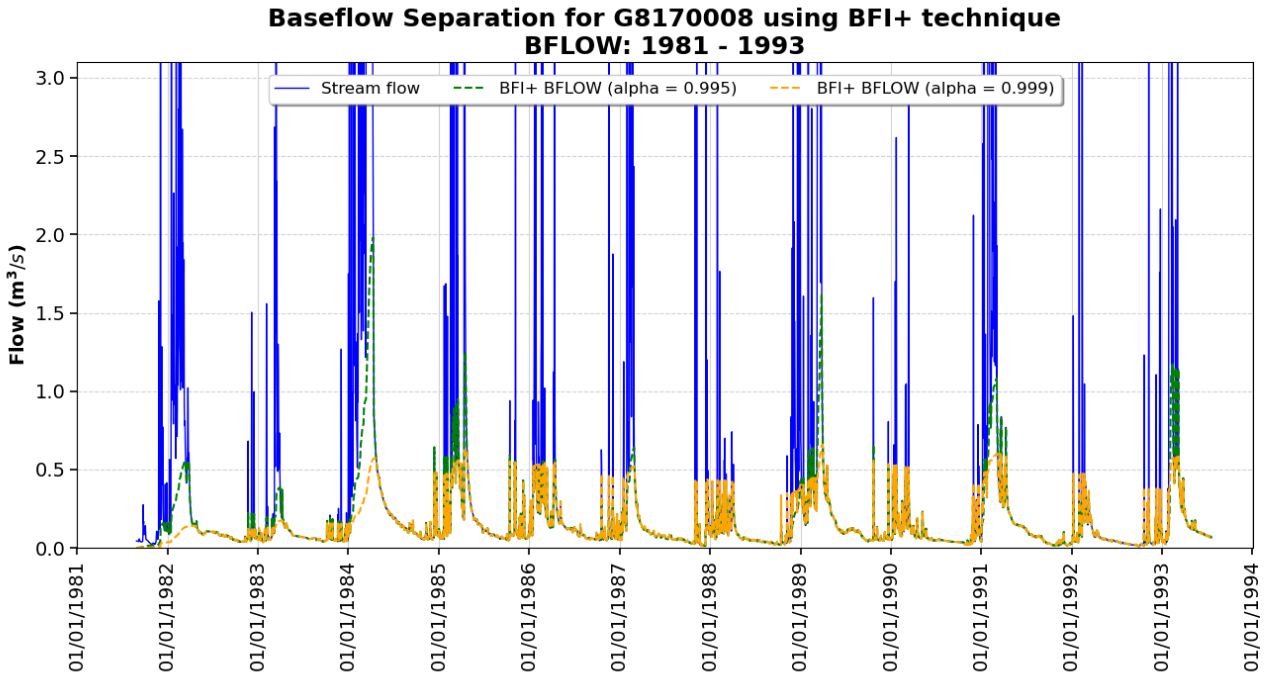

Baseflow Separation for G8170008 using BFI+ technique
Local minimum: 2003 - 2004
Stream flow
Local minimum
Flow (m³/s)
0
1
2
3
4
5
01/04/2003
01/05/2003
01/06/2003
01/07/2003
01/08/2003
01/09/2003
01/10/2003
01/11/2003
01/12/2003
01/01/2004

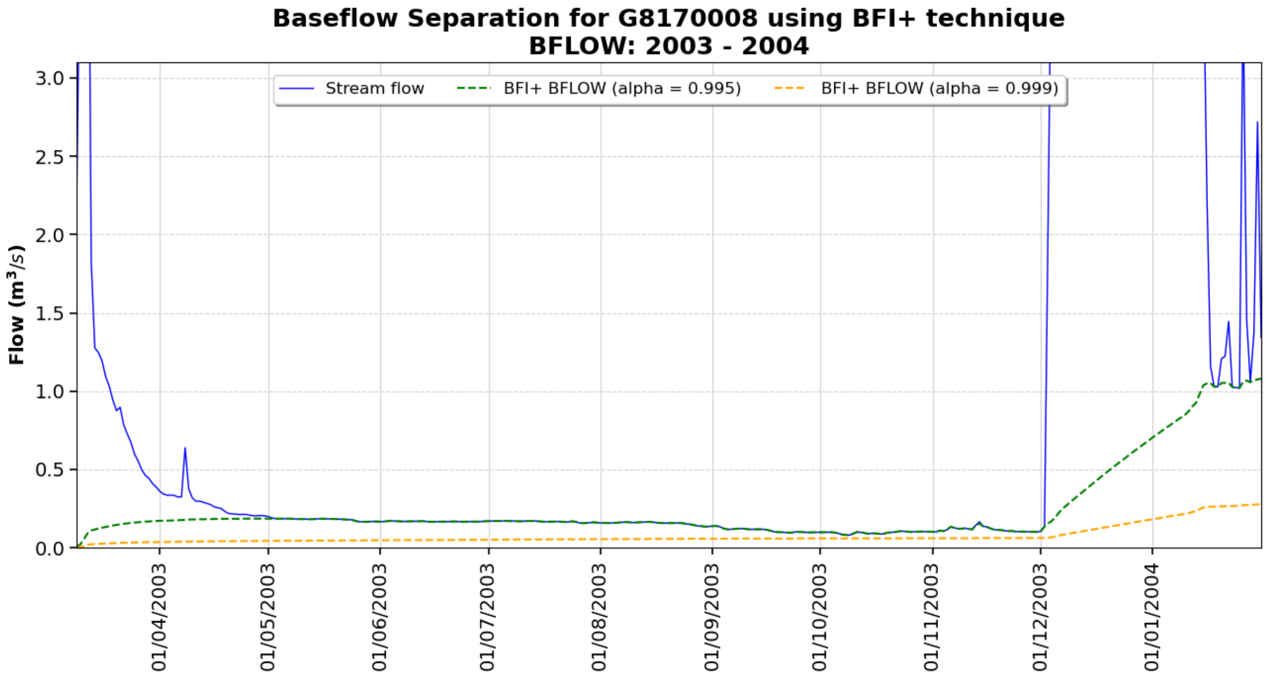

Baseflow Separation for G8170008 using BFI+ technique
Local minimum: 2005 - 2024
Stream flow
Local minimum
Flow (m³/s)
0
1
2
3
4
5
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

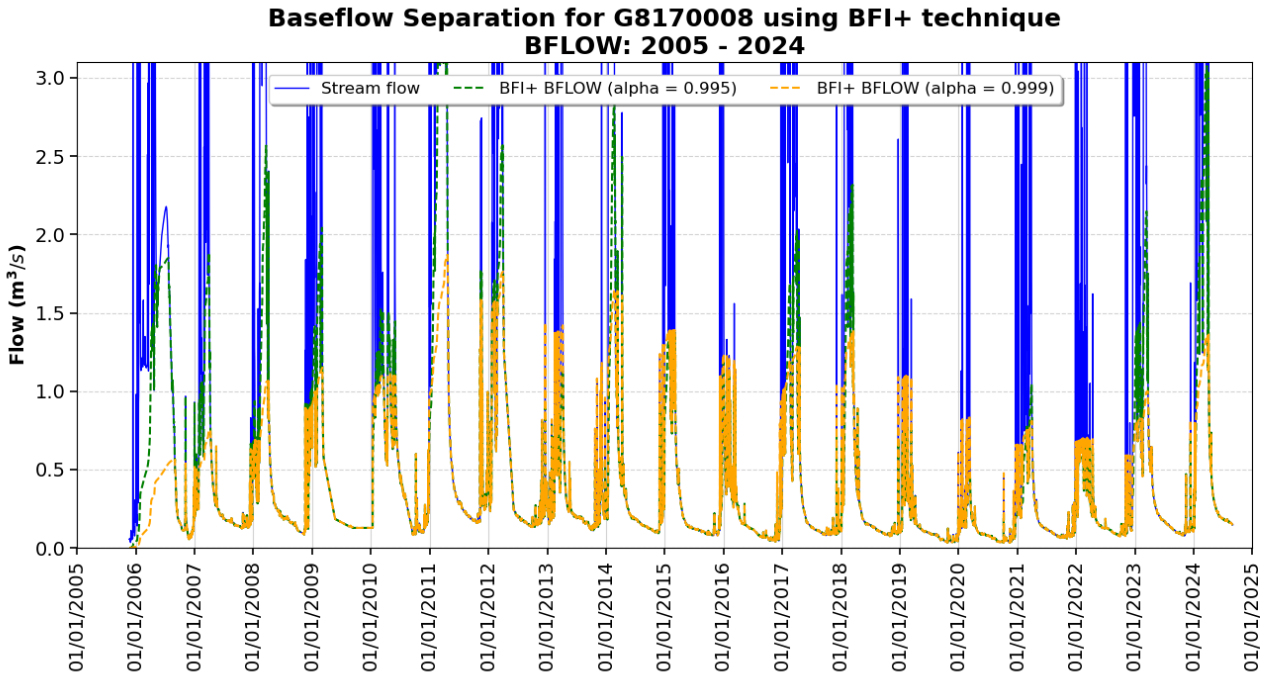

Baseflow Separation for G8170008 using BFI+ technique
EWMA: 1981 - 1993
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0
1
2
3
4
5
01/01/1981
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987
01/01/1988
01/01/1989
01/01/1990
01/01/1991
01/01/1992
01/01/1993

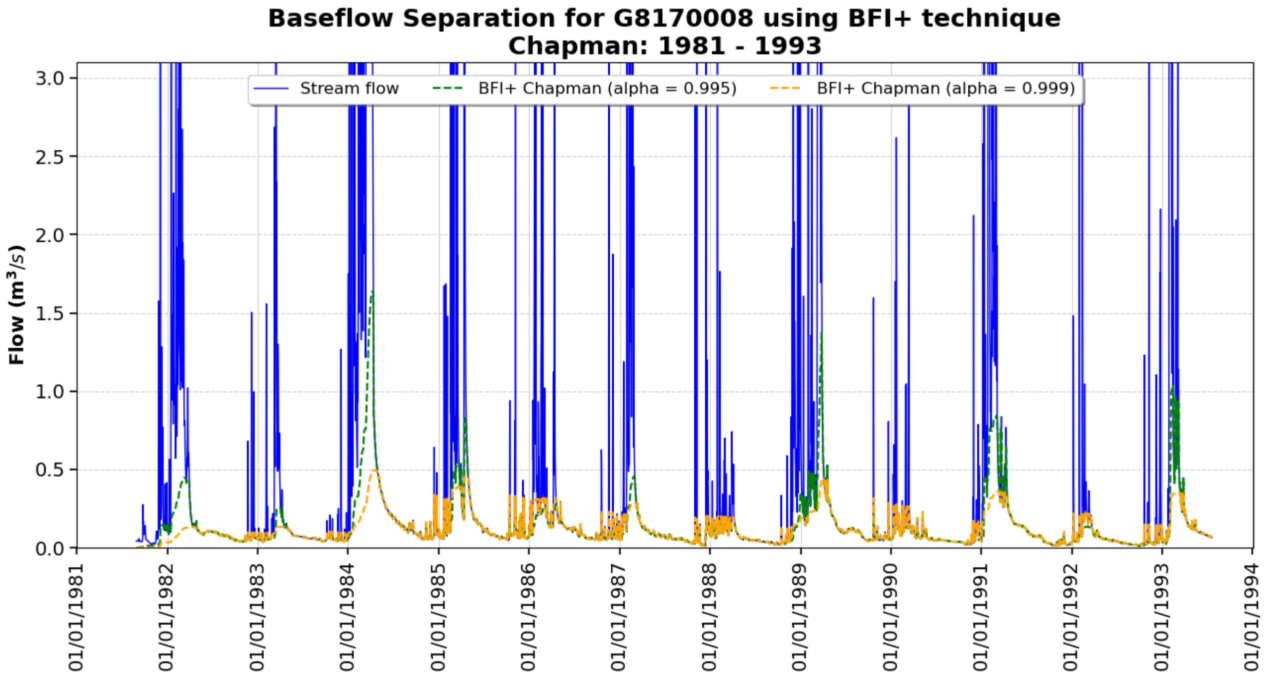

Baseflow Separation for G8170008 using BFI+ technique
EWMA: 2003 - 2004
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0
1
2
3
4
5
01/04/2003
01/05/2003
01/06/2003
01/07/2003
01/08/2003
01/09/2003
01/10/2003
01/11/2003
01/12/2003
01/01/2004

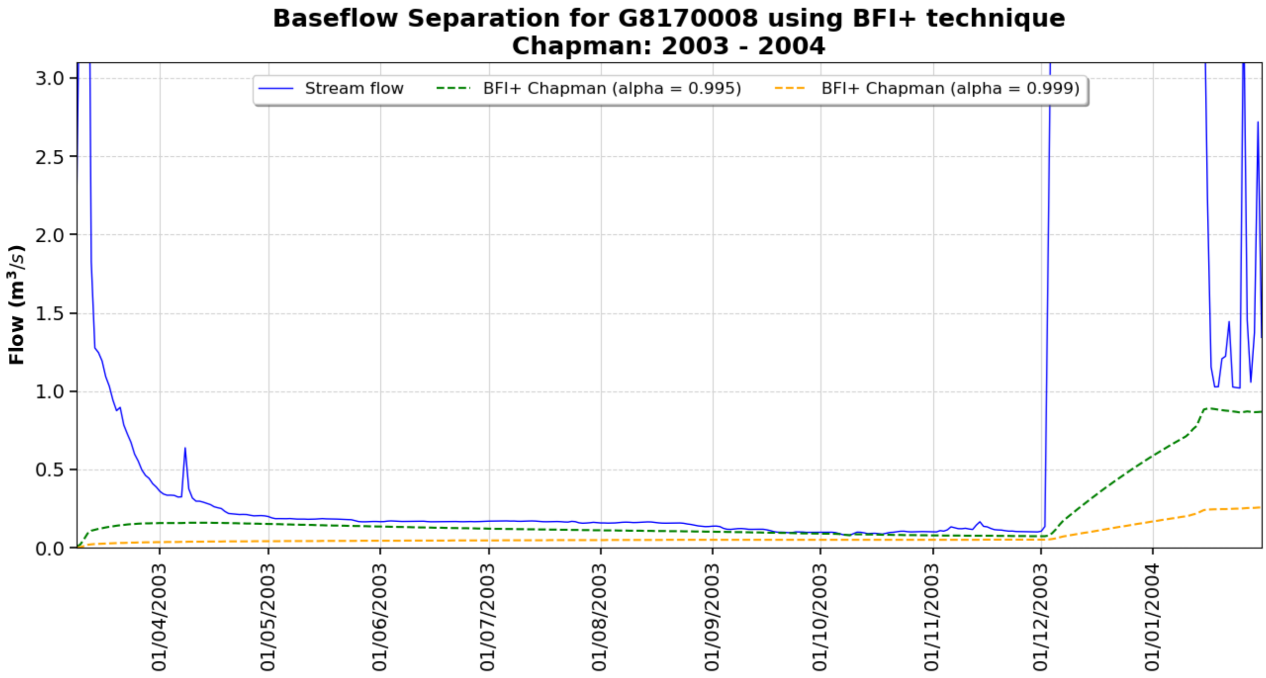

Baseflow Separation for G8170008 using BFI+ technique
EWMA: 2005 - 2024
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0
1
2
3
4
5
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

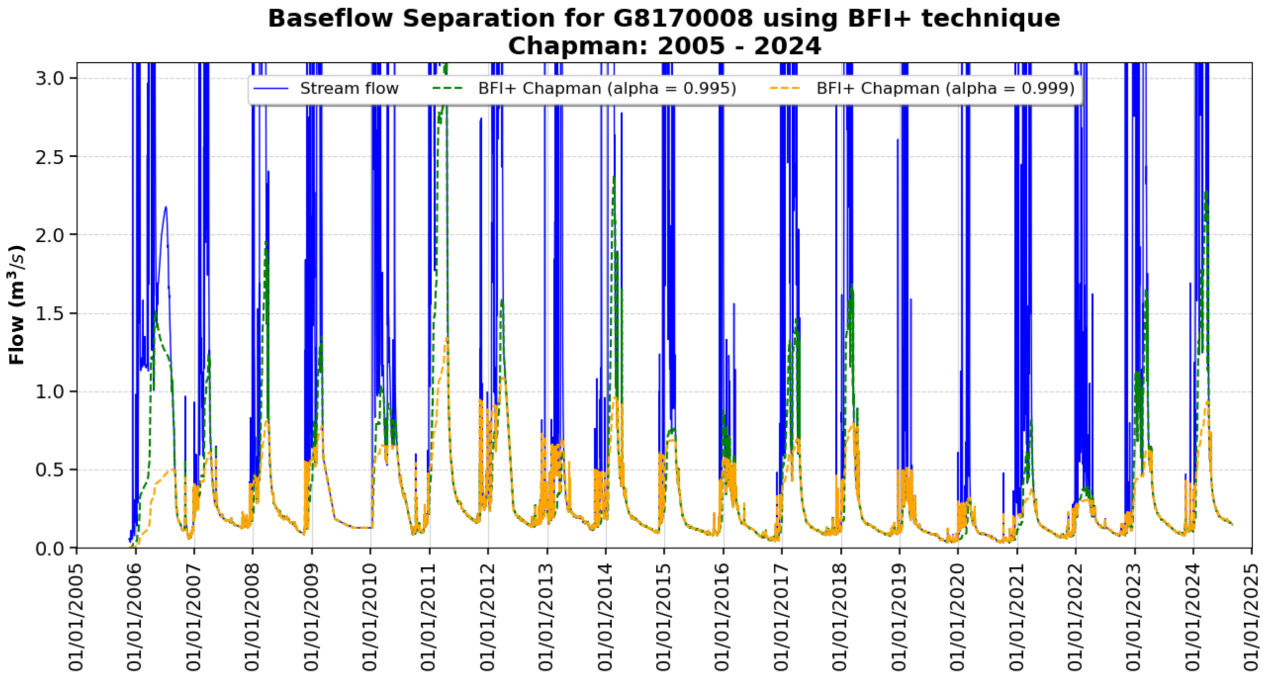

Baseflow Separation for G8170008 using BFI+ technique
BFLOW: 1981 - 1993
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/1981
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987
01/01/1988
01/01/1989
01/01/1990
01/01/1991
01/01/1992
01/01/1993
01/01/1994

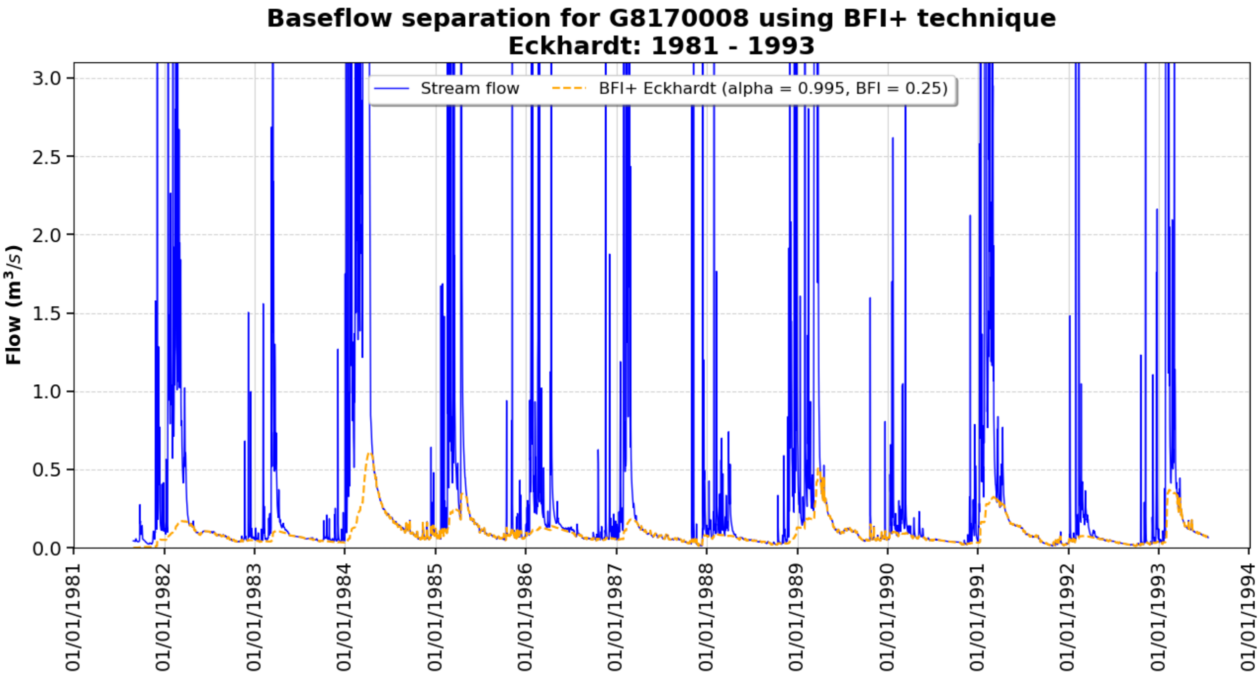

Baseflow Separation for G8170008 using BFI+ technique
BFLOW: 2003 - 2004
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/04/2003
01/05/2003
01/06/2003
01/07/2003
01/08/2003
01/09/2003
01/10/2003
01/11/2003
01/12/2003
01/01/2004

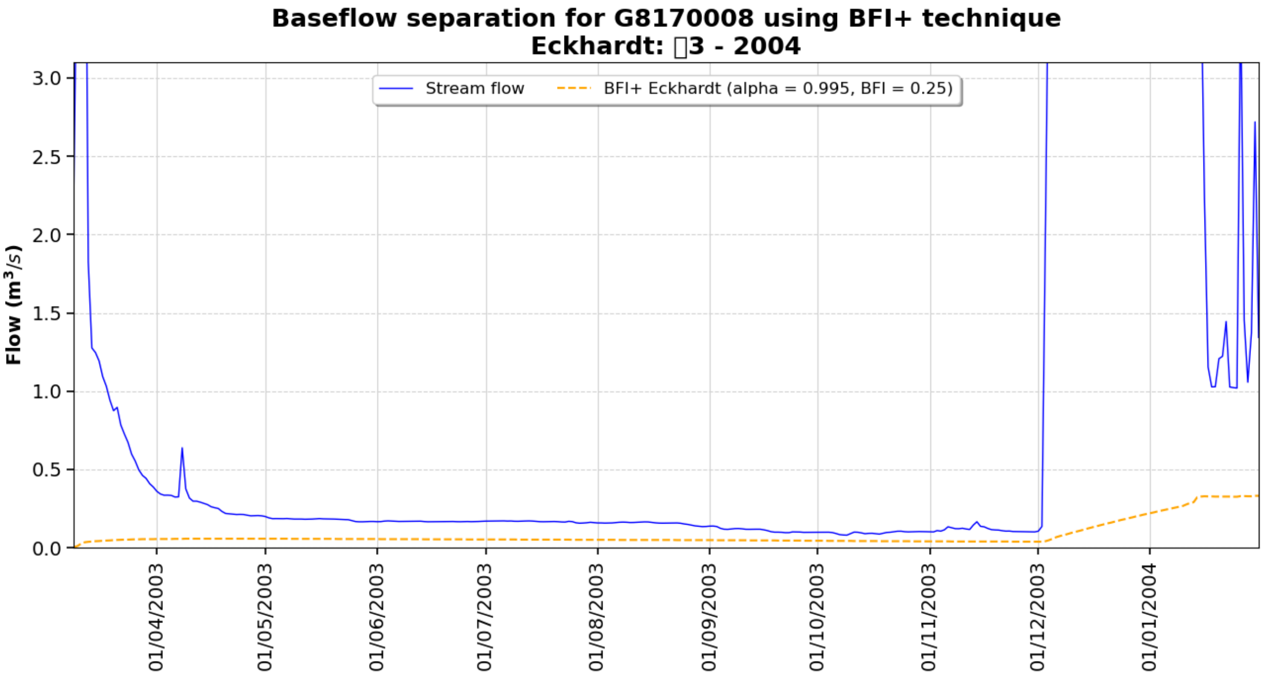

Baseflow Separation for G8170008 using BFI+ technique
BFLOW: 2005 - 2024
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)

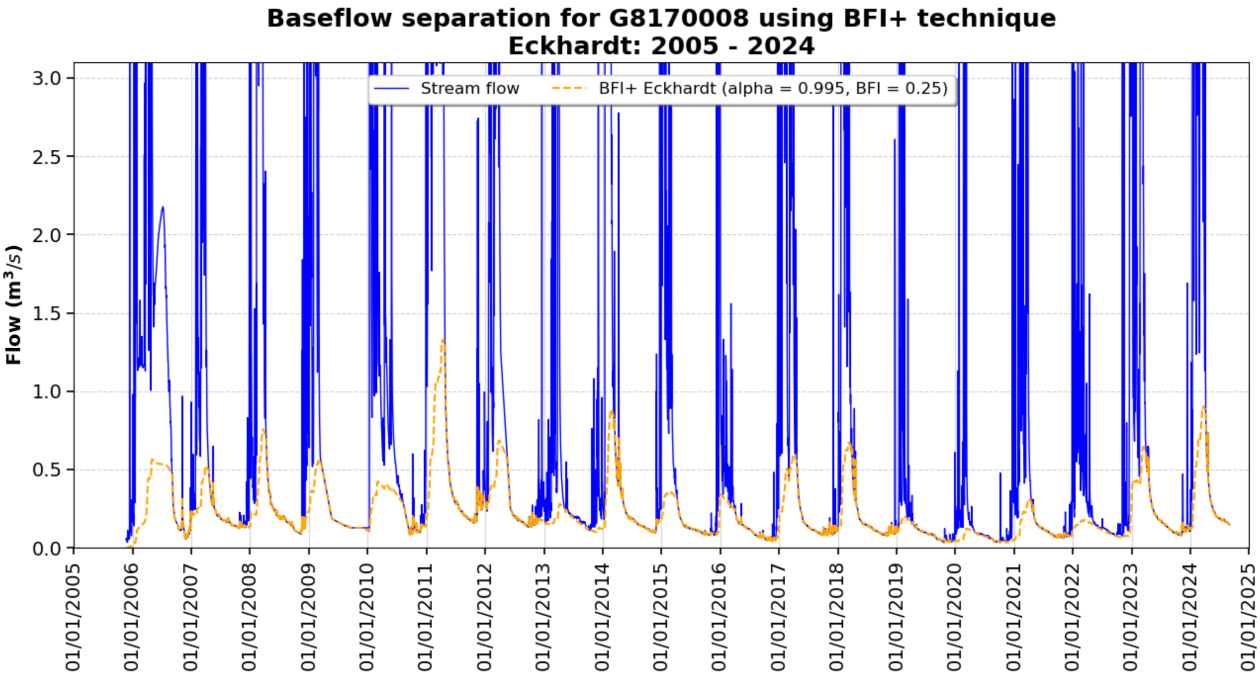

Baseflow Separation for G8170008 using BFI+ technique
Chapman: 1981 - 1993
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)


Baseflow Separation for G8170008 using BFI+ technique
Chapman: 2003 - 2004
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/04/2003
01/05/2003
01/06/2003
01/07/2003
01/08/2003
01/09/2003
01/10/2003
01/11/2003
01/12/2003
01/01/2004

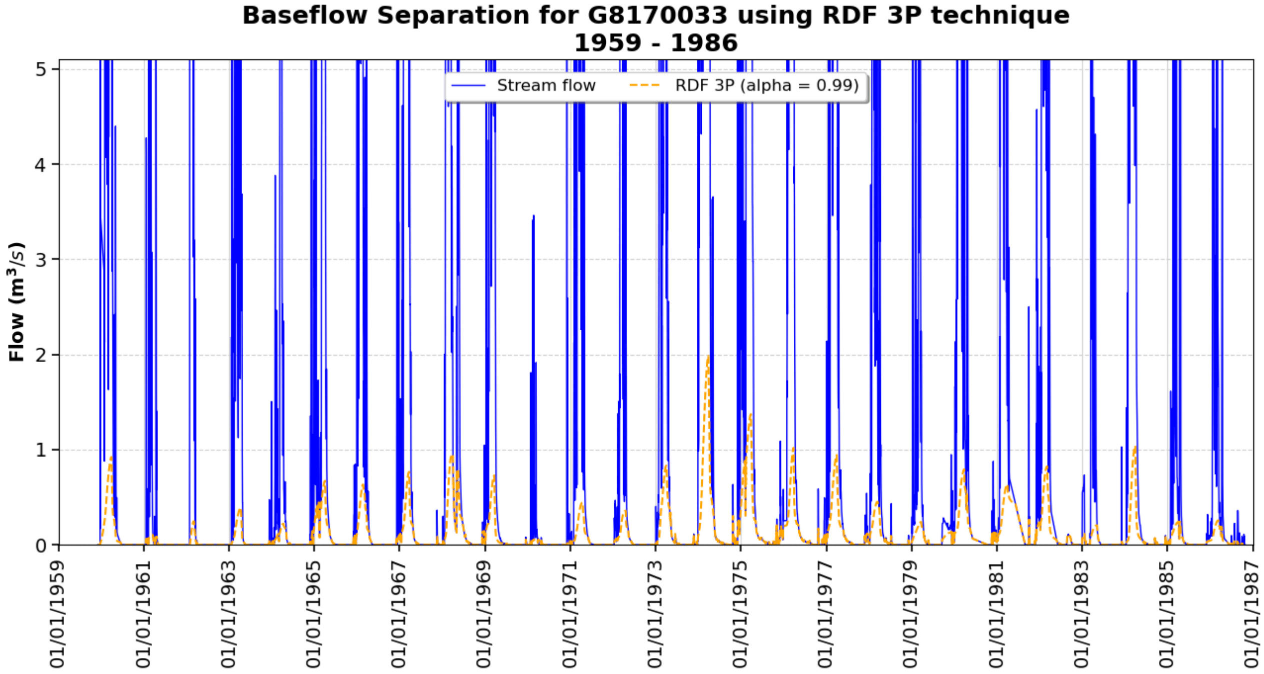

Baseflow Separation for G8170008 using BFI+ technique
Chapman: 2005 - 2024
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

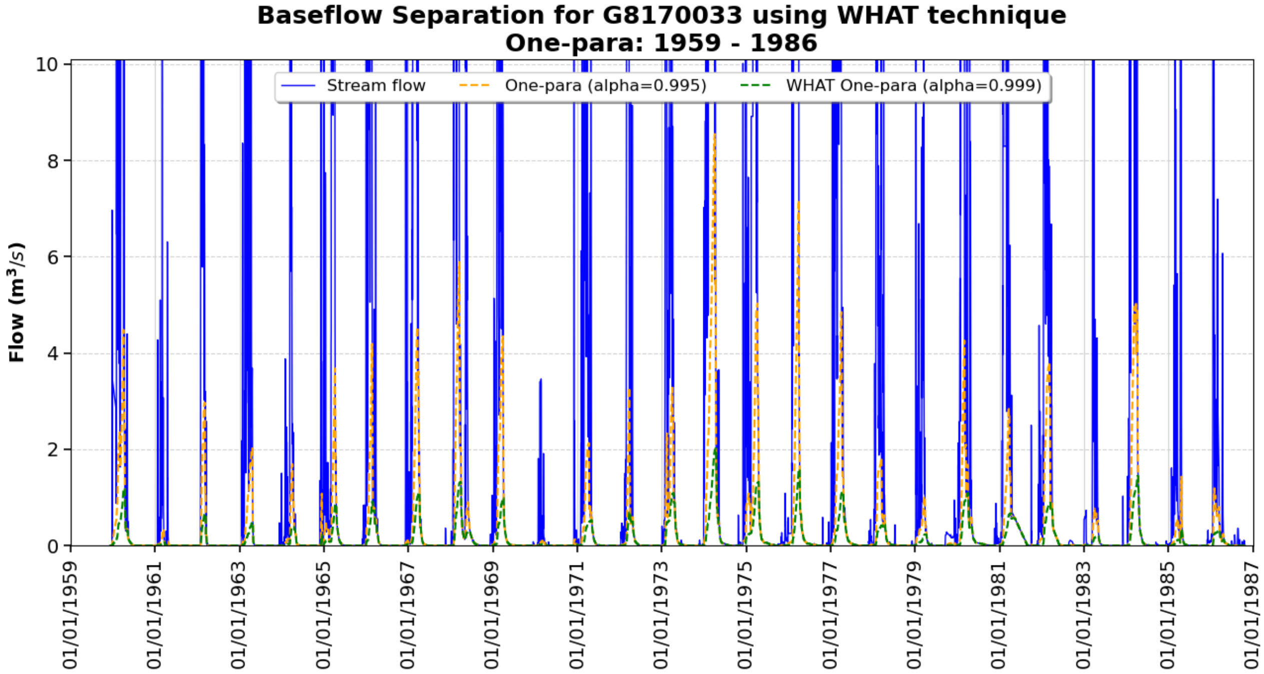

Baseflow separation for G8170008 using BFI+ technique
Eckhardt: 1981 - 1993
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/1981
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987
01/01/1988
01/01/1989
01/01/1990
01/01/1991
01/01/1992
01/01/1993
01/01/1994

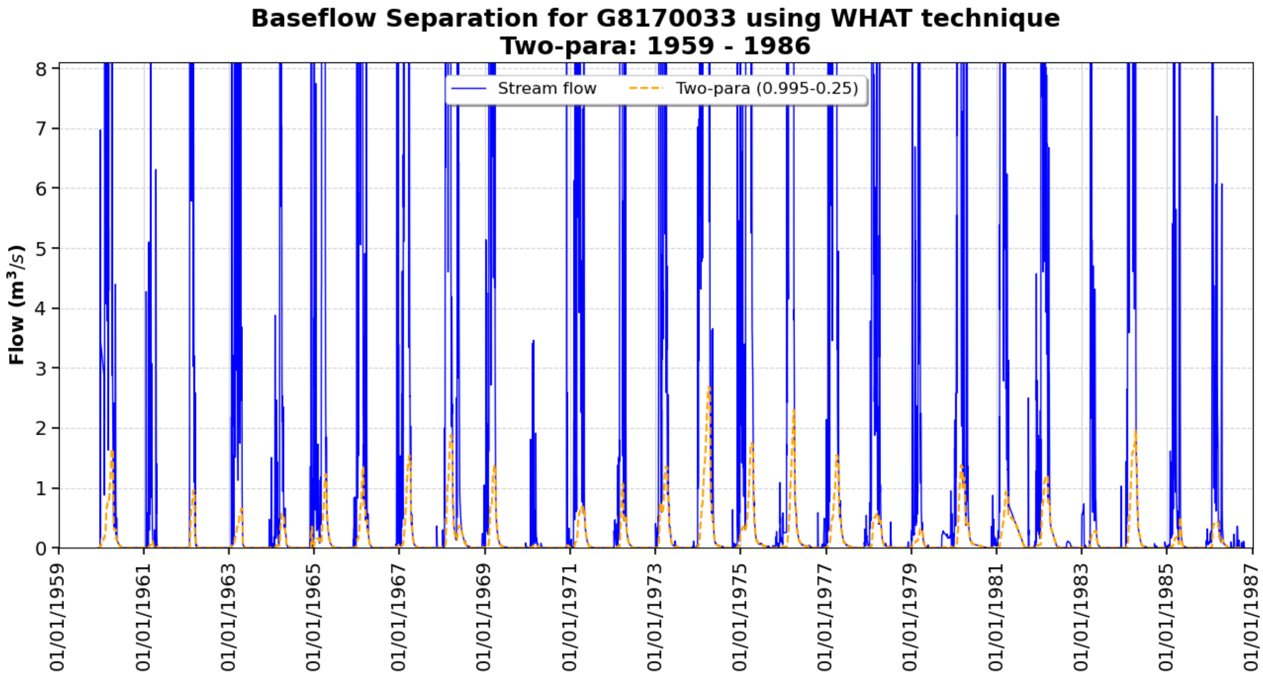

Baseflow separation for G8170008 using BFI+ technique
Eckhardt: □3 - 2004
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/04/2003
01/05/2003
01/06/2003
01/07/2003
01/08/2003
01/09/2003
01/10/2003
01/11/2003
01/12/2003
01/01/2004

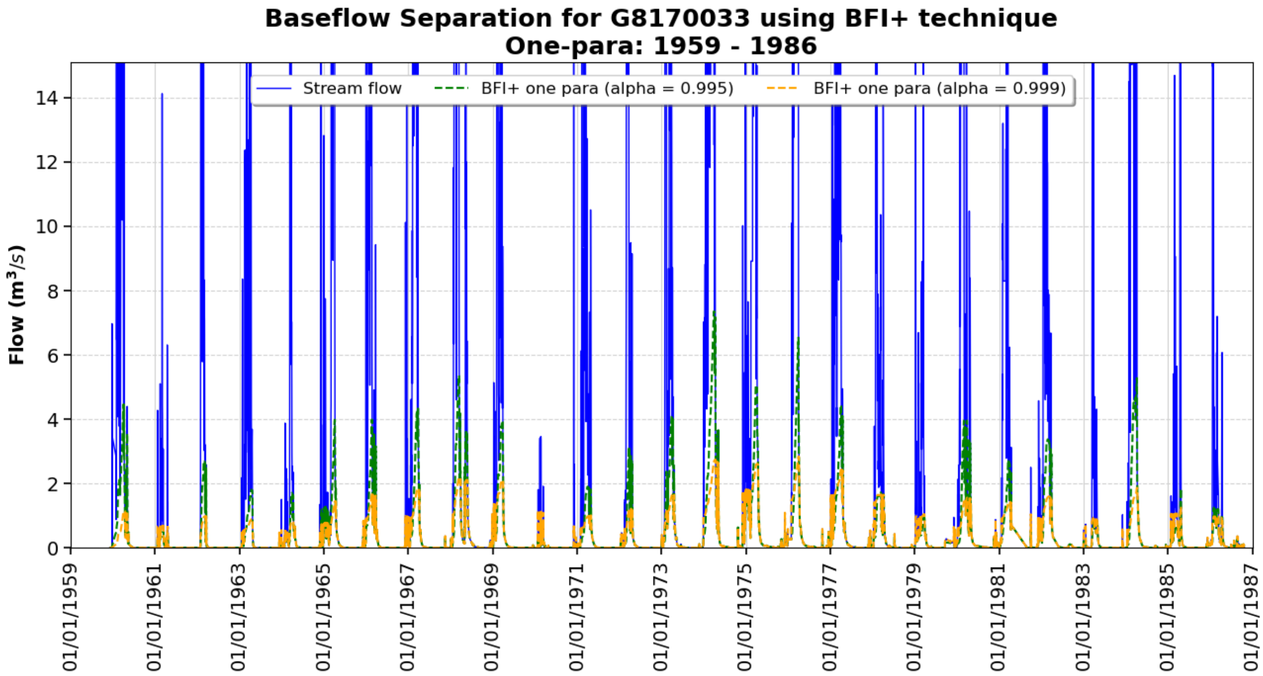

Baseflow separation for G8170008 using BFI+ technique
Eckhardt: 2005 - 2024
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

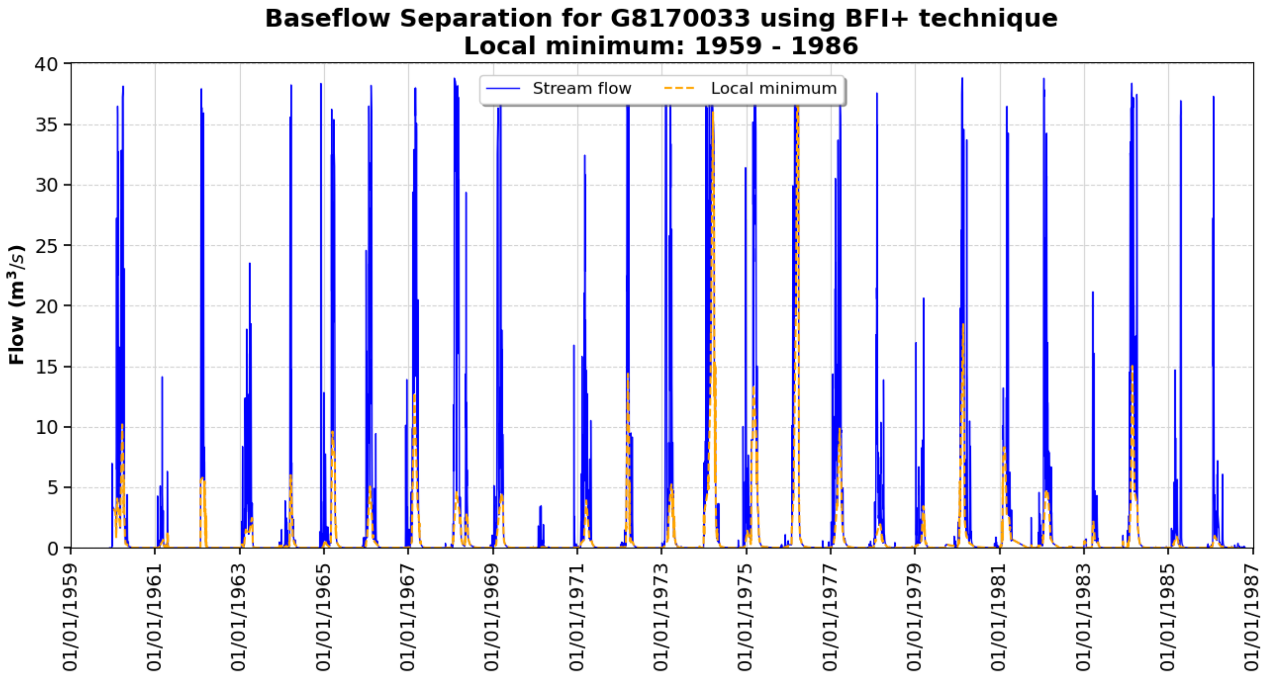
Appendix E: Baseflow separation hydrographs for G8170033

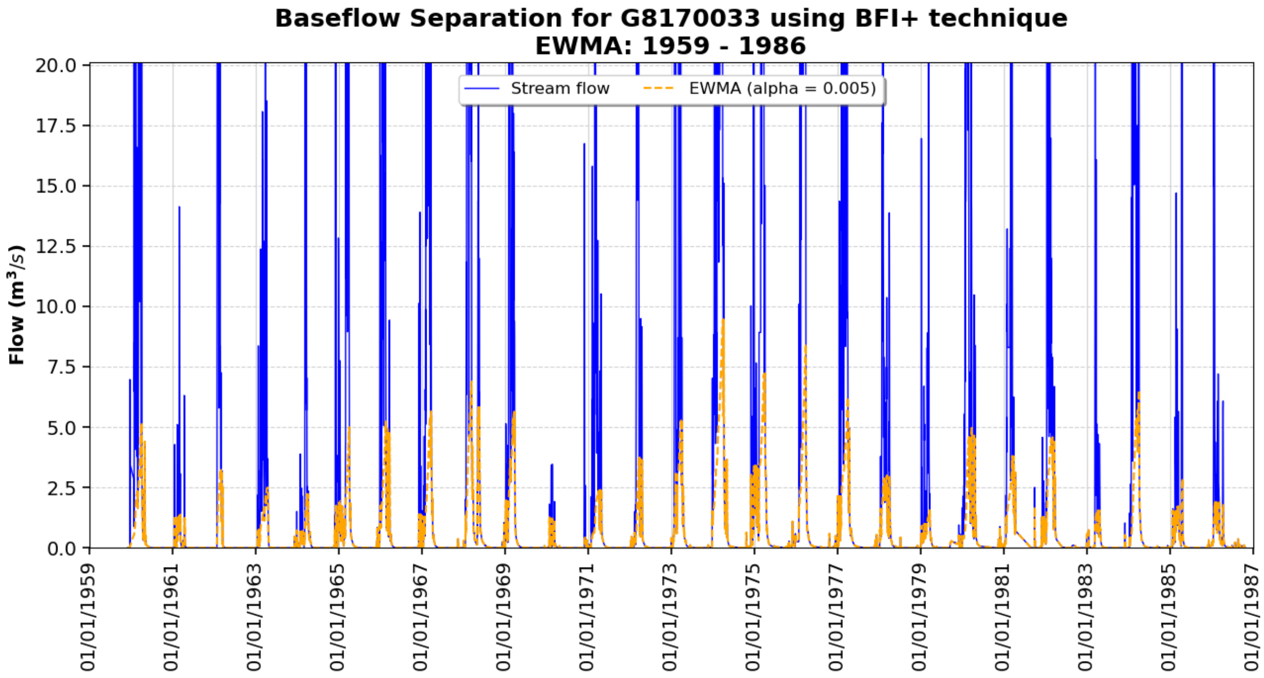


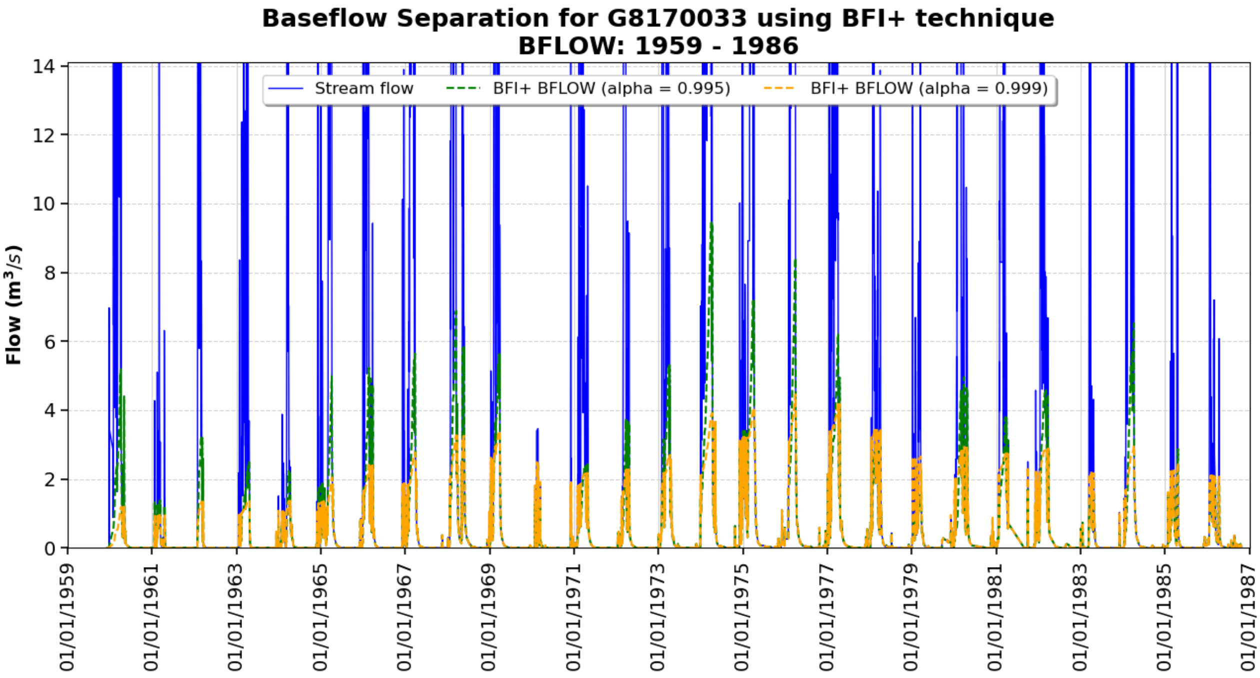


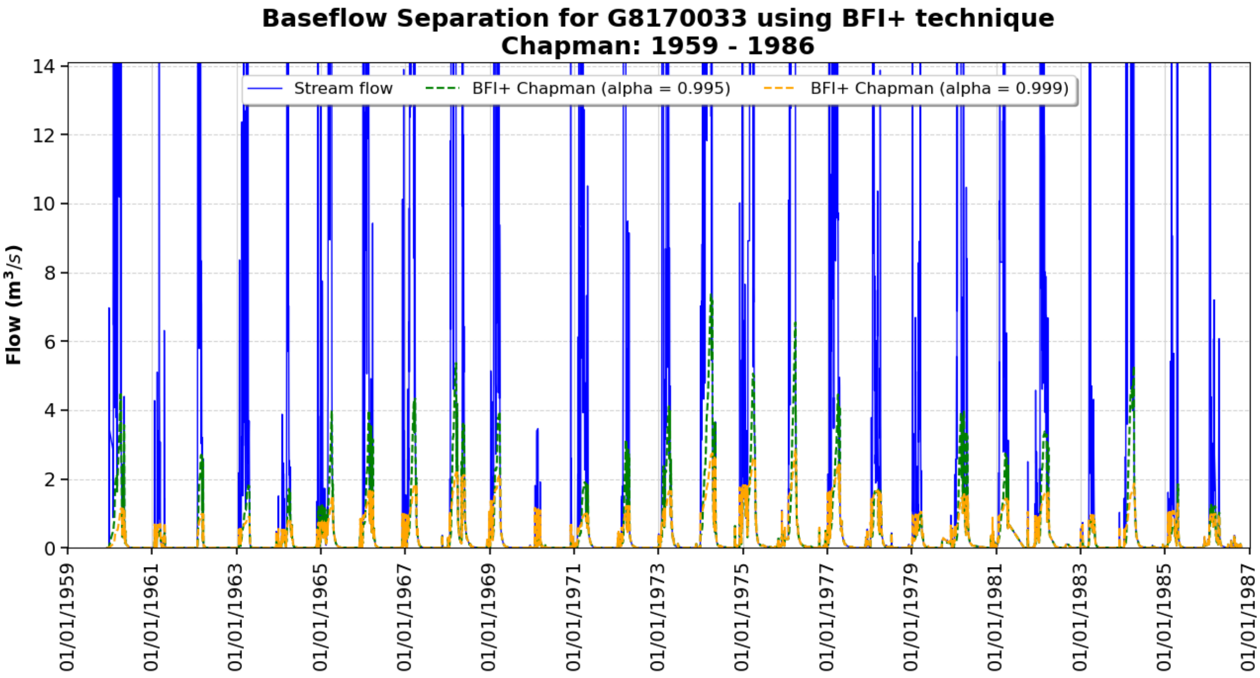

Baseflow Separation for G8170033 using WHAT technique
Two-para: 1959 - 1986
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0
1
2
3
4
5
6
7
8
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987

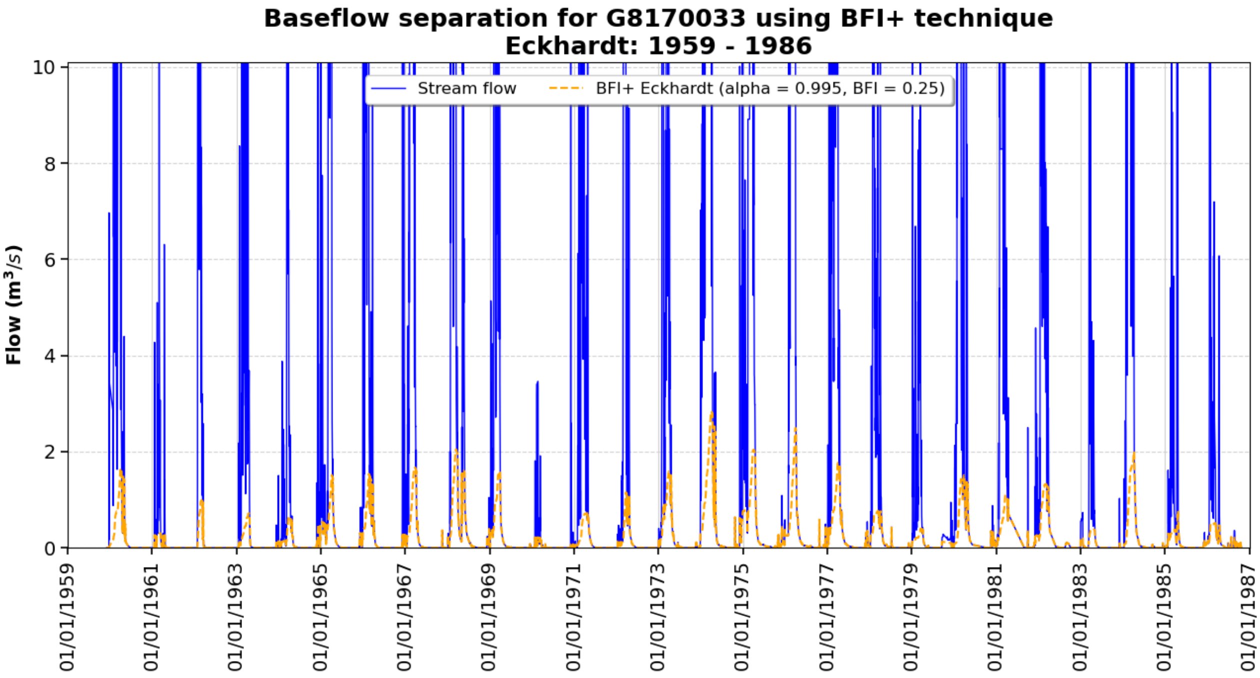

Baseflow Separation for G8170033 using BFI+ technique
One-para: 1959 - 1986
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
0
2
4
6
8
10
12
14
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987


Baseflow Separation for G8170033 using BFI+ technique
Local minimum: 1959 - 1986
Stream flow
Local minimum
Flow (m³/s)
0
5
10
15
20
25
30
35
40
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987

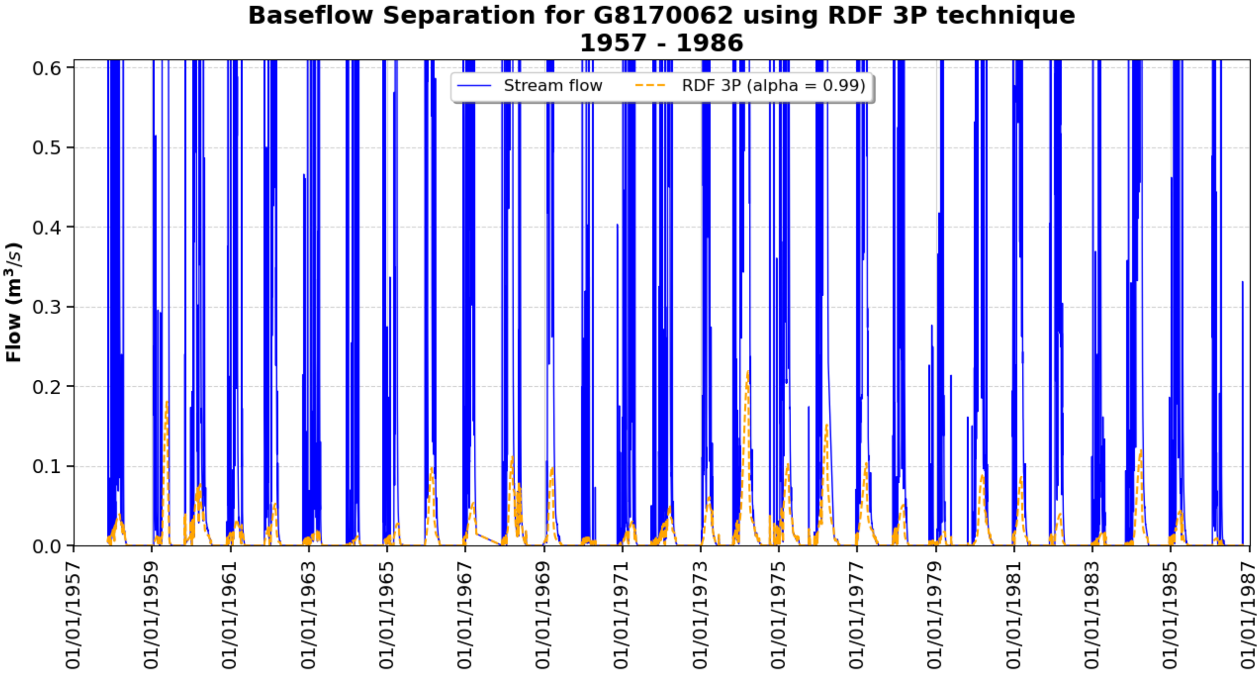

Baseflow Separation for G8170033 using BFI+ technique
EWMA: 1959 - 1986
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987

