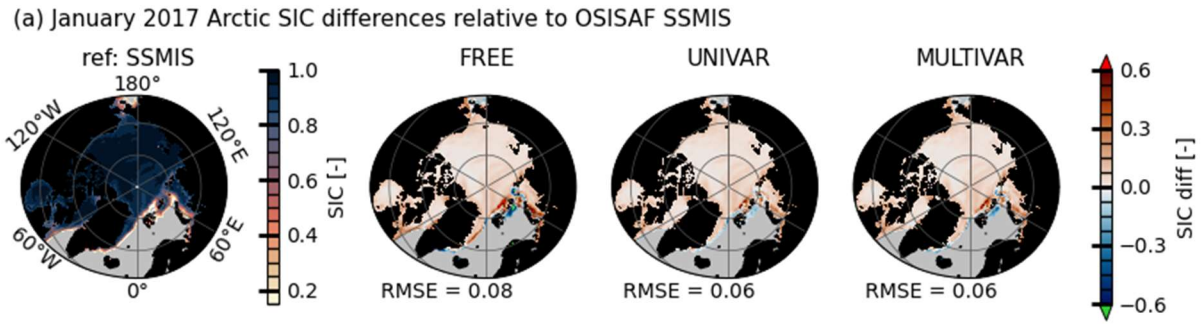
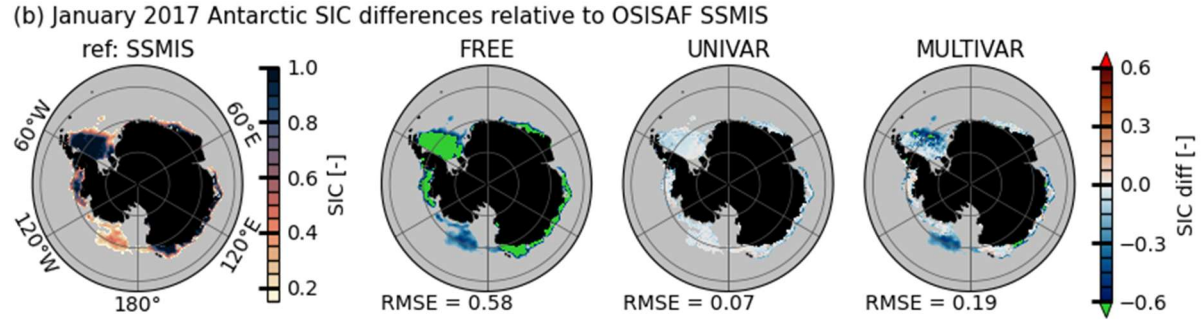
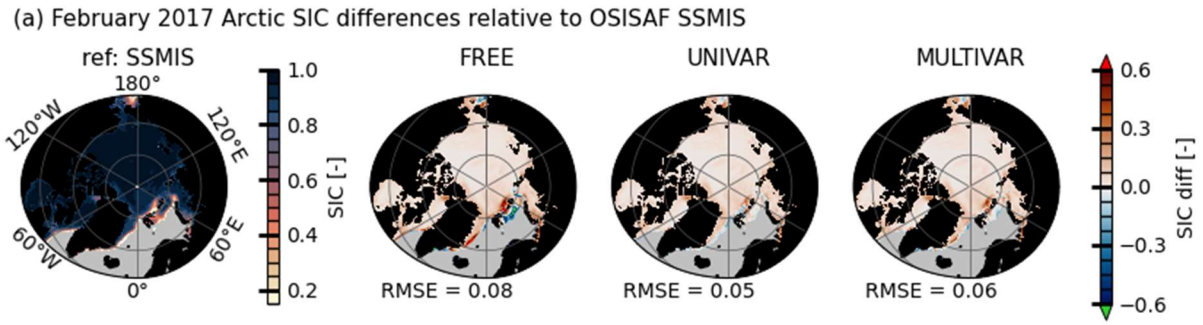
Figures for RC1

