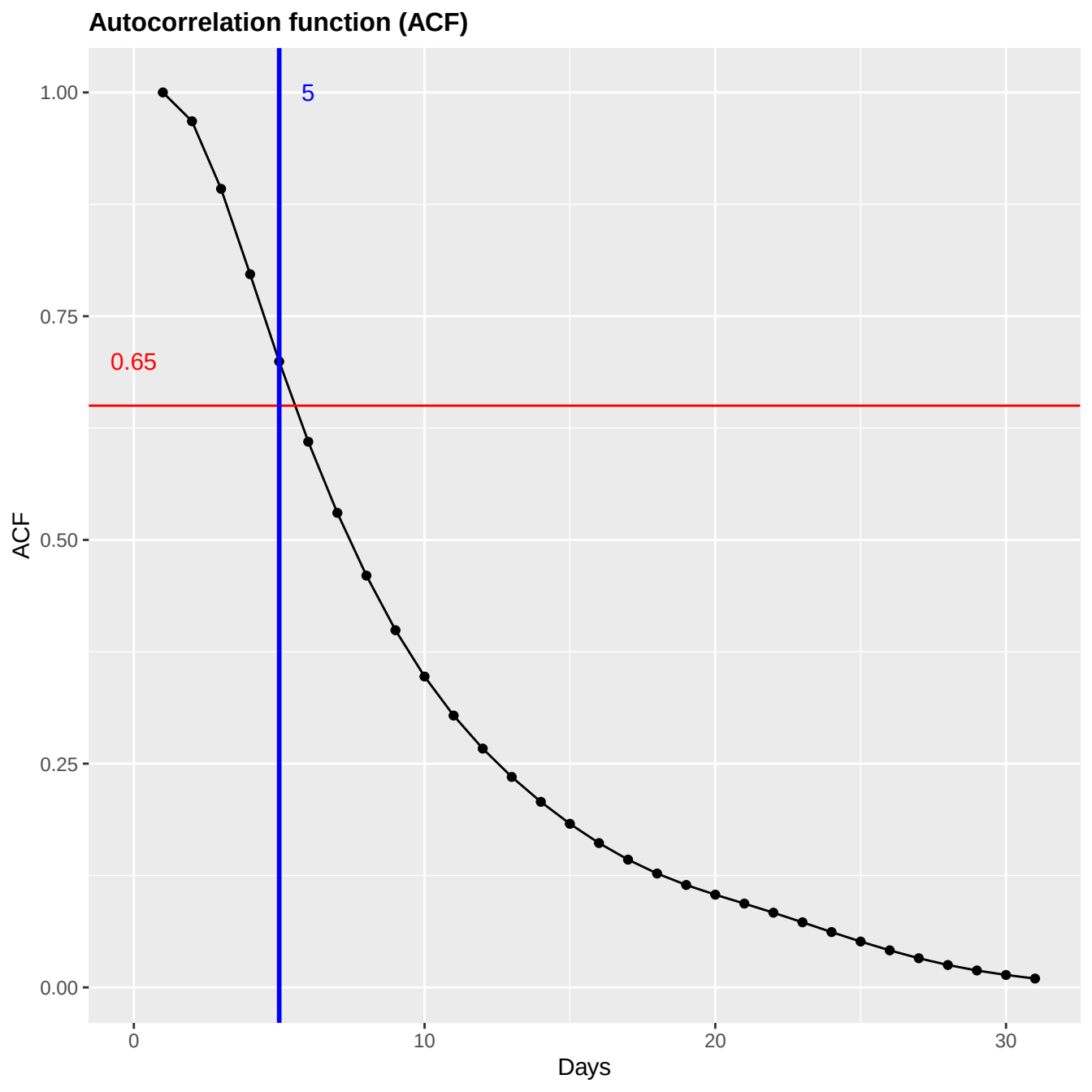
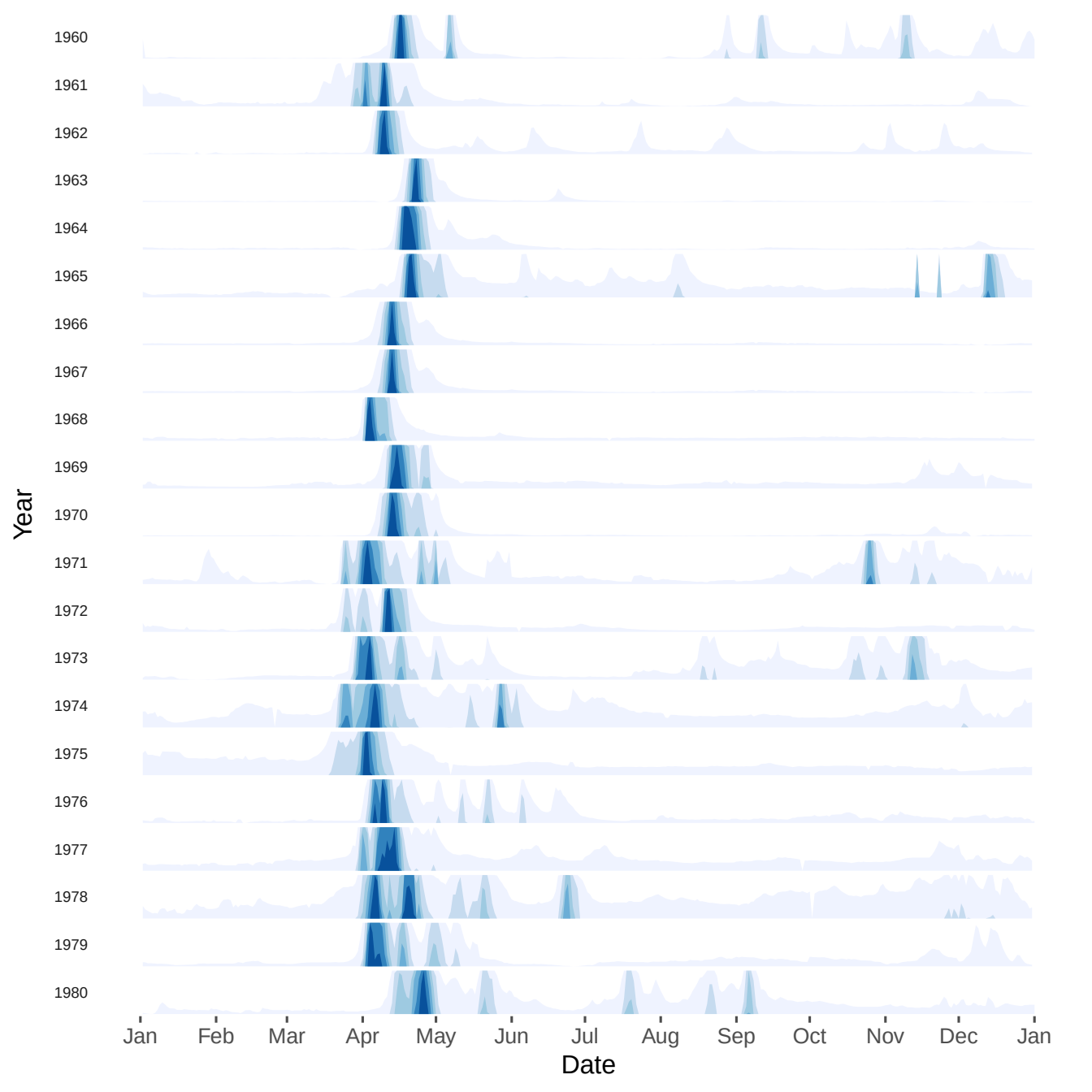
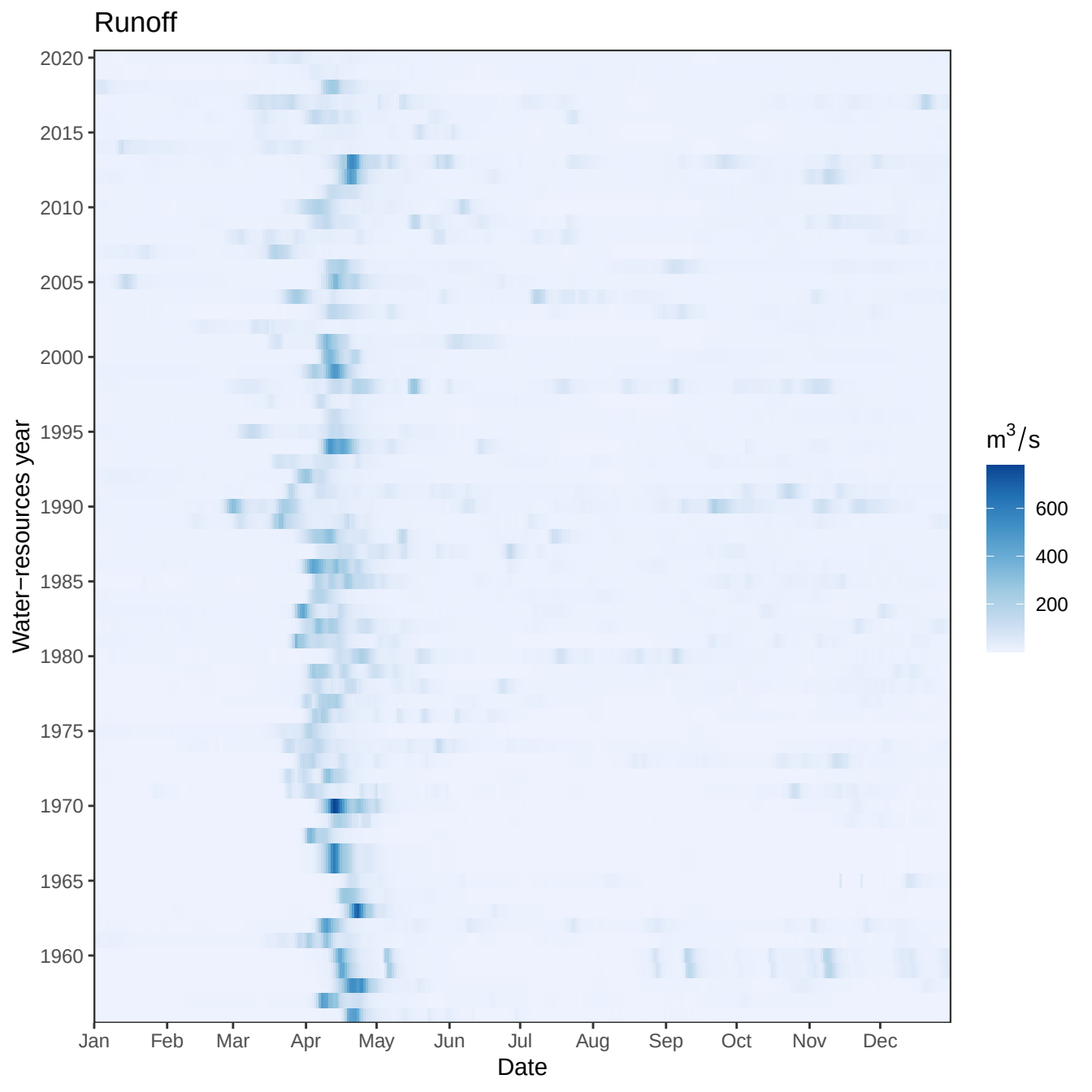
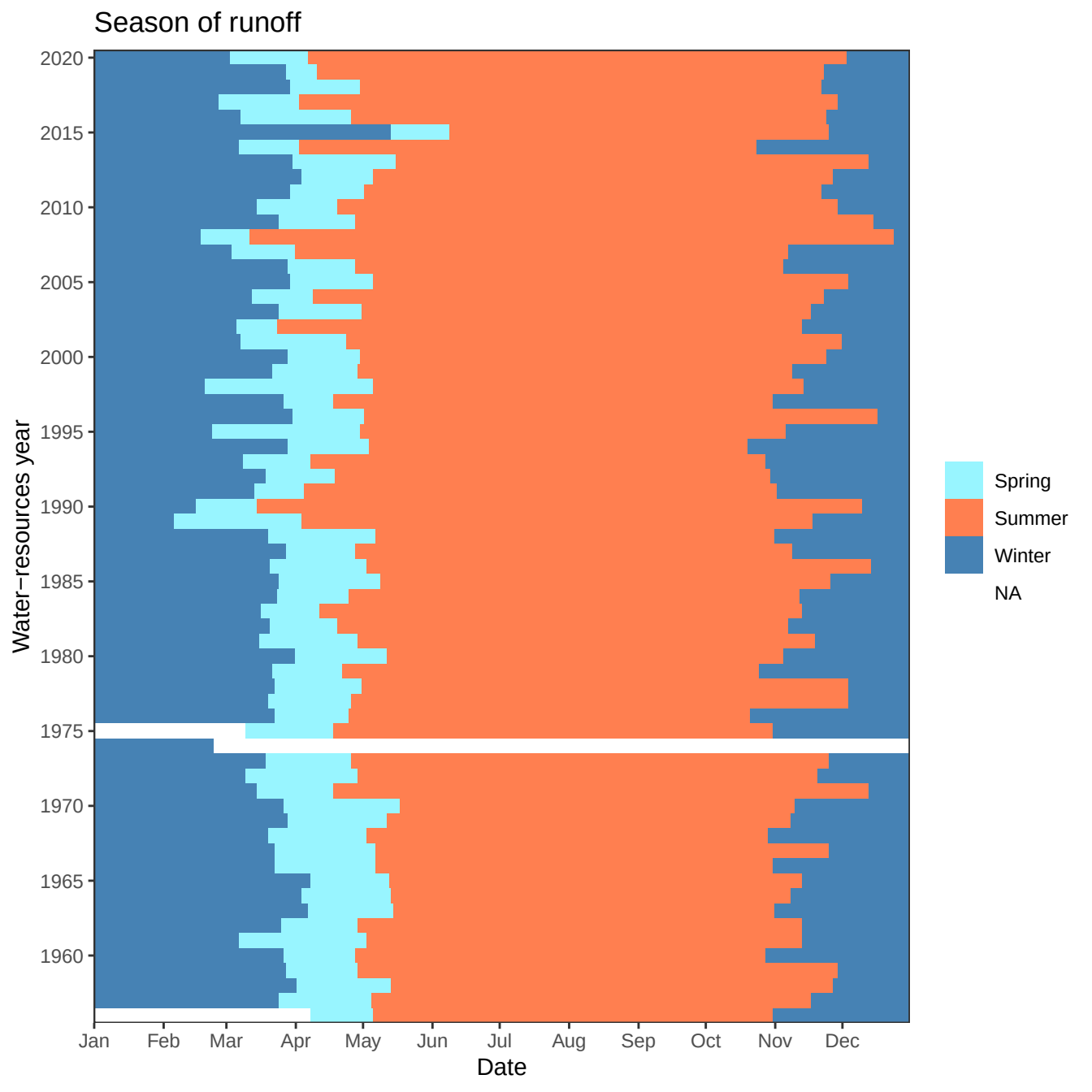
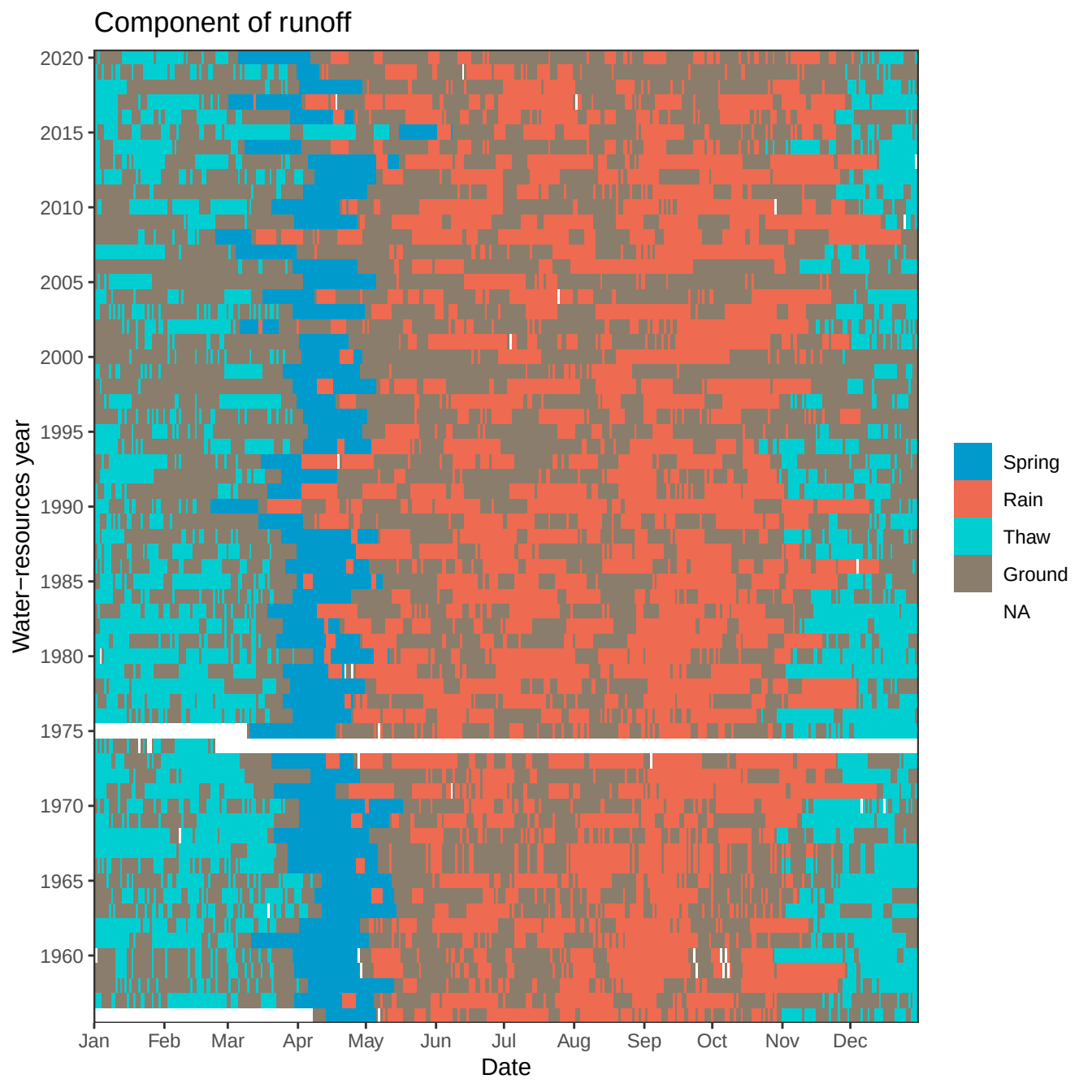

Autocorrelation function (ACF)
1.00
0.75
0.50
0.25
0.00
ACF
5
0.65
0
10
20
30
Days

