HYDROLOGICAL BULLETIN

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LIST

Hydrological bulletin – September 2025

Preface

The rainfall totals reported in this bulletin correspond to observations carried out at the meteorological stations in Schifflange and Roodt (operated by LIST since 2004 and 2006, respectively).

The hydrological response of rivers to rainfall is analyzed through discharge series recorded over several decades at four gauging stations: the Wiltz at Winseler (station operated since 1949, initially by the administration of technical agricultural services [ASTA], and by the Luxembourg Institute of Science and Technology [LIST] since 2001), the Roudbach at Platen (station operated since 1995 by LIST), the Eisch at Hagen (station operated since 1996 by LIST), and the Alzette at Hunsdorf (station operated since 2001 by LIST).

The exceptional length of discharge observations of the Wiltz River at the Winseler station (76 years) allows for the calculation of multiple thirty-year normals (or averages established over a period of 30 years). These normals thus serve as reference values to characterize the situation for the current month or year as above, below, or equal to the thirty-year normal. At the Alzette station in Hunsdorf, the Eisch in Hagen, and the Roudbach in Platen, the discharge observation series being shorter (24 years, 28 years, and 29 years, respectively), the average discharge values do not yet cover a proper thirty-year normal.

These four catchments are characterized by very contrasting geological substrates with distinctive hydrogeological features (Wiltz: fairly permeable schistose substrate; Roudbach: mixture of schistose, sandy, and marly substrates with varying permeability; Eisch: predominantly marly substrate with limited permeability; Alzette: mixture of sandy and marly substrates with varying permeability). The type of geological substrate and its associated permeability largely determine the catchment's capacity to store groundwater reserves in winter and to maintain sustained base flow during the summer and/or periods of low rainfall.

This report presents several statistics to characterize the hydrological regime of rivers: monthly discharge, annual discharge, and the Pardé coefficient as an expression of the flow regime (the ratio of the discharge of a given month to the annual mean discharge).

Precipitation

Since the beginning of 2025, cumulative rainfall has been close to, or slightly above, the long-term averages. In the south of Luxembourg, the Schifflange weather station recorded a total of 632 mm of rain between January and September 2025 (compared to an average of 518 mm over the first nine months of the year for the period 2004-2024). Further north, the Roodt weather station recorded 797 mm (compared to an average of 600 mm over the first nine months of the year for the period 2006-2024).

