Estimating the variation in runoff due to landcover changes using the SWAT model

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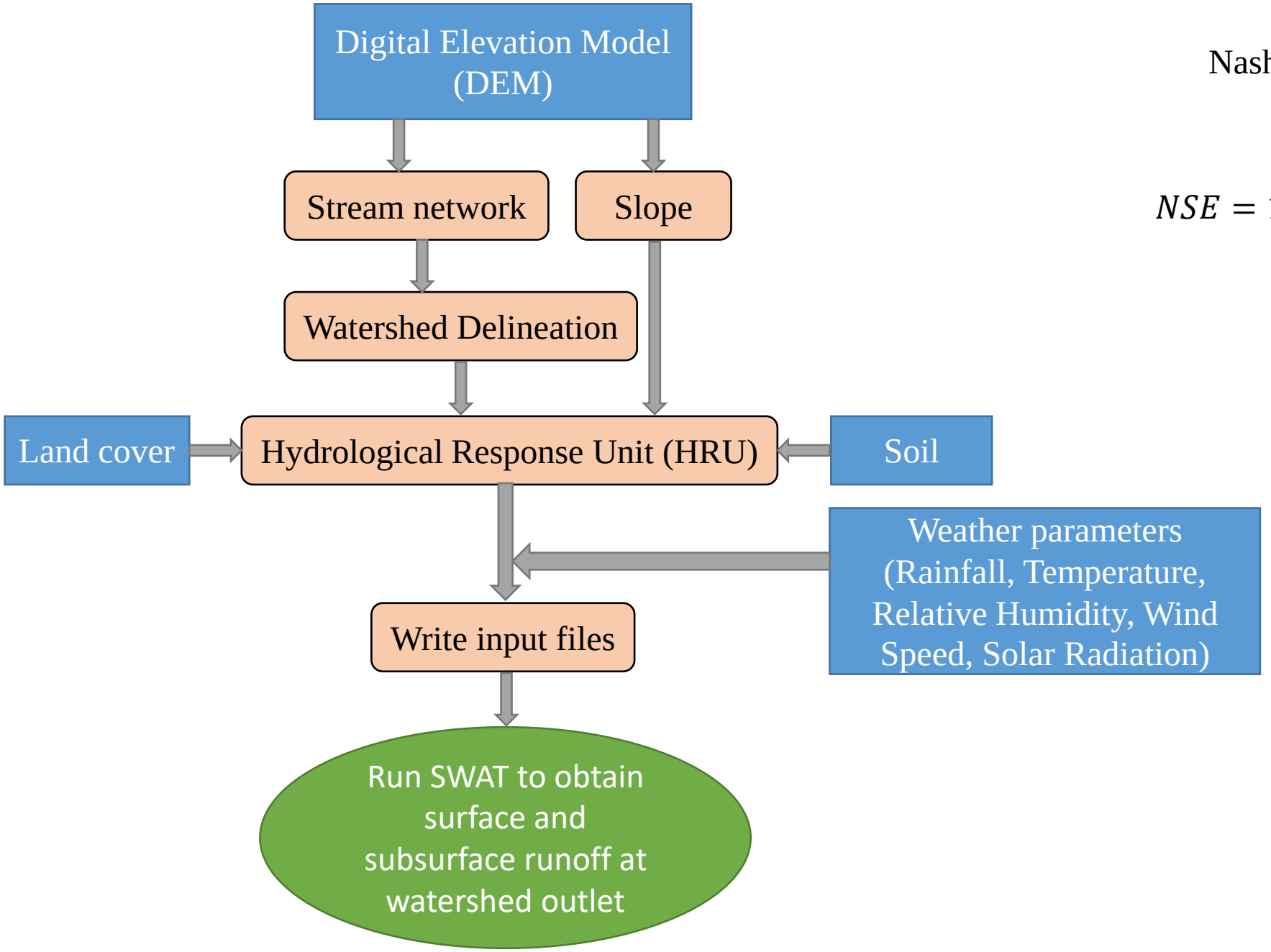
Historical records of flooding in Dublin