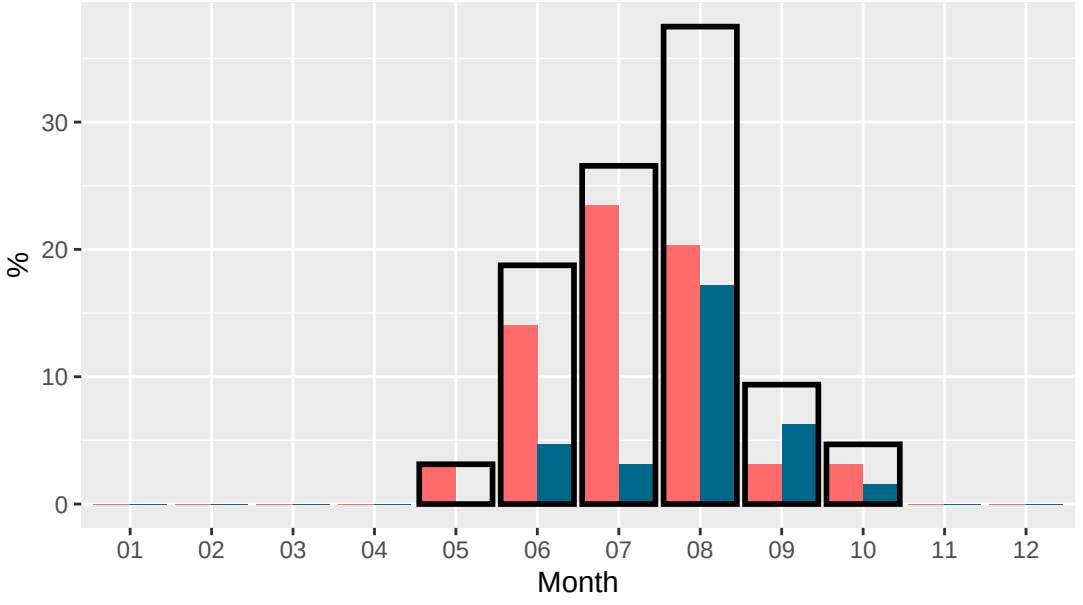

Year
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Date


Runoff
Water−resources year
2020
2015
2010
2005
2000
1995
1990
1985
1980
1975
1970
1965
1960
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date
m3/s
600
400
200

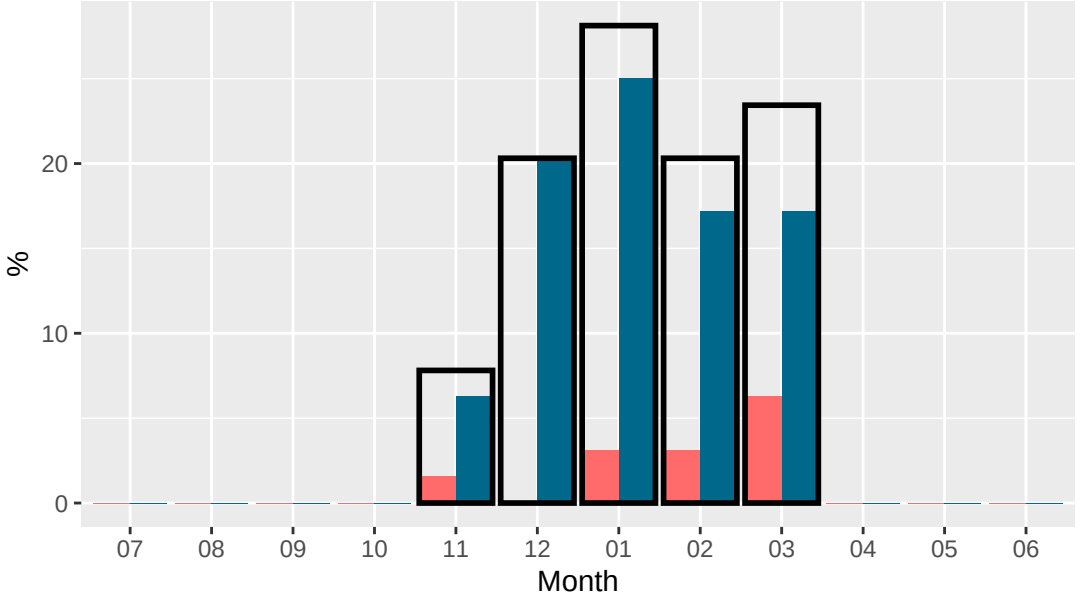

Season of runoff
Water−resources year
2020
2015
2010
2005
2000
1995
1990
1985
1980
1975
1970
1965
1960
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date
Spring
Summer
Winter
NA


Component of runoff
Water−resources year
2020
2015
2010
2005
2000
1995
1990
1985
1980
1975
1970
1965
1960
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date
Spring
Rain
Thaw
Ground
NA

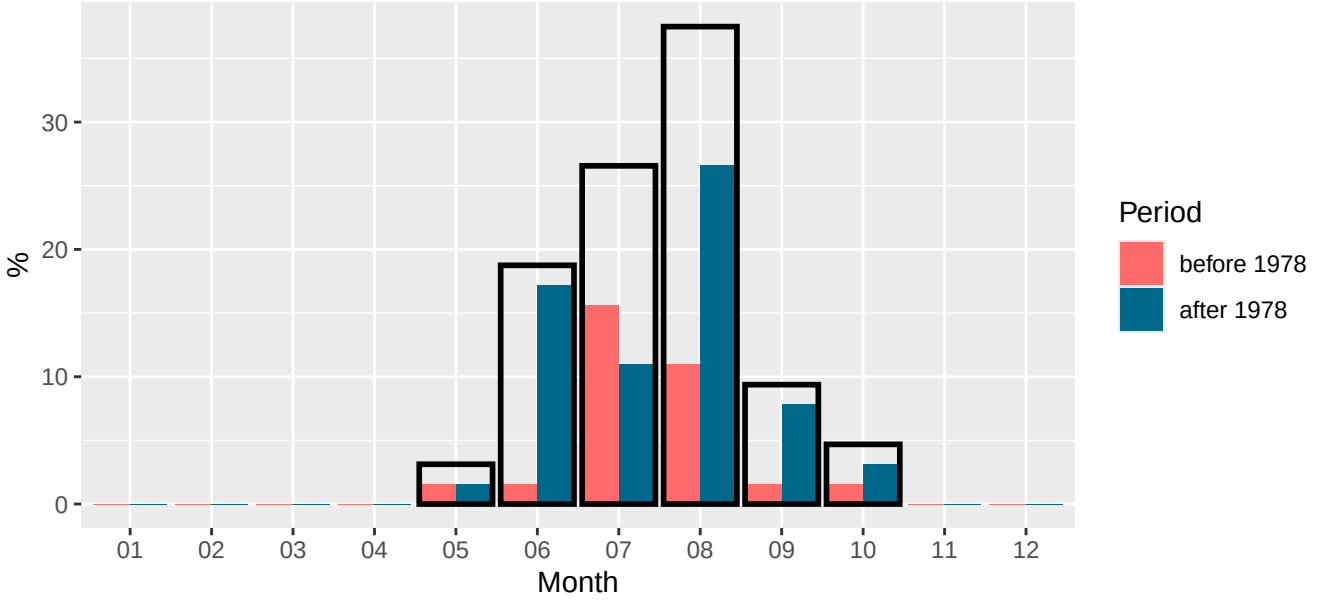
Month of a minimum monthly runoff during summer



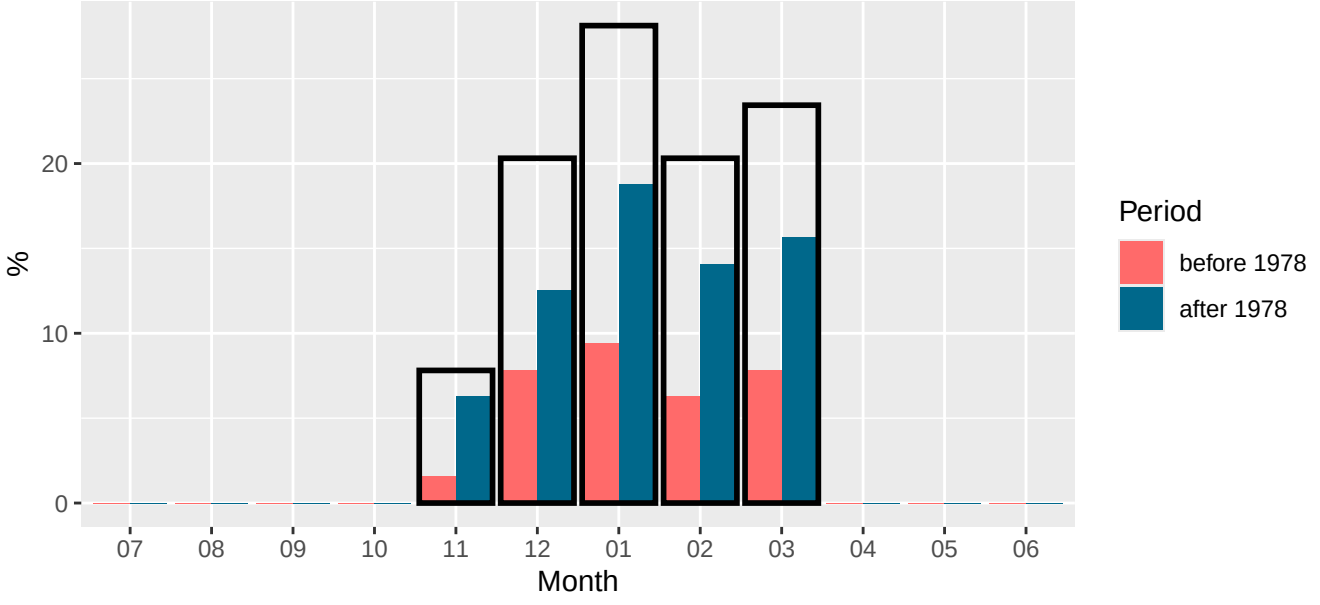
Month of a minimum monthly runoff during winter

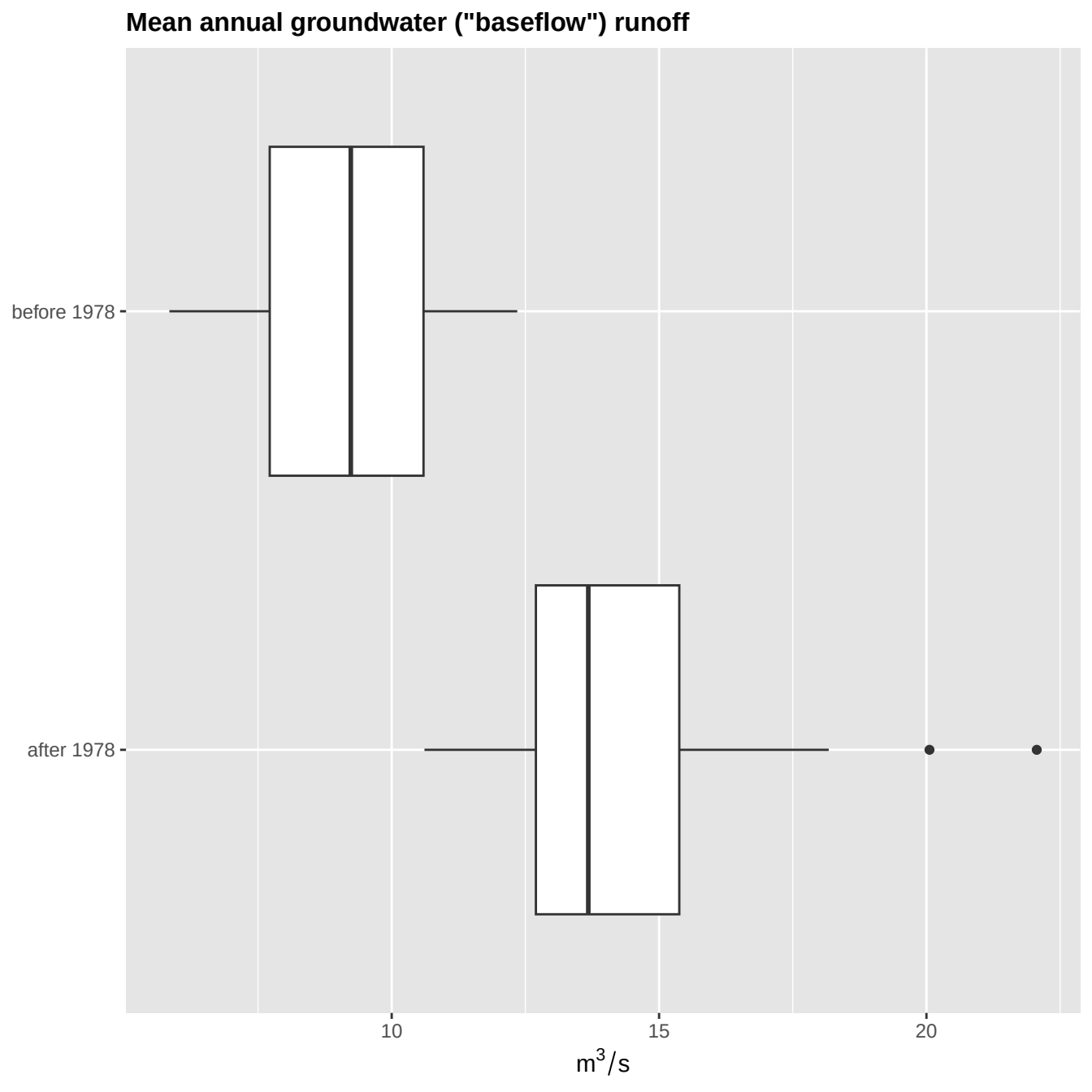


Month of a minimum monthly runoff during summer



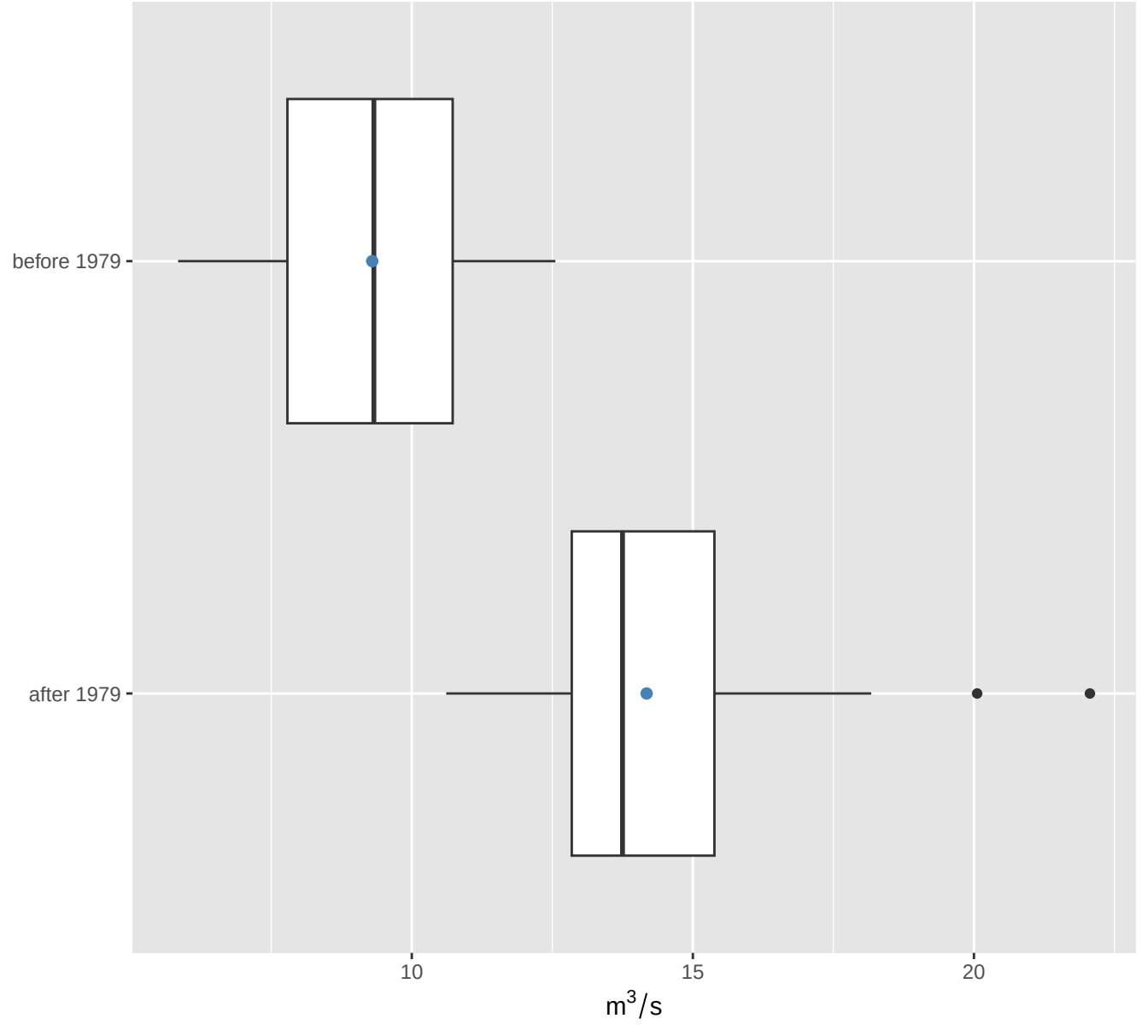
Month of a minimum monthly runoff during winter




Mean annual groundwater ("baseflow") runoff
before 1978
after 1978
10
15
20
m3/s

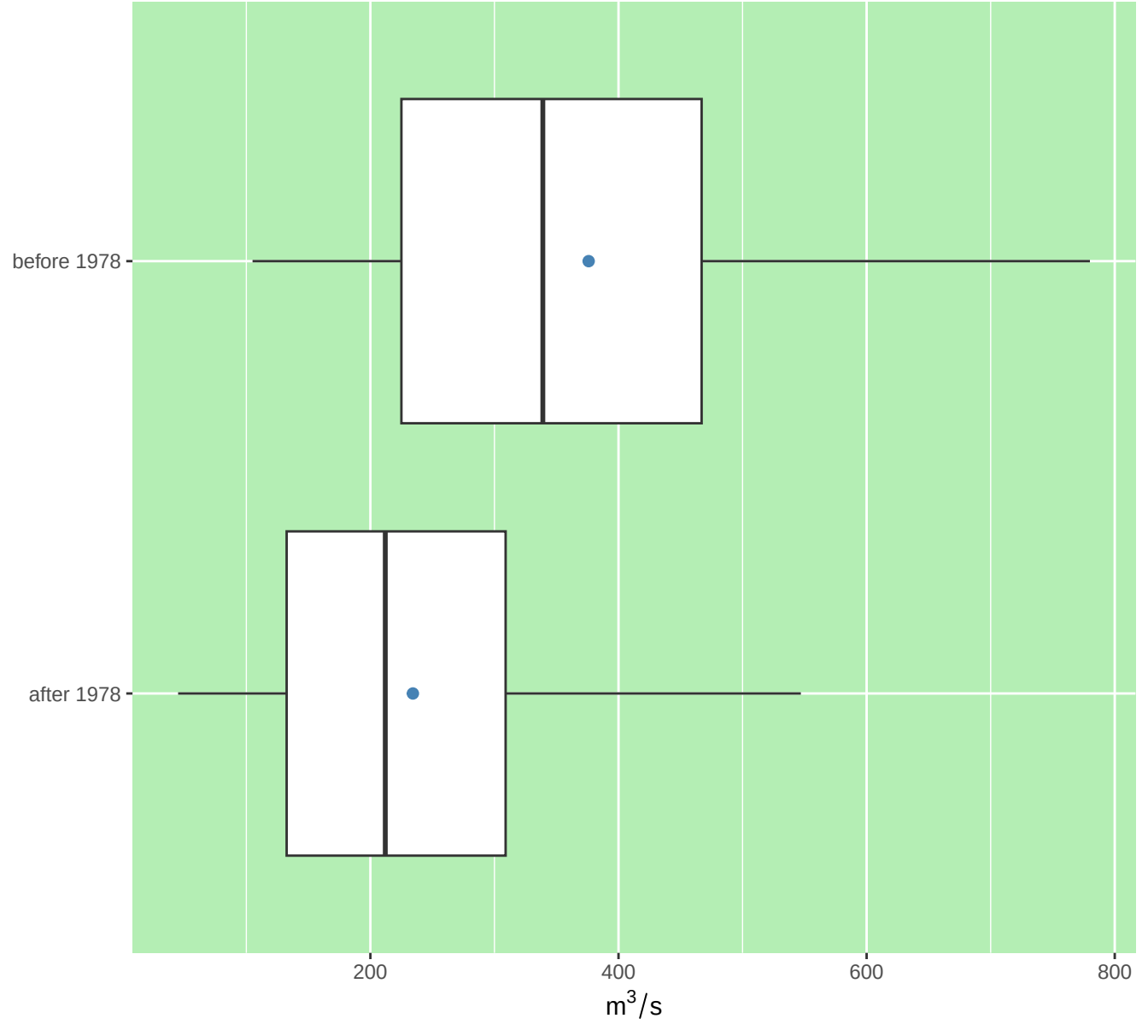
Mean annual groundwater ("baseflow") runoff