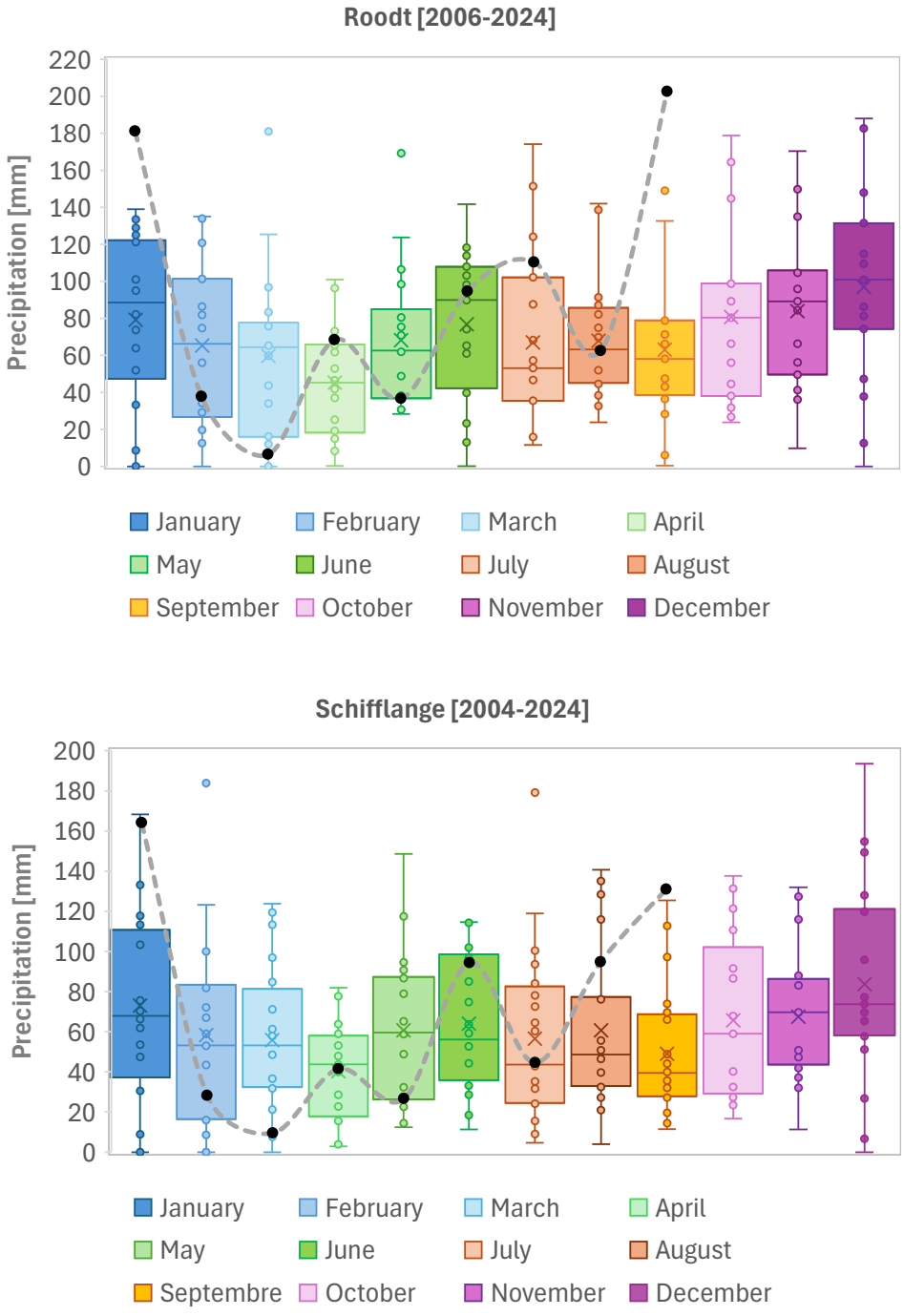

Figure 1. *Monthly rainfall totals observed at the Roodt station (reference period 2006-2024) and Schifflange station (reference period 2004-2024). Box plots (1st & 3rd quartiles, median) with whiskers indicating extreme values. Black dots connected by dashes: monthly rainfall totals recorded in 2025.*

While January was particularly wet, with 163 mm recorded in Schifflange (the 3rd highest monthly total in January since 2004) and 180 mm in Roodt (the highest monthly total observed for any January since 2006), subsequent rainfall was largely below average (Figure 1).

Between February and May 2025, only 107 mm (compared to an average of 215 mm between 2004-2024) were recorded in Schifflange and 150 mm (compared to an average of 239 mm between 2006-2024) at the Roodt weather station. These significant rainfall deficits could not be compensated by the more abundant precipitation in June (94.2 mm in Roodt, compared to an annual average of 76.9 mm; 93.7 mm in Schifflange, compared to an annual average of 64.1 mm).

While the month of July was above average in Roodt, with 110 mm recorded against an interannual average of 67 mm, further south the Schifflange station experienced a slight rainfall deficit, with 45 mm recorded compared to an interannual average of 57 mm. The month of August was slightly wetter at the Schifflange station, where the rainfall surplus reached 33 mm compared to the interannual average of 61 mm. The Roodt station experienced a slight rainfall deficit of 6 mm (for an interannual average of 68 mm).

September rainfall was particularly abundant, with monthly precipitation totals of 201 mm in Roodt (an excess of 136 mm) and 130 mm in Schifflange (an excess of 81 mm compared to the long-term average). These monthly rainfall surpluses are primarily due to the exceptional rains from September 8 to 9 and from September 23 to 24. Notably, in the Mersch area, precipitation totals of around 180 mm were recorded between September 8 and 9, 2025.

Hydrological regime

With the highest monthly discharge usually occurring in January/February and the lowest monthly discharge taking place in August/September, the hydrological regime of Luxembourg's rivers can be considered simple (according to Pardé's classification).

