

**Mapping Three Decades of Urban Growth in China:
A 30m Annual Building Height Dataset (1990 – 2019)**

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Supplementary Materials:

Figure S1. Accuracy assessment (RMSE, MAE, R² and OLS result) for each year from 1990 to 2019

Figure S2. Violin plot of different building height for each year from 1990 to 2019

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Figure S1. Accuracy assessment (RMSE, MAE, R² and OLS result) for each year from 1990 to 2019

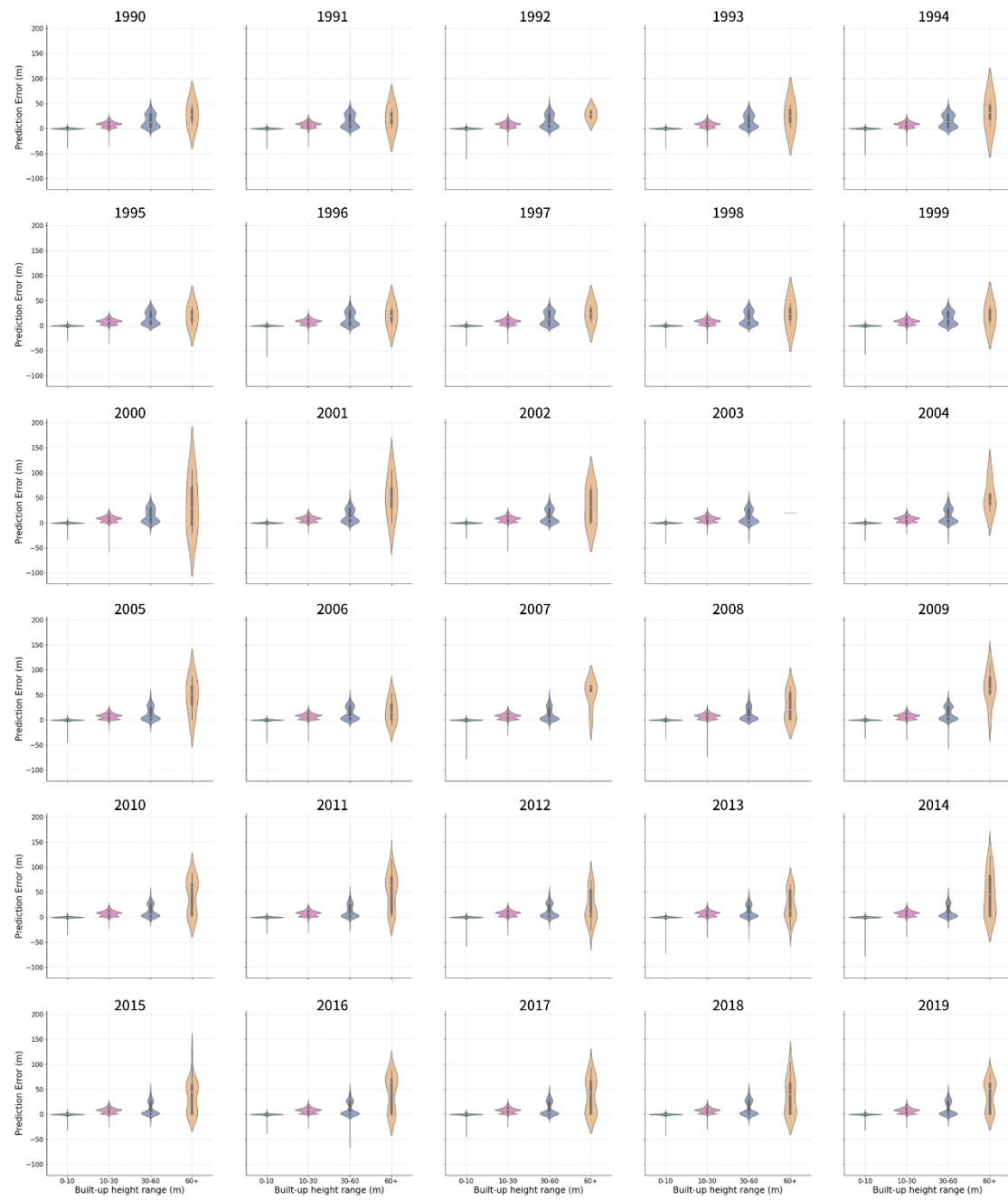


Figure S2. Violin plot of different building height for each year from 1990 to 2019