Student: t = −8.761, p = 0, m1 = 9.297, m2 = 14.177
Fisher: F = 0.569, p = 0.16762, cv1 = 0.203, cv2 = 0.176



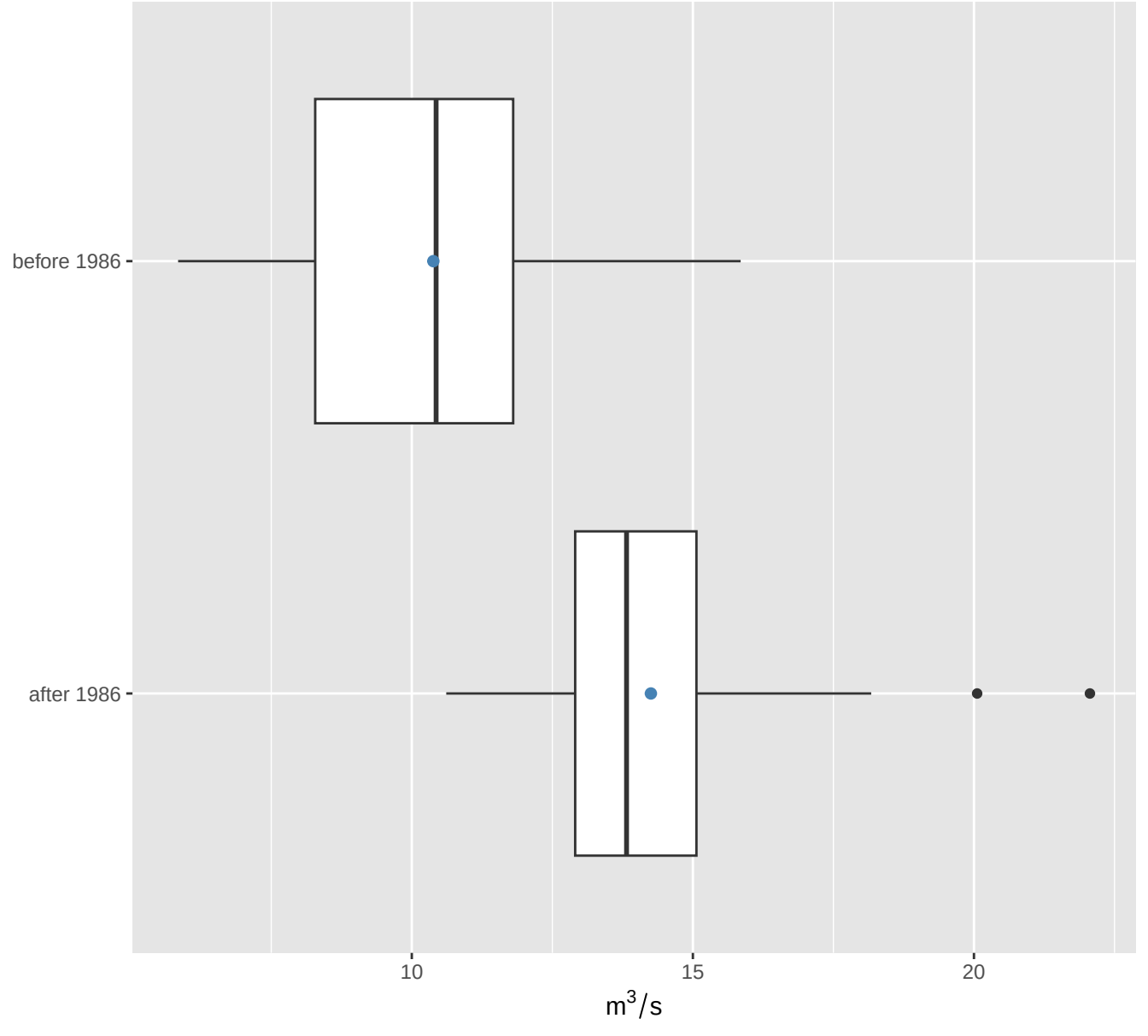
Maximum spring flood runoff

Student: t = −1.915, p = 0.06123, m1 = 375.952, m2 = 234.267
Fisher: F = 0.615, p = 0.24232, cv1 = 0.505, cv2 = 0.563



Mean annual groundwater ("baseflow") runoff

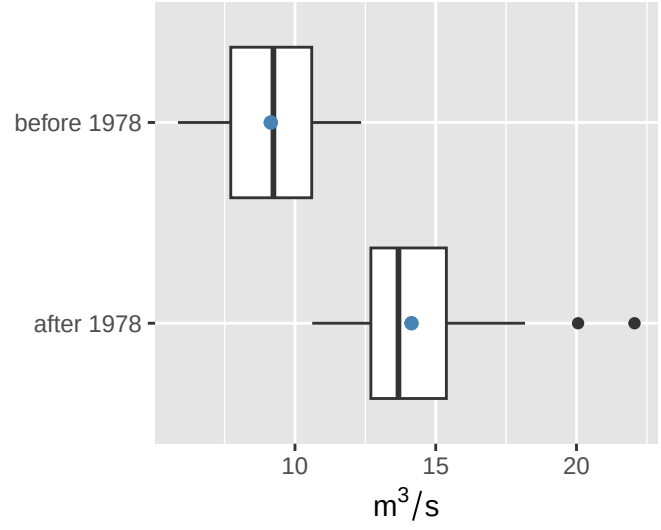
Student: t = 2.686, p = 0.00946, m1 = 10.383, m2 = 14.253
Fisher: F = 1.247, p = 0.5351, cv1 = 0.259, cv2 = 0.184



Mean annual groundwater ("basefl

Student: t = −1.915, p = 0.06123, m1 = 9

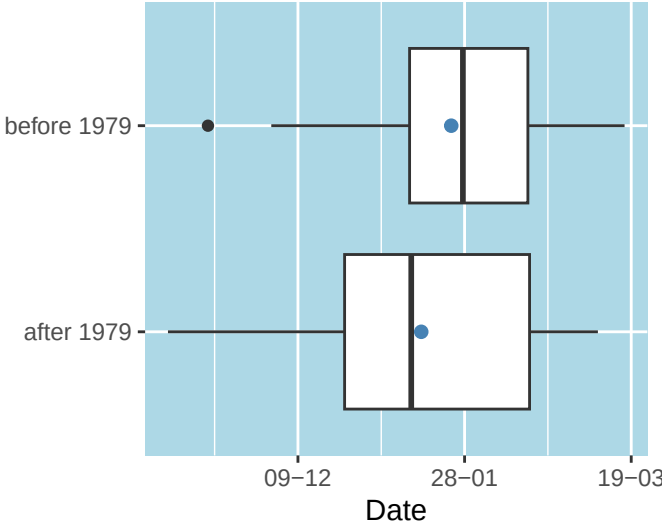
Fisher: F = 0.615, p = 0.24232, cv1 = 0.



First date of minimum 10−day aver

Student: t = −8.193, p = 0, m1 = 24−Jan

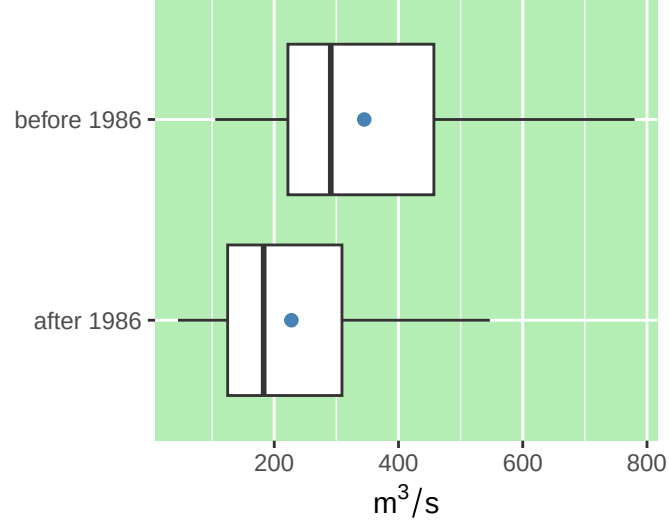
Fisher: F = 0.402, p = 0.02764, cv1 = 0.



Maximum spring flood runoff

Student: t = 2.686, p = 0.00946, m1 = 34

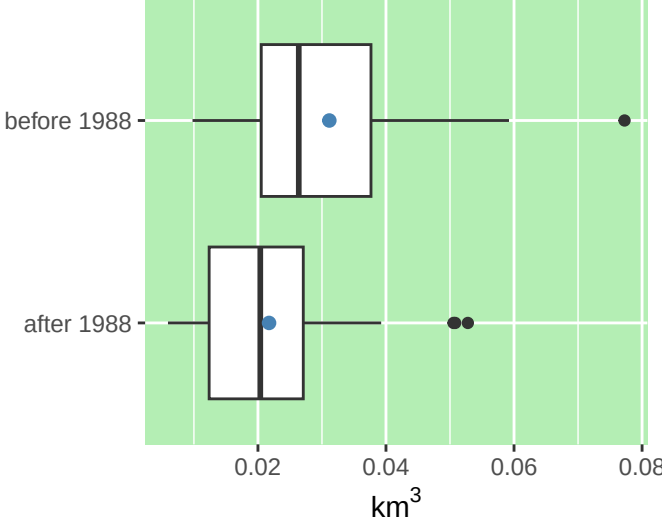
Fisher: F = 1.247, p = 0.5351, cv1 = 0.5

