

Supplementary tables: eclipse-model sensitivity in solar-radiation-pressure orbit propagation

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Abstract

Complete numerical records for Cases 5–8 accompany the representative tables in the main article. The archive includes 273 model-pair metric records, 210 numerical-comparison records, and 28 sampling records. M0 is cylindrical shadow, M1 analytic spherical occultation, M1r its matched ray control, M2 oblate-limb ray occultation, and M3 prescribed linear transmission. Distances are in metres. A/AT denote the adaptive and tighter adaptive settings; R and Q labels give nominal steps per period and solar-disc ray counts. The full-precision CSV exports accompany this document.

Table 1: All Case 5 configurations. Every run spans 50 initial periods with a frozen Sun, $u_0 = 0$, $C_R = 1$, 2304 rays, and $h_{\text{TOA}} = 50$ km.

ID	h (km)	i (deg)	Ω (deg)	A/m (m ² /kg)	Days
C5.1	700	51.6	0	0.01	3.4296
C5.2	20200	55	0	0.01	24.9548
C5.3	35786	51.6	0	0.01	49.8634
C5.4	60000	51.6	0	0.01	98.4929
C5.5	60000	0	0	0.05	98.4929
C5.6	75000	51.6	0	0.01	133.6992
C5.7	20200	55	350	0.01	24.9548

Table 2: Complete Case 5 sampled maxima (m). R1200, R2400, and R4800 denote nominal RK4 steps per period. A and AT denote the adaptive and tighter adaptive settings specified in the Methods section of the main article. R rows use checkpoints; A/AT rows use dense output. No original Case 1–4 value is substituted by these results.

ID	Setting	M0–M1	M1–M2	M2–M3	M0–M3
C5.1	R1200	0.104705	0.146956	0.250437	0.208185
C5.1	R2400	0.0862563	0.147977	0.251238	0.0352676
C5.1	R4800	0.0558328	0.148628	0.251931	0.159135
C5.1	A	0.00333549	0.147722	0.249108	0.104722
C5.1	AT	0.00139099	0.148456	0.25168	0.104615

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Table 2 (continued)

ID	Setting	M0–M1	M1–M2	M2–M3	M0–M3
C5.2	R1200	3.21504	0.754788	0.873522	3.09632
C5.2	R2400	0.497084	0.757658	0.879644	0.375127
C5.2	R4800	0.17103	0.774498	0.896	0.292533
C5.2	A	0.0363195	0.769258	0.890503	0.24529
C5.2	AT	0.0304196	0.768647	0.889792	0.251164
C5.3	R1200	9.83001	1.7887	2.1859	9.43286
C5.3	R2400	0.233209	1.73461	2.14172	0.640325
C5.3	R4800	1.91483	1.75444	2.16084	2.3212
C5.3	A	0.111532	1.735	2.13034	0.578328
C5.3	AT	0.0916805	1.72663	2.13165	0.58827
C5.4	R1200	24.4764	4.1432	5.08645	23.5333
C5.4	R2400	0.441493	4.16003	5.13847	1.41995
C5.4	R4800	4.60609	4.25435	5.22463	5.5763
C5.4	A	0.228526	4.24911	5.20477	1.43557
C5.4	AT	0.20618	4.23491	5.20568	1.44272
C5.5	R1200	53.1516	0.273094	26.7354	80.1597
C5.5	R2400	11.699	0.725921	27.6742	38.6471
C5.5	R4800	9.08347	0.0830055	26.8188	17.8187
C5.5	A	1.10115	0.0665463	26.9608	27.9954
C5.5	AT	1.06465	0.0287518	26.9466	27.9825
C5.6	R1200	15.4553	6.6749	8.16457	16.9449
C5.6	R2400	10.8734	6.61973	8.0861	9.40724
C5.6	R4800	7.85601	6.39436	7.85872	9.32027
C5.6	A	0.239283	6.39596	7.8403	2.14442
C5.6	AT	0.214744	6.36229	7.82505	2.15032
C5.7	R1200	0.94342	8.40129	1.09107	8.54878
C5.7	R2400	1.09136	8.43085	1.06149	8.40082
C5.7	R4800	0.0209169	8.42479	1.06814	9.51367
C5.7	A	0.0377755	8.74785	1.07923	9.52819
C5.7	AT	0.030037	8.75247	1.07638	9.52245

Table 3: Complete Case 5 numerical-comparison records. ID is the configuration index within the case. A/AT and R labels follow the integration settings; Q labels give the ray count. E , S , and ε are in metres, and the flag uses $E \leq \varepsilon$.