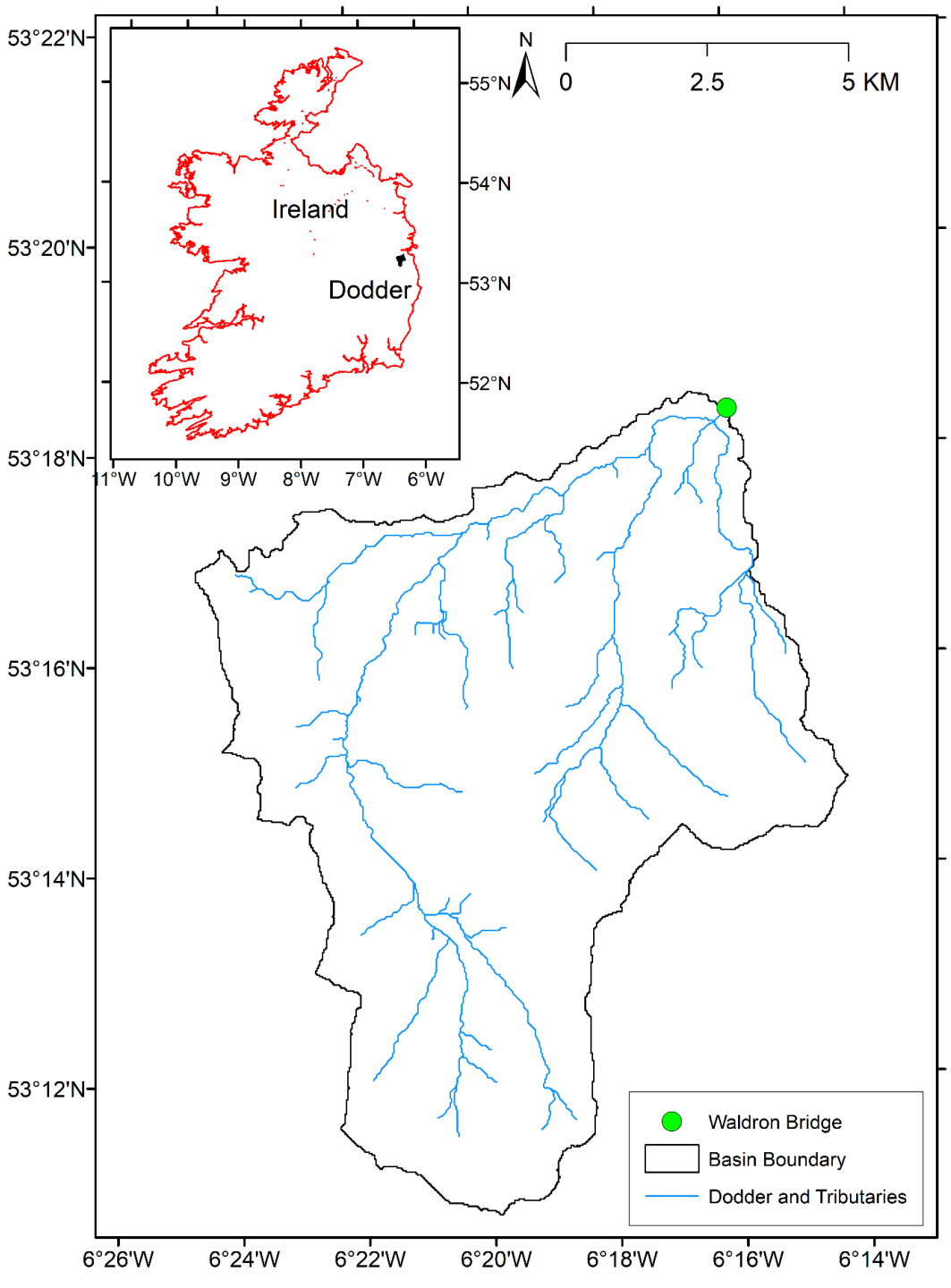
List of major historical flooding in Dublin, Ireland over the past three decades

