Table S1 - Freeze-up 2015 event sequence

Days from freeze-up	Date	Observations	Precipitation
-4	November 7th	Open water, fog	None
-3	November 8th	Grease ice and shuga	Light snowfall the previous night
-2	November 9th	Grease ice	None
-1	November 10th	Thermal ice extending from the north-eastern shore to the middle of the bay	None
0	November 11th	Ice completely covers the bay, showing no lateral movement	None

Table S2 - Freeze-up 2016 event sequence

Days from freeze-up	Date	Observations	Precipitation
-6	November 23rd	Open water, grease ice	None
-5	November 24th	Grease ice	None
-4	November 25th	Grease ice	None
-3	November 26th	Open water, fog	None
-2	November 27th	Nilas and other new ice types are forming in the bay	Light snowfall the previous night
-1	November 28th	Nilas and ice rind patches cover the bay, moving with the wind and the tides	None
0	November 29th	Overlapping patches of nilas cover the bay, showing no lateral movement	None

Table S3 - Freeze-up 2017 event sequence

Days from freeze-up	Date	Observations	Precipitation
-5	November 23rd	Open water	None
-4	November 24th	Nilas and ice rind patches cover the bay, moving with the wind and the tides	Light snowfall the previous night
-3	November 25th	Open water	None
-2	November 26th	Nilas, grease ice	None
-1	November 27th	Nilas and ice rind patches cover the bay, showing little lateral movement	None
0	November 28th	Overlapping patches of nilas cover the bay, showing no lateral movement	None
1	November 29th	Overlapping patches of nilas cover the bay, showing no lateral movement	Light snowfall the previous night
2	November 30th	Ice cover features moved south-east slightly during the night	None

Table S4 - Break-up 2016 event sequence

Days from first OW	Date	Observations from pictures	Observations from TerraSAR-X	Ship transits and manoeuvers
-9	June 10th	-	Deception River is frozen	
-3	June 16th	-	Deception River has thawed	The MV Nunavik enters the bay and performs ice-breaking manoeuvers
-2	June 17th	-	Some open water can be seen at the turning point in the MV Nunavik's track	-
-1	June 18th	The ice is covered in melt ponds; Some open water can be seen along the MV Arctic's track	-	-
0	June 19th	Open water can be seen near Deception River	-	-
1	June 20th	Open water extends to Canadian Royalties dock	-	-
2	June 21st	Open water extends past the camera location, with floating ice pieces	Open water extends halfway between the docks and Moosehead Island	-
3	June 22nd	Open water extends up to Moosehead Island, with floating ice pieces	-	-
4	June 23rd	Open water extends up to Moosehead Island	-	-
5	June 24th	Moosehead Island is ice-free	-	-

Table S5 - Break-up 2017 event sequence

Days from first OW	Date	Observations from pictures	Observations from TerraSAR-X	Ship transits and manoeuvers
-7	May 28th	-	Deception River is frozen	-
-5	May 30th	-	-	-
-4	May 31st	The ice is covered in melt ponds	-	-
-3	June 1st	-	-	-
-2	June 2nd	-	-	-
-1	June 3rd	-	Deception River has thawed	-
0	June 4th	Some open water can be seen along the MV Arctic's track	Some open water can be seen along the MV Nunavik and MV Arctic's tracks	-
1	June 5th	Open water near Deception River	-	The MV Arctic enters the bay
2	June 6th	Open water extends to Canadian Royalties dock	-	-
3	June 7th	Open water extends up to the camera location	-	-
4	June 8th	Open water extends past the camera location	Open water extends halfway between the docks and Moosehead Island	-
5	June 9th	Open water extends up to Moosehead Island	-	-
8	June 12th	Moosehead Island is ice-free	-	-

