

## Supplementary Information

### Extensive rainfall data analysis: event separation from continuous record, fitting of theoretical distributions, and event-based trend detection

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### S1 Visual comparison of the observed frequency, exponential modeling, and gamma modeling of the rainfall event characteristics

Figs. (S1.1a – S1.1c), (S1.2a – S1.2c), (S1.3a – S1.3c), and (S1.4a – S1.4c) show the visual comparison of the observed frequency, exponential modeling, and gamma modeling of the rainfall event characteristics ( $v$ ,  $t$ , and  $b$ ) with  $v_t \geq 1$  mm for the station in England, Scotland, Wales, and Northern Ireland, respectively

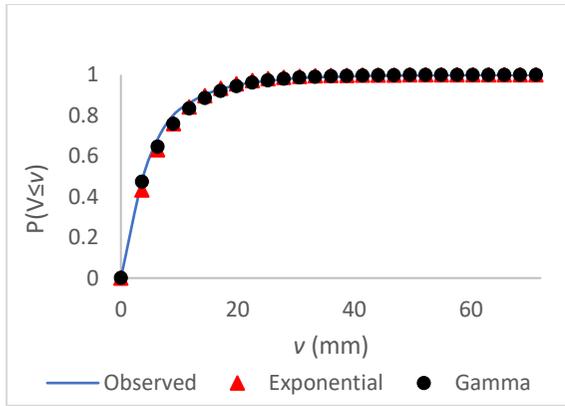


Fig. S1.1a England's station - rainfall event volume CDF plot

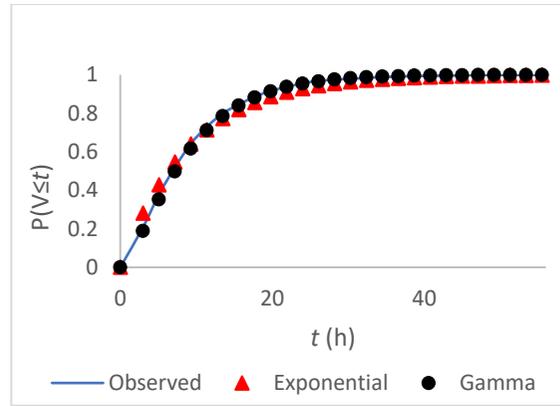


Fig. S1.1b England's station- rainfall event duration CDF plot

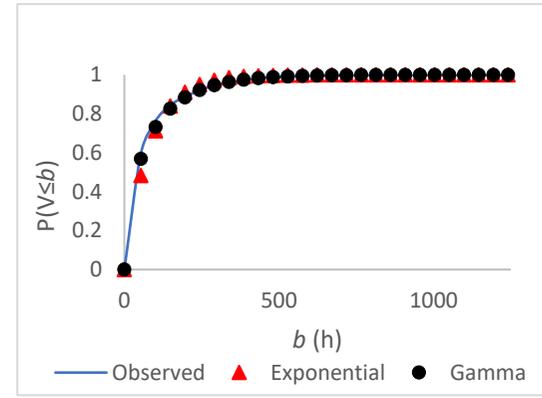


Fig. S1.1c England's station - Interevent time CDF plot