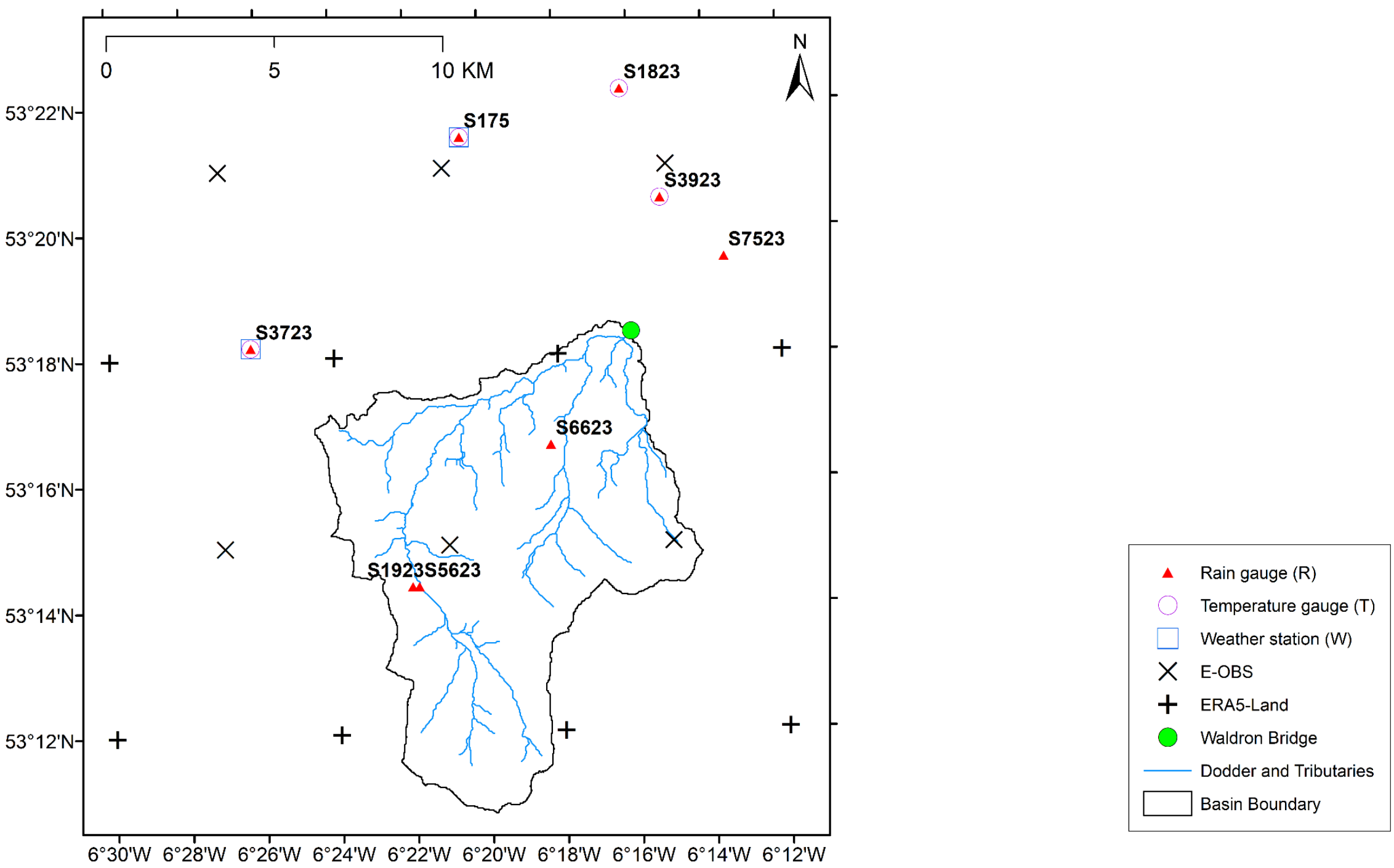
Sl. No.	Date	Area affected
1	10-11 June 1993	South Dublin
2	5-6 November 2000	South-West Dublin
3	23-24 October 2011	Entire Dublin
4	1 May 2012	Tallaght, Dublin
5	25-26 July 2013	Dublin city centre
6	30 July 2019	Dublin city centre