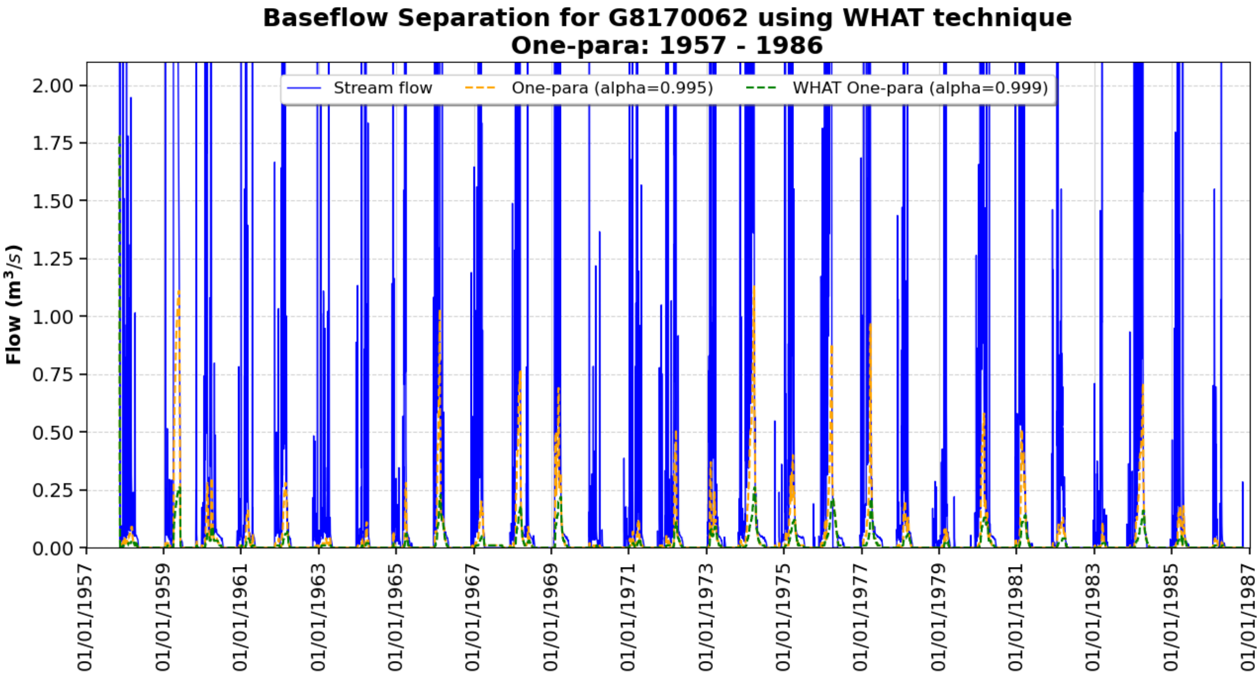

Baseflow Separation for G8170033 using BFI+ technique
BFLOW: 1959 - 1986
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0
2
4
6
8
10
12
14
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987

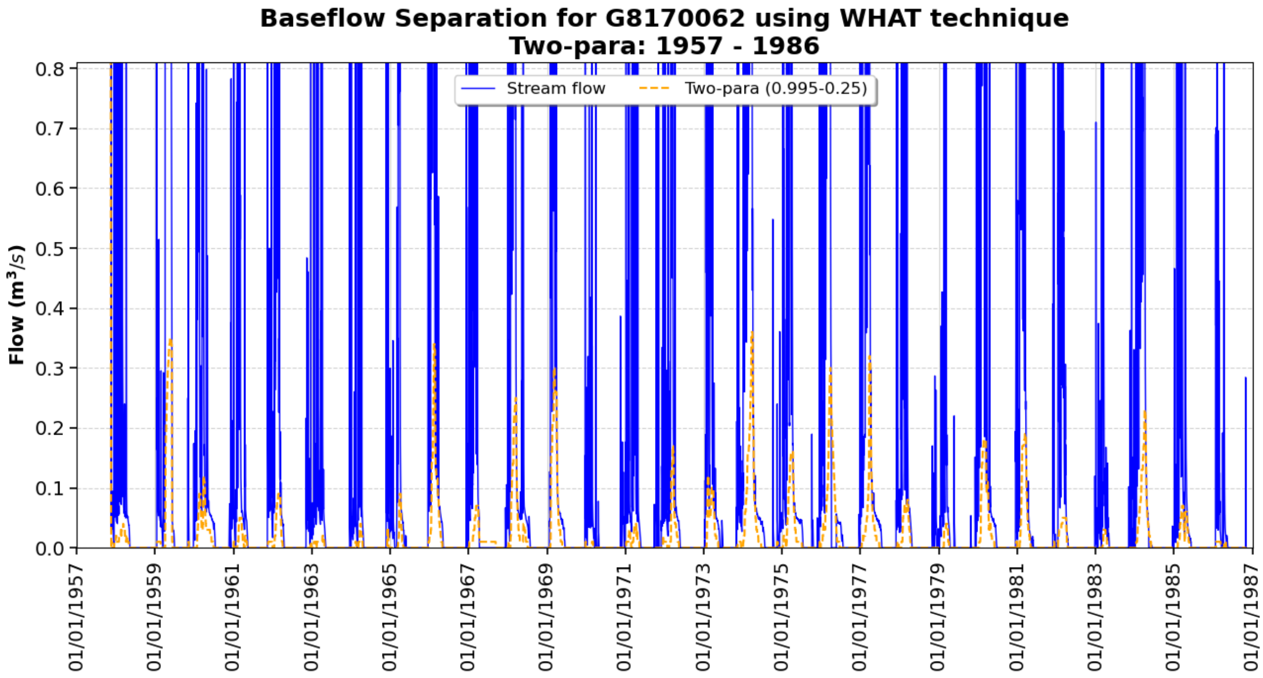

Baseflow Separation for G8170033 using BFI+ technique
Chapman: 1959 - 1986
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0
2
4
6
8
10
12
14
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987

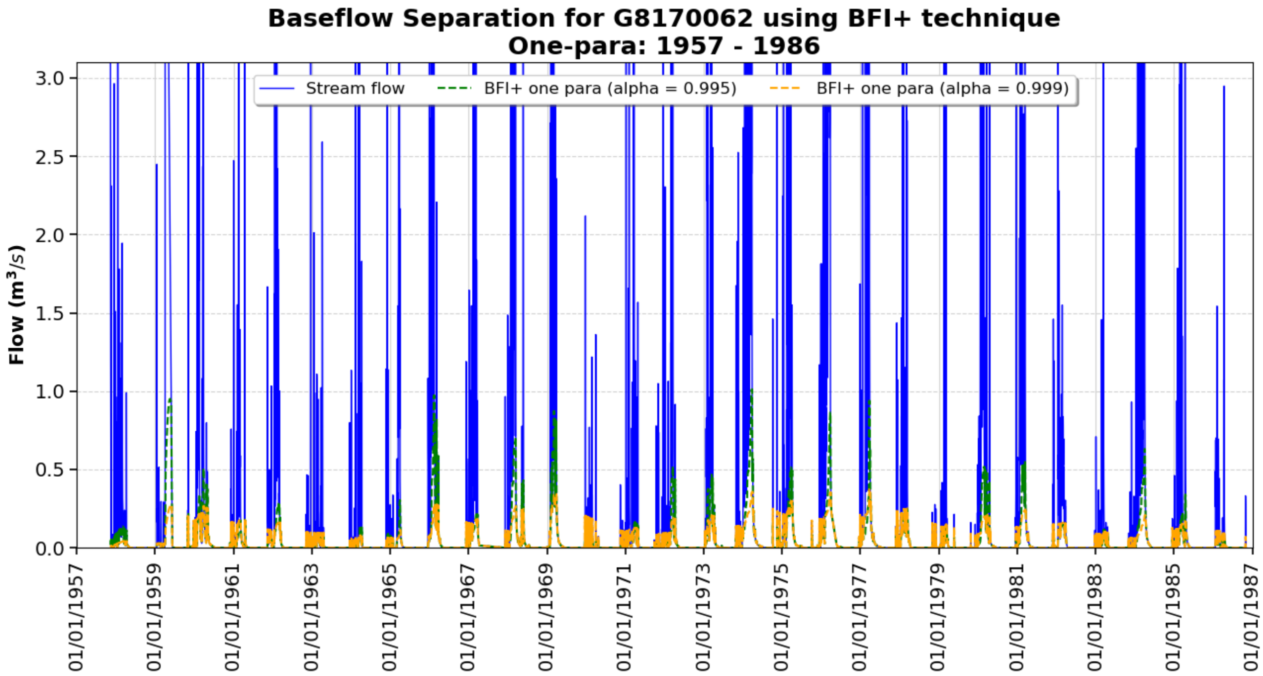

Baseflow separation for G8170033 using BFI+ technique
Eckhardt: 1959 - 1986
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m^3/s)
0
2
4
6
8
10
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987

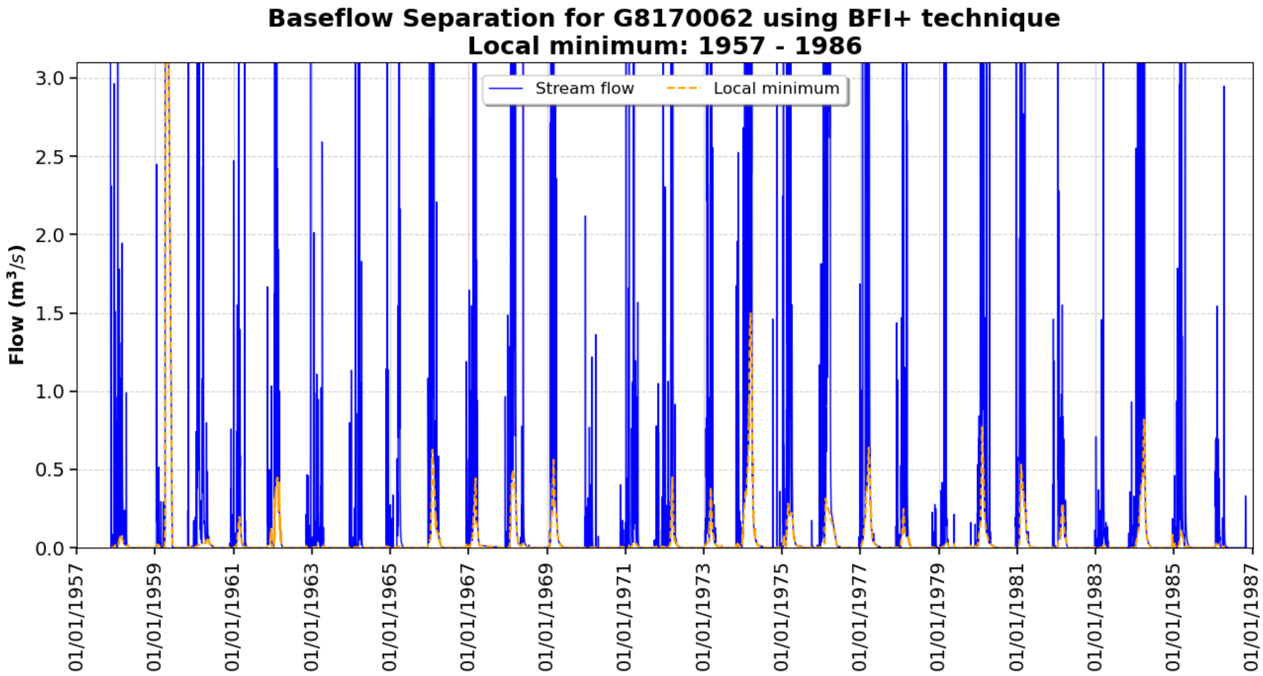
Appendix F: Baseflow separation hydrographs for G8170062

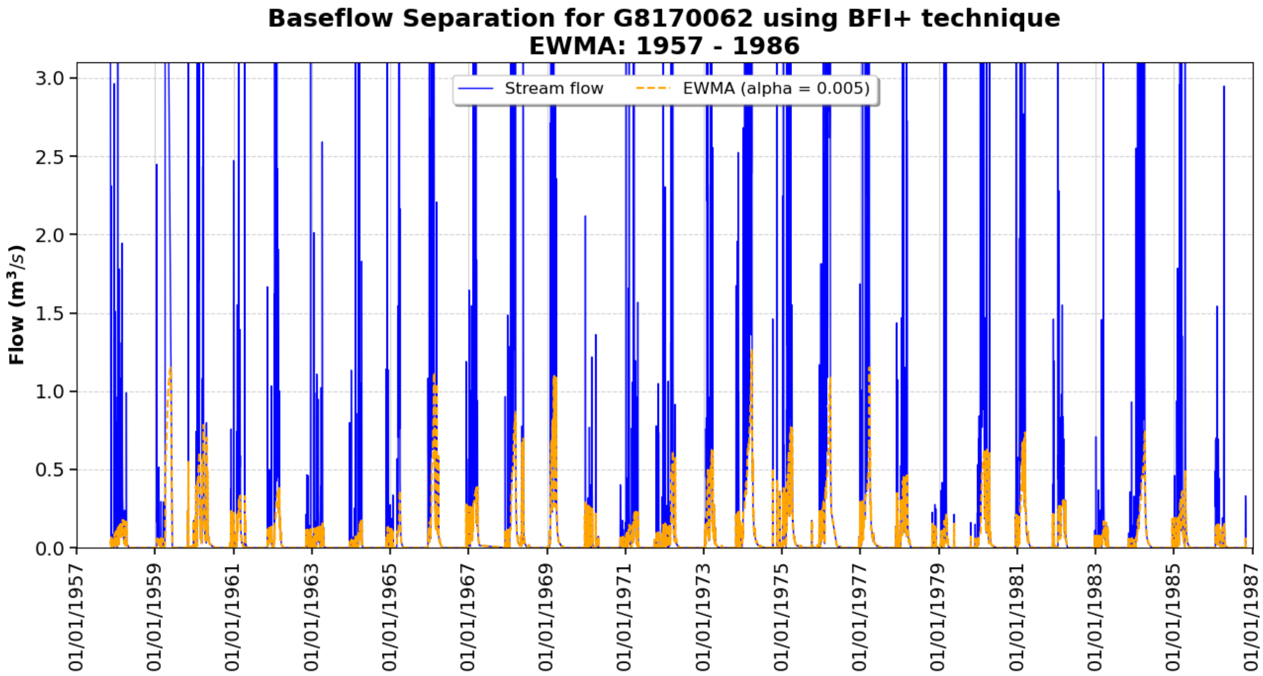


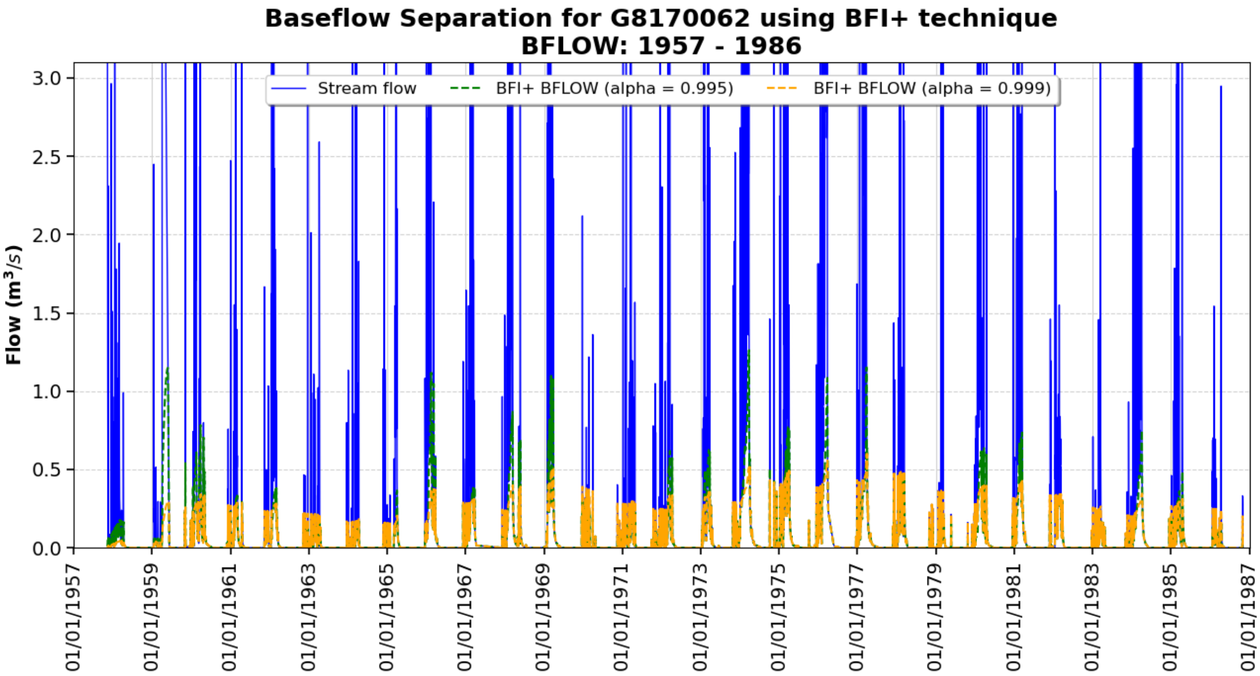



Baseflow Separation for G8170062 using WHAT technique
Two-para: 1957 - 1986
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
01/01/1957
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987

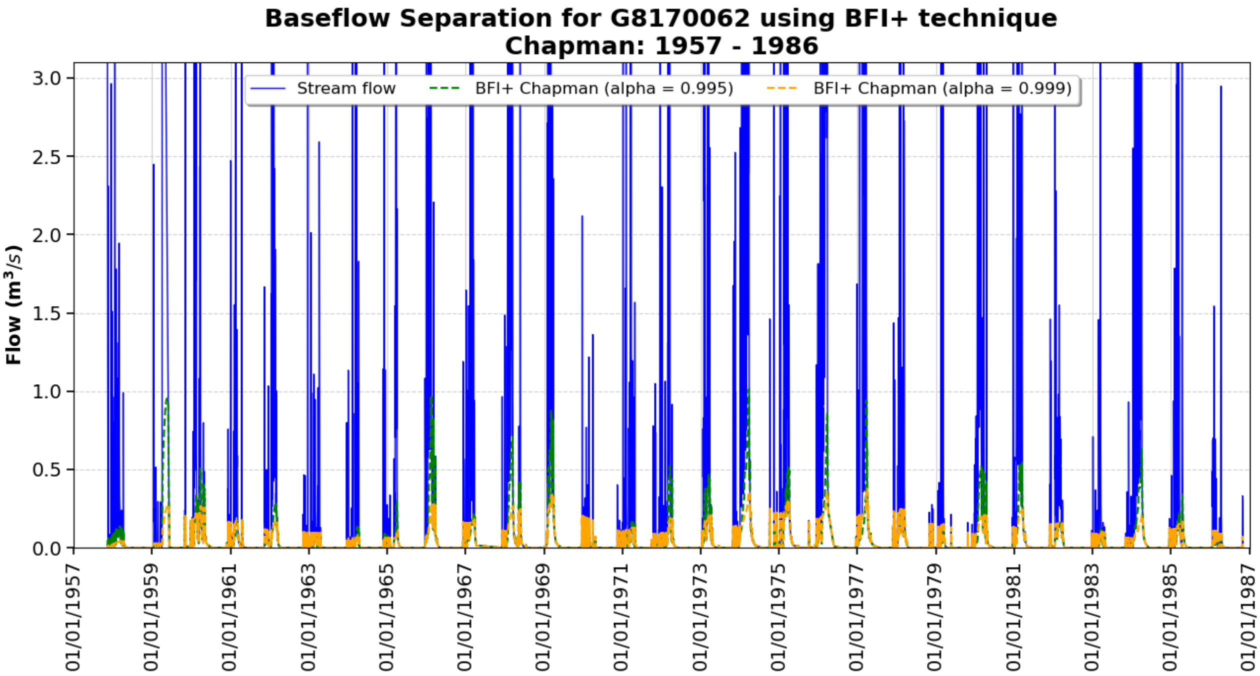

Baseflow Separation for G8170062 using BFI+ technique
One-para: 1957 - 1986
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/1957
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987


Baseflow Separation for G8170062 using BFI+ technique
Local minimum: 1957 - 1986
Stream flow
Local minimum
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/1957
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987

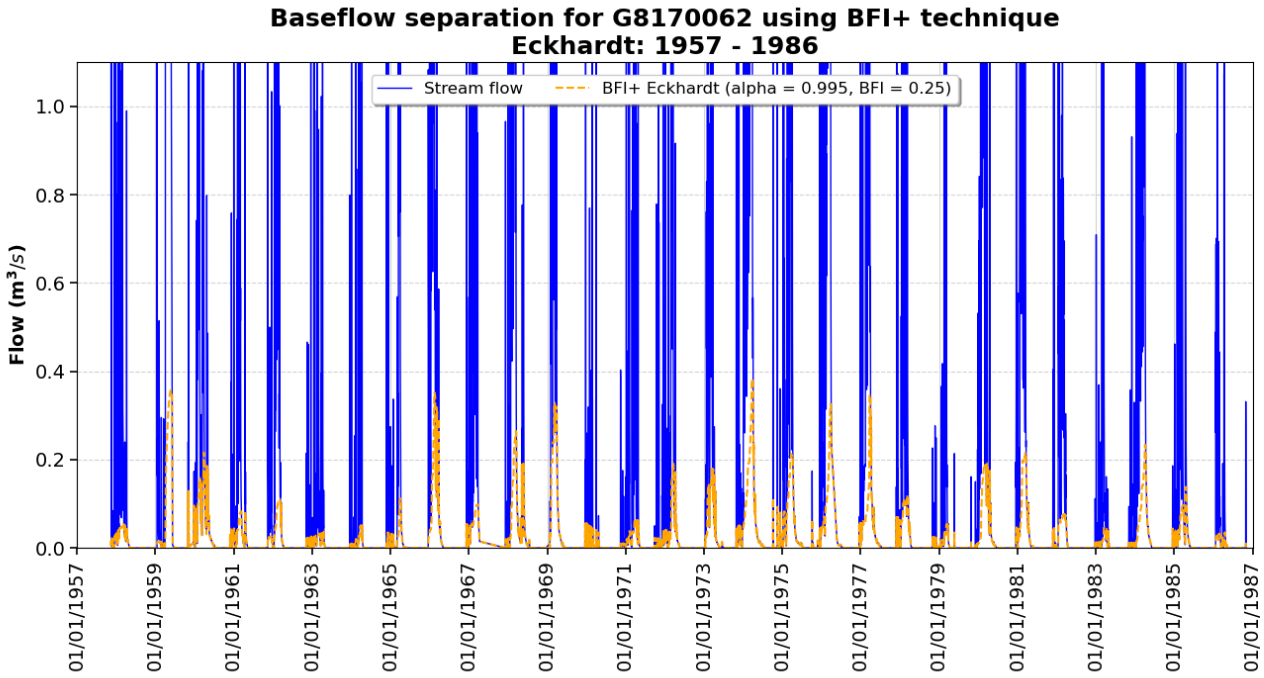

Baseflow Separation for G8170062 using BFI+ technique
EWMA: 1957 - 1986
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/1957
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987



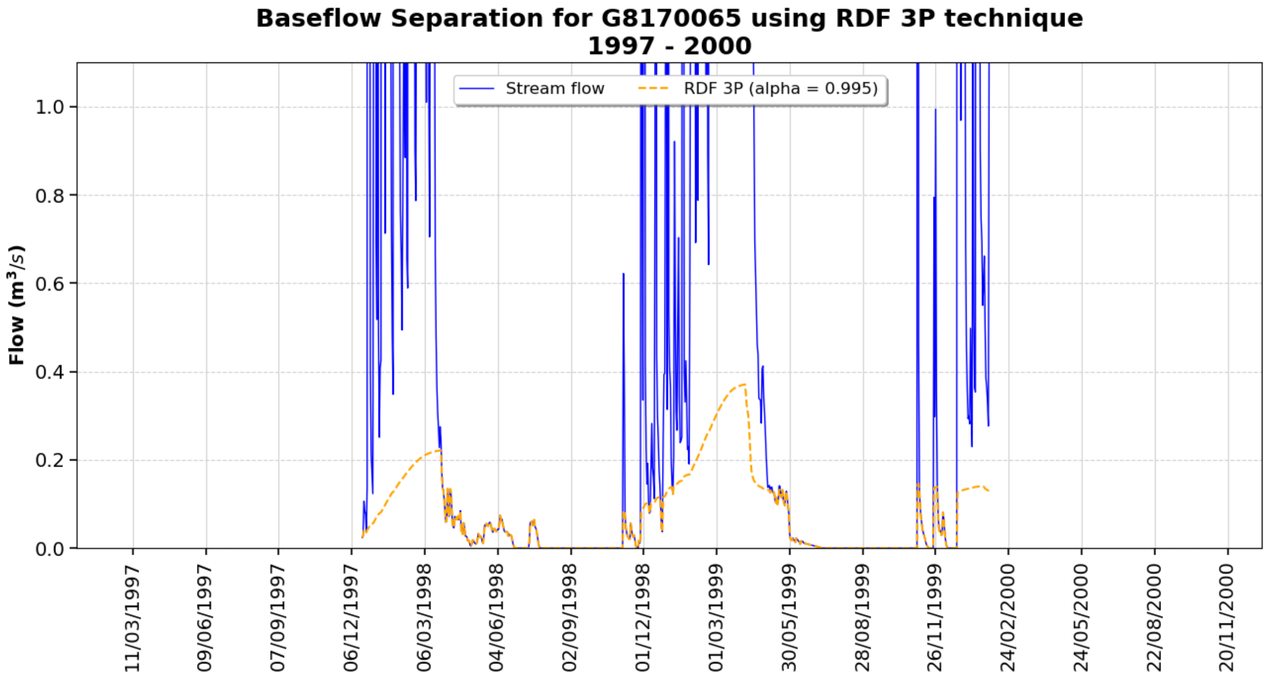
Baseflow Separation for G8170062 using BFI+ technique
BFLOW: 1957 - 1986
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/1957
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987

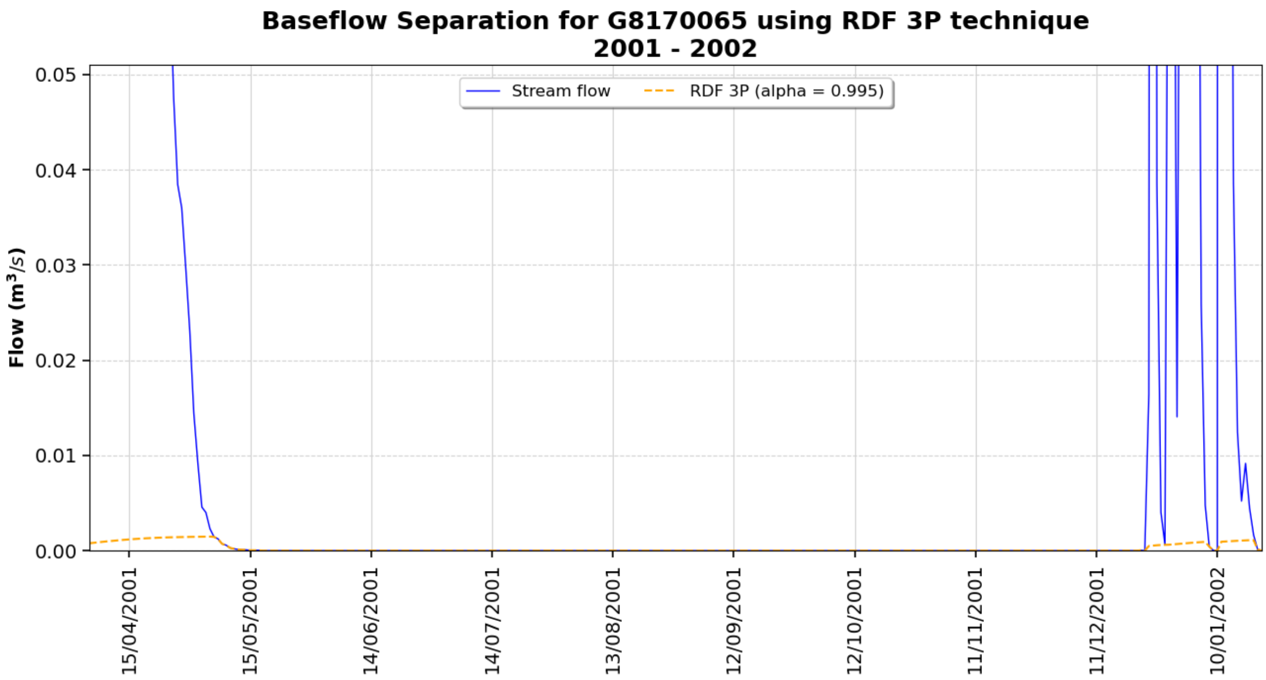


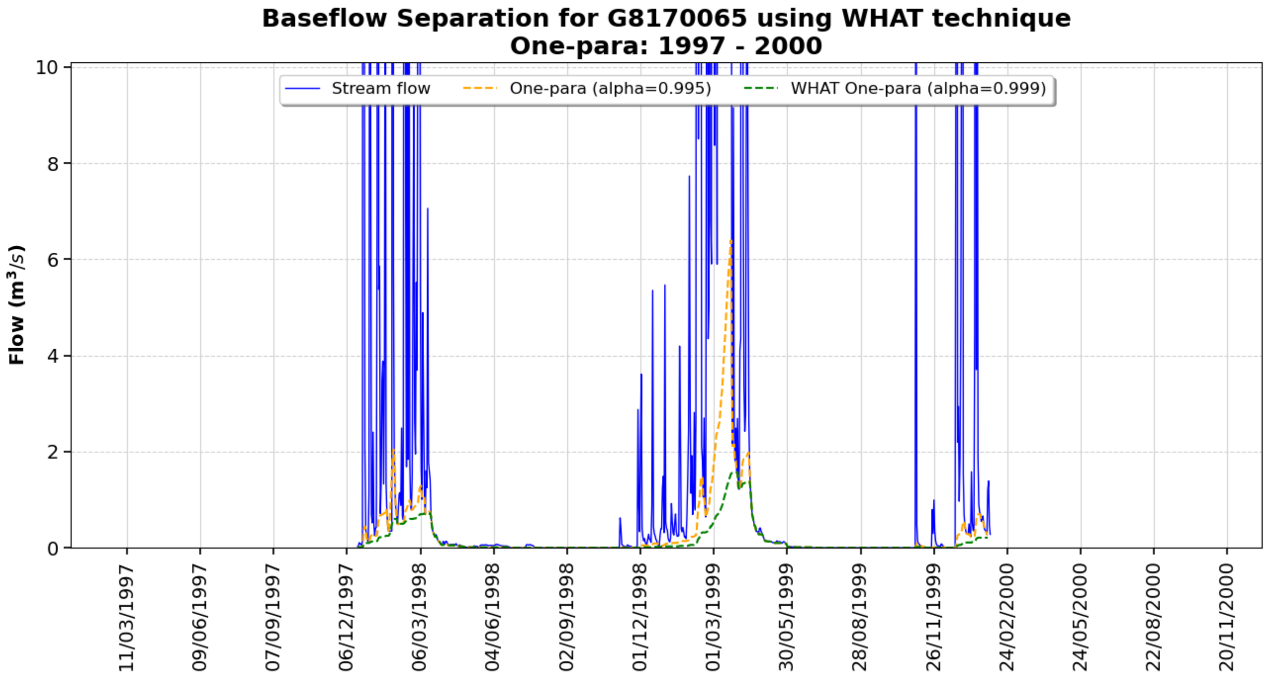
Baseflow Separation for G8170062 using BFI+ technique
Chapman: 1957 - 1986
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/1957
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987

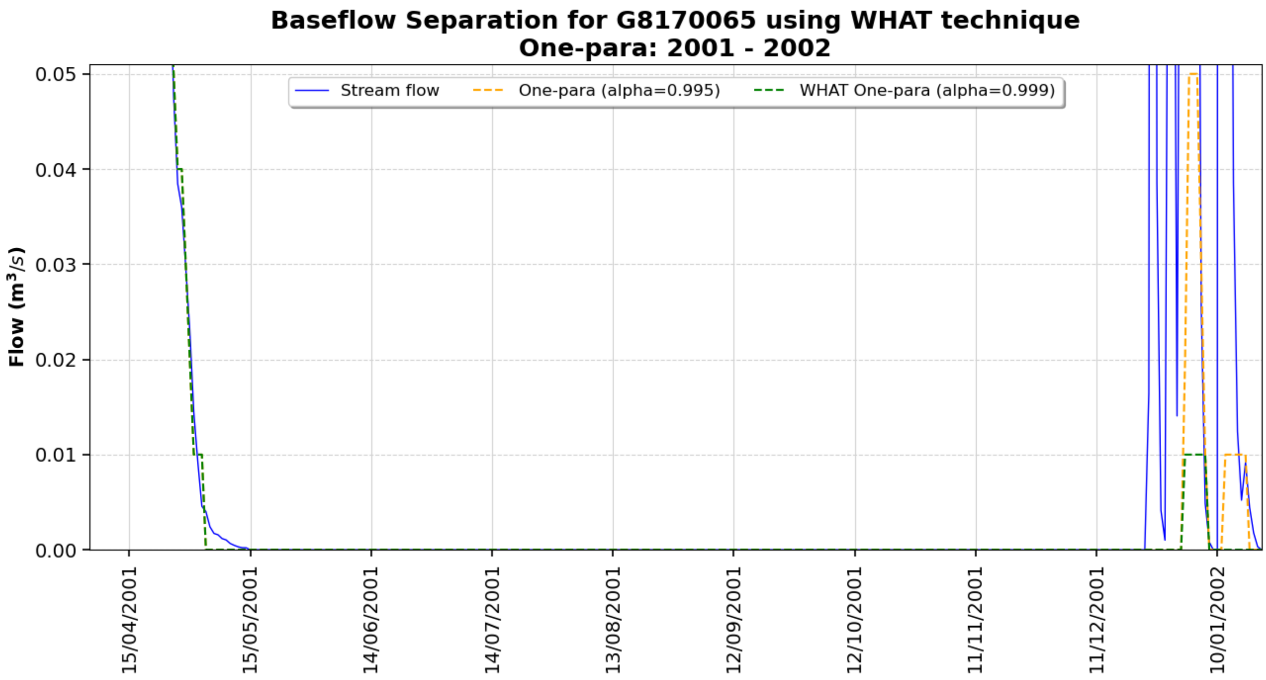

Baseflow separation for G8170062 using BFI+ technique
Eckhardt: 1957 - 1986
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0.0
0.2
0.4
0.6
0.8
1.0
01/01/1957
01/01/1959
01/01/1961
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981
01/01/1983
01/01/1985
01/01/1987

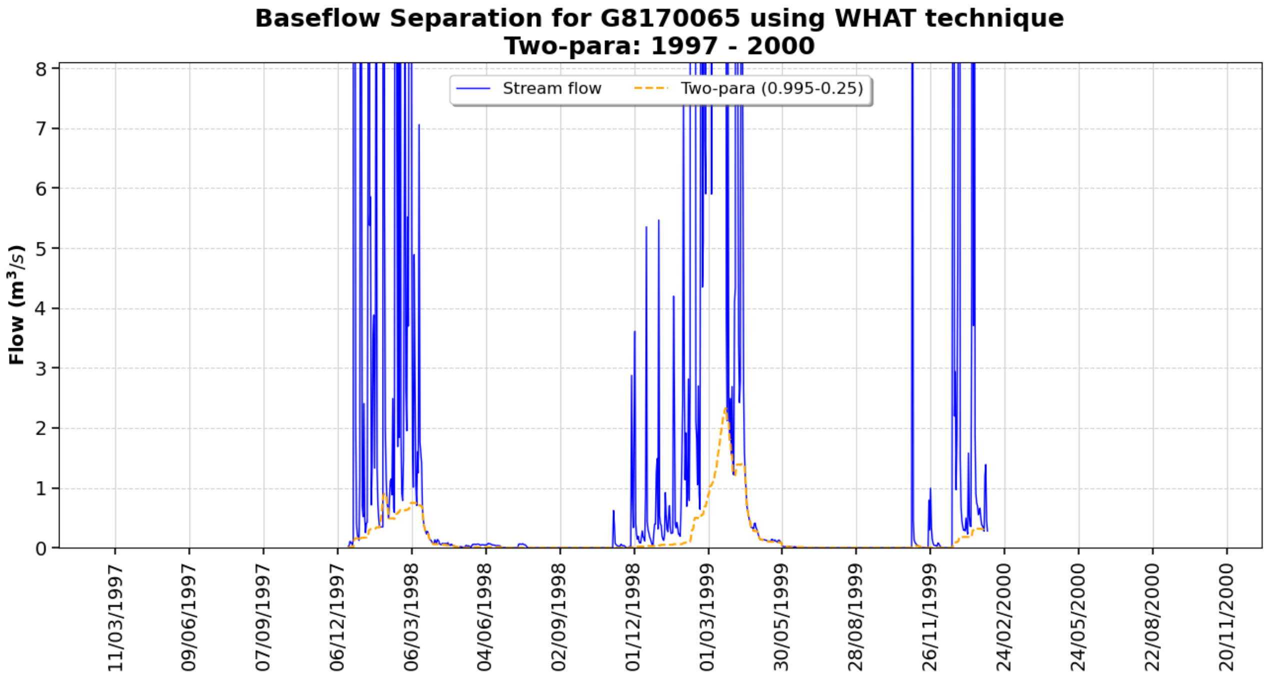
Appendix G: Baseflow separation hydrographs for G8170065

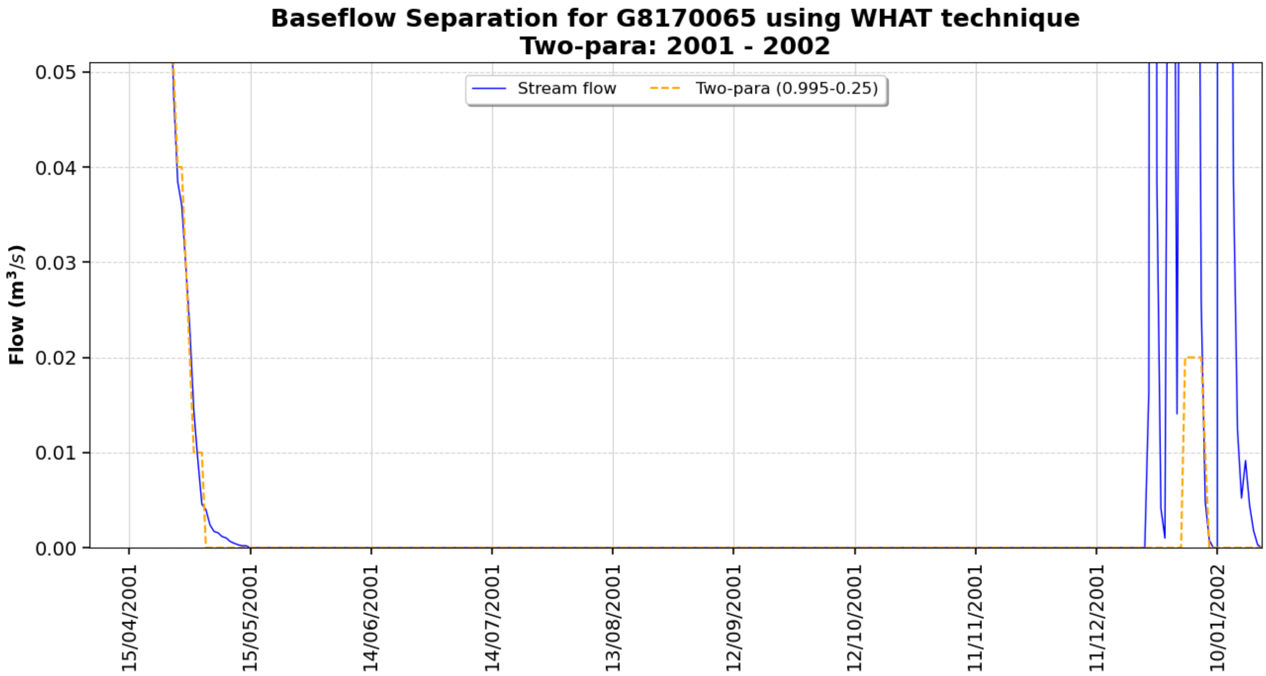


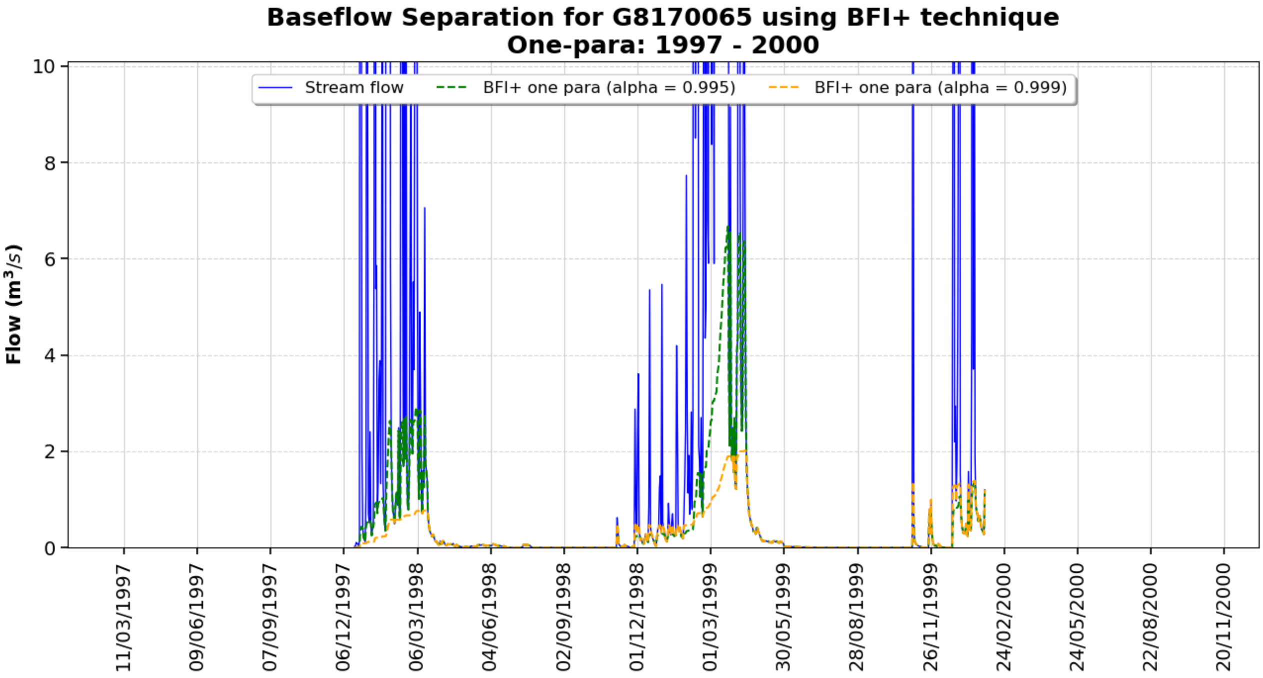


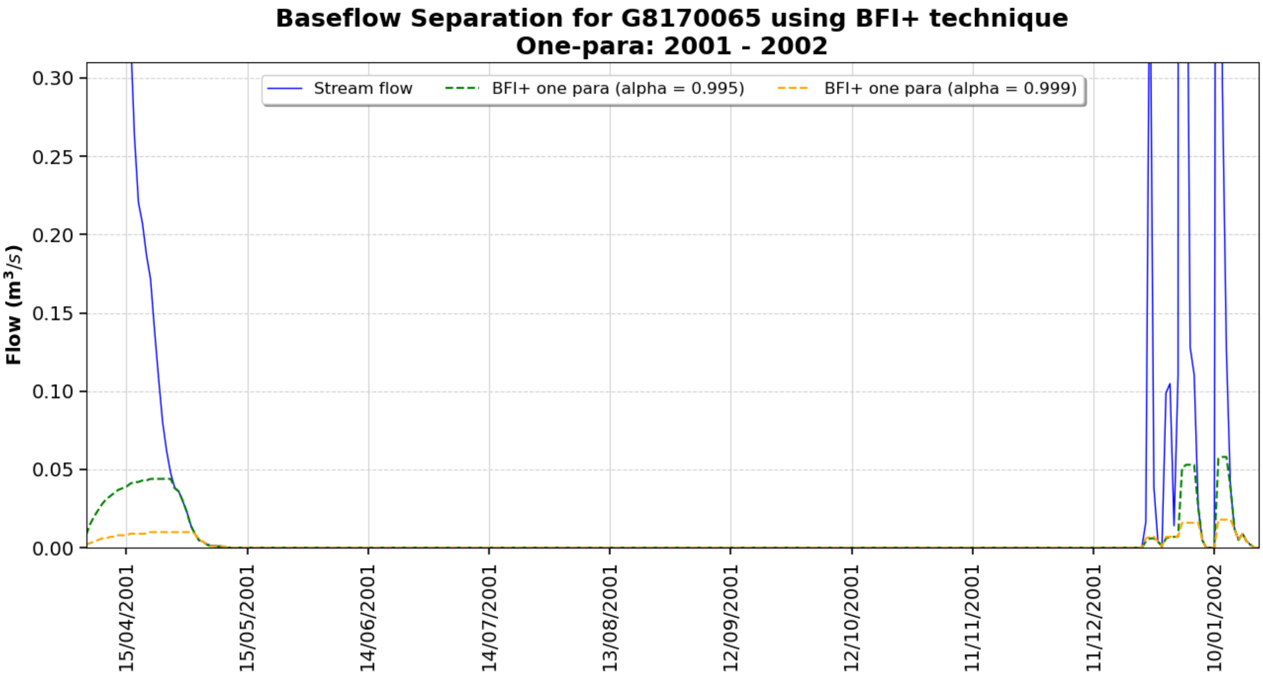

Baseflow Separation for G8170065 using WHAT technique
One-para: 1997 - 2000
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.999)
Flow (m³/s)
0
2
4
6
8
10
11/03/1997
09/06/1997
07/09/1997
06/12/1997
06/03/1998
04/06/1998
02/09/1998
01/12/1998
01/03/1999
30/05/1999
28/08/1999
26/11/1999
24/02/2000
24/05/2000
22/08/2000
20/11/2000

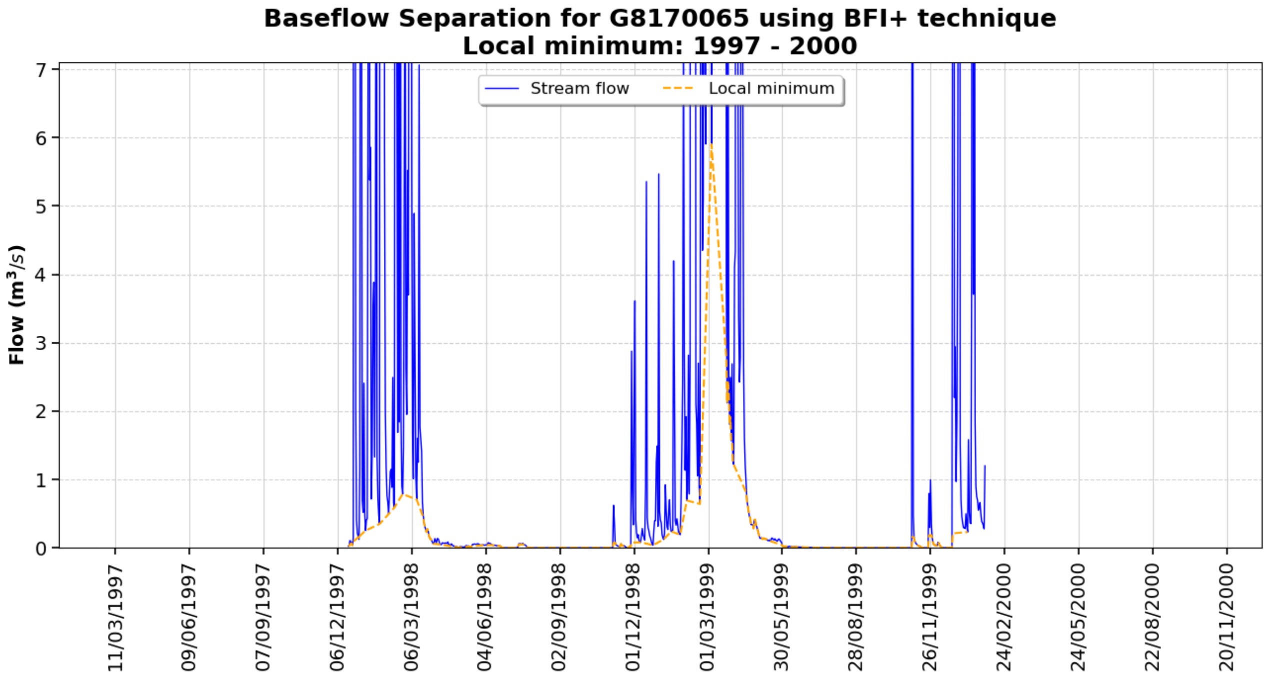

Baseflow Separation for G8170065 using WHAT technique
One-para: 2001 - 2002
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.999)
Flow (m³/s)
0.00
0.01
0.02
0.03
0.04
0.05
15/04/2001
15/05/2001
14/06/2001
14/07/2001
13/08/2001
12/09/2001
12/10/2001
11/11/2001
11/12/2001
10/01/2002

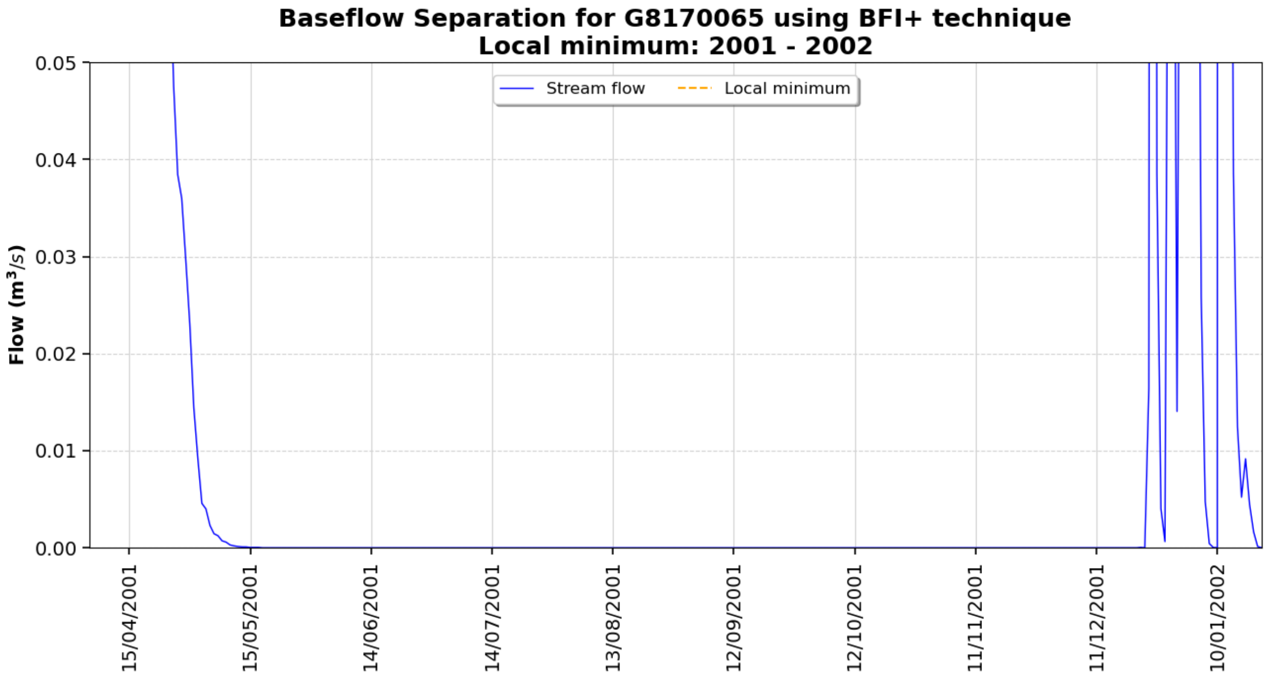

Baseflow Separation for G8170065 using WHAT technique
Two-para: 1997 - 2000
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0
1
2
3
4
5
6
7
8
11/03/1997
09/06/1997
07/09/1997
06/12/1997
06/03/1998
04/06/1998
02/09/1998
01/12/1998
01/03/1999
30/05/1999
28/08/1999
26/11/1999
24/02/2000
24/05/2000
22/08/2000
20/11/2000

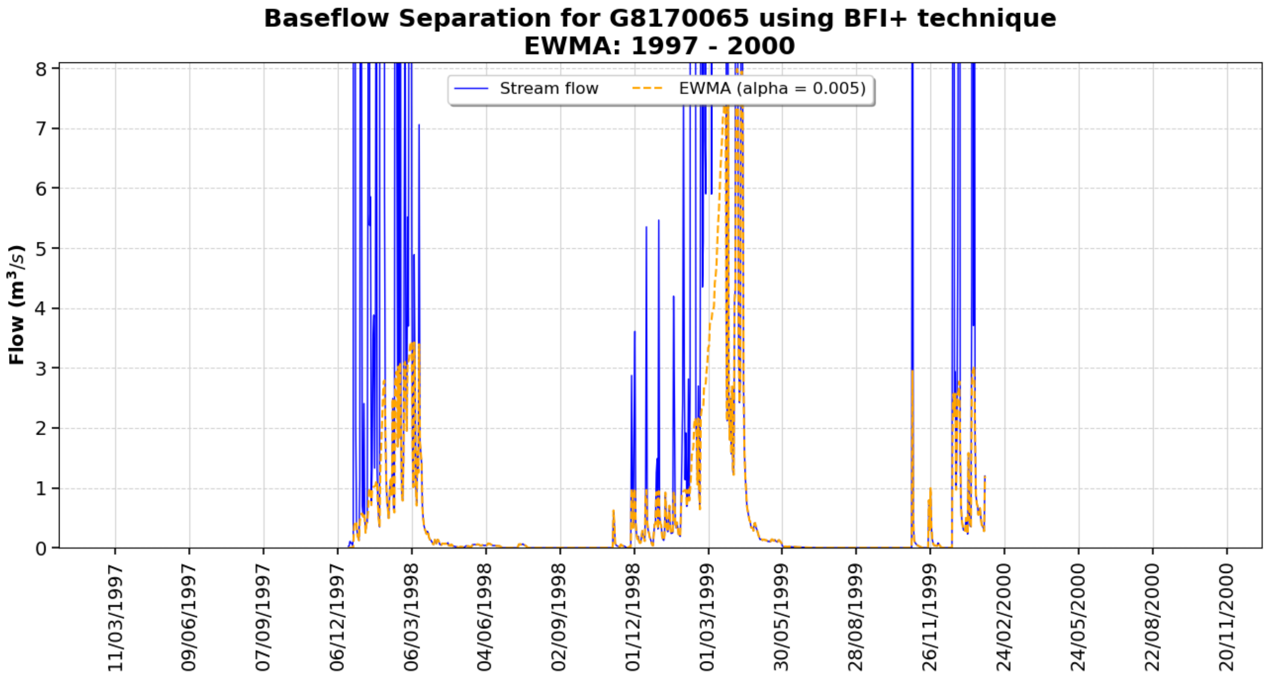

Baseflow Separation for G8170065 using WHAT technique
Two-para: 2001 - 2002
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0.00
0.01
0.02
0.03
0.04
0.05
15/04/2001
15/05/2001
14/06/2001
14/07/2001
13/08/2001
12/09/2001
12/10/2001
11/11/2001
11/12/2001
10/01/2002

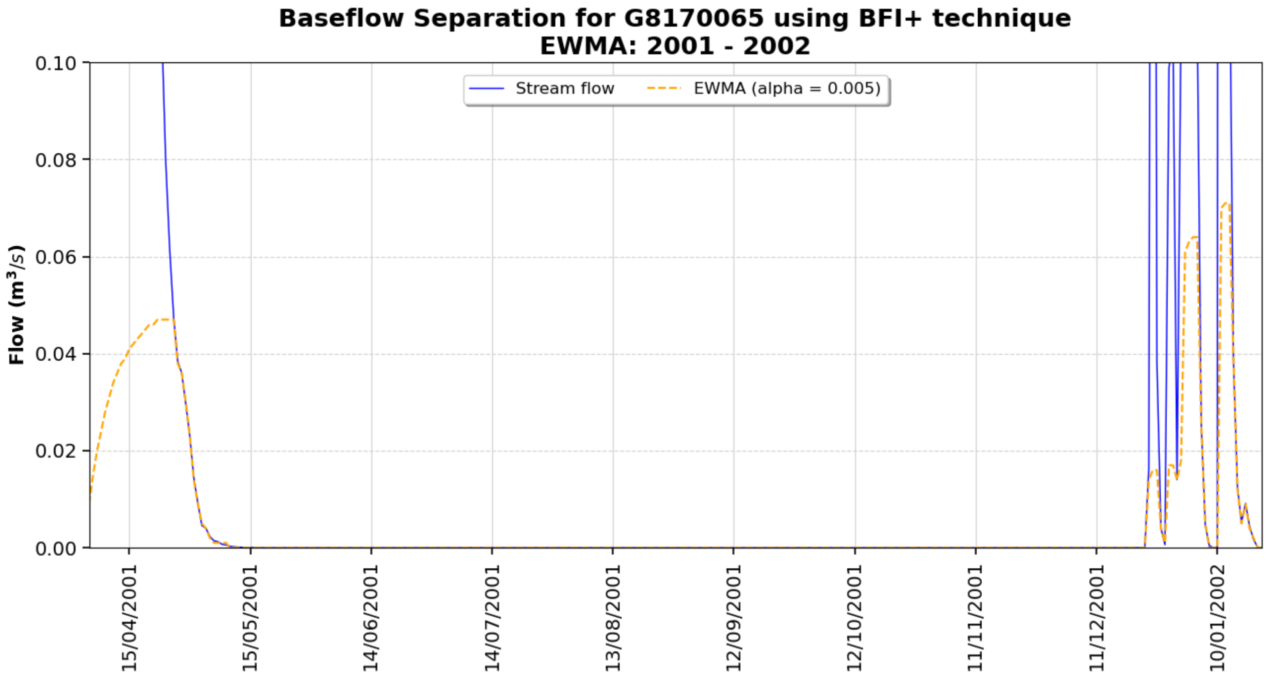

Baseflow Separation for G8170065 using BFI+ technique
One-para: 1997 - 2000
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
0
2
4
6
8
10
11/03/1997
09/06/1997
07/09/1997
06/12/1997
06/03/1998
04/06/1998
02/09/1998
01/12/1998
01/03/1999
30/05/1999
28/08/1999
26/11/1999
24/02/2000
24/05/2000
22/08/2000
20/11/2000