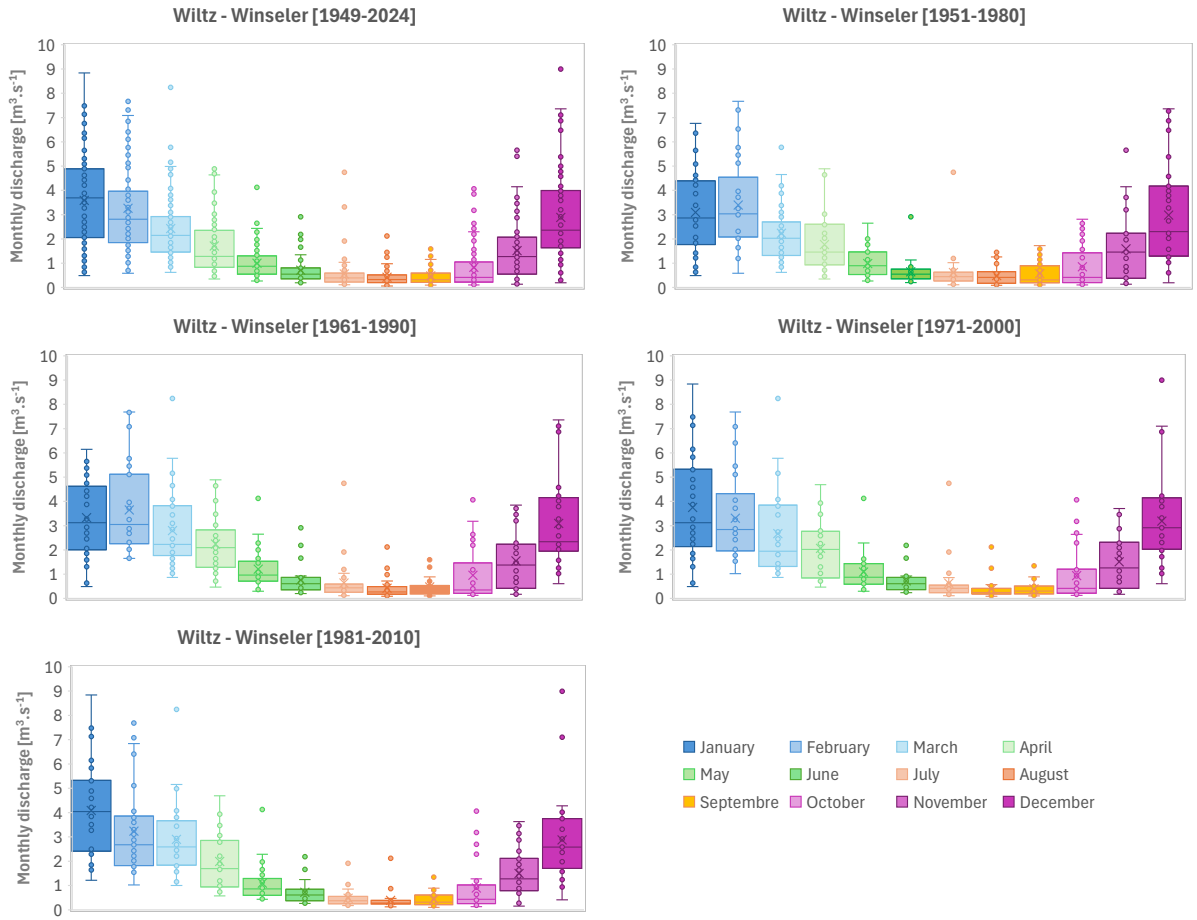

Figure 2. *Mean monthly discharge observed on the Wiltz River at Winseler. Box plots (1st & 3rd quartiles, median) with whiskers extending to extreme values. Thirty-year averages for the periods 1951-1980, 1961-1990, 1971-2000, 1981-2010, and 1991-2020.*

In this type of hydrological regime, also referred to as pluvio-evaporal, the high winter discharge is primarily due to rainfall inputs, while the low summer discharge is mainly linked to losses through evapotranspiration (under the effect of higher summer temperatures) and not necessarily to lower rainfall amounts (Figure 2). It should be noted that during the 1951-1980 and 1961-1990 normals, the highest mean monthly discharge was observed in February, probably reflecting the combined effect of rainfall and slight contributions to runoff from snow cover melt. Since then, snowfall has become rather rare, and the highest mean monthly discharge most often occurs in January.

Monthly river discharge in 2025

After reaching high levels in January, the river discharge remained (sometimes significantly) below the long-term average values between February and August 2025. The heavy rains in September 2025 led to a noticeable increase in the monthly discharge (higher than the values observed during the reference periods) in all rivers (Figure 3).