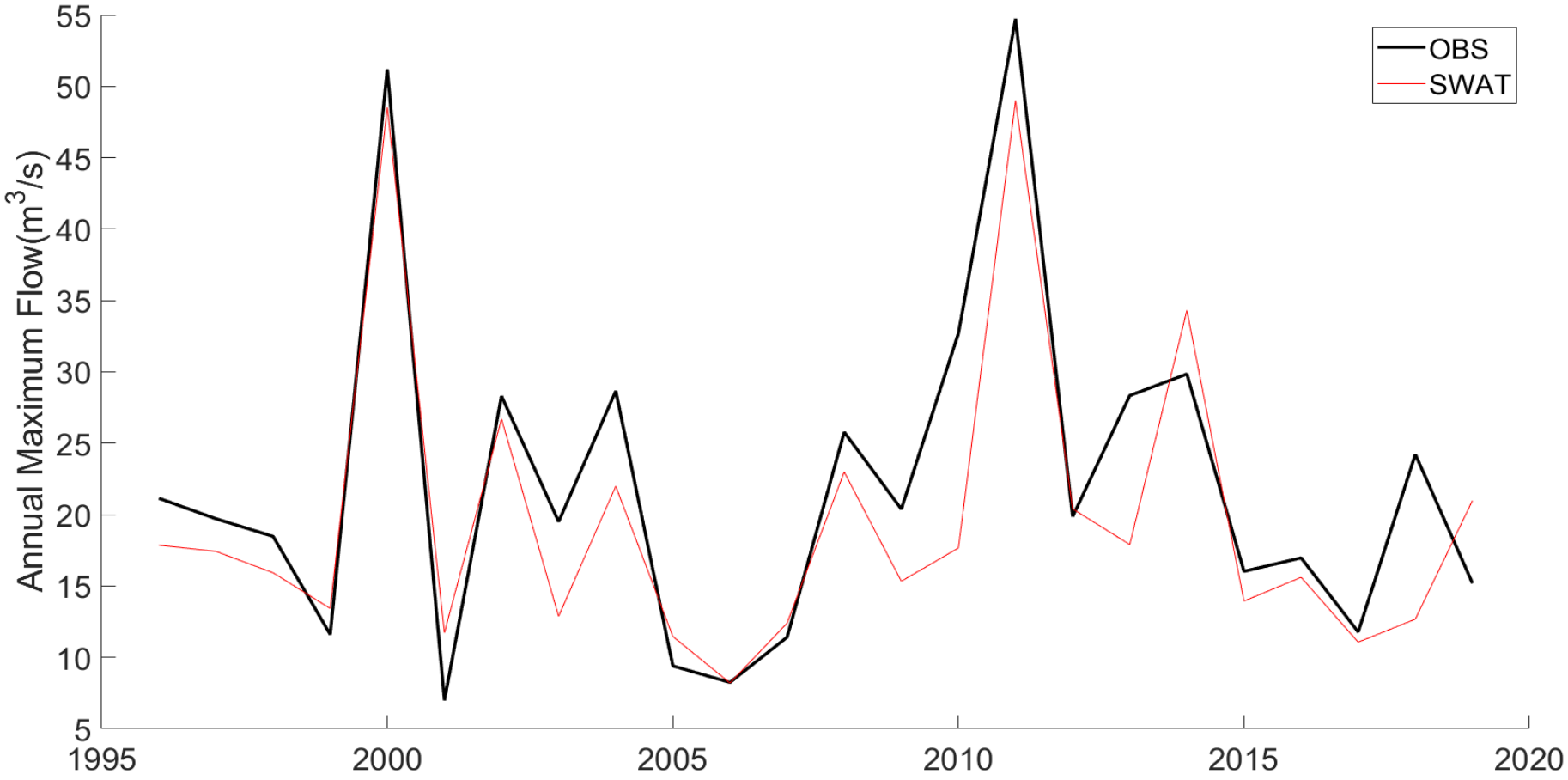
Nash-Sutcliffe Efficiency (NSE)

$$NSE = 1 - \frac{\sum_{t=1}^{T}[\hat{y}(t) - y(t)]^2}{\sum_{t=1}^{T}[y(t) - \bar{y}]^2}$$


53°22'N
53°20'N
53°18'N
53°16'N
53°14'N
53°12'N
6°26'W
6°24'W
6°22'W
6°20'W
6°18'W
6°16'W
6°14'W
N
0
2.5
5 KM
55°N
54°N
53°N
52°N
11°W
10°W
9°W
8°W
7°W
6°W
Ireland
Dodder
Waldron Bridge
Basin Boundary
Dodder and Tributaries