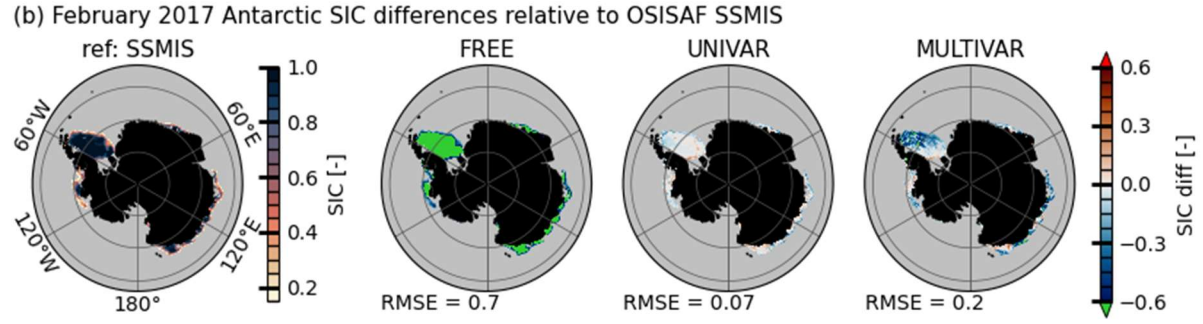
Monthly Sea ice concentration

The following figures, similar to Figure 2 in the manuscript, display monthly means of sea ice concentration (%) from January 2017 to January 2019 for Arctic and Antarctic. SSMIS observations are shown in the first column. Differences between the experiments (FREE, UNIVAR, MULTIVAR) and SSMIS are shown from the second to the fourth column. Root means squared errors (RMS) are provided under each plot.

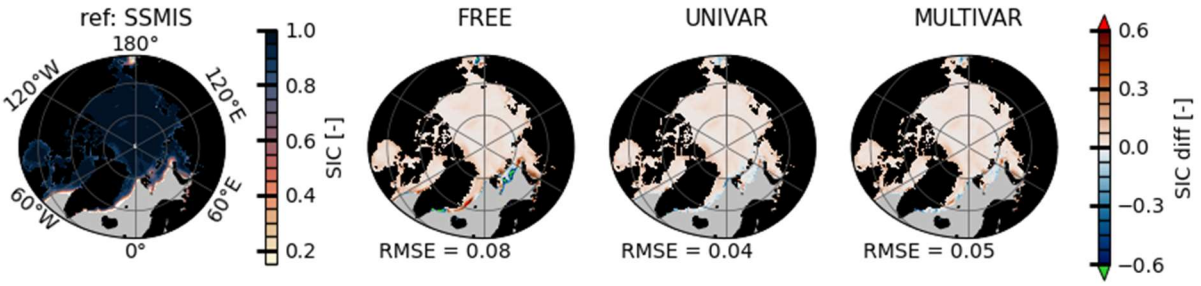




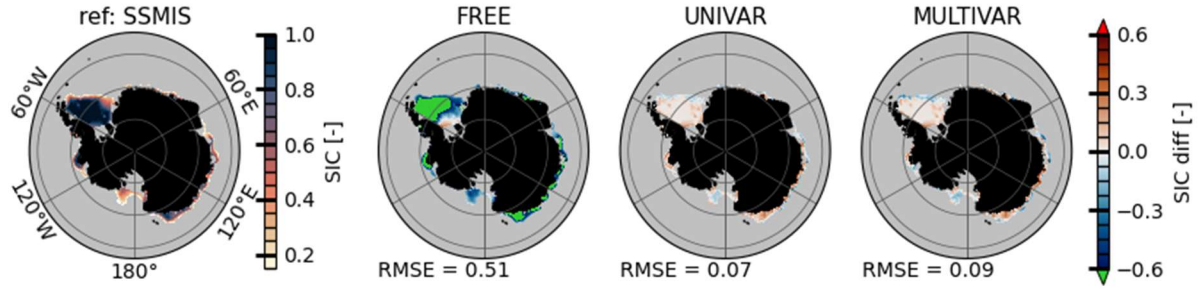




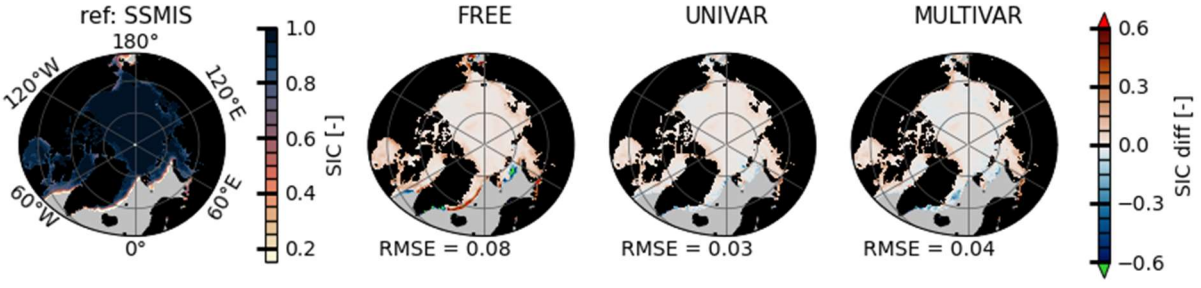
(a) March 2017 Arctic SIC differences relative to OSISAF SSMIS