ID	Settings	Pair	E	S	ε	Flag
1	A/AT	M0–M1	0.00194454	0.0019445	0.00101391	N
1	A/AT	M1–M2	0.000829489	0.000734488	0.00248456	Y
1	A/AT	M2–M3	0.00257161	0.00257155	0.0035168	Y
1	A/AT	M0–M3	0.000132221	0.00010737	0.00204615	Y
1	R1200/AT	M0–M1	0.103314	0.103314	0.00101391	N
1	R1200/AT	M1–M2	0.0015003	0.00150028	0.00248456	Y
1	R1200/AT	M2–M3	0.00124254	0.00124251	0.0035168	Y

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Table 3 (continued)

ID	Settings	Pair	E	S	ε	Flag
1	R1200/AT	M0–M3	0.103572	0.10357	0.00204615	N
1	R1200/R2400	M0–M1	0.190961	0.0184486	0.00186256	N
1	R1200/R2400	M1–M2	0.00102052	0.00102051	0.00247977	Y
1	R1200/R2400	M2–M3	0.000801079	0.000801065	0.00351238	Y
1	R1200/R2400	M0–M3	0.191181	0.172917	0.00135268	N
1	R2400/AT	M0–M1	0.0876472	0.0848653	0.00101391	N
1	R2400/AT	M1–M2	0.000479778	0.000479772	0.00248456	Y
1	R2400/AT	M2–M3	0.000441458	0.00044145	0.0035168	Y
1	R2400/AT	M0–M3	0.0876089	0.0693471	0.00204615	N
1	R2400/R4800	M0–M1	0.142089	0.0304234	0.00155833	N
1	R2400/R4800	M1–M2	0.00065117	0.000651159	0.00248628	Y
1	R2400/R4800	M2–M3	0.000692667	0.000692652	0.00351931	Y
1	R2400/R4800	M0–M3	0.142131	0.123868	0.00259135	N
1	R4800/AT	M0–M1	0.0544419	0.0544419	0.00101391	N
1	R4800/AT	M1–M2	0.000171393	0.000171387	0.00248456	Y
1	R4800/AT	M2–M3	0.00025121	0.000251202	0.0035168	Y
1	R4800/AT	M0–M3	0.0545217	0.0545207	0.00204615	N
2	A/AT	M0–M1	0.00590013	0.00589996	0.0013042	N
2	A/AT	M1–M2	0.00143831	0.000611687	0.00868647	Y
2	A/AT	M2–M3	0.000783382	0.000710903	0.00989792	Y
2	A/AT	M0–M3	0.0059994	0.00376769	0.00262206	N
2	R1200/AT	M0–M1	3.24546	3.18462	0.0013042	N
2	R1200/AT	M1–M2	0.0138586	0.0138585	0.00868647	N
2	R1200/AT	M2–M3	0.0162705	0.01627	0.00989792	N
2	R1200/AT	M0–M3	3.24787	2.93412	0.00262206	N
2	R1200/R2400	M0–M1	2.71795	2.71795	0.00597084	N
2	R1200/R2400	M1–M2	0.00286995	0.00286994	0.00857658	Y
2	R1200/R2400	M2–M3	0.00612216	0.00612202	0.00979644	Y
2	R1200/R2400	M0–M3	2.72121	2.72119	0.00475127	N
2	R2400/AT	M0–M1	0.527503	0.466665	0.0013042	N
2	R2400/AT	M1–M2	0.0109887	0.0109885	0.00868647	N
2	R2400/AT	M2–M3	0.0101483	0.010148	0.00989792	N
2	R2400/AT	M0–M3	0.526663	0.21292	0.00262206	N
2	R2400/R4800	M0–M1	0.668115	0.326054	0.0027103	N
2	R2400/R4800	M1–M2	0.0168397	0.0168395	0.00874498	N
2	R2400/R4800	M2–M3	0.0163567	0.0163562	0.00996	N
2	R2400/R4800	M0–M3	0.667632	0.0825938	0.00392533	N
2	R4800/AT	M0–M1	0.140612	0.140611	0.0013042	N
2	R4800/AT	M1–M2	0.00585102	0.00585095	0.00868647	Y
2	R4800/AT	M2–M3	0.00620835	0.00620818	0.00989792	Y
2	R4800/AT	M0–M3	0.140969	0.130327	0.00262206	N
3	A/AT	M0–M1	0.0198523	0.0198518	0.0019168	N
3	A/AT	M1–M2	0.00837301	0.00837274	0.0182663	Y
3	A/AT	M2–M3	0.00171162	0.00131045	0.0223165	Y
3	A/AT	M0–M3	0.010169	0.00871506	0.00600915	N
3	R1200/AT	M0–M1	9.92169	9.73833	0.0019168	N

