

Table S1a. Confusion Matrix of image classification obtained by Sentinel-2 image acquired on 2022/03/18.

Class	Snow	Shadow on Snow	Freshwater	Total
Unclassified	0.00	0.00	0.00	0.00
Snow	100.00	0.00	0.48	37.88
Shadow on Snow	0.00	100.00	0.00	50.92
Freshwater	0.00	0.00	99.52	11.20
Total	100.00	100.00	100.00	100.00

Table S1b. Classification errors of image classification obtained by Sentinel-2 image acquired on 2022/03/18.

Class	Commission (%)	Omission (%)
Snow	0.14	0.00
Shadow on Snow	0.00	0.00
Freshwater	0.00	0.48

Table S1c. Classification accuracy of image classification obtained by Sentinel-2 image acquired on 2022/03/18.

Class	Producer Acc. (%)	User Acc. (%)
Snow	100.00	98.86
Shadow on Snow	100.00	100.00
Freshwater	99.52	100.00

Table S2a. Confusion Matrix of image classification obtained by Sentinel-2 image acquired on 2022/03/26.

Class	Snow	Shadow on Snow	Freshwater	Total
Unclassified	0.00	0.00	3.47	0.68
Snow	100.00	0.00	0.39	29.79
Shadow on Snow	0.00	100.00	0.00	50.61
Freshwater	0.00	0.00	96.14	18.92
Total	100.00	100.00	100.00	100.00

Table S2b. Classification errors of image classification obtained by Sentinel-2 image acquired on 2022/03/26.

Class	Commission (%)	Omission (%)
Snow	0.26	0.00
Shadow on Snow	0.00	0.00
Freshwater	0.00	3.86

Table S2c. Classification accuracy of image classification obtained by Sentinel-2 image acquired on 2022/03/26.

Class	Producer Acc. (%)	User Acc. (%)
Snow	100.00	99.74
Shadow on Snow	100.00	100.00
Freshwater	96.14	100.00

Table S3a. Confusion Matrix of image classification obtained by Sentinel-2 image acquired on 2022/03/30.

Class	Snow	Shadow on Snow	Freshwater	Total
Unclassified	0.00	0.00	10.16	1.63
Snow	100.00	0.00	0.53	39.81
Shadow on Snow	0.00	100.00	0.00	44.26
Freshwater	0.00	0.00	89.30	14.30
Total	100.00	100.00	100.00	100.00

Table S3b. Classification errors of image classification obtained by Sentinel-2 image acquired on 2022/03/30.

Class	Commission (%)	Omission (%)
Snow	0.22	0.00
Shadow on Snow	0.00	0.00
Freshwater	0.00	10.70

Table S3c. Classification accuracy of image classification obtained by Sentinel-2 image acquired on 2022/03/30.

Class	Producer Acc. (%)	User Acc. (%)
Snow	100.00	99.78
Shadow on Snow	100.00	100.00
Freshwater	89.30	100.00

Table S4a. Confusion Matrix of image classification obtained by Sentinel-2 image acquired on 2022/04/08.

Class	Snow	Shadow on Snow	Freshwater	Total
Unclassified	0.00	0.00	22.06	1.35
Snow	100.00	0.00	0.00	46.75
Shadow on Snow	0.00	100.00	0.00	47.11
Freshwater	0.00	0.00	77.94	4.78
Total	100.00	100.00	100.00	100.00

Table S4b. Classification errors of image classification obtained by Sentinel-2 image acquired on 2022/04/08.

Class	Commission (%)	Omission (%)
Snow	0.00	0.00
Shadow on Snow	0.00	0.00
Freshwater	0.00	22.06

Table S4c. Classification accuracy of image classification obtained by Sentinel-2 image acquired on 2022/04/08.

Class	Producer Acc. (%)	User Acc. (%)
Snow	100.00	100.00
Shadow on Snow	100.00	100.00
Freshwater	77.94	100.00

Table S5a. Confusion Matrix of image classification obtained by Sentinel-2 image acquired on 2022/04/11.

Class	Snow	Shadow on Snow	Freshwater	Total
Unclassified	0.00	0.00	0.00	0.00
Snow	100.00	0.60	0.00	38.23
Shadow on Snow	0.00	99.40	0.00	34.02
Freshwater	0.00	0.00	100.00	27.75
Total	100.00	100.00	100.00	100.00

Table S5b. Classification errors of image classification obtained by Sentinel-2 image acquired on 2022/04/11.