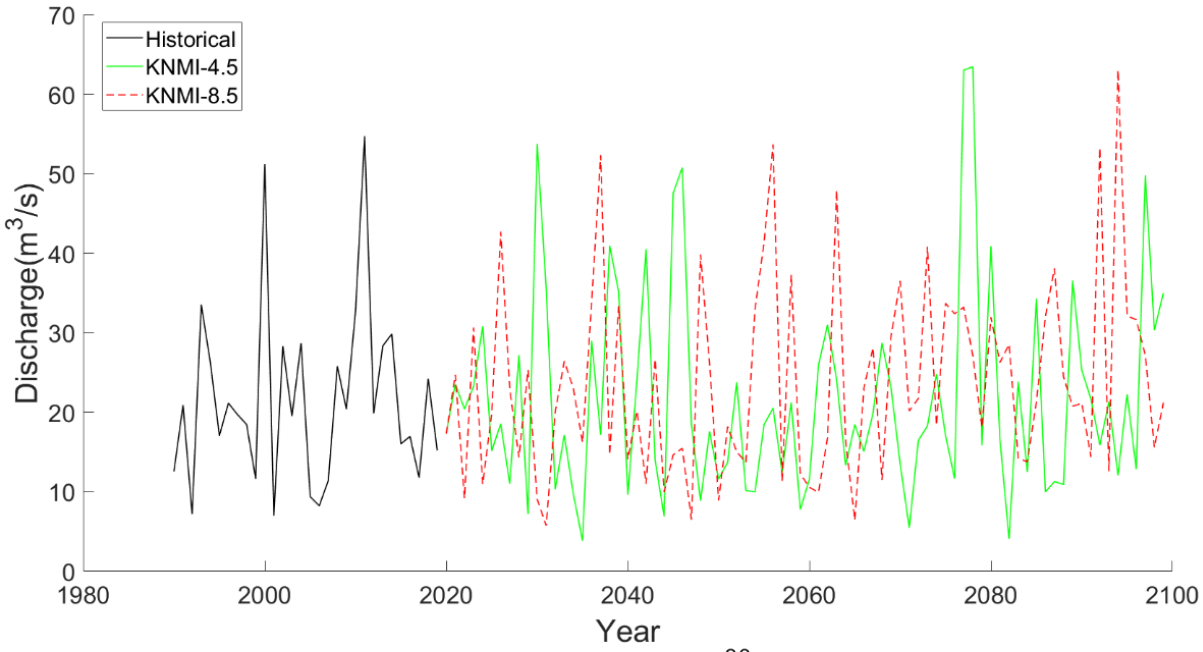

0
5
10 KM
N
S1823
S175
S3923
S7523
S3723
S6623
S1923S5623
53°22'N
53°20'N
53°18'N
53°16'N
53°14'N
53°12'N
6°30'W
6°28'W
6°26'W
6°24'W
6°22'W
6°20'W
6°18'W
6°16'W
6°14'W
6°12'W
Rain gauge (R)
Temperature gauge (T)
Weather station (W)
E-OBS
ERA5-Land
Waldron Bridge
Dodder and Tributaries
Basin Boundary

