

Supplementary Information

5 **Table S1. The normalized backscatters in SAR images. We sampled the land ice and sea ice with obviously lower backscatters, as opposed to sampling randomly. The backscatter averages of sampled land ice during September and December are similar to those of sampled landlocked lakes' open water (LLOW) during January.**

Image	Land cover	Sample size	Min	Mean
VHs_2019_10_02	Land ice	146059	-1.83	-1.41
	Sea water	392647	-1.87	-1.55
	Sea ice	585496	-1.88	-1.60
VHs_2017_11_06	Land ice	32353	-1.76	-1.34
	Sea water	1225456	-1.75	-0.95
	Sea ice	448936	-1.79	-1.19
LHs_2019_11_28	Land ice	2444	-1.70	-0.95
	Sea water	110285	-1.86	-1.63
	Sea ice	248556	-1.85	-1.48
LHs_2018_01_25	LLOW	1435	-1.69	-1.31
LHs_2017_01_22	LLOW	3302	-1.75	-1.37

Table S2. The miss error percentage of landlocked lakes' open water (LLOW) identification in the testing dataset. The percentage is the ratio of the ground truth area to the false negative results area.

Study Area	> 10000 m² area	1000-10000 m² area	< 1000 m² area
CWM	0.23	0.35	0.57
LHs	0.28	0.47	0.64
VHs	0.48	0.76	0.69
SO	0.38	0.61	0.65

10