Class	Commission (%)	Omission (%)
Snow	0.54	0.00
Shadow on Snow	0.00	0.60
Freshwater	0.00	0.00

Table S5c. Classification accuracy of image classification obtained by Sentinel-2 image acquired on 2022/04/11.

Class	Producer Acc. (%)	User Acc. (%)
Snow	100.00	99.46
Shadow on Snow	100.00	100.00
Freshwater	99.40	100.00

Table S6a. Confusion Matrix of image classification obtained by Sentinel-2 image acquired on 2022/05/11.

Class	Snow	Freshwater	Total
Unclassified	0.00	0.00	0.00
Snow	100.00	0.00	68.10
Freshwater	0.00	100.00	31.90
Total	100.00	100.00	100.00

Table S6b. Classification errors of image classification obtained by Sentinel-2 image acquired on 2022/05/11.

Class	Commission (%)	Omission (%)
Snow	0.00	0.00
Freshwater	0.00	0.00

Table S6c. Classification accuracy of image classification obtained by Sentinel-2 image acquired on 2022/05/11.

Class	Producer Acc. (%)	User Acc. (%)
Snow	100.00	100.00
Freshwater	100.00	100.00

Table S7a. Confusion Matrix of image classification obtained by Sentinel-2 image acquired on 2022/05/29.

Class	Snow	Freshwater	Sediments	Snow-Free	Total
Unclassified	0.00	0.00	0.00	14.19	3.64
Snow	100.00	0.00	0.38	0.00	19.45
Freshwater	0.00	95.75.00	3.01	0.00	30.73
Sediments	0.00	4.25	96.62	0.00	24.16
Snow-Free	0.00	0.00	0.00	85.81	22.02
Total	100.00	100.00	100.00	100.00	100.00

Table S7b. Classification errors of image classification obtained by Sentinel-2 image acquired on 2022/05/29.

Class	Commission (%)	Omission (%)
Snow	0.46	0.00
Freshwater	2.31	4.25
Sediments	5.51	3.38
Snow-Free	0.00	14.19

Table S7c. Classification accuracy of image classification obtained by Sentinel-2 image acquired on 2022/05/29.

Class	Producer Acc. (%)	User Acc. (%)
Snow	100.00	99.54
Freshwater	85.81	97.69
Sediments	96.62	94.49
Snow-Free	95.75	100.00

Table S8a. Confusion Matrix of image classification obtained by Sentinel-2 image acquired on 2022/06/02.

Class	Snow	Freshwater	Sediments	Snow-Free	Total
Unclassified	0.00	0.00	0.00	0.00	0.00
Snow	99.49	1.18	0.00	0.00	27.85
Freshwater	0.51	97.65	2.63	0.00	24.05
Sediments	0.00	1.18	97.37	0.00	21.10
Snow-Free	0.00	0.00	0.00	100.00	27.00
Total	100.00	100.00	100.00	100.00	100.00

Table S8b. Classification errors of image classification obtained by Sentinel-2 image acquired on 2022/06/02.

Class	Commission (%)	Omission (%)
Snow	1.01	0.51
Freshwater	2.92	2.35
Sediments	1.33	2.63
Snow-Free	0.00	0.00

Table S8c. Classification accuracy of image classification obtained by Sentinel-2 image acquired on 2022/06/02.

Class	Producer Acc. (%)	User Acc. (%)
Snow	97.37	98.67
Freshwater	97.65	97.08
Sediments	97.37	98.67
Snow-Free	100.00	100.00

Table S9a. Confusion Matrix of image classification obtained by Sentinel-2 image acquired on 2022/06/25.

Class	Snow	Freshwater	Sediments	Snow-Free	Total
Unclassified	0.00	0.00	0.00	0.00	0.00
Snow	84.62	0.00	0.00	0.00	20.07
Freshwater	0.00	100.00	0.00	0.00	30.29
Sediments	0.00	1.18	100.00	10.00	42.70
Snow-Free	15.38	0.00	0.00	90.00	6.93
Total	100.00	100.00	100.00	100.00	100.00

Table S9b. Classification errors of image classification obtained by Sentinel-2 image acquired on 2022/06/25.

Class	Commission (%)	Omission (%)
Snow	0.00	15.38
Freshwater	0.00	0.00
Sediments	0.85	0.00
Snow-Free	52.63	10.00

Table S9c. Classification accuracy of image classification obtained by Sentinel-2 image acquired on 2022/06/25.