(b) March 2017 Antarctic SIC differences relative to OSISAF SSMIS



(a) April 2017 Arctic SIC differences relative to OSISAF SSMIS



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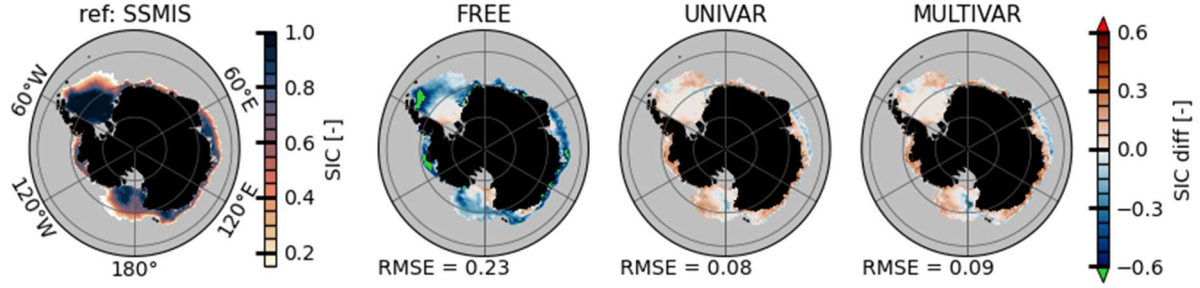
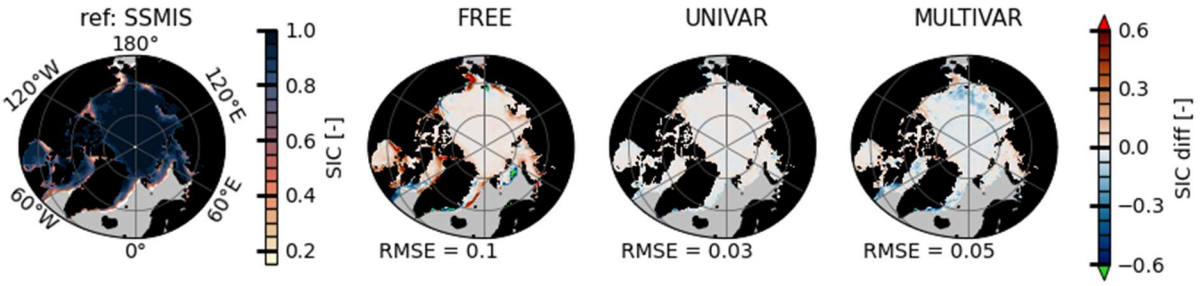
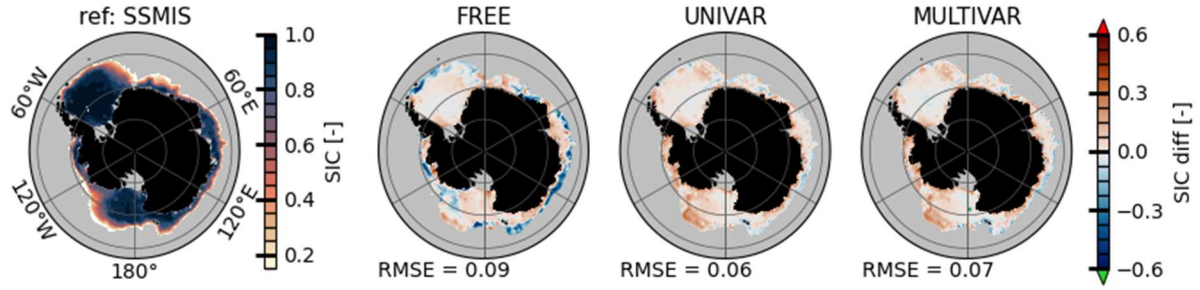