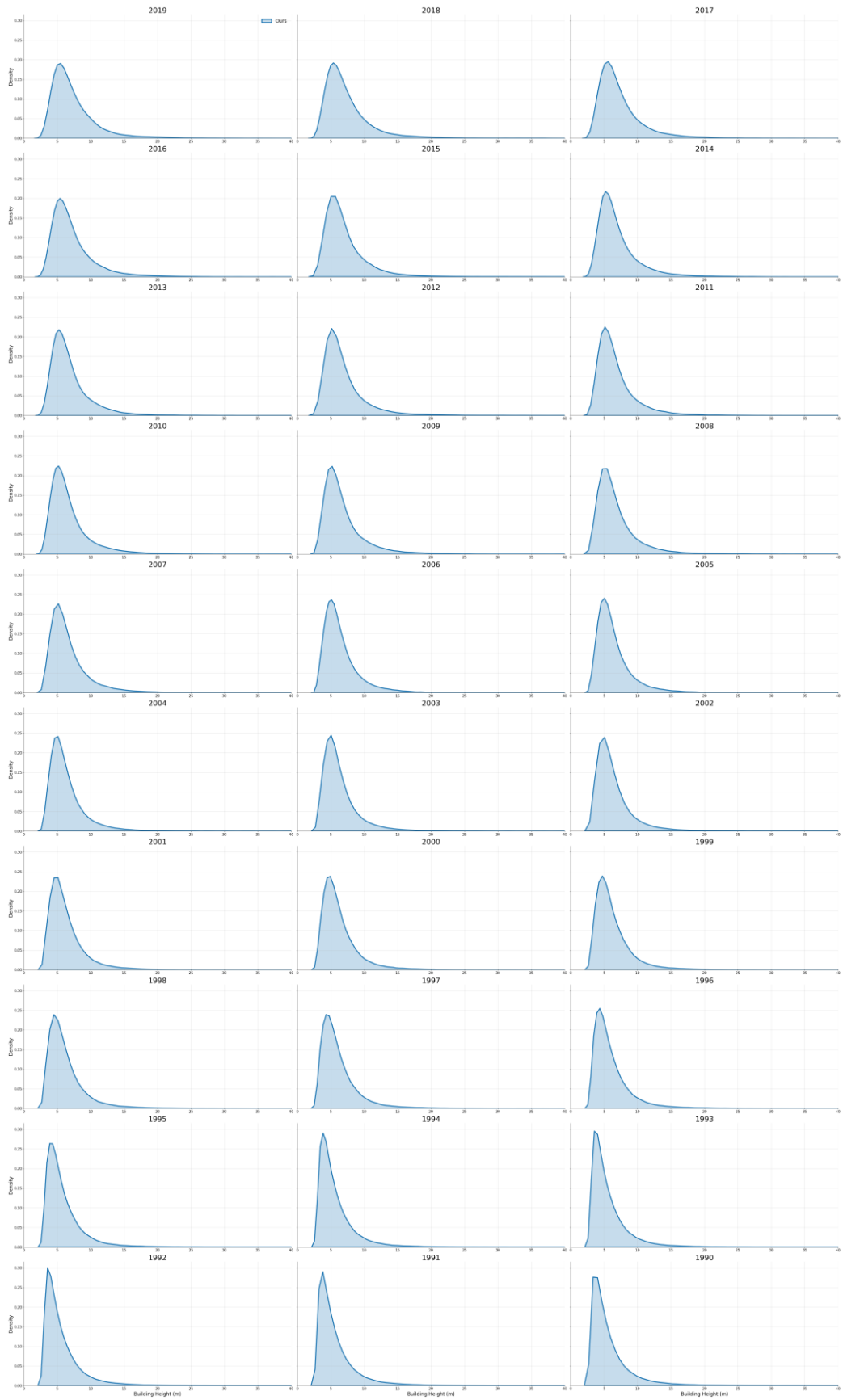


Figure S3. Distribution of building height in our dataset each year from 1990 to 2019