Class	Producer Acc. (%)	User Acc. (%)
Snow	84.62	100.00
Freshwater	100.00	100.00
Sediments	100.00	99.15
Snow-Free	90.00	47.37

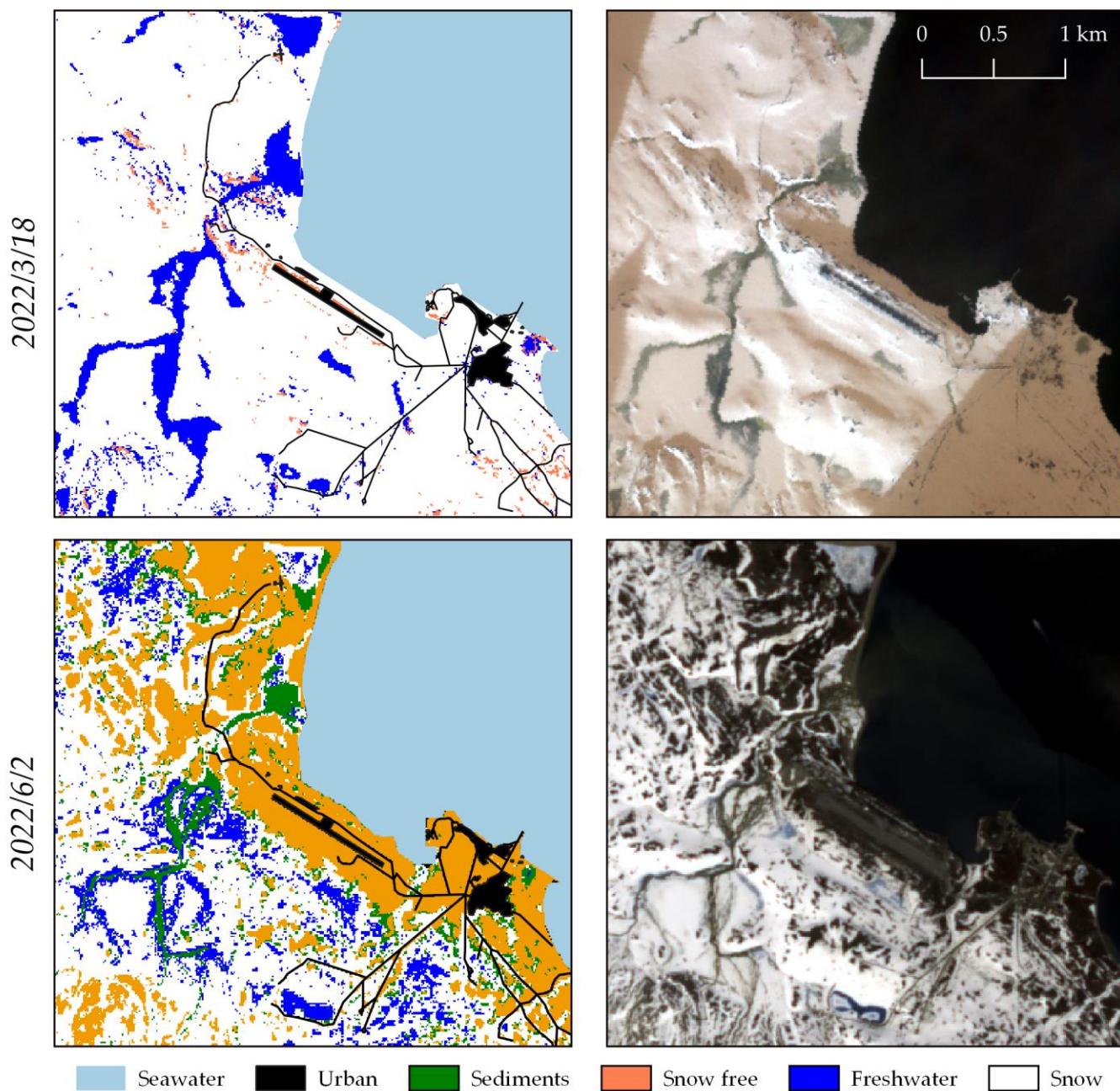


Figure S1. Comparison between the RGB visualizations and classifications of two Sentinel-2 images acquired respectively in March (a) and June (b) 2022.