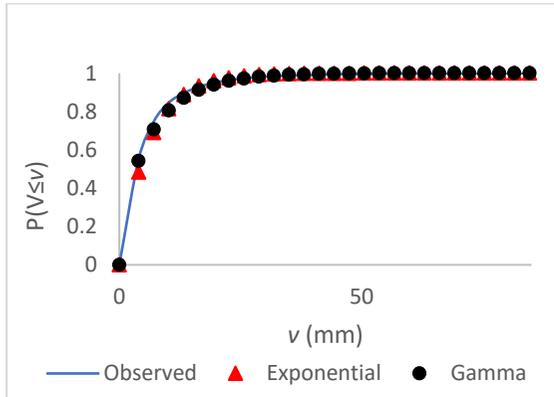


Fig. S1.2a Scotland's station - rainfall event volume CDF plot

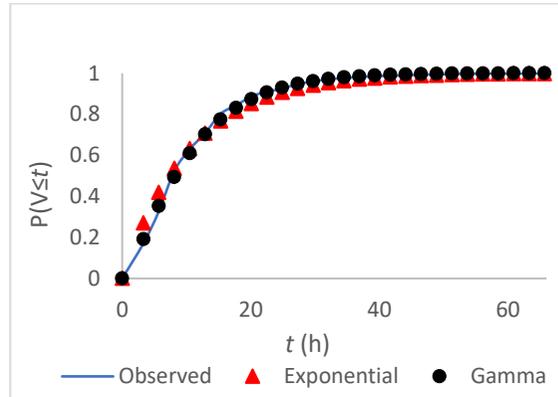


Fig. S1.2b Scotland's station - rainfall event duration CDF plot

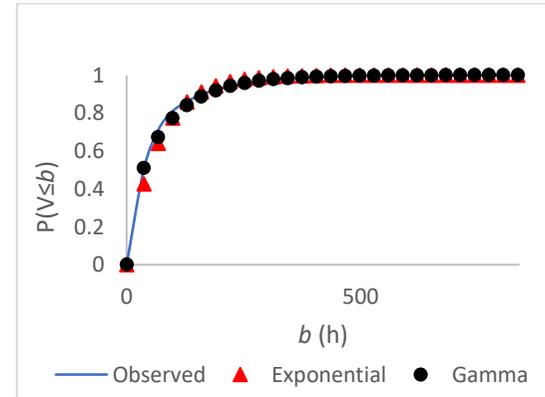


Fig. S1.2c Scotland's station - Interevent time CDF plot

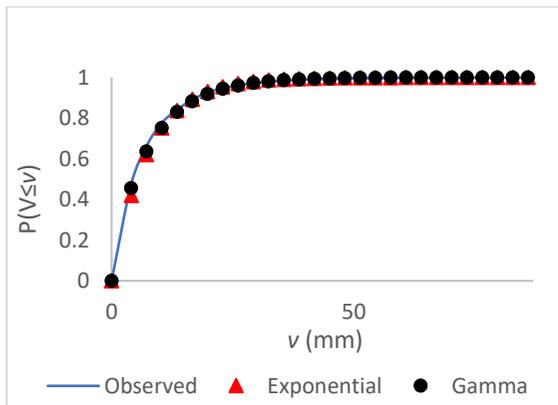


Fig. S1.3a Wales' station - rainfall event volume CDF plot

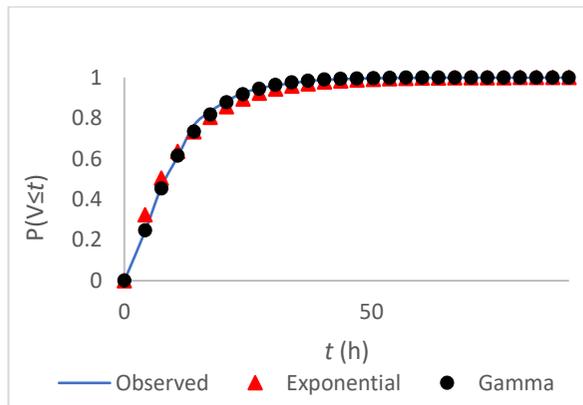


Fig. S1.3b Wales' station - rainfall event duration CDF plot

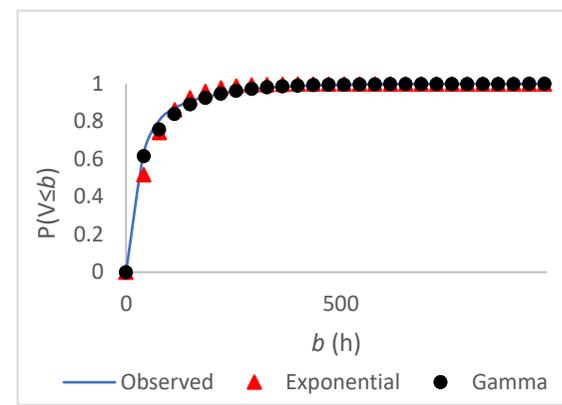


Fig. S1.3c Wales' station - Interevent time CDF plot

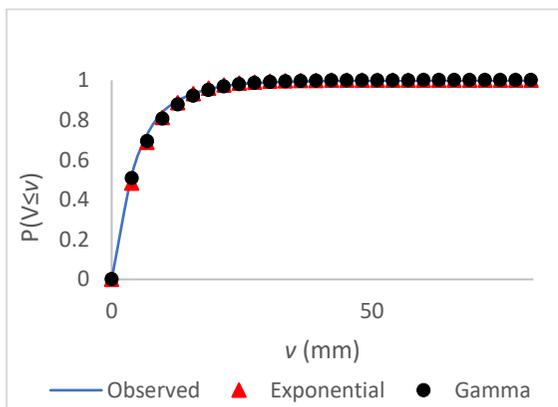


Fig. S1.4a N. Ireland's station - rainfall event volume CDF plot

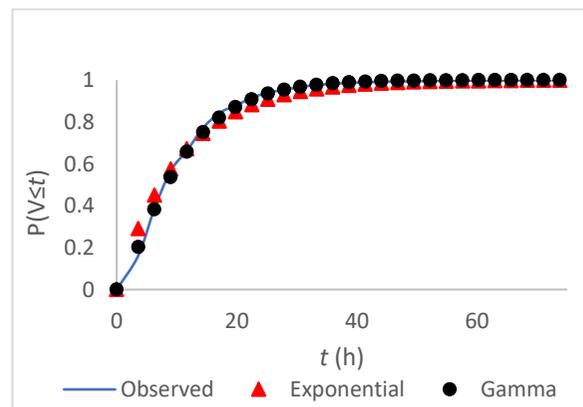


Fig. S1.4b N. Ireland's station - rainfall event duration CDF plot

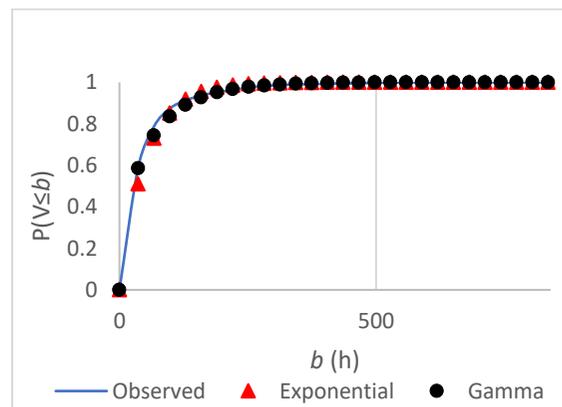


Fig. S1.4c N. Ireland's station - Interevent time CDF plot

**S2 Year ranking matrix**

Table S2.1 provides the ascending order ranking of the 55-year continuous historical climate data recorded in the four nations (England, Scotland, Wales, and Northern Ireland) of the UK.