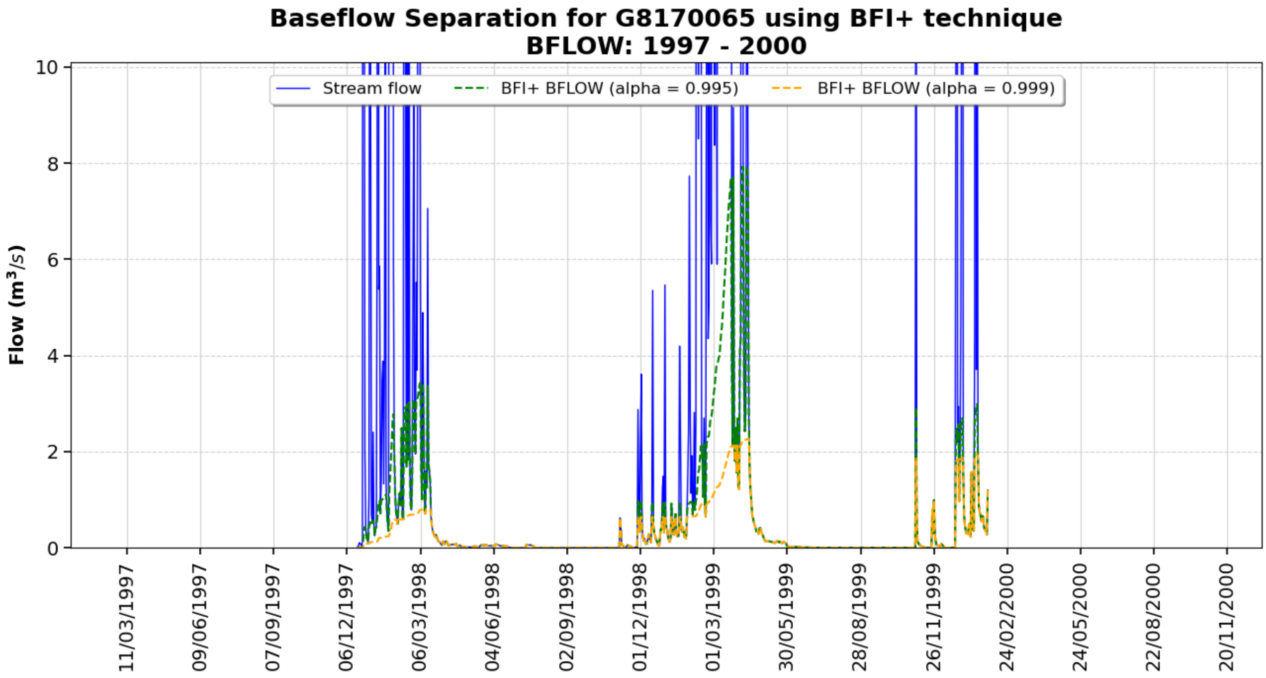

Baseflow Separation for G8170065 using BFI+ technique
One-para: 2001 - 2002
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
15/04/2001
15/05/2001
14/06/2001
14/07/2001
13/08/2001
12/09/2001
12/10/2001
11/11/2001
11/12/2001
10/01/2002

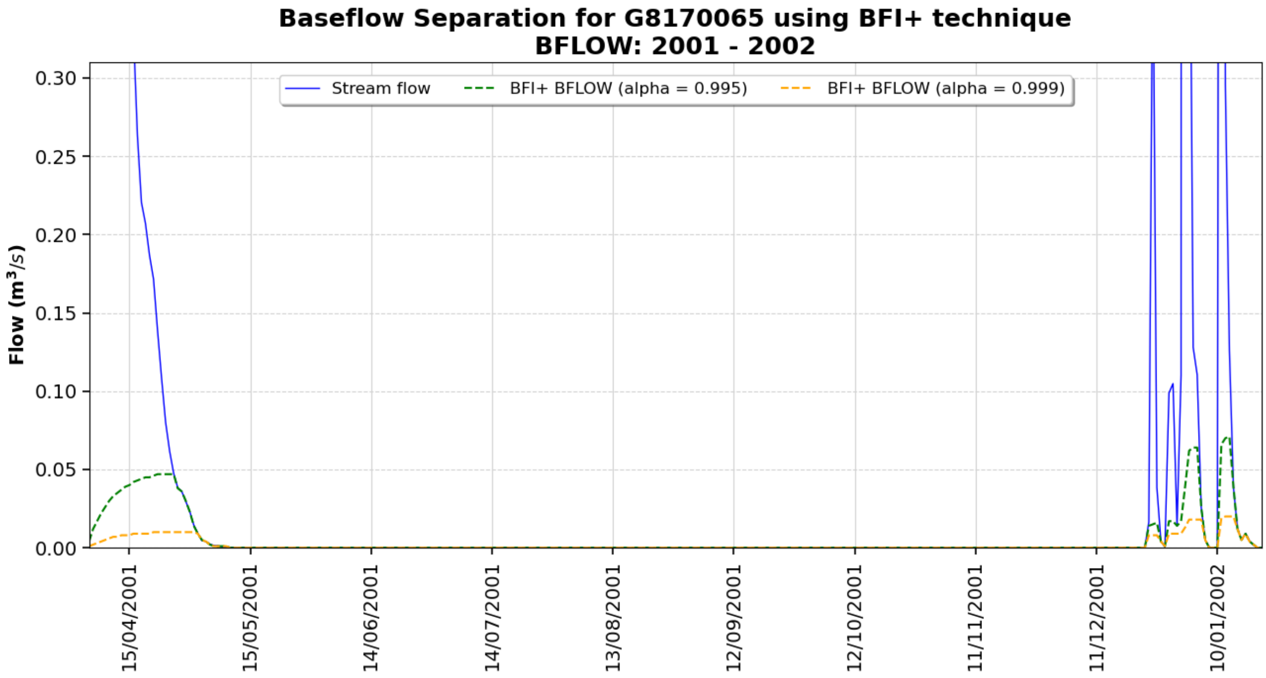

Baseflow Separation for G8170065 using BFI+ technique
Local minimum: 1997 - 2000
Stream flow
Local minimum
Flow (m³/s)
0
1
2
3
4
5
6
7
11/03/1997
09/06/1997
07/09/1997
06/12/1997
06/03/1998
04/06/1998
02/09/1998
01/12/1998
01/03/1999
30/05/1999
28/08/1999
26/11/1999
24/02/2000
24/05/2000
22/08/2000
20/11/2000

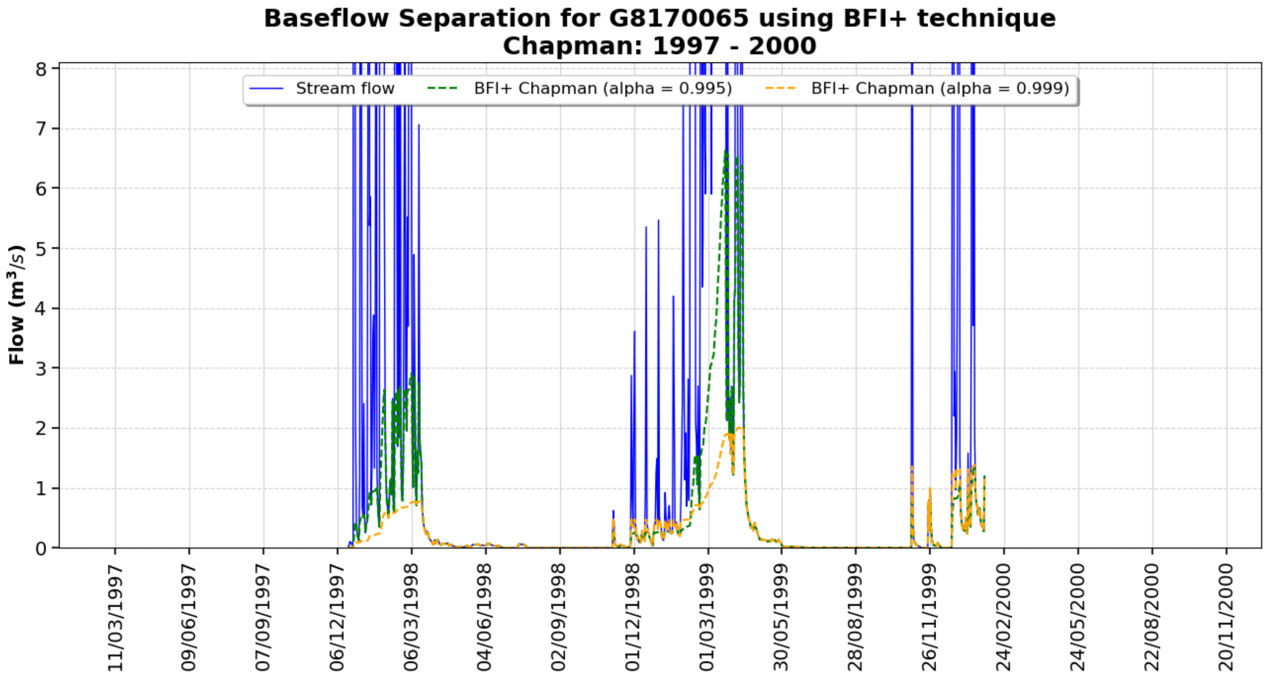

Baseflow Separation for G8170065 using BFI+ technique
Local minimum: 2001 - 2002
Stream flow
Local minimum
Flow (m³/s)
0.00
0.01
0.02
0.03
0.04
0.05
15/04/2001
15/05/2001
14/06/2001
14/07/2001
13/08/2001
12/09/2001
12/10/2001
11/11/2001
11/12/2001
10/01/2002

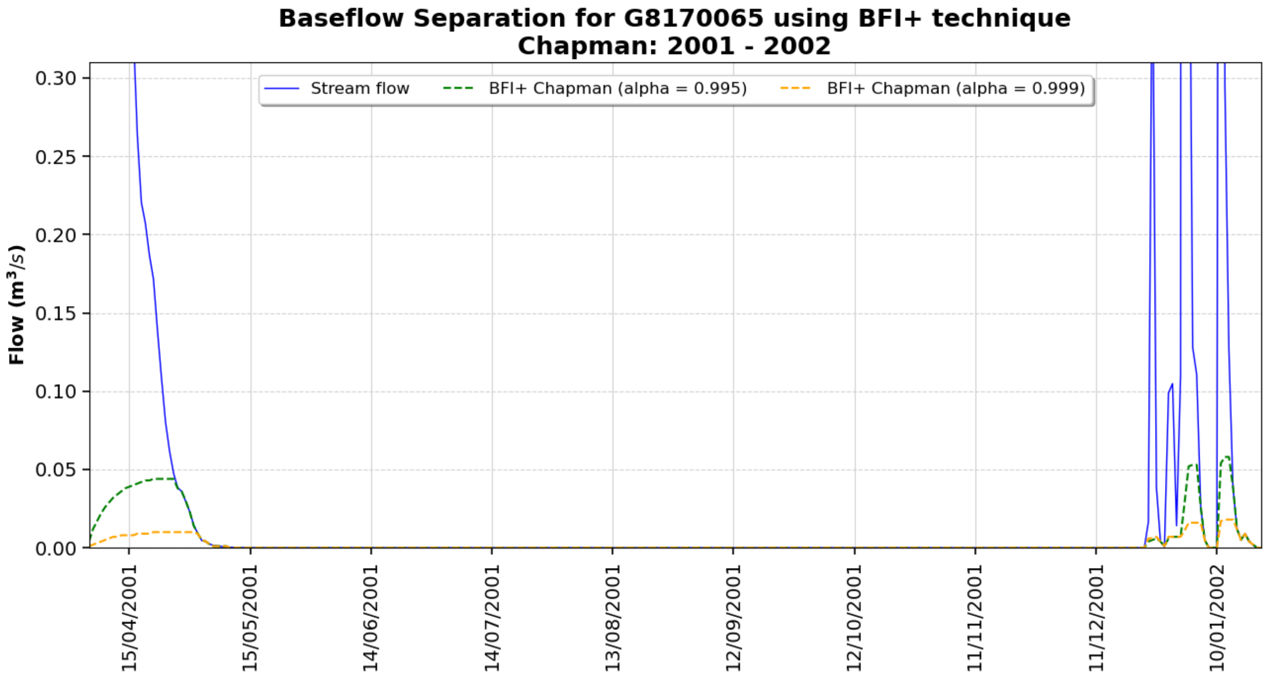

Baseflow Separation for G8170065 using BFI+ technique
EWMA: 1997 - 2000
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0
1
2
3
4
5
6
7
8
11/03/1997
09/06/1997
07/09/1997
06/12/1997
06/03/1998
04/06/1998
02/09/1998
01/12/1998
01/03/1999
30/05/1999
28/08/1999
26/11/1999
24/02/2000
24/05/2000
22/08/2000
20/11/2000

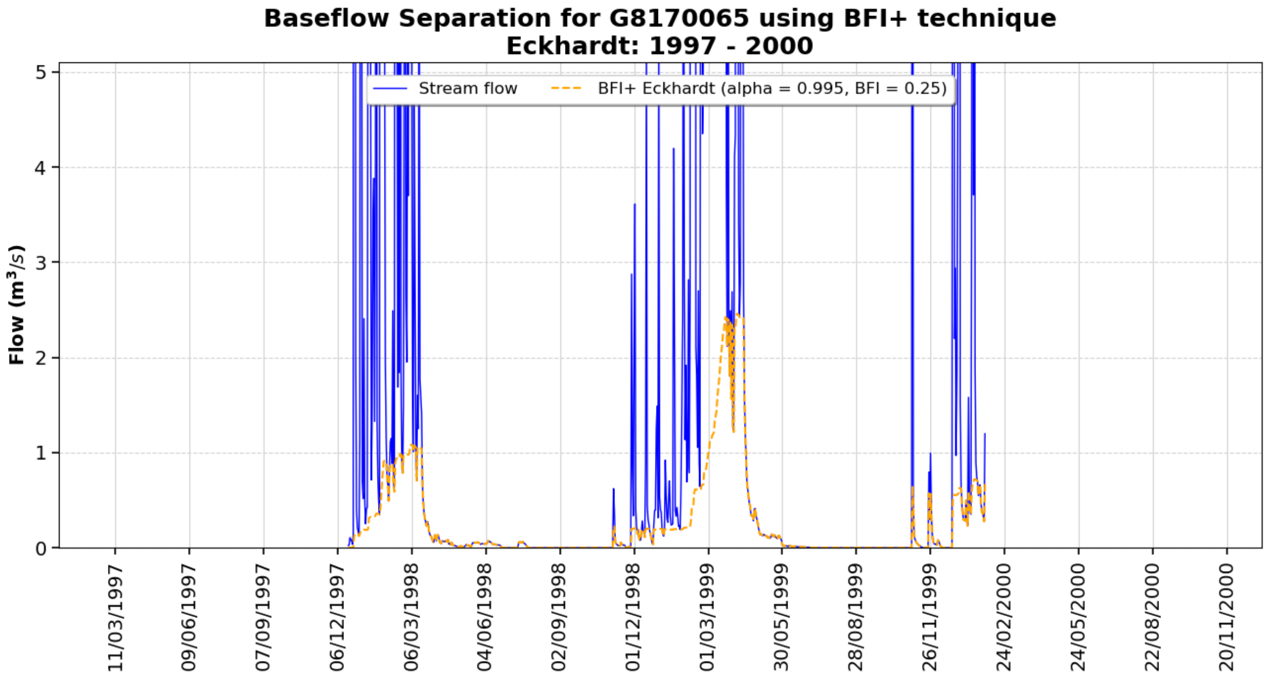

Baseflow Separation for G8170065 using BFI+ technique
EWMA: 2001 - 2002
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0.00
0.02
0.04
0.06
0.08
0.10
15/04/2001
15/05/2001
14/06/2001
14/07/2001
13/08/2001
12/09/2001
12/10/2001
11/11/2001
11/12/2001
10/01/2002

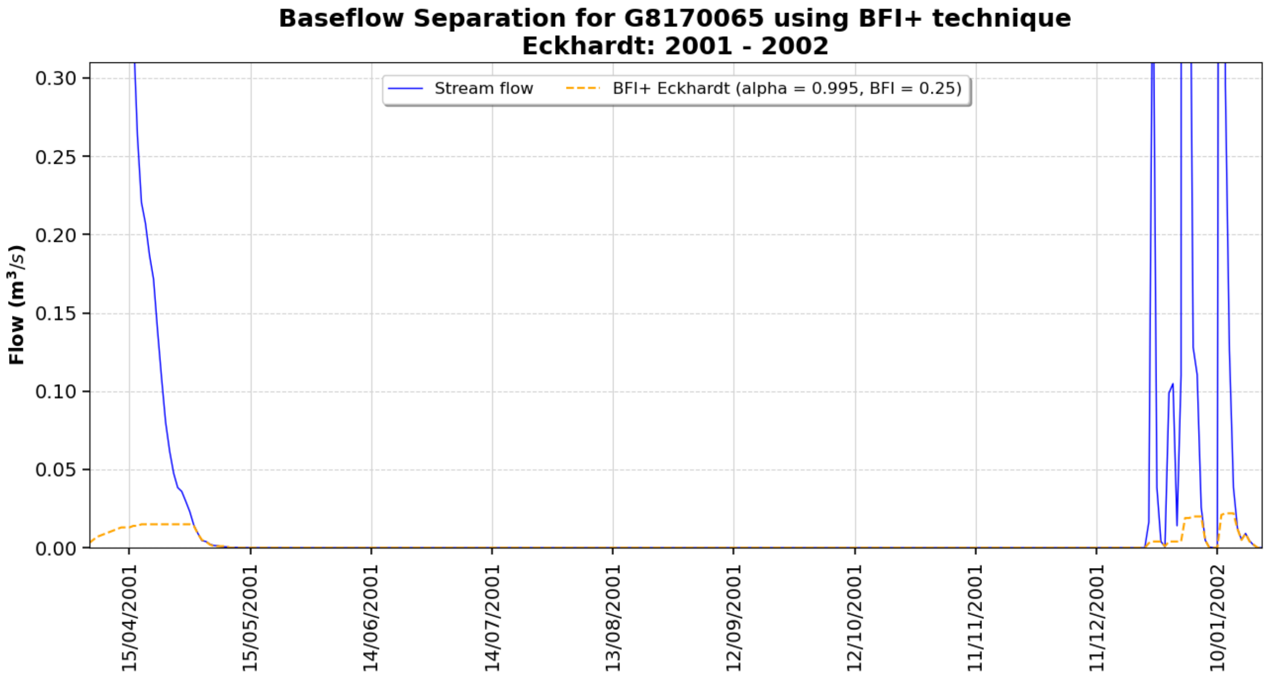

Baseflow Separation for G8170065 using BFI+ technique
BFLOW: 1997 - 2000
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0
2
4
6
8
10
11/03/1997
09/06/1997
07/09/1997
06/12/1997
06/03/1998
04/06/1998
02/09/1998
01/12/1998
01/03/1999
30/05/1999
28/08/1999
26/11/1999
24/02/2000
24/05/2000
22/08/2000
20/11/2000


Baseflow Separation for G8170065 using BFI+ technique
BFLOW: 2001 - 2002
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
15/04/2001
15/05/2001
14/06/2001
14/07/2001
13/08/2001
12/09/2001
12/10/2001
11/11/2001
11/12/2001
10/01/2002

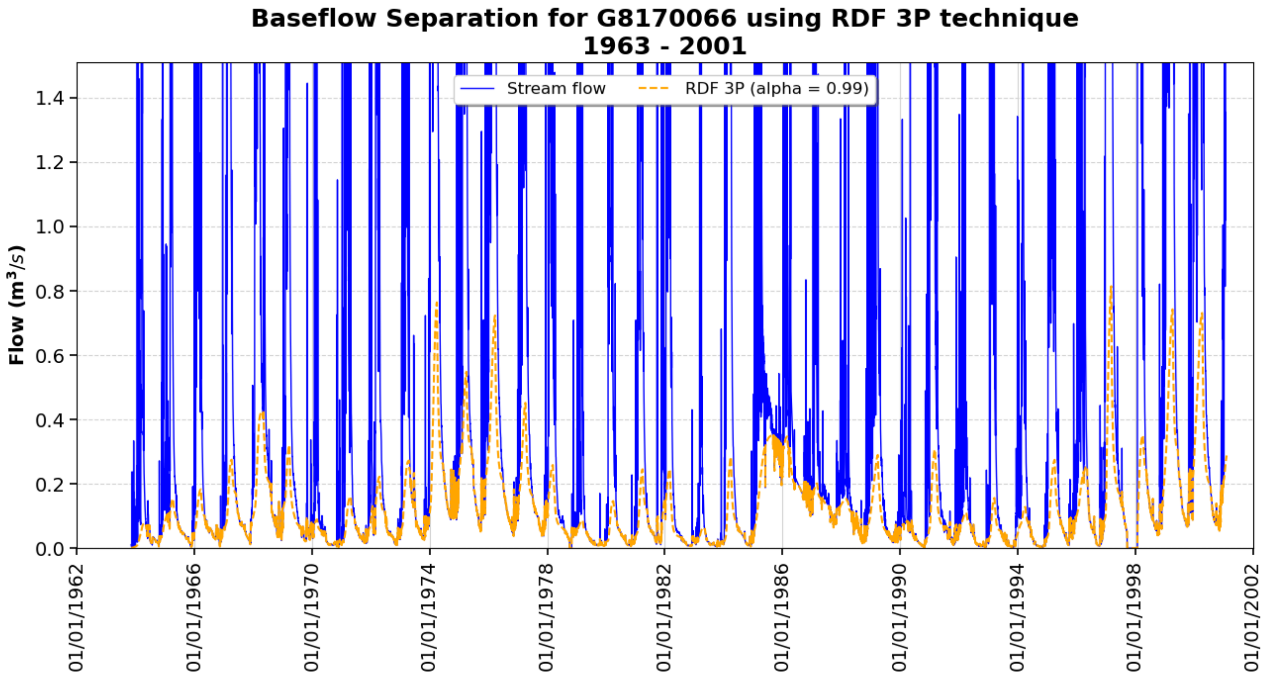

Baseflow Separation for G8170065 using BFI+ technique
Chapman: 1997 - 2000
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0
1
2
3
4
5
6
7
8
11/03/1997
09/06/1997
07/09/1997
06/12/1997
06/03/1998
04/06/1998
02/09/1998
01/12/1998
01/03/1999
30/05/1999
28/08/1999
26/11/1999
24/02/2000
24/05/2000
22/08/2000
20/11/2000

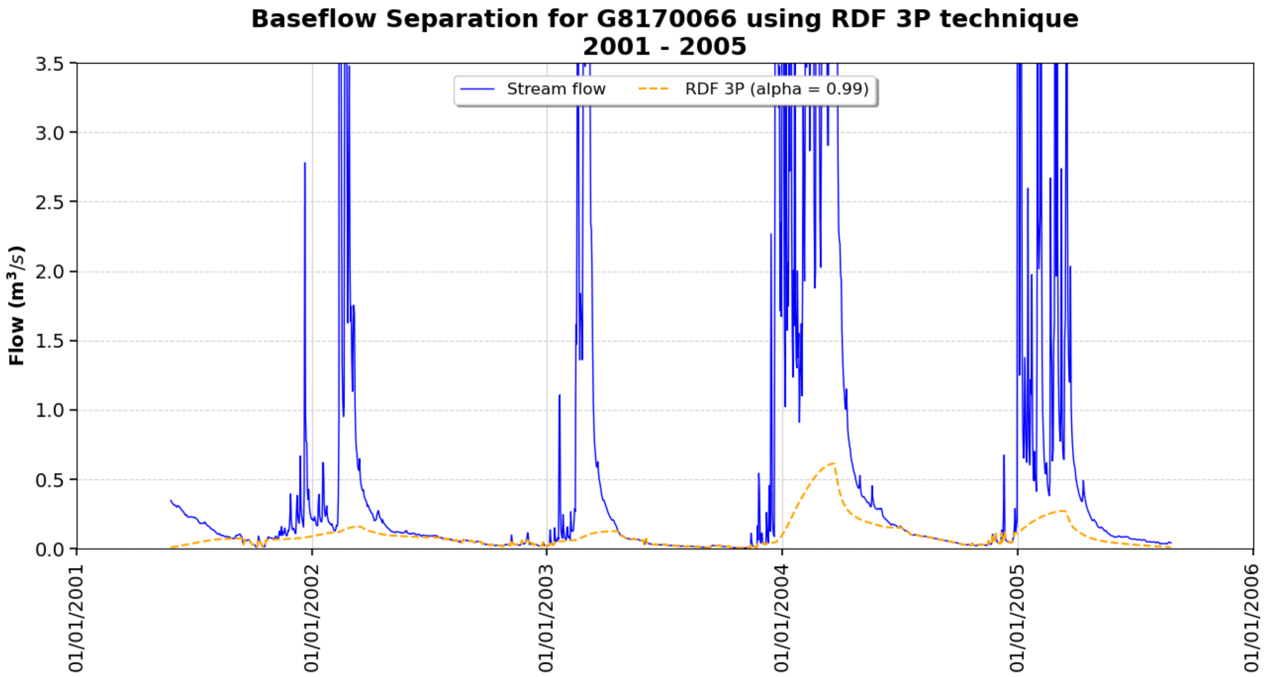

Baseflow Separation for G8170065 using BFI+ technique
Chapman: 2001 - 2002
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
15/04/2001
15/05/2001
14/06/2001
14/07/2001
13/08/2001
12/09/2001
12/10/2001
11/11/2001
11/12/2001
10/01/2002

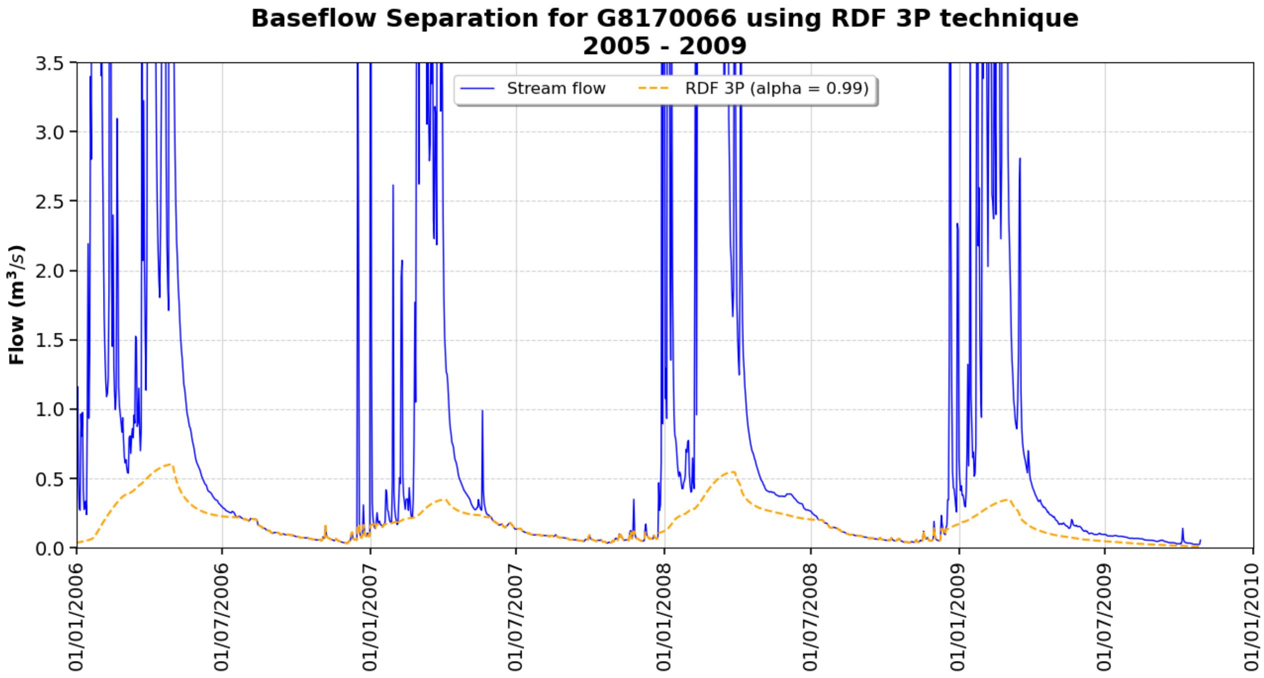

Baseflow Separation for G8170065 using BFI+ technique
Eckhardt: 1997 - 2000
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0
1
2
3
4
5
11/03/1997
09/06/1997
07/09/1997
06/12/1997
06/03/1998
04/06/1998
02/09/1998
01/12/1998
01/03/1999
30/05/1999
28/08/1999
26/11/1999
24/02/2000
24/05/2000
22/08/2000
20/11/2000


Baseflow Separation for G8170065 using BFI+ technique
Eckhardt: 2001 - 2002
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
15/04/2001
15/05/2001
14/06/2001
14/07/2001
13/08/2001
12/09/2001
12/10/2001
11/11/2001
11/12/2001
10/01/2002

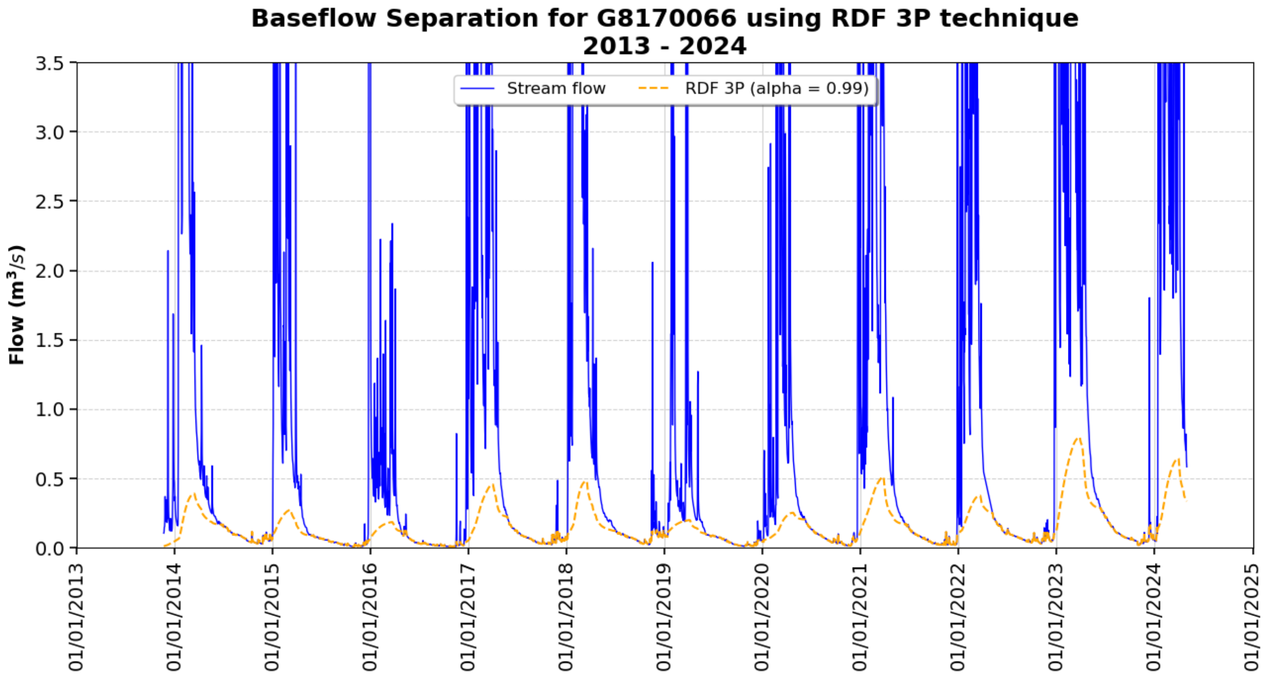
Appendix H: Baseflow separation hydrographs for G8170066



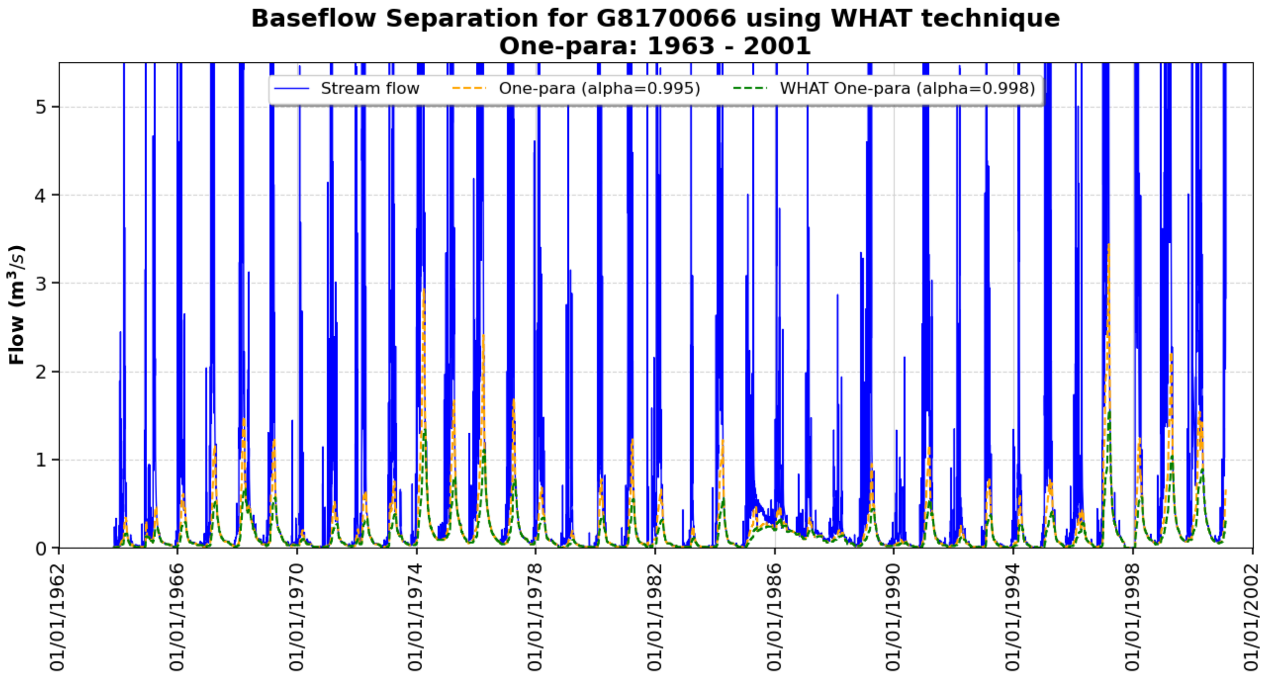


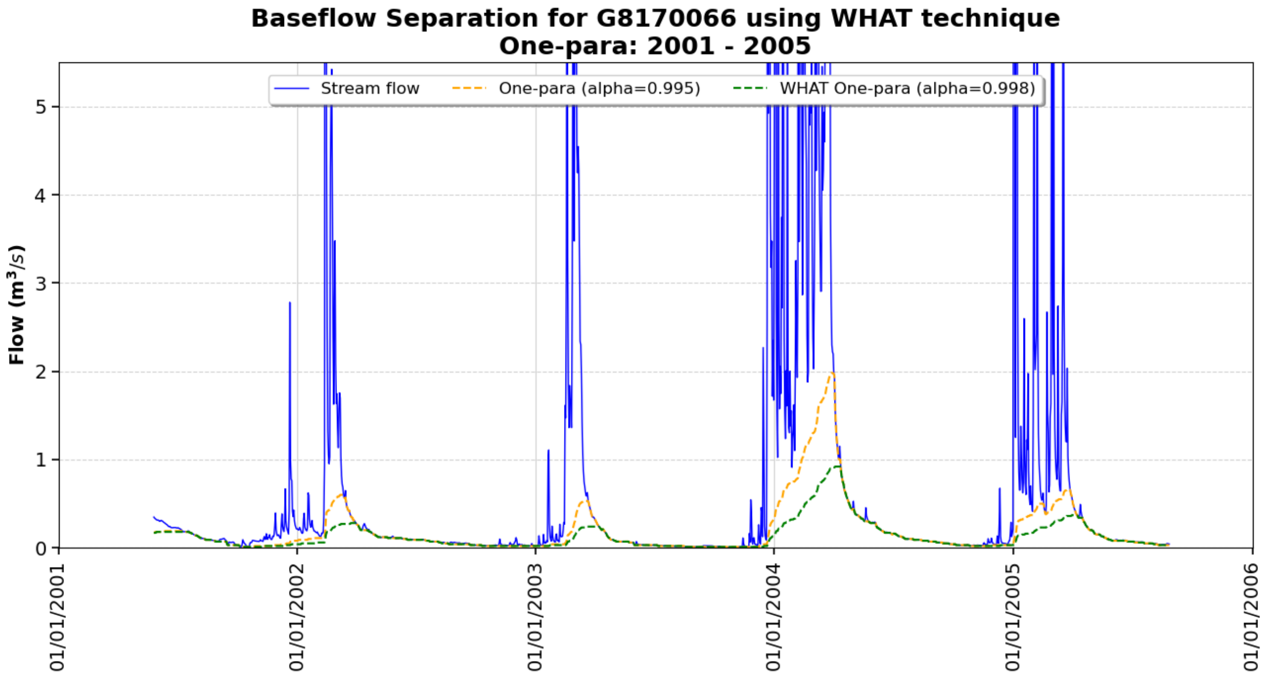


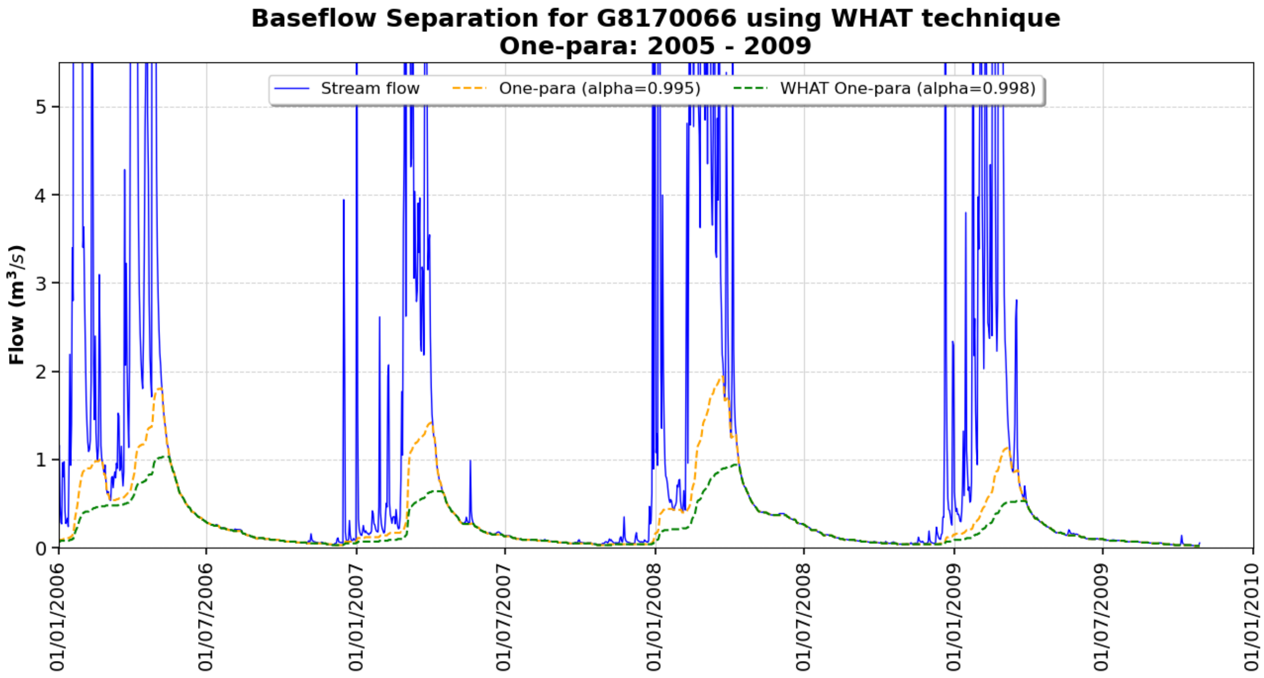
Baseflow Separation for G8170066 using RDF 3P technique
2005 - 2009
Stream flow
RDF 3P (alpha = 0.99)
Flow (m³/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/2006
01/07/2006
01/01/2007
01/07/2007
01/01/2008
01/07/2008
01/01/2009
01/07/2009
01/01/2010

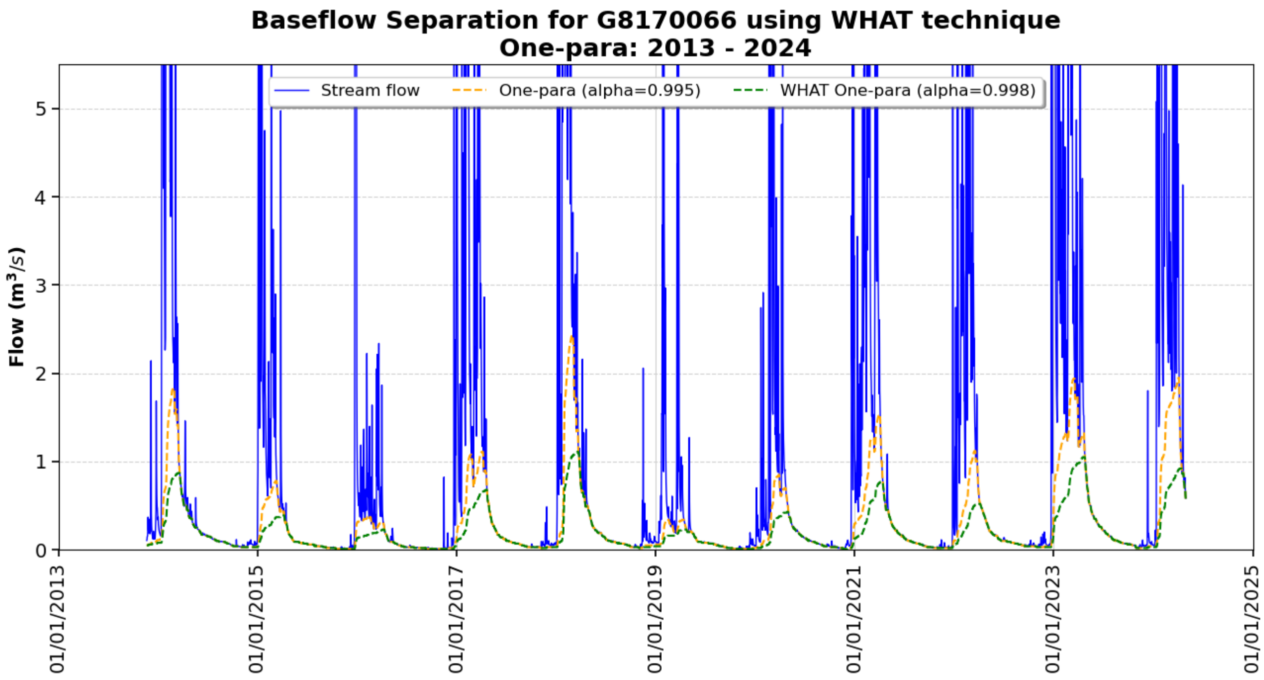


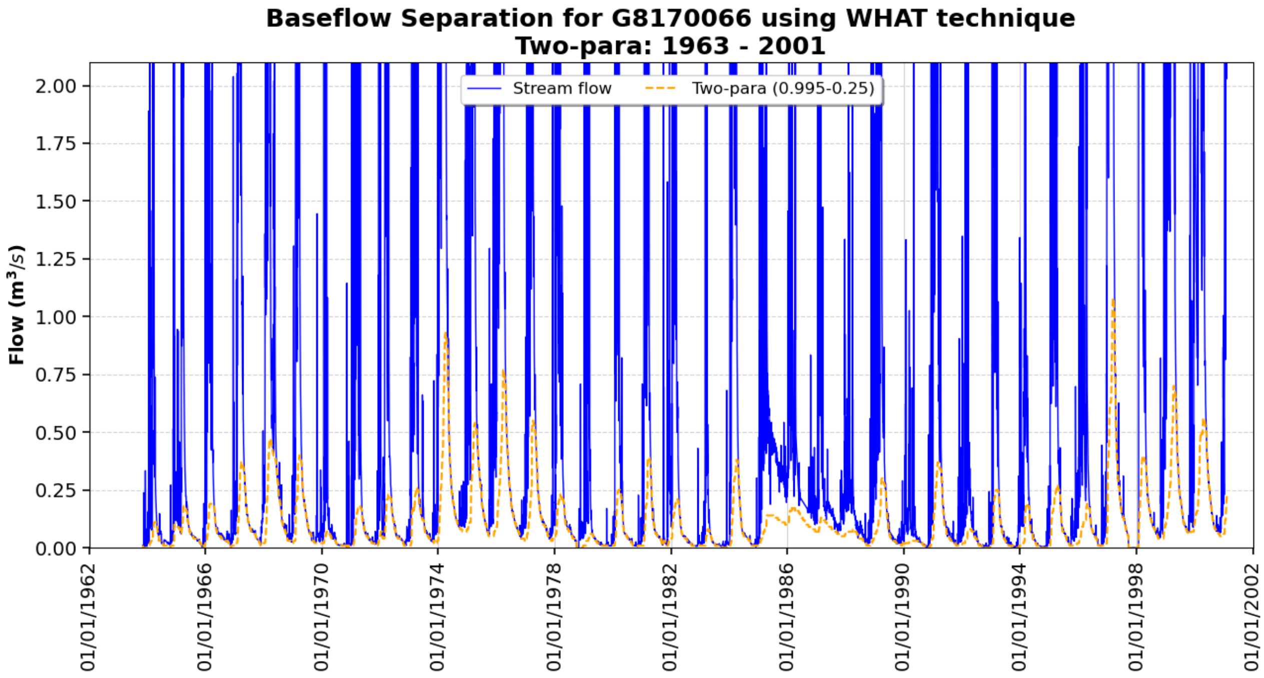
Baseflow Separation for G8170066 using RDF 3P technique
2013 - 2024
Stream flow
RDF 3P (alpha = 0.99)
Flow (m³/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

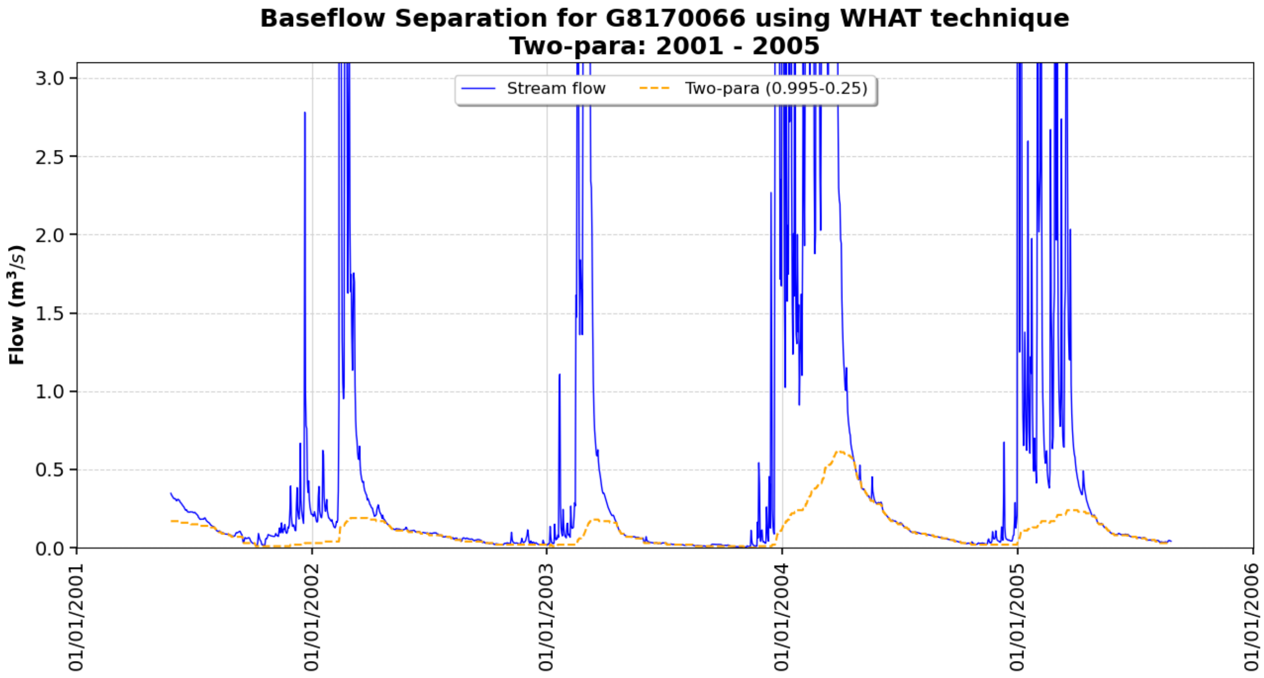

Baseflow Separation for G8170066 using WHAT technique
One-para: 1963 - 2001
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.998)
Flow (m^3/s)
0
1
2
3
4
5
01/01/1962
01/01/1966
01/01/1970
01/01/1974
01/01/1978
01/01/1982
01/01/1986
01/01/1990
01/01/1994
01/01/1998
01/01/2002

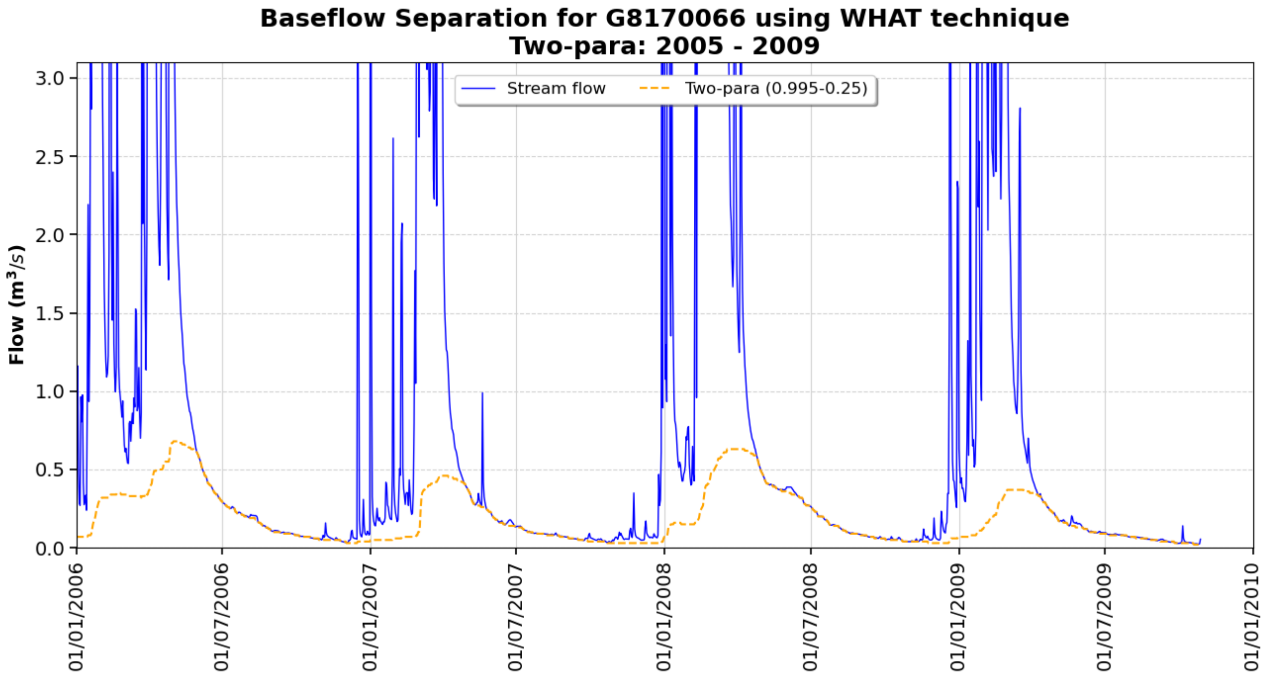

Baseflow Separation for G8170066 using WHAT technique
One-para: 2001 - 2005
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.998)
Flow (m^3/s)
0
1
2
3
4
5
01/01/2001
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006

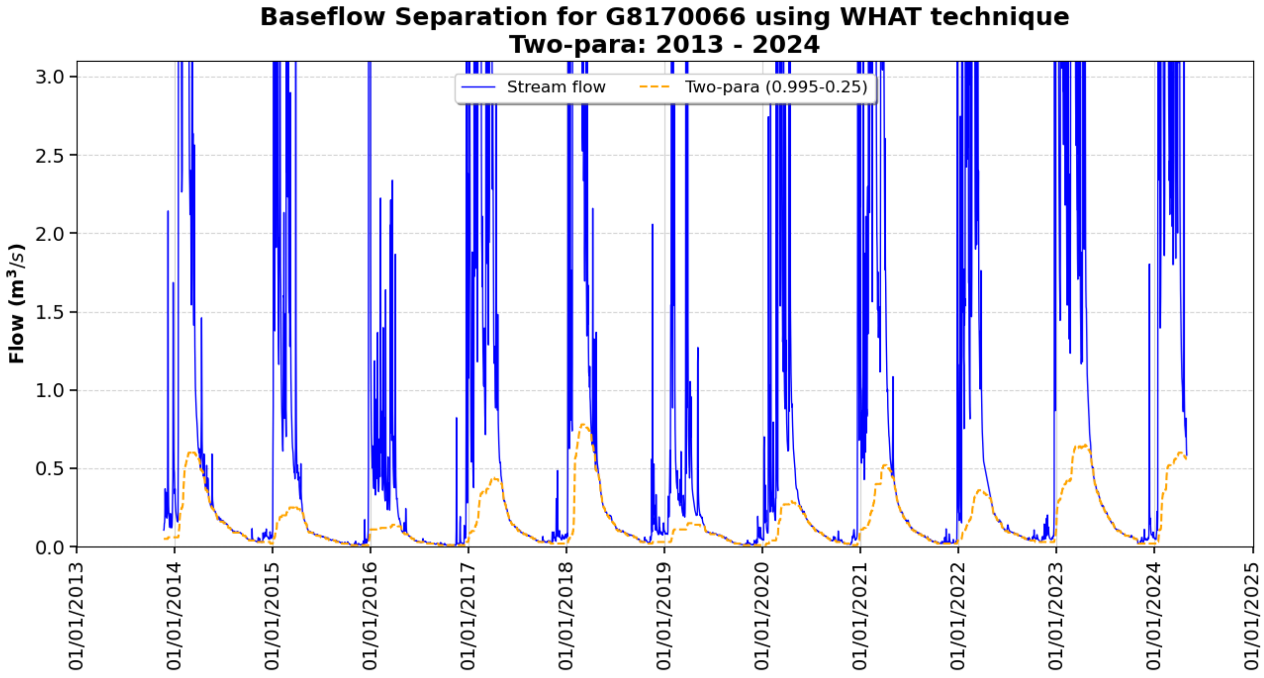

Baseflow Separation for G8170066 using WHAT technique
One-para: 2005 - 2009
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.998)
Flow (m³/s)
0
1
2
3
4
5
01/01/2006
01/07/2006
01/01/2007
01/07/2007
01/01/2008
01/07/2008
01/01/2009
01/07/2009
01/01/2010

