Table 1. Comparison of average results from a 10-fold cross-validation.

Method	N	R^2	MAE (m)	MBE (m)	SMAPE	RMSE (m)	Observed mean (m)
NPBN	23,736	0.35	3.25	0.09	0.17	4.72	9.60
Random Forest	23,736	0.30	3.11	-1.40	0.18	5.26	9.60

Table 2. Validation statistics for the building height prediction model (mean value of the uncertainty distribution), depending on the degree of urbanization at municipal level. Validated for 2% of data points in cities and towns/suburbs, and for all data points in rural areas.

Degree of urbanisation	N	R^2	MAE (m)	MBE (m)	SMAPE	RMSE (m)	Observed mean (m)
Cities	44,949	0.35	3.32	0.06	0.17	4.79	9.77
Towns and suburbs	2685	0.15	2.15	0.63	0.14	2.85	7.13
Rural areas	3191	0.24	2.09	0.34	0.16	3.44	6.44

Table 3. Validation statistics for the building height prediction model (mean value of the uncertainty distribution) for different cities. For all cities, the results are an average of results for a 10-fold cross-validation. For individual cities, the results are an out-of-sample validation (i.e. the model's sample excluded the city that was validated).

Area	N	R^2	MAE [m]	MBE [m]	SMAPE	RMSE [m]	Obs. mean [m]
All cities (cross-validation)	23,736	0.35	3.25	0.09	0.17	4.72	9.60
Amsterdam	24,506	0.31	2.50	-0.17	0.15	3.43	8.69
Athens	18,177	0.25	4.38	-1.70	0.16	5.52	14.20
Berlin	25,526	0.49	3.65	-1.29	0.18	5.10	10.51
Bratislava	926	0.42	6.81	-4.61	0.30	10.44	13.57
Brussels	19,845	0.12	3.77	-1.00	0.17	5.00	11.50
Bucharest	1695	0.36	6.01	1.00	0.28	7.93	10.35
Budapest	1963	0.37	4.14	-1.72	0.19	6.76	11.80
Copenhagen	10,747	0.24	2.55	2.00	0.17	3.32	6.42
Dublin	12,648	0.09	1.69	1.13	0.12	2.21	6.57
Helsinki	8053	0.34	2.62	1.01	0.17	3.68	7.11
Lisbon	3486	0.10	5.37	-0.60	0.20	7.42	13.42
Ljubljana	1196	0.19	3.28	1.97	0.22	4.39	6.35
London	22,17	0.10	3.36	2.65	0.18	4.48	7.79
Luxembourg	582	0.19	2.26	-0.11	0.12	3.18	9.60
Madrid	4909	0.13	6.19	-1.43	0.20	8.72	16.22
Nicosia	283	0.05	3.23	-0.70	0.18	4.60	9.23
Oslo	4750	0.45	2.76	1.68	0.18	3.52	6.79
Paris	23,441	0.23	3.03	0.99	0.16	4.60	8.98
Prague	6802	0.47	3.92	-1.86	0.19	6.02	11.46
Reykjavik	2364	0.05	2.99	2.05	0.22	3.61	5.80
Riga	1423	0.29	4.31	-1.57	0.21	6.53	11.10
Rome	5397	0.36	3.97	-1.69	0.16	5.45	13.14
Sofia	4127	0.39	4.35	-0.56	0.21	6.38	10.49

Stockholm	8748	0.25	2.23	0.62	0.16	3.48	6.82
Tallinn	1386	0.39	3.48	0.58	0.21	5.18	8.13
Valletta	123	0.13	4.32	0.24	0.18	6.49	11.66
Vienna	8690	0.50	2.89	-0.11	0.16	4.34	9.34
Vilnius	757	0.42	2.79	-0.91	0.17	4.82	8.86
Warsaw	7662	0.24	3.05	-0.14	0.17	5.22	9.10
Zagreb	4979	0.17	2.58	0.31	0.16	4.07	8.05

Table 4. Validation statistics for the building height prediction model (mean value of the uncertainty distribution) for various sets of residential buildings.