Table S2.1 Year ranking of the 55-year continuous rainfall data observed in the UK

Year position	Year			
	England	Scotland	Wales	Northern Ireland
1st	1949	1960	1960	1960
2nd	1950	1961	1961	1961
3rd	1951	1962	1962	1962
4th	1952	1963	1963	1963
5th	1953	1964	1964	1964
6th	1954	1965	1965	1965
7th	1955	1966	1966	1966
8th	1956	1967	1967	1967
9th	1957	1968	1969	1968
10th	1958	1969	1970	1969
11th	1959	1970	1971	1970
12th	1960	1971	1972	1971
13th	1961	1972	1973	1972
14th	1962	1973	1974	1973
15th	1963	1974	1975	1974
16th	1964	1975	1976	1975
17th	1965	1976	1977	1976
18th	1966	1977	1979	1977
19th	1967	1979	1980	1978
20th	1968	1980	1981	1979
21st	1969	1981	1982	1980
22nd	1970	1982	1983	1981
23rd	1971	1983	1984	1982
24th	1972	1984	1985	1983
25th	1973	1985	1986	1984
26th	1974	1986	1987	1985
27th	1975	1987	1989	1986
28th	1976	1988	1990	1987
29th	1977	1989	1991	1988
30th	1979	1990	1992	1989
31st	1980	1991	1993	1991
32nd	1981	1992	1994	1992