(a) Mai 2017 Arctic SIC differences relative to OSISAF SSMIS



(b) Mai 2017 Antarctic SIC differences relative to OSISAF SSMIS



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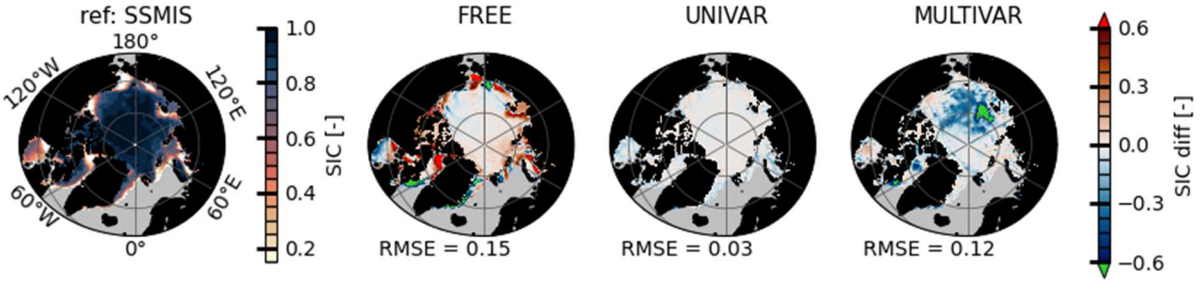

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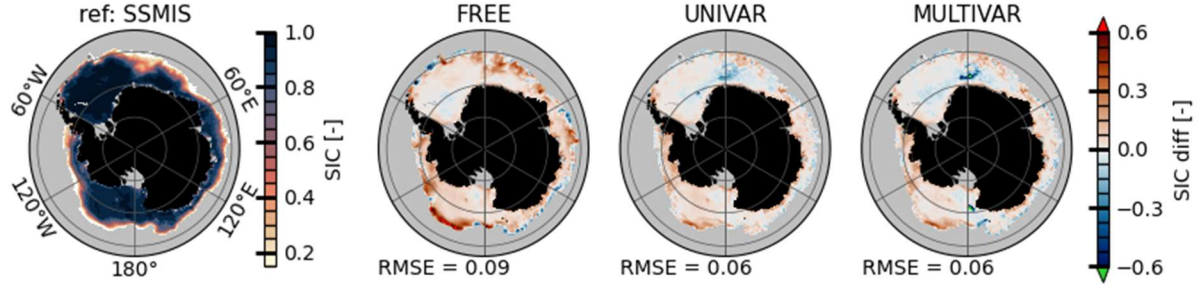

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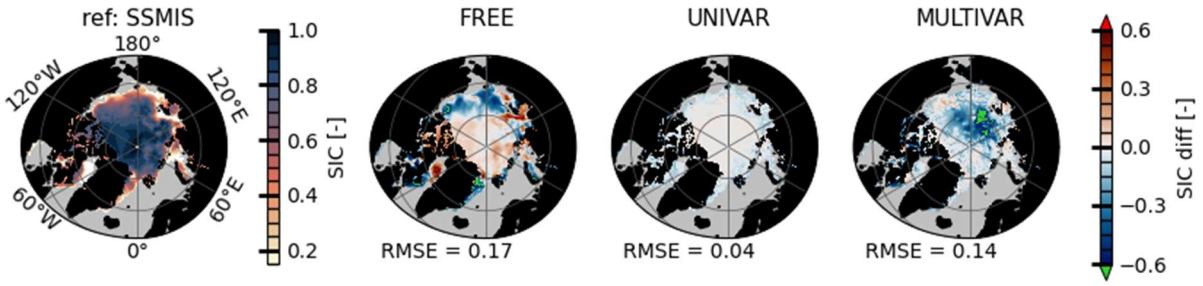

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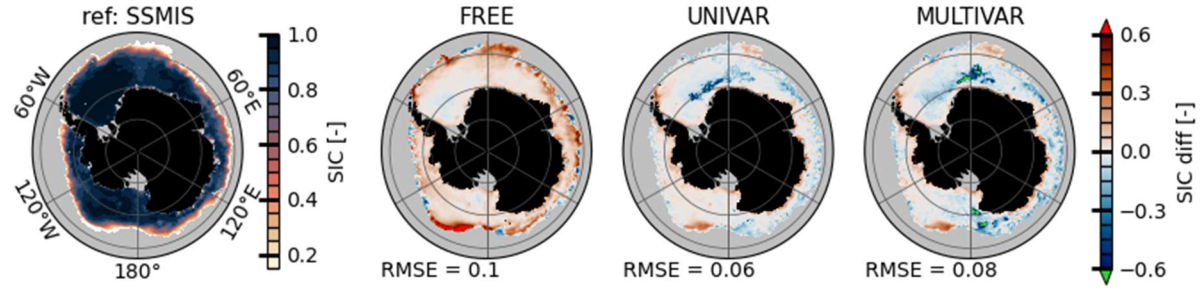