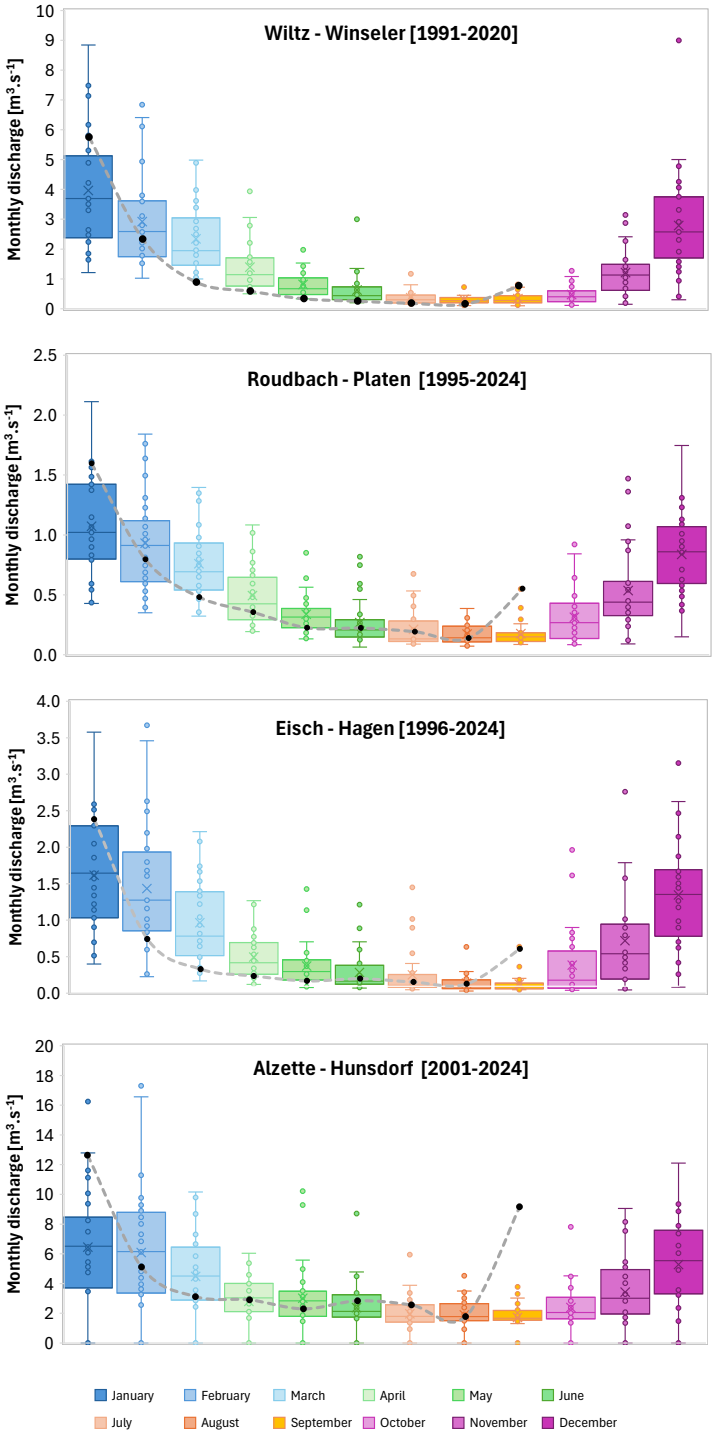

Figure 3. *Monthly discharge of the Wiltz at Winseler, the Roudbach at Platen, the Eisch at Hagen, and the Alzette at Hunsdorf. Monthly discharge for various reference periods represented by box plots (1st & 3rd quartiles, median) with whiskers extending to extreme values. Black dots connected by dashes: monthly discharge in 2025.*

The Wiltz River in Winseler

River :	Wiltz
Discharge station :	Winseler
Year of establishment :	1949
Operator :	ASTA, then LIST (since 2001)
Basin area :	102.5 km^2
Land use :	grassland & forests
Geology :	schists

Thirty-year hydrological normals (Table 1; Figure 2):

During the thirty-year reference periods 1951-1980 and 1961-1990, the highest monthly discharge of the Wiltz River was consistently observed in February. Since the reference period 1971-2000, the highest monthly discharge has occurred as early as January. Furthermore, the Pardé coefficient for the month of January has risen from 1.97 (1951-1980) to 2.74 (1991-2020), reflecting a gradual increase in the contribution of this month to the annual flow.

Mean discharge [m³/s]	Qmean 1951-1980	Pardé coeff. 1951-1980	Qmean 1961-1990	Pardé coeff. 1961-1990	Qmean 1971-2000	Pardé coeff. 1971-2000	Qmean 1981-2010	Pardé coeff. 1981-2010	Qmean 1991-2020	Pardé coeff. 1991-2020	Qmean 2025
January	3.11	1.97	3.36	**1.93**	3.76	2.20	4.10	2.40	3.97	**2.74**	**5.76**
February	3.38	**2.14**	3.66	2.10	3.32	1.94	3.24	**1.89**	2.94	2.03	**2.38**
March	2.22	**1.41**	2.79	1.60	2.67	1.56	2.90	**1.70**	2.34	1.61	**0.95**
April	1.77	1.12	2.24	**1.29**	2.07	1.21	1.99	1.16	1.39	**0.96**	**0.66**
May	0.98	0.62	1.21	**0.70**	1.09	0.64	1.09	0.64	0.82	**0.57**	**0.40**
June	0.65	**0.41**	0.76	**0.44**	0.73	0.43	0.72	0.42	0.62	0.43	**0.33**
July	0.62	**0.39**	0.64	0.37	0.63	0.37	0.48	0.28	0.37	**0.26**	**0.25**
August	0.49	**0.31**	0.42	0.24	0.39	0.23	0.39	0.23	0.31	**0.21**	**0.23**
September	0.57	**0.36**	0.47	0.27	0.40	0.23	0.43	0.25	0.34	**0.23**	**0.83**
October	0.85	0.54	0.95	**0.55**	0.94	0.55	0.90	0.53	0.47	**0.32**	
November	1.59	**1.01**	1.55	0.89	1.54	0.90	1.53	0.89	1.24	**0.86**	
December	3.00	1.90	3.11	1.79	3.20	1.87	2.87	**1.68**	2.78	**1.92**	
Annual	1.58		1.74		1.71		1.71		1.45		

Table 1. *Monthly and annual discharge (Q_{mean}, in m³/s) with Pardé coefficients of the Wiltz River at Winseler for 5 successive thirty-year periods. Monthly discharge for the current year 2025. Values marked in red: minimum thirty-year normals of the Pardé coefficient; Values marked in blue: maximum thirty-year normals of the Pardé coefficient.*

In contrast, the decrease in the values of the Pardé coefficient between April and September over successive thirty-year reference periods reflects an almost uninterrupted decline over the last 75 years in the summer contributions to annual runoff (between April and September: 0.31 < Pardé coefficient < 1.12 for the 1951-1980 period, compared to 0.21 < Pardé coefficient < 0.96 for the 1991-2020 period). For the 1991-2020 reference period, the Pardé coefficients for seven months (April, May, July, August, September, October, November) were notably lower than for all previous reference periods (established since 1950).