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Table 3 (continued)

ID	Settings	Pair	E	S	ε	Flag
3	R1200/AT	M1–M2	0.062072	0.0620713	0.0182663	N
3	R1200/AT	M2–M3	0.0542419	0.0542404	0.0223165	N
3	R1200/AT	M0–M3	9.92952	8.93194	0.00600915	N
3	R1200/R2400	M0–M1	10.0632	9.59681	0.00333209	N
3	R1200/R2400	M1–M2	0.0540854	0.0540847	0.0183461	N
3	R1200/R2400	M2–M3	0.0441755	0.0441741	0.0224172	N
3	R1200/R2400	M0–M3	10.0731	8.79254	0.00740325	N
3	R2400/AT	M0–M1	0.141532	0.141528	0.0019168	N
3	R2400/AT	M1–M2	0.00798669	0.00798666	0.0182663	Y
3	R2400/AT	M2–M3	0.0100665	0.0100663	0.0223165	Y
3	R2400/AT	M0–M3	0.143612	0.13941	0.00600915	N
3	R2400/R4800	M0–M1	1.68162	1.68162	0.0201483	N
3	R2400/R4800	M1–M2	0.0198266	0.0198263	0.0185444	N
3	R2400/R4800	M2–M3	0.0191162	0.0191155	0.0226084	Y
3	R2400/R4800	M0–M3	1.68091	1.68088	0.024212	N
3	R4800/AT	M0–M1	1.82315	1.82315	0.0019168	N
3	R4800/AT	M1–M2	0.0278133	0.0278129	0.0182663	N
3	R4800/AT	M2–M3	0.0291826	0.0291818	0.0223165	N
3	R4800/AT	M0–M3	1.82452	1.82028	0.00600915	N
4	A/AT	M0–M1	0.0223458	0.0223454	0.0030618	N
4	A/AT	M1–M2	0.014201	0.014201	0.0433491	Y
4	A/AT	M2–M3	0.000964722	0.000911095	0.0530568	Y
4	A/AT	M0–M3	0.0072336	0.00576059	0.0128986	Y
4	R1200/AT	M0–M1	24.6826	24.2703	0.0030618	N
4	R1200/AT	M1–M2	0.0917045	0.0917034	0.0433491	N
4	R1200/AT	M2–M3	0.119226	0.119222	0.0530568	N
4	R1200/AT	M0–M3	24.7101	22.3434	0.0128986	N
4	R1200/R2400	M0–M1	24.9179	24.035	0.00541493	N
4	R1200/R2400	M1–M2	0.016827	0.016827	0.0426003	Y
4	R1200/R2400	M2–M3	0.0520173	0.0520161	0.0523847	Y
4	R1200/R2400	M0–M3	24.9531	22.1134	0.0151995	N
4	R2400/AT	M0–M1	0.235329	0.235313	0.0030618	N
4	R2400/AT	M1–M2	0.0748776	0.0748764	0.0433491	N
4	R2400/AT	M2–M3	0.0672086	0.0672062	0.0530568	N
4	R2400/AT	M0–M3	0.242997	0.230084	0.0128986	N
4	R2400/R4800	M0–M1	4.1646	4.1646	0.0470609	N
4	R2400/R4800	M1–M2	0.0943222	0.0943209	0.0435435	N
4	R2400/R4800	M2–M3	0.0861634	0.0861606	0.0532463	N
4	R2400/R4800	M0–M3	4.15644	4.15635	0.056763	N
4	R4800/AT	M0–M1	4.39991	4.39991	0.0030618	N
4	R4800/AT	M1–M2	0.0194446	0.0194445	0.0433491	Y
4	R4800/AT	M2–M3	0.0189548	0.0189544	0.0530568	Y
4	R4800/AT	M0–M3	4.39942	4.38644	0.0128986	N
5	A/AT	M0–M1	0.036496	0.036495	0.0116465	N
5	A/AT	M1–M2	0.0377949	0.0377945	0.00128752	N
5	A/AT	M2–M3	0.0142218	0.0142209	0.270466	Y