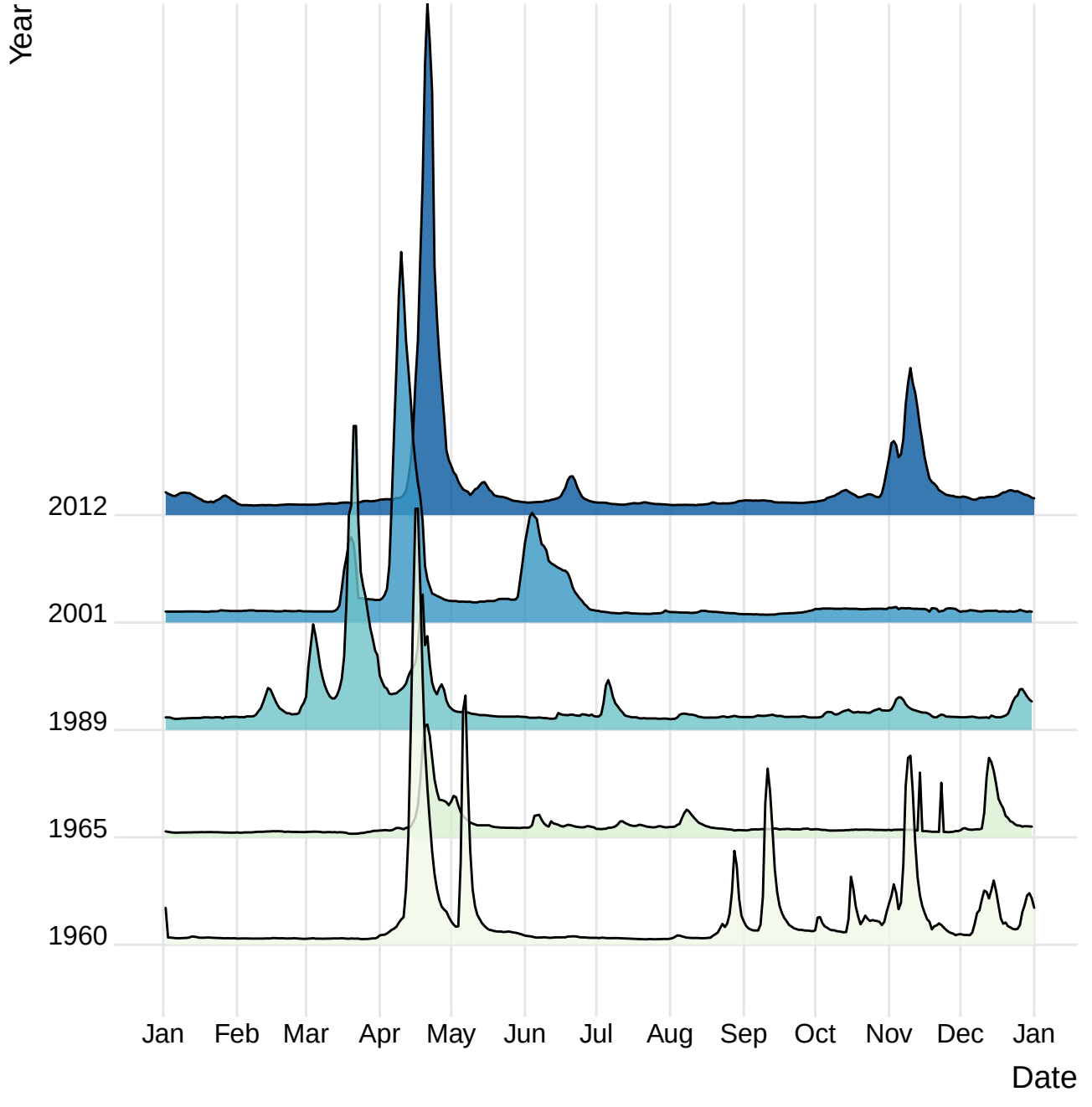


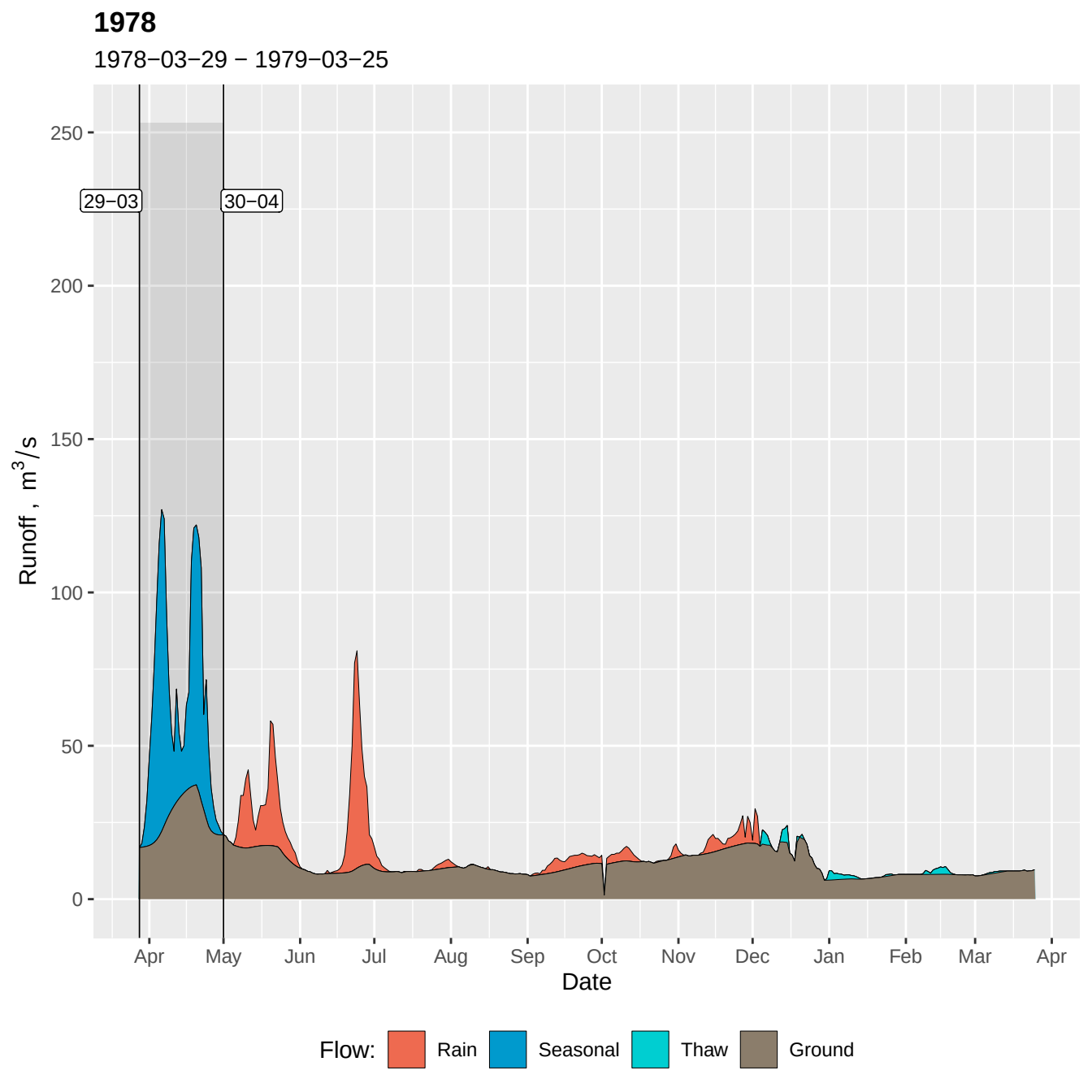
Spring flood runoff volume (with g

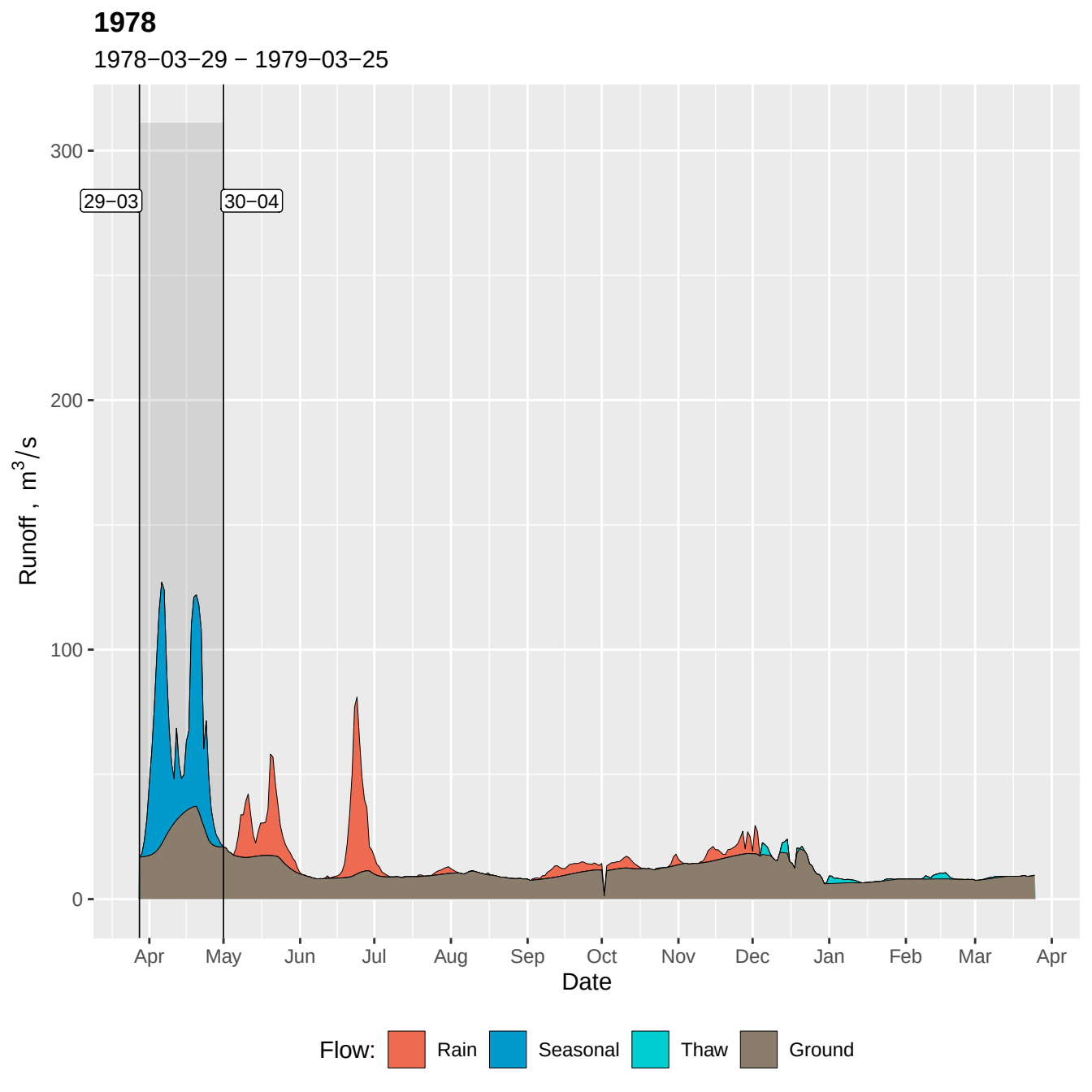
Student: t = 2.753, p = 0.00785, m1 = 0.

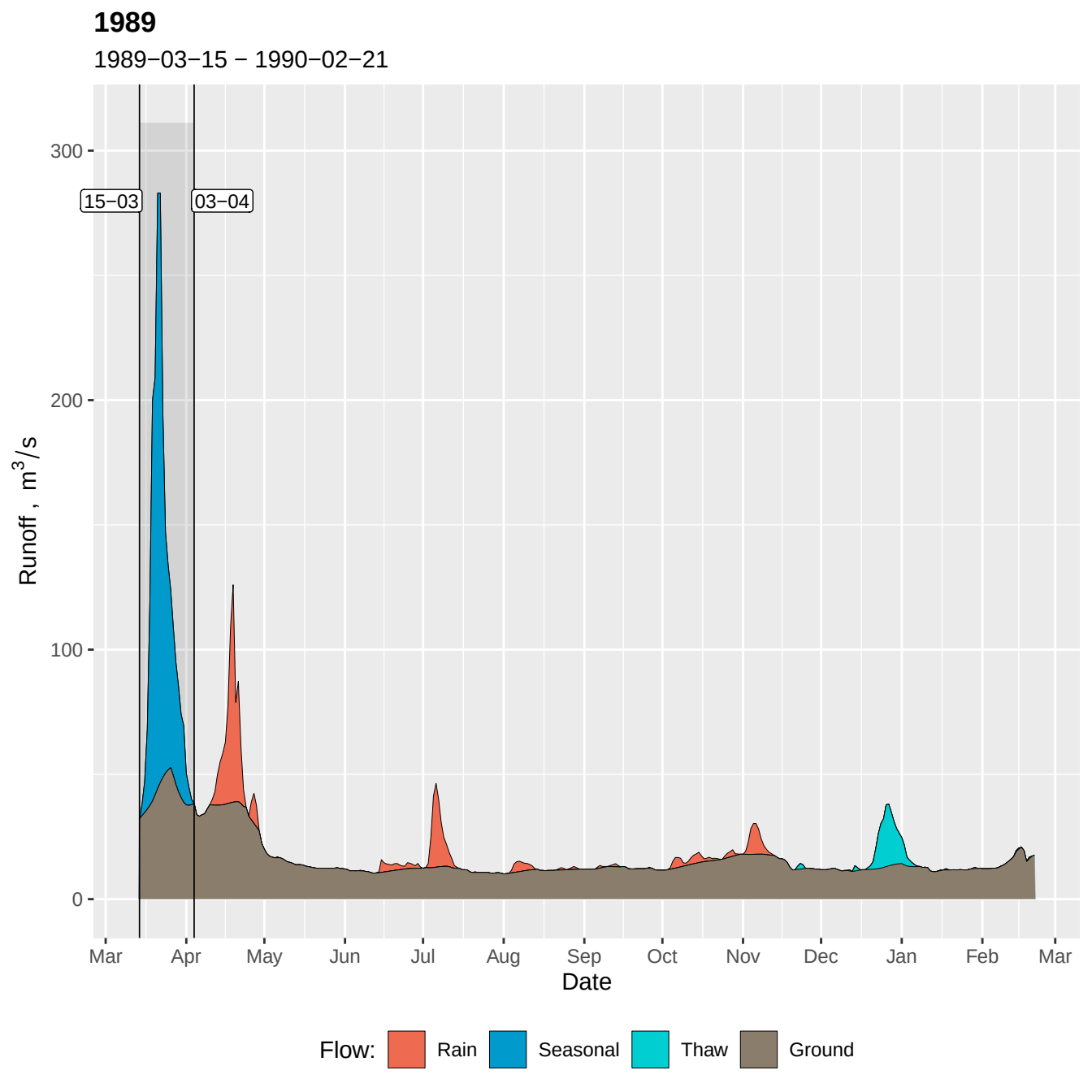
Fisher: F = 1.419, p = 0.33267, cv1 = 0.




Year
2012
2001
1989
1965
1960
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Date

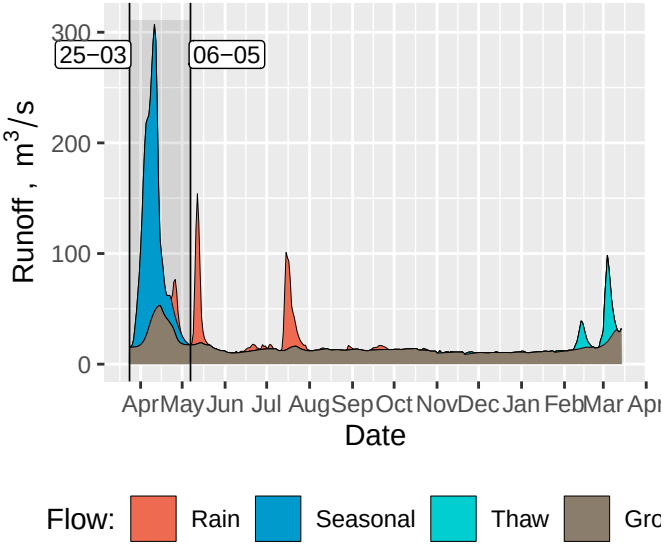

1978
1978−03−29 − 1979−03−25
29−03
30−04
250
200
150
100
50
0
Runoff , m3/s
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Date
Flow:
Rain
Seasonal
Thaw
Ground


1978
1978−03−29 − 1979−03−25
300
200
100
0
29−03
30−04
Runoff , m3/s
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Date
Flow:
Rain
Seasonal
Thaw
Ground


1989
1989−03−15 − 1990−02−21
300
200
100
0
15−03
03−04
Runoff , m3/s
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Date
Flow:
Rain
Seasonal
Thaw
Ground