Hydrological situation in 2025: Spring drought and summer floods

In January 2025, two particularly heavy rainfall episodes generated two flood events of the Wiltz Rivers at Winseler, significantly exceeding the thirty-year normal (the daily average flow of 12.8 m³/s on January 10 had been exceeded less than 5% of the time during the reference period 1991-2020, and the daily average flow of 10.2 m³/s on January 28 had previously been exceeded less than 10% of the time during the reference period 1991-2020**).**

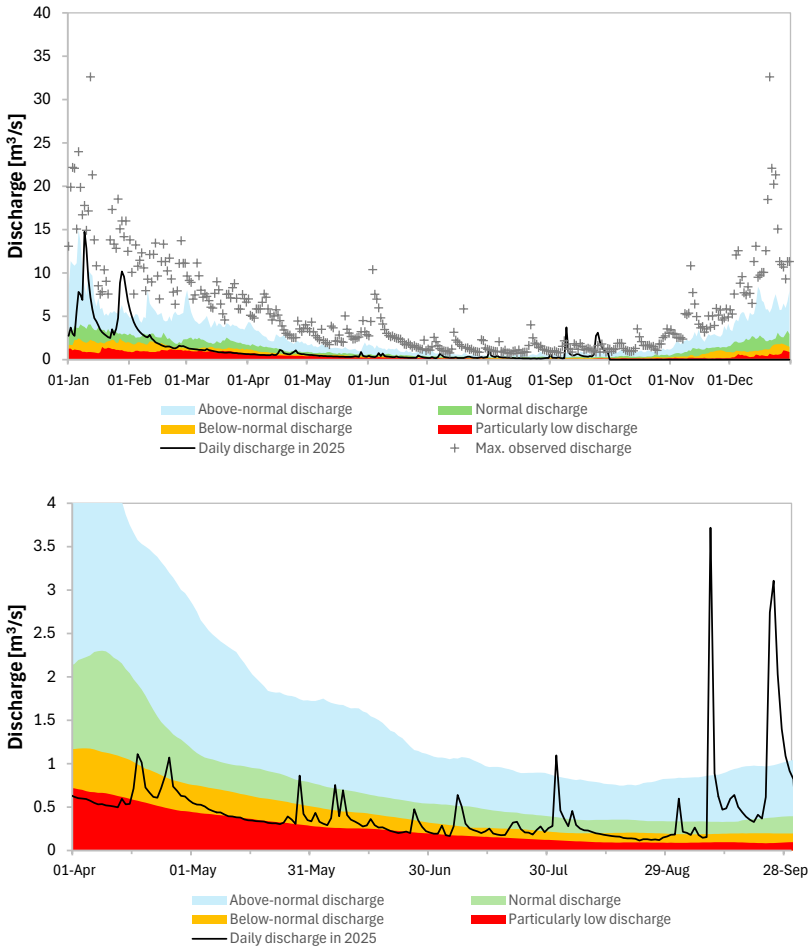

Figure 4. *Ranking of daily discharge of the Wiltz River at Winseler between January 1 and December 31, as measured from 1991 to 2020 [top graph]. Zoom on the ranking of daily discharge for the period from April 1 to September 30, 2025 [bottom graph]. The daily discharge for the year 2025 is represented by a continuous black line.*

In response to the marked rainfall deficit between February and May 2025, the average daily discharge of the Wiltz River decreased rapidly, reaching particularly low levels for the season in spring (early April, mid-May, late June) (discharge lower than that observed less than 10% of the time over the entire 1991-2020 reference period). Between July and early August 2025, a series of rainfall events gradually contributed to increasing the discharge to levels closer to normal. The relatively dry conditions in the second half of August once again led to a progressive decrease in discharge, reaching values below the 1991-2020 normal. These low water and soil drought conditions contributed to limiting the response to the locally very heavy rains at the beginning of September. Although the flood on September 9 (daily average flow of 3.72 m³/s) was only exceeded once in 30 years of observations on the Wiltz at Winseler at this time of year, barely 7% of the rainfall during this episode contributed to runoff. This reflects the relatively dry conditions that prevailed before the late summer rains and that allowed the soils to absorb a large portion of the water volumes. Soils that had since become wetter contributed to 13% of the rainfall from September 21 to 25, leading to a significant flood on September 25 (3.11 m³/s).

The Eisch River in Hagen

River :	Eisch
Discharge station :	Hagen
Year of establishment :	1997
Operator :	LIST
Basin area :	48.8 km^2
Land use :	grassland
Geology :	marls

Thirty-year hydrological normals (Table 2):

During the reference period 1997-2020, the monthly discharge of the Eisch at Hagen were at their highest in January, while the lowest monthly discharge usually occurred in September. From December to February, the Pardé coefficient (1997-2020) was greater than 2, indicating a discharge production twice as high as the annual mean discharge during this period. In August and September, the discharge dropped to just under one-fifth of the annual mean discharge for the reference period 1997-2020 (Pardé coefficient between 0.17 and 0.19).