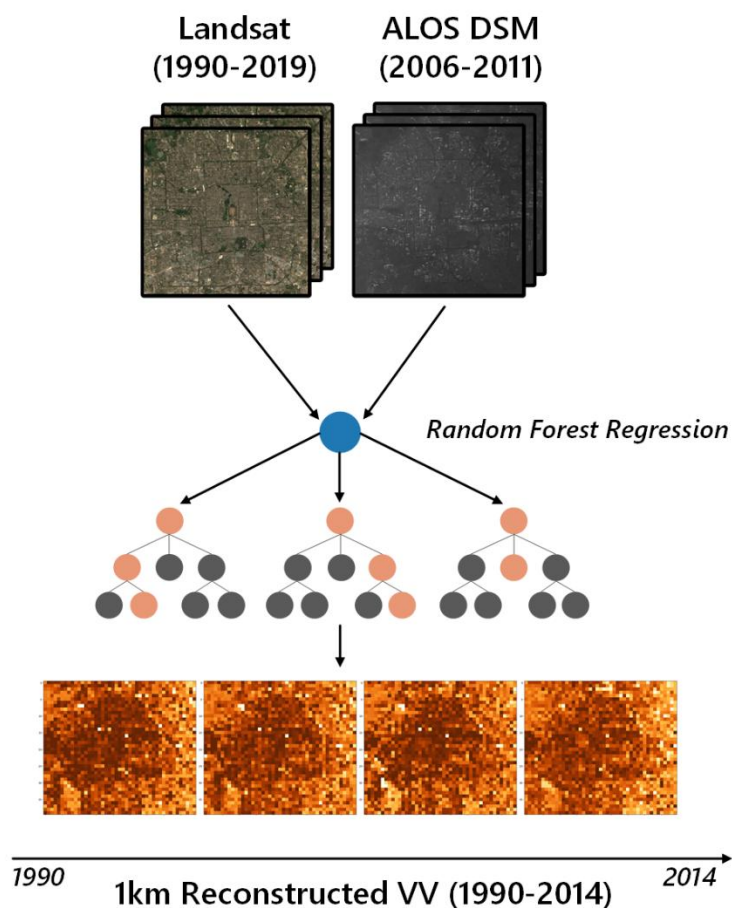


Figure S4. A brief method demonstration of 1km VV backscatter reconstruction

Year	Total	Height			
		<10m	10-30m	30-60m	>60m
1990	1473108	1106154	323456	35412	8086
1991	1528503	1149574	334128	36539	8262
1992	1573418	1184274	343355	37382	8407
1993	1641594	1234689	359393	38762	8750
1994	1737704	1301708	385238	41377	9381
1995	1827014	1368561	405555	43191	9707
1996	1907470	1426979	425301	45112	10078
1997	1976082	1478425	440590	46629	10438
1998	2035993	1523604	453864	47865	10660
1999	2097645	1569420	467707	49469	11049
2000	2191636	1640938	487223	51934	11541
2001	2331073	1744209	518170	56220	12474
2002	2489678	1861743	553410	61127	13398
2003	2643154	1975107	587781	65939	14327
2004	2850716	2129032	633321	72619	15744
2005	3066739	2288133	682684	79043	16879
2006	3287314	2450179	732334	86405	18396
2007	3507332	2608207	783917	94835	20373