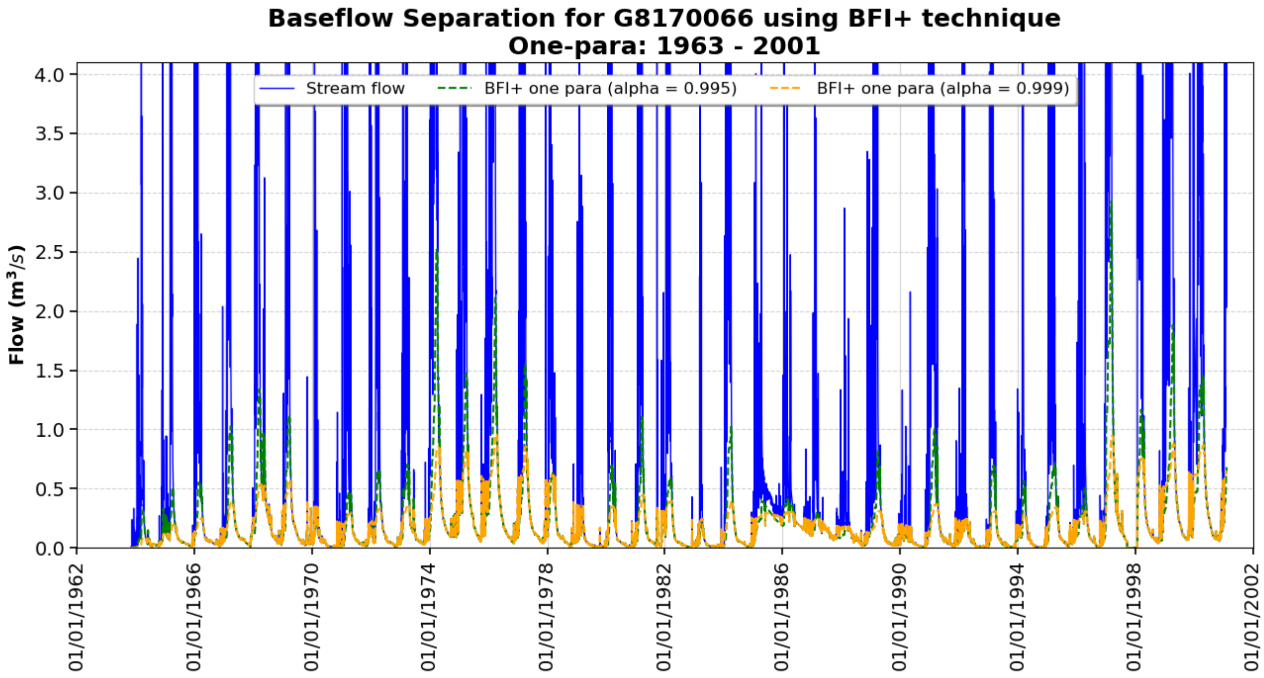

Baseflow Separation for G8170066 using WHAT technique
One-para: 2013 - 2024
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.998)
Flow (m³/s)
0
1
2
3
4
5
01/01/2013
01/01/2015
01/01/2017
01/01/2019
01/01/2021
01/01/2023
01/01/2025

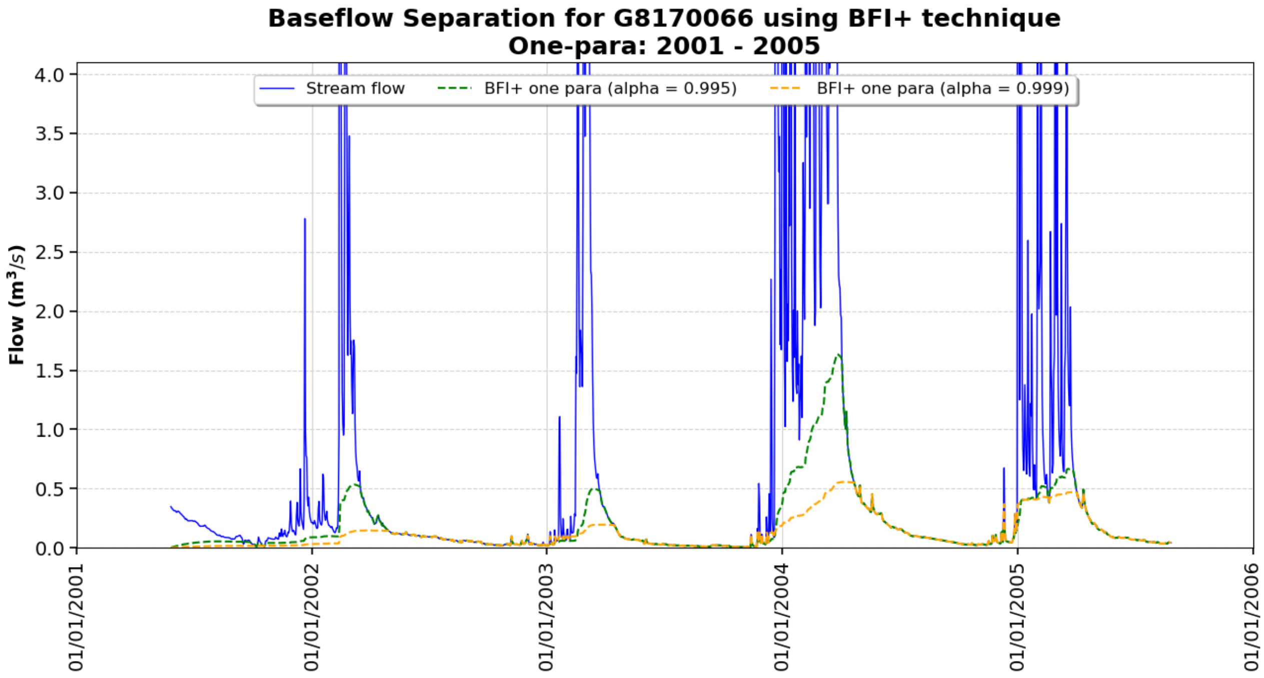

Baseflow Separation for G8170066 using WHAT technique
Two-para: 1963 - 2001
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
01/01/1962
01/01/1966
01/01/1970
01/01/1974
01/01/1978
01/01/1982
01/01/1986
01/01/1990
01/01/1994
01/01/1998
01/01/2002

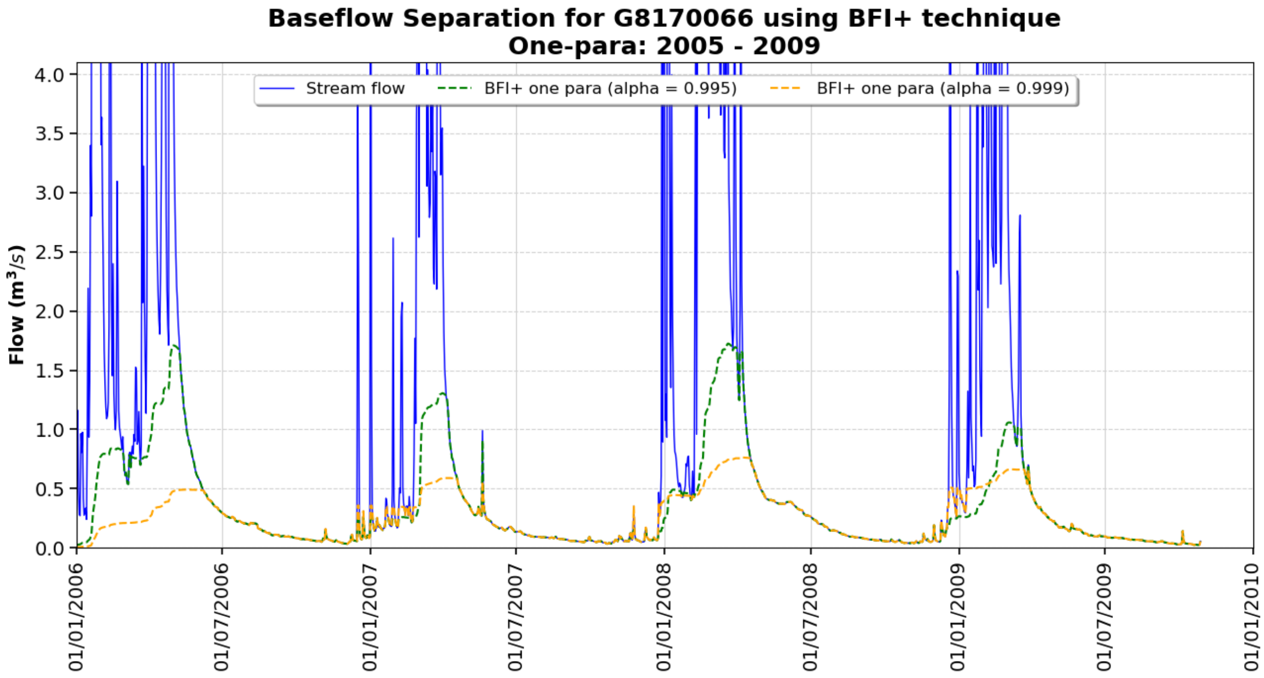

Baseflow Separation for G8170066 using WHAT technique
Two-para: 2001 - 2005
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/2001
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006

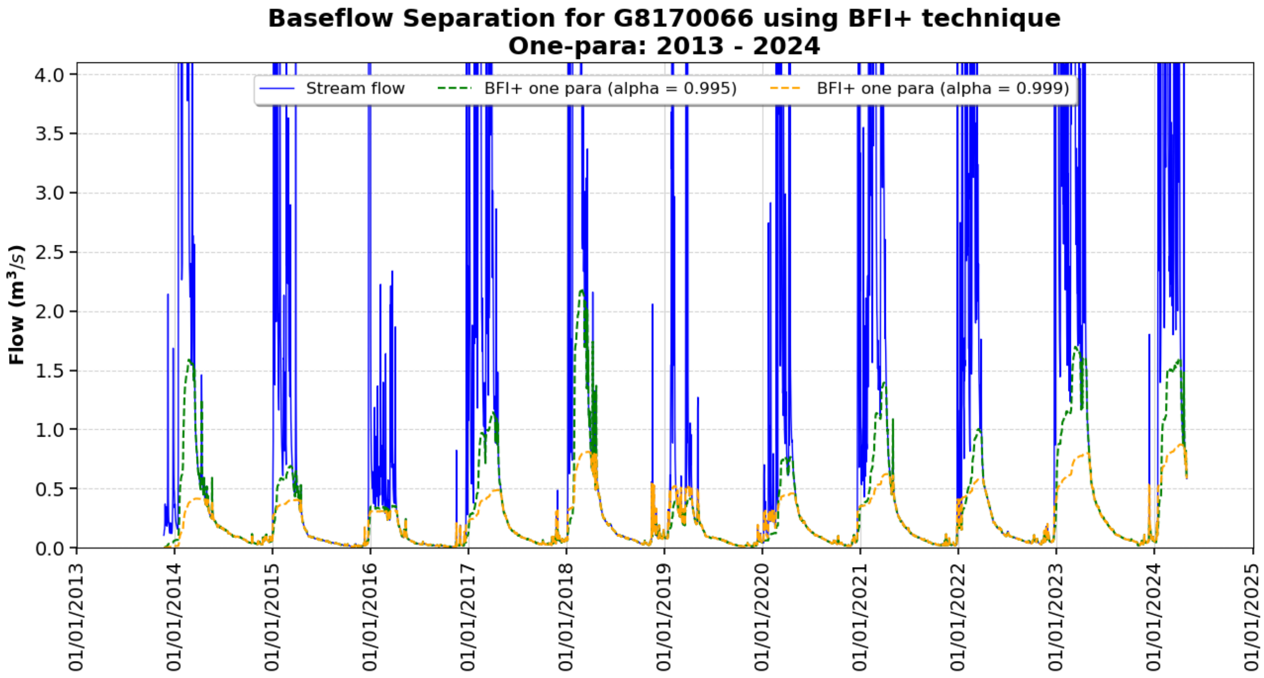

Baseflow Separation for G8170066 using WHAT technique
Two-para: 2005 - 2009
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/2006
01/07/2006
01/01/2007
01/07/2007
01/01/2008
01/07/2008
01/01/2009
01/07/2009
01/01/2010

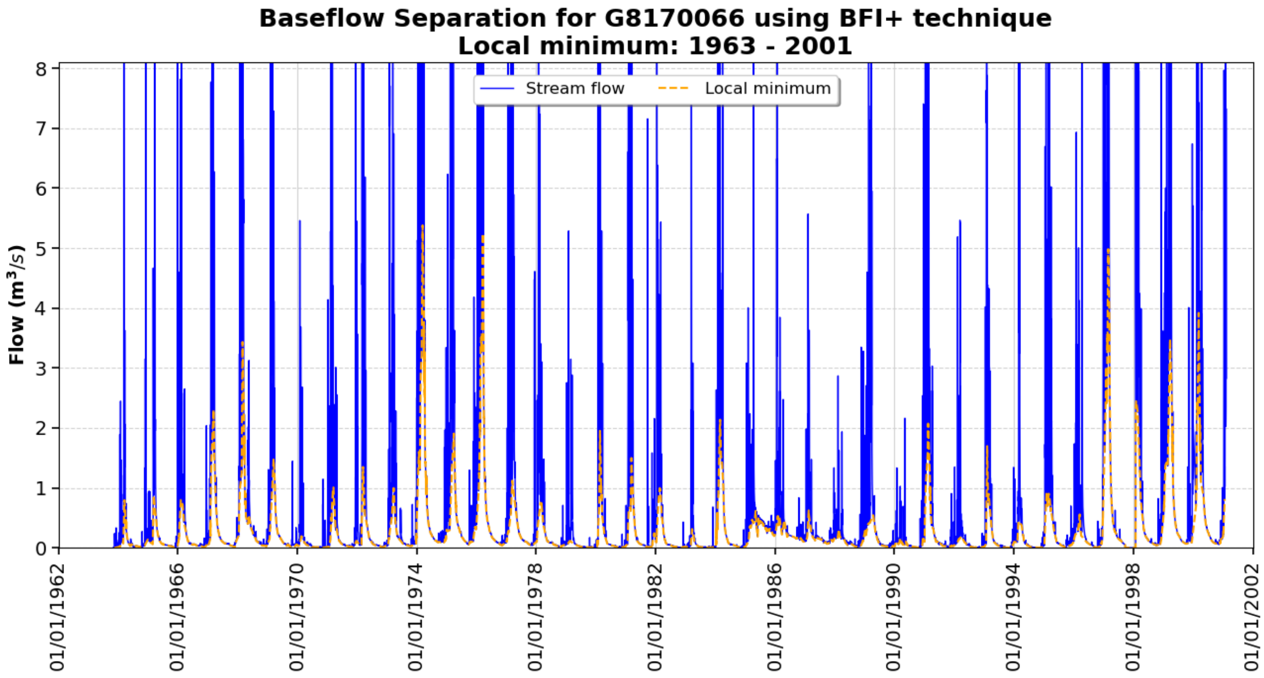

Baseflow Separation for G8170066 using WHAT technique
Two-para: 2013 - 2024
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

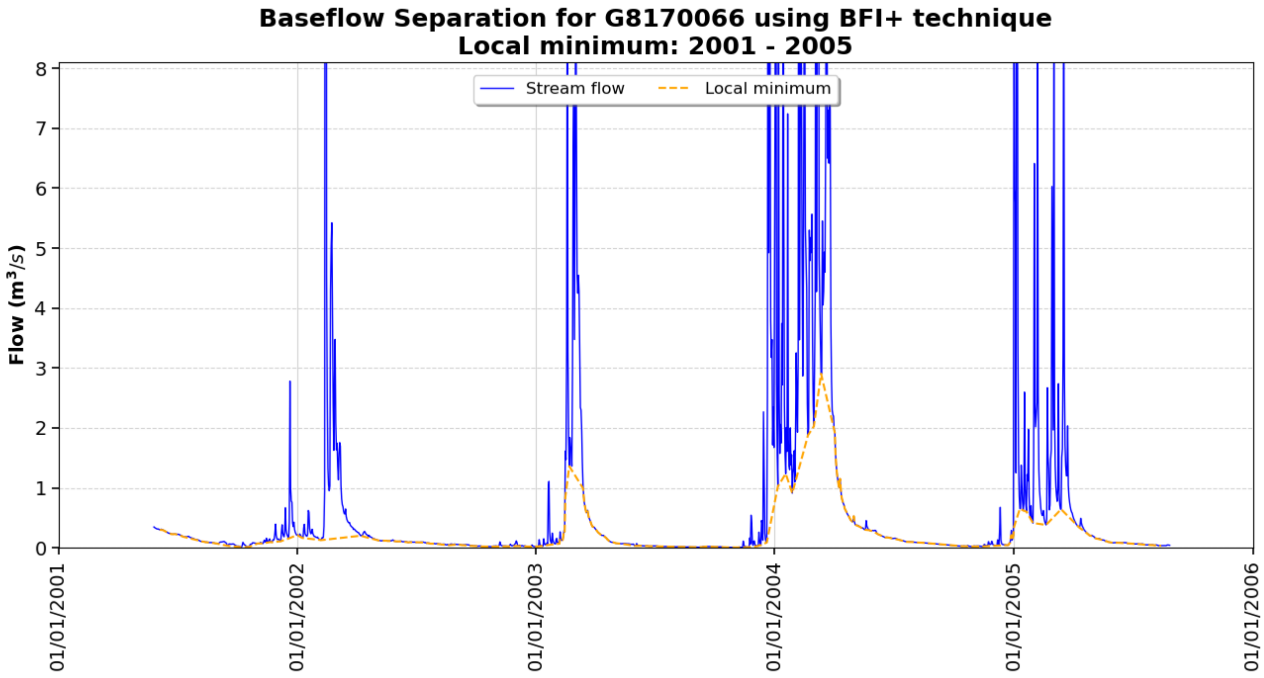

Baseflow Separation for G8170066 using BFI+ technique
One-para: 1963 - 2001
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
01/01/1962
01/01/1966
01/01/1970
01/01/1974
01/01/1978
01/01/1982
01/01/1986
01/01/1990
01/01/1994
01/01/1998
01/01/2002

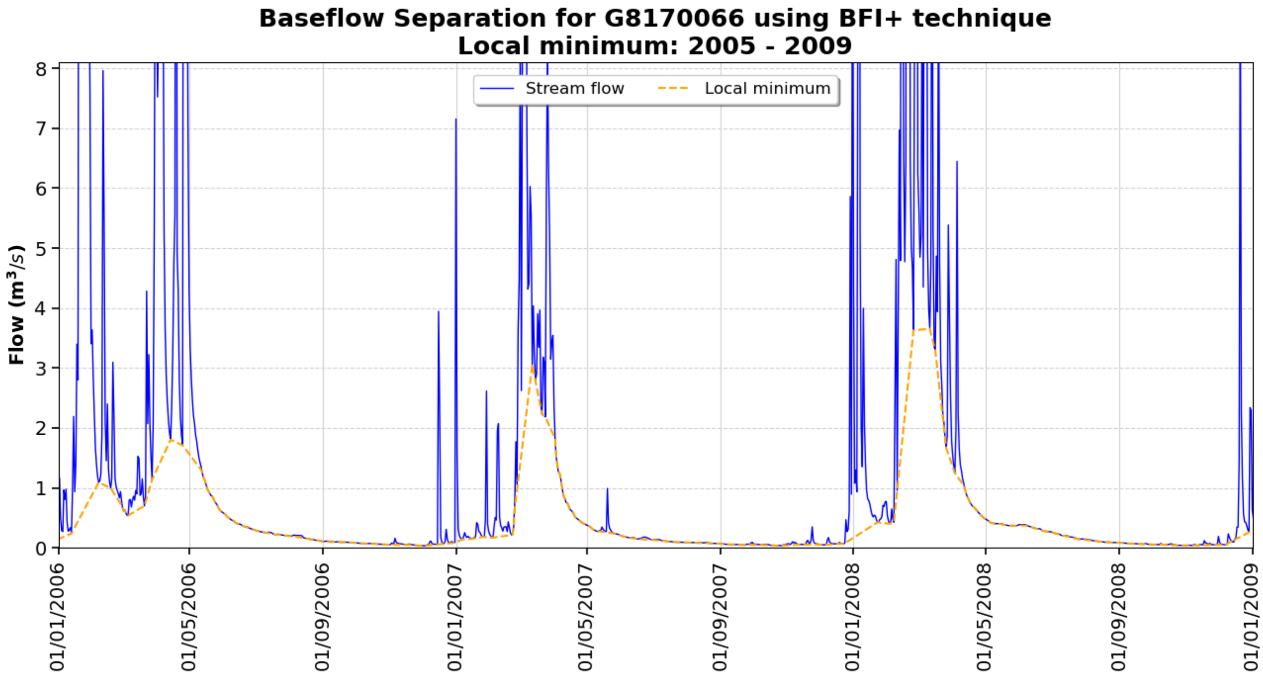

Baseflow Separation for G8170066 using BFI+ technique
One-para: 2001 - 2005
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
01/01/2001
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006

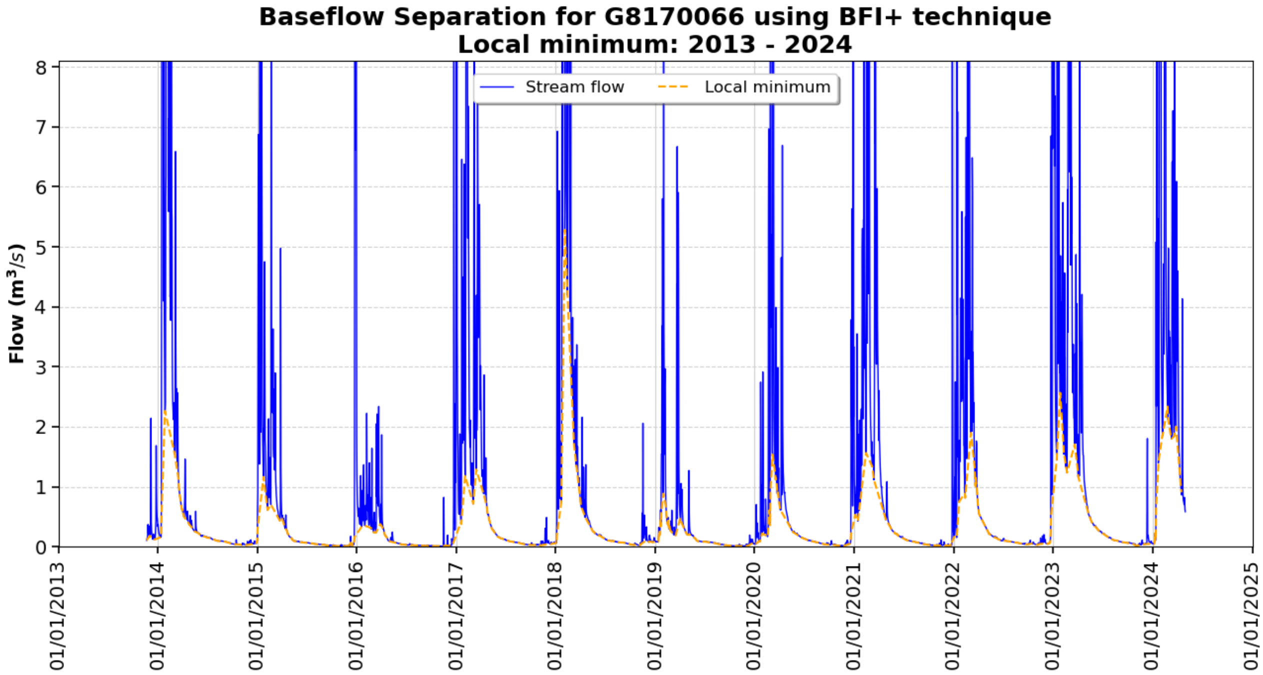

Baseflow Separation for G8170066 using BFI+ technique
One-para: 2005 - 2009
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/2006
01/07/2006
01/01/2007
01/07/2007
01/01/2008
01/07/2008
01/01/2009
01/07/2009
01/01/2010

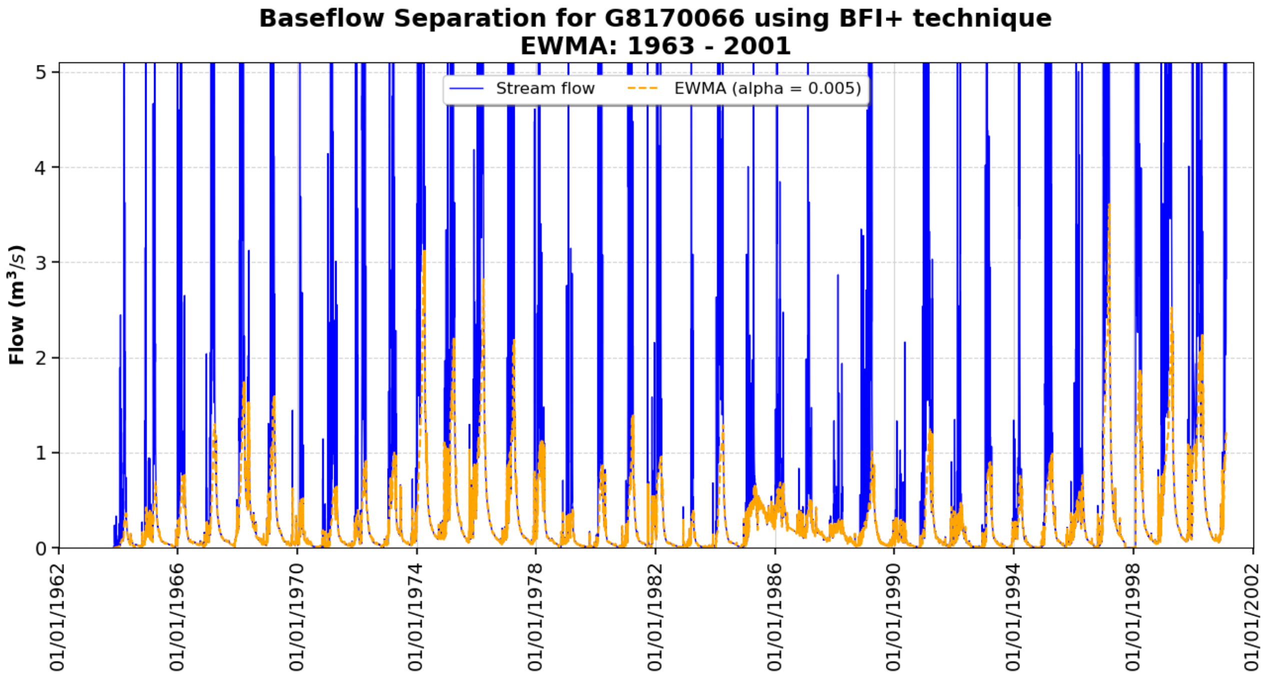

Baseflow Separation for G8170066 using BFI+ technique
One-para: 2013 - 2024
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

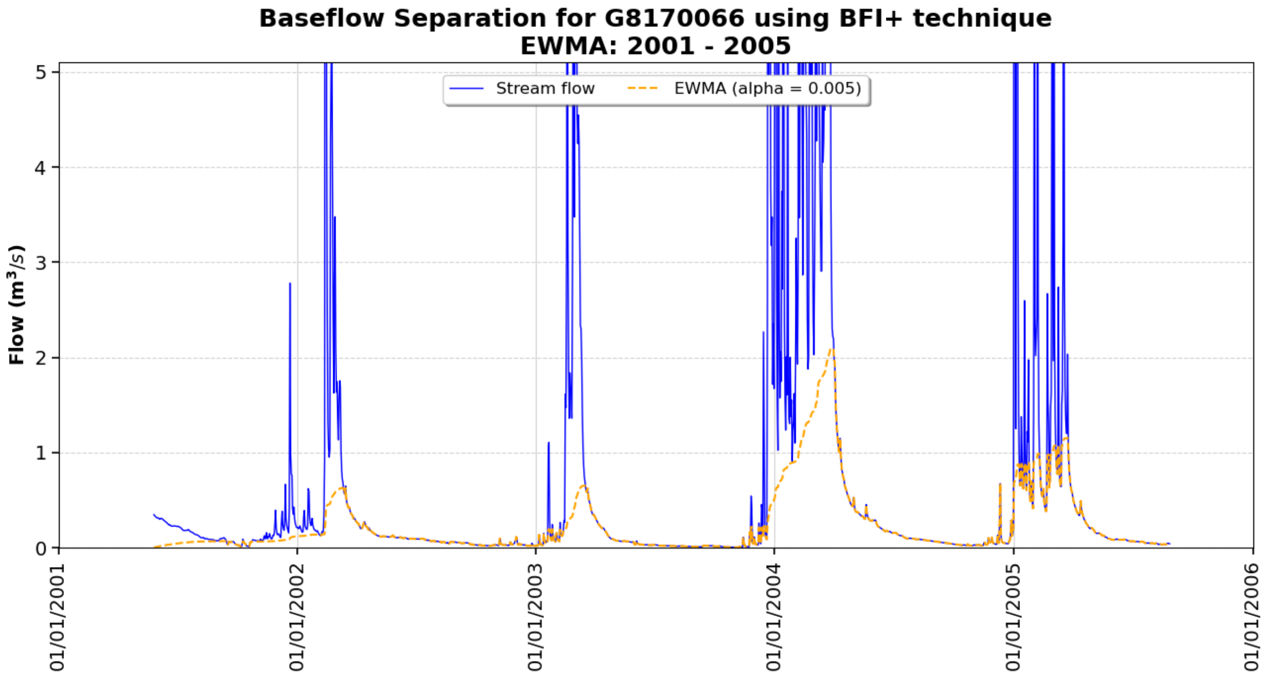

Baseflow Separation for G8170066 using BFI+ technique
Local minimum: 1963 - 2001
Stream flow
Local minimum
Flow (m³/s)
0
1
2
3
4
5
6
7
8
01/01/1962
01/01/1966
01/01/1970
01/01/1974
01/01/1978
01/01/1982
01/01/1986
01/01/1990
01/01/1994
01/01/1998
01/01/2002

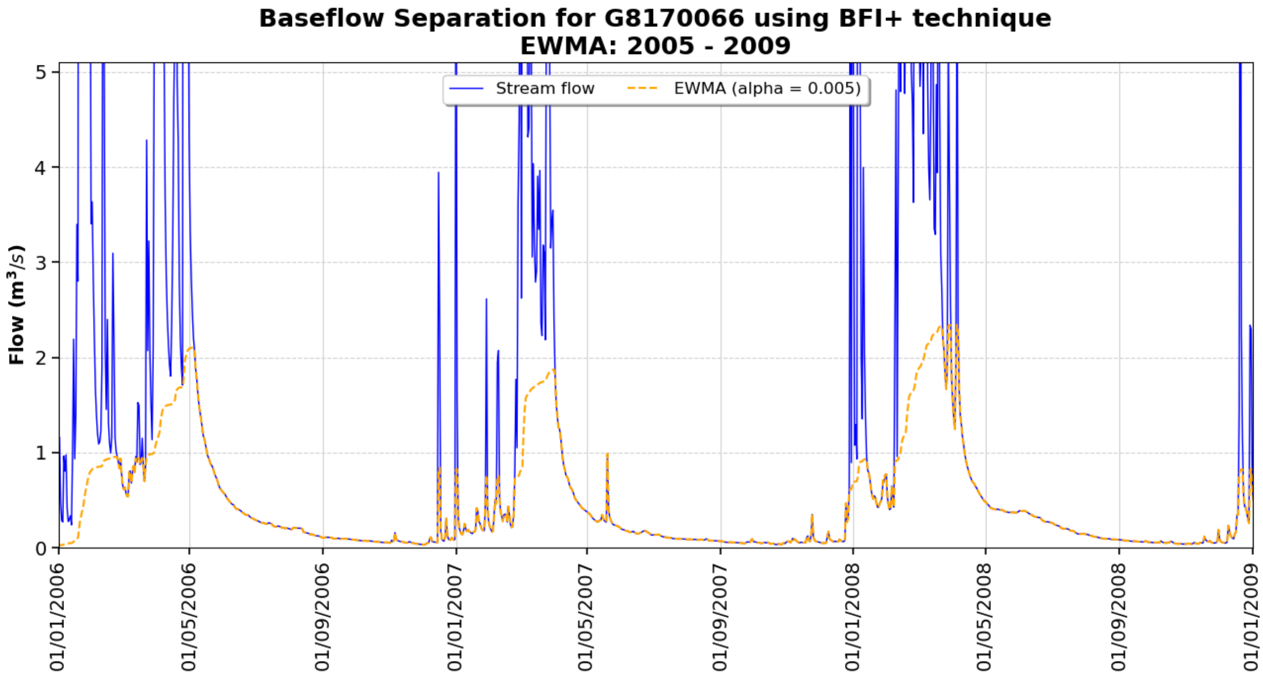

Baseflow Separation for G8170066 using BFI+ technique
Local minimum: 2001 - 2005
Stream flow
Local minimum
Flow (m³/s)
0
1
2
3
4
5
6
7
8
01/01/2001
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006

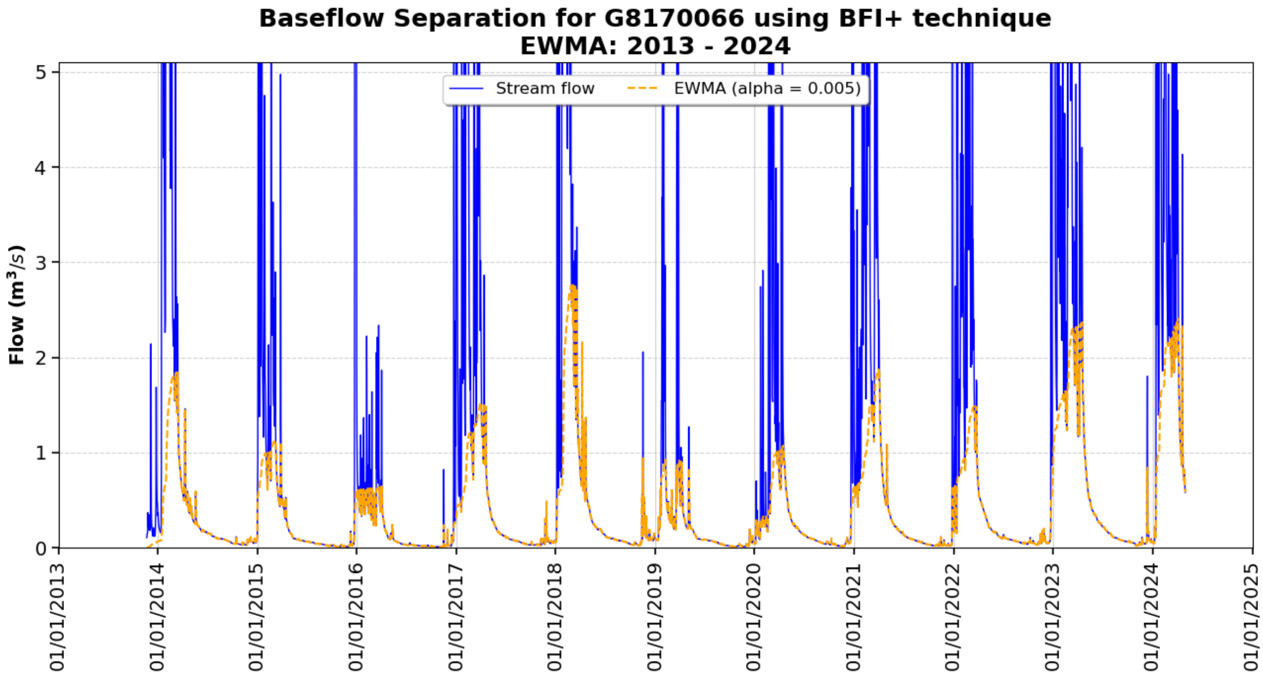

Baseflow Separation for G8170066 using BFI+ technique
Local minimum: 2005 - 2009
Stream flow
Local minimum
Flow (m³/s)
0
1
2
3
4
5
6
7
8
01/01/2006
01/05/2006
01/09/2006
01/01/2007
01/05/2007
01/09/2007
01/01/2008
01/05/2008
01/09/2008
01/01/2009

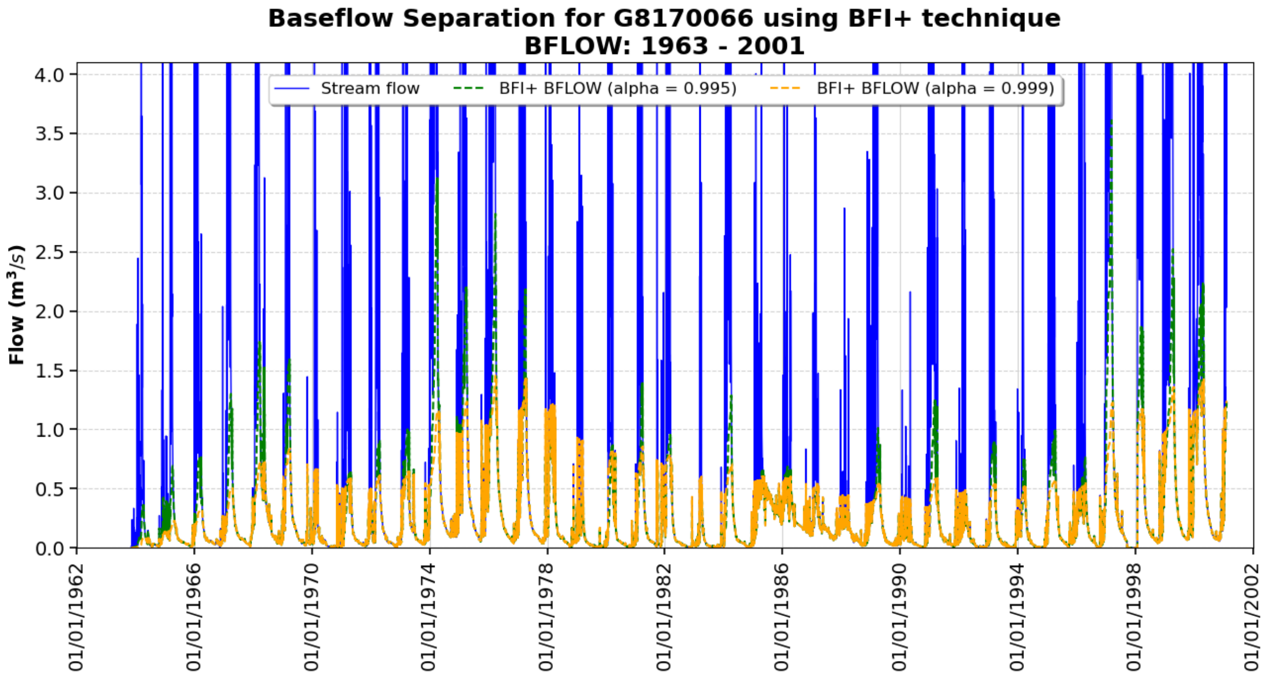

Baseflow Separation for G8170066 using BFI+ technique
Local minimum: 2013 - 2024
Stream flow
Local minimum
Flow (m³/s)
0
1
2
3
4
5
6
7
8
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

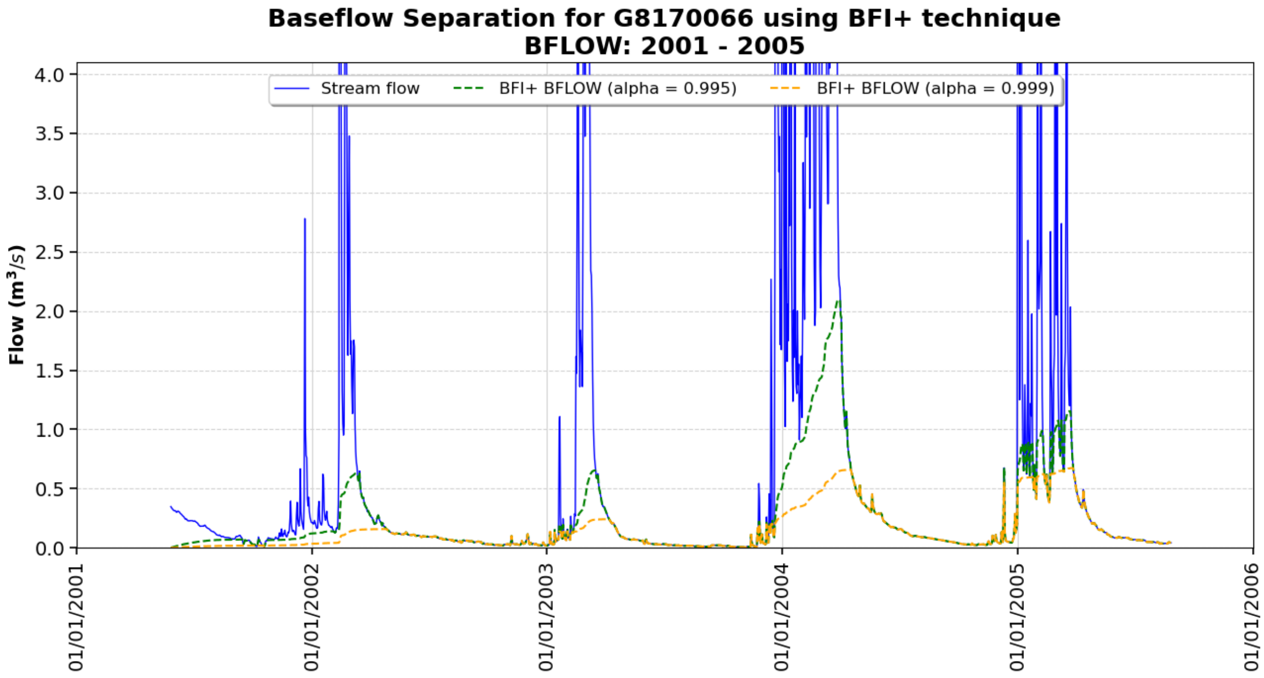

Baseflow Separation for G8170066 using BFI+ technique
EWMA: 1963 - 2001
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0
1
2
3
4
5
01/01/1962
01/01/1966
01/01/1970
01/01/1974
01/01/1978
01/01/1982
01/01/1986
01/01/1990
01/01/1994
01/01/1998
01/01/2002

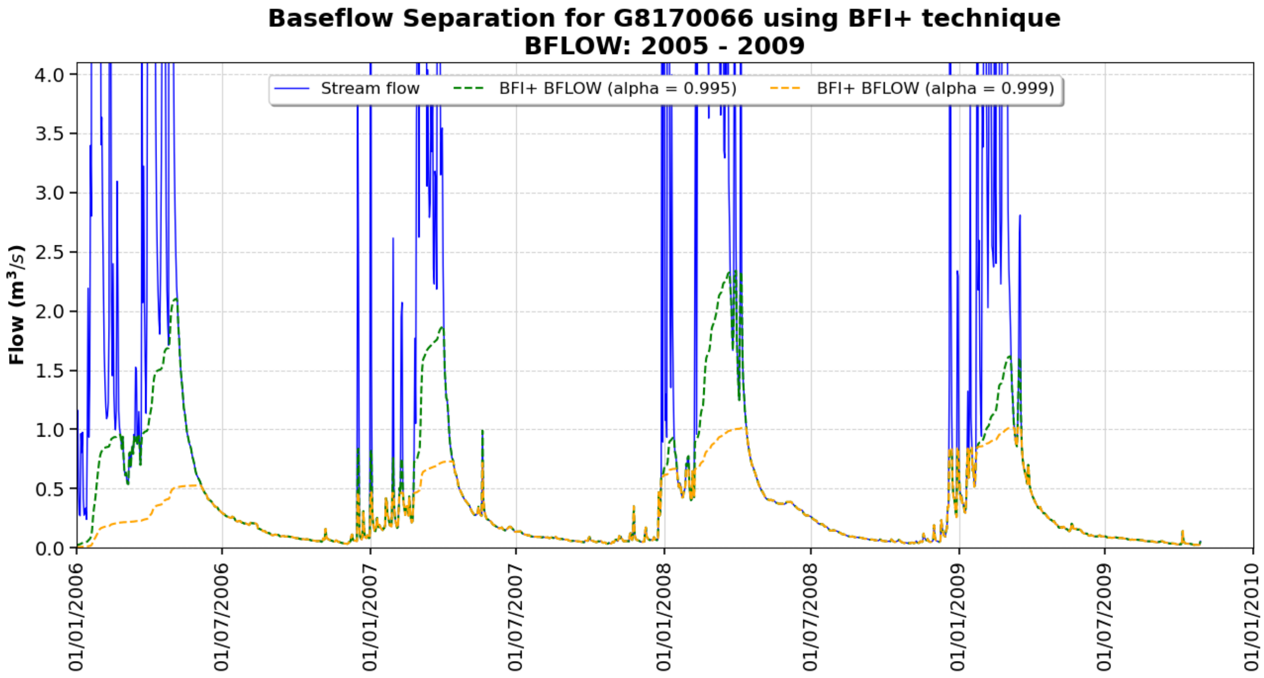

Baseflow Separation for G8170066 using BFI+ technique
EWMA: 2001 - 2005
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0
1
2
3
4
5
01/01/2001
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006

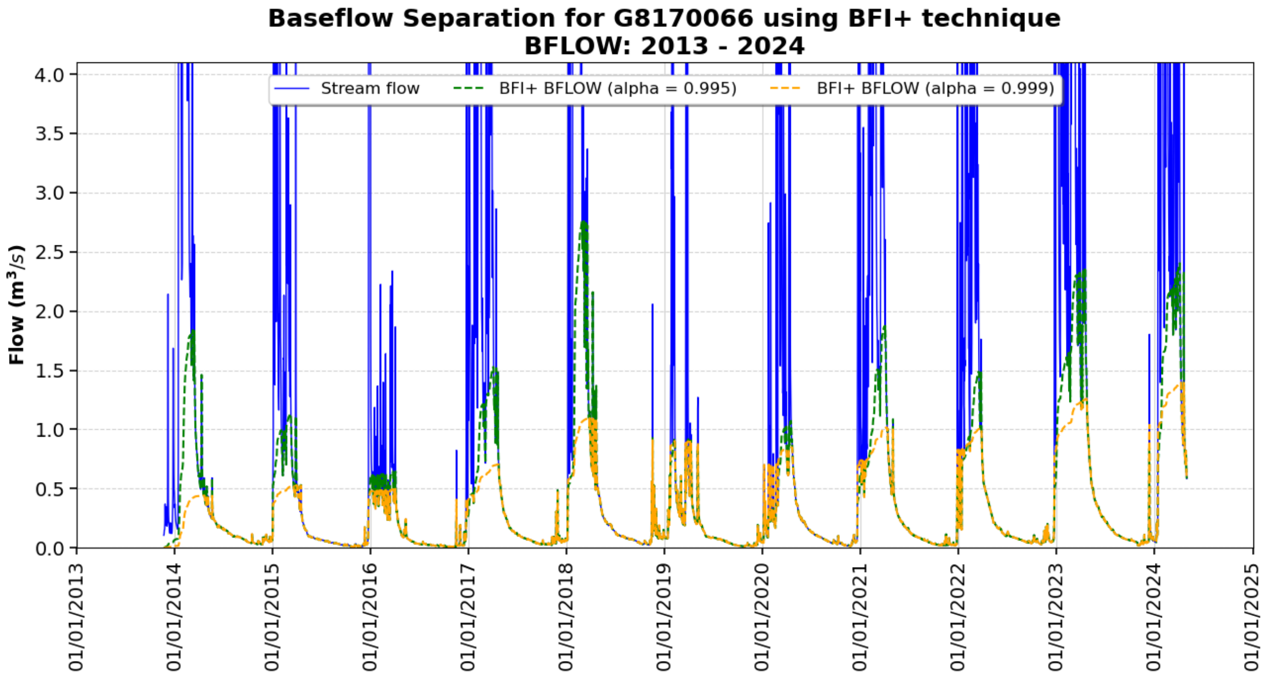

Baseflow Separation for G8170066 using BFI+ technique
EWMA: 2005 - 2009
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0
1
2
3
4
5
01/01/2006
01/05/2006
01/09/2006
01/01/2007
01/05/2007
01/09/2007
01/01/2008
01/05/2008
01/09/2008
01/01/2009

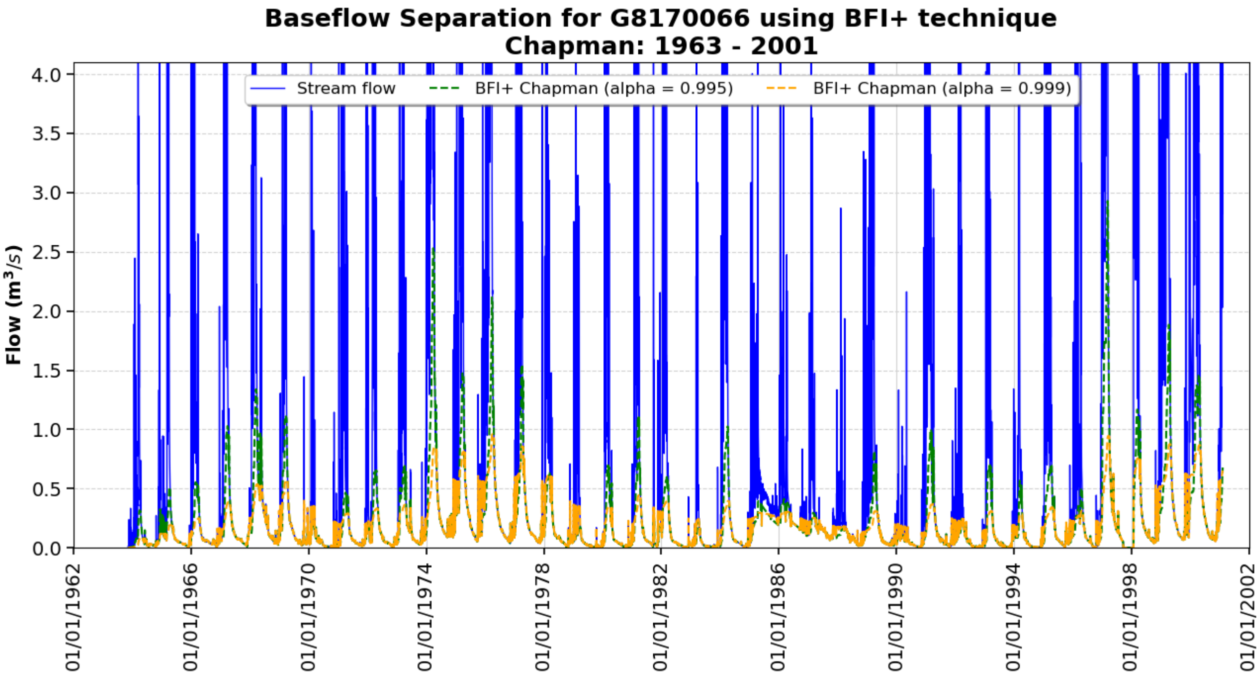

Baseflow Separation for G8170066 using BFI+ technique
EWMA: 2013 - 2024
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0
1
2
3
4
5
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

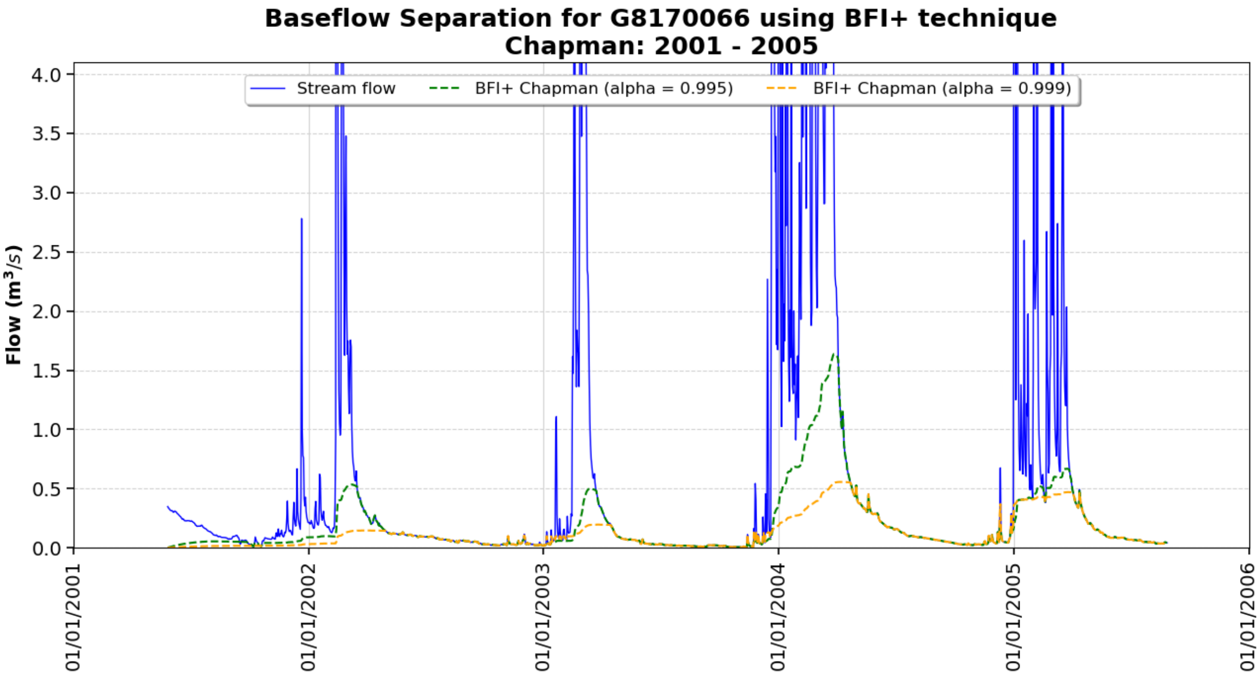

Baseflow Separation for G8170066 using BFI+ technique
BFLOW: 1963 - 2001
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/1962
01/01/1966
01/01/1970
01/01/1974
01/01/1978
01/01/1982
01/01/1986
01/01/1990
01/01/1994
01/01/1998
01/01/2002

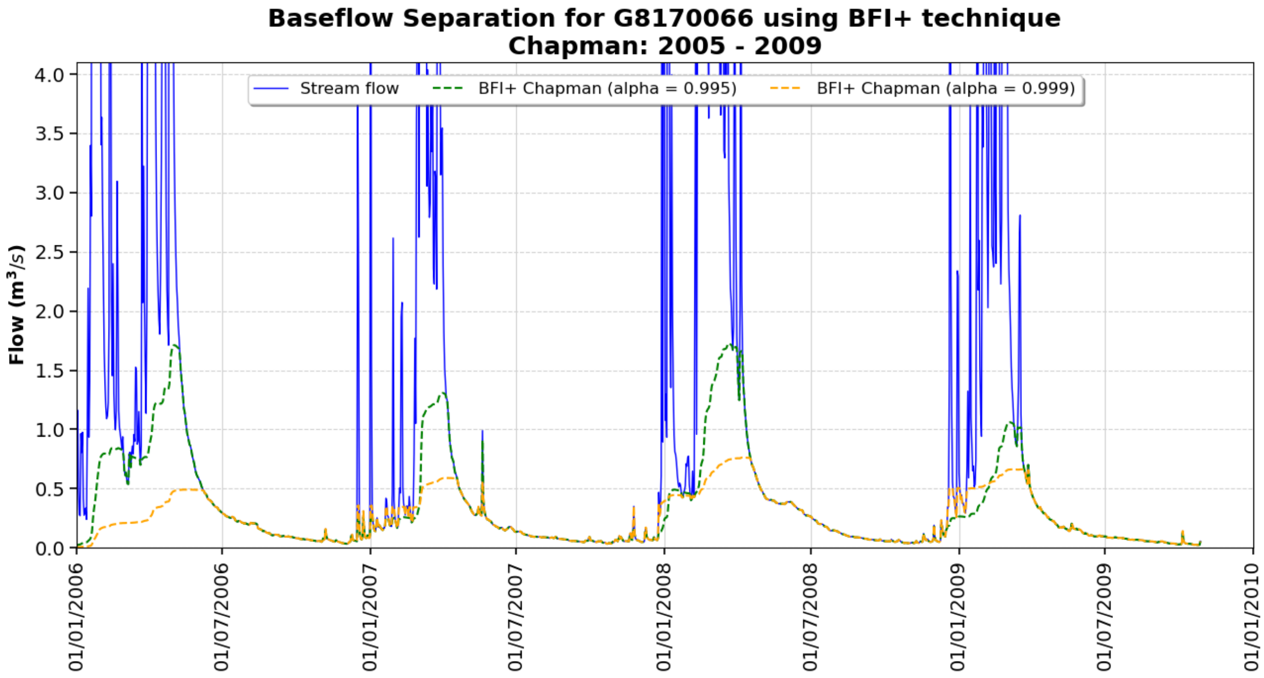

Baseflow Separation for G8170066 using BFI+ technique
BFLOW: 2001 - 2005
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/2001
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006