Mean discharge [m^3/s]	Q_{mean} 1990-2020	Pardé coeff. 1991-2020	Q_{mean} 2025
January	1.49	2.29	**2.39**
February	1.40	2.15	**0.68**
March	1.00	1.53	**0.24**
April	0.48	0.74	**0.15**
May	0.34	0.53	**0.08**
June	0.28	0.43	**0.13**
July	0.21	0.32	**0.06**
August	0.13	0.19	**0.03**
September	0.11	0.17	**0.54**
October	0.33	0.51	
November	0.68	1.04	
December	1.36	2.08	
Annual	0.65		

Table 2. *Monthly and annual discharge (Q_{mean}, in m^3/s) with Pardé coefficients of the Eisch at Hagen for the reference period 1997-2020. Monthly discharge for the current year 2025.*

Hydrological situation in 2025: Spring drought and summer floods

In January 2025, two particularly heavy rainfall events caused two floods of the Eisch at Hagen, far exceeding the reference period 1997-2020 (on January 9, 10.99 m³/s, discharge exceeded only 1% of the time in the reference period 1997-2020; on January 26, 4.67 m³/s, flow exceeded only 5% of the time in the reference period 1997-2020).

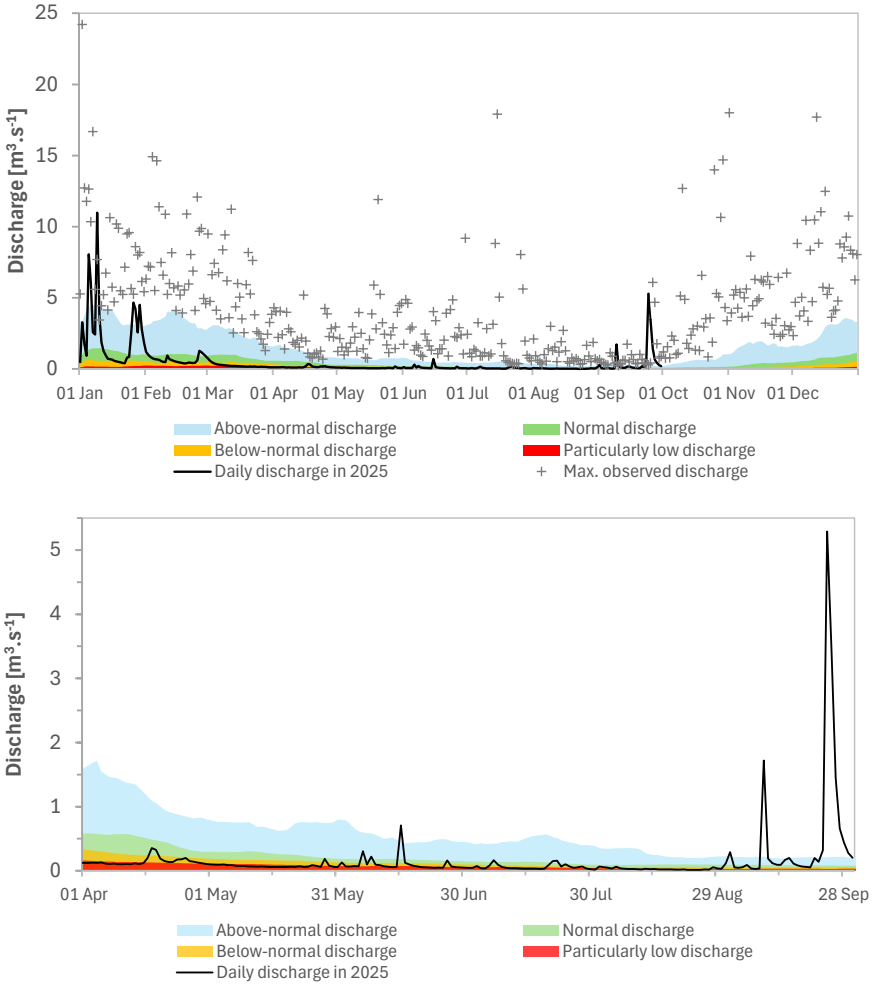

Figure 5. *Classifications of daily discharge of the Eisch River at Hagen between January 1 and December 31 as measured from 1997 to 2020 [top chart]. Enlargement of the classification of daily discharge for the period from April 1 to September 30, 2025 [bottom chart]. The daily discharge of the year 2025 is represented by a solid black line.*

In response to the pronounced rainfall deficit between February and May 2025, the average daily discharge of the Eisch River at Hagen dropped quickly, reaching very low levels unusually early in the spring (early April) — flows lower than those observed less than 5% of the time during the reference period 1997-2020. In June and July 2025, a few significant rainfall events temporarily brought the daily discharge values back to levels close to, or even above, the seasonal norms (e.g., 0.71 m³/s on June 15). After each rainfall event, the discharge of the Eisch quickly fell back to below the long-term average, or even particularly low for the season. The heavy rains during the first half of September led to significant floods. With 1.72 m³/s, the average daily discharge on September 9 was well above normal (higher discharge has been observed less than 5% of the time at this time of year over the reference period 1997-2020). Since antecedent conditions were relatively dry, only 5% of the rainfall contributed to runoff. Due to progressively wetter soils, this contribution rose to 23% during the rains from September 21 to 24. The maximum average daily flow for this event reached 5.29 m³/s on September 24.