2008	3704665	2749958	829888	102621	22198
2009	3936444	2913653	885403	112548	24840
2010	4127598	3048693	931321	120830	26754
2011	4384794	3226568	994709	133386	30131
2012	4556830	3343027	1038757	142647	32399
2013	4767442	3488825	1090728	153616	34273
2014	4994561	3644466	1147038	165798	37259
2015	5226514	3806877	1203443	176743	39451
2016	5404416	3935963	1243871	183792	40790
2017	5581662	4070432	1280343	188903	41984
2018	5801213	4241866	1322437	194023	42887
2019	5984743	4389390	1354458	197435	43460

Table S1. Detailed sample counts and proportions for each year

Year	Total Validated Samples	Accurate Samples	Accuracy(%)
1990	268267	178351	66.48
1991	291148	193505	66.46
1992	331777	218945	65.99
1993	374071	244216	65.29
1994	411879	269261	65.37
1995	463103	307051	66.3
1996	515976	342303	66.34
1997	564208	373214	66.15
1998	622275	421245	67.69
1999	672652	462295	68.73
2000	758118	528517	69.71
2001	832633	569839	68.44
2002	905789	616905	68.11
2003	982672	683523	69.56
2004	1053250	759842	72.14
2005	1120137	838019	74.81
2006	1178456	904747	76.77
2007	1224090	965382	78.87
2008	1275174	1033647	81.06
2009	1316426	1097526	83.37
2010	1358834	1160563	85.41
2011	1387420	1206570	86.97
2012	1415484	1262628	89.2
2013	1433020	1306494	91.17
2014	1449677	1347021	92.92
2015	1462710	1385135	94.7
2016	1472736	1423383	96.65
2017	1476362	1452553	98.39
2018	1477628	1470337	99.51
2019	1477758	1477758	100

Table S2. Number of validated samples and accuracy using Lianjia data

Year	RMSE	MAE	R²
1990	5.994001	3.480429	0.393769
1991	5.980459	3.469782	0.396505
1992	5.952357	3.444393	0.402164
1993	5.966455	3.459669	0.399328
1994	5.9752	3.461418	0.397566
1995	5.958563	3.45692	0.400916
1996	5.975891	3.448721	0.397427
1997	5.949463	3.436525	0.402745
1998	5.941781	3.429879	0.404286
1999	5.941631	3.423402	0.404316
2000	5.98639	3.418165	0.400993
2001	5.970532	3.430596	0.406168
2002	5.975189	3.426488	0.420174
2003	5.967215	3.442007	0.413776
2004	6.043312	3.468931	0.419406
2005	6.077223	3.475488	0.41879
2006	6.07542	3.492525	0.428394
2007	6.156129	3.529483	0.426392
2008	6.214702	3.568118	0.430928
2009	6.336802	3.604438	0.422876
2010	6.3221	3.629313	0.434313
2011	6.506802	3.698226	0.429969
2012	6.520787	3.733498	0.423193
2013	6.556938	3.754666	0.423963
2014	6.690913	3.798594	0.417125
2015	6.636257	3.816825	0.438914
2016	6.619971	3.808973	0.435059
2017	6.60282	3.79405	0.427995
2018	6.466874	3.723968	0.450584
2019	6.3731	3.664484	0.458283

