

Supplement of

Rapid flood damage estimation tool for urban pluvial floods with scarce data

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S1. Predictor Variables

The optimization procedure searched at the same time hyperparameter values and the inclusion or exclusion of pre-selected predictor variables.

- 10 Table S1 presents all considered possibilities. To avoid cross-correlation, variables that represent the same construct were tested individually, that is, only one such variable at a time was considered, or none representing that construct. For example, to represent contamination in the flood waters, the options were: (a) none, (b) oil contamination only, or (c) overall contamination score, but never (b) and (c) together.

15 **Table S1. Summary of tested and adopted predictor variables**

Aspect	Variable	Description	Range		
			Training set (n=367)	Test set (n=184)	Validation set (n=44)
Water Depth *	Water Depth (wd)	Maximum water depth outside the house [cm]	0 – 300 cm Mean: 25	0 – 200 cm Mean: 24	0 – 150 cm Mean: 39
		Hazard Rating (HR) = water depth*(velocity + 0.5)	0 – 2 Median: 0	0 – 2 Median: 0	0 – 2 Median: 1
Flood Intensity *	Flood Intensity (fi)	DEFRA classes	HR split	Surveyed classes	(adopted)
		Low	$0 < HR < 0.75$	0: “Could easily stand”	
		Medium	$0.75 < HR < 1.25$	1: “Would struggle to stand”	
		High	$1.25 < HR < 2.5$	2: “Would	
		Extreme	$2.5 < HR$	2: “Would	

have been
carried away”
OR
”Water was
too deep to
stand”

Contamination in flood waters	Contamination with heating oil (con_oil)	Indicator of contamination in the floodwater: 0=no contamination to 1=heavy contamination with heating oil [-]	y/n Mean: 3%	y/n Mean: 4%	y/n Mean: 14%
	Contamination score	Indicator of contamination in the floodwater: 0=no contamination to 2=heavy contamination [-] (Thieken et al., 2005)	0 – 2 Median: 0	0 – 2 Median: 0	0 – 2 Median: 0
Building size	Floor Space (fs)	Floor space of the whole building [m ²]	50 – 12,000 m ² Mean: 239 m ²	55 – 4900 m ² Mean: 222 m ²	30 – 1100 m ² Mean: 216 m ²
	Building footprint	Footprint of the building [m ²]	30 – 13,000 m ² Mean: 180 m ²	55 – 4900 m ² Mean: 138 m ²	15 – 165 m ² Mean: 73 m ²
	Number of floors (AND Building footprint)	Number of floors besides cellar [#] (included in the model alongside building footprint)	1 – 12 Median: 2	1 – 7 Median: 2	1 – 4 Median: 2
	Floor space AND Building footprint	-	-	-	-
	Floor space AND Building footprint AND Number of floors	-	-	-	-
Underground floor	Cellar (cel)	Presence of a cellar [y/n]	y/n Mean: 97%	y/n Mean: 95%	y/n Mean: 70 %
	Flag: only cellar	Among the flooded floors, only the cellar was	y/n	y/n	y/n

	was flooded	reported as flooded	Mean: 87%	Mean: 86%	Mean: 55%
	Flag: negative	When the reported highest level of water inside	y/n	y/n	y/n
	water depth	the house in relation to ground level is negative,	Mean: 84%	Mean: 83%	Mean: 41%
	inside the house	implying only underground floor was affected			
	in relation to				
	ground level				
	Flag: water depth	'wd' is very low, represented as binay variable	y/n	y/n	y/n
	outside the house		Mean: 34%	Mean: 32%	Mean: 25%
	is low <5cm				
	Flag: water depth	'wd' is zero, represented as binay variable	y/n	y/n	y/n
	outside the house		Mean: 27%	Mean: 21%	Mean: 18%
	is zero				
Property-Level Precautionary Measures (plpm)	PLPM score	Score of implemented precautionary measures	0 – 48	0 – 47	0 – 36
		at the property, from 0 up to 48 (Laudan et al.,	Median: 6	Median: 6	Median: 1
		2020; Thicken et al., 2008) [-]			
	Backflow	Installed a backflow preventer	y/n	y/n	y/n
	preventer		Mean: 27%	Mean: 29%	Mean: 25%
	Water barrier	Installed a fixed or mobile water barrier	y/n	y/n	y/n
			Mean: 5%	Mean: 8%	Mean: 5%
	Backflow	Either measure	y/n	y/n	y/n
	preventer OR		Mean: 29%	Mean: 32%	Mean: 27%
	Water barrier				
Building age	Building Year	Year of construction in classes: [-]	1 – 5	1 – 5	1 – 5
	(by) class	1: until 1924; 2: 1925-1948; 3: 1949-1964; 4:	Median: 4	Median: 4	Median: 1
		1964-1990; 5: after 1990			

* wd and fi were always included.

References

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