The Roudbach River in Platen

River :	Roudbach
Discharge station :	Platen
Year of establishment :	1995
Operator :	LIST
Basin area :	44.2 km^2
Land use :	grassland, forests
Geology :	schists, sandstone, marls

Thirty-year hydrological normals (Table 3):

During the reference period 1995-2020, the highest monthly discharge was commonly observed in January on the Roudbach River. From November to March, the Pardé coefficient was greater than 1, indicating a runoff production higher than the annual mean discharge (up to twice as high in January). Between July and September, this runoff production decreased significantly (with the Pardé coefficient ranging from 0.17 to 0.19 for the 1995-2020 reference period).

	Q_{mean} 1995-2020	Pardé coeff. 1995-2020	Q_{mean} 2025
January	1.03	2.06	**1.59**
February	0.96	1.92	**0.78**
March	0.80	1.60	**0.46**
April	0.49	0.98	**0.34**
May	0.33	0.66	**0.21**
June	0.26	0.52	**0.20**
July	0.19	0.38	**0.17**
August	0.16	0.32	**0.12**
September	0.17	0.34	**0.53**
October	0.29	0.58	
November	0.51	1.02	
December	0.84	1.68	
Annual	0.50		

Table 3. *Monthly and annual discharge (Q_{mean}, in m³/s) with Pardé coefficients of the Roudbach River at Platen for the reference period 1995-2020. Monthly discharge for the current year 2025.*

Hydrological situation in 2025: Spring drought and summer floods

In January, two episodes of heavy rainfall caused floods on the Roudbach River at Platen, with discharge well above the thirty-year normal (on January 9, 4.87 m³/s, discharge exceeded only 5% of the time during the reference period 1995-2020; on January 28, 3.09 m³/s, discharge exceeded only 5% of the time during the reference period 1995-2020).

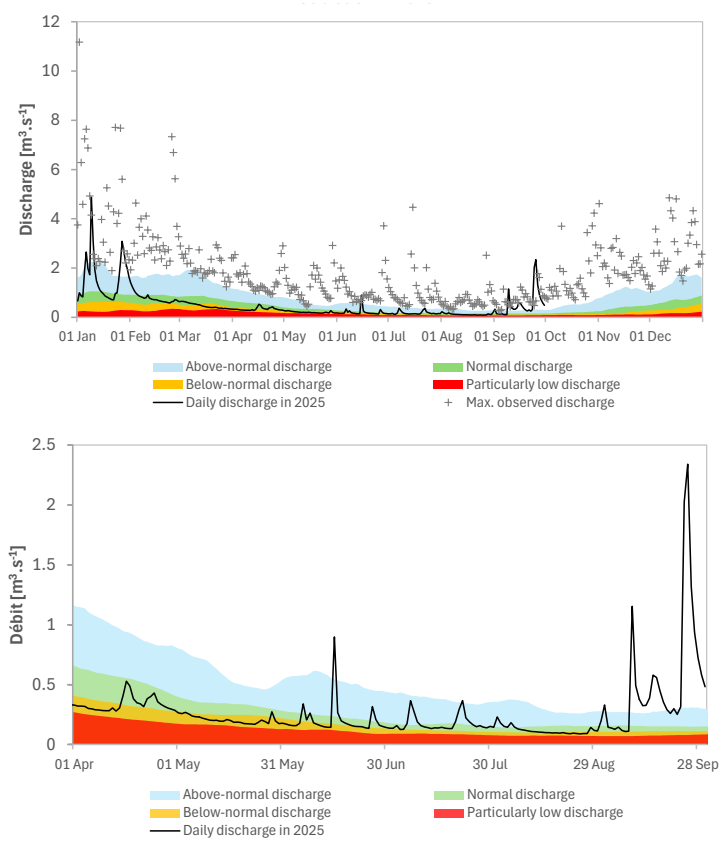

Figure 6. *Daily discharge classifications of the Roudbach River at Platen from January 1 to December 31 as measured between 1995 and 2020 [top graph]. Enlargement of the daily discharge classification for the period from April 1 to September 30, 2025 [bottom graph]. The daily discharge of the year 2025 is represented by a solid black line.*

In response to the pronounced rainfall deficit between February and May 2025, the average daily discharge of the Roudbach River at Platen gradually decreased, reaching below-normal levels in spring (early April, May, late June). In June and July, a few significant rainfall events gradually brought daily discharge values back to levels close to seasonal norms, or even above during flood episodes (e.g., 0.89 m³/s on June 15). The lowest discharge values were recorded in the second half of August. Heavy rainfall at the beginning of September produced a first significant flood (average daily discharge of 1.15 m³/s on September 9, with a runoff coefficient of only 5%). A second flood occurred between September 24 and 28, with a maximum daily discharge of 2.34 m³/s observed on September 25. Due to the previously higher soil moisture, about 25% of the rainfall contributed to this flood event.

