

A Comparison of UAV-Derived Dense Point Clouds Using LiDAR and NIR Photogrammetry in an Australian Eucalypt Forest

Megan Winsen * and Grant Hamilton

Table S1. Default Open Drone Map pre-processing settings.

Option	Default Setting	Option	Default Setting
pc-classify	off	mesh-octree-depth	10
orthophoto-png	off	matcher-distance	0
smrf-scalar	1.25	split-overlap	150
opensfm-depthmap-min-patch-sd	1	optimize-disk-space	off
smrf-window	18	dec-decimation	1
feature-type	sift	orthophoto-cutline	off
sm-cluster	None	pc-filter	2.5
min-num-features	8000	split	999999
resize-to	2048	fast-orthophoto	off
smrf-slope	0.15	pc-ept	off
rerun-from	blank	crop	3
split-multitracks	off	pc-las	off
pc-sample	0	merge	all
use-3dmesh	off	gps-accuracy	15
mve-confidence	0.6	dsm	off
radiometric-calibration	none	dem-gapfill-steps	3
texturing-skip-hole-filling	off	mesh-point-weight	4
texturing-outlier-removal-type	gauss_clamping	max-concurrency	4
orthophoto-resolution	5	texturing-tone-mapping	none
dtm	off	cameras (json)	blank
orthophoto-no-tiled	off	dem-euclidean-map	off
dem-resolution	5	camera-lens	auto
mesh-size	200000	skip-3dmodel	off
force-gps	off	matcher-neighbors	8
orthophoto-compression	deflate	pc-csv	off
ignore-gsd	off	end-with	odm_report
build-overviews	off	depthmap-resolution	640
use-opensfm-dense	off	texturing-data-term	gmi
opensfm-depthmap-min-consistent-views	3	texturing-skip-visibility-test	off
texturing-skip-local-seam-levelling	off	opensfm-depthmap-method	PATCH_MATCH
texturing-keep-unseen-faces	off	use-fixed-camera-params	off
debug	off	smrf-threshold	0.5
use-exif	off	verbose	off
mesh-samples	1	use-hybrid-bundle-adjustment	off
pc-rectify	off		

Table S2. Full dataset for CPC and CHM point density at field data collection points (n=84).

Transect	Distance (m)	Field	SfM-NIR Point Density		LiDAR Point Density	
		CPC	Mean	SD	Mean	SD
1	0	0.15	0.0000	0.0000	0.7722	1.8346
1	5	0.16	0.0000	0.0000	7.3718	7.8022
1	10	0.37	0.0789	0.3147	58.3067	28.6189
1	15	0.61	3.1169	2.4440	78.9250	37.8480
1	20	0.3	9.1282	9.4018	7.8734	10.3647
1	25	0.22	0.0000	0.0000	0.0000	0.0000
1	30	0.39	0.3797	1.4258	0.6835	1.8863
1	35	0.5	6.4744	7.8622	36.2208	16.3426
1	40	0.31	2.4304	3.4151	24.4737	14.5190
1	45	0.4	3.7792	2.9657	44.3590	18.2518
1	50	0.4	0.0270	0.1622	0.2821	1.2999
1	55	0.51	2.3418	4.0154	7.0125	6.8657
1	60	0.45	18.3924	6.4148	21.3205	9.1686
1	65	0.37	10.4051	7.4043	17.7692	7.7293
1	70	0.47	0.0000	0.0000	21.8442	19.1407
1	75	0.29	0.2105	0.6138	18.7067	11.1747
1	80	0.37	3.0390	4.0338	16.7500	16.8408
1	85	0.62	0.8590	1.2375	24.4937	15.9023
1	90	0.41	0.0000	0.0000	43.9747	21.7442
1	95	0.46	0.1000	0.3742	23.2500	13.8252
1	100	0.43	1.7051	3.3783	39.4805	27.7286
2	0	0.7	22.9872	5.3768	23.6582	7.6454
2	5	0.44	0.0375	0.1900	18.4375	13.0813
2	10	0.38	1.1266	2.3566	59.8442	21.3937
2	15	0.35	2.5443	2.1216	23.7750	11.6758
2	20	0.19	10.8000	7.1910	25.8875	13.6400
2	25	0.28	0.0000	0.0000	0.0000	0.0000
2	30	0.37	16.5443	12.3522	20.8462	11.5360
2	35	0.62	21.4872	16.1418	26.3125	12.1744
2	40	0.39	11.4156	9.6811	24.3544	11.4073
2	45	0.34	12.7051	10.1856	34.4430	14.3842
2	50	0.53	0.0128	0.1125	6.0250	9.1964
2	55	0.37	15.4935	8.9073	27.1795	12.7829
2	60	0.22	2.1013	3.0795	28.1899	17.4197
2	65	0.26	0.0000	0.0000	0.0000	0.0000
2	70	0.48	0.3247	1.0375	4.5974	7.7882
2	75	0.45	1.9605	4.3602	28.9487	25.5724
2	80	0.48	3.2192	4.2563	16.7532	10.2046
2	85	0.41	1.5513	2.2851	8.9870	4.8523
2	90	0.41	1.2564	2.4360	50.1646	22.9178
2	95	0.37	0.0000	0.0000	32.9730	19.5800