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Table 3 (continued)

ID	Settings	Pair	E	S	ε	Flag
5	A/AT	M0–M3	0.0129229	0.0129224	0.280825	Y
5	R1200/AT	M0–M1	52.087	52.087	0.0116465	N
5	R1200/AT	M1–M2	0.301845	0.244342	0.00128752	N
5	R1200/AT	M2–M3	0.21123	0.211229	0.270466	Y
5	R1200/AT	M0–M3	52.1776	52.1772	0.280825	N
5	R1200/R2400	M0–M1	41.4527	41.4527	0.11799	N
5	R1200/R2400	M1–M2	0.999015	0.452827	0.00825921	N
5	R1200/R2400	M2–M3	0.938881	0.938863	0.277742	N
5	R1200/R2400	M0–M3	41.5128	41.5126	0.387471	N
5	R2400/AT	M0–M1	10.6343	10.6343	0.0116465	N
5	R2400/AT	M1–M2	0.69717	0.697169	0.00128752	N
5	R2400/AT	M2–M3	0.727651	0.727634	0.270466	N
5	R2400/AT	M0–M3	10.6648	10.6646	0.280825	N
5	R2400/R4800	M0–M1	20.7824	2.61548	0.0918347	N
5	R2400/R4800	M1–M2	0.808926	0.642915	0.00183006	N
5	R2400/R4800	M2–M3	0.855425	0.855407	0.269188	N
5	R2400/R4800	M0–M3	20.8289	20.8284	0.179187	N
5	R4800/AT	M0–M1	10.1481	8.01882	0.0116465	N
5	R4800/AT	M1–M2	0.111757	0.0542537	0.00128752	N
5	R4800/AT	M2–M3	0.127775	0.127773	0.270466	Y
5	R4800/AT	M0–M3	10.1641	10.1638	0.280825	N
6	A/AT	M0–M1	0.0245402	0.0245397	0.00314744	N
6	A/AT	M1–M2	0.0336669	0.0336667	0.0646229	Y
6	A/AT	M2–M3	0.0152485	0.0152481	0.0792505	Y
6	A/AT	M0–M3	0.00612181	0.00422372	0.0180306	Y
6	R1200/AT	M0–M1	15.2406	15.2406	0.00314744	N
6	R1200/AT	M1–M2	0.312611	0.312608	0.0646229	N
6	R1200/AT	M2–M3	0.339526	0.339518	0.0792505	N
6	R1200/AT	M0–M3	15.2675	15.2419	0.0180306	N
6	R1200/R2400	M0–M1	26.3288	4.58192	0.109734	N
6	R1200/R2400	M1–M2	0.0551715	0.0551714	0.0671973	Y
6	R1200/R2400	M2–M3	0.0784661	0.0784652	0.081861	Y
6	R1200/R2400	M0–M3	26.352	7.53768	0.0950724	N
6	R2400/AT	M0–M1	11.0882	10.6587	0.00314744	N
6	R2400/AT	M1–M2	0.257439	0.257436	0.0646229	N
6	R2400/AT	M2–M3	0.26106	0.261053	0.0792505	N
6	R2400/AT	M0–M3	11.0845	7.70418	0.0180306	N
6	R2400/R4800	M0–M1	18.7294	3.01741	0.0795601	N
6	R2400/R4800	M1–M2	0.225366	0.225364	0.0649436	N
6	R2400/R4800	M2–M3	0.227392	0.227387	0.0795872	N
6	R2400/R4800	M0–M3	18.7274	0.0869674	0.0942027	N
6	R4800/AT	M0–M1	7.64127	7.64126	0.00314744	N
6	R4800/AT	M1–M2	0.0320733	0.0320727	0.0646229	Y
6	R4800/AT	M2–M3	0.033668	0.0336666	0.0792505	Y
6	R4800/AT	M0–M3	7.64286	7.61721	0.0180306	N
7	A/AT	M0–M1	0.00773924	0.00773841	0.00130037	N

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Table 3 (continued)