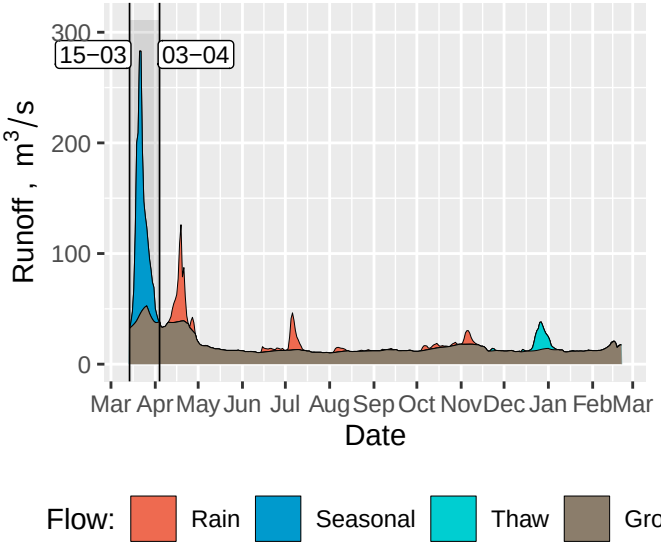
1988

1988−03−25 − 1989−03−14



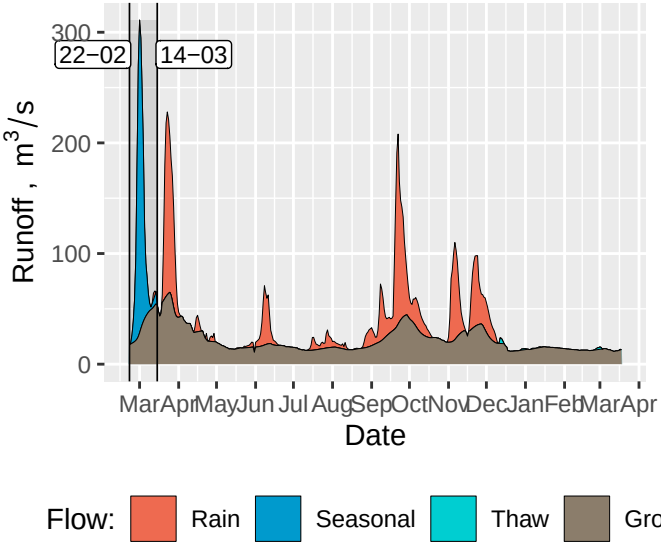
1989

1989−03−15 − 1990−02−21



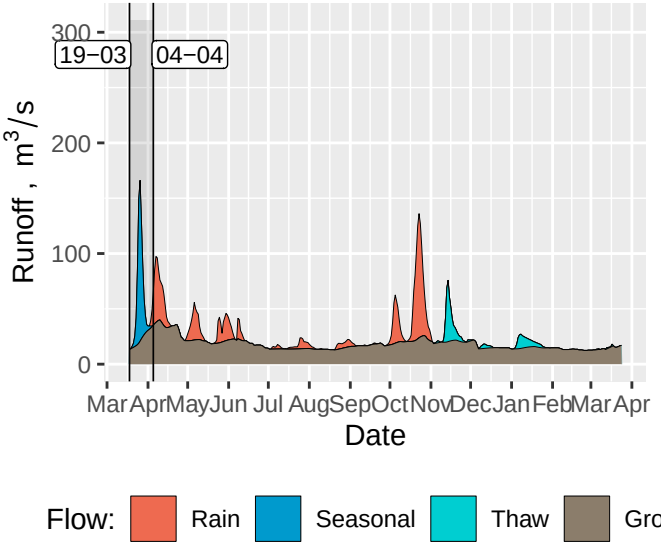
1990

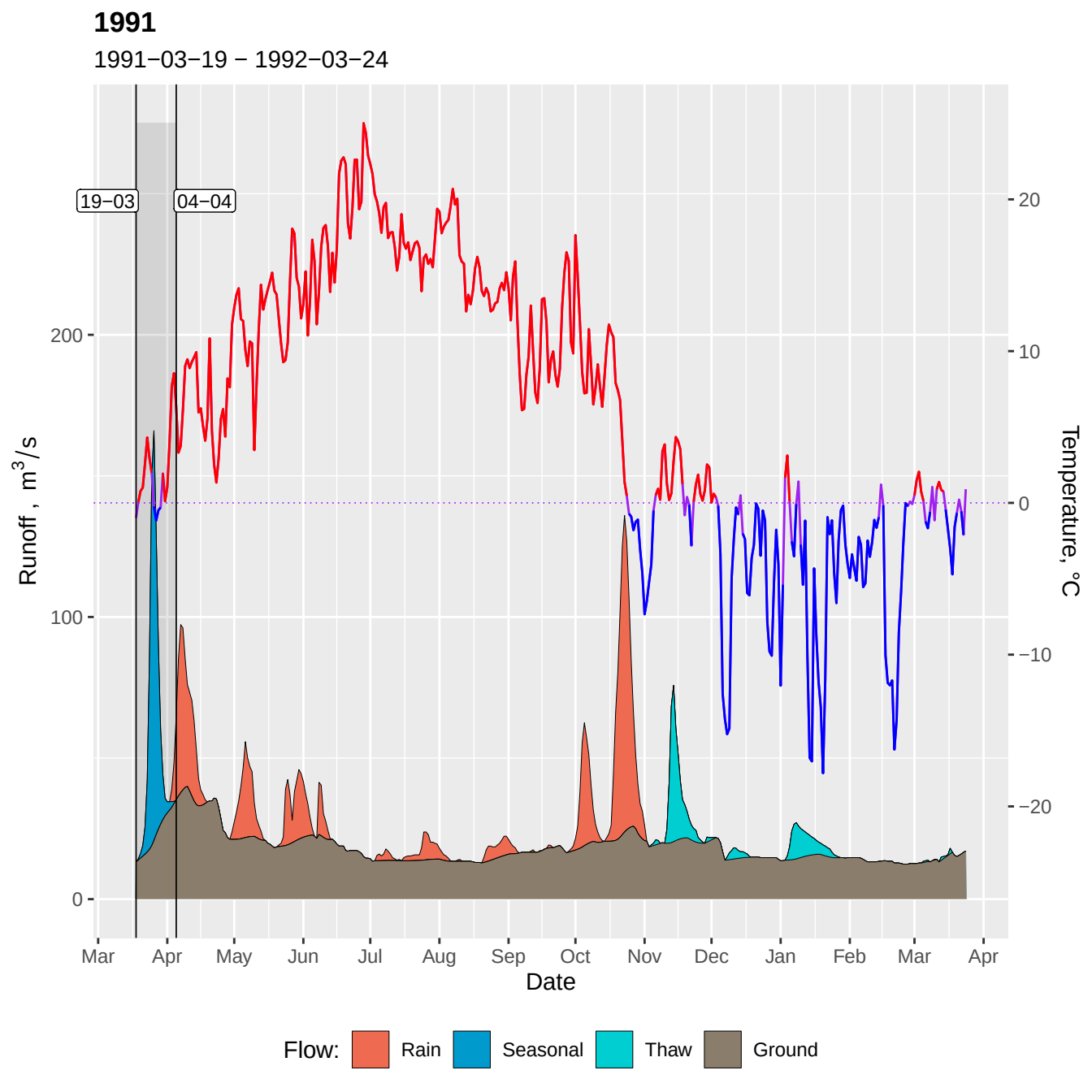
1990−02−22 − 1991−03−18

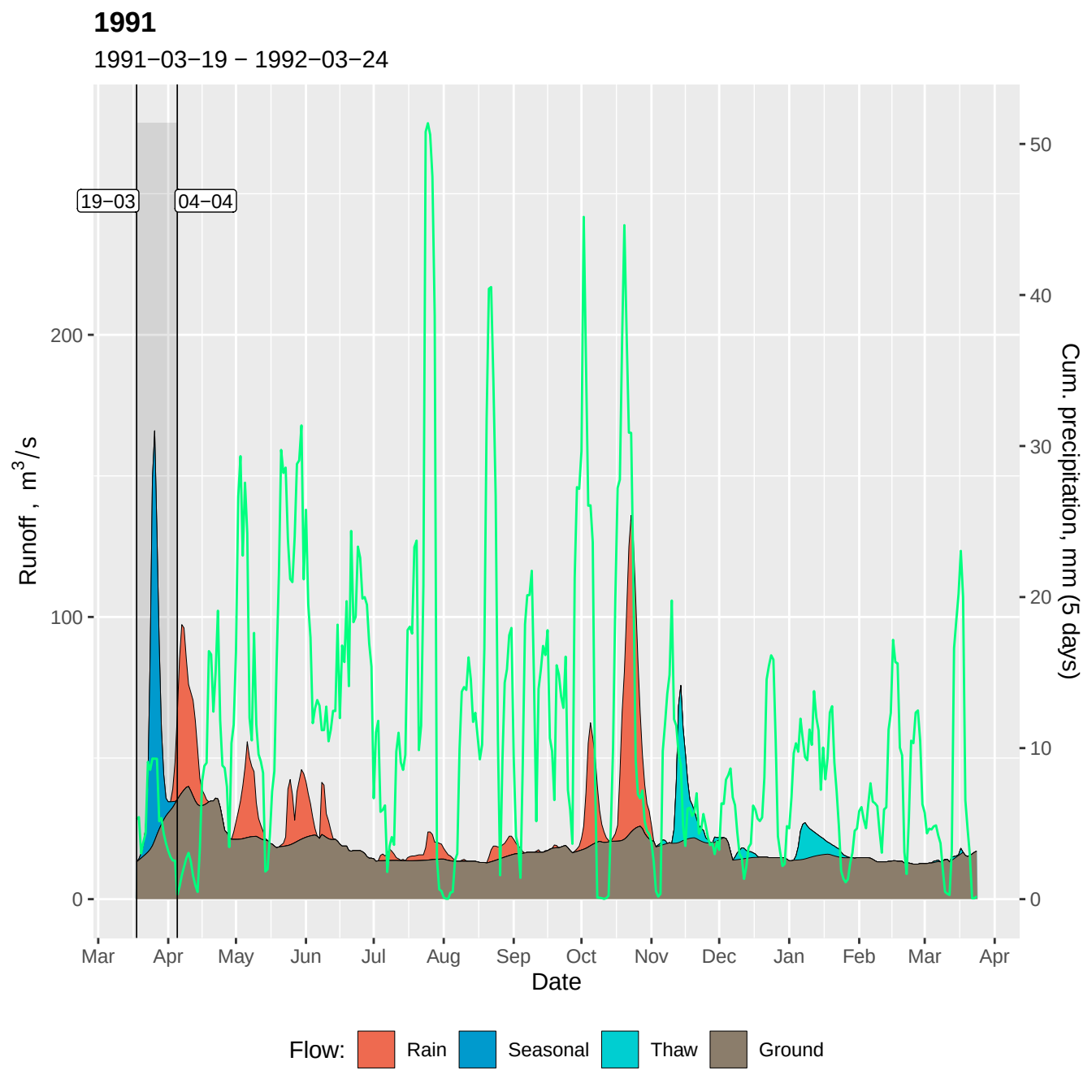


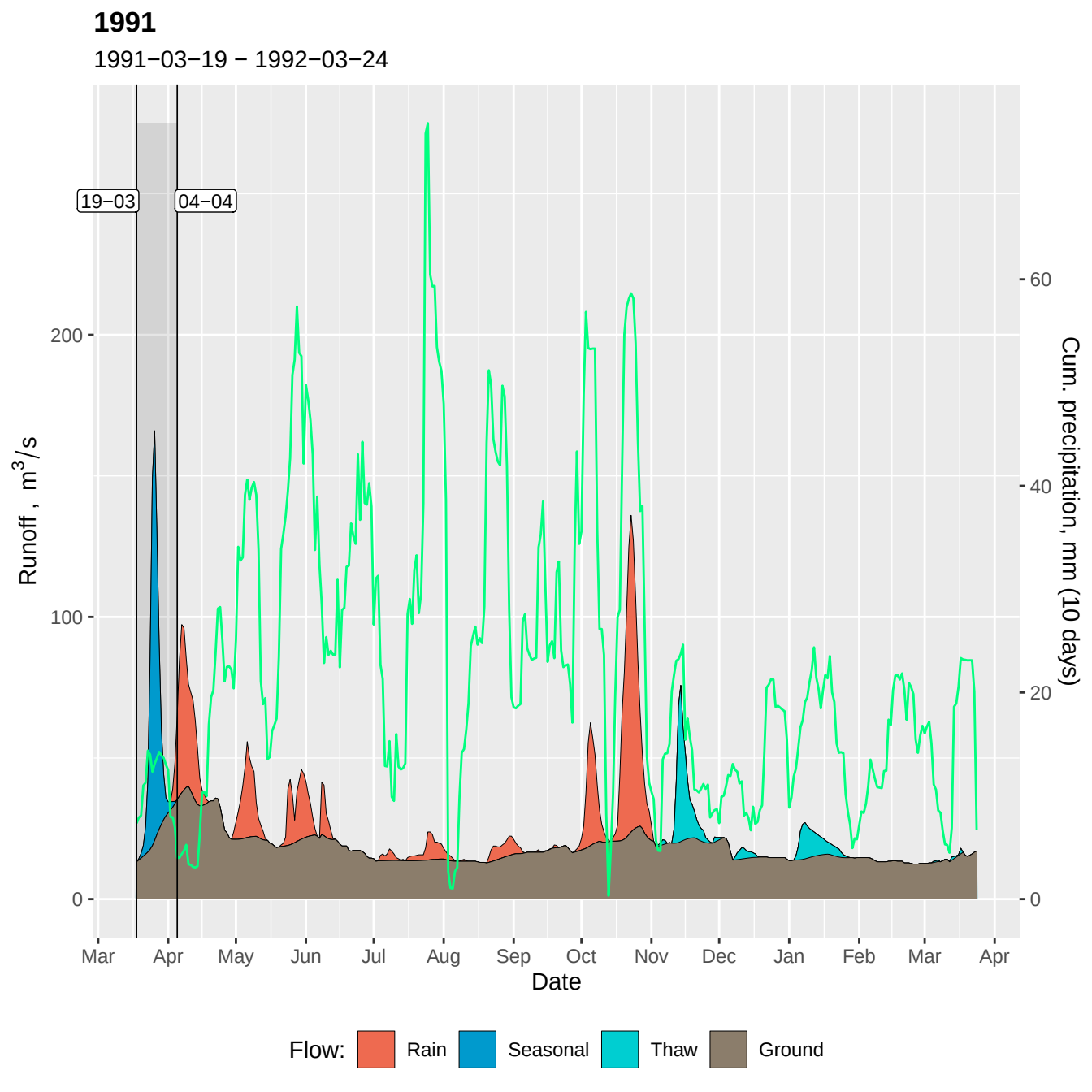
1991

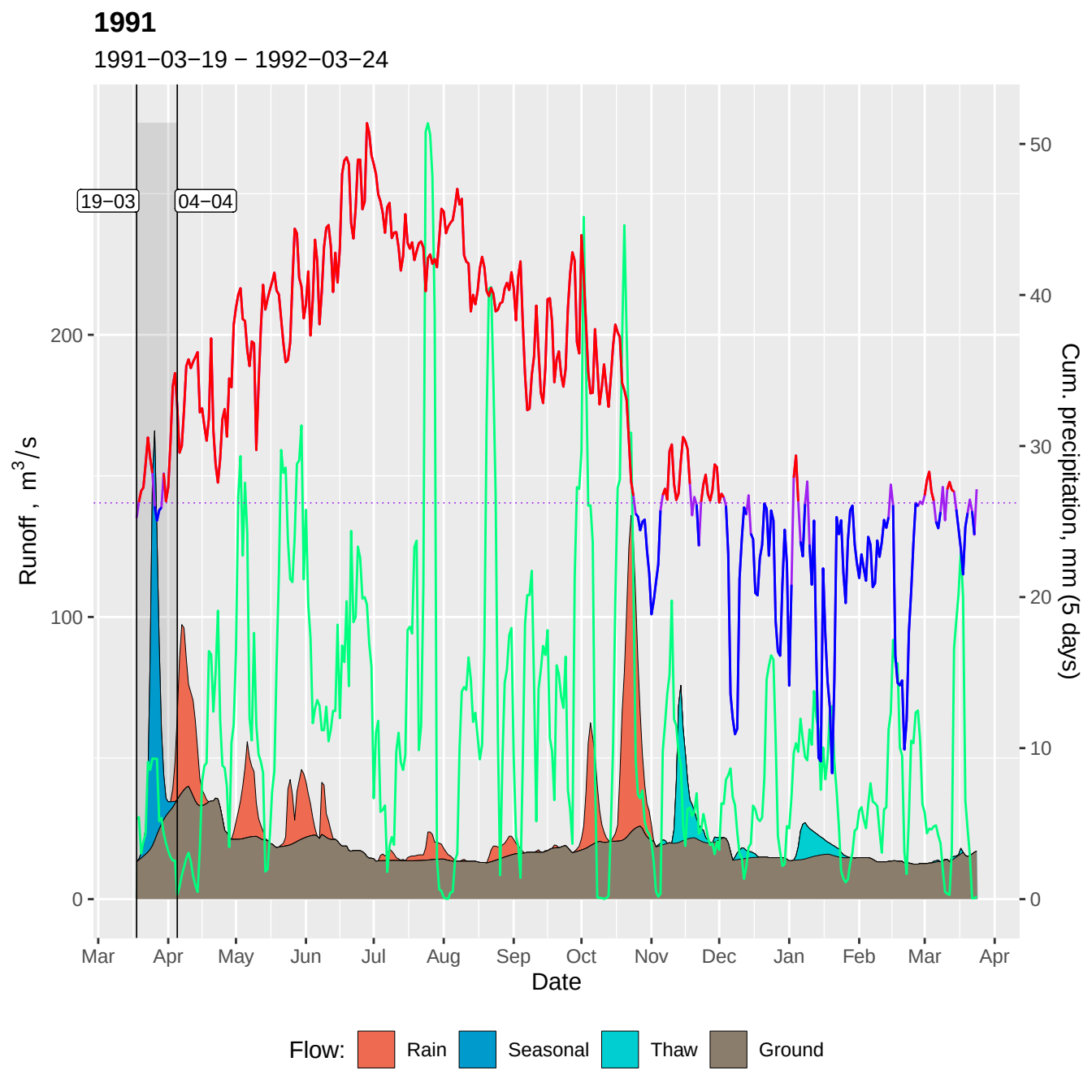
1991−03−19 − 1992−03−24

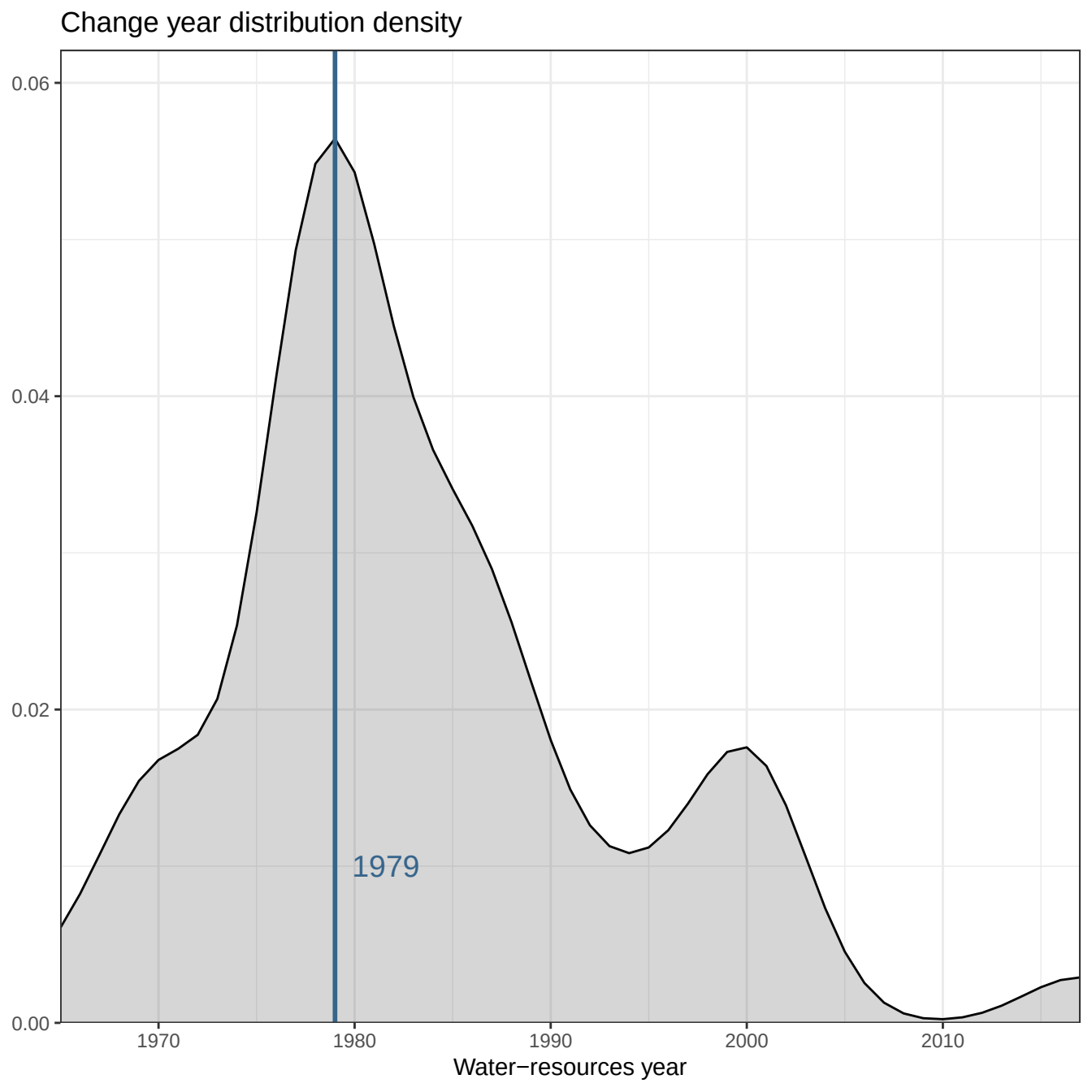


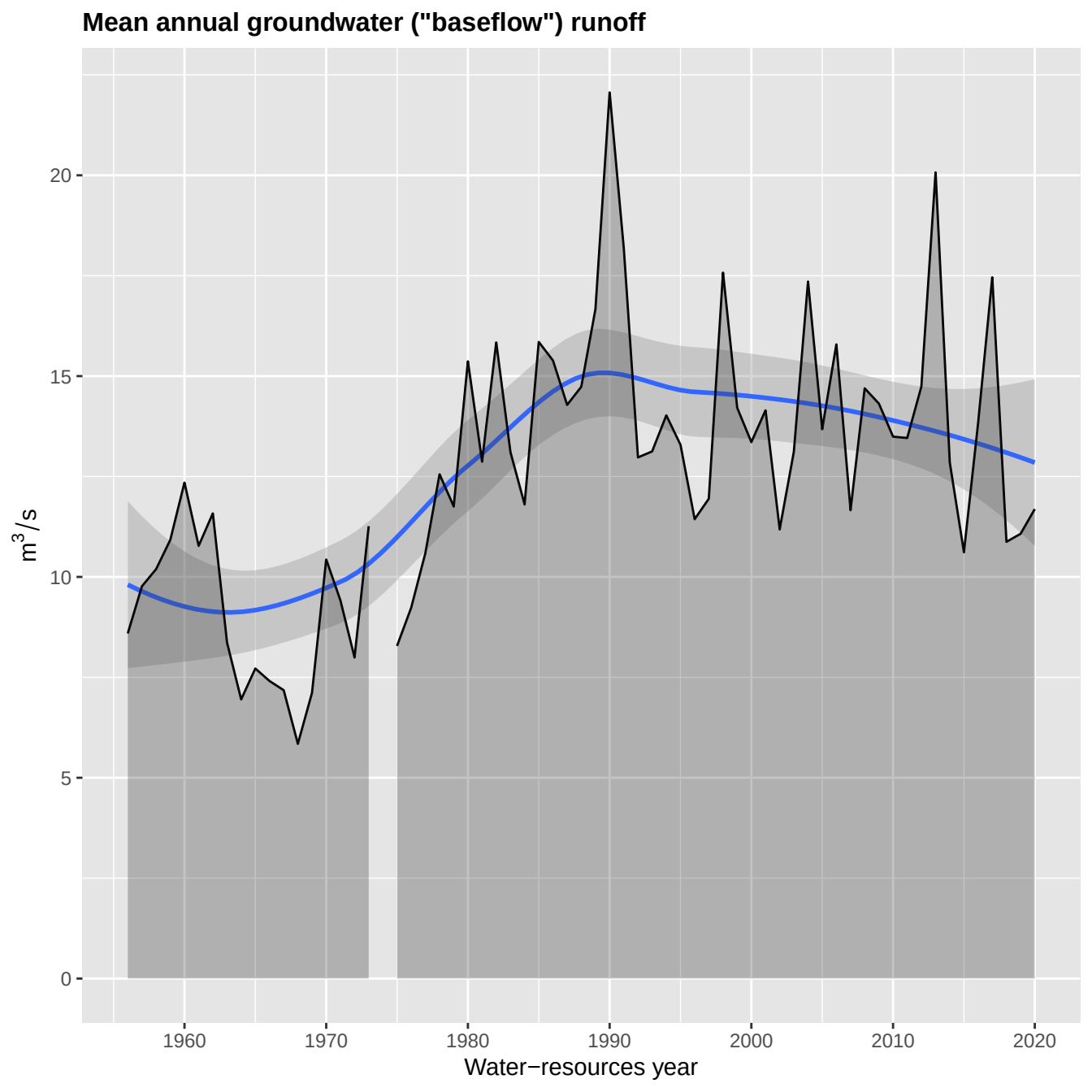

1991
1991−03−19 − 1992−03−24
19−03
04−04
200
100
0
Runoff , m3/s
20
10
0
−10
−20
Temperature, °C
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Date
Flow:
Rain
Seasonal
Thaw
Ground

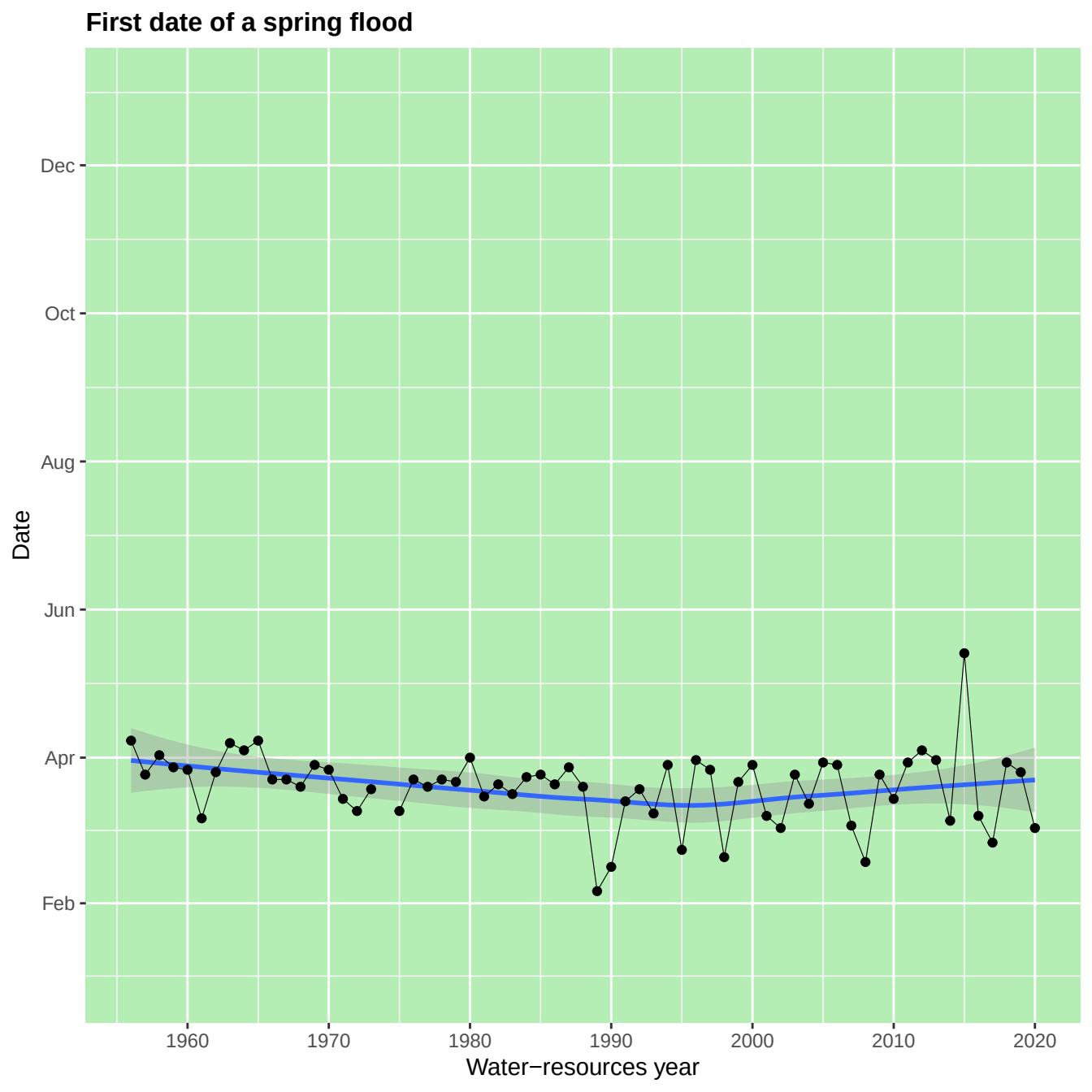

1991
1991−03−19 − 1992−03−24
19−03
04−04
200
100
0
Runoff , m3/s
50
40
30
20
10
0
Cum. precipitation, mm (5 days)
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Date
Flow:
Rain
Seasonal
Thaw
Ground

