

Supplementary material:

Table S1. Statistical values of SDLR errors at different PWV ranges, corresponding to Figure 10.

PWV range (cm)		(0, 1]	(1, 2]	(2,3]	(3, 4]	(4, 5]	(5, 6]	(6, 7]	(7, 8]
Sample		97416	70883	39957	28336	19556	19151	6740	467
RMSE (W/m ²)	Zhou2007	27.2	21.5	20.6	16.6	15.1	15.6	19.8	25.2
	Calibrated-zhou	26.7	21.1	19.6	17.2	14.8	12.2	10.0	6.3
	New model	25.4	20.3	19.1	16.8	14.4	11.9	9.6	7.4
MBE (W/m ²)	Zhou2007	4.5	4.3	6.0	-0.2	-6.3	-9.8	-17.1	-24.0
	Calibrated-zhou	-0.9	-4.4	-1.3	-3.3	-3.9	-1.1	-1.5	-0.8
	New model	0.0	0.0	-0.4	-3.3	-3.9	-0.7	0.2	2.9
First quartile (W/m ²)	Zhou2007	-15.0	-9.9	-5.8	-10.2	-15.0	-17.9	-23.8	-29.2
	Calibrated-zhou	-20.5	-18.4	-13.1	-13.8	-13.2	-8.9	-8.0	-4.7
	New model	-16.8	-13.3	-11.7	-13.3	-12.6	-8.2	-6.3	-1.8
Third quartile (W/m ²)	Zhou2007	24.4	17.8	17.2	9.5	2.5	-1.8	-10.8	-19.3
	Calibrated-zhou	19.1	8.7	9.8	6.7	5.5	7.2	5.0	3.1
	New model	18.3	12.6	10.4	6.4	5.3	7.3	6.5	7.5
Median value (W/m ²)	Zhou2007	5.4	2.0	4.3	-0.2	-6.2	-9.7	-17.4	-24.4
	Calibrated-zhou	0.1	-6.6	-2.5	-2.8	-3.5	-0.5	-1.2	-0.7
	New model	1.0	-2.2	-1.5	-2.9	-3.4	-0.1	0.5	2.8
Upper limit (W/m ²)	Zhou2007	83.6	59.2	51.7	39.1	28.8	22.2	8.7	-4.5
	Calibrated-zhou	78.4	49.4	44.3	37.5	33.6	31.4	24.4	14.7
	New model	71.0	51.3	43.7	36.0	32.2	30.5	25.7	21.4
Lower limit (W/m ²)	Zhou2007	-74.2	-51.3	-40.3	-39.8	-41.3	-41.9	-43.3	-44.0
	Calibrated-zhou	-79.9	-59.1	-47.6	-44.5	-41.3	-33.1	-27.4	-16.3
	New model	-69.5	-52.1	-45.0	-42.8	-39.6	-31.5	-25.4	-15.7
Interquartile range (W/m ²)	Zhou2007	39.5	27.6	23.0	19.7	17.5	16.0	13.0	9.9
	Calibrated-zhou	39.6	27.1	23.0	20.5	18.7	16.1	13.0	7.7
	New model	35.1	25.9	22.2	19.7	17.9	15.5	12.8	9.3

Table S2. Statistical values of SDLR errors at different LWP ranges for water and mixed phase clouds, corresponding to Figure 11a.