ID	Settings	Pair	E	S	ε	Flag
7	A/AT	M1–M2	0.00485379	0.00485372	0.0851621	Y
7	A/AT	M2–M3	0.00284634	0.00284599	0.0117638	Y
7	A/AT	M0–M3	0.00573182	0.00573181	0.0962245	Y
7	R1200/AT	M0–M1	0.973452	0.913383	0.00130037	N
7	R1200/AT	M1–M2	0.0149209	0.0149209	0.0851621	Y
7	R1200/AT	M2–M3	0.0146937	0.0146914	0.0117638	N
7	R1200/AT	M0–M3	0.973679	0.973674	0.0962245	N
7	R1200/R2400	M0–M1	0.147969	0.147943	0.0119136	N
7	R1200/R2400	M1–M2	0.0295693	0.0295693	0.0853085	Y
7	R1200/R2400	M2–M3	0.0295818	0.029577	0.0116149	N
7	R1200/R2400	M0–M3	0.147981	0.147962	0.0850082	N
7	R2400/AT	M0–M1	1.1214	1.06133	0.00130037	N
7	R2400/AT	M1–M2	0.0146483	0.0146483	0.0851621	Y
7	R2400/AT	M2–M3	0.0148881	0.0148856	0.0117638	N
7	R2400/AT	M0–M3	1.12164	1.12164	0.0962245	N
7	R2400/R4800	M0–M1	1.11228	1.07045	0.00120917	N
7	R2400/R4800	M1–M2	0.0060675	0.00606749	0.0852479	Y
7	R2400/R4800	M2–M3	0.00664349	0.00664218	0.0116814	Y
7	R2400/R4800	M0–M3	1.11286	1.11285	0.0961367	N
7	R4800/AT	M0–M1	0.00990304	0.00912015	0.00130037	N
7	R4800/AT	M1–M2	0.00858084	0.00858083	0.0851621	Y
7	R4800/AT	M2–M3	0.00824461	0.00824339	0.0117638	Y
7	R4800/AT	M0–M3	0.00969395	0.00878058	0.0962245	Y

Table 4: All 28 Case 5 tighter-reference sampling records (m).
The gap is the dense sampled maximum minus the checkpoint maximum; zero refers only to the tested sample sets.

ID	Pair	Checkpoint	Dense	Gap
C5.1	M0–M1	0.00139099	0.00139099	0
C5.1	M1–M2	0.148456	0.148456	0
C5.1	M2–M3	0.25168	0.25168	0
C5.1	M0–M3	0.104615	0.104615	0
C5.2	M0–M1	0.0304196	0.0304196	0
C5.2	M1–M2	0.768647	0.768647	0
C5.2	M2–M3	0.889792	0.889792	0
C5.2	M0–M3	0.162206	0.251164	0.0889577
C5.3	M0–M1	0.0916805	0.0916805	0
C5.3	M1–M2	1.72663	1.72663	0
C5.3	M2–M3	2.13165	2.13165	0
C5.3	M0–M3	0.500915	0.58827	0.0873547
C5.4	M0–M1	0.20618	0.20618	0
C5.4	M1–M2	4.23491	4.23491	0
C5.4	M2–M3	5.20568	5.20568	0

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Table 4 (continued)

ID	Pair	Checkpoint	Dense	Gap
C5.4	M0–M3	1.18986	1.44272	0.252857
C5.5	M0–M1	1.06465	1.06465	0
C5.5	M1–M2	0.0287518	0.0287518	0
C5.5	M2–M3	26.9466	26.9466	0
C5.5	M0–M3	27.9825	27.9825	0
C5.6	M0–M1	0.214744	0.214744	0
C5.6	M1–M2	6.36229	6.36229	0
C5.6	M2–M3	7.82505	7.82505	0
C5.6	M0–M3	1.70306	2.15032	0.447256
C5.7	M0–M1	0.030037	0.030037	0
C5.7	M1–M2	8.41621	8.75247	0.336262
C5.7	M2–M3	1.07638	1.07638	0
C5.7	M0–M3	9.52245	9.52245	0

Table 5: Complete Case 6 checkpoint maxima (m), at 4800 RK4 steps per period and 50 periods. C6.1: 700 km, $i = 51.6^\circ$, $\Omega = 0$; C6.2: 60000 km, $i = \Omega = 0$; C6.3: 20200 km, $i = 55^\circ$, $\Omega = 350^\circ$. All have $A/m = 0.01 \text{ m}^2/\text{kg}$ and frozen solar geometry.