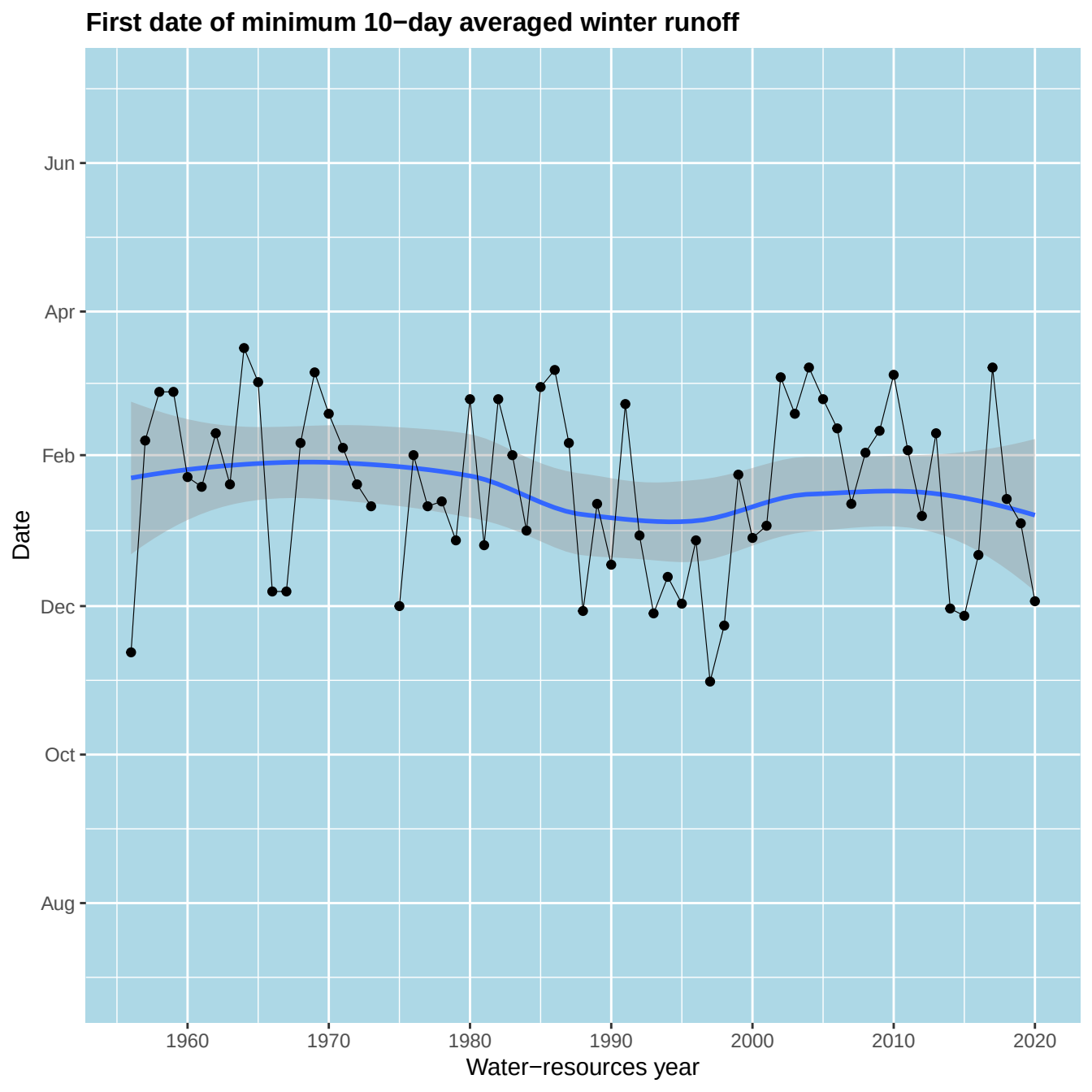

1991
1991−03−19 − 1992−03−24
19−03
04−04
200
100
0
Runoff , m3/s
60
40
20
0
Cum. precipitation, mm (10 days)
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Date
Flow:
Rain
Seasonal
Thaw
Ground

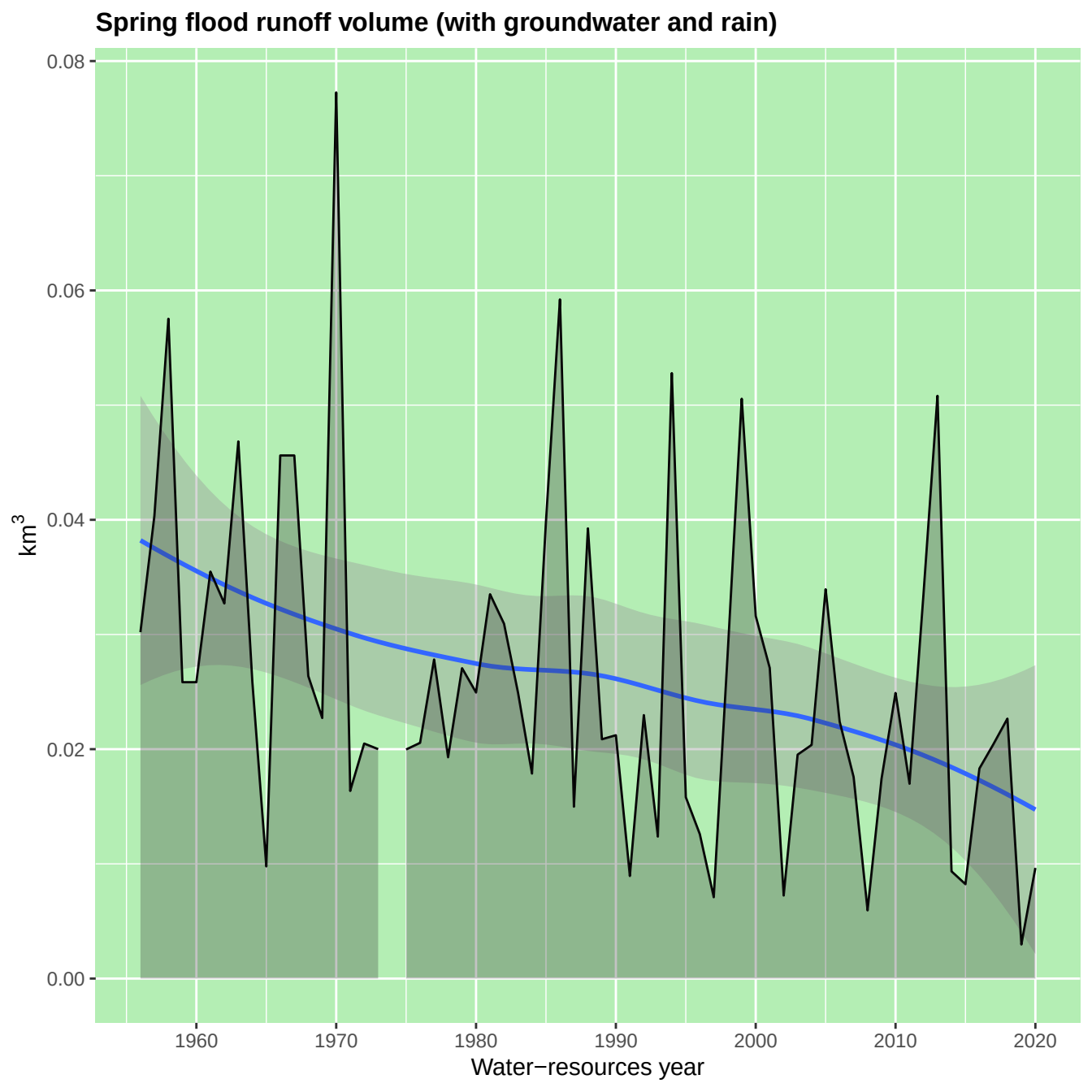

1991
1991−03−19 − 1992−03−24
19−03
04−04
200
100
0
Runoff , m3/s
50
40
30
20
10
0
Cum. precipitation, mm (5 days)
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Date
Flow:
Rain
Seasonal
Thaw
Ground

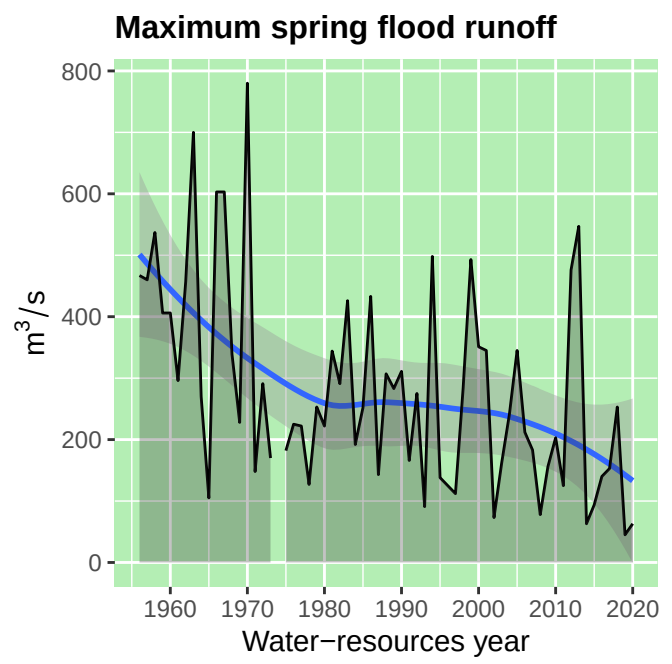

Change year distribution density
0.06
0.04
0.02
0.00
1979
1970
1980
1990
2000
2010
Water−resources year

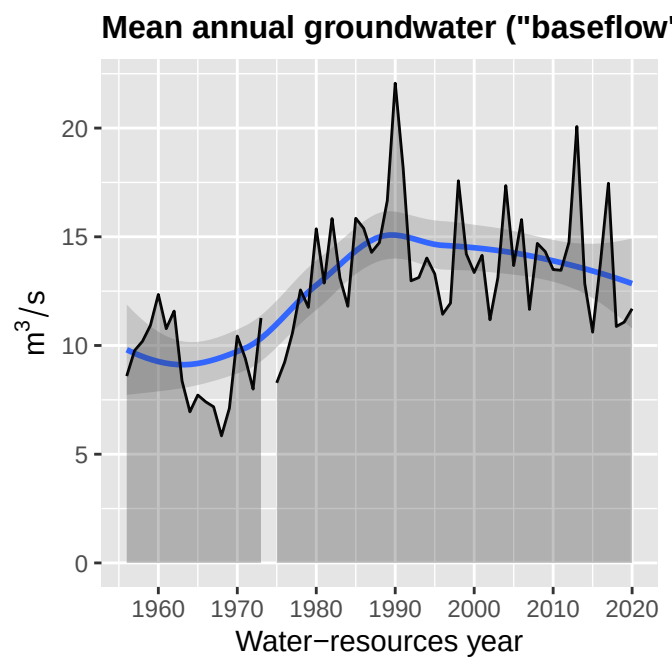

Mean annual groundwater ("baseflow") runoff
m3/s
0
5
10
15
20
1960
1970
1980
1990
2000
2010
2020
Water−resources year

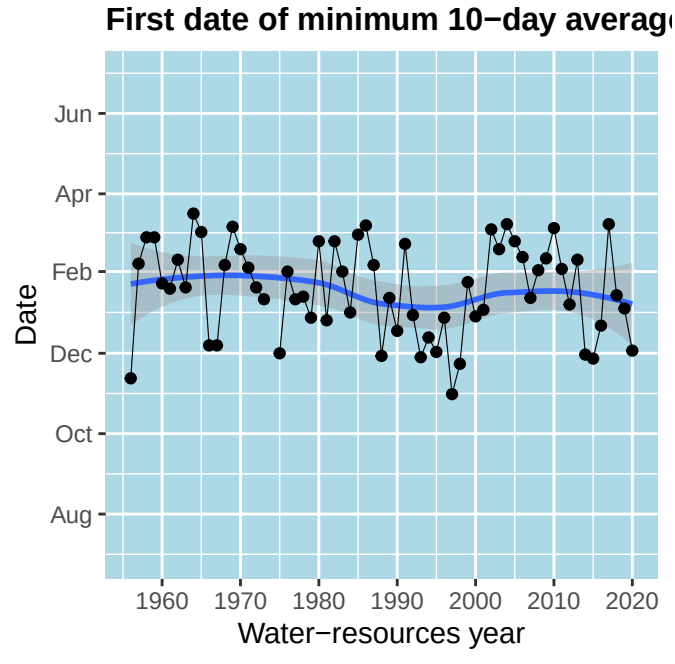

First date of a spring flood
Dec
Oct
Aug
Jun
Apr
Feb
Date
1960
1970
1980
1990
2000
2010
2020
Water−resources year

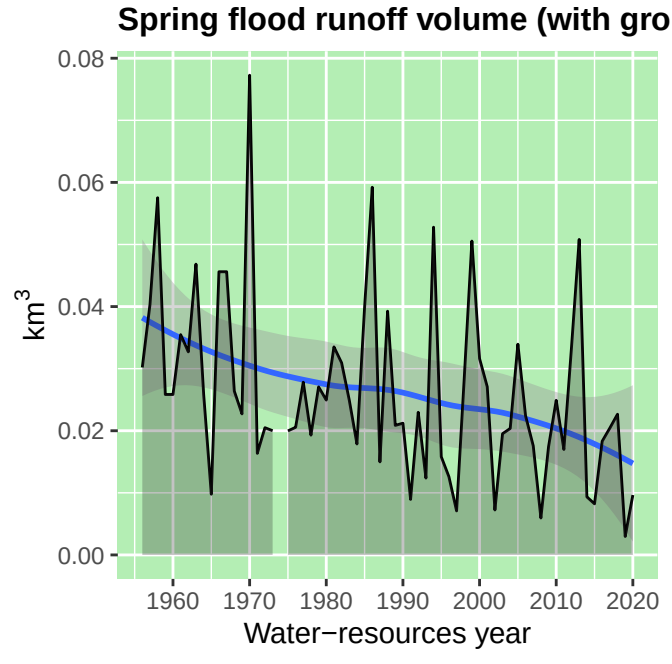

First date of minimum 10−day averaged winter runoff
Jun
Apr
Feb
Dec
Oct
Aug
Date
1960
1970
1980
1990
2000
2010
2020
Water−resources year


Spring flood runoff volume (with groundwater and rain)
0.08
0.06
0.04
0.02
0.00
km3
1960
1970
1980
1990
2000
2010
2020
Water−resources year


Maximum spring flood runoff
m3/s
800
600
400
200
0
1960
1970
1980
1990
2000
2010
2020
Water−resources year

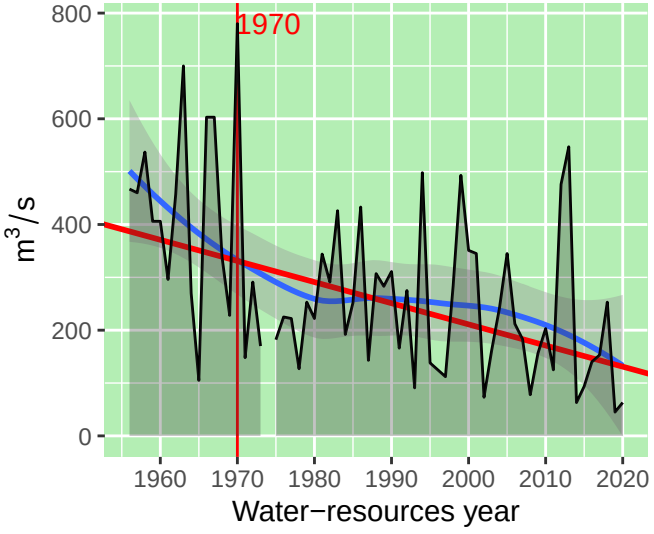

Mean annual groundwater ("baseflow"
m3/s
20
15
10
5
0
1960
1970
1980
1990
2000
2010
2020
Water−resources year


First date of minimum 10−day averag
Date
Jun
Apr
Feb
Dec
Oct
Aug
1960
1970
1980
1990
2000
2010
2020
Water−resources year


Spring flood runoff volume (with gro
km3
0.08
0.06
0.04
0.02
0.00
1960
1970
1980
1990
2000
2010
2020
Water−resources year

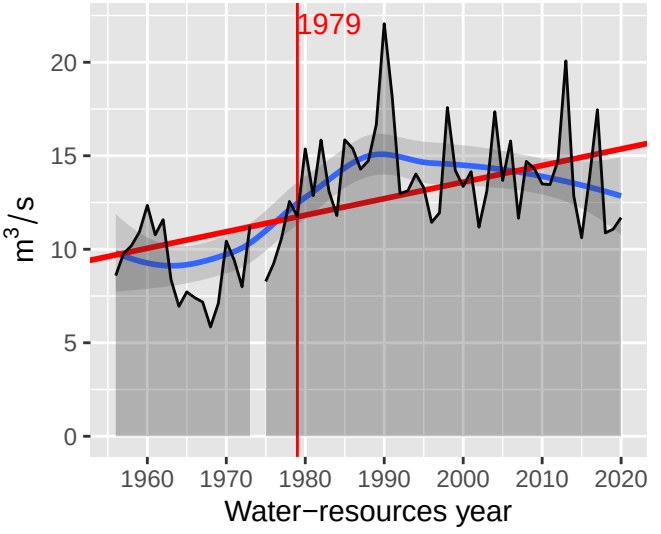
Maximum spring flood runoff

Mann−Kendall: z = −3.946, p = 8e−05
Theil−Sen: i = −4, p = 0. Pettitt: U* = 481, p



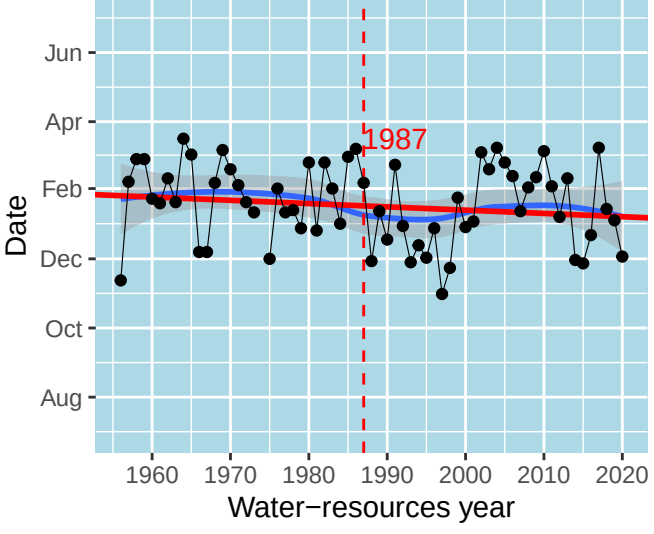
Mean annual groundwater ("baseflow"