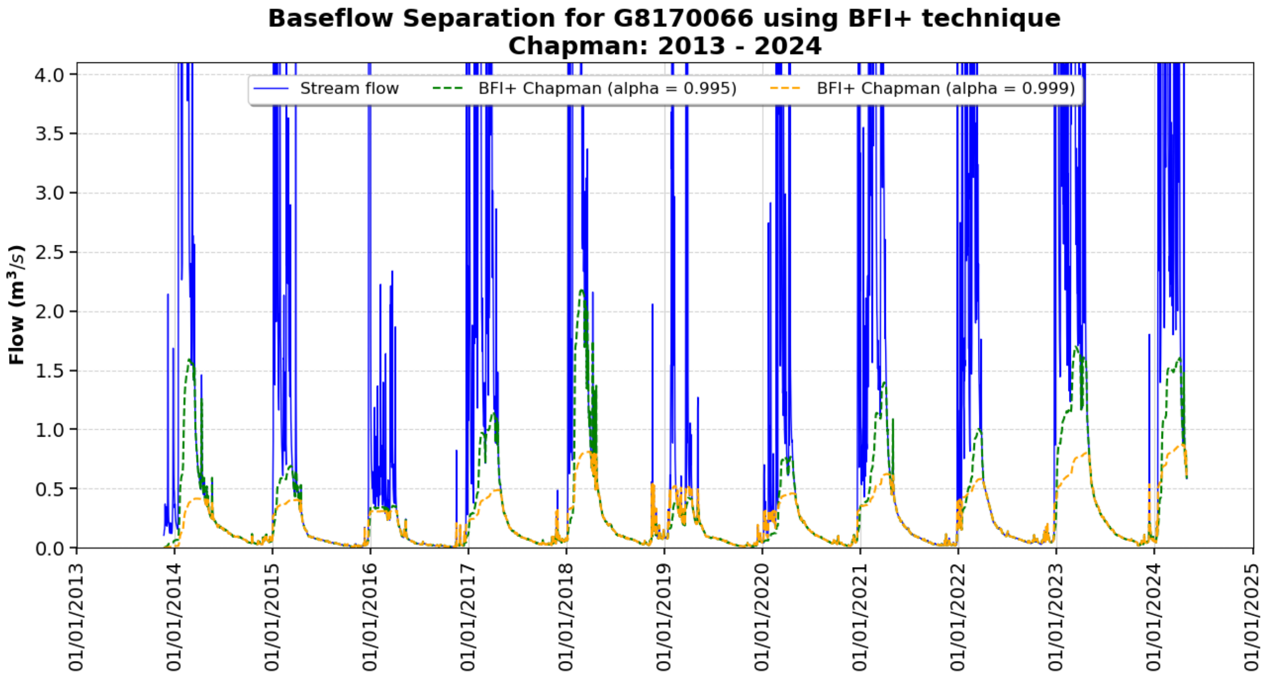

Baseflow Separation for G8170066 using BFI+ technique
BFLOW: 2005 - 2009
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/2006
01/07/2006
01/01/2007
01/07/2007
01/01/2008
01/07/2008
01/01/2009
01/07/2009
01/01/2010

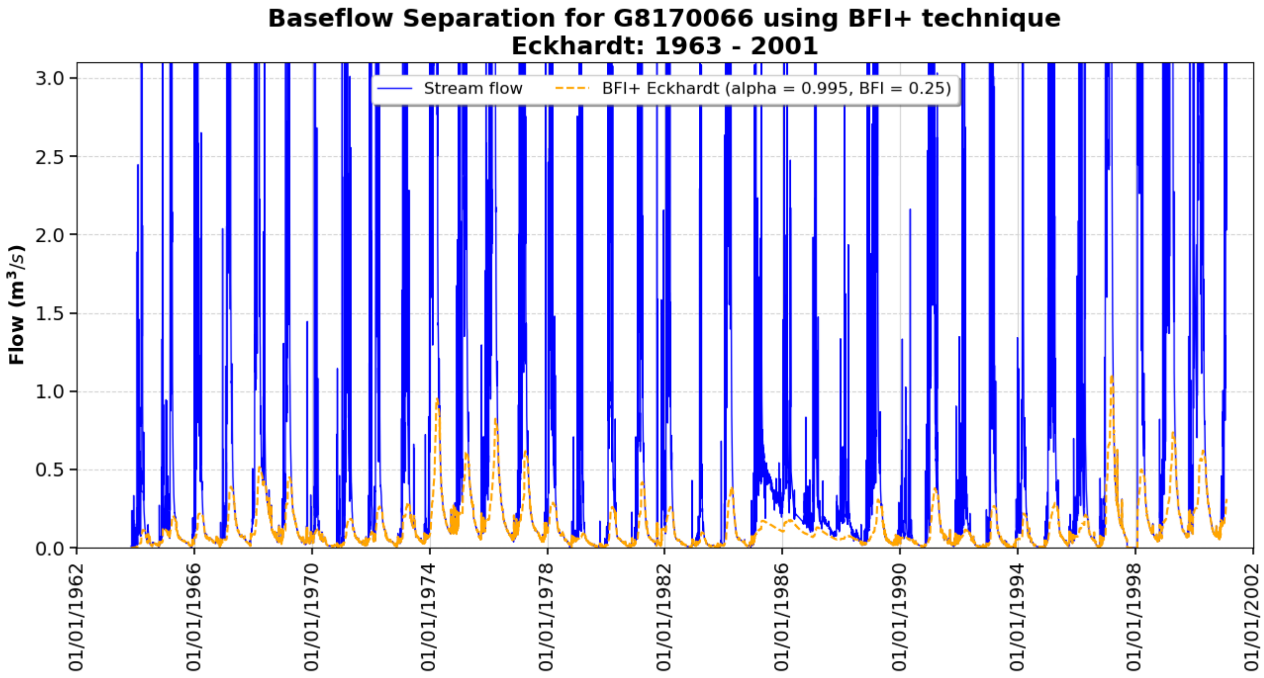

Baseflow Separation for G8170066 using BFI+ technique
BFLOW: 2013 - 2024
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

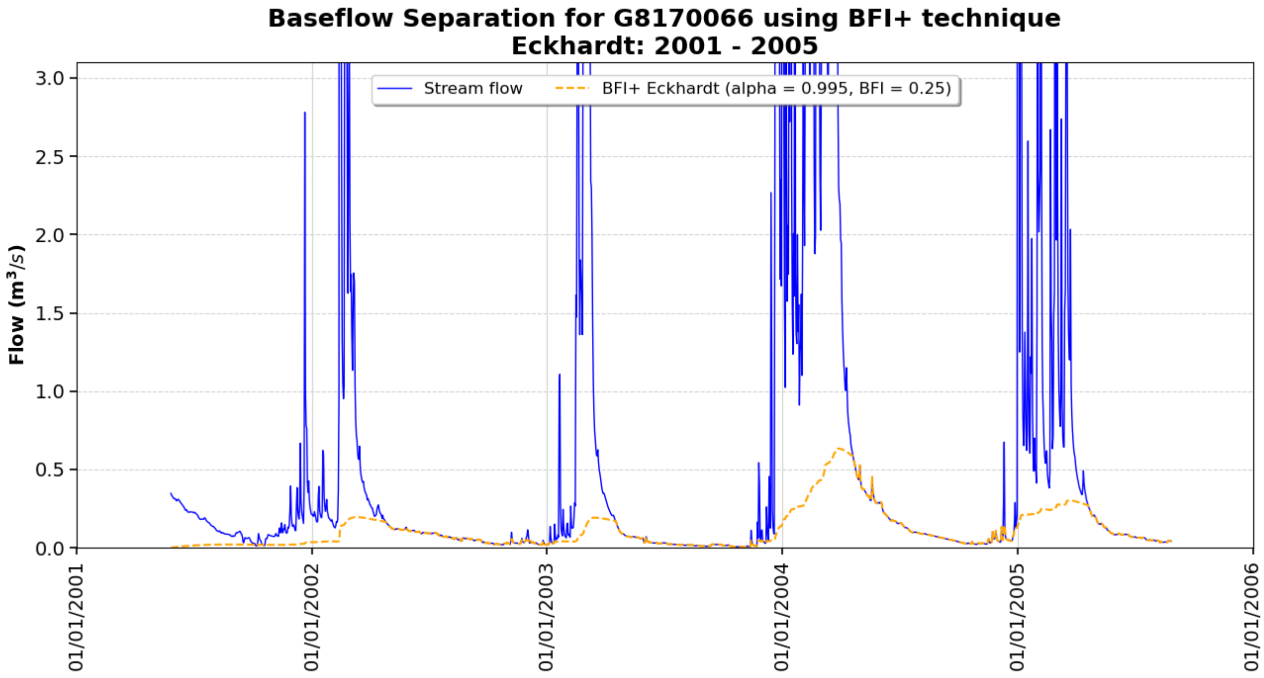

Baseflow Separation for G8170066 using BFI+ technique
Chapman: 1963 - 2001
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
01/01/1962
01/01/1966
01/01/1970
01/01/1974
01/01/1978
01/01/1982
01/01/1986
01/01/1990
01/01/1994
01/01/1998
01/01/2002

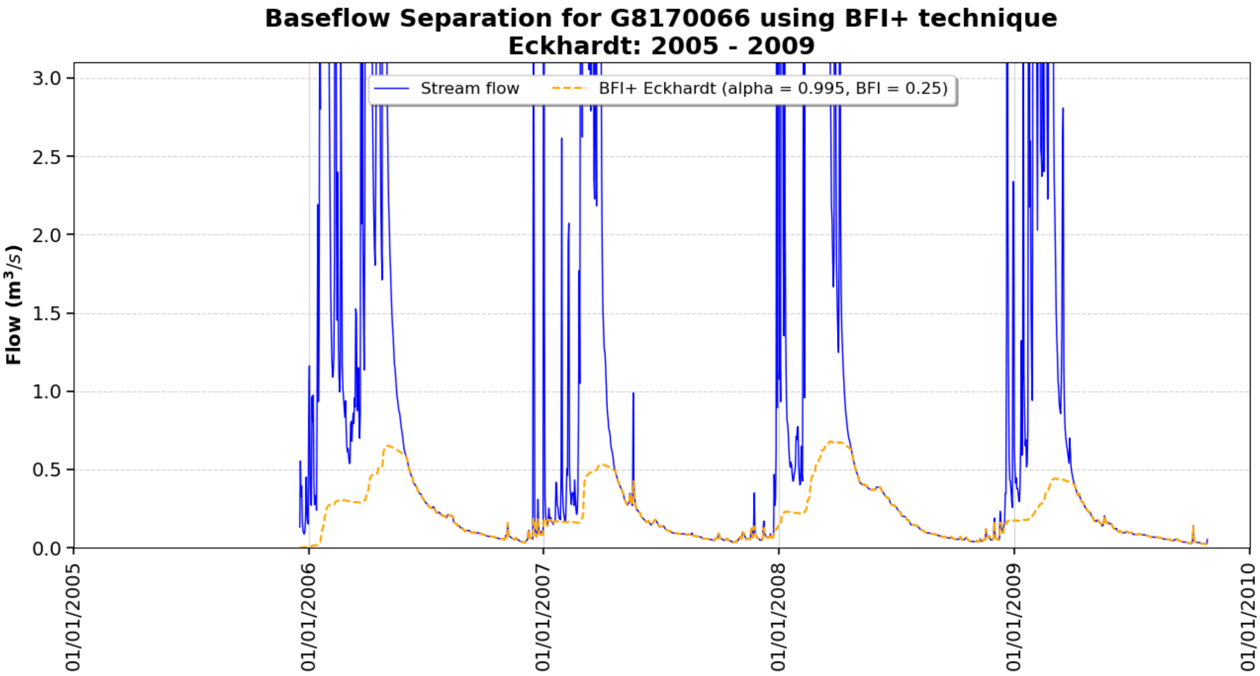

Baseflow Separation for G8170066 using BFI+ technique
Chapman: 2001 - 2005
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0
01/01/2001
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006

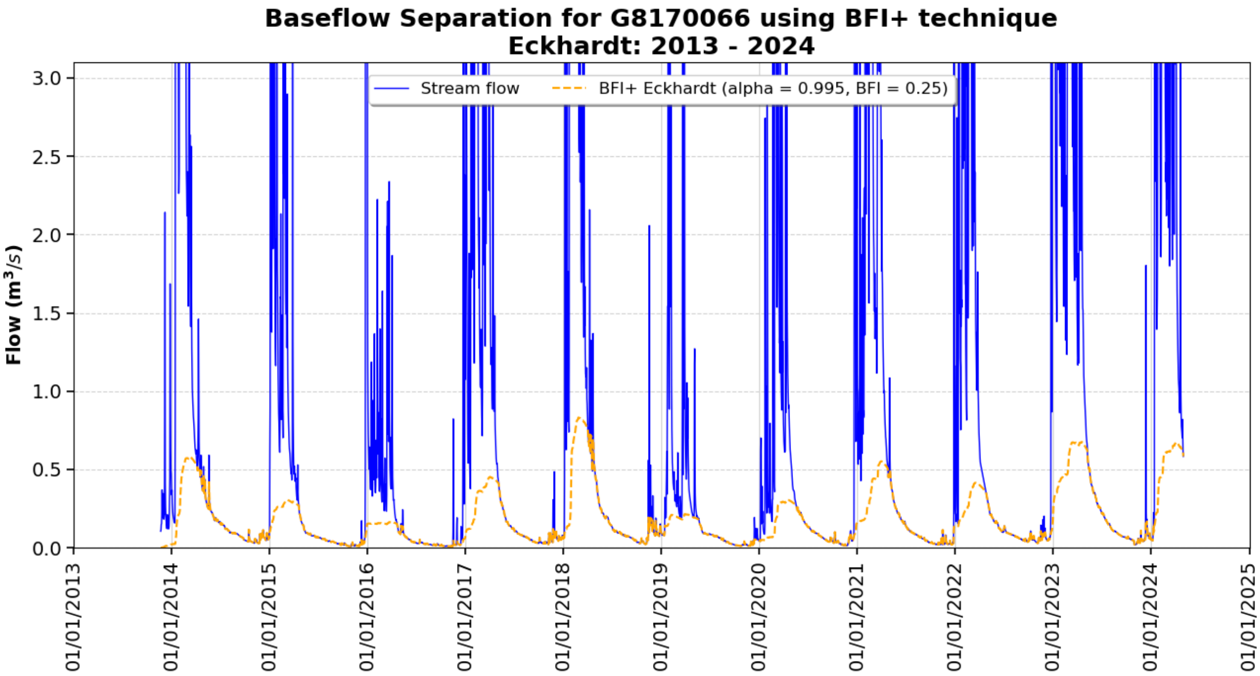

Baseflow Separation for G8170066 using BFI+ technique
Chapman: 2005 - 2009
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/2006
01/07/2006
01/01/2007
01/07/2007
01/01/2008
01/07/2008
01/01/2009
01/07/2009
01/01/2010


Baseflow Separation for G8170066 using BFI+ technique
Chapman: 2013 - 2024
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

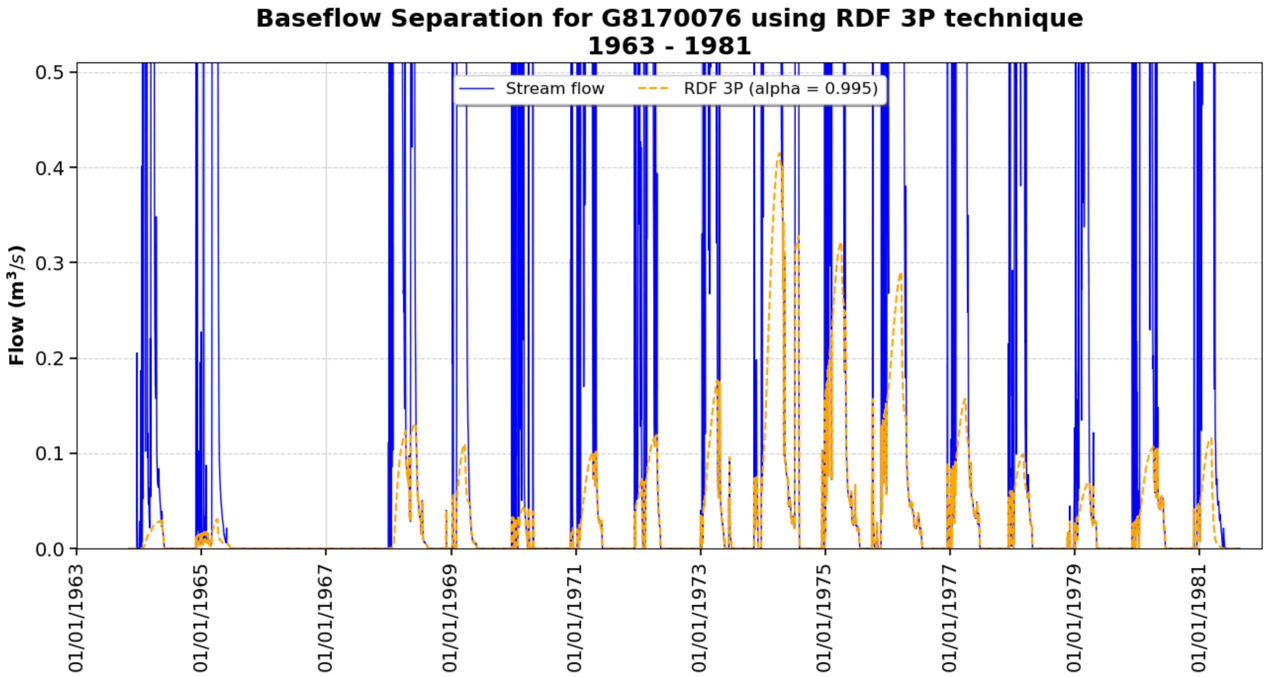

Baseflow Separation for G8170066 using BFI+ technique
Eckhardt: 1963 - 2001
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/1962
01/01/1966
01/01/1970
01/01/1974
01/01/1978
01/01/1982
01/01/1986
01/01/1990
01/01/1994
01/01/1998
01/01/2002

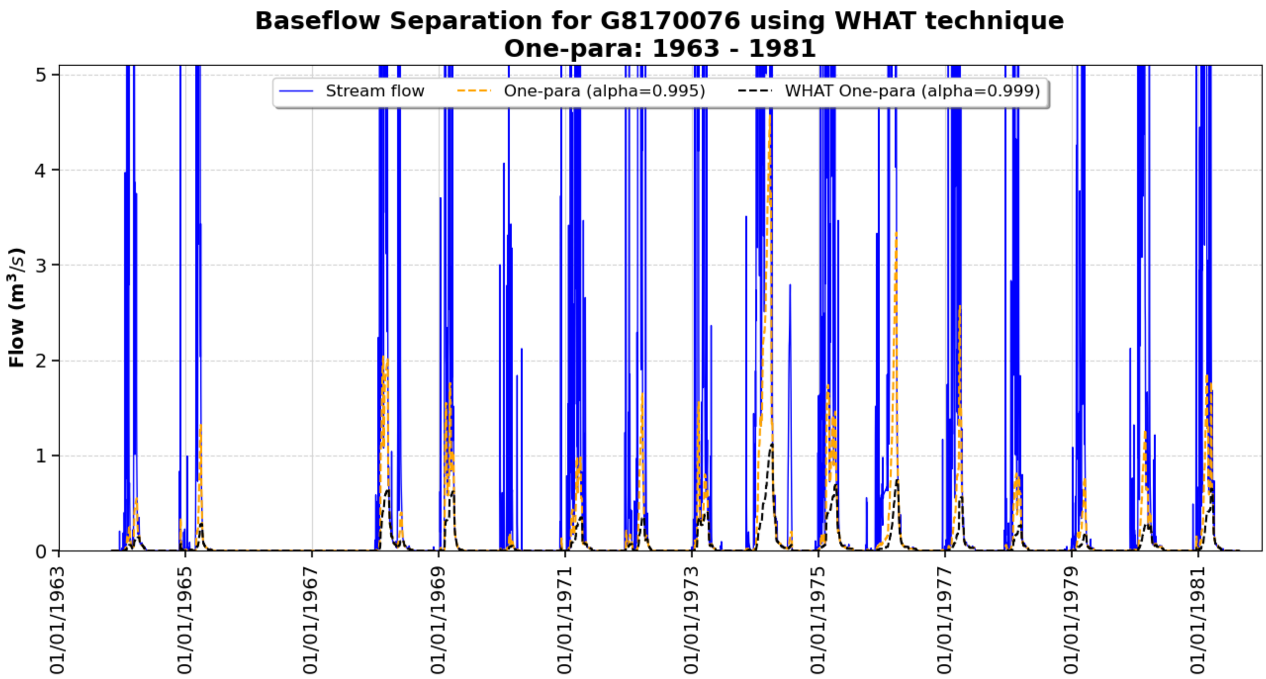

Baseflow Separation for G8170066 using BFI+ technique
Eckhardt: 2001 - 2005
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/2001
01/01/2002
01/01/2003
01/01/2004
01/01/2005
01/01/2006

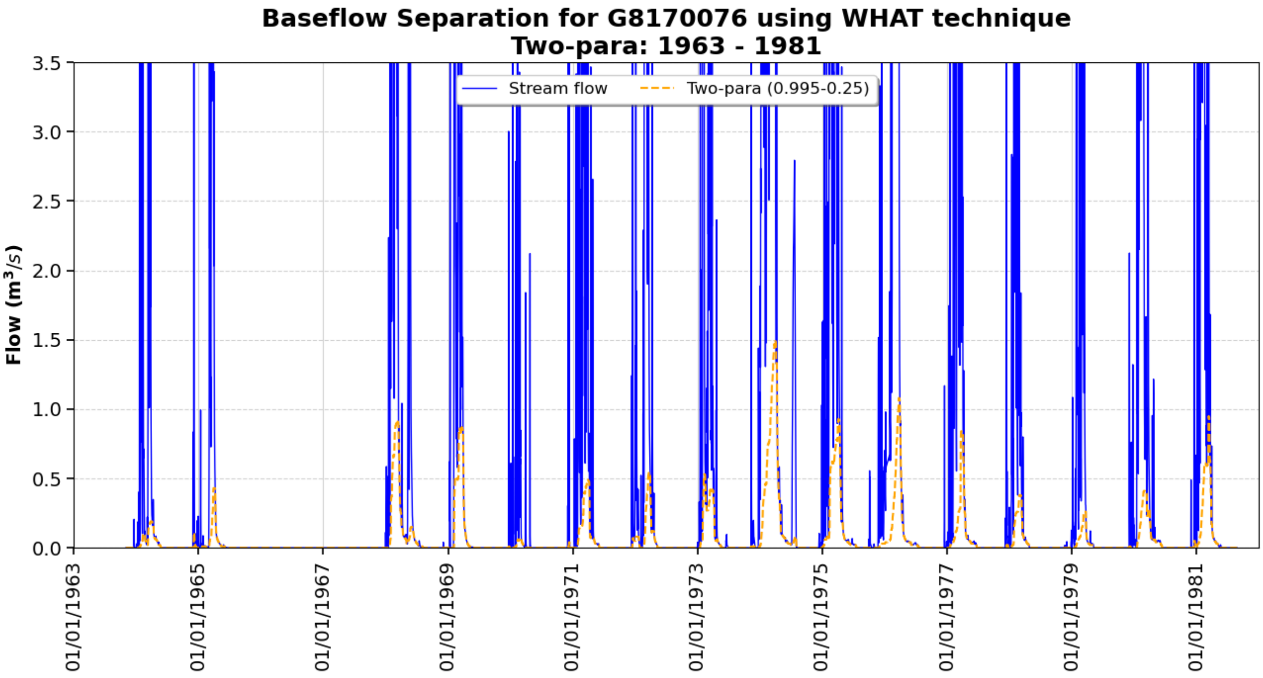

Baseflow Separation for G8170066 using BFI+ technique
Eckhardt: 2005 - 2009
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010

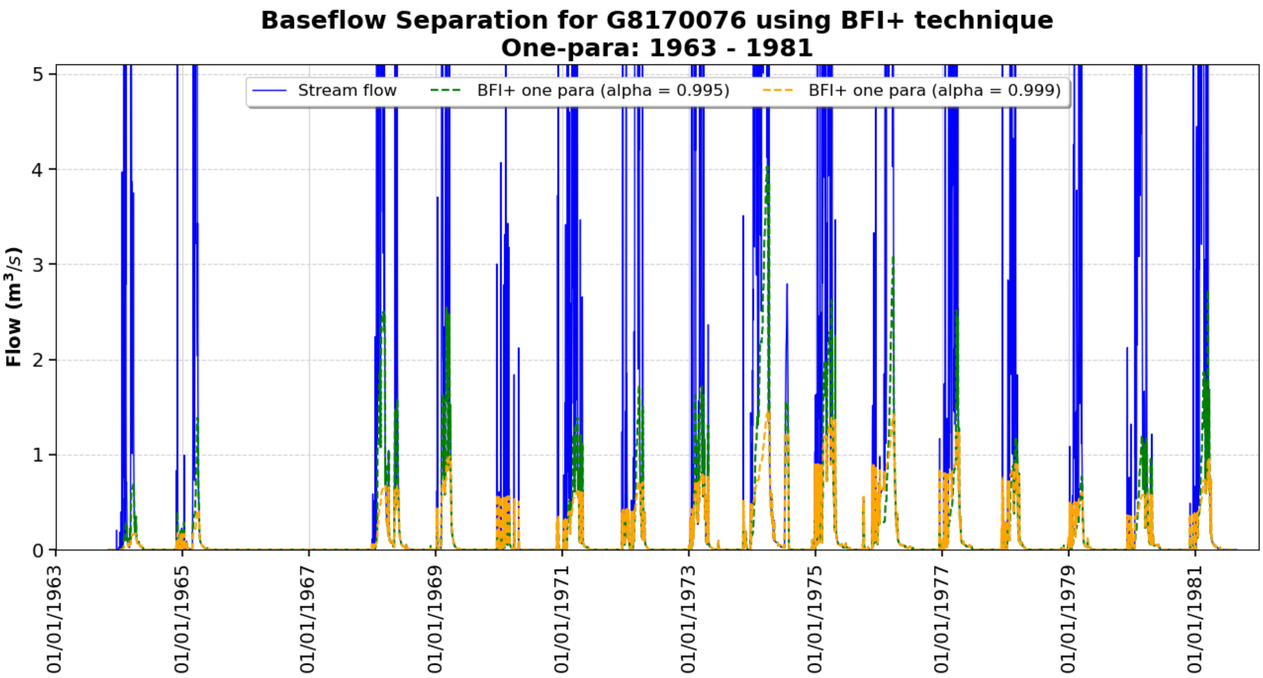

Baseflow Separation for G8170066 using BFI+ technique
Eckhardt: 2013 - 2024
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

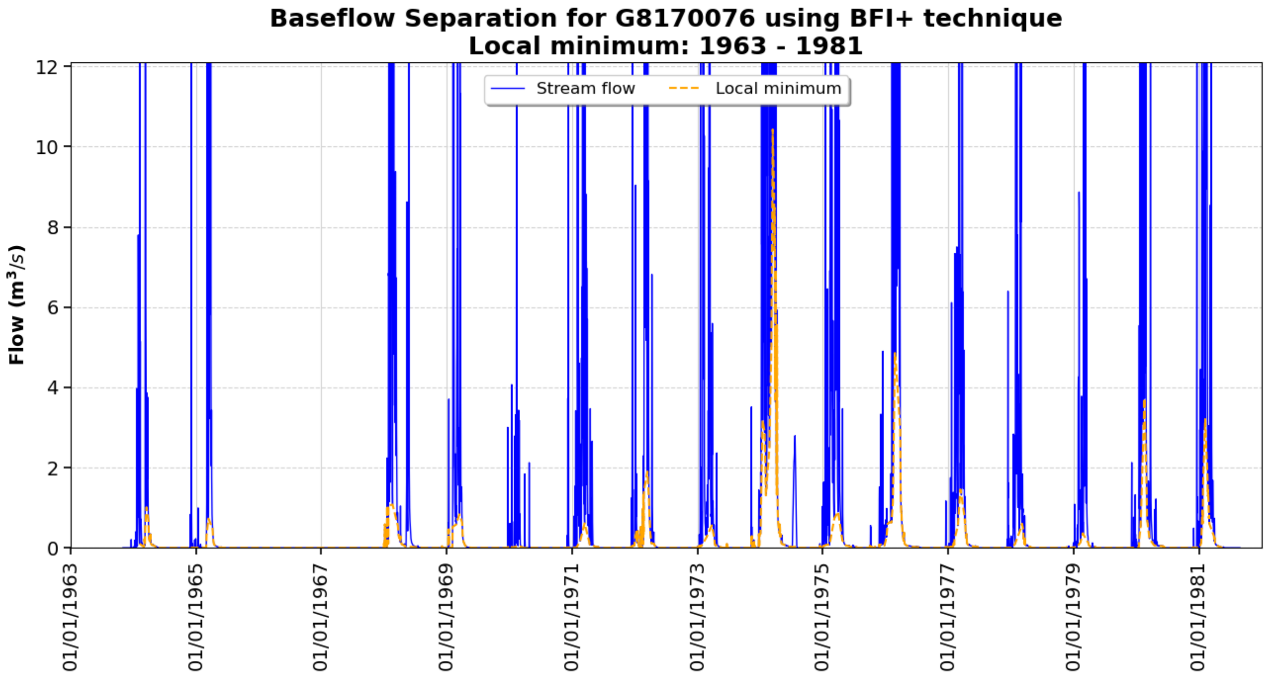
Appendix I: Baseflow separation hydrographs for G8170076

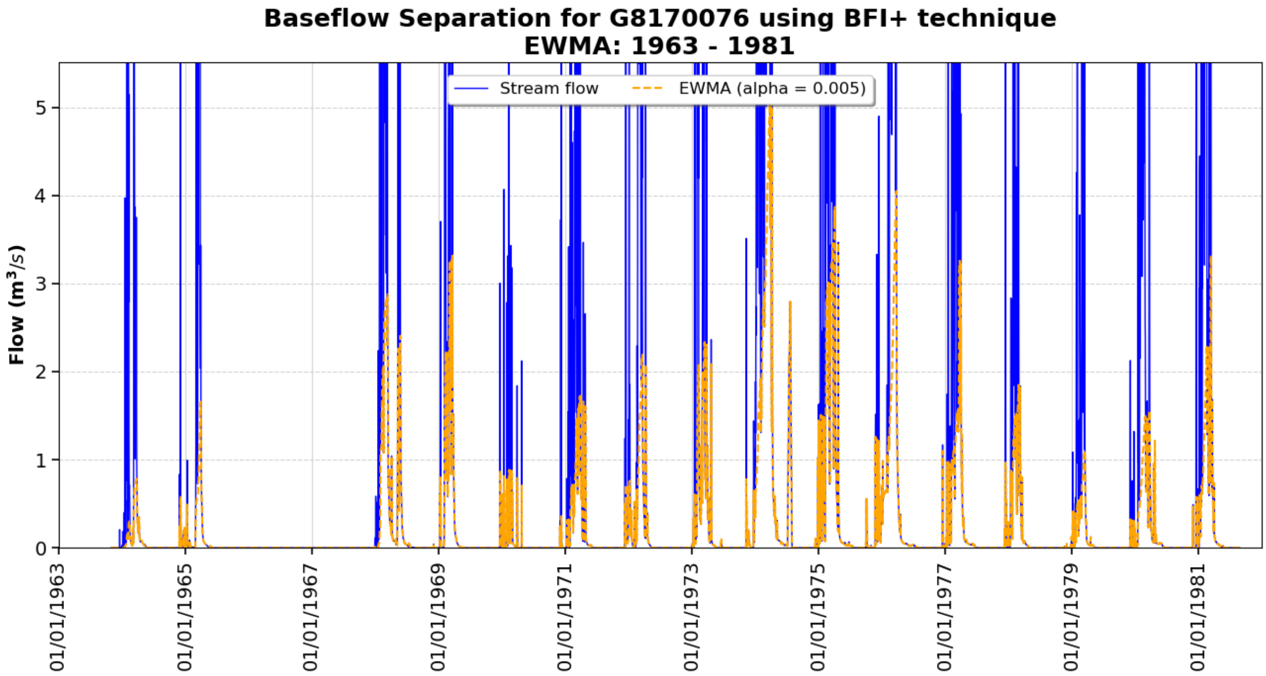


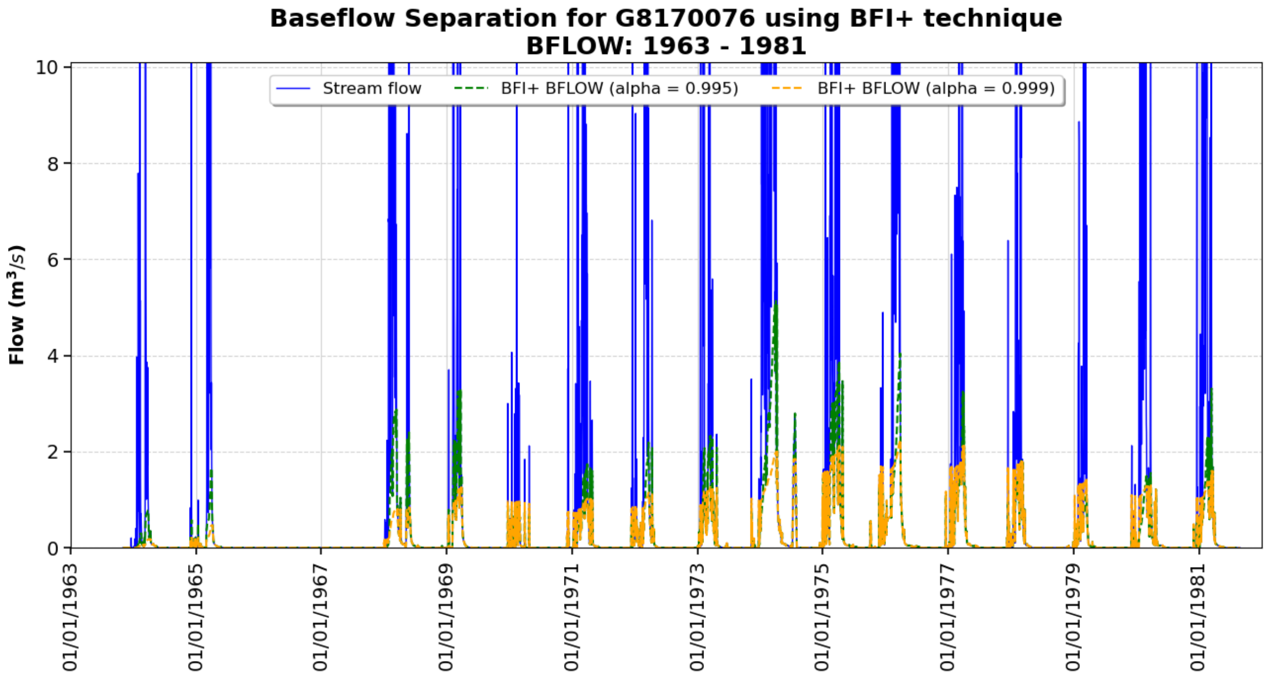


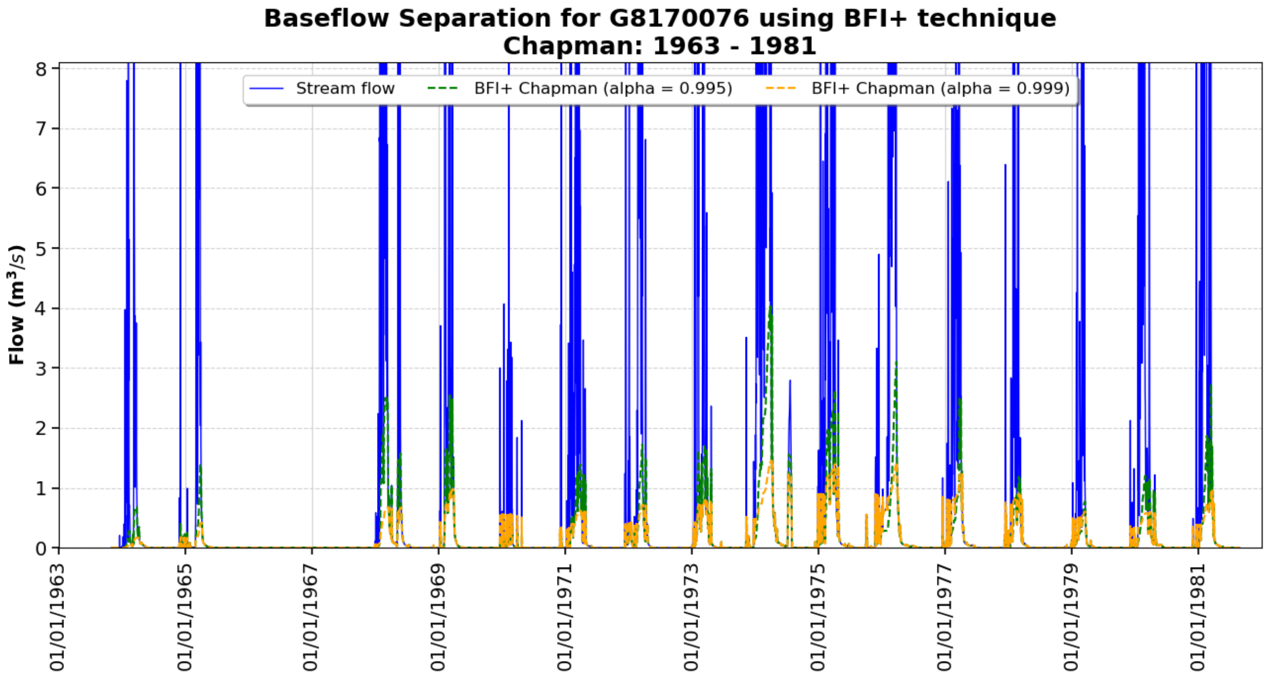

Baseflow Separation for G8170076 using WHAT technique
Two-para: 1963 - 1981
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981

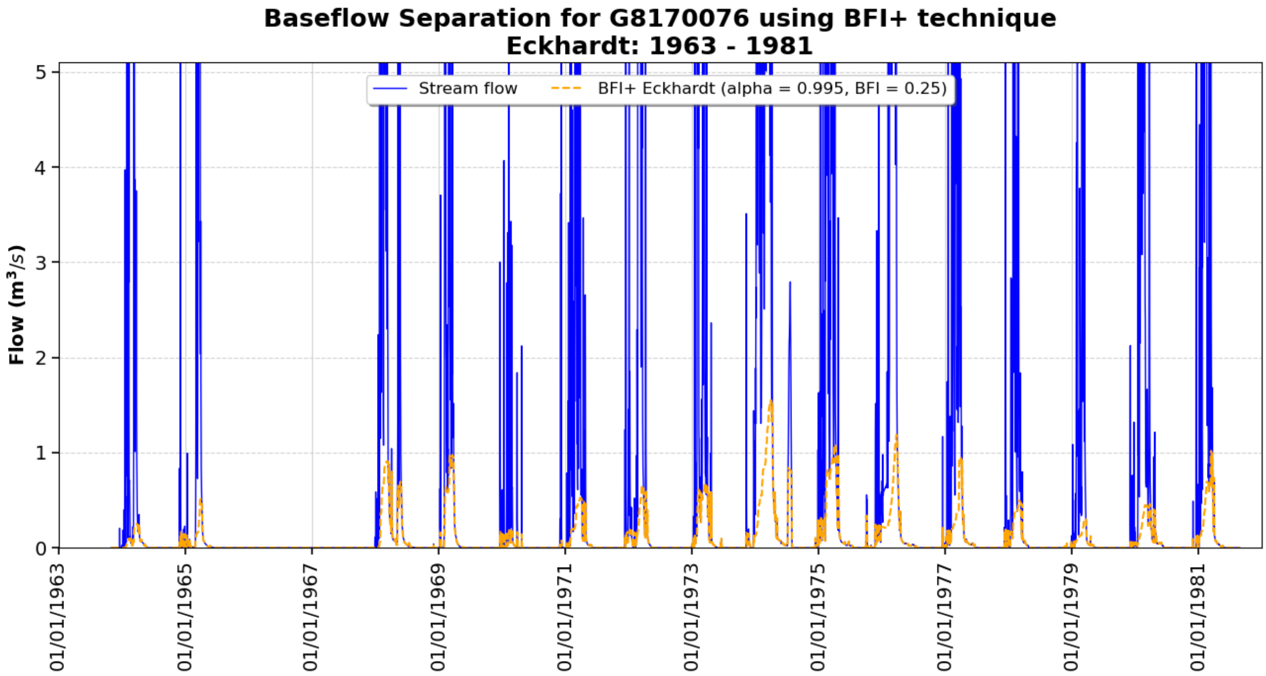

Baseflow Separation for G8170076 using BFI+ technique
One-para: 1963 - 1981
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
5
4
3
2
1
0
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981


Baseflow Separation for G8170076 using BFI+ technique
Local minimum: 1963 - 1981
Stream flow
Local minimum
Flow (m³/s)
0
2
4
6
8
10
12
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981

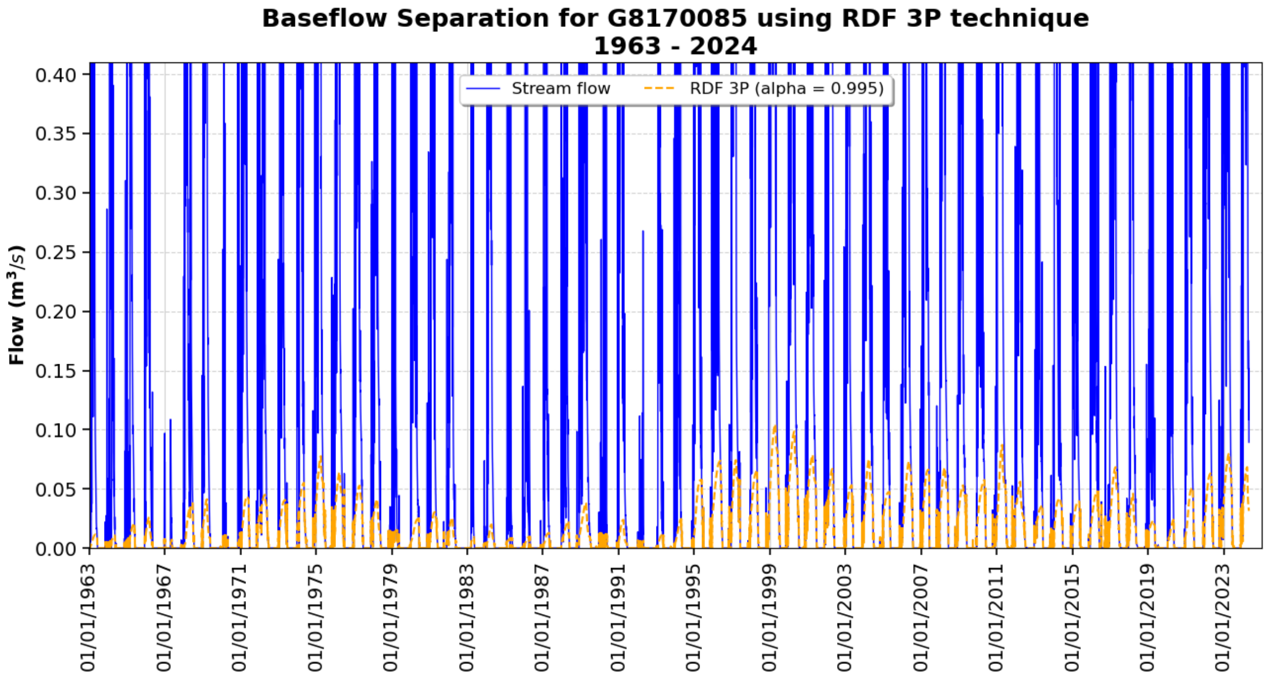

Baseflow Separation for G8170076 using BFI+ technique
EWMA: 1963 - 1981
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0
1
2
3
4
5
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981

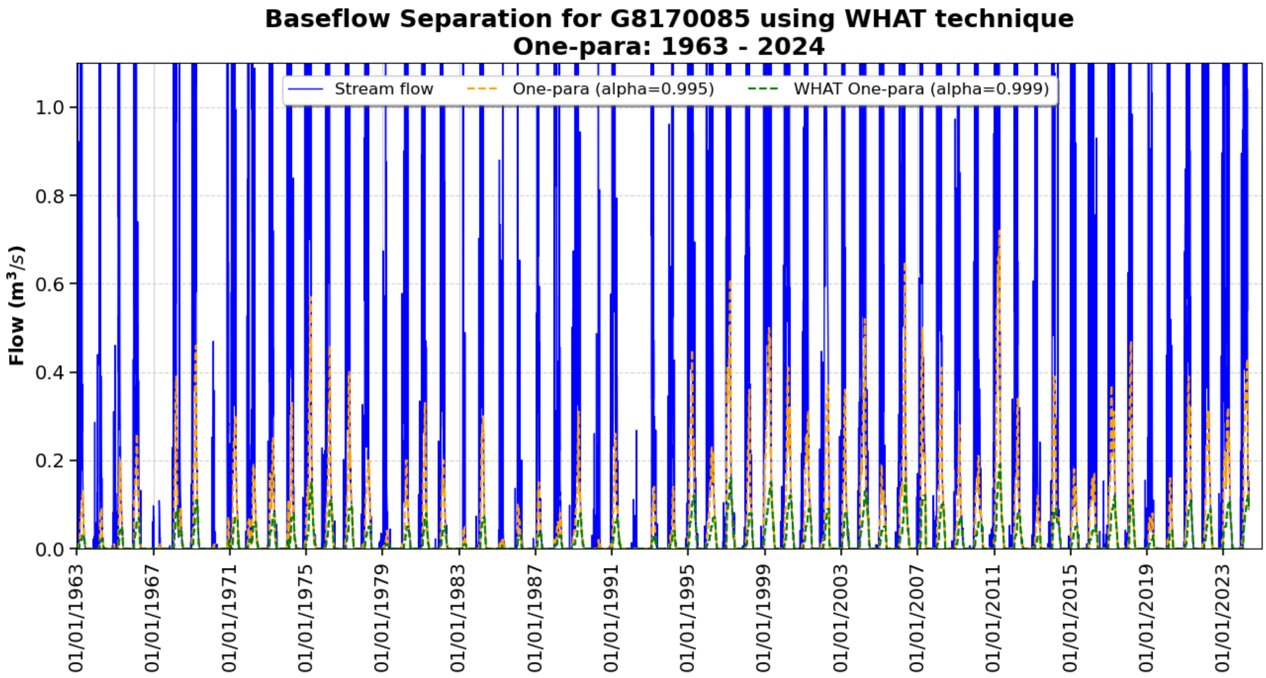

Baseflow Separation for G8170076 using BFI+ technique
BFLOW: 1963 - 1981
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0
2
4
6
8
10
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981

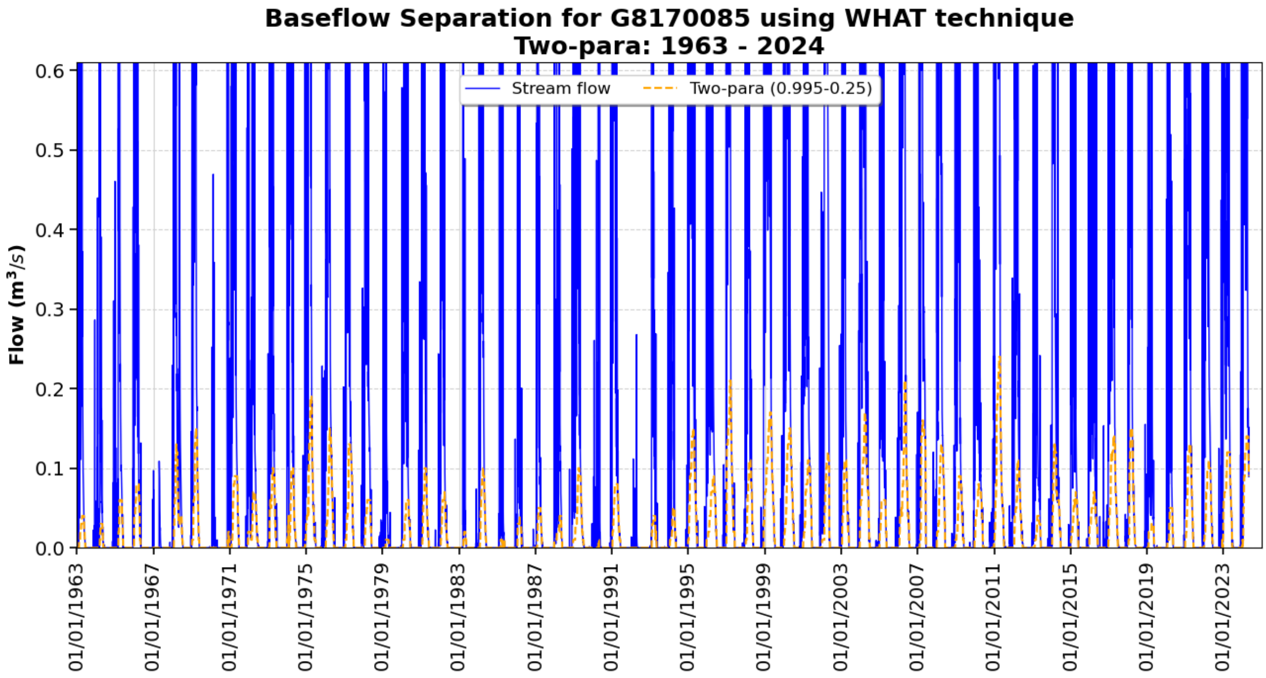

Baseflow Separation for G8170076 using BFI+ technique
Chapman: 1963 - 1981
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0
1
2
3
4
5
6
7
8
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981

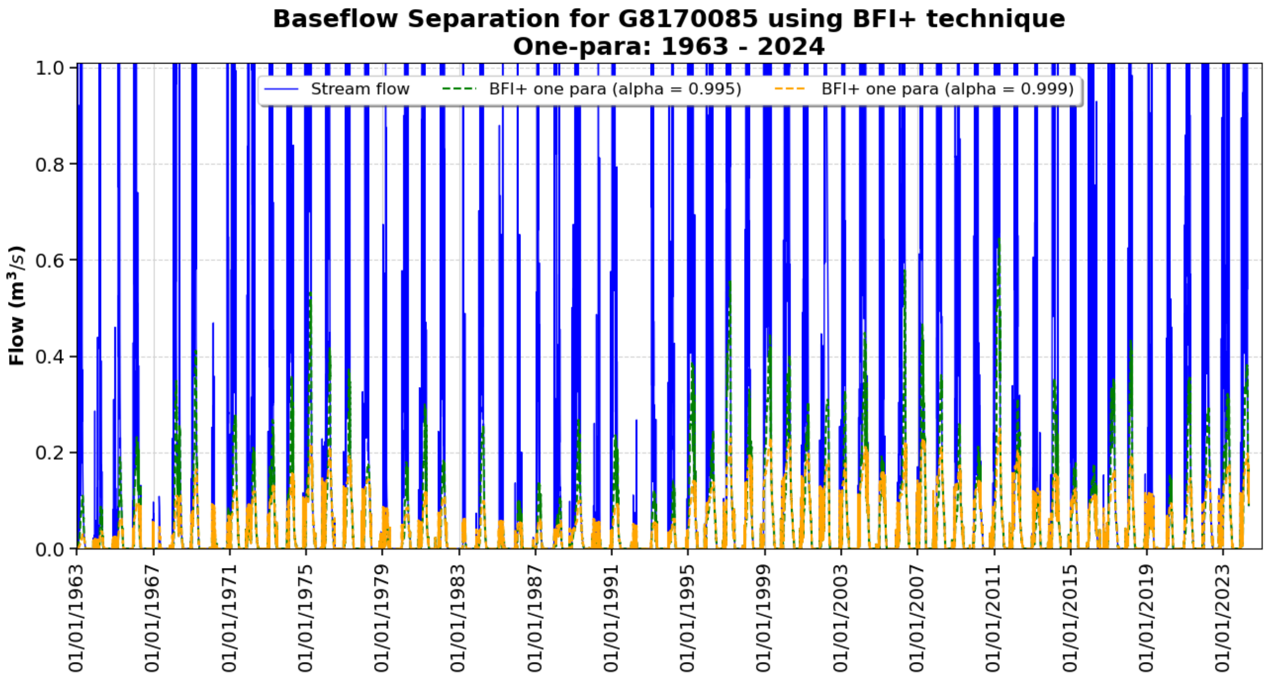

Baseflow Separation for G8170076 using BFI+ technique
Eckhardt: 1963 - 1981
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0
1
2
3
4
5
01/01/1963
01/01/1965
01/01/1967
01/01/1969
01/01/1971
01/01/1973
01/01/1975
01/01/1977
01/01/1979
01/01/1981

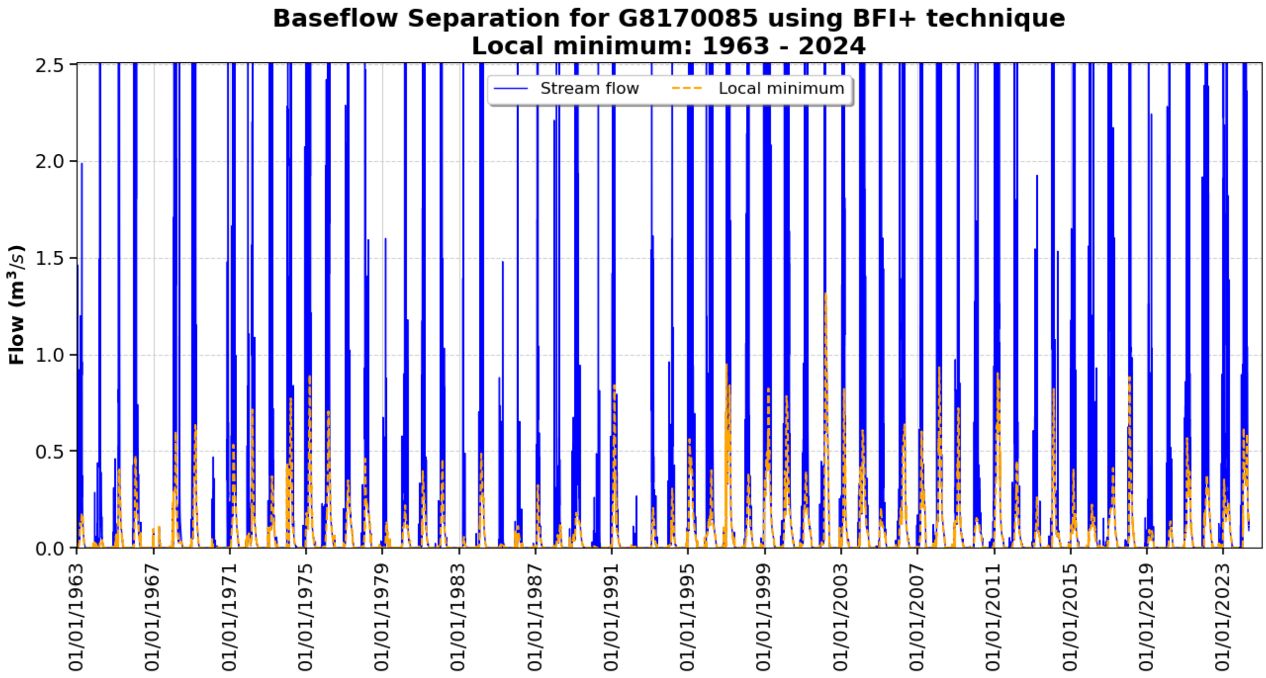
Appendix J: Baseflow separation hydrographs for G8170085