Table S3. RMSEs, MAEs and R²s each year

Year	2019		
	RMSE	MAE	R2
aomen	3.510009	2.114936	0.879104
baoding	2.624771	1.956749	0.76608
beijing	3.002325	2.112569	0.862034
changchun	2.574066	1.890675	0.797196
changsha	2.984106	2.076423	0.864787
changzhou	2.871607	2.001894	0.823328
chengdu	3.255984	2.245725	0.861949
chongqing	3.926292	2.671563	0.850691
dalian	2.77602	2.020402	0.807341
dongguan	3.005018	1.95063	0.738957
eerduosi	2.204777	1.688692	0.841329
foshan	3.230958	1.873658	0.949881
fuzhou	2.790599	1.982865	0.819735
guangzhou	2.955463	1.710652	0.961164
guiyang	3.120889	2.00563	0.868929
haikou	2.152264	1.46353	0.873692
hangzhou	3.012302	2.123595	0.846316
harbin	3.048555	2.228619	0.849053
hefei	3.269959	2.340996	0.814084
huhehaote	2.489037	1.866704	0.798953
huizhou	2.890151	1.911194	0.888753
jiaxing	2.910958	2.098027	0.719166
jinan	3.134484	2.320533	0.799783
jinhua	2.582773	1.779373	0.81719
kunming	2.949059	1.998631	0.891583
lanzhou	2.808071	1.978832	0.802861
lasa	2.260213	1.85652	-0.09028
luoyang	3.107158	2.2326	0.832199
nanchang	2.754308	1.997275	0.798607
nanjing	2.856256	2.06243	0.778531
nanning	2.614729	1.647287	0.893827
nantong	2.661824	1.95156	0.785113
ningbo	2.638663	1.829527	0.833478
qingdao	2.756672	2.014946	0.804564
sanya	2.243765	1.629709	0.828192
shanghai	2.795507	1.990732	0.82677
shantou	2.061923	1.564285	0.824511
shaoxing	2.592048	1.884921	0.792955
shenzhen	3.168579	1.983126	0.896324
shijiazhuang	3.337844	2.324085	0.820002
suzhou	2.644066	1.828174	0.79711
taiyuan	2.788726	2.016921	0.806851

tangshan	2.542297	1.894825	0.775117
tianjin	2.781506	2.031711	0.794688
wenzhou	2.624608	1.904577	0.797709
wuhan	3.134485	2.212117	0.792477
wuhu	2.495269	1.850964	0.725926
wuxi	2.801836	2.012849	0.800828
xiamen	2.566152	1.798937	0.839771
xian	3.489922	2.349061	0.852309
xianggang	4.198532	2.180704	0.922751
xining	2.509427	1.780256	0.839763
xuzhou	2.715917	1.979027	0.728199
yangzhou	2.190522	1.642295	0.642578
yantai	2.205646	1.772753	-0.07153
yinchuan	2.392125	1.784971	0.761148
zhengzhou	3.084661	2.19087	0.830312
zhongshan	1.907946	1.407927	0.839033

The full table including indices from 1990 to 2019 is very long and could be acquired at <https://doi.org/10.6084/m9.figshare.29918978> in 'Accuracy assessment by city.xlsx'

Table S4. Accuracy Assessment ((RMSE, MAE and R^2) for each training sample city each year from 1990 to 2019 (excerpt in 2019)

Year	Mean Height (m)	Built-up Area (km²)	Total Volume (km³)
1990	7.396	56413.684	417.236
1991	7.375	59201.842	436.595
1992	7.324	61700.547	451.886
1993	7.269	64532.238	469.059
1994	7.09	67837.036	480.954
1995	7.022	70951.261	498.224
1996	6.944	73988.195	513.742
1997	6.888	76868.438	529.449
1998	6.758	79899.44	539.971
1999	6.772	83438.724	565.022
2000	6.737	88133.89	593.755
2001	6.683	91967.698	614.626
2002	6.615	96259.234	636.768
2003	6.436	99718.724	641.826
2004	6.361	103240.613	656.725
2005	6.31	107082.292	675.717
2006	6.285	110982.889	697.497
2007	6.248	115301.218	720.454
2008	6.211	119709.792	743.498
2009	6.186	124206.831	768.307
2010	6.137	128960.507	791.439
2011	6.101	134916.136	823.165
2012	5.996	141496.999	848.4
2013	5.808	149059.629	865.753
2014	5.6	156059.643	873.899
2015	5.35	164451.02	879.814
2016	5.181	171959.639	891
2017	5.096	173499.979	884.187
2018	5.068	174359.339	883.633
2019	5.075	174320.663	884.687

Table S5. Annual statistics for impervious surface area, building volume and mean height