Mann−Kendall: z = 4.374, p = 1e−05
Theil−Sen: i = 0.08852, p = 0. Pettitt: U* = 80



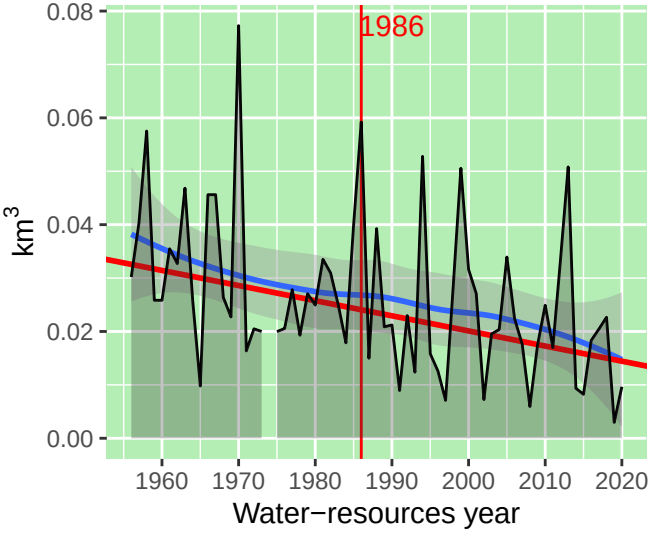
First date of minimum 10−day averag

Mann−Kendall: z = −1.142, p = 0.25361
Theil−Sen: i = −0.2892, p = 4e−05. Pettitt: U



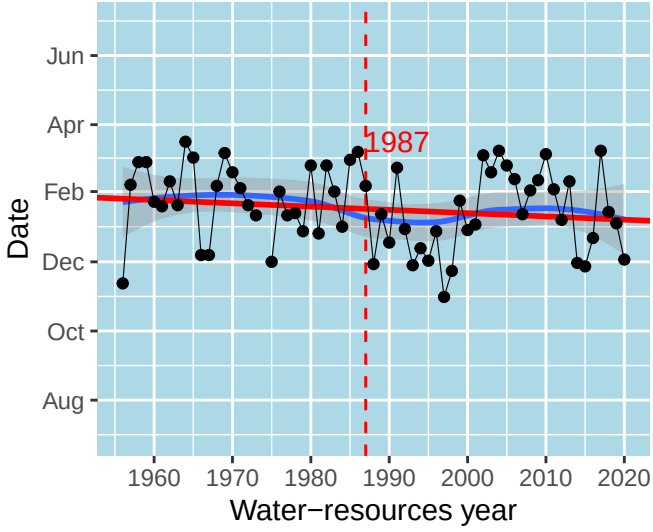
Spring flood runoff volume (with gro

Mann−Kendall: z = −3.372, p = 0.00075
Theil−Sen: i = −0.00028, p = 0. Pettitt: U* =



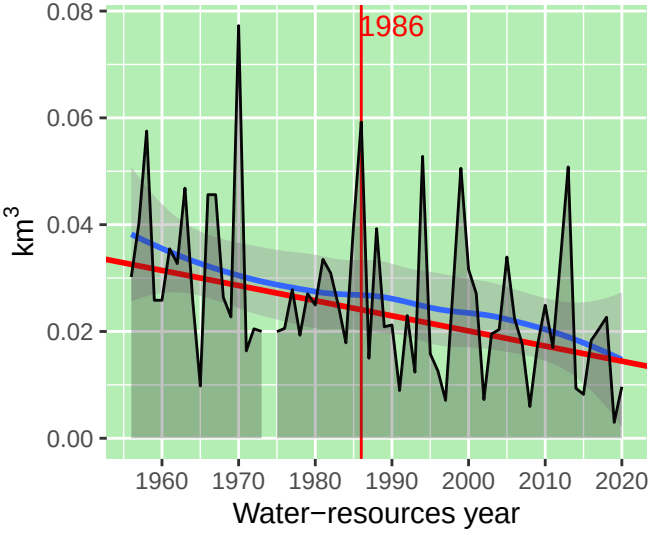
First date of minimum 10−day averag

Mann−Kendall: z = −1.142, p = 0.25361
Theil−Sen: i = −0.2892, p = 4e−05. Pettitt: U



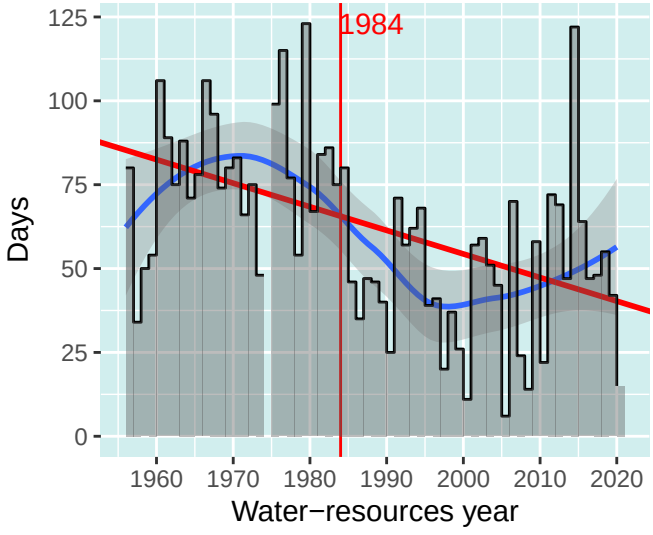
Spring flood runoff volume (with gro

Mann−Kendall: z = −3.372, p = 0.00075
Theil−Sen: i = −0.00028, p = 0. Pettitt: U* =



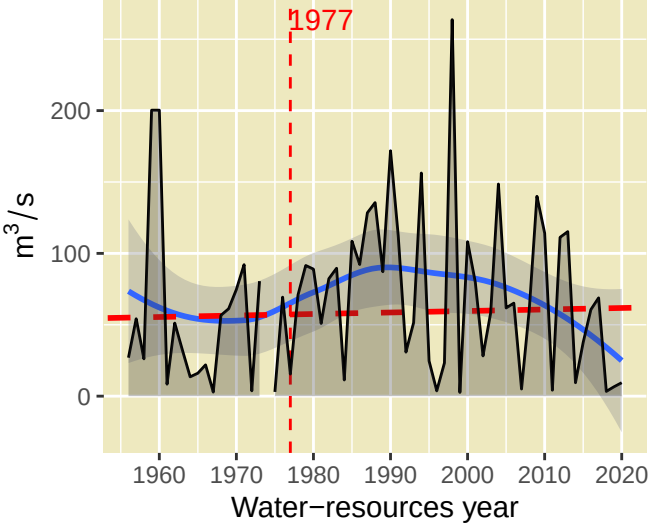
Number of thaw flood days

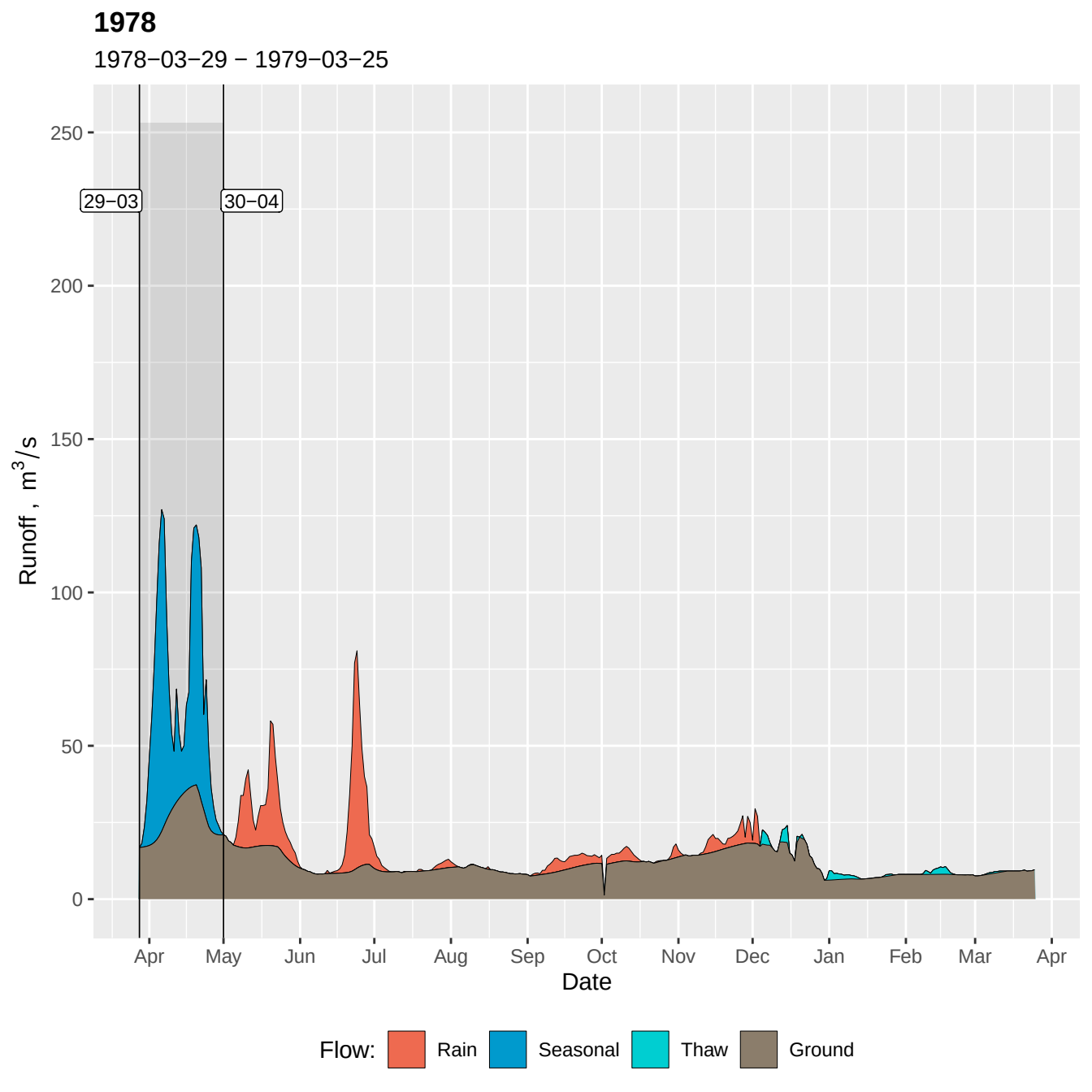
Mann−Kendall: z = −4.08, p = 5e−05
Theil−Sen: i = −0.7032, p = 0. Pettitt: U* = 7



Maximum rain flood runoff

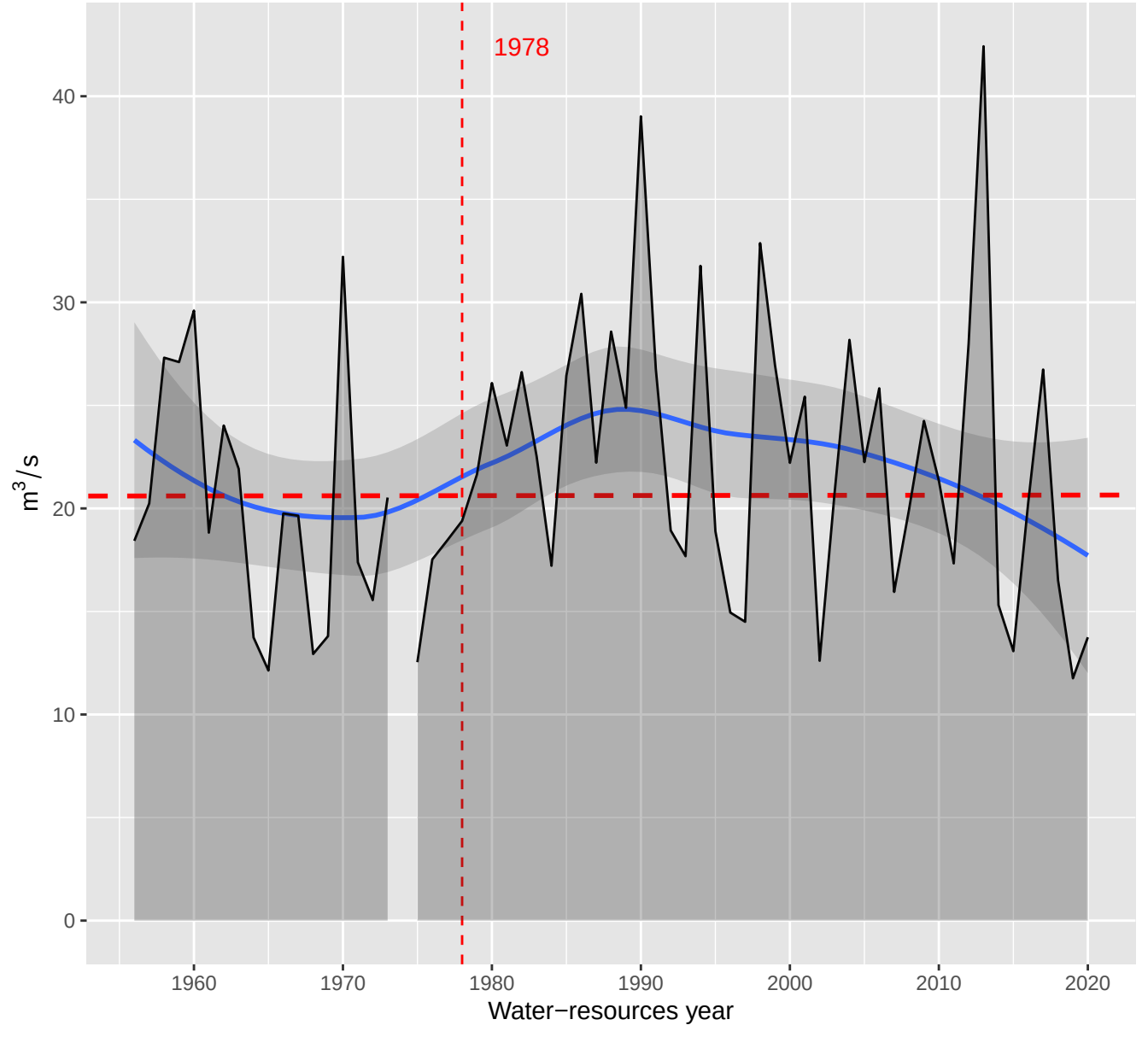
Mann−Kendall: z = 0.411, p = 0.68081
Theil−Sen: i = 0.10523, p = 0.17458. Pettitt




1978
1978−03−29 − 1979−03−25
29−03
30−04
250
200
150
100
50
0
Runoff , m3/s
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Date
Flow:
Rain
Seasonal
Thaw
Ground