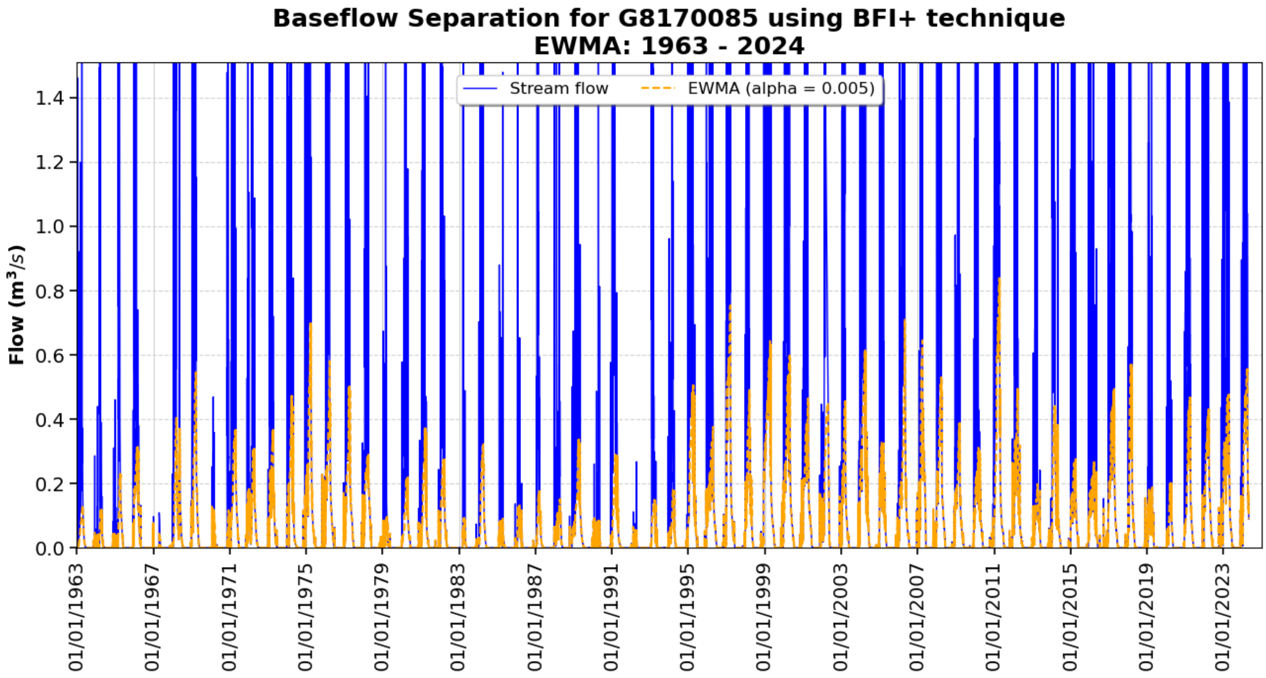


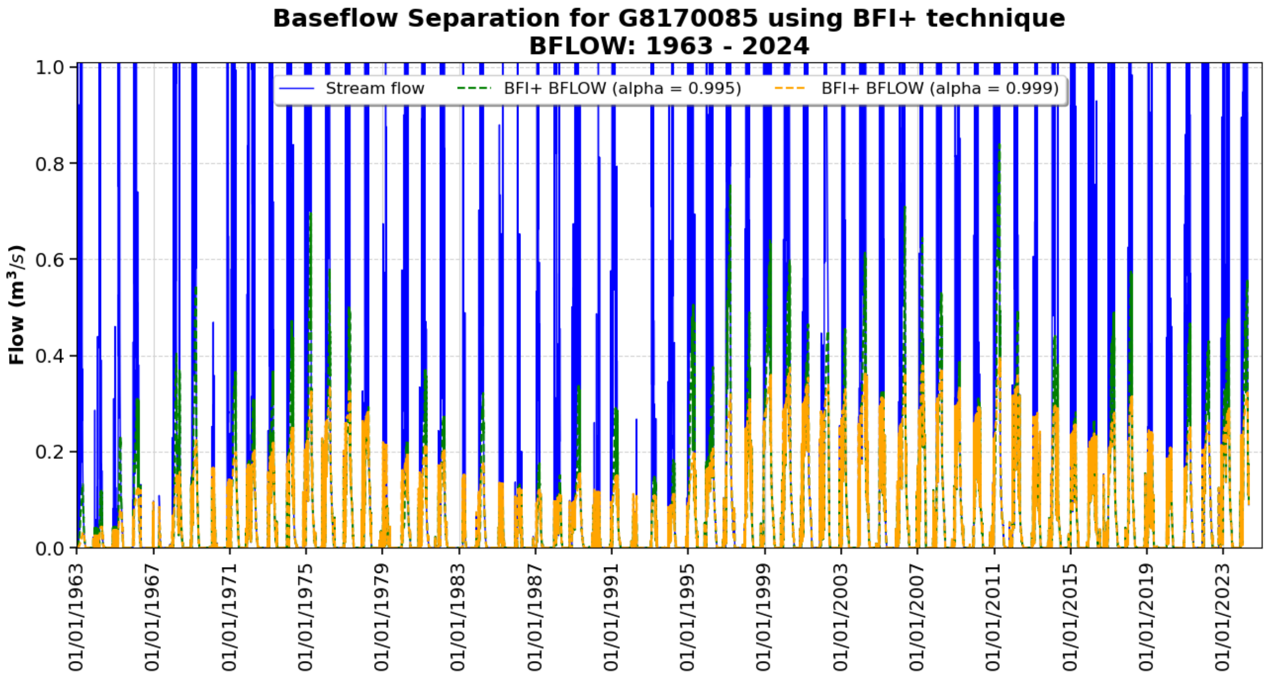


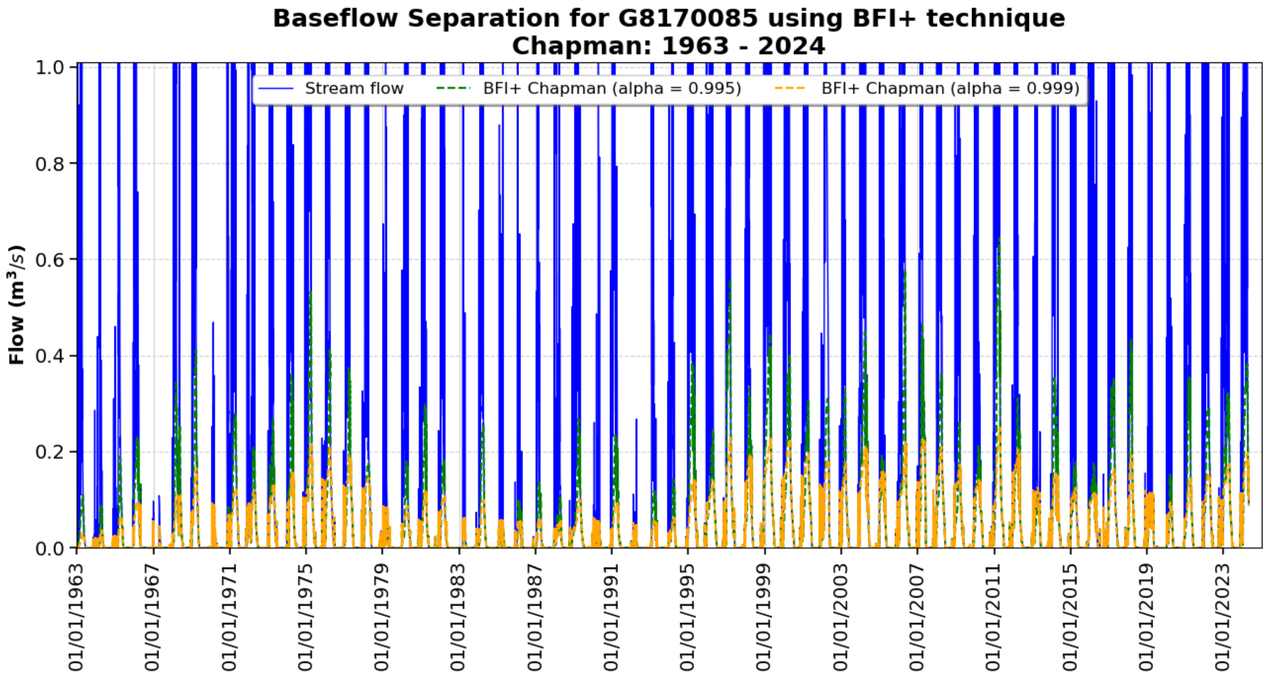

Baseflow Separation for G8170085 using WHAT technique
Two-para: 1963 - 2024
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
01/01/1963
01/01/1967
01/01/1971
01/01/1975
01/01/1979
01/01/1983
01/01/1987
01/01/1991
01/01/1995
01/01/1999
01/01/2003
01/01/2007
01/01/2011
01/01/2015
01/01/2019
01/01/2023

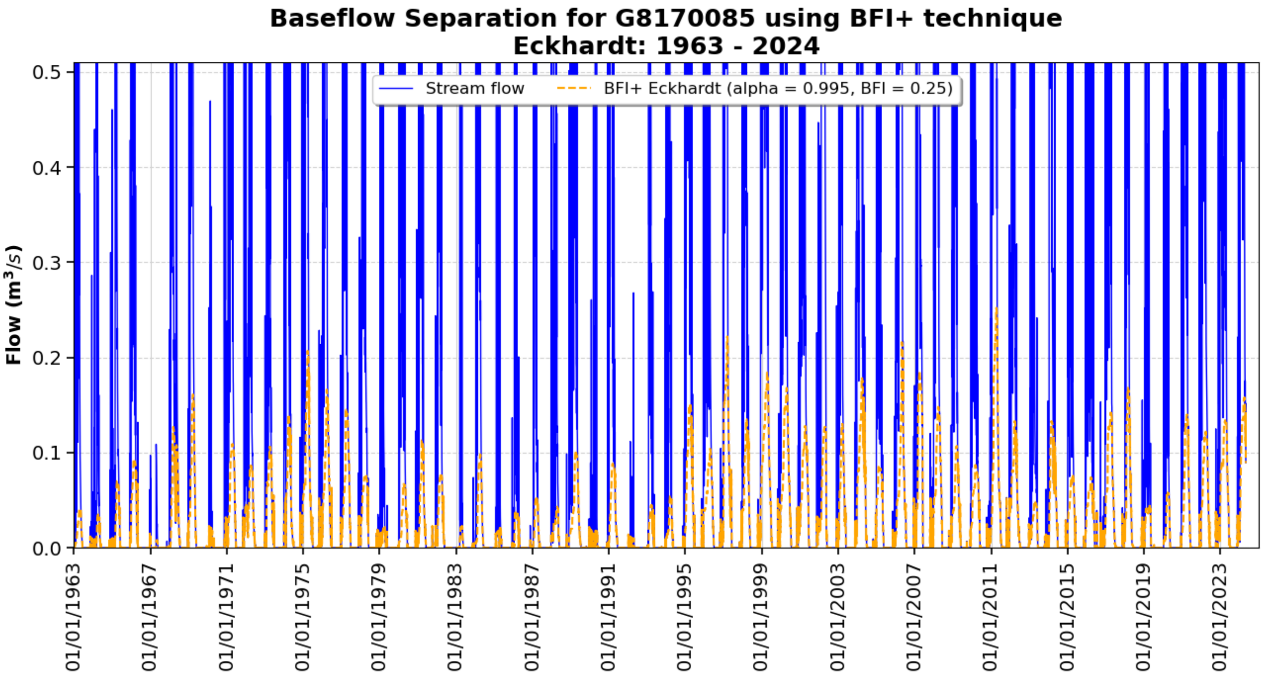

Baseflow Separation for G8170085 using BFI+ technique
One-para: 1963 - 2024
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
0.0
0.2
0.4
0.6
0.8
1.0
01/01/1963
01/01/1967
01/01/1971
01/01/1975
01/01/1979
01/01/1983
01/01/1987
01/01/1991
01/01/1995
01/01/1999
01/01/2003
01/01/2007
01/01/2011
01/01/2015
01/01/2019
01/01/2023


Baseflow Separation for G8170085 using BFI+ technique
Local minimum: 1963 - 2024
Stream flow
Local minimum
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
01/01/1963
01/01/1967
01/01/1971
01/01/1975
01/01/1979
01/01/1983
01/01/1987
01/01/1991
01/01/1995
01/01/1999
01/01/2003
01/01/2007
01/01/2011
01/01/2015
01/01/2019
01/01/2023

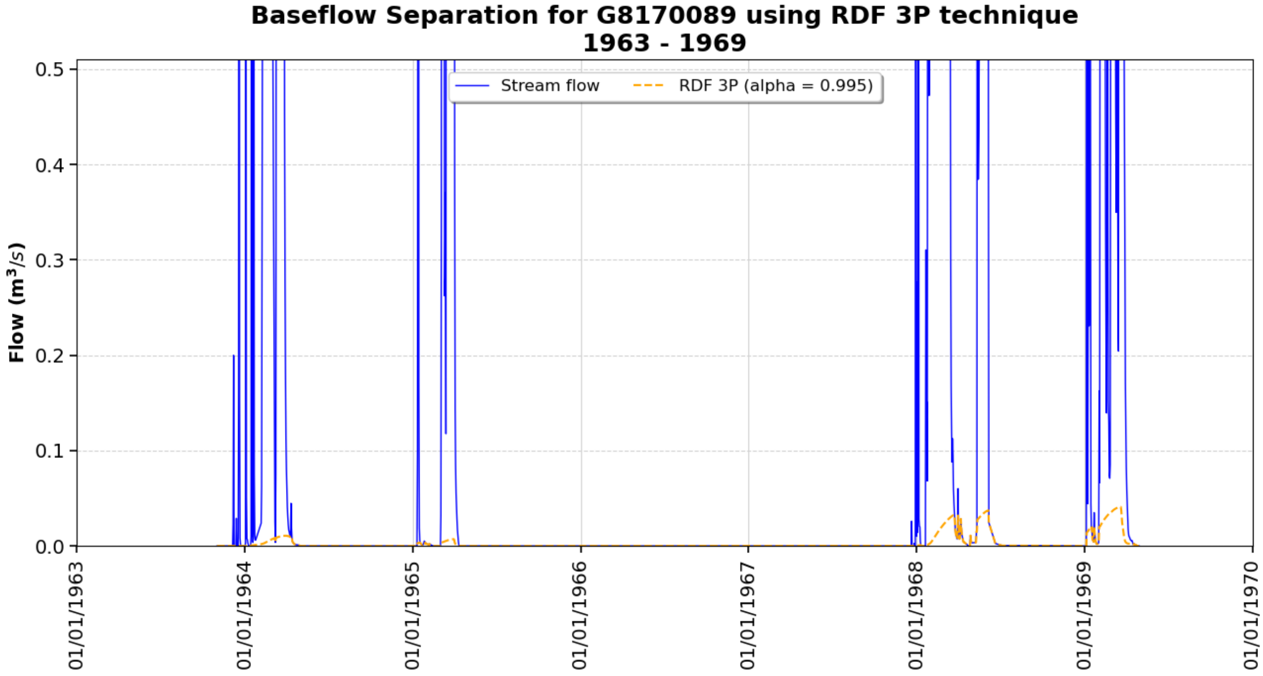

Baseflow Separation for G8170085 using BFI+ technique
EWMA: 1963 - 2024
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0.0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
01/01/1963
01/01/1967
01/01/1971
01/01/1975
01/01/1979
01/01/1983
01/01/1987
01/01/1991
01/01/1995
01/01/1999
01/01/2003
01/01/2007
01/01/2011
01/01/2015
01/01/2019
01/01/2023

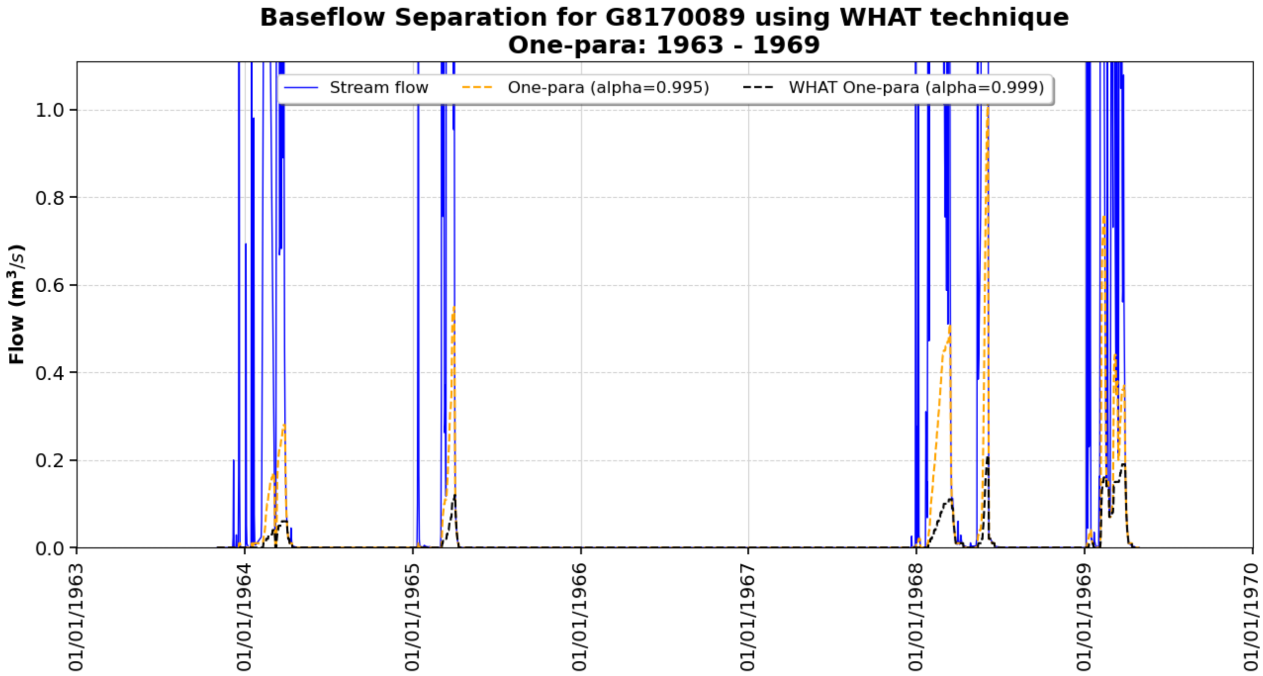

Baseflow Separation for G8170085 using BFI+ technique
BFLOW: 1963 - 2024
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m^3/s)
0.0
0.2
0.4
0.6
0.8
1.0
01/01/1963
01/01/1967
01/01/1971
01/01/1975
01/01/1979
01/01/1983
01/01/1987
01/01/1991
01/01/1995
01/01/1999
01/01/2003
01/01/2007
01/01/2011
01/01/2015
01/01/2019
01/01/2023

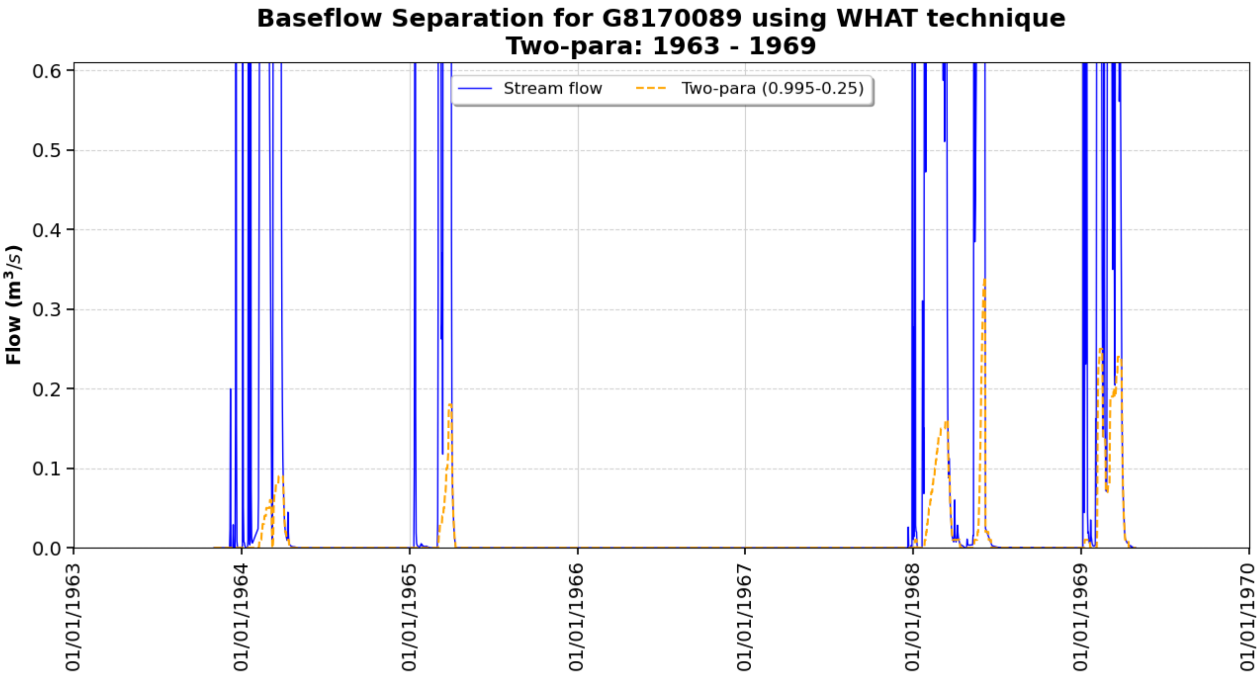

Baseflow Separation for G8170085 using BFI+ technique
Chapman: 1963 - 2024
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m^3/s)
0.0
0.2
0.4
0.6
0.8
1.0
01/01/1963
01/01/1967
01/01/1971
01/01/1975
01/01/1979
01/01/1983
01/01/1987
01/01/1991
01/01/1995
01/01/1999
01/01/2003
01/01/2007
01/01/2011
01/01/2015
01/01/2019
01/01/2023

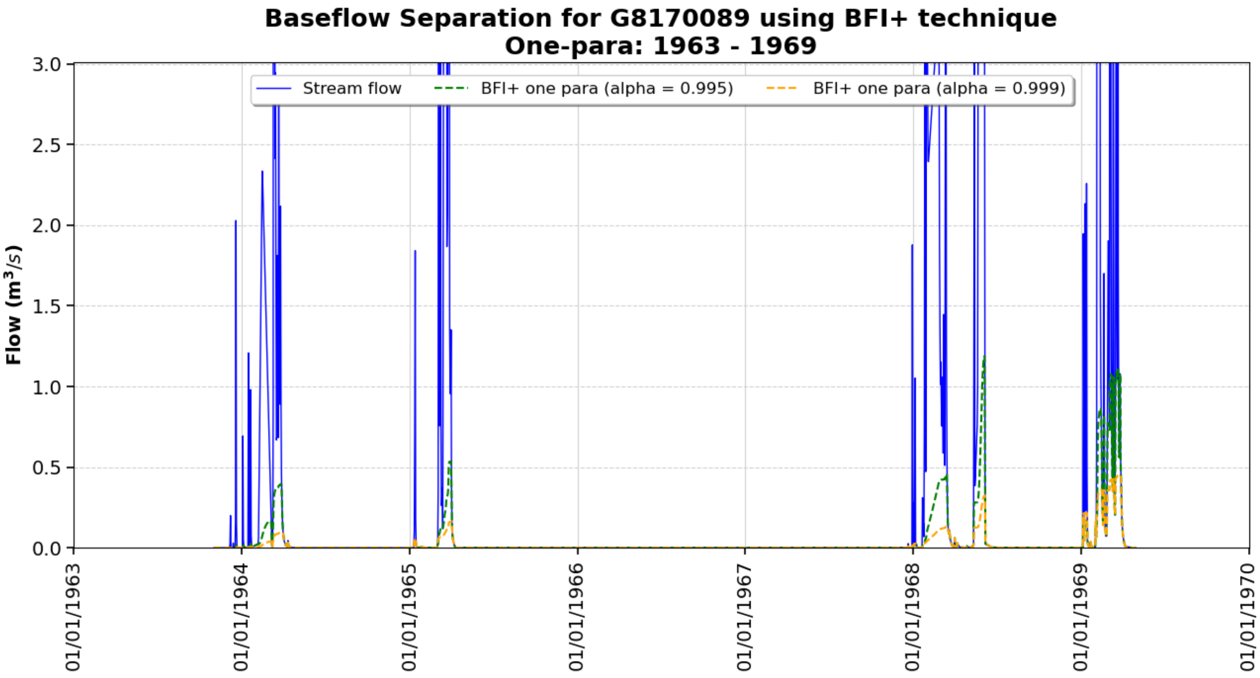

Baseflow Separation for G8170085 using BFI+ technique
Eckhardt: 1963 - 2024
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m^3/s)
0.0
0.1
0.2
0.3
0.4
0.5
01/01/1963
01/01/1967
01/01/1971
01/01/1975
01/01/1979
01/01/1983
01/01/1987
01/01/1991
01/01/1995
01/01/1999
01/01/2003
01/01/2007
01/01/2011
01/01/2015
01/01/2019
01/01/2023

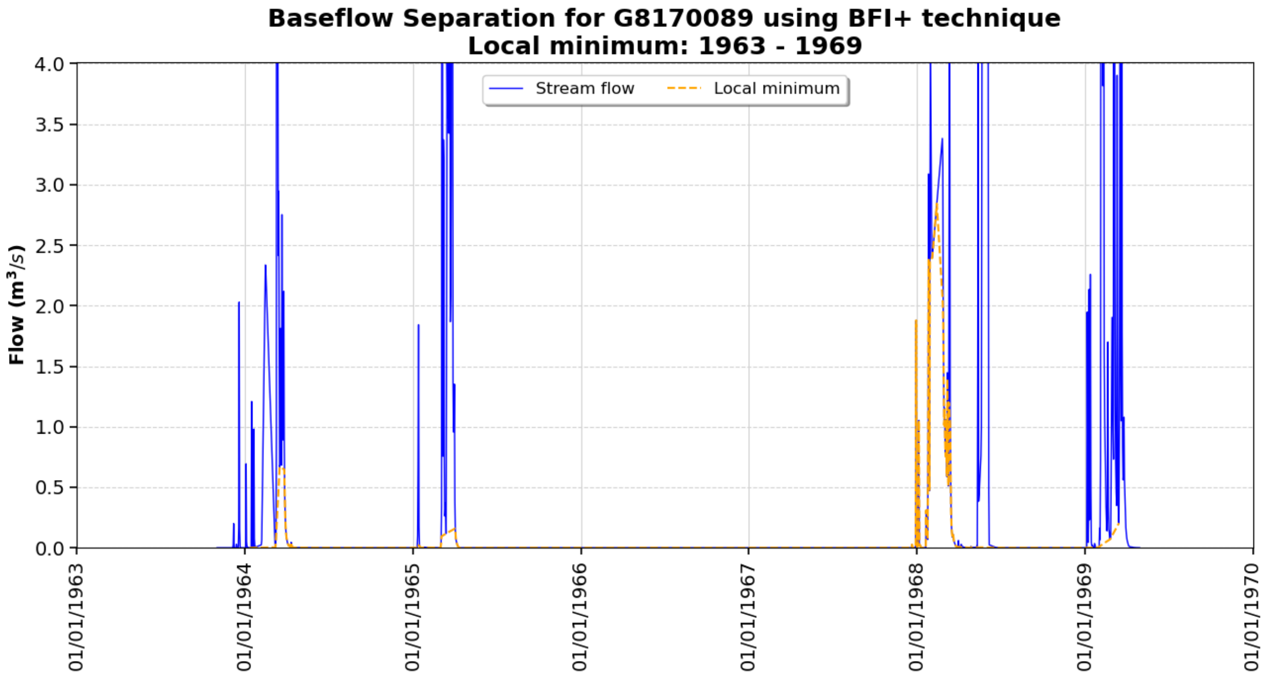
Appendix K: Baseflow separation hydrographs for G8170089

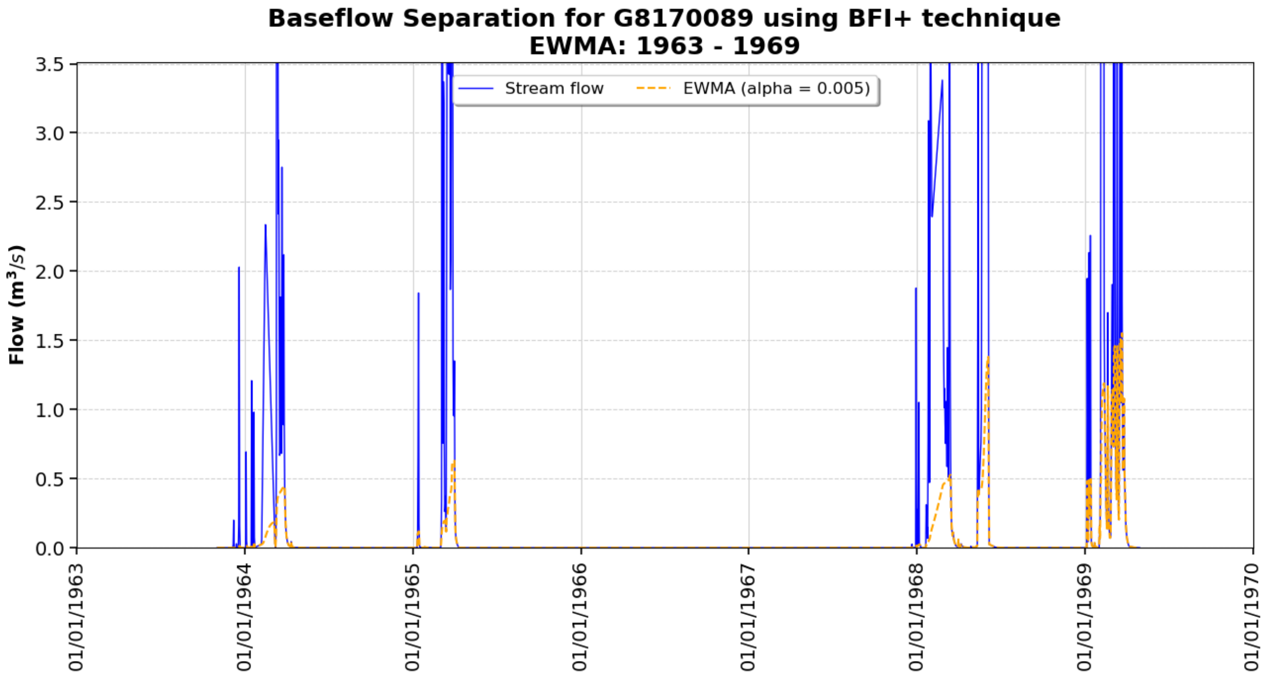


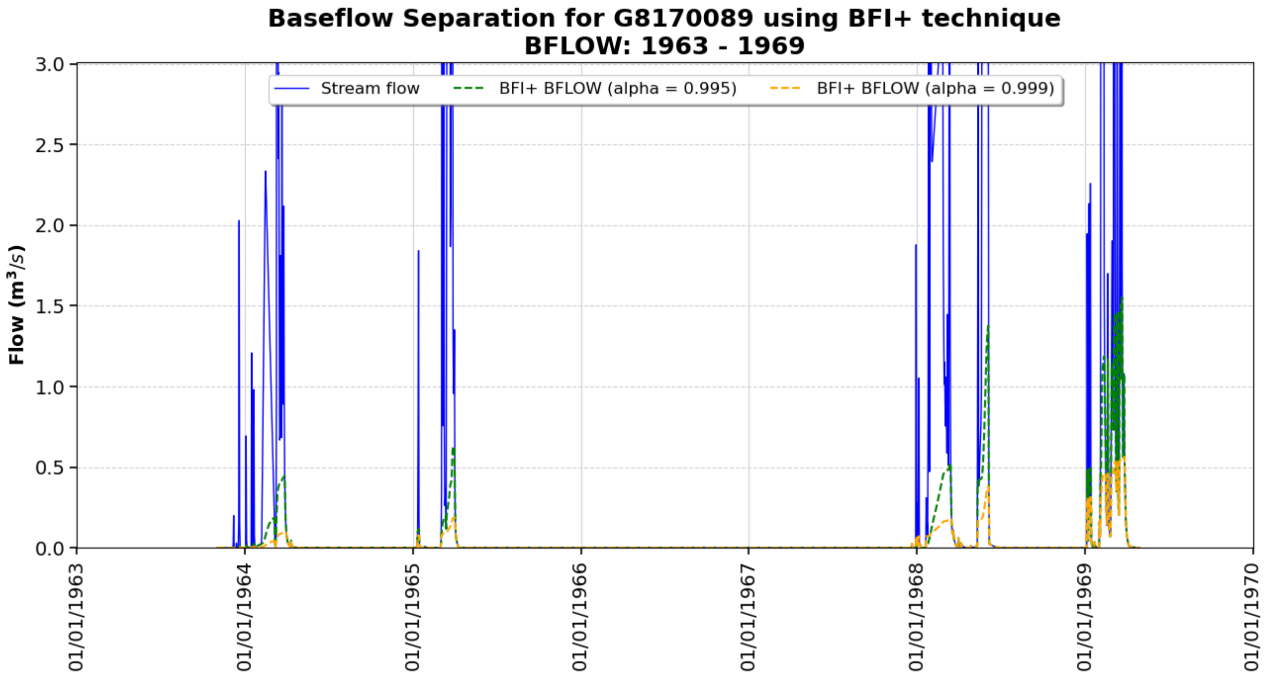


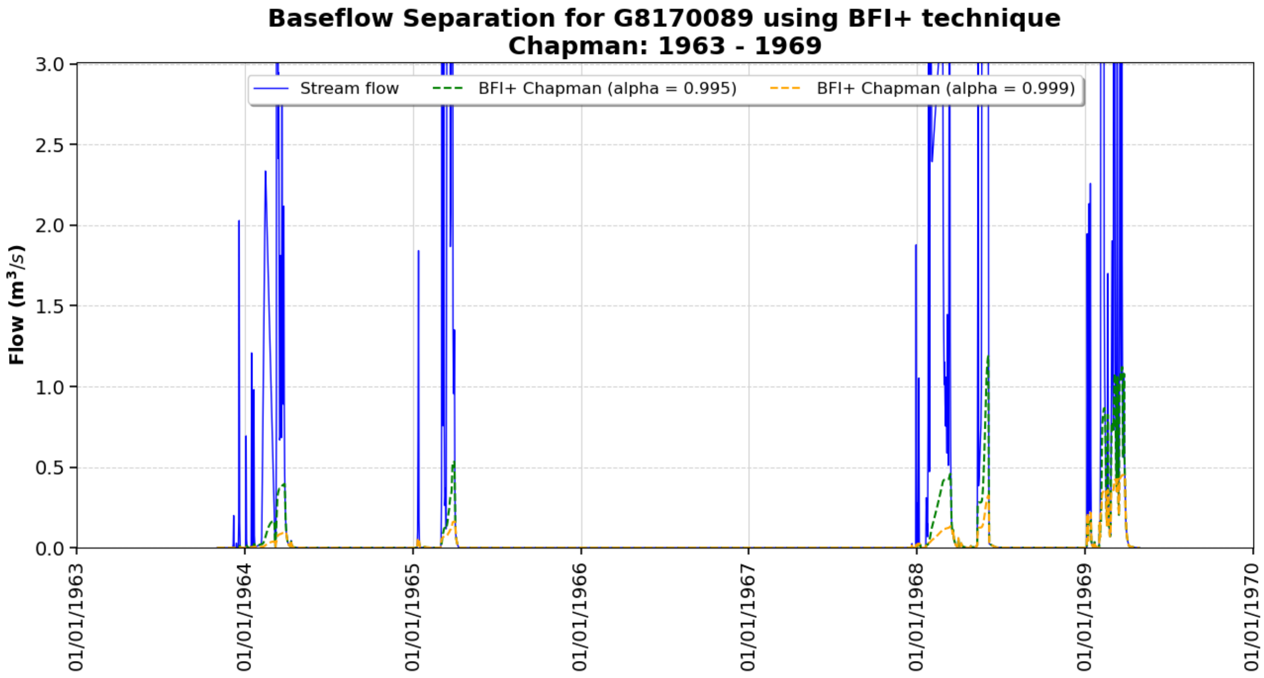

Baseflow Separation for G8170089 using WHAT technique
Two-para: 1963 - 1969
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0.0
0.1
0.2
0.3
0.4
0.5
0.6
01/01/1963
01/01/1964
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970

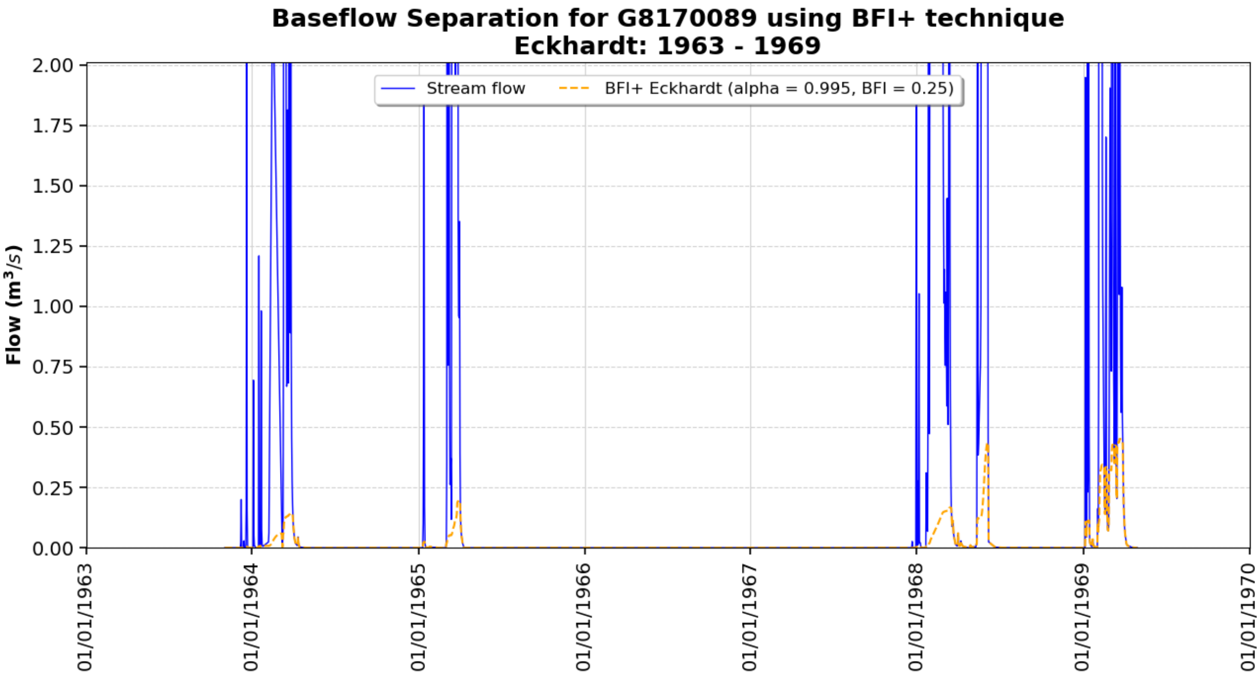

Baseflow Separation for G8170089 using BFI+ technique
One-para: 1963 - 1969
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
0.0
0.5
1.0
1.5
2.0
2.5
3.0
01/01/1963
01/01/1964
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970


Baseflow Separation for G8170089 using BFI+ technique
Local minimum: 1963 - 1969
Stream flow
Local minimum
Flow (m³/s)
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/1963
01/01/1964
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970

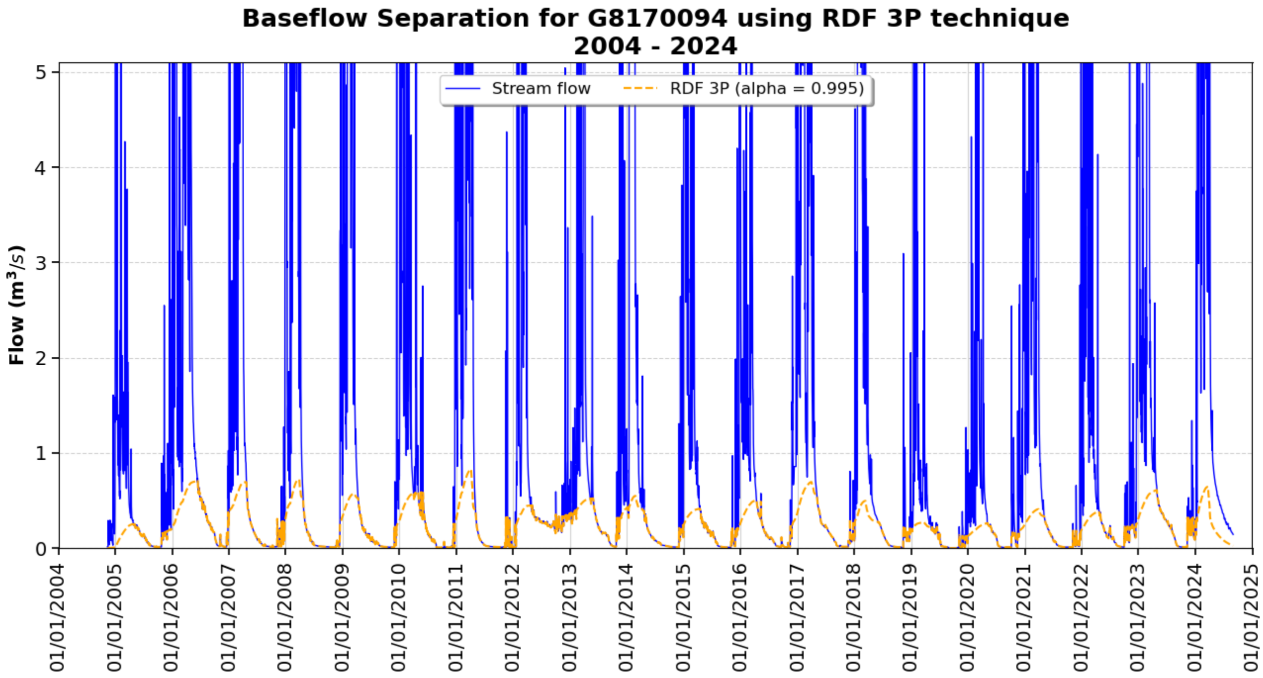

Baseflow Separation for G8170089 using BFI+ technique
EWMA: 1963 - 1969
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/1963
01/01/1964
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970

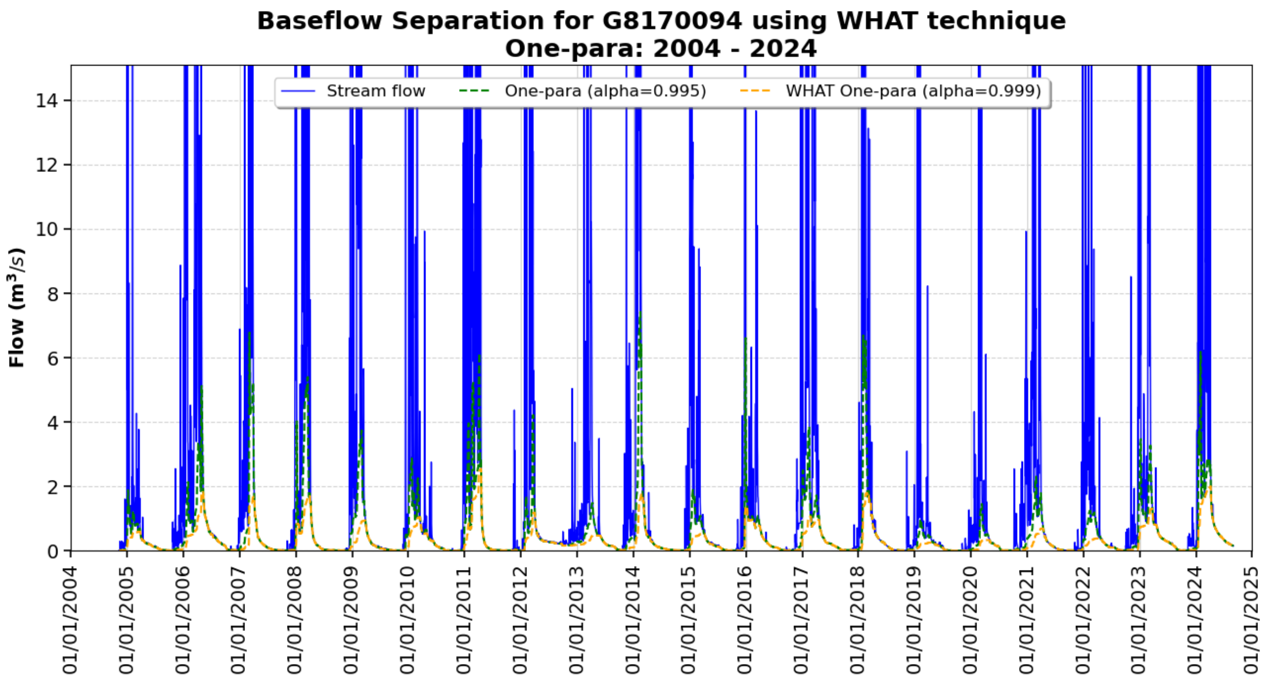

Baseflow Separation for G8170089 using BFI+ technique
BFLOW: 1963 - 1969
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/1963
01/01/1964
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970

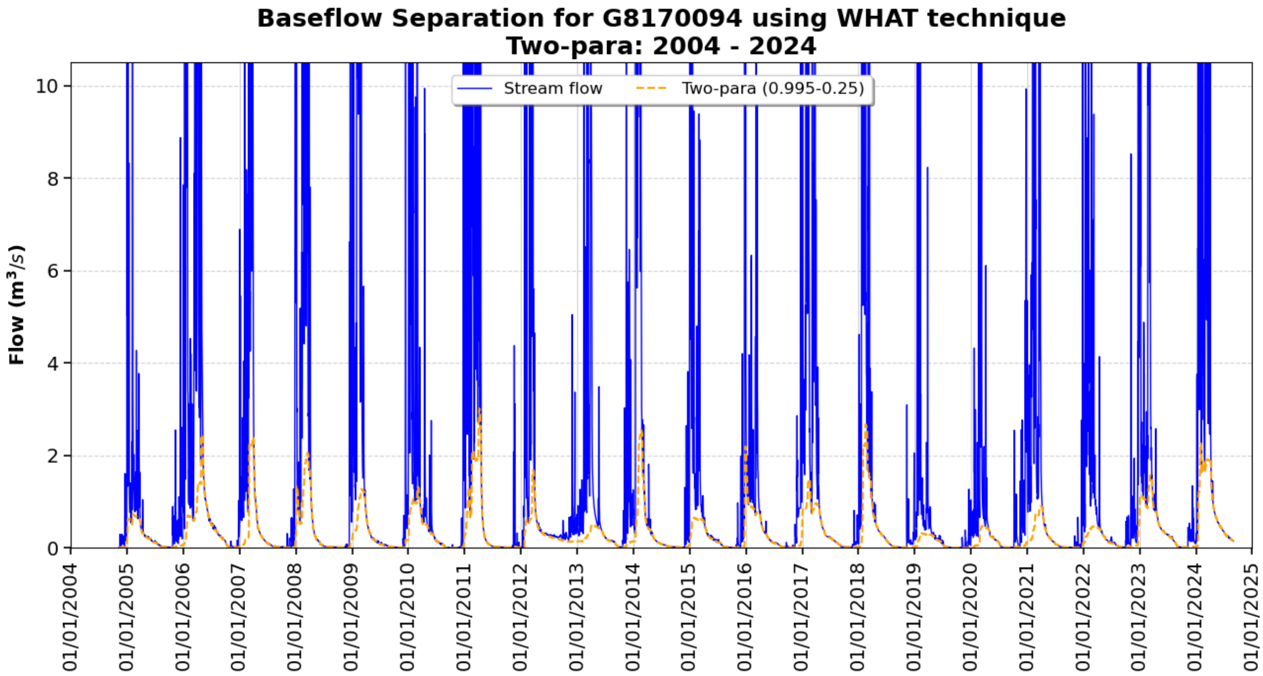

Baseflow Separation for G8170089 using BFI+ technique
Chapman: 1963 - 1969
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
01/01/1963
01/01/1964
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970

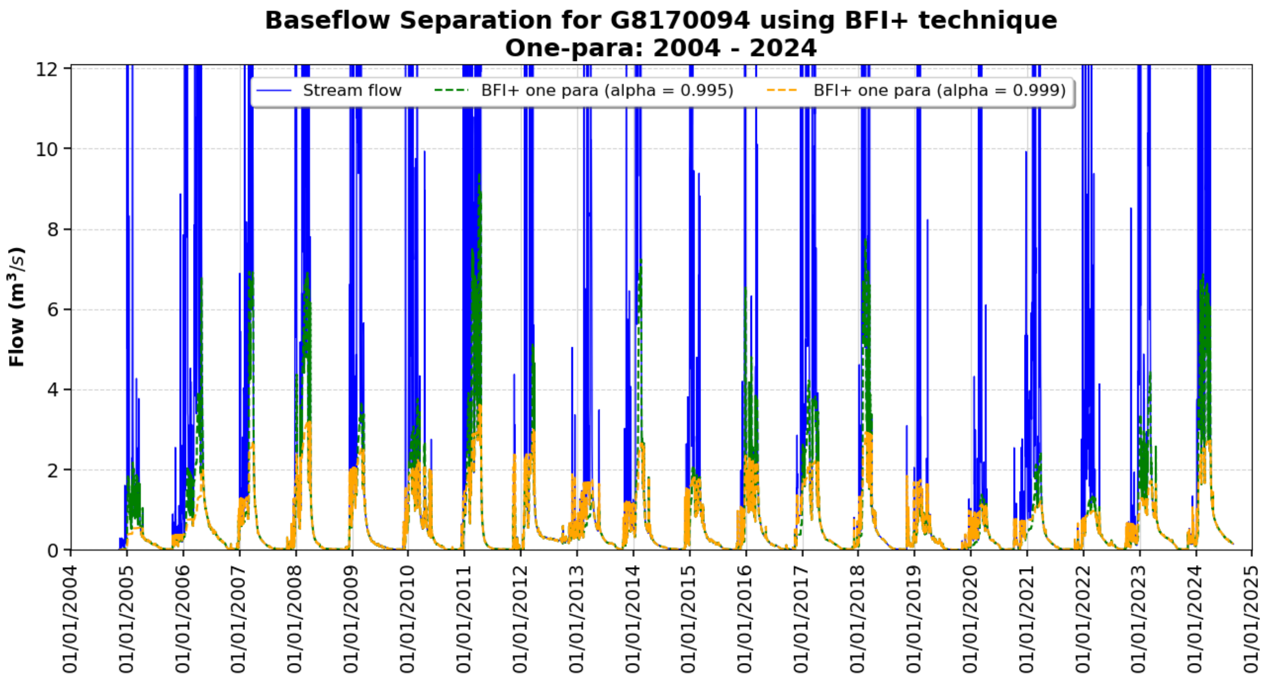

Baseflow Separation for G8170089 using BFI+ technique
Eckhardt: 1963 - 1969
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
01/01/1963
01/01/1964
01/01/1965
01/01/1966
01/01/1967
01/01/1968
01/01/1969
01/01/1970

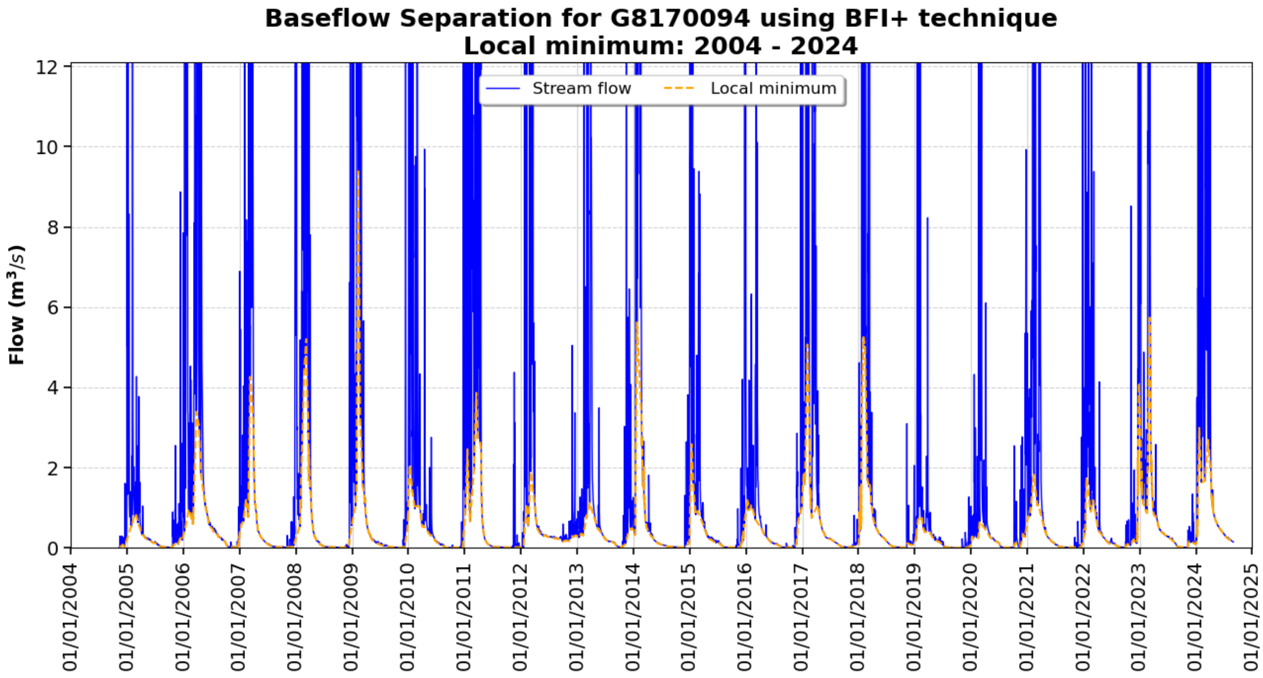
Appendix L: Baseflow separation hydrographs for G8170094

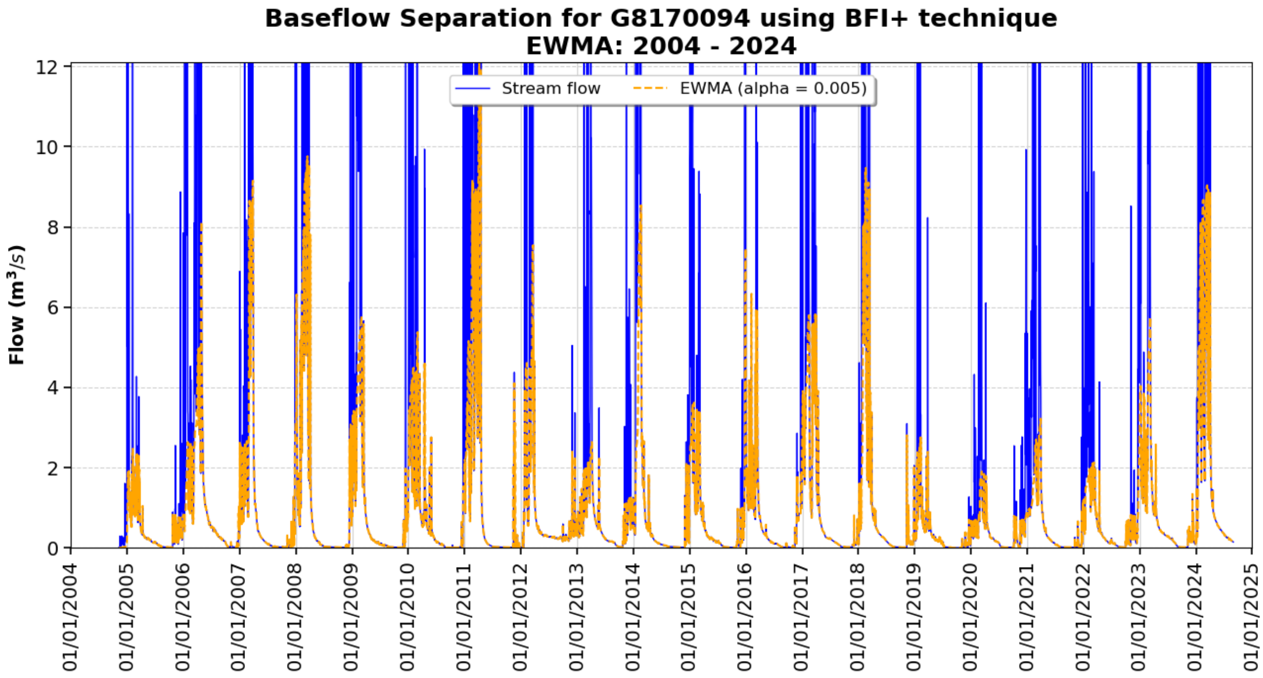


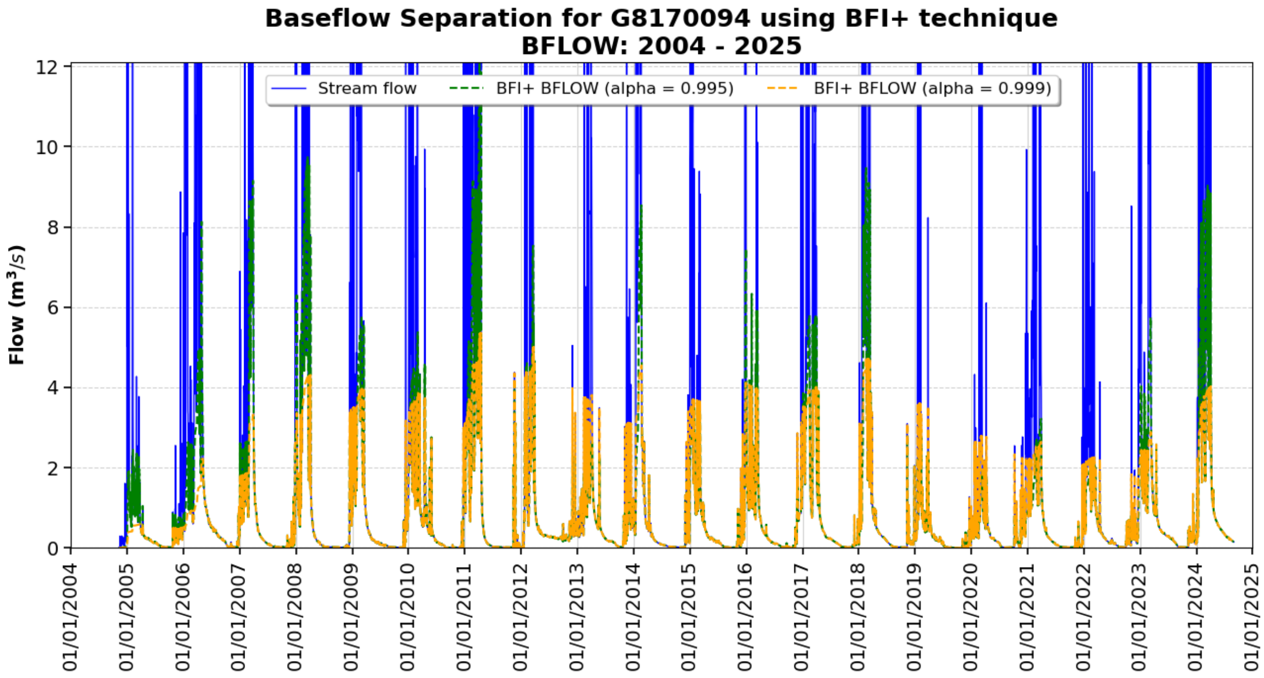


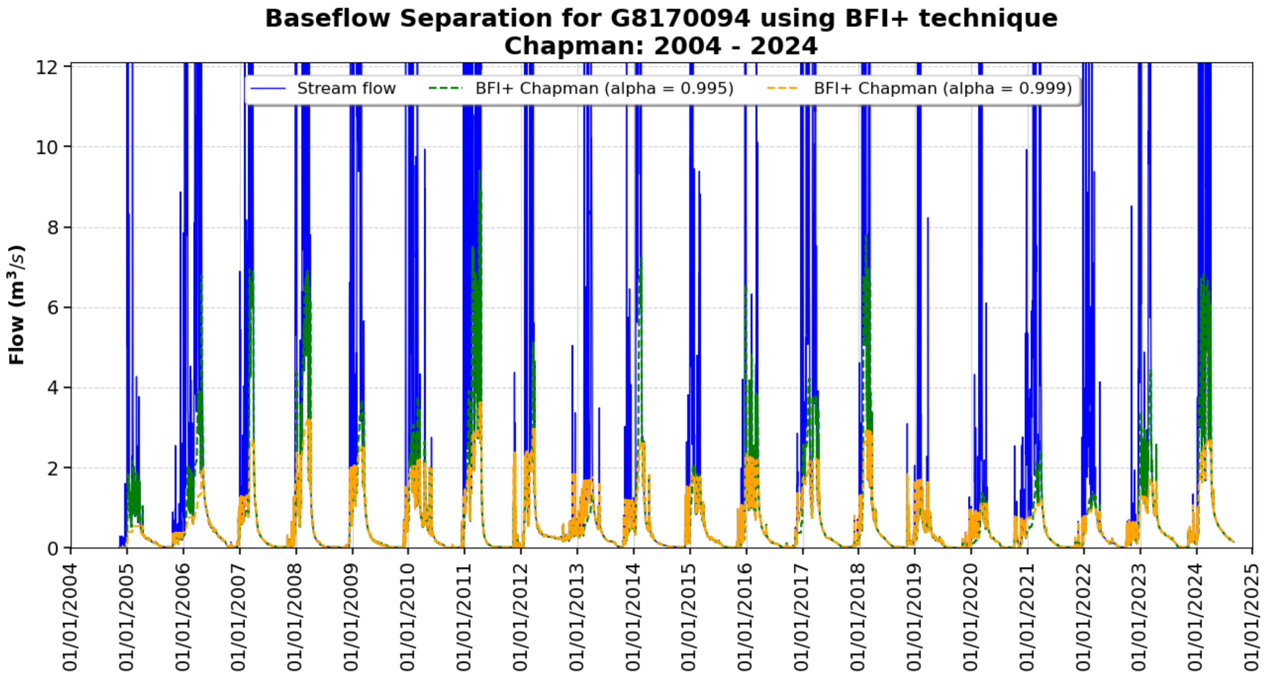

Baseflow Separation for G8170094 using WHAT technique
Two-para: 2004 - 2024
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0
2
4
6
8
10
01/01/2004
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