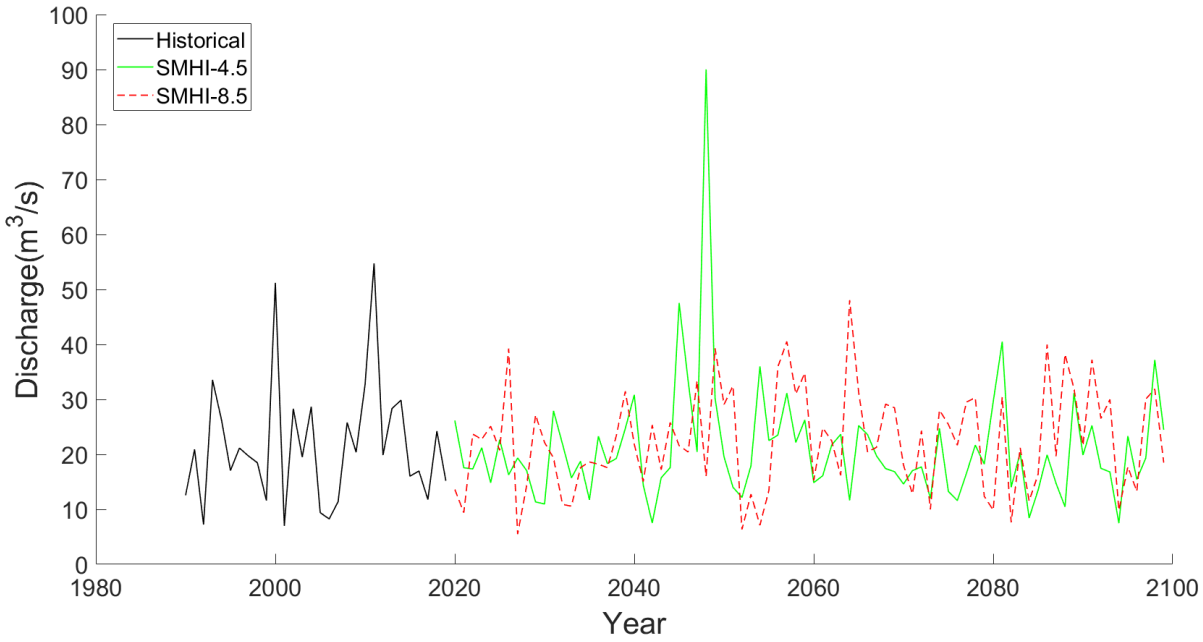
Comparison of annual maximum flow at Waldron bridge based on observations (OBS) and SWAT simulations for the period 1996-2019