33rd	1982	1993	1995	1993
34th	1983	1994	1997	1994
35th	1984	1995	1998	1995
36th	1989	1996	1999	1996
37th	1991	1997	2000	1997
38th	1992	1998	2001	1998
39th	1994	2001	2002	1999
40th	1996	2003	2003	2000
41st	1997	2004	2004	2001
42nd	1998	2006	2005	2002
43rd	1999	2007	2006	2003
44th	2000	2008	2007	2004
45th	2001	2009	2008	2005
46th	2002	2010	2009	2006
47th	2007	2011	2010	2007
48th	2008	2012	2011	2008
49th	2009	2013	2012	2009
50th	2010	2014	2013	2012
51st	2011	2015	2014	2014
52nd	2012	2016	2016	2015
53rd	2014	2017	2017	2016
54th	2015	2018	2018	2017
55th	2017	2019	2019	2019

**S3 Demi-decade-averaged (5-yearly average) temperature, total number of extreme rainfall events, and total number of interevent times greater than its individual nation station’s average interevent time (INSAIT)**

Fig. S3.1 – S3.4 show the trends of the demi-decade-averaged (5-yearly average) temperature and demi-decade total number of extreme rainfall events observed at the selected weather stations in the four nations, while Fig. S3.5 – S3.8 show the trend plots of the demi-decade-averaged temperature and demi-decade total number of interevent times greater than its individual nation station’s average interevent time (INSAIT).

Electronic Supplementary Material (ESI) for Environmental Science: Advances

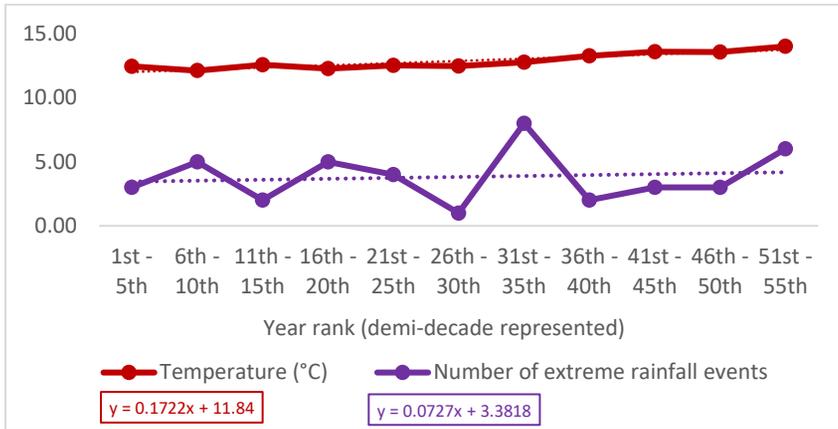


Fig. S3.1 Demi-decade-averaged temperature and demi-decade total number of extreme rainfall events for England's station

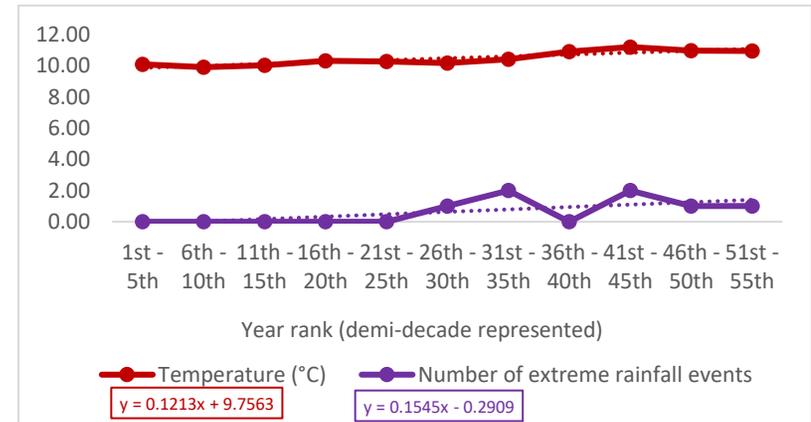


Fig. S3.2 Demi-decade-averaged temperature and demi-decade total number of extreme rainfall events for Scotland's station