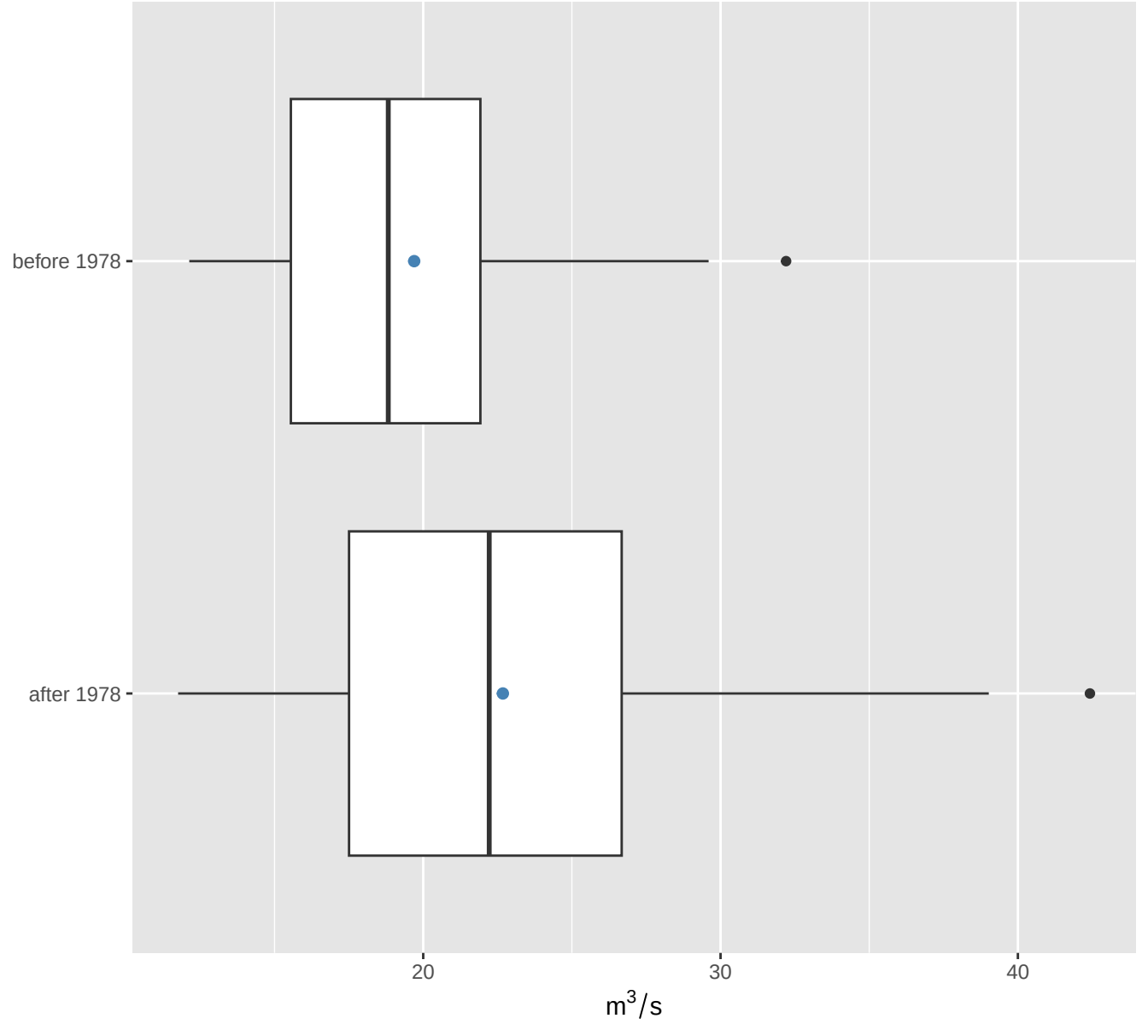
Mean annual runoff

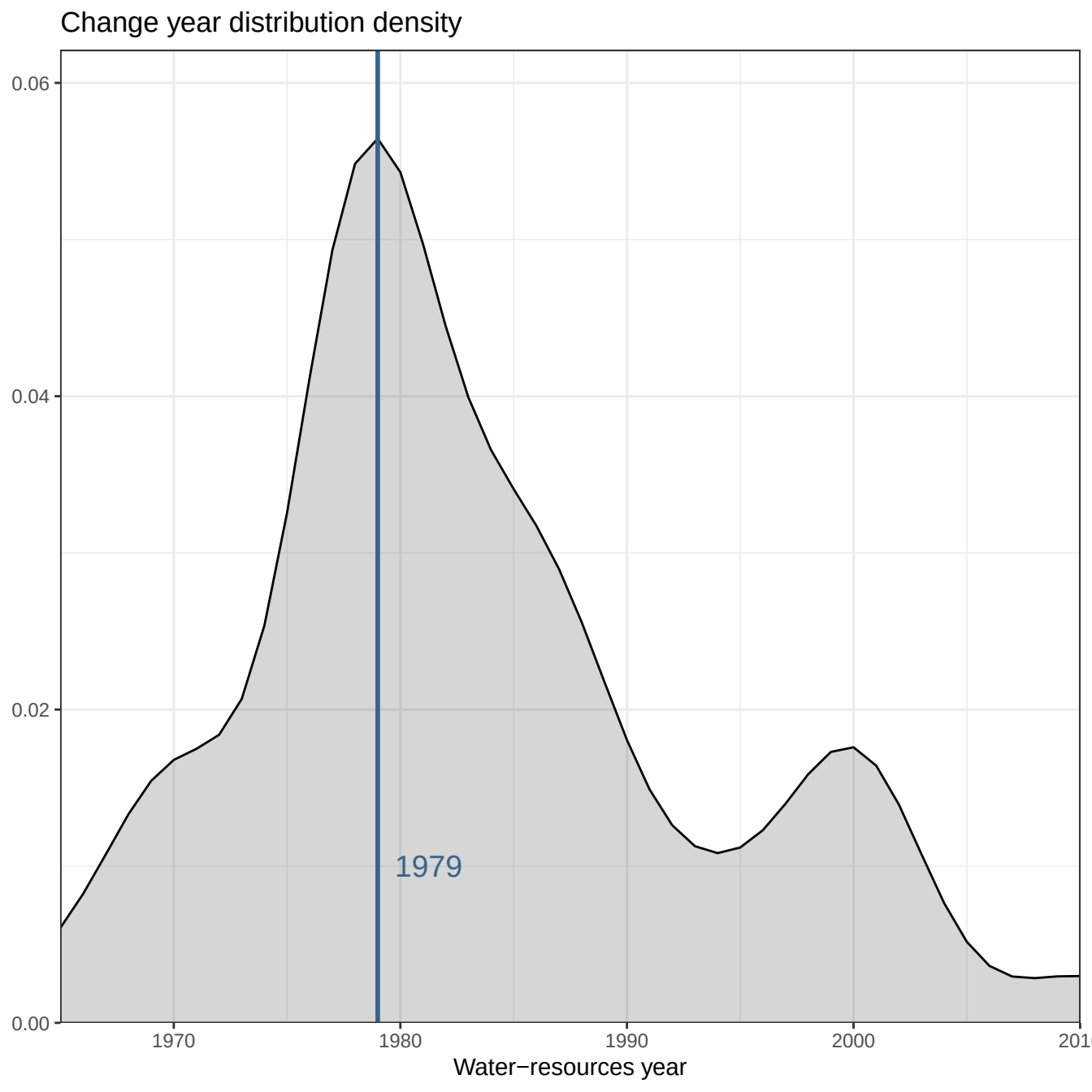
Mann−Kendall: z = 0.017, p = 0.98613
Theil−Sen: i = 0.00067, p = 0.71842. Pettitt: U* = 252, p = 0.47808



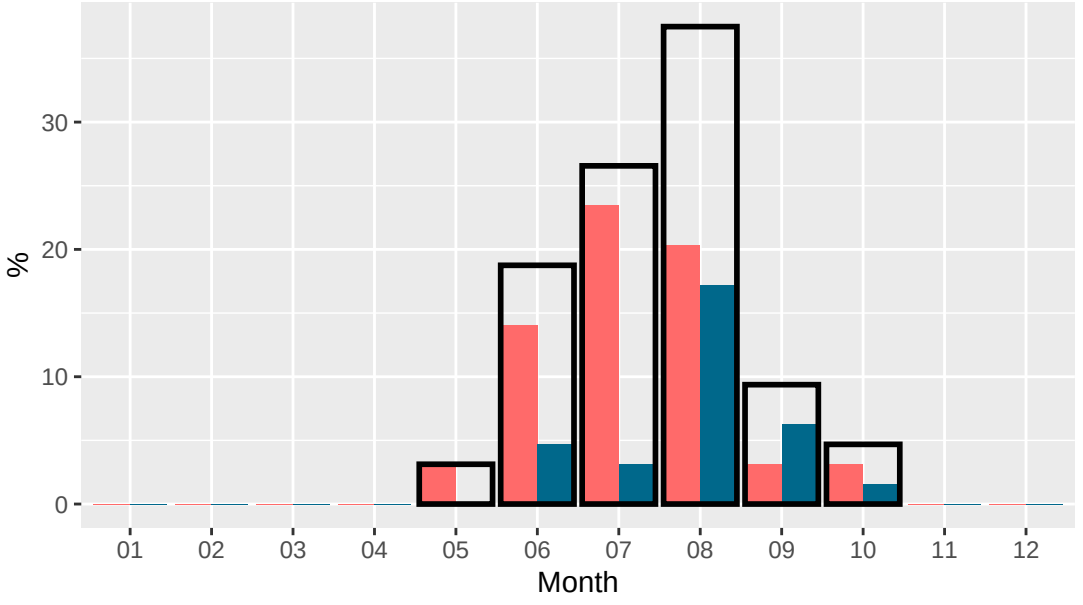
Mean annual runoff

Student: t = −1.915, p = 0.06124, m1 = 19.696, m2 = 22.679
Fisher: F = 0.615, p = 0.24205, cv1 = 0.289, cv2 = 0.298

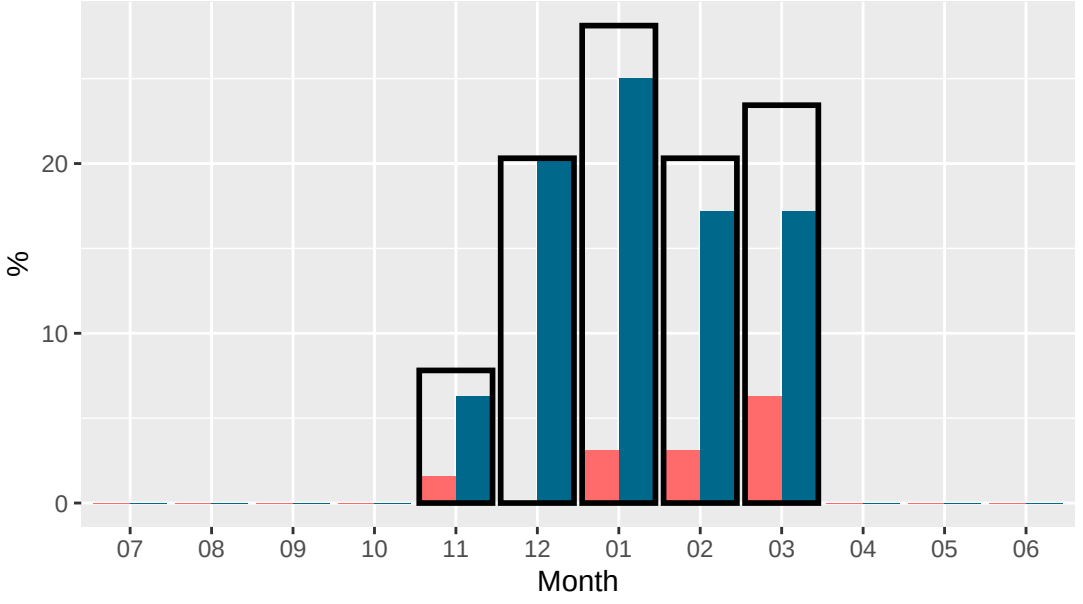


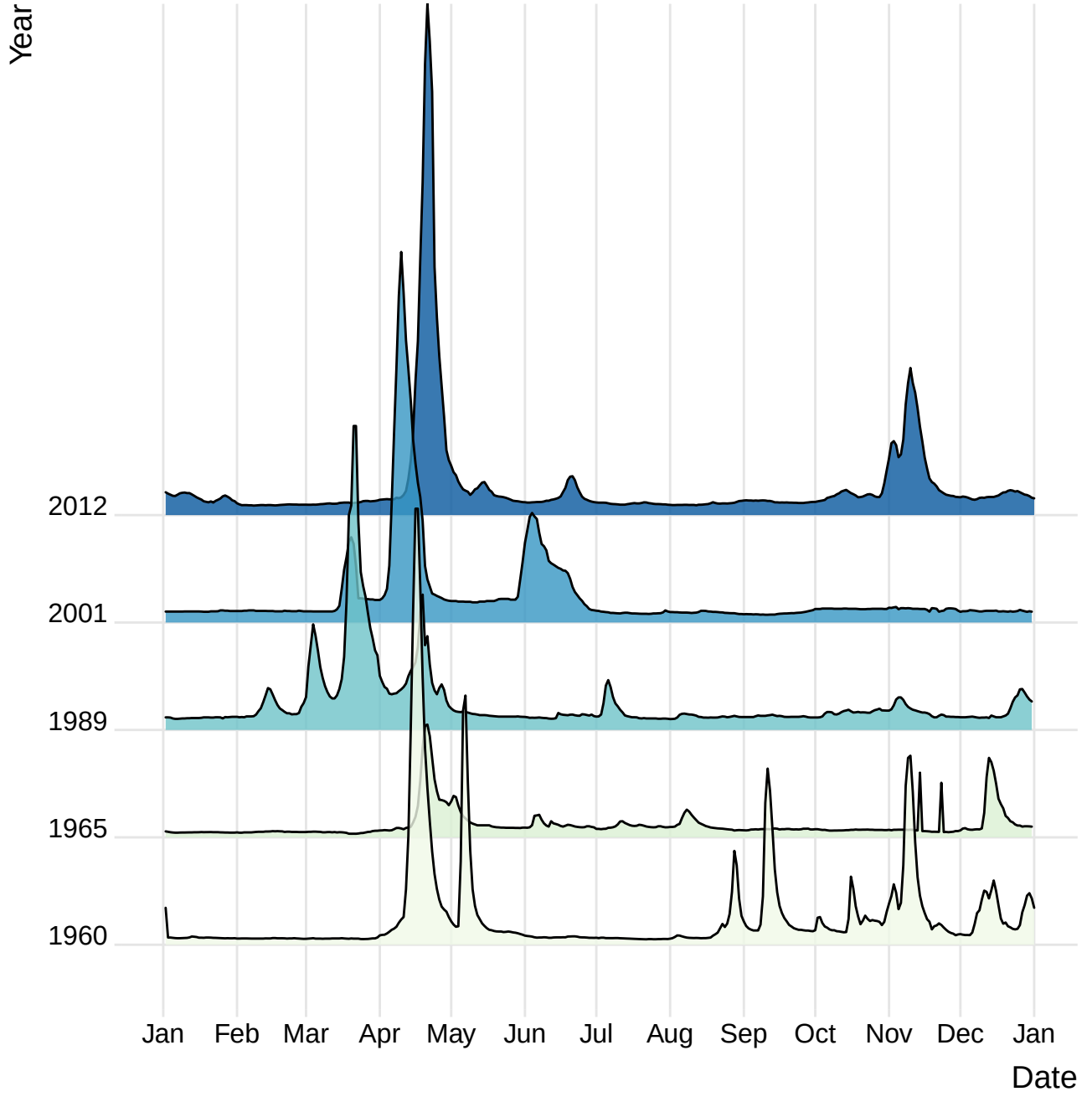

Change year distribution density
0.06
0.04
0.02
0.00
1979
1970
1980
1990
2000
Water−resources year

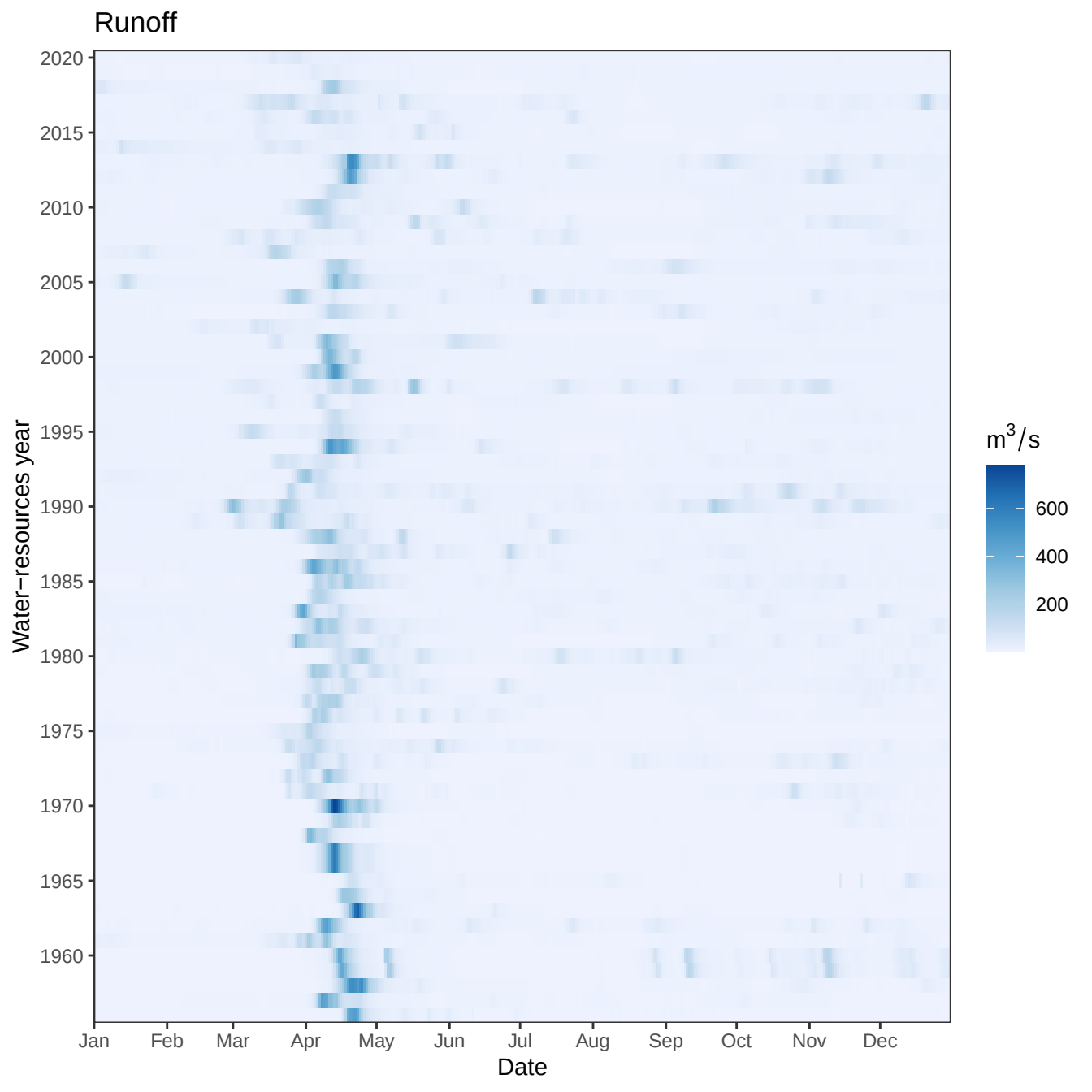
Month of a minimum monthly runoff during summer

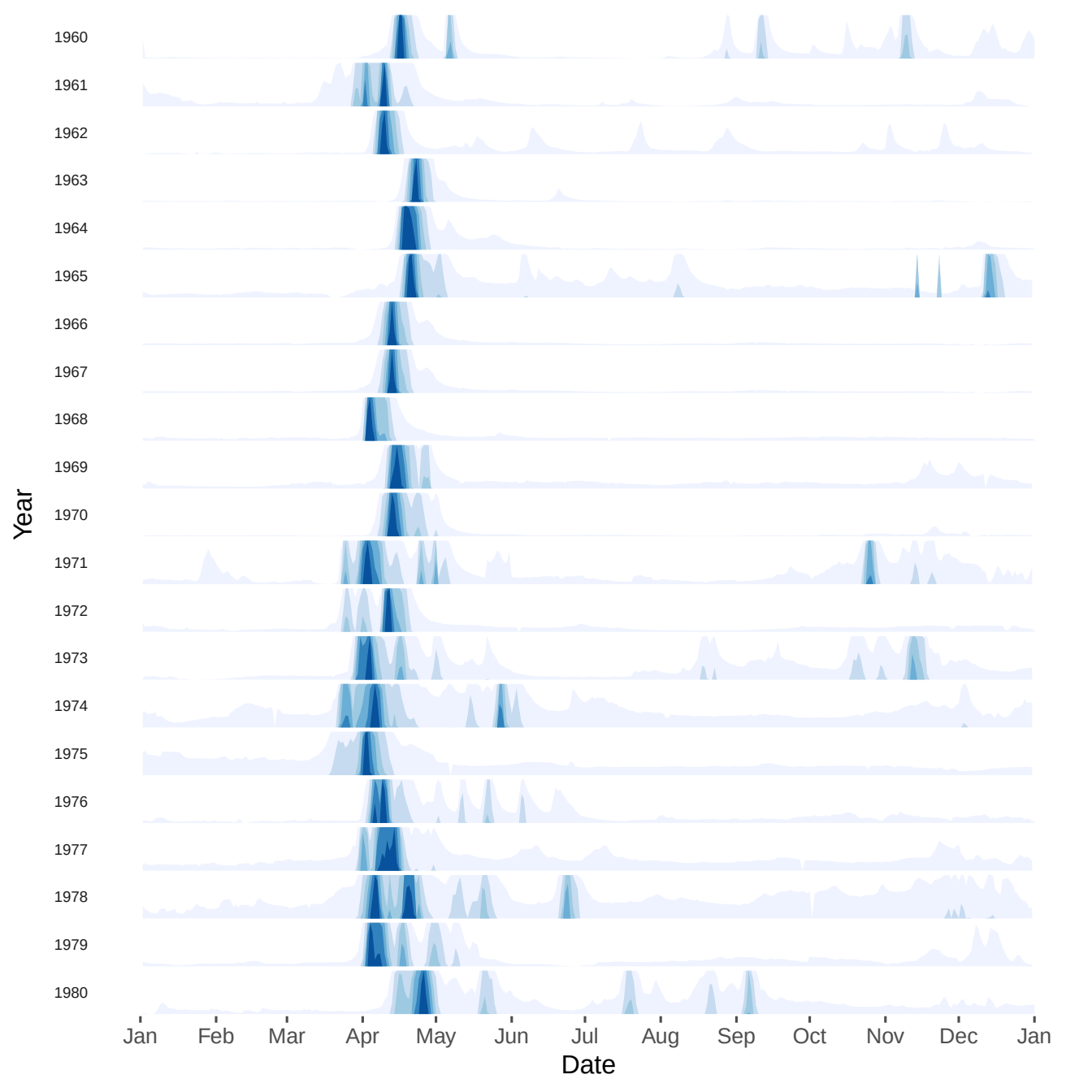


Month of a minimum monthly runoff during winter




Year
2012
2001
1989
1965
1960
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Date


Runoff
Water−resources year
2020
2015
2010
2005
2000
1995
1990
1985
1980
1975
1970
1965
1960
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Date
m3/s
600
400
200


Year
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Date