ID	Rays	M1– M_{1r}	M_{1r} –M2	M2–M3	M1–M2
C6.1	2304	0.000604859	0.148023	0.251931	0.148628
C6.1	4096	0.000651459	0.148599	0.25125	0.147948
C6.1	9216	0.000196827	0.148381	0.251486	0.148184
C6.2	2304	0.0282408	0.00690648	5.17291	0.0213344
C6.2	4096	0.0290928	0.00770875	5.17865	0.0213841
C6.2	9216	0.00594898	0.016502	5.22093	0.022451
C6.3	2304	0.00120724	8.42599	1.06814	8.42479
C6.3	4096	0.0057724	8.4139	1.07305	8.41967
C6.3	9216	0.0046256	8.42104	1.07629	8.41641

Table 6: Complete Case 6 numerical-comparison records. ID is the configuration index within the case. A/AT and R labels follow the integration settings; Q labels give the ray count. E , S , and ε are in metres, and the flag uses $E \leq \varepsilon$.

ID	Settings	Pair	E	S	ε	Flag
1	Q2304/Q4096	M1– M_{1r}	0.00125632	4.66001e-05	0.00100651	N
1	Q2304/Q4096	M_{1r} –M2	0.000576317	0.000576304	0.00248599	Y
1	Q2304/Q4096	M2–M3	0.000680877	0.000680861	0.0035125	Y
1	Q2304/Q4096	M1–M2	0.000680001	0.000679988	0.00247948	Y
1	Q4096/Q9216	M1– M_{1r}	0.000454632	0.000454632	0.00100197	Y

Continued on next page

Table 6 (continued)

ID	Settings	Pair	E	S	ε	Flag
1	Q4096/Q9216	M_{1r} -M2	0.000218527	0.000218522	0.00248381	Y
1	Q4096/Q9216	M2-M3	0.000235536	0.000235533	0.00351486	Y
1	Q4096/Q9216	M1-M2	0.000236106	0.000236103	0.00248184	Y
2	Q2304/Q4096	$M1-M_{1r}$	0.000852384	0.000851967	0.00129093	Y
2	Q2304/Q4096	M_{1r} -M2	0.000802281	0.00080227	0.00107709	Y
2	Q2304/Q4096	M2-M3	0.00573566	0.00573563	0.0527865	Y
2	Q2304/Q4096	M1-M2	0.000797512	4.9726e-05	0.00121384	Y
2	Q4096/Q9216	$M1-M_{1r}$	0.0350417	0.0231438	0.00105949	N
2	Q4096/Q9216	M_{1r} -M2	0.00879326	0.00879324	0.00116502	N
2	Q4096/Q9216	M2-M3	0.0422834	0.0422823	0.0532093	Y
2	Q4096/Q9216	M1-M2	0.043835	0.00106683	0.00122451	N
3	Q2304/Q4096	$M1-M_{1r}$	0.00697963	0.00456516	0.00105772	N
3	Q2304/Q4096	M_{1r} -M2	0.0120927	0.0120927	0.085139	Y
3	Q2304/Q4096	M2-M3	0.00490989	0.00490915	0.0117305	Y
3	Q2304/Q4096	M1-M2	0.00511303	0.00511303	0.0851967	Y
3	Q4096/Q9216	$M1-M_{1r}$	0.010398	0.0011468	0.00104626	N
3	Q4096/Q9216	M_{1r} -M2	0.0071378	0.0071378	0.0852104	Y
3	Q4096/Q9216	M2-M3	0.00324283	0.00324246	0.0117629	Y
3	Q4096/Q9216	M1-M2	0.0032602	0.00326018	0.0851641	Y

Table 7: Fifty-period Case 7 checkpoint maxima (m). Regimes (h [km], i [deg]) are LEO (700, 51.6), MEO (20200, 55), GEO (35786, 0), and High (60000, 0). All use $\Omega = 0$, $A/m = 0.01 \text{ m}^2/\text{kg}$, 4800 RK4 steps per period, and 2304 rays.