Table S6 - Break-up 2018 event sequence

Days from first OW	Date	Observations from pictures	Observations from TerraSAR-X	Ship transits and manoeuvers
-9	June 17th	Meltwater can be seen on the ice surface	Deception River is frozen; Meltwater can be seen on parts of the bay	The MV Nunavik and MV Arctic enter the bay
-6	June 20th	-	-	-
-5	June 21st	Some open water can be seen along the MV Nunavik and MV Arctic's tracks	-	-
-4	June 22nd	-	-	-
-3	June 23rd	Open water in the ship tracks extends up to the MV Arctic's turning point	Deception River has thawed; Some open water can be seen along the MV Nunavik and MV Arctic's tracks	-
-2	June 24th	-	-	-
-1	June 25th	Cracks perpendicular to the shore appear in the ice near the MV Arctic's turning point; The ice is covered in melt ponds	-	The MV Nunavik and MV Arctic leave the bay
0	June 26th	Open water can be seen in front of the south-west shore; the ice shows no lateral movements	-	-
1	June 27th	Ice pieces in the bay show lateral movement	-	-
2	June 28th	Open water can be seen in front of the north-east shore	The ice cover is fractured along the ship tracks, up to halfway between the docks and Moosehead Island	-
7	July 3rd	Moosehead Island is ice-free	-	-
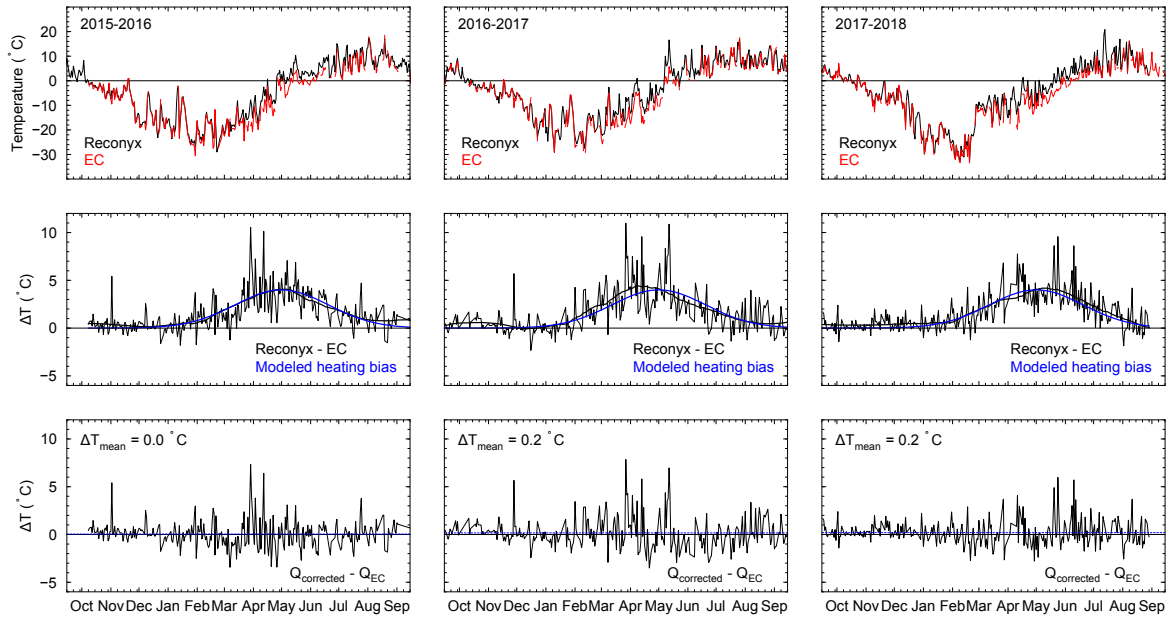
Figure S1: Camera-heating bias correction for air temperatures measured by a Reconyx camera installed in Quaqtaq. Top: Daily mean air temperature measured by the camera (black), and by Environment Canada (EC) at the airport (red). Middle: Difference between the camera and EC measured air temperature (black), both daily and smoothed, and model for the bias (blue). Bottom: Difference between the bias-corrected camera measurement and the EC measurement.
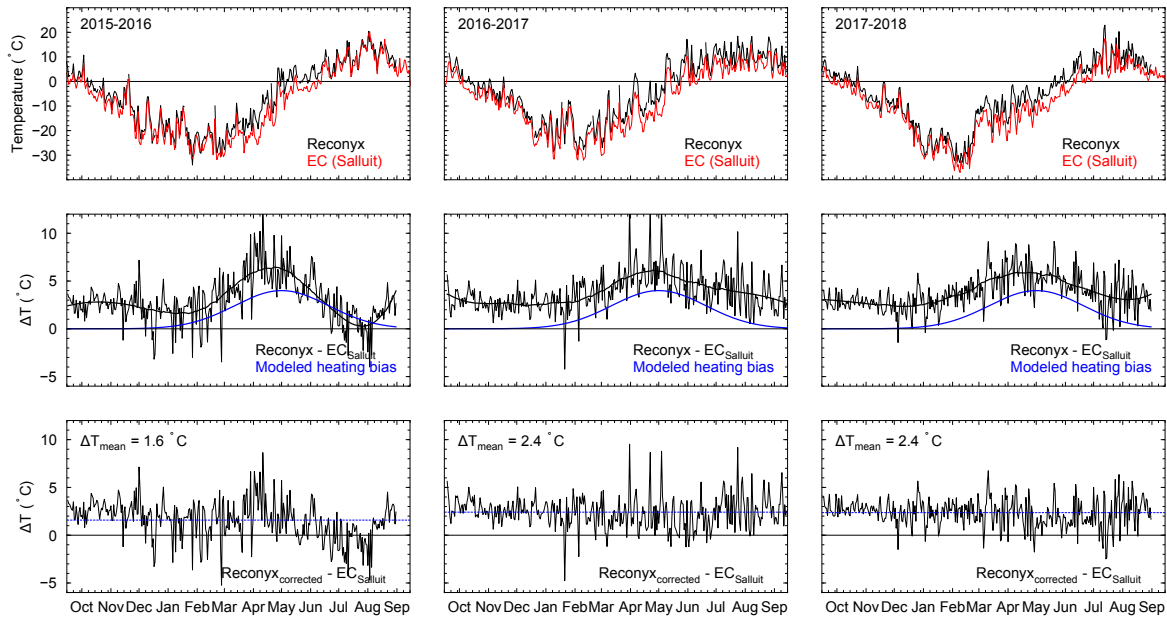