LWP range (g/m ²)		(0, 50]	(50, 100]	(100,150]	(150,200]	(200,250]	(250,300]	(300,350]	(350,400]	(400, 1000]
sample		11683	17452	10610	8141	4242	142055	1691	1312	5425
RMSE (W/m ²)	Zhou2007	20.1	20.5	19.4	18.3	19.1	24.4	19.0	18.8	21.2
	Calibrated-zhou	19.8	20.5	21.0	21.0	21.8	23.2	22.4	22.5	24.1
	New model	18.7	19.4	19.9	18.9	19.9	22.5	20.1	20.1	21.9
MBE (W/m ²)	Zhou2007	1.9	2.2	-2.6	-4.7	-4.3	5.6	-4.5	-4.8	-2.8
	Calibrated-zhou	-3.1	-4.6	-9.3	-11.1	-11.0	-1.0	-11.9	-12.5	-10.6
	New model	-2.6	-1.8	-6.3	-8.1	-7.9	0.7	-9.1	-9.5	-8.3
First quartile (W/m ²)	Zhou2007	-10.3	-10.9	-14.7	-15.4	-15.0	-10.0	-15.9	-15.8	-14.3
	Calibrated-zhou	-14.7	-17.1	-20.8	-21.8	-22.2	-16.2	-24.3	-25.1	-23.5
	New model	-13.2	-13.2	-17.5	-17.7	-17.9	-13.1	-19.8	-20.0	-18.7
Third quartile (W/m ²)	Zhou2007	14.6	15.5	8.6	4.6	4.8	21.6	5.1	4.0	6.5
	Calibrated-zhou	9.2	8.2	1.7	-1.5	-1.2	14.3	-1.1	-2.3	0.3
	New model	9.2	10.7	4.5	1.2	1.2	15.3	0.2	0.0	1.5
Median value (W/m ²)	Zhou2007	1.8	2.0	-3.6	-5.8	-5.7	4.3	-6.1	-6.4	-4.5
	Calibrated-zhou	-2.2	-4.4	-9.7	-11.8	-11.3	-1.6	-13.2	-13.3	-11.8
	New model	-1.1	-0.8	-6.7	-8.4	-8.4	0.4	-9.5	-9.8	-9.0
Upper limit (W/m ²)	Zhou2007	52.1	55.2	43.5	34.5	34.6	69.0	36.7	33.7	37.7
	Calibrated-zhou	45.1	46.3	35.4	29.0	30.2	59.9	33.8	31.9	36.2
	New model	42.9	46.5	37.5	29.5	29.7	57.9	30.4	29.9	31.9
Lower limit (W/m ²)	Zhou2007	-47.8	-50.6	-49.7	-45.3	-44.8	-57.4	-47.5	-45.4	-45.4
	Calibrated-zhou	-50.6	-55.1	-54.5	-52.3	-53.6	-61.8	-59.1	-59.2	-59.3
	New model	-46.8	-49.0	-50.4	-46.1	-46.4	-55.6	-50.0	-49.9	-49.1
Interquartile range (W/m ²)	Zhou2007	25.0	26.4	23.3	19.9	19.8	31.6	21.1	19.8	20.8
	Calibrated-zhou	23.9	25.4	22.5	20.3	20.9	30.4	23.2	22.8	23.9
	New model	22.4	23.9	22.0	18.9	19.0	28.4	20.1	20.0	20.2

Table S3. Statistical values of SDLR errors at different IWP ranges for ice clouds, corresponding to Figure 11a.

IWP range (g/m ²)		(0, 100]	(100,200]	(200,300]	(300,400]	(400,500]	(500,600]	(600,700]	(700,1000]
Sample		56216	5096	3332	2236	1882	1471	1263	3532
RMSE (W/m ²)	Zhou2007	20.2	19.2	20.6	20.2	19.9	18.7	20.4	19.5
	Calibrated-zhou	18.8	18.7	20.4	19.5	18.7	17.8	18.9	17.7
	New model	18.5	18.2	18.7	17.7	15.9	14.7	15.5	13.8
MBE (W/m ²)	Zhou2007	-0.2	-3.5	-8.1	-8.6	-10.4	-10.1	-11.9	-11.9
	Calibrated-zhou	1.6	-3.8	-7.5	-7.0	-8.0	-7.4	-8.3	-7.8
	New model	0.9	-2.3	-3.8	-1.9	-2.5	-1.5	-1.8	-1.3
First quartile (W/m ²)	Zhou2007	-14.0	-16.0	-19.8	-20.3	-21.4	-19.8	-21.4	-20.9
	Calibrated-zhou	-10.5	-15.2	-18.4	-17.8	-18.3	-17.5	-18.1	-17.2
	New model	-11.0	-13.4	-14.5	-12.3	-11.6	-10.3	-10.7	-8.7
Third quartile (W/m ²)	Zhou2007	12.8	8.8	3.3	1.8	0.1	-0.8	-2.9	-2.9
	Calibrated-zhou	13.1	8.1	4.1	3.8	2.7	2.9	2.3	2.5
	New model	11.9	8.5	6.7	7.1	6.3	6.9	6.6	6.3
Median value (W/m ²)	Zhou2007	-2.0	-3.7	-8.4	-9.5	-10.7	-10.3	-12.3	-11.5
	Calibrated-zhou	1.5	-3.6	-6.6	-7.0	-7.5	-6.6	-6.7	-6.2
	New model	-0.2	-2.2	-3.5	-3.2	-3.2	-1.8	-1.8	-1.2
Upper limit (W/m ²)	Zhou2007	53.1	46.0	38.0	34.9	32.2	27.7	24.9	24.2
	Calibrated-zhou	48.5	43.0	37.8	36.2	34.2	33.4	32.7	32.1
	New model	46.2	41.4	38.6	36.1	33.1	32.7	32.5	28.8
Lower limit (W/m ²)	Zhou2007	-54.3	-53.1	-54.5	-53.4	-53.5	-48.4	-49.2	-48.0
	Calibrated-zhou	-46.0	-50.1	-52.1	-50.2	-49.7	-48.0	-48.6	-46.7
	New model	-45.3	-46.3	-46.3	-41.4	-38.3	-36.1	-36.6	-31.3
Interquartile range (W/m ²)	Zhou2007	26.9	24.8	23.1	22.1	21.4	19.0	18.5	18.1
	Calibrated-zhou	23.6	23.3	22.5	21.6	21.0	20.4	20.3	19.7
	New model	22.9	21.9	21.2	19.4	17.9	17.2	17.3	15.0