Regime	Sun	Days	M0-M1	M1-M2	M2-M3	M0-M3
LEO	frozen	3.4296	0.0558328	0.148628	0.251931	0.159135
LEO	moving	3.4296	0.00491629	0.0952508	0.251489	0.161155
MEO	frozen	24.9548	0.17103	0.774498	0.896	0.292533
MEO	moving	24.9548	0.0387078	4.24994	1.07142	5.35898
GEO	frozen	49.8634	0.746033	0.0216048	2.10792	1.38353
GEO	moving	49.8634	0.156818	0.63346	1.5414	0.898098
High	frozen	98.4929	1.87167	0.0213344	5.17291	3.32267
High	moving	98.4929	0.612193	0.462228	1.17426	1.29407

Table 8: Thirty-day Case 7 checkpoint maxima (m). Regimes (h [km], i [deg]) are LEO (700, 51.6), MEO (20200, 55), GEO (35786, 0), and High (60000, 0). All use $\Omega = 0$, $A/m = 0.01$ m²/kg, 4800 RK4 steps per period, and 2304 rays.

Regime	Sun	Days	M0–M1	M1–M2	M2–M3	M0–M3
LEO	frozen	30.0000	4.64202	2.50018	2.2632	4.40503
LEO	moving	30.0000	0.05057	33.1621	2.18471	34.4557
MEO	frozen	30.0000	0.241047	0.992981	1.07739	0.32546
MEO	moving	30.0000	0.0692313	6.91731	1.52534	8.46602
GEO	frozen	30.0000	0.261976	0.00830395	1.26663	1.01747
GEO	moving	30.0000	0.156818	0.63779	1.52272	0.847032
High	frozen	30.0000	0.169384	0.00176896	1.54497	1.39743
High	moving	30.0000	0.612193	0.462228	1.14921	1.29407

Table 9: Complete Case 7 transmission-height comparison: M2–M3 maxima (m) over 50 periods with a frozen Sun. The numerical refinement envelope is held at 75 km for all three heights; the linear transmission law, 4800 steps per period, and 2304 rays are retained.

TOA height (km)	LEO	MEO
25	0.125231	0.451326
50	0.251931	0.896
75	0.380497	1.34085

Table 10: All Case 8 M0–M1 sampled maxima (m), for $\Omega = 0$, $A/m = 0.01$ m²/kg, a frozen Sun, and 50 periods. R1200/R4800 use checkpoints; AT uses the exported dense adaptive output.

ID	Altitude (km)	i (deg)	R1200	R4800	AT
C8.1	50000	51.6	5.60349	2.47194	0.163773
C8.2	55000	51.6	20.7239	4.14886	0.187138
C8.3	60000	51.6	24.4764	4.60609	0.20618
C8.4	65000	51.6	10.0626	0.928985	0.219152
C8.5	70000	51.6	11.7728	1.36143	0.223119
C8.6	75000	51.6	15.4553	7.85601	0.214744
C8.7	60000	5	7.80943	3.65385	0.206311
C8.8	60000	10	31.233	2.12367	0.206691
C8.9	60000	15	19.1094	0.926116	0.206722

Table 11: Complete Case 8 numerical-comparison records. ID is the configuration index within the case. A/AT and R labels follow the integration settings; Q labels give the ray count. E , S , and ε are in metres, and the flag uses $E \leq \varepsilon$.

ID	Settings	Pair	E	S	ε	Flag
1	R1200/R4800	M0-M1	8.07544	3.13155	0.0257194	N
1	R4800/AT	M0-M1	2.63571	2.30817	0.00263773	N
2	R1200/R4800	M0-M1	24.8727	16.575	0.0424886	N
2	R4800/AT	M0-M1	3.96172	3.96172	0.00287138	N
3	R1200/R4800	M0-M1	29.0825	19.8704	0.0470609	N
3	R4800/AT	M0-M1	4.39991	4.39991	0.0030618	N
4	R1200/R4800	M0-M1	9.13362	9.13362	0.0102898	N
4	R4800/AT	M0-M1	0.709837	0.709833	0.00319152	N
5	R1200/R4800	M0-M1	10.4113	10.4113	0.0146143	N
5	R4800/AT	M0-M1	1.13832	1.13832	0.00323119	N
6	R1200/R4800	M0-M1	7.59934	7.59934	0.0795601	N
6	R4800/AT	M0-M1	7.64127	7.64126	0.00314744	N
7	R1200/R4800	M0-M1	4.15558	4.15558	0.0375385	N
7	R4800/AT	M0-M1	3.44754	3.44753	0.00306311	N
8	R1200/R4800	M0-M1	29.1093	29.1093	0.0222367	N
8	R4800/AT	M0-M1	1.91699	1.91698	0.00306691	N
9	R1200/R4800	M0-M1	20.0355	18.1833	0.0102612	N
9	R4800/AT	M0-M1	0.719407	0.719393	0.00306722	N