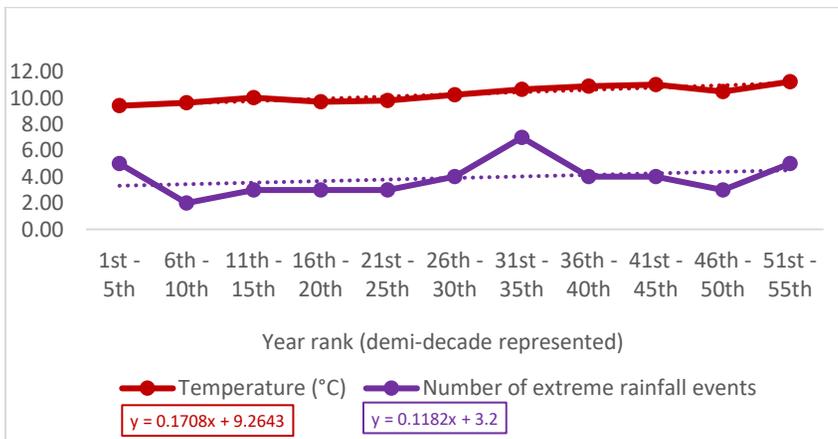


Fig. S3.3 Demi-decade-averaged temperature and demi-decade total number of extreme rainfall events for Wales' station

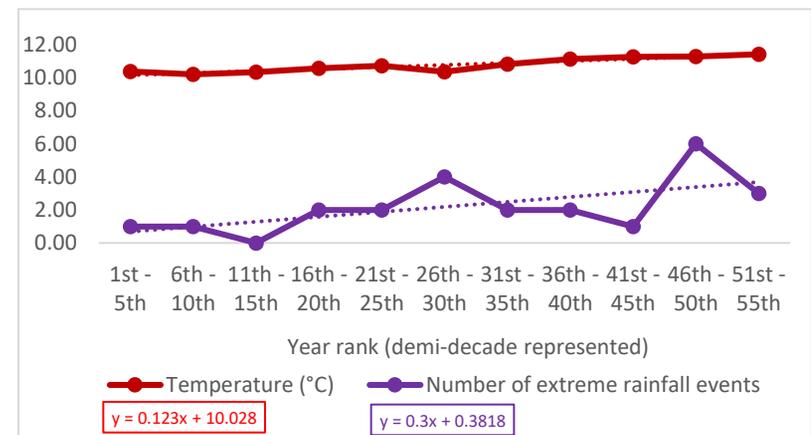


Fig. S3.4 Demi-decade-averaged temperature and demi-decade total number of extreme rainfall events for Northern Ireland's station

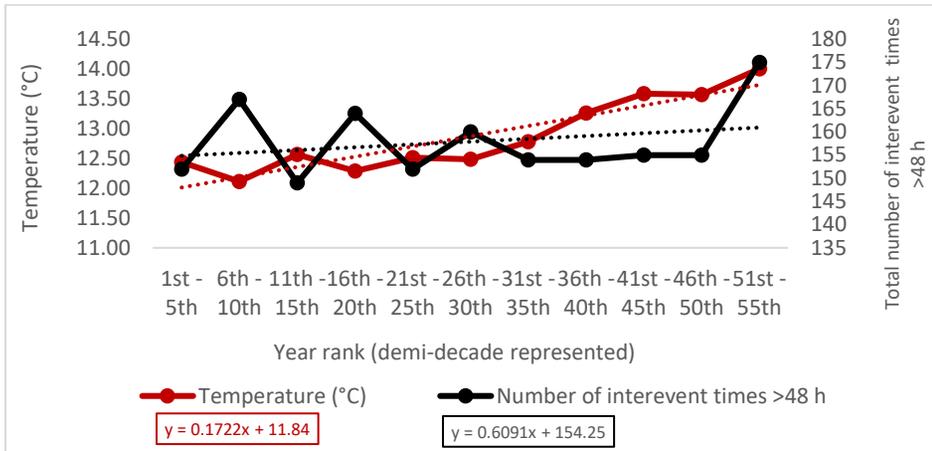


Fig. S3.5 Demi-decade-averaged temperature and demi-decade total number of interevent times > 48 h plot for England's station