The Alzette River in Hunsdorf

River :	Alzette
Discharge station :	Hunsdorf
Year of establishment :	1995
Operator :	LIST
Basin area :	410.1 km^2
Land use :	grassland, agricultural land, forests
Geology :	sandstone, marls

Thirty-year hydrological normals (Table 4):

During the reference period 2001-2020, the highest monthly discharge of the Alzette River at Hunsdorf was observed in January. From December to March, the Pardé coefficient was greater than 1, indicating a discharge production above the annual mean discharge (up to twice as high in January). Between July and September, this discharge production gradually decreased (Pardé coefficient of 0.48 in September for the reference period 2001-2020).

	Q_{mean} 2001-2020	Pardé coeff. 2001-2020	Q_{mean} 2025
January	7.49	1.85	**12.57**
February	7.37	1.82	**4.84**
March	5.56	1.37	**2.80**
April	3.15	0.78	**2.58**
May	3.47	0.86	**1.95**
June	2.94	0.72	**2.51**
July	2.14	0.53	**2.22**
August	2.12	0.52	**1.41**
September	1.94	0.48	**9.00**
October	2.51	0.62	
November	3.77	0.93	
December	6.23	1.54	
Annual	4.06		

Table 3. *Monthly and annual discharge (Q_{mean}, in m^3/s) with Pardé coefficients of the Alzette River at Hunsdorf for the reference period 2001-2020. Monthly discharge for the current year 2025.*

Hydrological situation in 2025: Spring drought and summer floods

Heavy rainfall caused three successive floods, each with daily average flows much higher than those of the reference period 2001-2020 (on January 6, 33.22 m³/s; on January 9, 48.78 m³/s; on January 26, 20.72 m³/s).

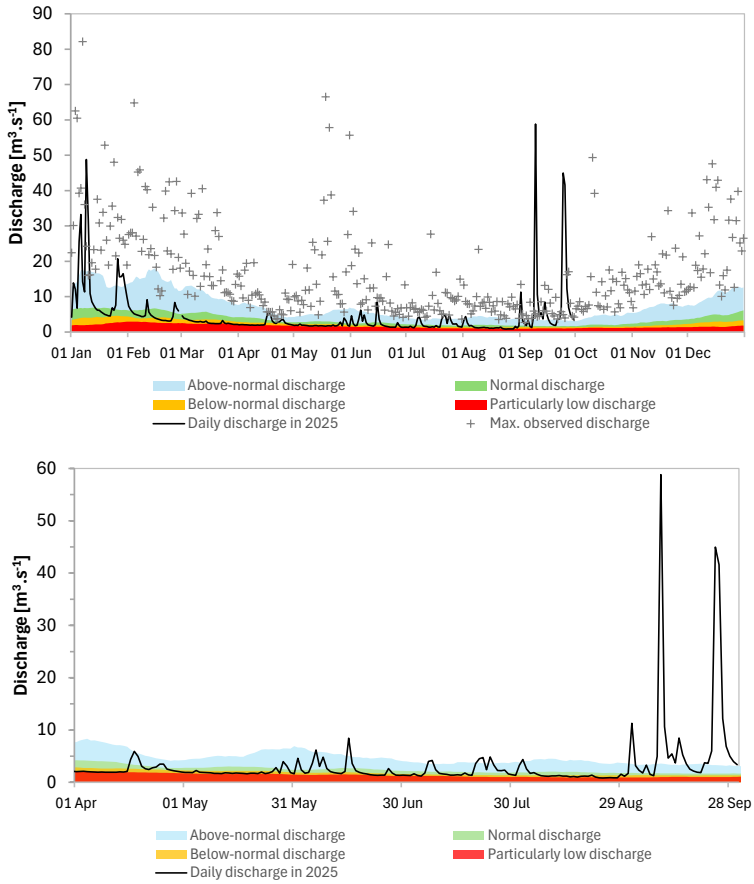

Figure 7. *Classifications of the daily discharge of the Alzette River at Hunsdorf between January 1 and December 31 [top graph]. Enlargement of the classification of daily discharge for the period from April 1 to July 31, 2025 [bottom graph]. The daily discharge for the year 2025 is represented by a solid black line.*

Following the pronounced rainfall deficit between February and May 2025, the average daily discharge of the Alzette River at Hunsdorf decreased almost continuously, reaching particularly low levels on several occasions (compared to the reference period 2001-2020). In June and July, a few marked rainfall events gradually brought the daily discharge values back to levels close to seasonal norms. The heavy rains at the beginning of September contributed to accelerating the hydrological response of the Alzette within a few weeks. Following torrential rainfall (concentrated within a 20 km perimeter around the locality of Mersch), an initial flood reached an average daily discharge of 58.8 m³/s. Due to the still relatively high soil absorption capacity at the end of the summer period, only 19% of this exceptional rainfall event contributed to the Alzette's flood wave. A few days later, a second rainy episode (less intense, with ~85 mm) from September 24 to 28 caused another significant flood, with an average daily discharge of 44.96 m^3/s observed on September 24. During this second flood event, about 29% of the rainfall contributed to the discharge of the Alzette River at Hunsdorf.

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