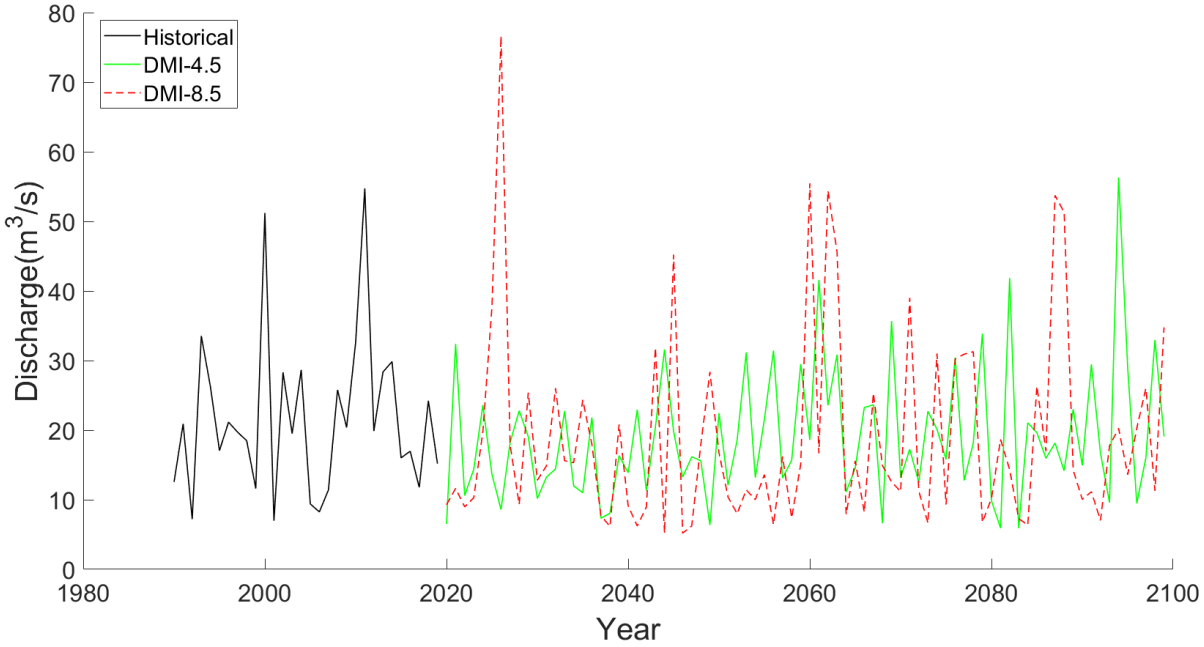


NSE=0.772

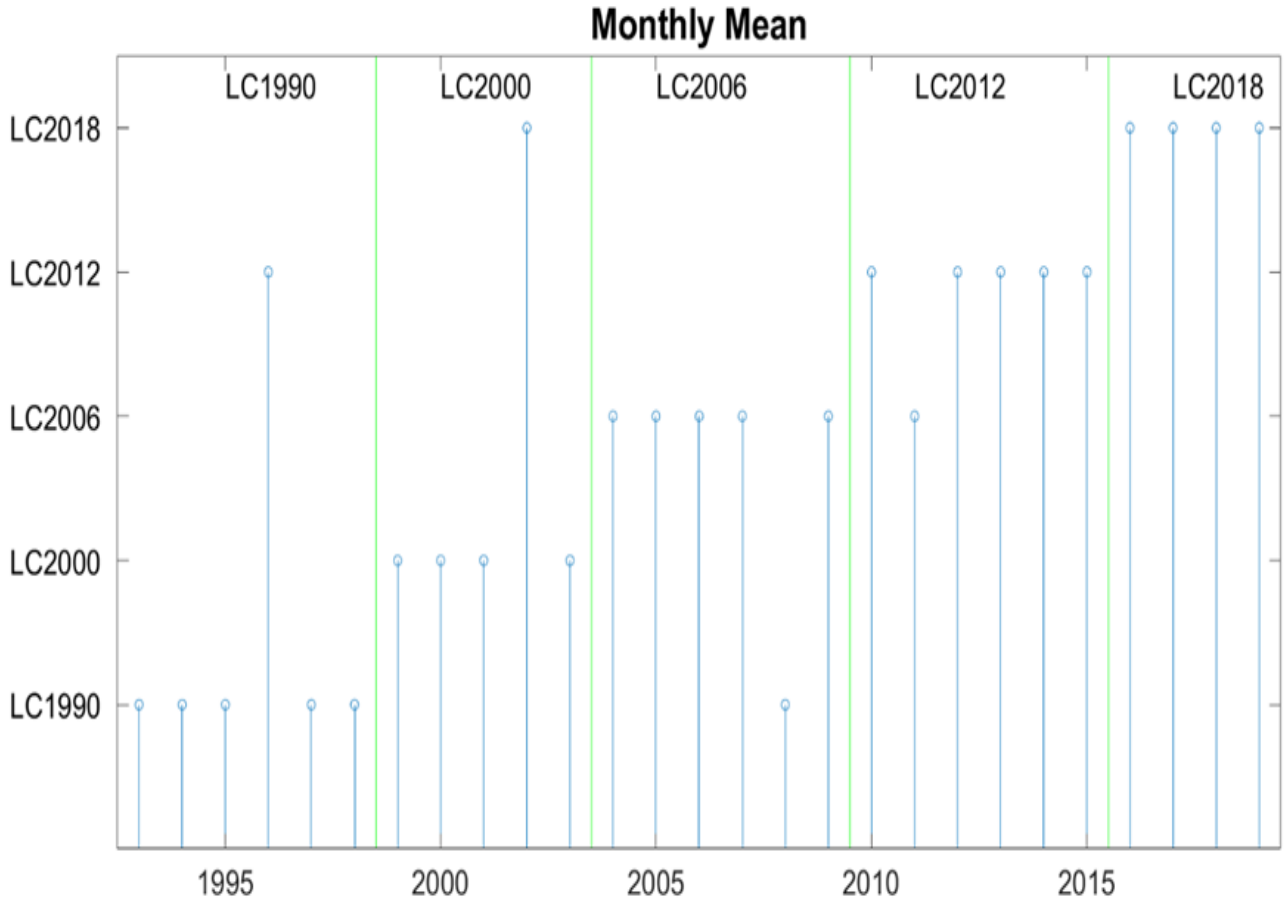
Projected Annual Maximum Flow plots corresponding to RCP scenarios RCP4.5 and RCP8.5 obtained from SWAT model