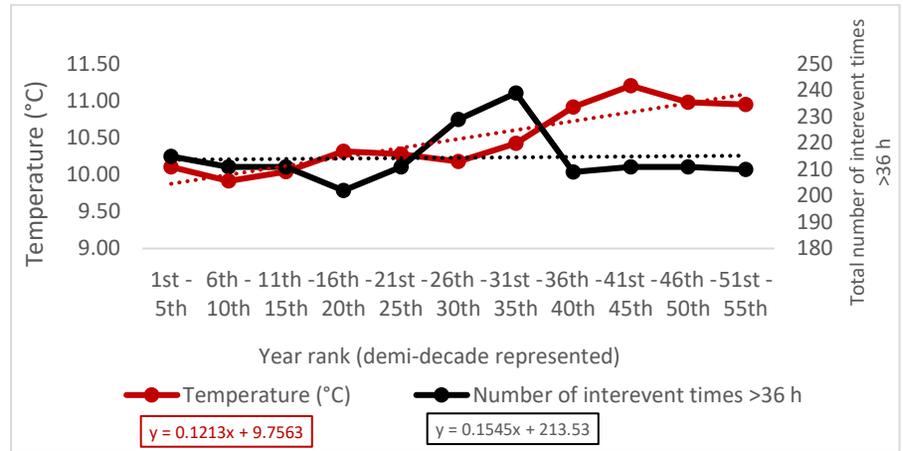


Fig. S3.6 Demi-decade-averaged temperature and demi-decade total number of interevent times > 36 h plot for Scotland's station

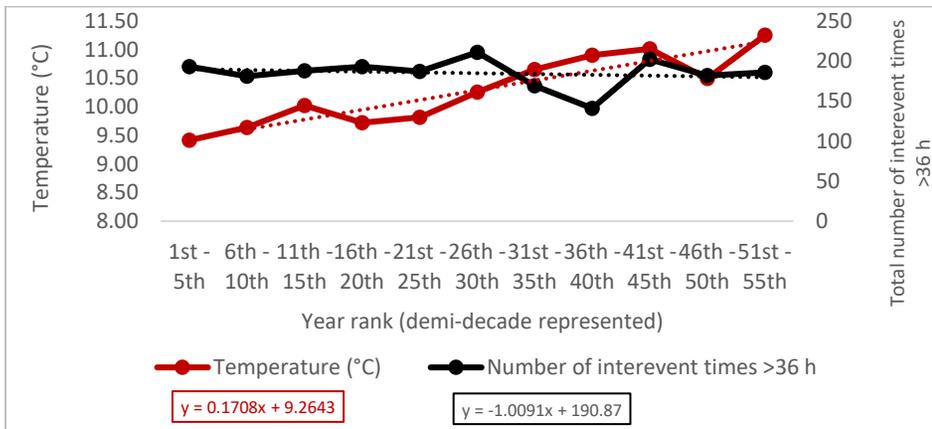


Fig. S3.7 Demi-decade-averaged temperature and demi-decade total number of interevent times >36 h plot for Wales' station

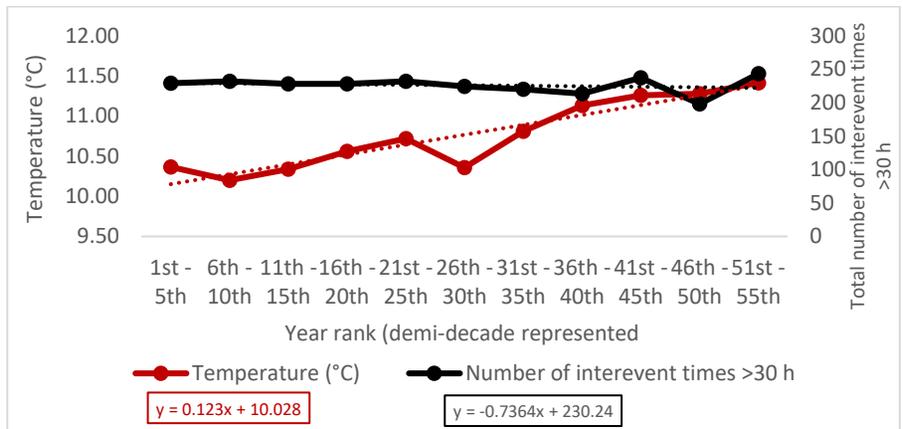


Fig. S3.8 Demi-decade-averaged temperature and demi-decade total number of interevent times >30 h plot for Northern Ireland's station