Figure S2: Camera-heating bias correction for air temperatures measured by the Deception Bay Reconyx camera. Top: Daily mean air temperature measured by the camera (black) and by Environment Canada (EC) at the Salluit airport 50 km away (red). Middle: Difference between the camera and the Salluit EC measured air temperature (black), both daily and smoothed, and model for the bias (blue). Bottom: Difference between the bias-corrected camera measurement at Deception Bay and the Salluit EC measurement.
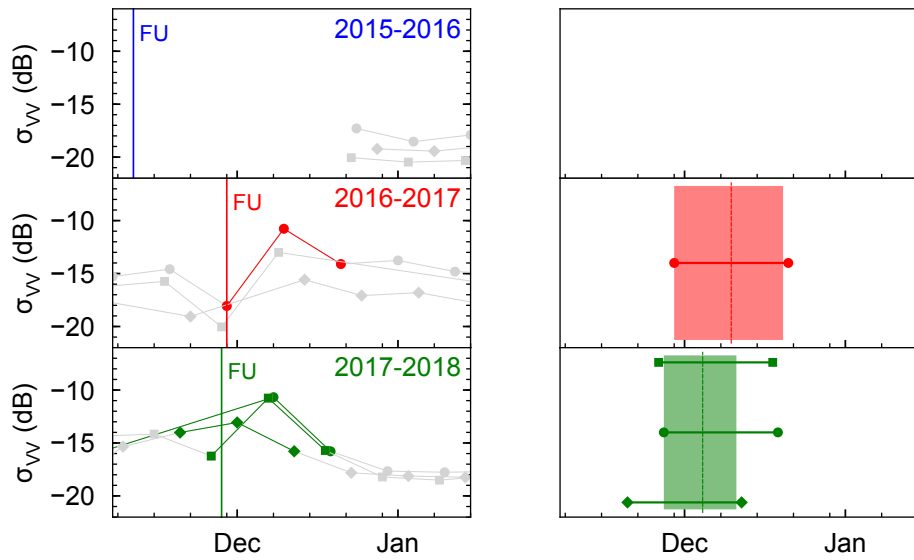
Figure S3: Post-freeze-up peak estimation. Left: TerraSAR-X median VV in orbits 13 (square), 21 (circle) and 89 (diamond). Markers used for peak estimation are in color, the rest of the series is in gray. For reference, freeze-up is identified with a vertical line. Right: Peak ranges reproduced from left. The range obtained from combining all orbits is color-shaded. Peak estimation is indicated with a dashed line. Data is color-coded for each year.
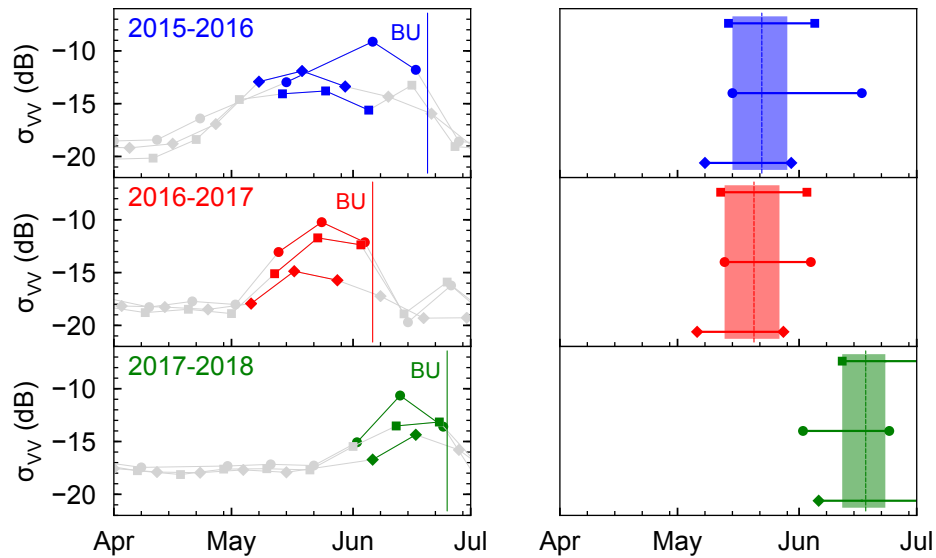