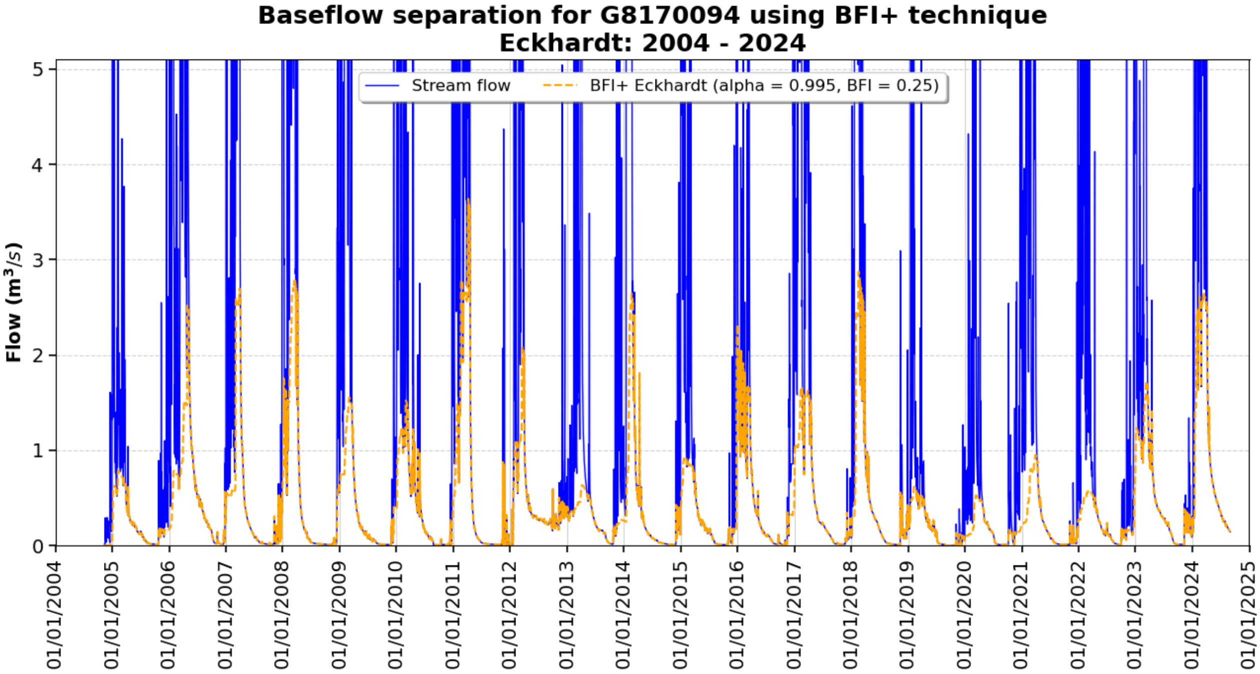

Baseflow Separation for G8170094 using BFI+ technique
One-para: 2004 - 2024
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
0
2
4
6
8
10
12
01/01/2004
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025


Baseflow Separation for G8170094 using BFI+ technique
Local minimum: 2004 - 2024
Stream flow
Local minimum
Flow (m³/s)

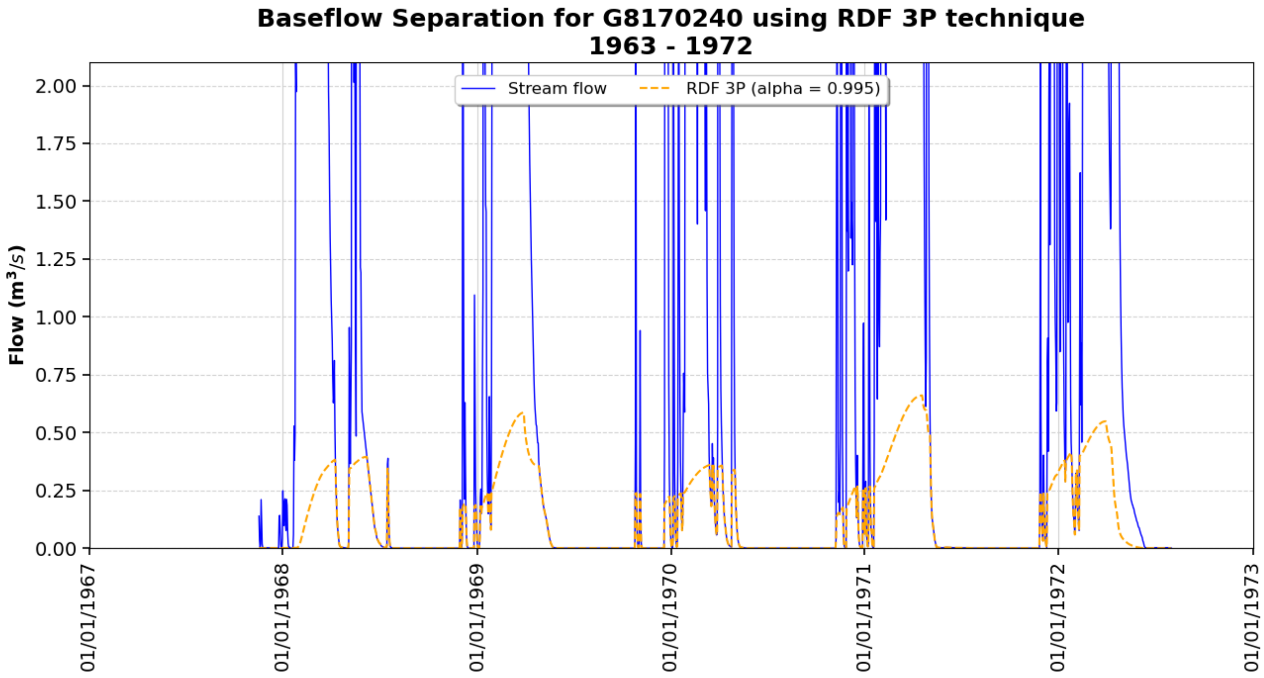

Baseflow Separation for G8170094 using BFI+ technique
EWMA: 2004 - 2024
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)

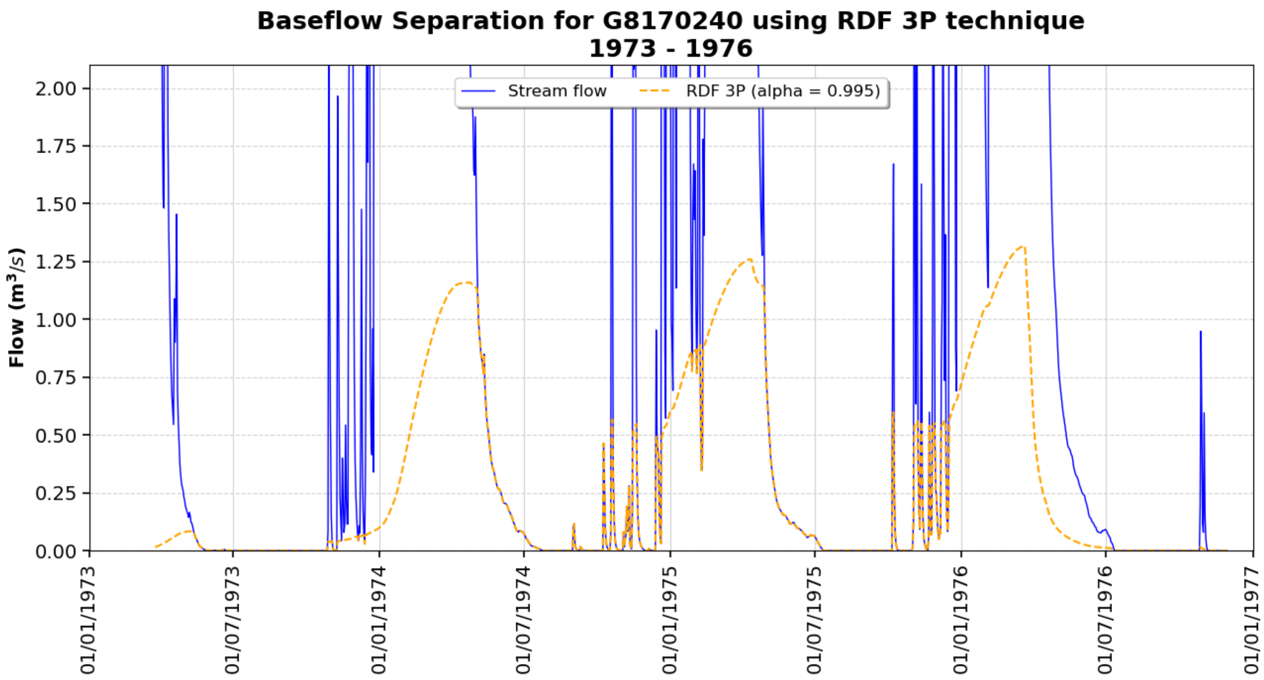

Baseflow Separation for G8170094 using BFI+ technique
BFLOW: 2004 - 2025
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0
2
4
6
8
10
12
01/01/2004
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

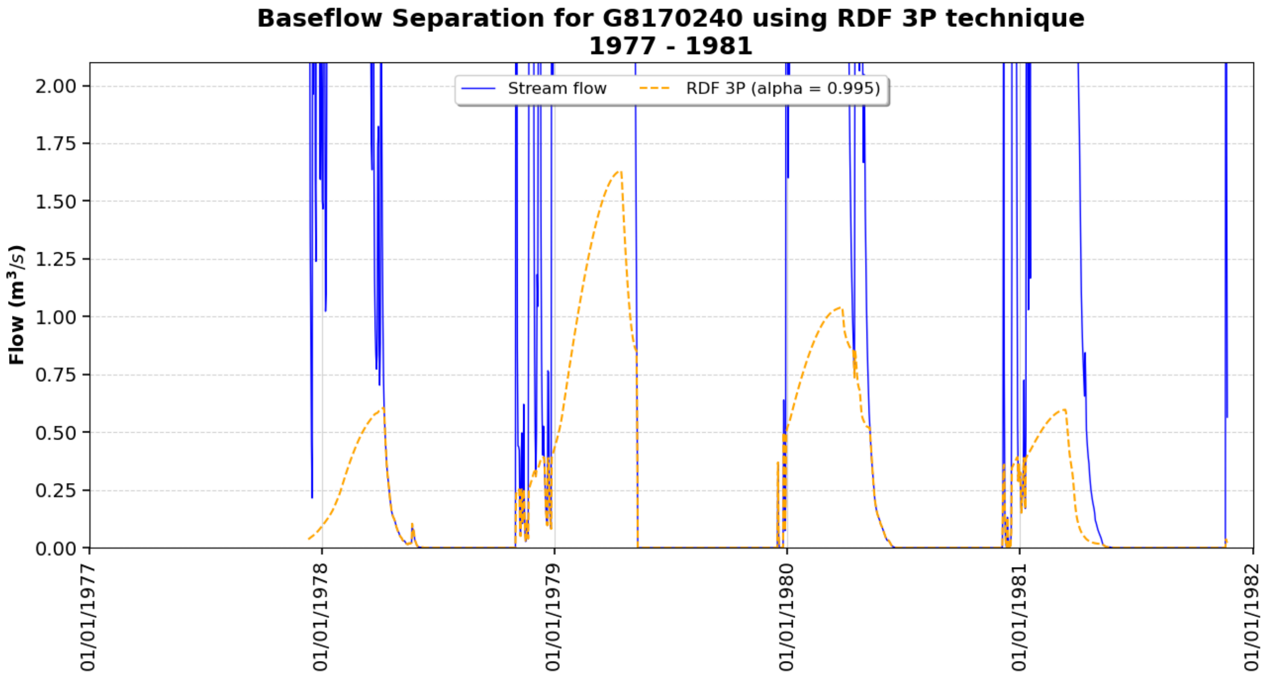

Baseflow Separation for G8170094 using BFI+ technique
Chapman: 2004 - 2024
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
0
2
4
6
8
10
12
01/01/2004
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

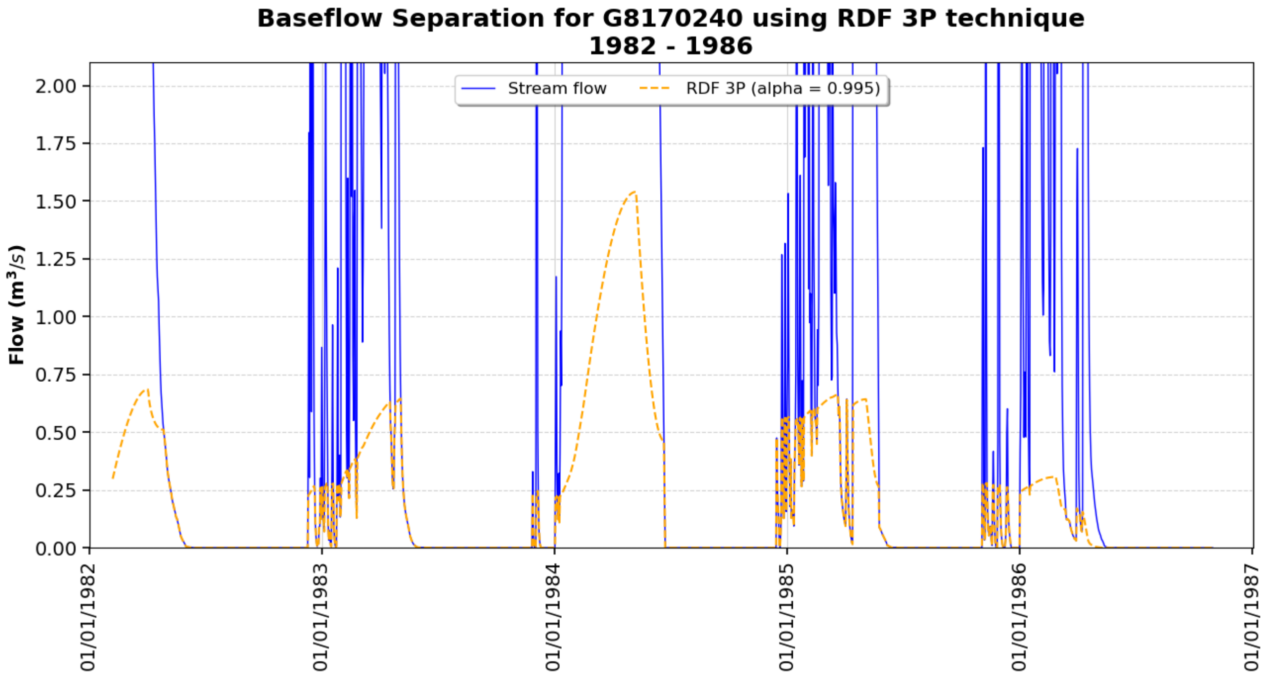

Baseflow separation for G8170094 using BFI+ technique
Eckhardt: 2004 - 2024
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0
1
2
3
4
5
01/01/2004
01/01/2005
01/01/2006
01/01/2007
01/01/2008
01/01/2009
01/01/2010
01/01/2011
01/01/2012
01/01/2013
01/01/2014
01/01/2015
01/01/2016
01/01/2017
01/01/2018
01/01/2019
01/01/2020
01/01/2021
01/01/2022
01/01/2023
01/01/2024
01/01/2025

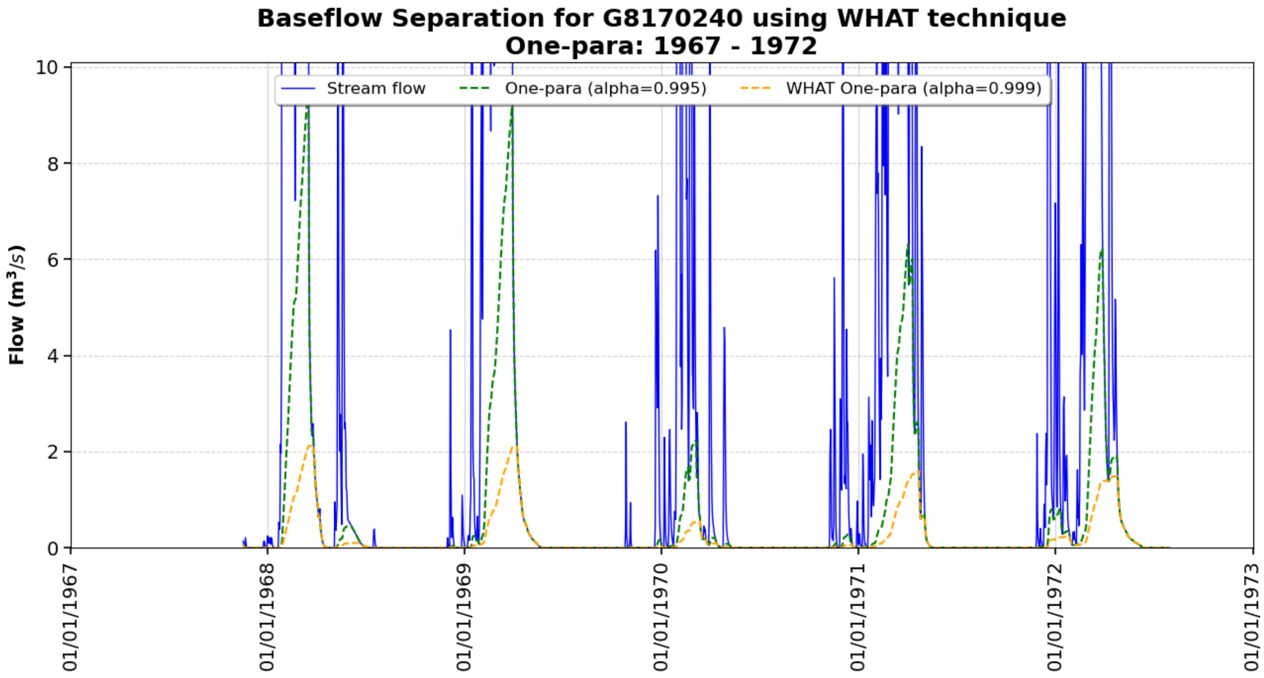
Appendix M: Baseflow separation hydrographs for G8170240

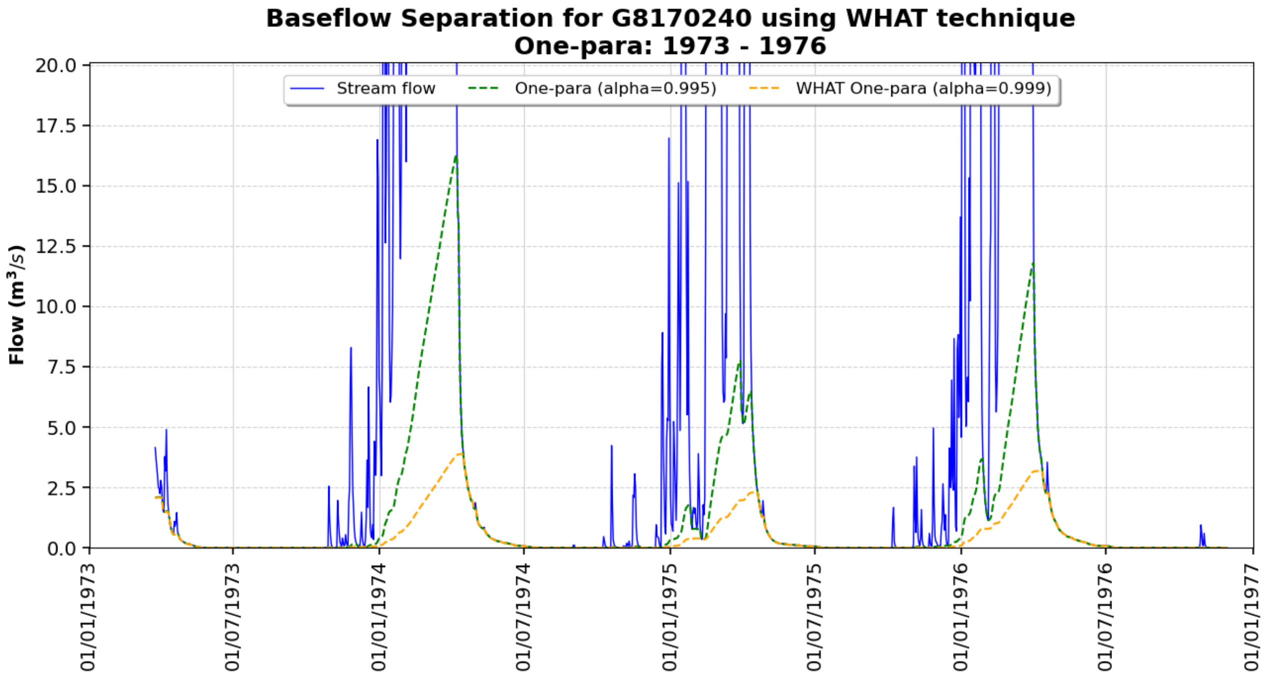


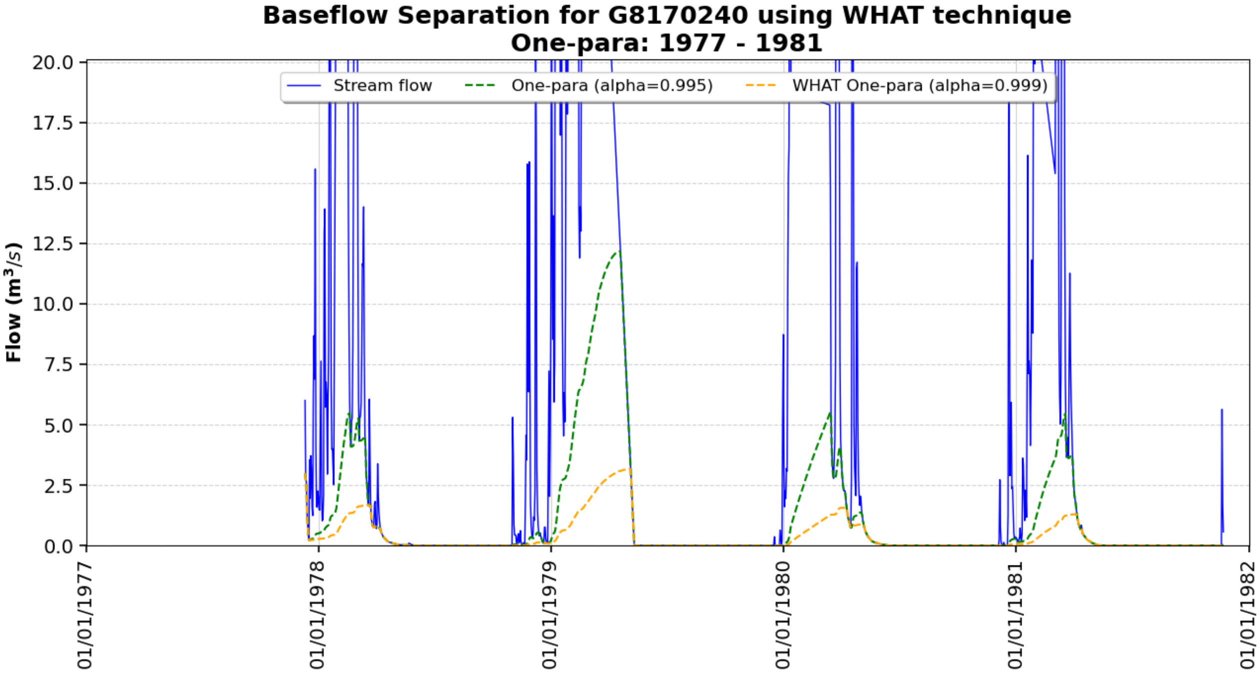


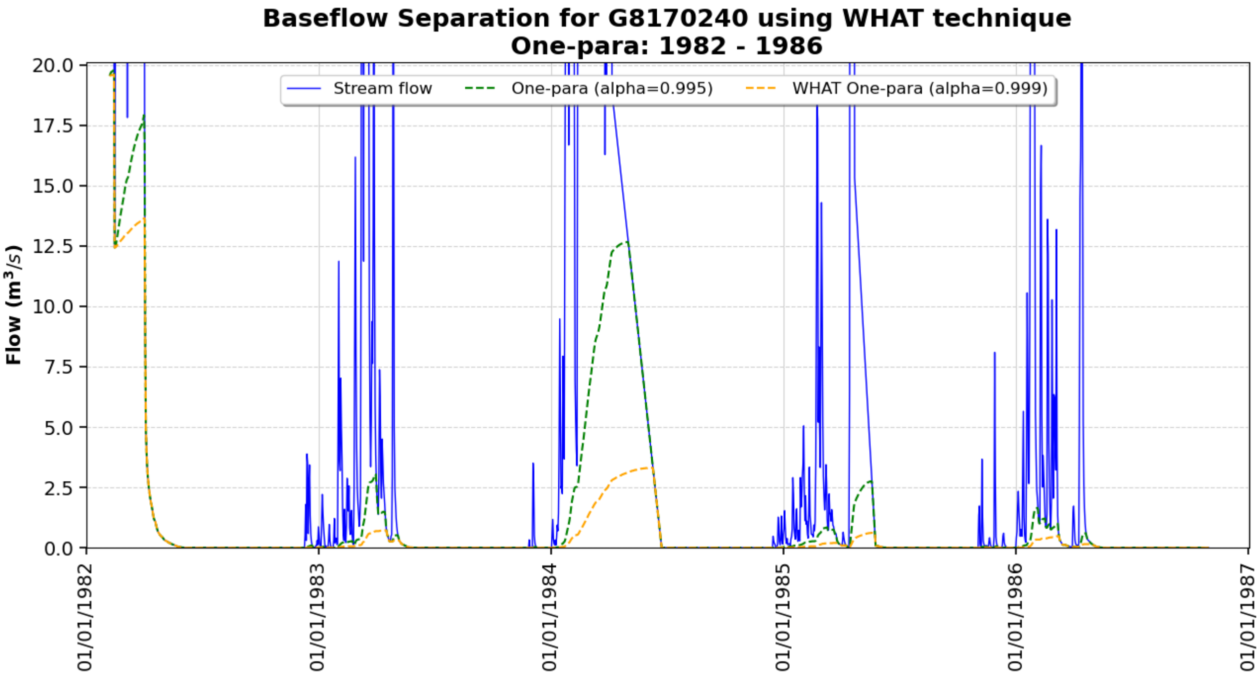

Baseflow Separation for G8170240 using RDF 3P technique
1977 - 1981
Stream flow
RDF 3P (alpha = 0.995)
Flow (m³/s)
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
01/01/1977
01/01/1978
01/01/1979
01/01/1980
01/01/1981
01/01/1982

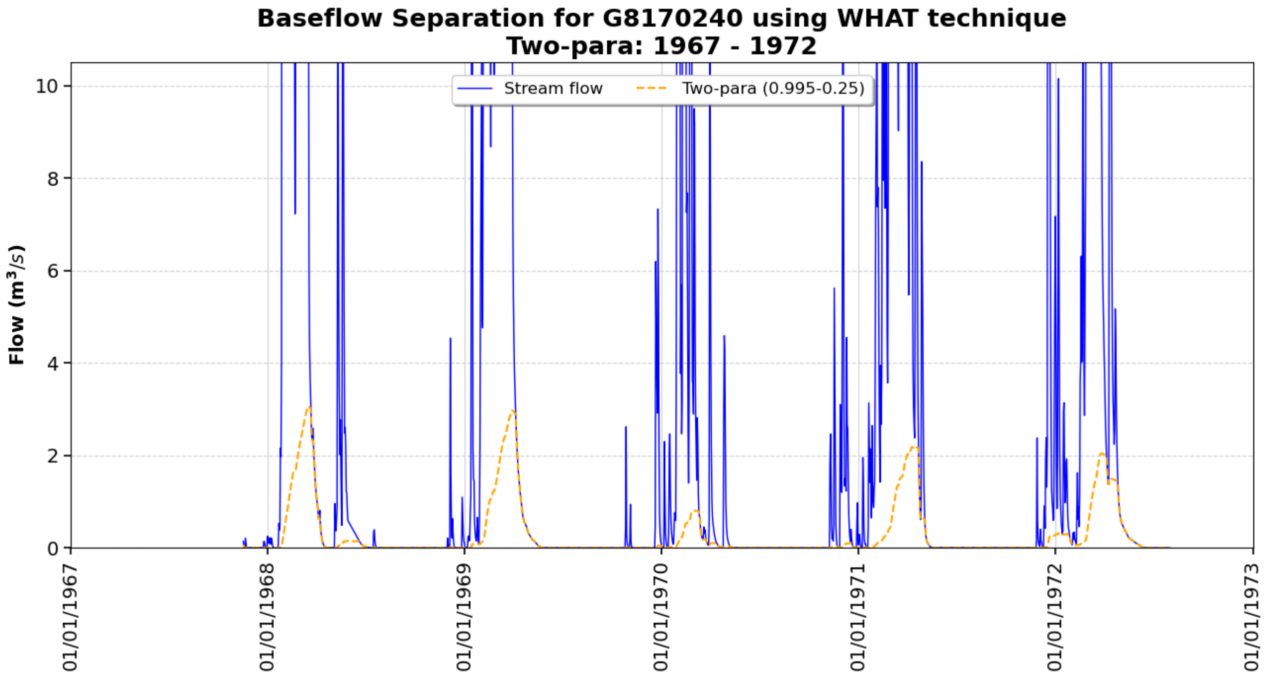

Baseflow Separation for G8170240 using RDF 3P technique
1982 - 1986
Stream flow
RDF 3P (alpha = 0.995)
Flow (m³/s)
2.00
1.75
1.50
1.25
1.00
0.75
0.50
0.25
0.00
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987

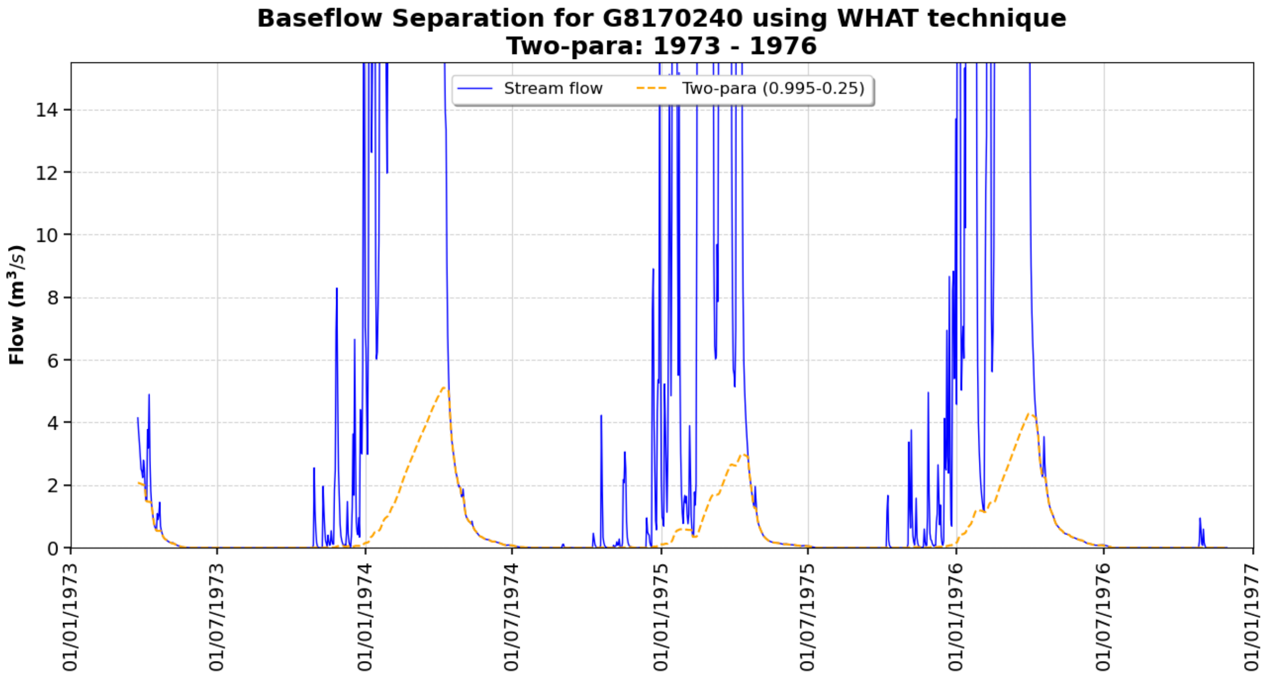

Baseflow Separation for G8170240 using WHAT technique
One-para: 1967 - 1972
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.999)
Flow (m³/s)
0
2
4
6
8
10
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972
01/01/1973

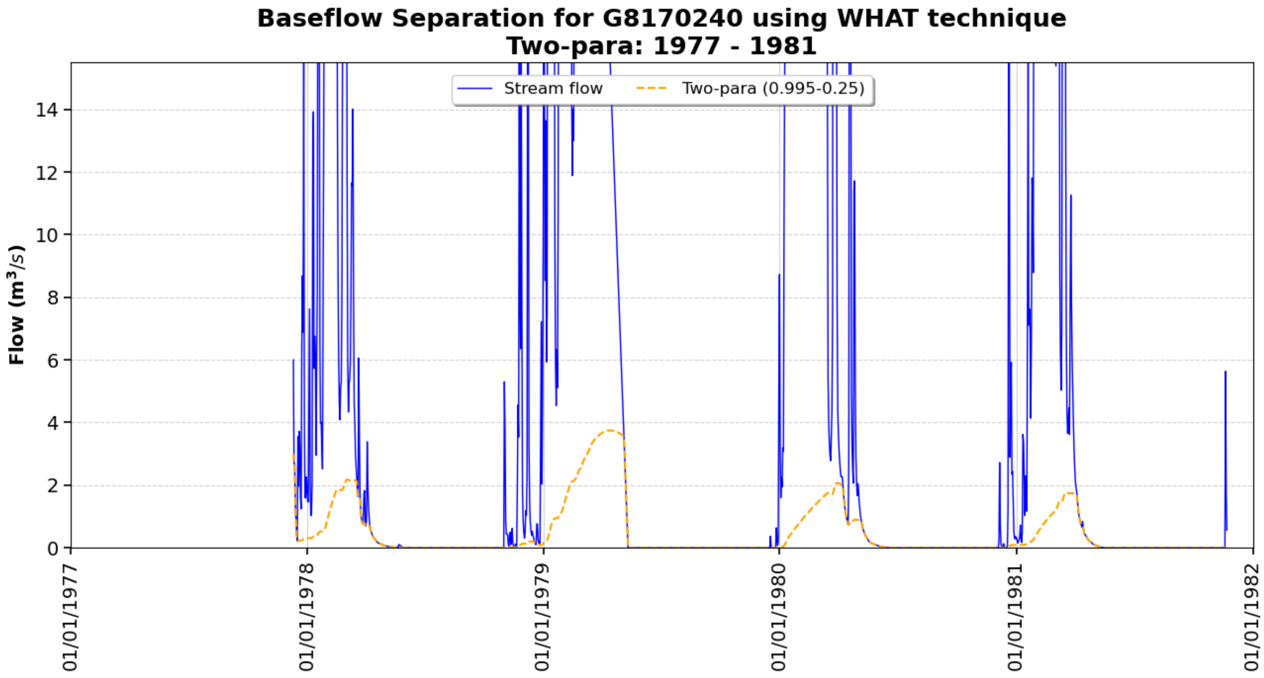

Baseflow Separation for G8170240 using WHAT technique
One-para: 1973 - 1976
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.999)
Flow (m³/s)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
01/01/1973
01/07/1973
01/01/1974
01/07/1974
01/01/1975
01/07/1975
01/01/1976
01/07/1976
01/01/1977

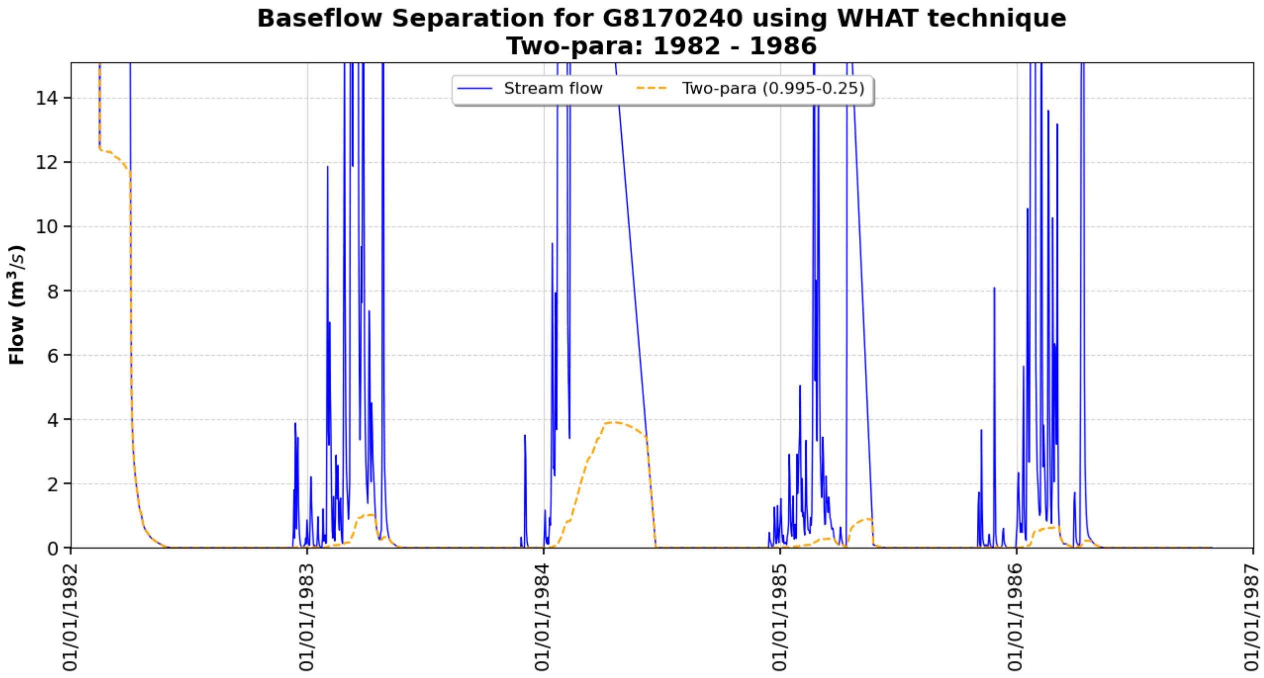

Baseflow Separation for G8170240 using WHAT technique
One-para: 1977 - 1981
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.999)
Flow (m³/s)
01/01/1977
01/01/1978
01/01/1979
01/01/1980
01/01/1981
01/01/1982

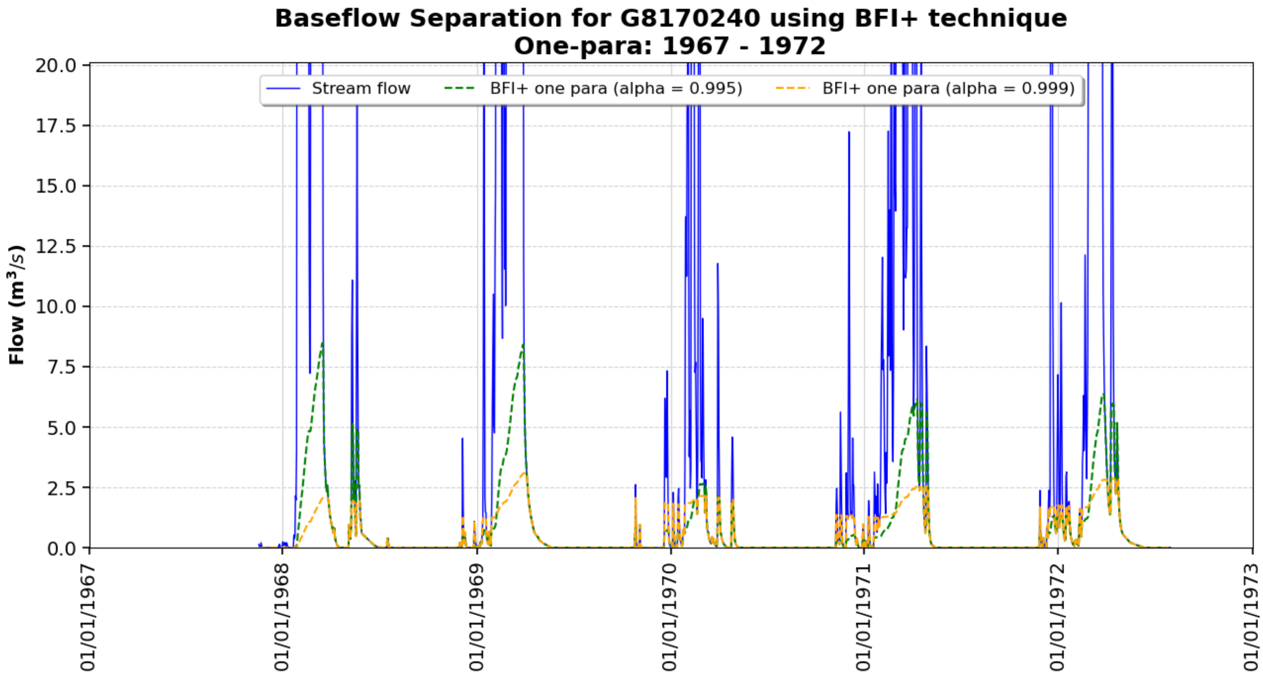

Baseflow Separation for G8170240 using WHAT technique
One-para: 1982 - 1986
Stream flow
One-para (alpha=0.995)
WHAT One-para (alpha=0.999)
Flow (m³/s)
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987

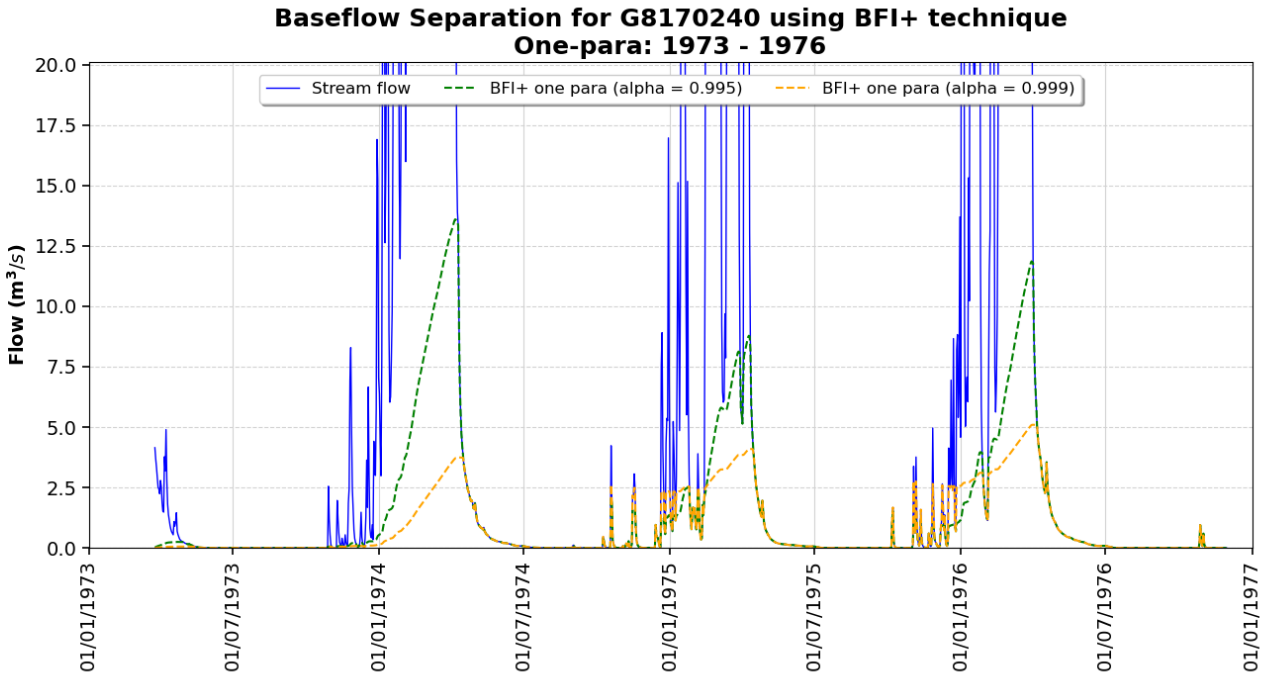

Baseflow Separation for G8170240 using WHAT technique
Two-para: 1967 - 1972
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0
2
4
6
8
10
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972
01/01/1973

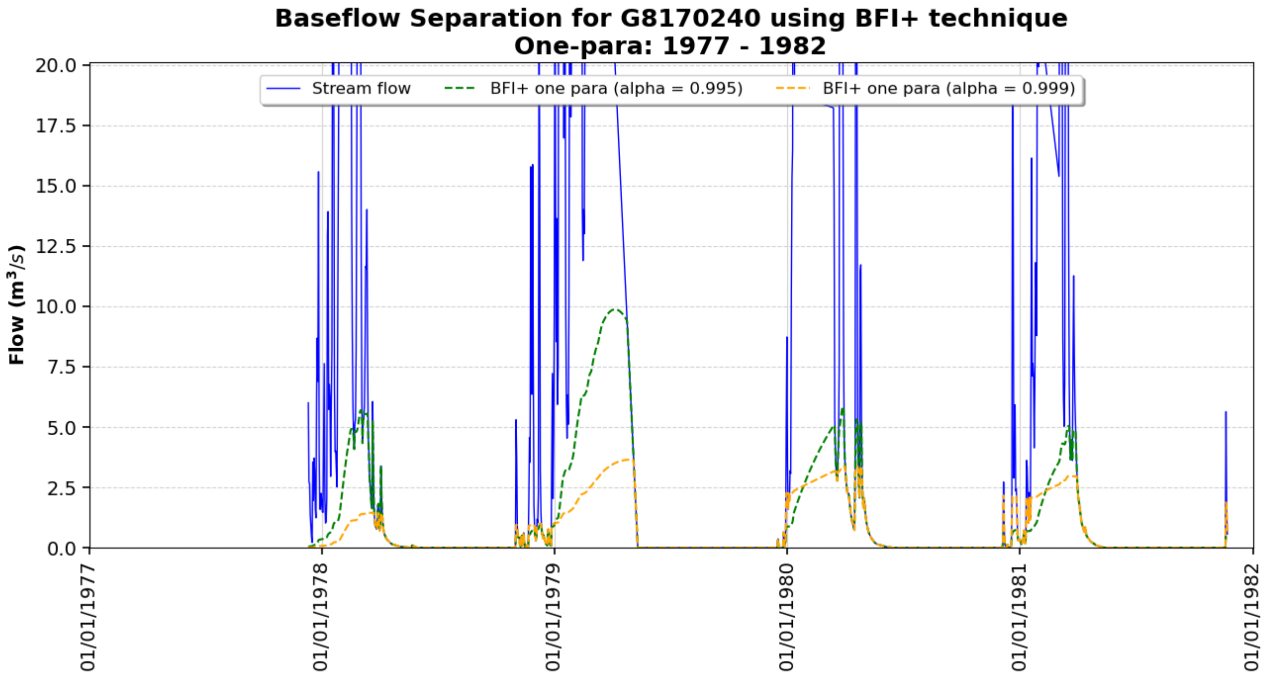

Baseflow Separation for G8170240 using WHAT technique
Two-para: 1973 - 1976
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0
2
4
6
8
10
12
14
01/01/1973
01/07/1973
01/01/1974
01/07/1974
01/01/1975
01/07/1975
01/01/1976
01/07/1976
01/01/1977

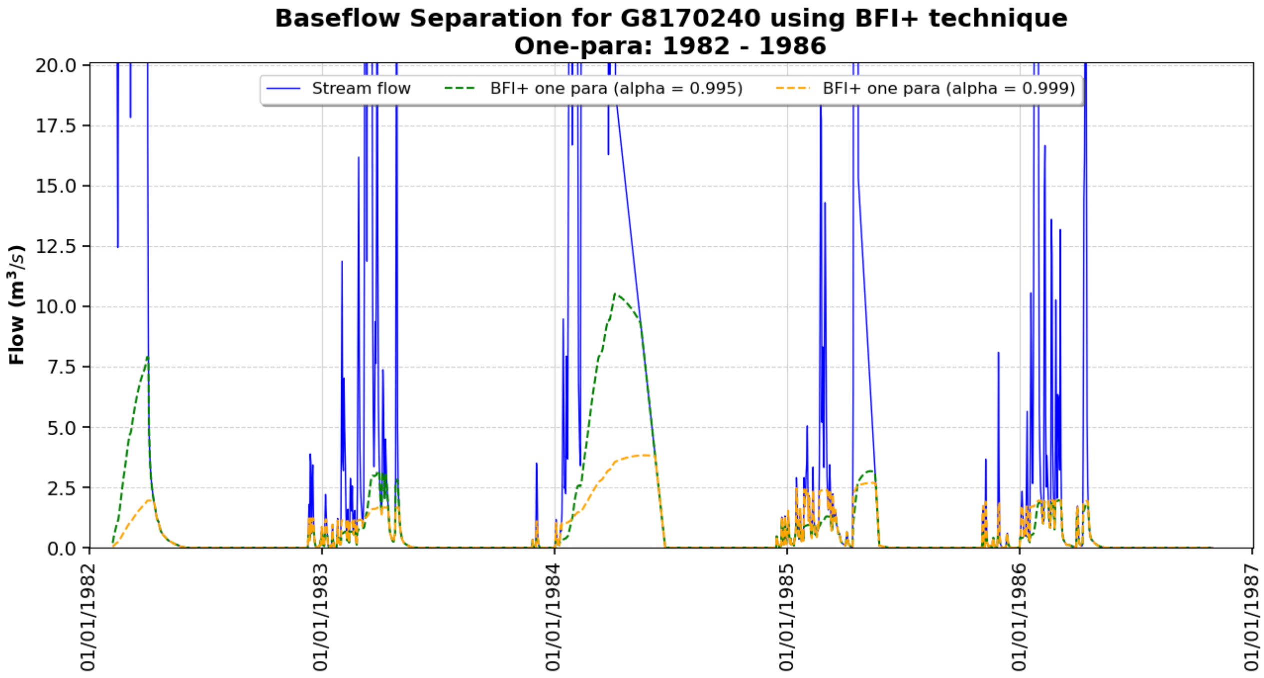

Baseflow Separation for G8170240 using WHAT technique
Two-para: 1977 - 1981
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0
2
4
6
8
10
12
14
01/01/1977
01/01/1978
01/01/1979
01/01/1980
01/01/1981
01/01/1982

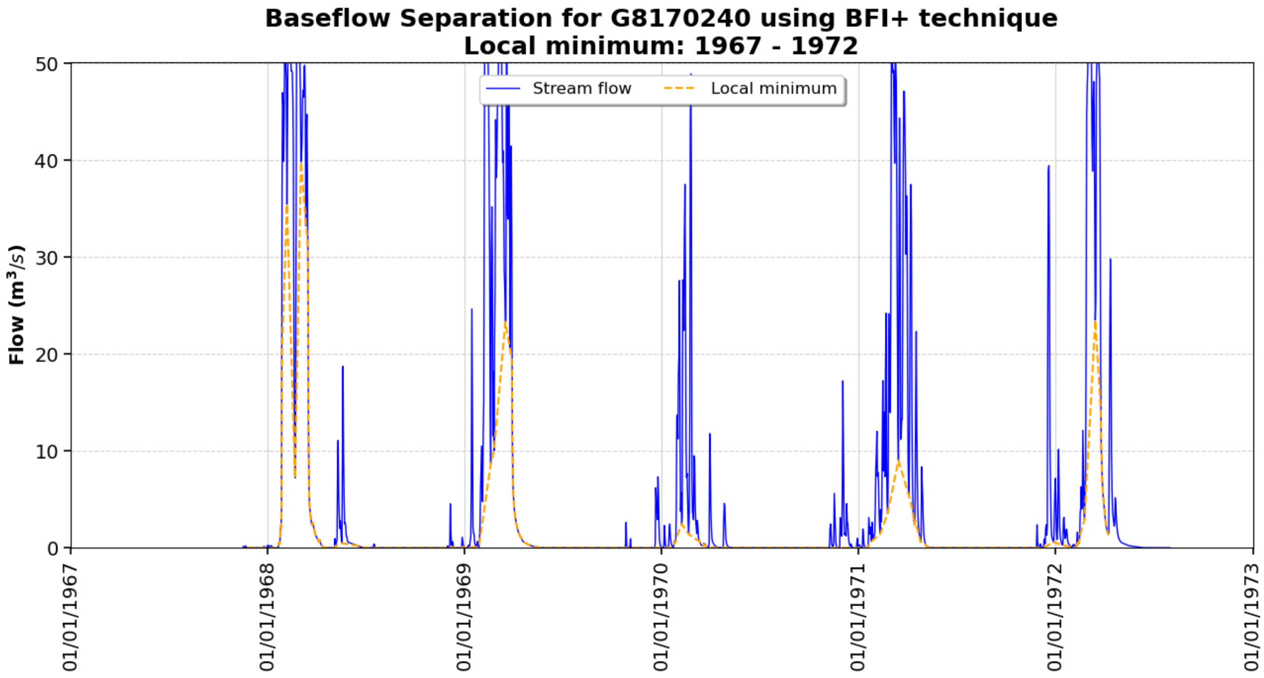

Baseflow Separation for G8170240 using WHAT technique
Two-para: 1982 - 1986
Stream flow
Two-para (0.995-0.25)
Flow (m³/s)
0
2
4
6
8
10
12
14
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987