| Dataset	N	R^2	MAE	MBE	SMAPE	RMSE	Obs. mean
Number of floors in residential buildings, Polish coast	62,58	0.33	0.65	-0.06	0.16	1.02	2.01
of which: houses with 1 flat	54,41	0.13	0.58	-0.10	0.16	0.85	1.80
houses with 2 flats	1145	0.04	0.64	-0.04	0.16	0.95	2.02
houses with 3 or more flats	7025	0.16	1.24	0.18	0.16	1.86	3.66
Floor space area, detached houses, Meuse flood 1993	3043	0.41	54.0 m^2	-17.3 m^2	0.18	83.5 m^2	160 m^2
Floor space area, all houses, German floods 2002-2014	2868	0.33	119 m^2	32.9 m^2	0.26	206 m^2	214 m^2
of which: detached houses	1556	0.15	94.5 m^2	34.4 m^2	0.26	138 m^2	166 m^2
semi-detached houses	662	0.20	100 m^2	43.2 m^2	0.25	147 m^2	178 m^2
multi-family houses	647	0.30	196 m^2	19.3 m^2	0.26	346 m^2	366 m^2
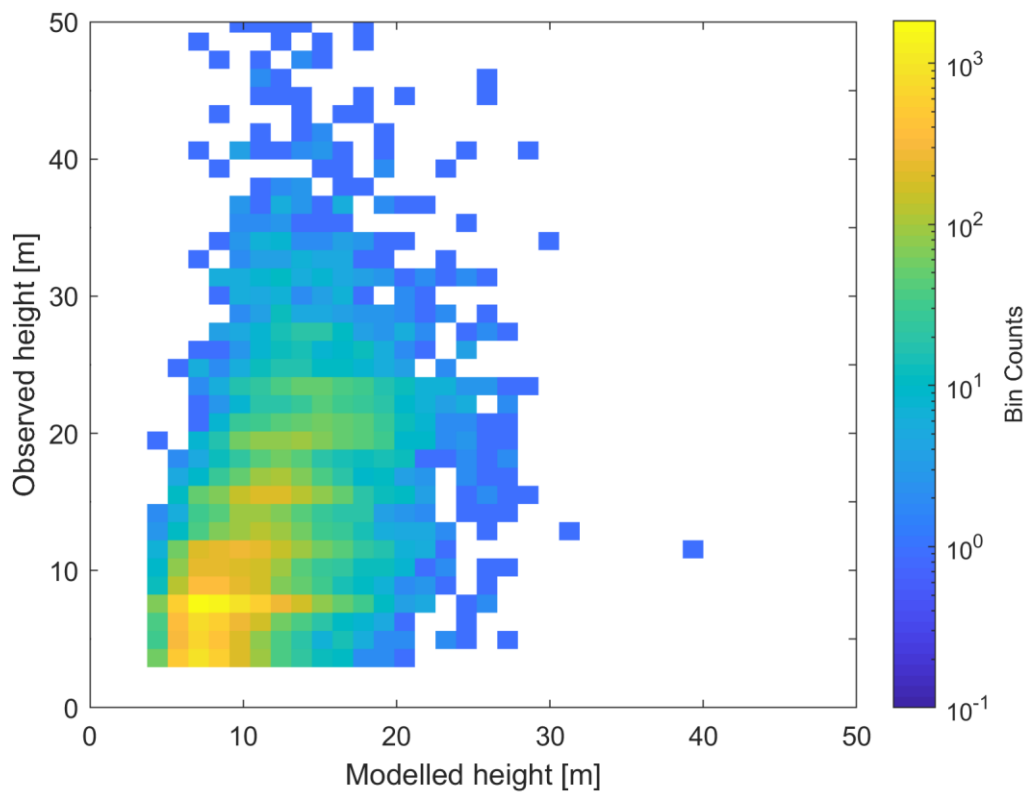
Figure 1. Binned scatter plot for observed and modelled heights of residential buildings for 30 European capitals, out-of-sample validation.

Table S3. Reference to methodologies used for obtaining building stock.

Method	Countries
Building stock taken directly from Eurostat database	Austria, Belgium, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Luxembourg, Netherlands, Portugal, Slovakia, Slovenia, United Kingdom
Eq. 3 (PIM)	Iceland, Malta, Norway, Spain, Sweden and Switzerland
Eq. 4 (modified PIM)	Bulgaria, Latvia, Poland, Romania