Supplementary Materials for:

Morphological reconstruction based on optical images for the seabed semi-buried polymetallic nodules: a fusion model of Elliptic Approximation and Contour Interweaving Methods

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This supplementary document provides additional details and results supporting the main manuscript "Morphological reconstruction based on optical images for the seabed semi-buried polymetallic nodules: a fusion model of Elliptic Approximation and Contour Interweaving Methods." It includes extended tables not included in the main publication.

S1. Additional Tables

Table S1. U-Net versus two reconstruction methods on each metric (boundaries region)

Metric	Method	Maximum	Minimum	Mean	Median	Std Dev
AR	U-Net	95.66%	47.08%	81.62%	85.43%	0.1297
	EAM	222.39%	*79.69%*	111.88%	105.06%	0.2585
	CIM	*106.39%*	66.06%	*95.52%*	*97.81%*	0.0766
APC	U-Net	52.92%	3.34%	18.38%	14.57%	0.1297
	EAM	122.39%	0.97%	16.76%	8.35%	0.2293
	CIM	33.94%	*0.05%*	*5.94%*	*3.36%*	0.0657
IoU	U-Net	93.83%	47.08%	81.11%	85.02%	0.1291
	EAM	95.29%	43.18%	83.33%	87.07%	0.1165
	CIM	*98.29%*	*64.56%*	*91.14%*	*94.03%*	0.0767
CD	U-Net	2.9101	0.1351	0.6699	0.3915	0.6162
	EAM	5.0425	0.0325	0.5149	0.2146	0.8792
	CIM	1.9361	*0.0089*	*0.2112*	*0.0476*	0.3574

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Table S2. Binary shapes (BS) versus two reconstruction methods on each metric

Metric	Method	Maximum	Minimum	Mean	Median	Std Dev
AR	U-Net	92.43%	20.7%	64.1%	64.5%	0.1586
	EAM	162.67%	24.27%	110.29%	110.57%	0.1722
	CIM	101.12%	14.44%	90.67%	92.94%	0.1183
APC	U-Net	87.40%	7.57%	36.06%	35.5%	0.1633
	EAM	75.73%	0.04%	14.34%	10.98%	0.1398
	CIM	85.56%	0.06%	9.44%	7.06%	0.1175
IoU	U-Net	91.47%	12.35%	63.01%	63.23%	0.1613
	EAM	94.89%	23.79%	82.61%	84.45%	0.0996
	CIM	98.85%	14.15%	88.9%	90.83%	0.1143
CD	U-Net	9.1221	0.0919	1.3684	0.8611	1.5048
	EAM	6.3361	0.0403	0.6286	0.3079	0.8369
	CIM	8.7895	0.0065	0.4299	0.0863	1.0847

Table S3. EA-CIM on each metric (binary images)

Metric	Maximum	Minimum	Mean	Median	Std Dev
AR	106.62%	24.27%	93.93%	95.47%	0.1006
APC	75.73%	0.06%	6.87%	4.68%	0.0952
IoU	98.85%	23.79%	90.21%	92.1%	0.0927
CD	6.3361	0.0065	0.2964	0.082	0.7501