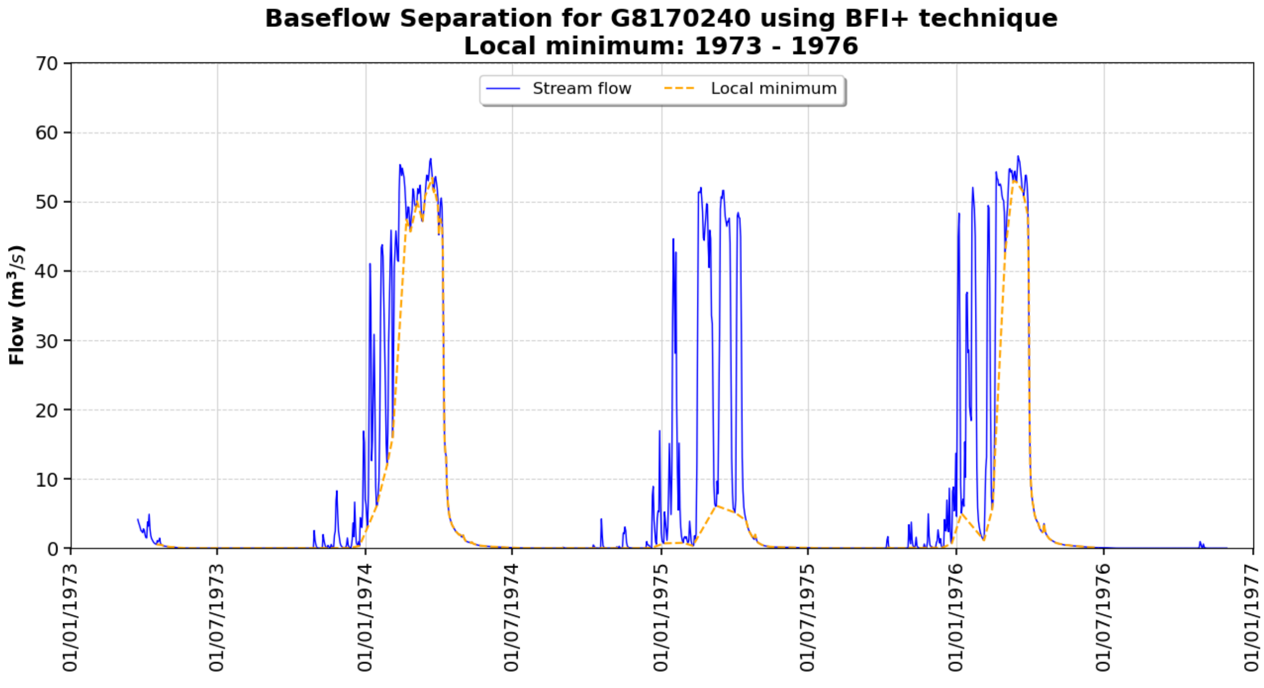

Baseflow Separation for G8170240 using BFI+ technique
One-para: 1967 - 1972
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972
01/01/1973

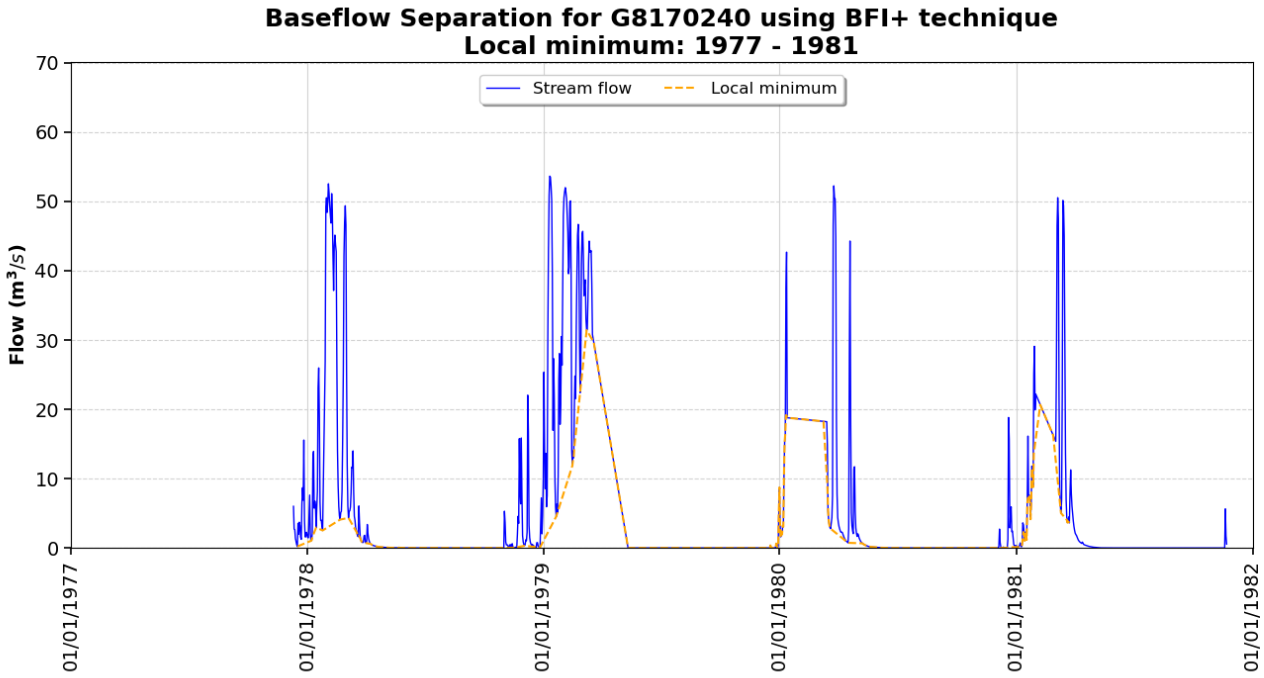

Baseflow Separation for G8170240 using BFI+ technique
One-para: 1973 - 1976
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1973
01/07/1973
01/01/1974
01/07/1974
01/01/1975
01/07/1975
01/01/1976
01/07/1976
01/01/1977

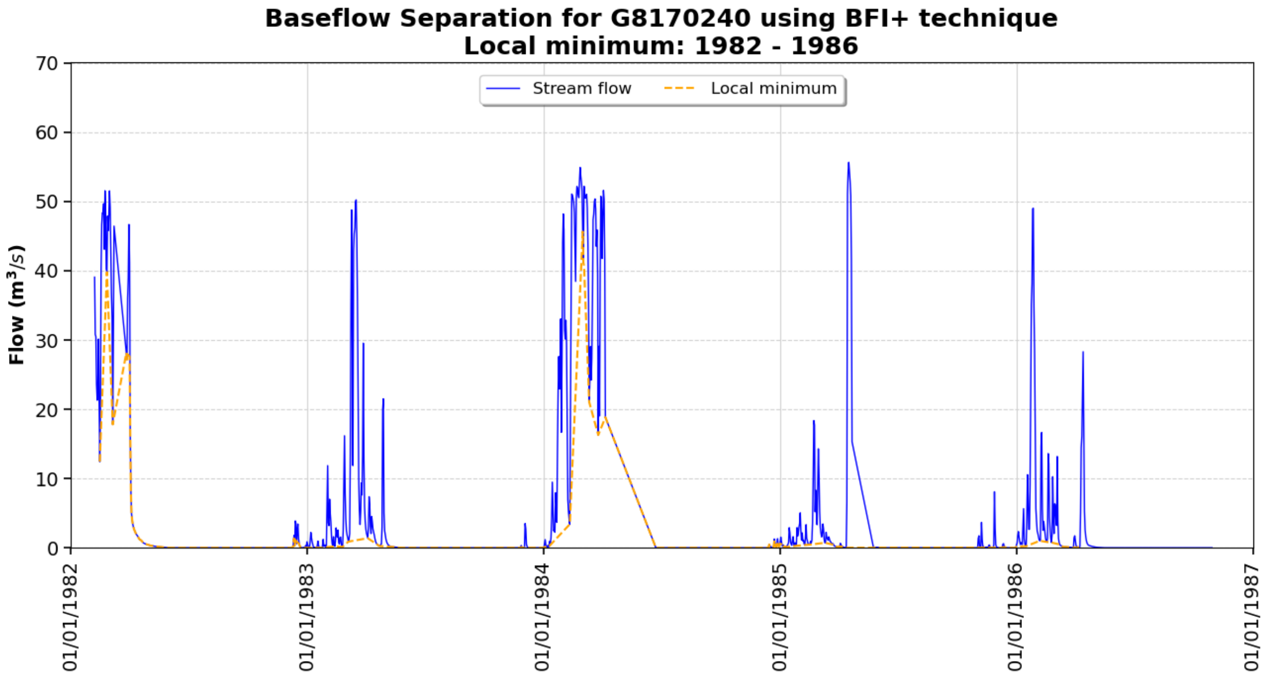

Baseflow Separation for G8170240 using BFI+ technique
One-para: 1977 - 1982
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1977
01/01/1978
01/01/1979
01/01/1980
01/01/1981
01/01/1982

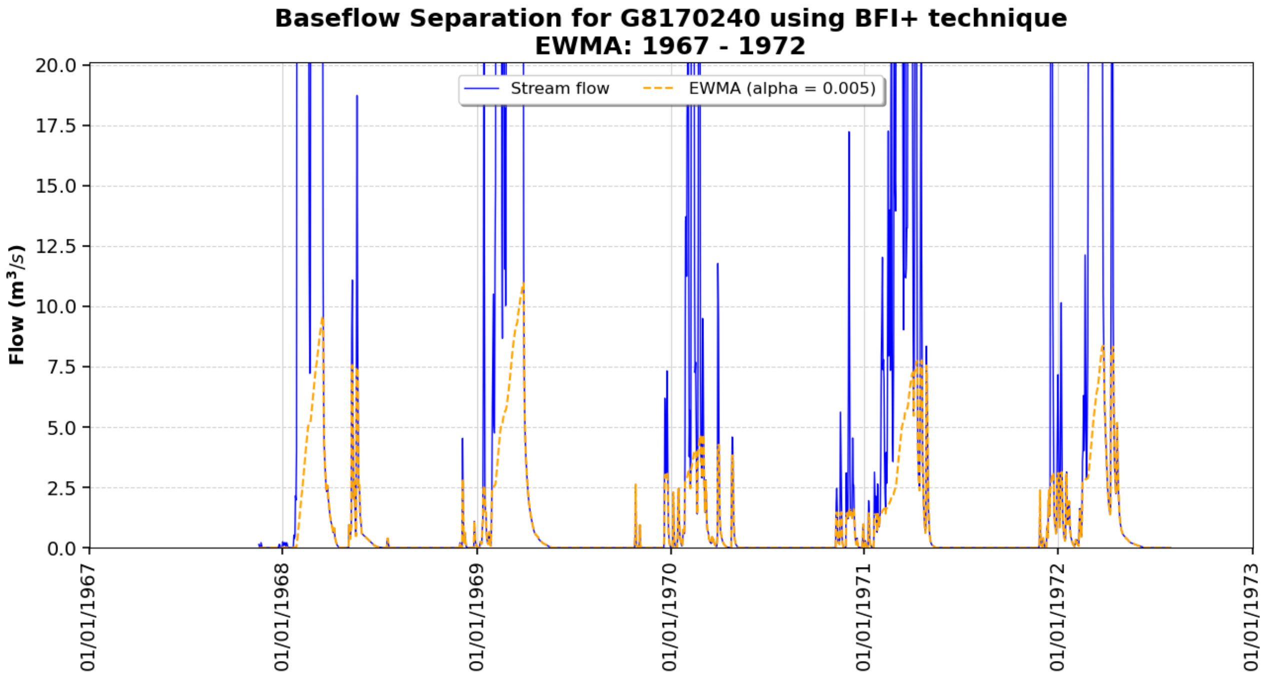

Baseflow Separation for G8170240 using BFI+ technique
One-para: 1982 - 1986
Stream flow
BFI+ one para (alpha = 0.995)
BFI+ one para (alpha = 0.999)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987

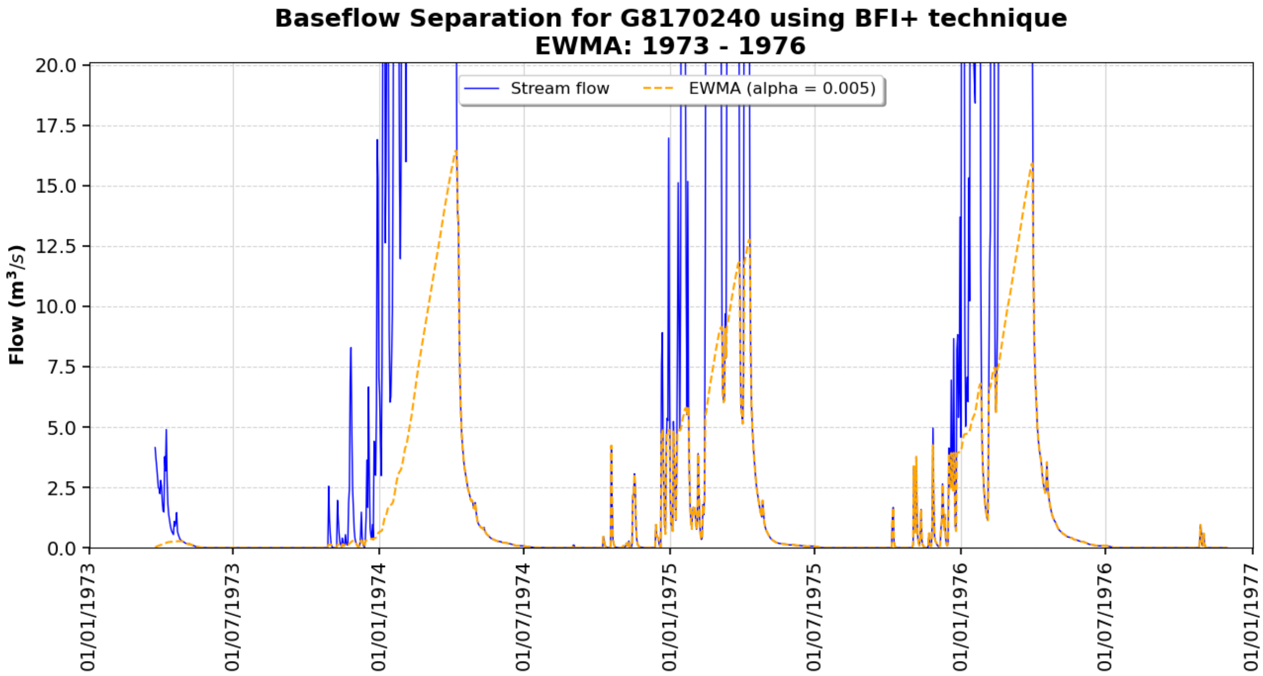

Baseflow Separation for G8170240 using BFI+ technique
Local minimum: 1967 - 1972
Stream flow
Local minimum
Flow (m³/s)
50
40
30
20
10
0
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972
01/01/1973


Baseflow Separation for G8170240 using BFI+ technique
Local minimum: 1973 - 1976
Stream flow
Local minimum
Flow (m³/s)
70
60
50
40
30
20
10
0
01/01/1973
01/07/1973
01/01/1974
01/07/1974
01/01/1975
01/07/1975
01/01/1976
01/07/1976
01/01/1977


Baseflow Separation for G8170240 using BFI+ technique
Local minimum: 1977 - 1981
Stream flow
Local minimum
Flow (m³/s)
0
10
20
30
40
50
60
70
01/01/1977
01/01/1978
01/01/1979
01/01/1980
01/01/1981
01/01/1982


Baseflow Separation for G8170240 using BFI+ technique
Local minimum: 1982 - 1986
Stream flow
Local minimum
Flow (m³/s)
0
10
20
30
40
50
60
70
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987


Baseflow Separation for G8170240 using BFI+ technique
EWMA: 1967 - 1972
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972
01/01/1973


Baseflow Separation for G8170240 using BFI+ technique
EWMA: 1973 - 1976
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1973
01/07/1973
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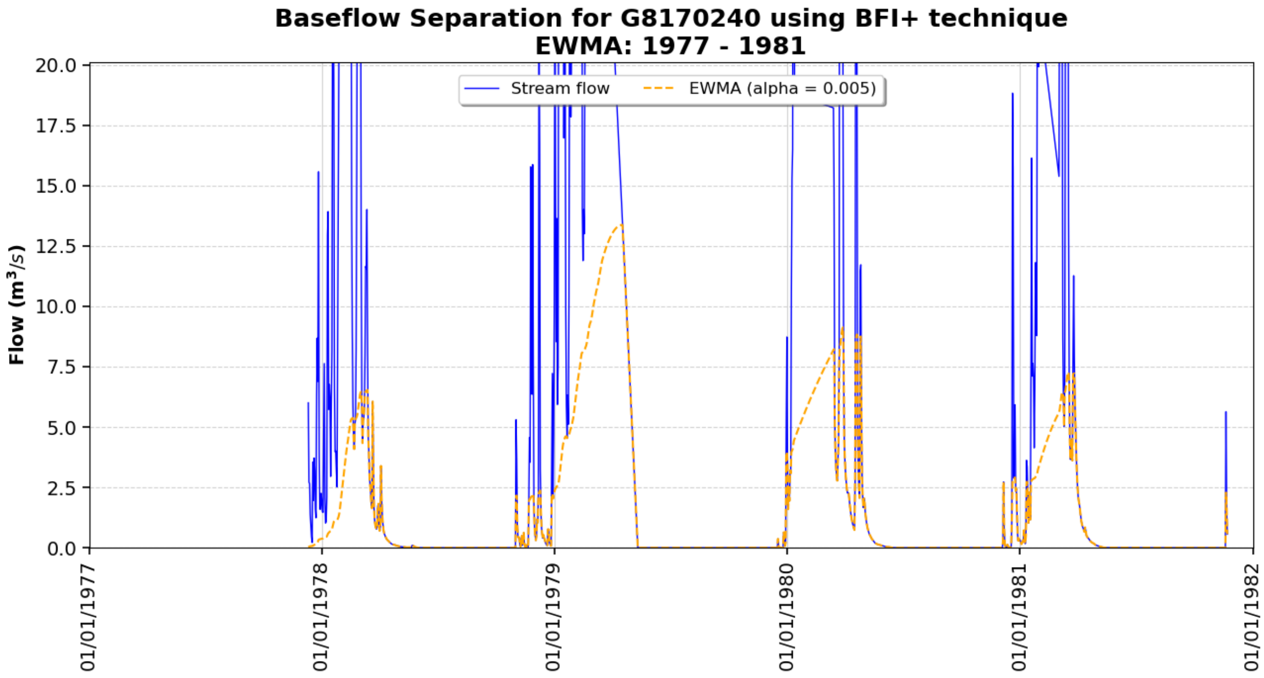
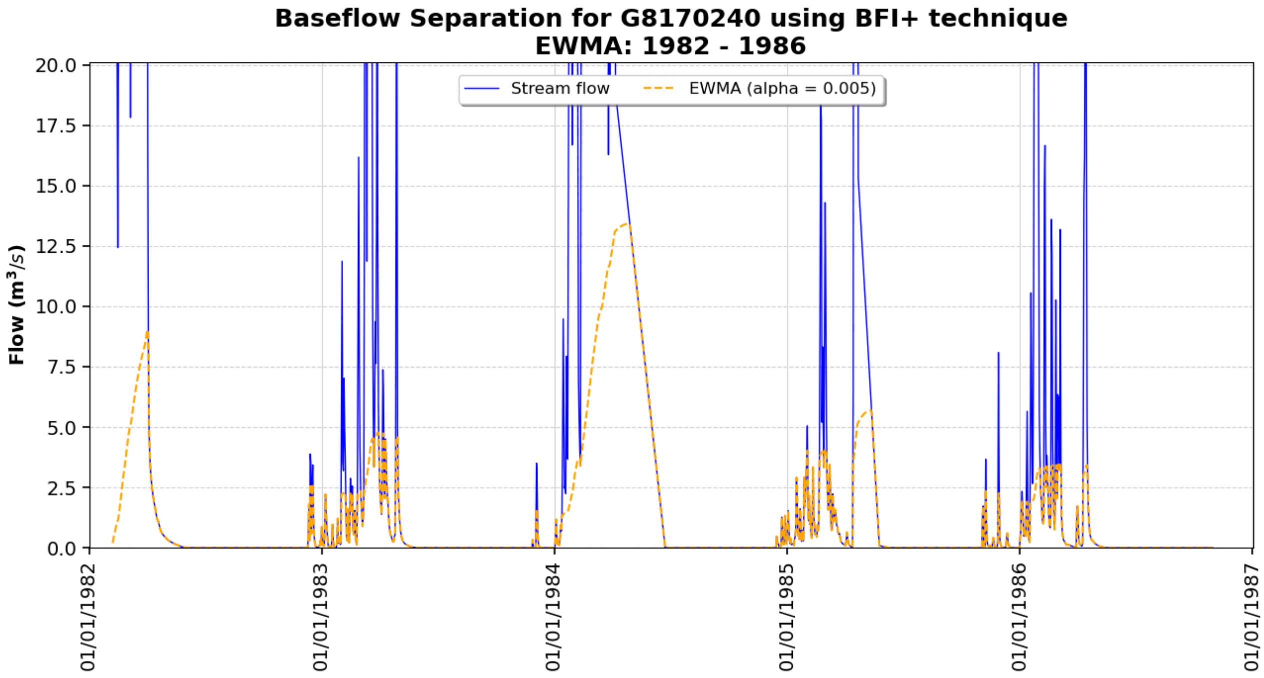
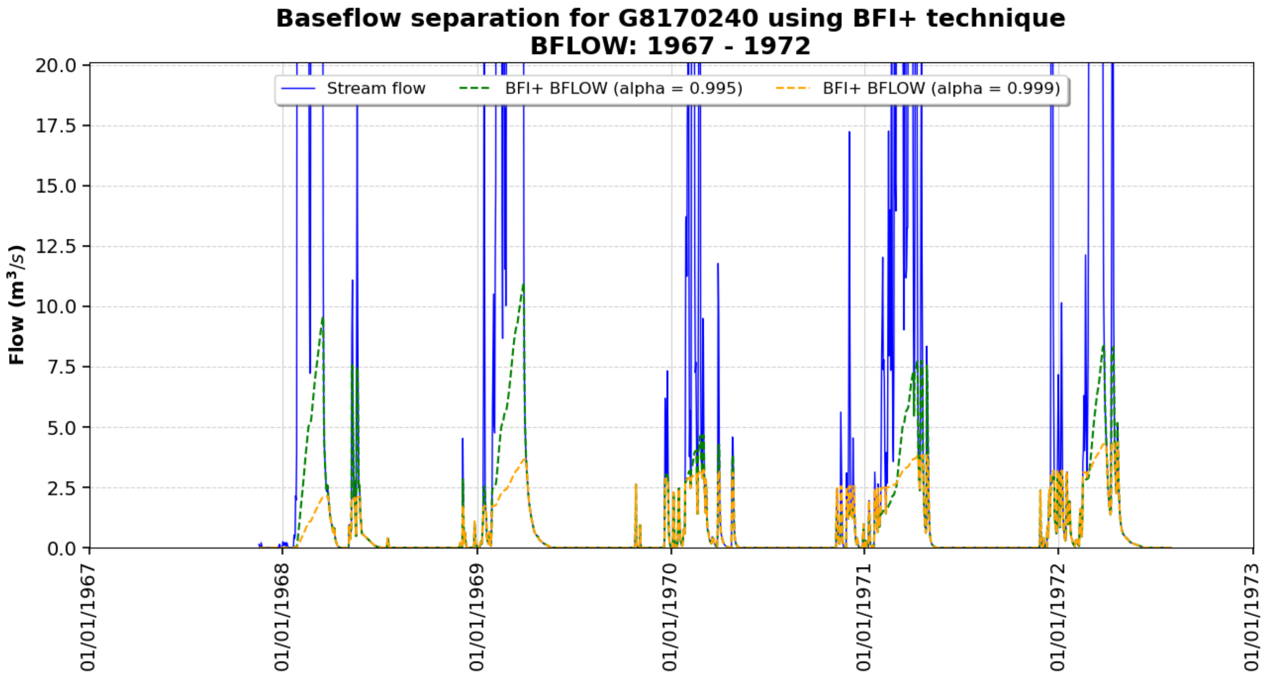
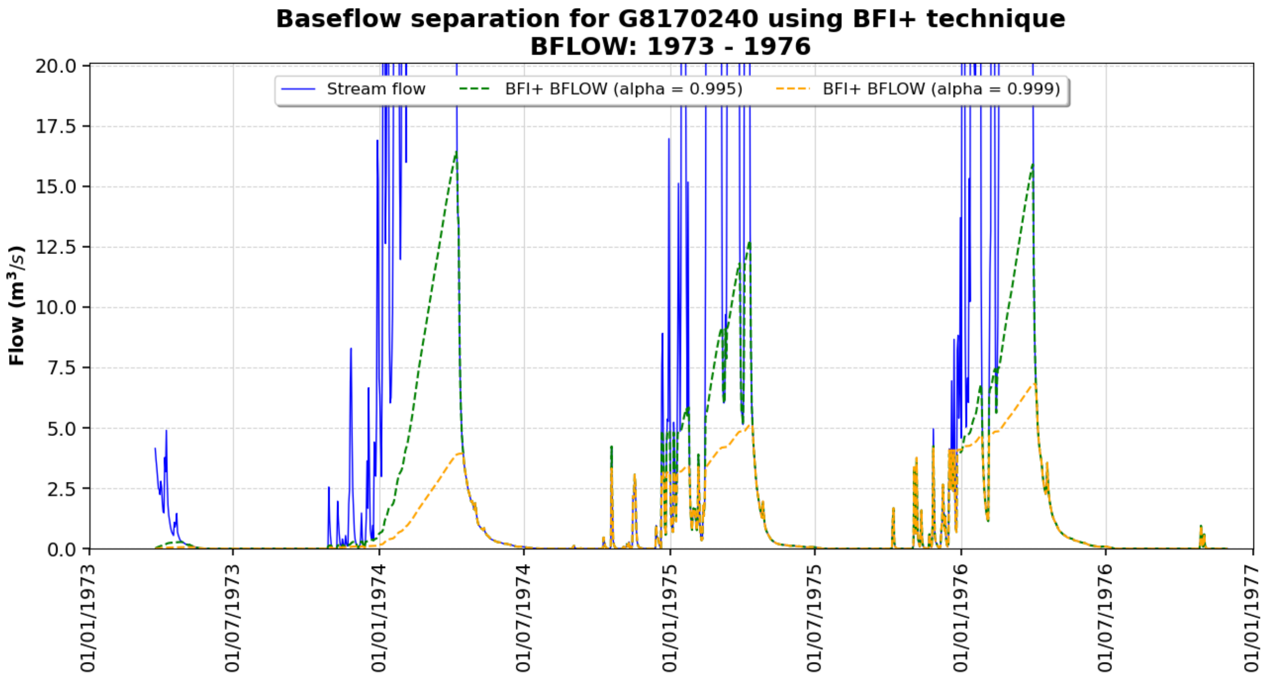
01/01/1976
01/07/1976
01/01/1977


Baseflow Separation for G8170240 using BFI+ technique
EWMA: 1977 - 1981
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
01/01/1977
01/01/1978
01/01/1979
01/01/1980
01/01/1981
01/01/1982


Baseflow Separation for G8170240 using BFI+ technique
EWMA: 1982 - 1986
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987


Baseflow separation for G8170240 using BFI+ technique
BFLOW: 1967 - 1972
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972
01/01/1973


Baseflow separation for G8170240 using BFI+ technique
BFLOW: 1973 - 1976
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
0.0
2.5
5.0
7.5
10.0
12.5
15.0
17.5
20.0
01/01/1973
01/07/1973
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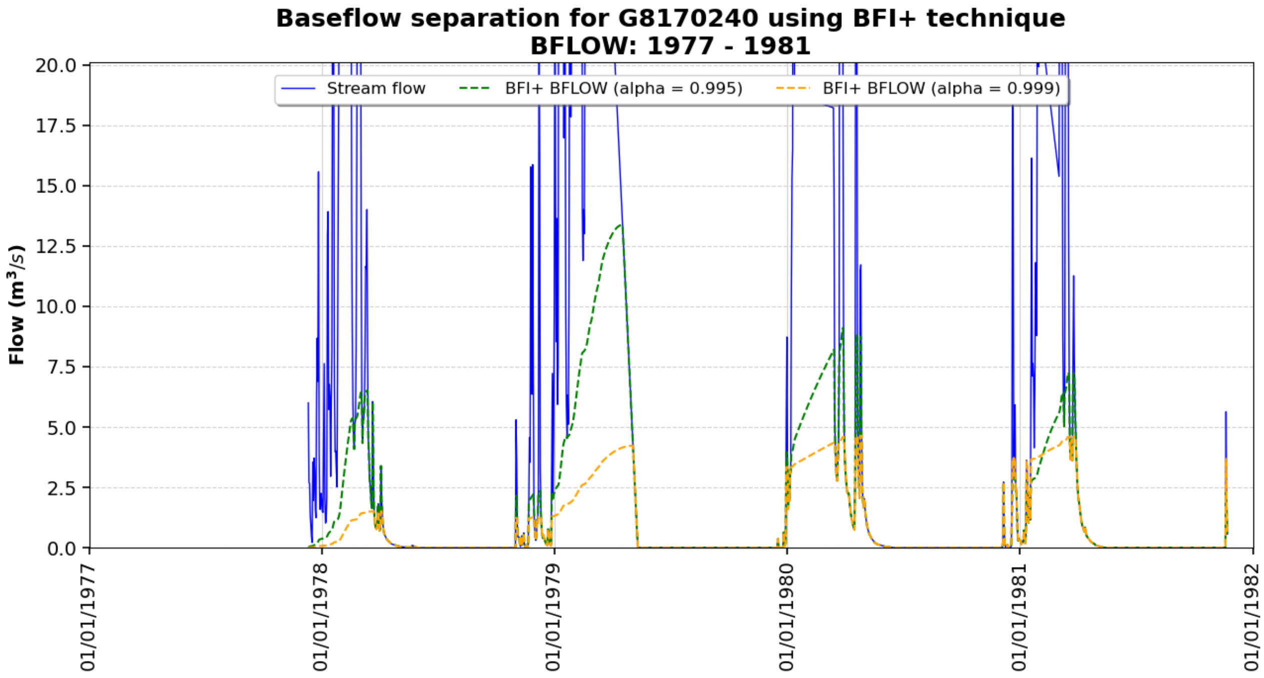
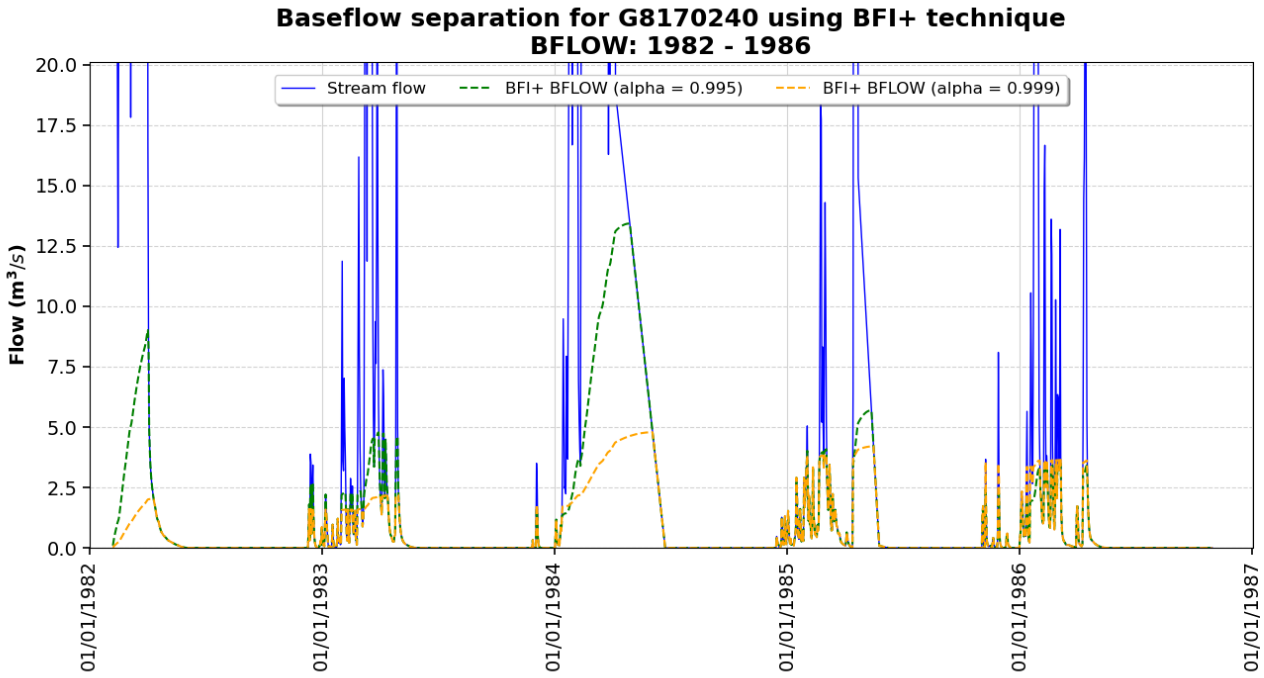
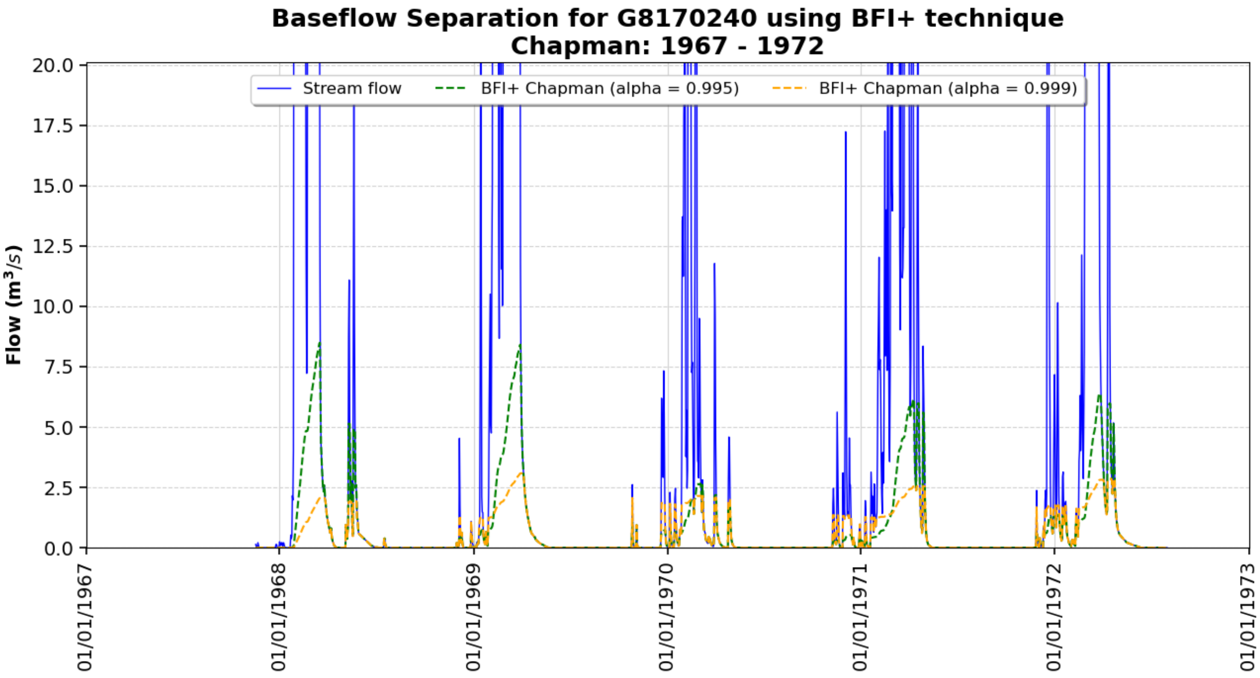
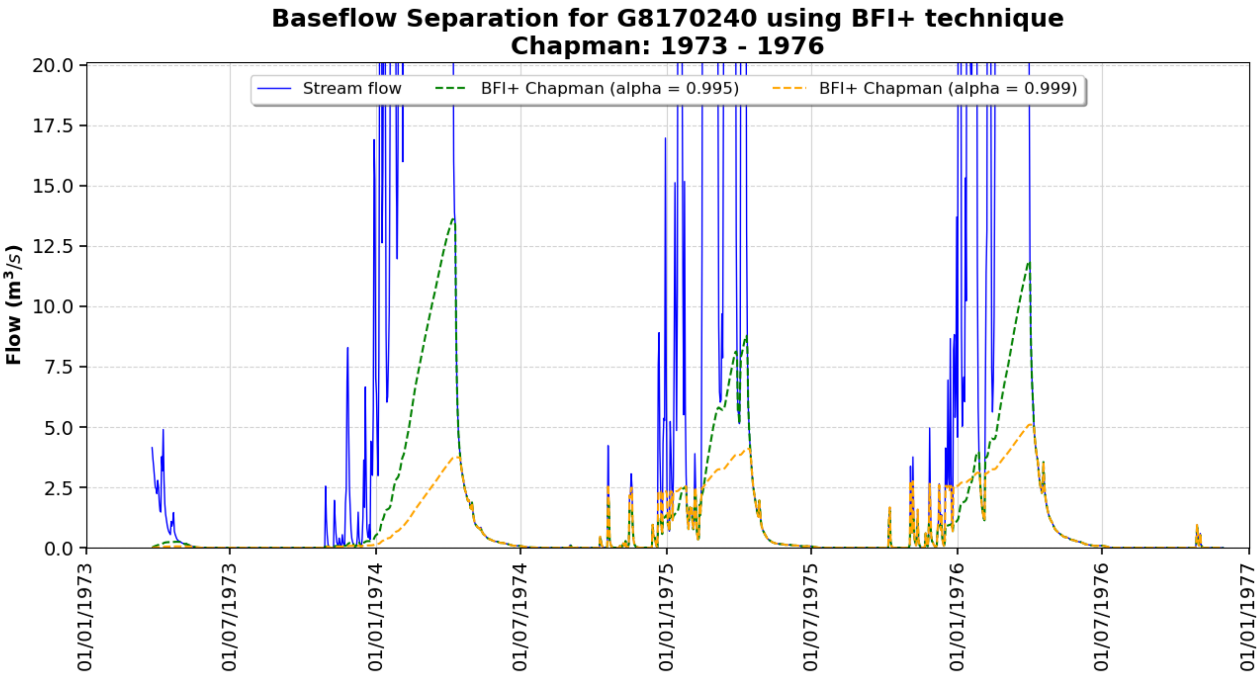
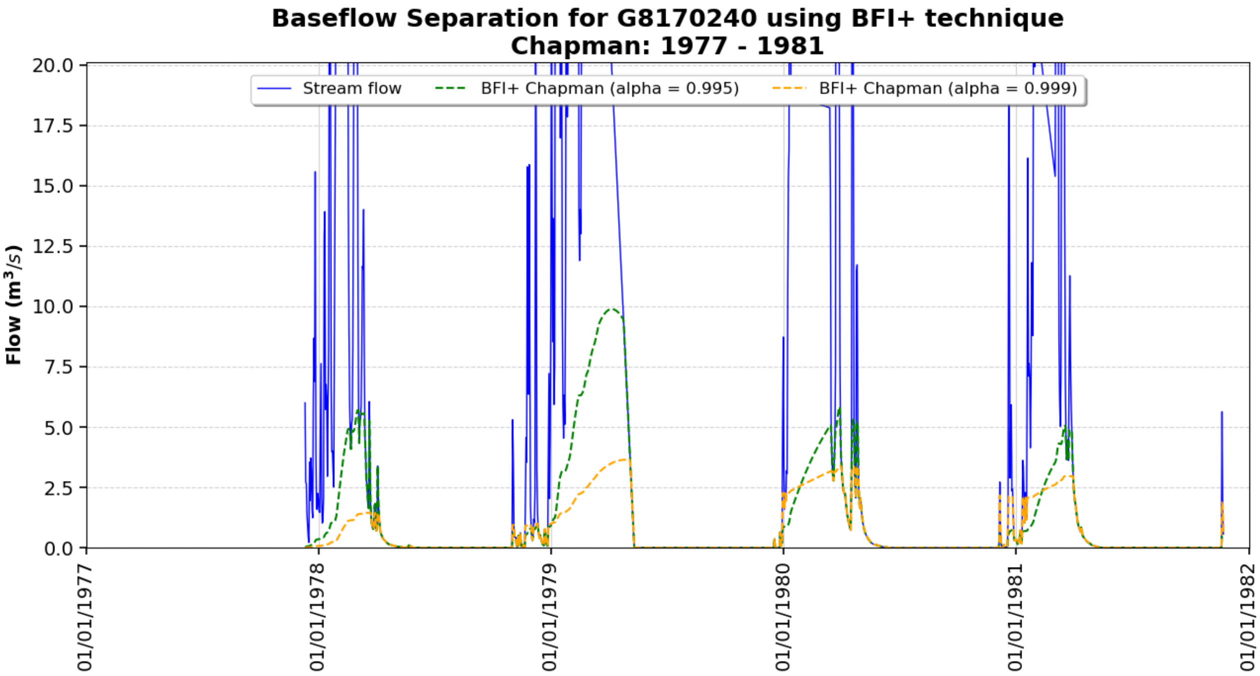
01/07/1976
01/01/1977


Baseflow separation for G8170240 using BFI+ technique
BFLOW: 1977 - 1981
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1977
01/01/1978
01/01/1979
01/01/1980
01/01/1981
01/01/1982


Baseflow separation for G8170240 using BFI+ technique
BFLOW: 1982 - 1986
Stream flow
BFI+ BFLOW (alpha = 0.995)
BFI+ BFLOW (alpha = 0.999)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987


Baseflow Separation for G8170240 using BFI+ technique
Chapman: 1967 - 1972
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972
01/01/1973


Baseflow Separation for G8170240 using BFI+ technique
Chapman: 1973 - 1976
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1973
01/07/1973
01/01/1974
01/07/1974
01/01/1975
01/07/1975
01/01/1976
01/07/1976
01/01/1977


Baseflow Separation for G8170240 using BFI+ technique
Chapman: 1977 - 1981
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1977
01/01/1978
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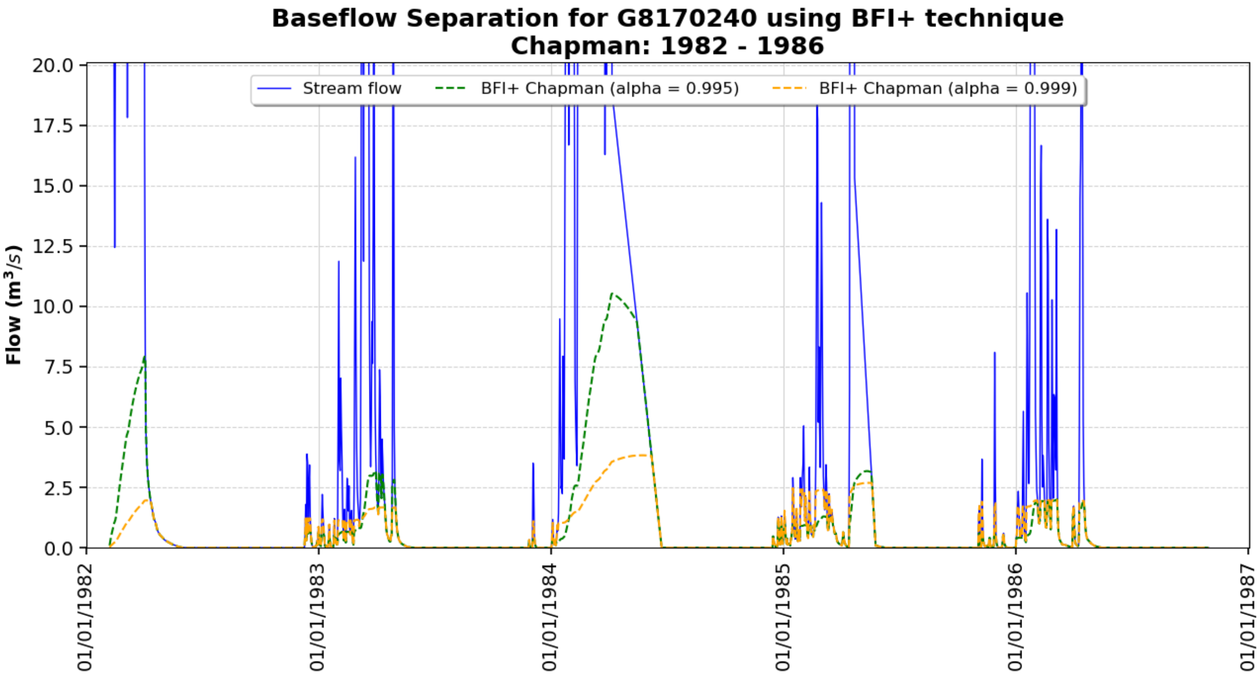
01/01/1980
01/01/1981
01/01/1982


Baseflow Separation for G8170240 using BFI+ technique
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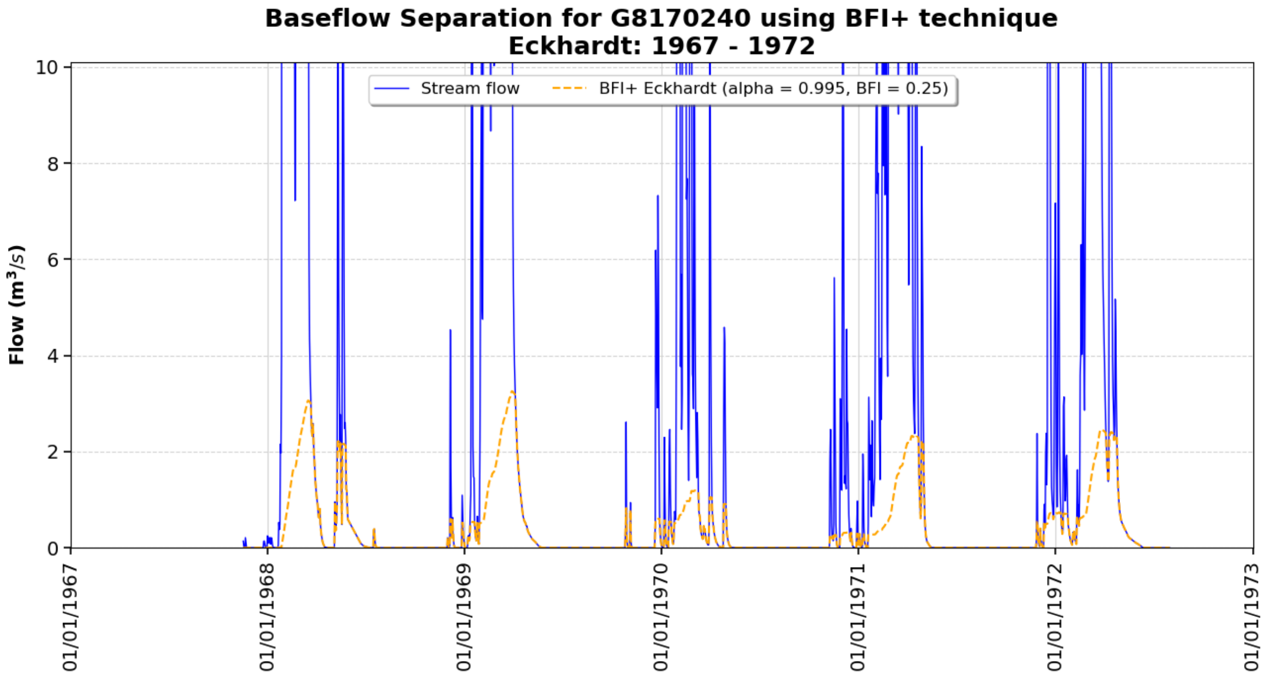
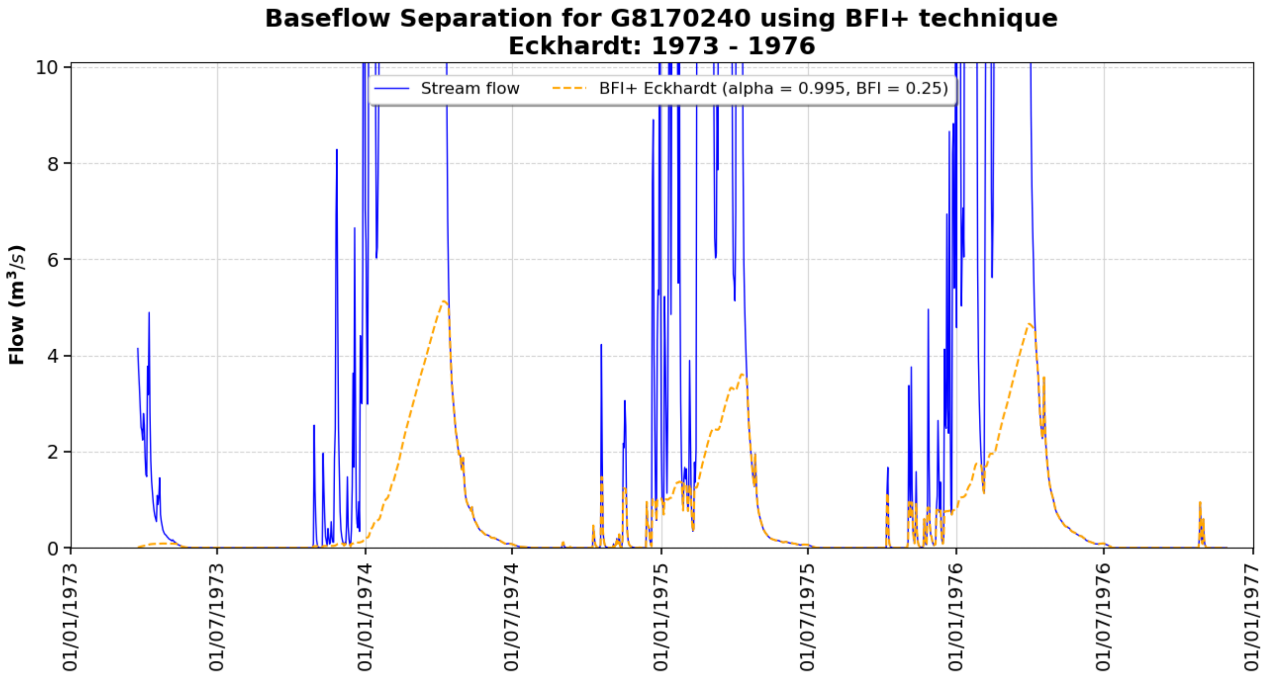
Stream flow
BFI+ Chapman (alpha = 0.995)
BFI+ Chapman (alpha = 0.999)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987


Baseflow Separation for G8170240 using BFI+ technique
Eckhardt: 1967 - 1972
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0
2
4
6
8
10
01/01/1967
01/01/1968
01/01/1969
01/01/1970
01/01/1971
01/01/1972
01/01/1973


Baseflow Separation for G8170240 using BFI+ technique
Eckhardt: 1973 - 1976
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
0
2
4
6
8
10
01/01/1973
01/07/1973
01/01/1974
01/07/1974
01/01/1975
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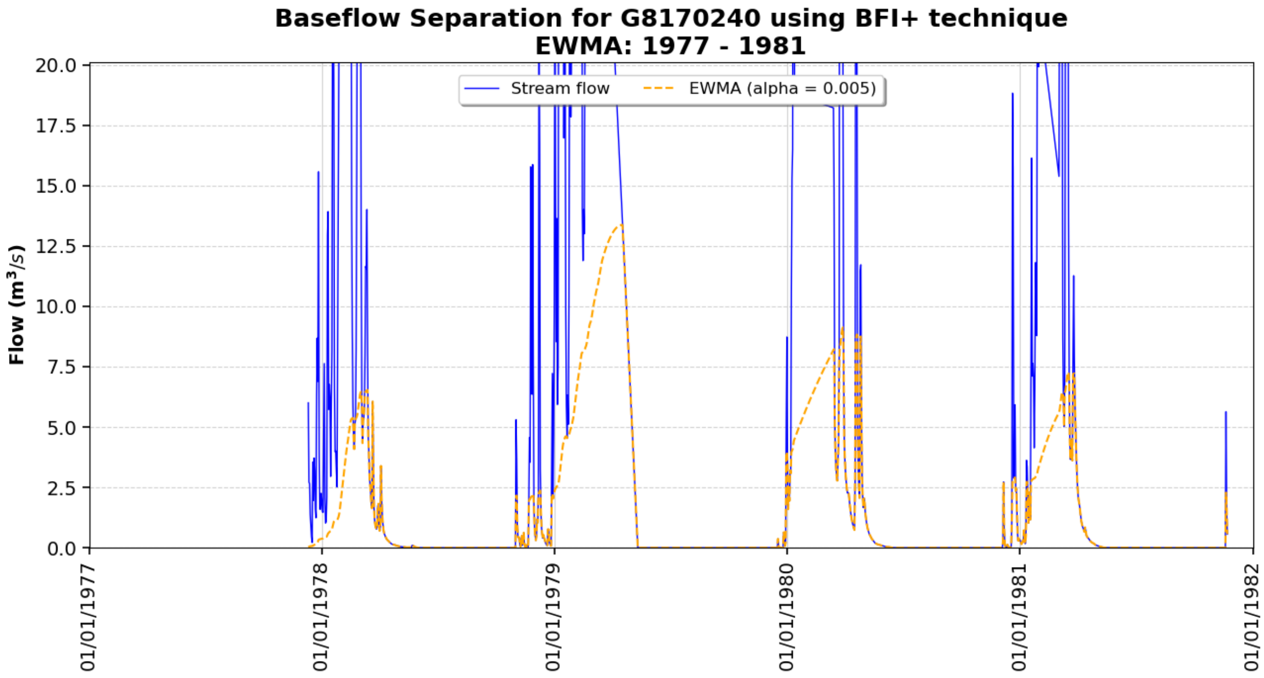
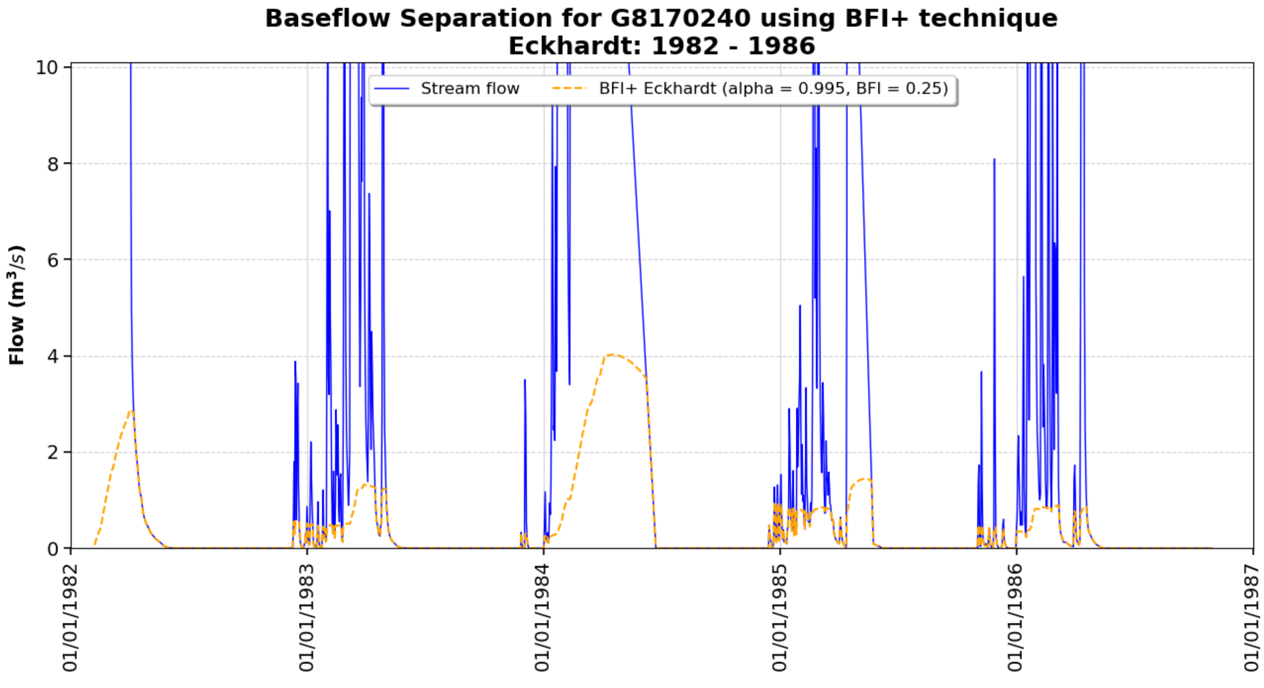
01/07/1976
01/01/1977


Baseflow Separation for G8170240 using BFI+ technique
EWMA: 1977 - 1981
Stream flow
EWMA (alpha = 0.005)
Flow (m³/s)
20.0
17.5
15.0
12.5
10.0
7.5
5.0
2.5
0.0
01/01/1977
01/01/1978
01/01/1979
01/01/1980
01/01/1981
01/01/1982


Baseflow Separation for G8170240 using BFI+ technique
Eckhardt: 1982 - 1986
Stream flow
BFI+ Eckhardt (alpha = 0.995, BFI = 0.25)
Flow (m³/s)
10
8
6
4
2
0
01/01/1982
01/01/1983
01/01/1984
01/01/1985
01/01/1986
01/01/1987