Figure S4: Spring peak estimation. Left: TerraSAR-X median VV in orbits 13 (square), 21 (circle) and 89 (diamond). Markers used for peak estimation are in color, the rest of the series is in gray. For reference, break up is identified with a vertical line. Right: Peak ranges reproduced from left. The range obtained from combining all orbits is color-shaded. Peak estimation is indicated with a dashed line. Data is color-coded for each year.
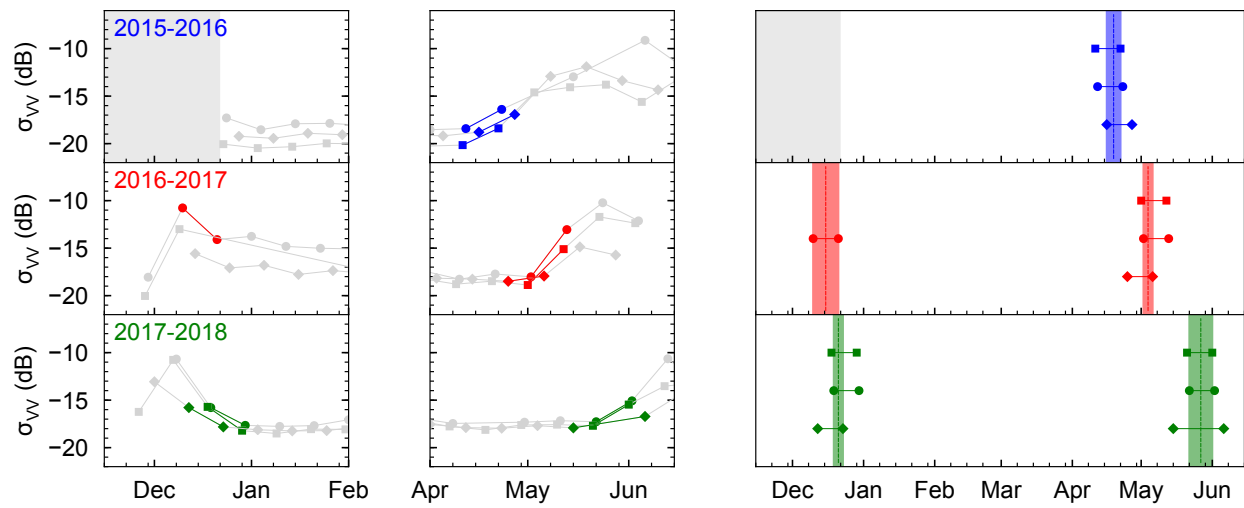
Figure S5: Monotone backscattering limits estimation. Left and center: TerraSAR-X median VV in orbits 13 (square), 21 (circle) and 89 (diamond). Markers used for limit estimation are in color, the rest of the series is in gray. Right: Limit ranges reproduced from left and center. The ranges obtained from combining all orbits are color-shaded. Limit estimation is indicated with a dashed line. Data is color-coded for each year.
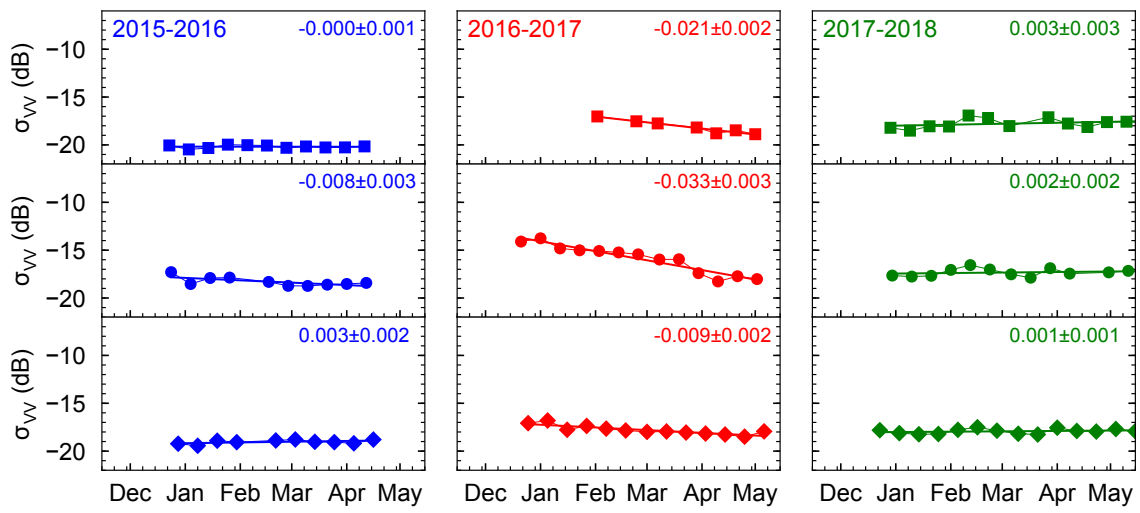