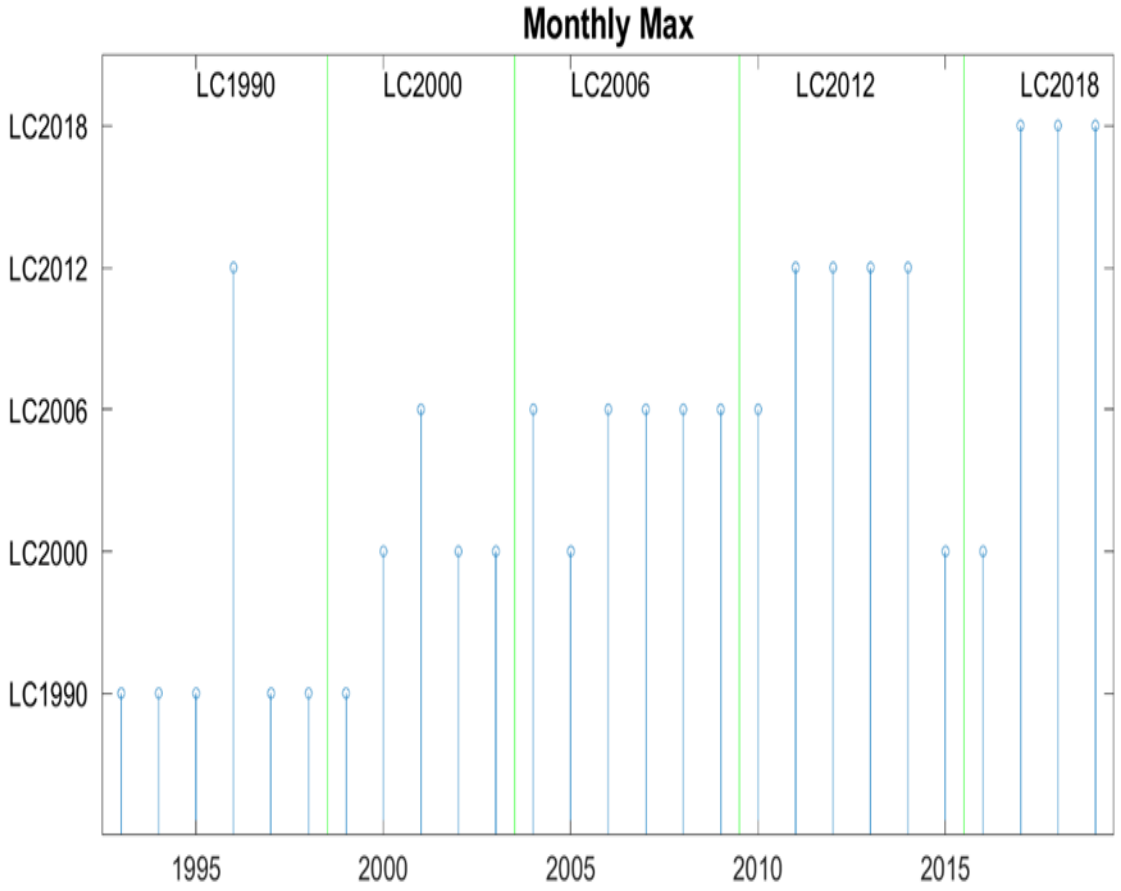






Best-fit SWAT model data obtained for the year 1990, 2000, 2006, 2012 and 2018 respectively to simulate a) Monthly mean runoff and b) Monthly maximum runoff at Waldron bridge.





Conclusion

- The model simulations indicate a possible increase in future flood quantile up to 16% for the 100-year return period frequency and 31% for the 1000-year return period frequency.
- The model performance is highest when the land cover data has been collated as close to the time period across which the simulations need to be performed.

Publications

- Sarkar Basu, A., Gill, L.W., Pilla, F. and Basu, B., 2022. Assessment of climate change impact on the annual maximum flood in an urban river in Dublin, Ireland. Sustainability, 14(8), p.4670.
- Basu, A.S., Gill, L.W., Pilla, F. and Basu, B., 2022. Assessment of Variations in Runoff Due to Landcover Changes Using the SWAT Model in an Urban River in Dublin, Ireland. Sustainability, 14(1), p.534.