2	100	0.36	0.6709	1.1770	75.5455	17.8526
3	0	0.4	0.5570	1.0031	30.0385	11.4382
3	5	0.45	9.0649	11.3759	15.6835	14.4910
3	10	0.37	0.4459	1.0285	41.6410	14.9022
3	15	0.38	0.0000	0.0000	6.3919	7.9403
3	20	0.24	5.1392	7.3014	16.1410	13.8070
3	25	0.22	1.1875	2.0802	16.0759	14.1115
3	30	0.28	0.0000	0.0000	0.0000	0.0000
3	35	0.33	0.3671	1.4771	17.2821	15.5563
3	40	0.57	0.6835	2.3576	29.1772	24.9662
3	45	0.45	1.4359	2.0791	60.7089	23.7605
3	50	0.51	0.5063	1.0296	60.6923	21.4663
3	55	0.36	19.4474	9.8721	25.7564	12.5168
3	60	0.55	0.0000	0.0000	0.0000	0.0000
3	65	0.37	3.0909	3.2720	12.6538	9.8056
3	70	0.35	2.1538	2.9875	5.0909	6.4991
3	75	0.56	6.0390	4.5994	23.9615	10.5581
3	80	0.29	1.4615	2.0859	17.6494	7.2806
3	85	0.27	0.8395	1.8755	33.5000	12.5899
3	90	0.29	21.3544	16.8200	28.1235	22.1217
3	95	0.38	20.1538	15.9760	43.2405	13.3731
3	100	0.47	5.8553	6.8915	15.5000	10.8009
4	0	0.53	2.4615	3.1853	62.5443	23.6995
4	5	0.37	0.0000	0.0000	0.1410	0.6350
4	10	0.26	0.0000	0.0000	0.0000	0.0000
4	15	0.29	9.3924	13.0077	20.3580	18.2007
4	20	0.3	0.0000	0.0000	3.4359	6.1302
4	25	0.37	5.2692	4.9502	36.6250	16.8474
4	30	0.3	2.4156	2.4619	38.2658	16.2479
4	35	0.43	0.4810	0.9919	33.2338	21.1561
4	40	0.38	0.2597	0.8739	16.9872	12.5723
4	45	0.61	14.4359	11.5110	22.2436	10.0730
4	50	0.45	0.0000	0.0000	2.0875	4.2077
4	55	0.45	1.8228	6.8228	2.0128	4.0494
4	60	0.51	2.8205	3.6082	31.5897	21.8945
4	65	0.25	13.0541	4.4748	37.6753	15.8716
4	70	0.29	0.0000	0.0000	2.9091	7.9678
4	75	0.42	25.4103	18.1655	24.7564	9.4234
4	80	0.26	16.8608	9.4638	22.7403	8.4736
4	85	0.43	4.1975	6.2705	5.8875	8.9540
4	90	0.36	4.0260	5.6153	14.3205	11.2335
4	95	0.33	3.0897	5.1246	18.0641	15.2705
4	100	0.45	3.5195	4.0855	37.1266	17.7103

Table S3. Full dataset for field-measured and corresponding CHM heights (n=45).

Tree ID	Field-measured height (m)	SfM-NIR CHM height (m)	LiDAR CHM height (m)	Tree ID	Field-measured height (m)	SfM-NIR CHM height (m)	LiDAR CHM height (m)
1	30.54	0.00	29.69	24	28.06	0.00	21.01
2	37.32	0.00	26.24	25	18.88	0.00	24.79
3	15.28	23.89	24.63	26	6.01	12.80	13.63
4	17.65	25.08	26.23	27	7.54	15.02	15.14
5	12.69	0.00	24.62	28	13.76	0.00	6.98
6	9.05	0.00	25.80	29	13.82	0.00	12.35
7	12.73	10.59	11.43	30	10.37	0.00	10.99
8	8.64	0.00	0.00	31	6.71	16.66	17.19
9	10.22	10.04	15.72	32	10.19	0.00	16.53
10	13.24	29.24	29.64	33	36.69	27.70	28.06
11	38.44	25.48	25.39	34	17.14	26.17	26.18
12	11.55	0.00	17.95	35	20.04	0.00	24.98
13	7.43	0.00	23.73	36	6.01	23.41	24.04
14	10.17	27.33	28.84	37	7.55	12.25	14.13
15	19.51	14.10	13.56	38	7.46	0.00	5.84
16	8.56	13.95	12.99	39	5.93	0.00	12.58
17	17.13	12.88	17.50	40	19.12	19.43	19.54
18	9.08	0.00	10.53	41	9.16	16.56	16.92
19	5.36	12.92	14.49	42	12.09	11.47	12.22
20	6.50	16.14	17.29	43	8.60	20.72	0.00
21	4.28	0.00	11.04	44	6.61	0.00	0.00
22	11.85	11.20	11.88	45	21.08	0.00	0.00
23	38.38	29.12	30.93				