Figure S6: TerraSAR-X median VV backscattering during the monotone period. Observations are plotted for each orbit (orbit 13: squares, orbit 21: circles, orbit 89: diamonds) and color-coded for each year. The linear regression on the data is plotted as a solid line. Slope and standard error are indicated in the top right corner.
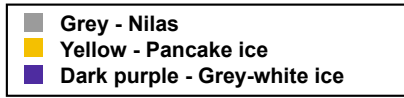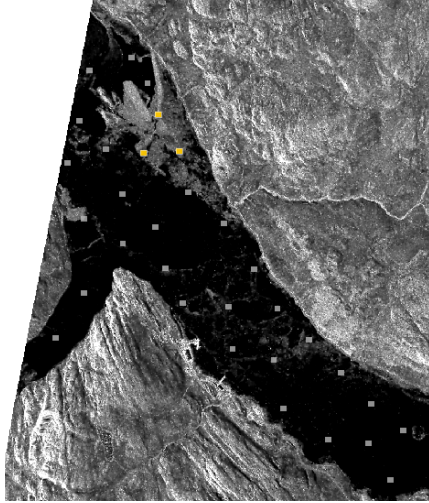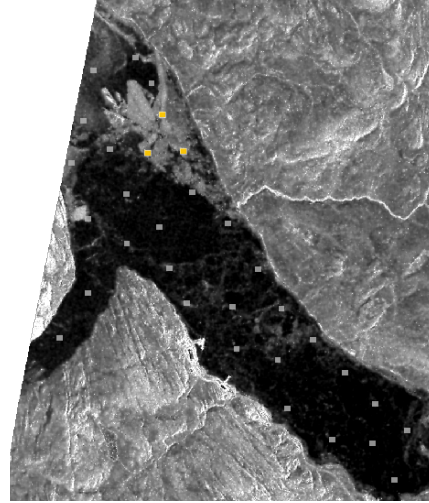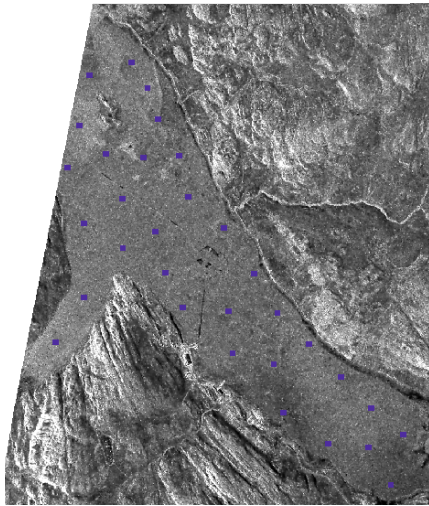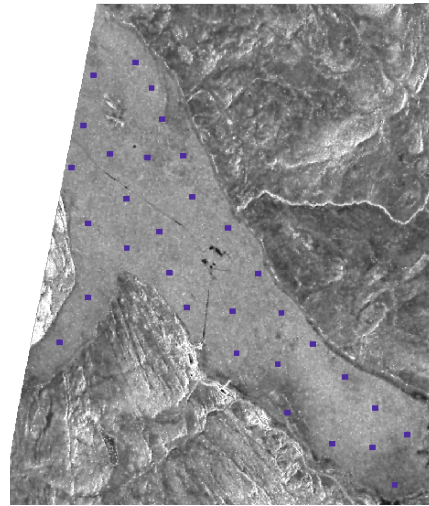
Figure S7: TerraSAR-X VV images of newly formed ice in 2016 (scaled from -19 to -5 dB) and AOIs used to compute statistics.
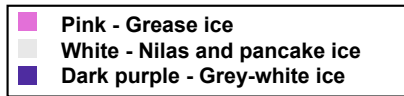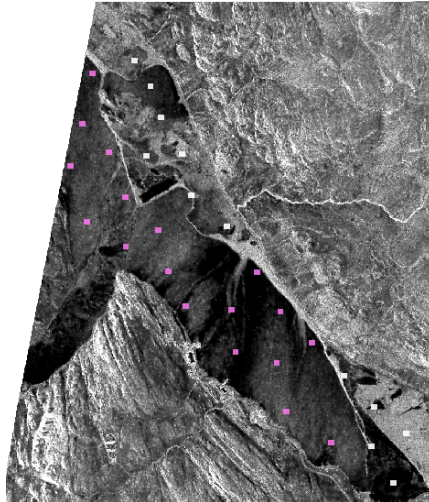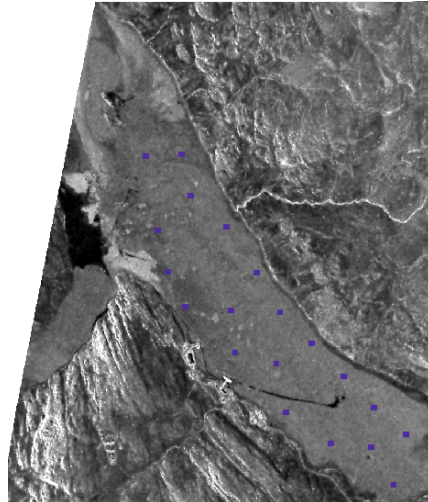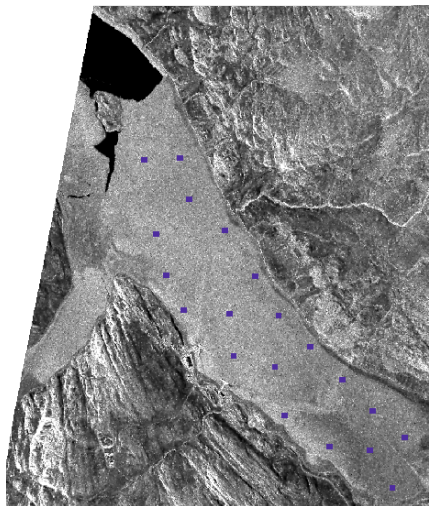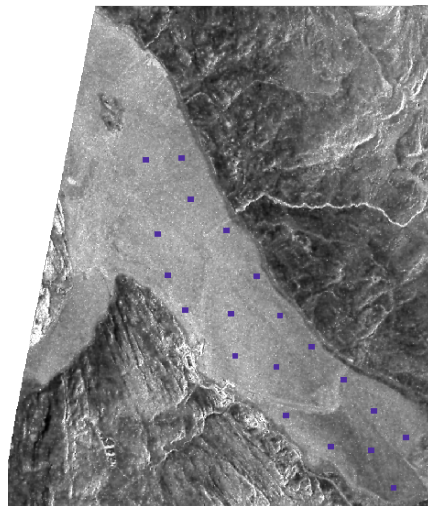
Figure S8: TerraSAR-X VV images of newly formed ice in 2017 (scaled from -19 to -5 dB) and AOIs used to compute statistics.