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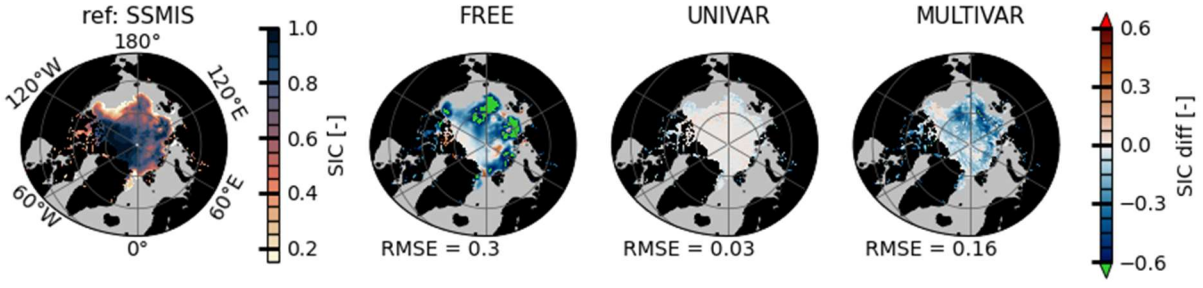

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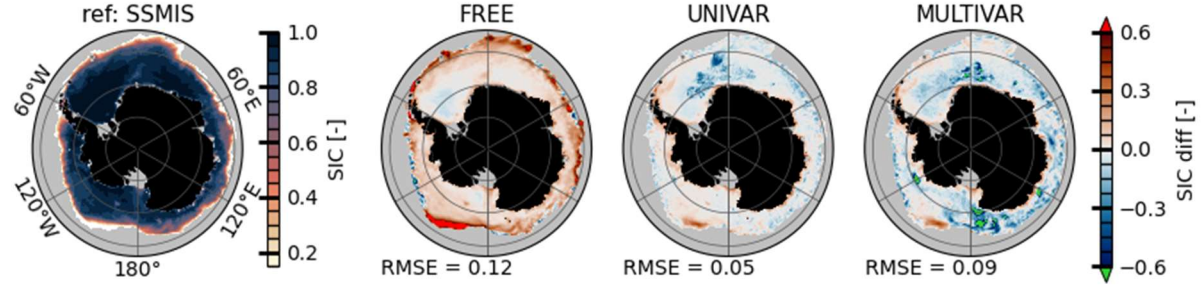

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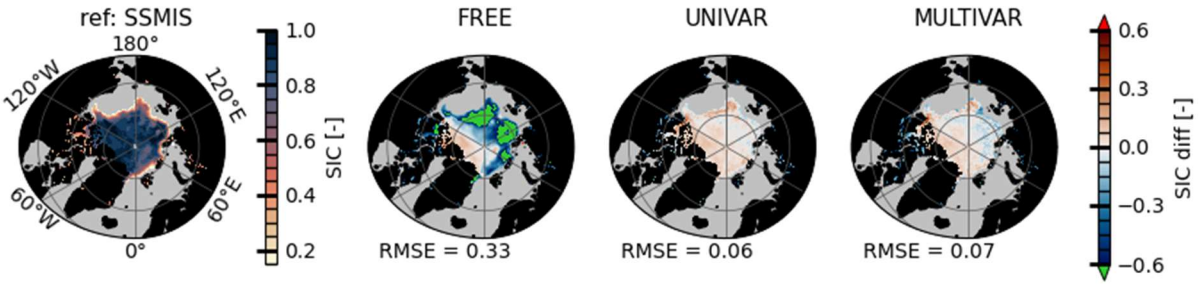

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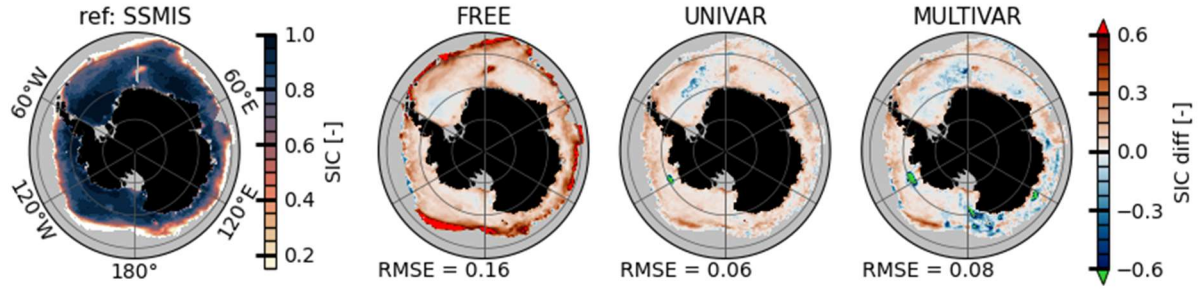

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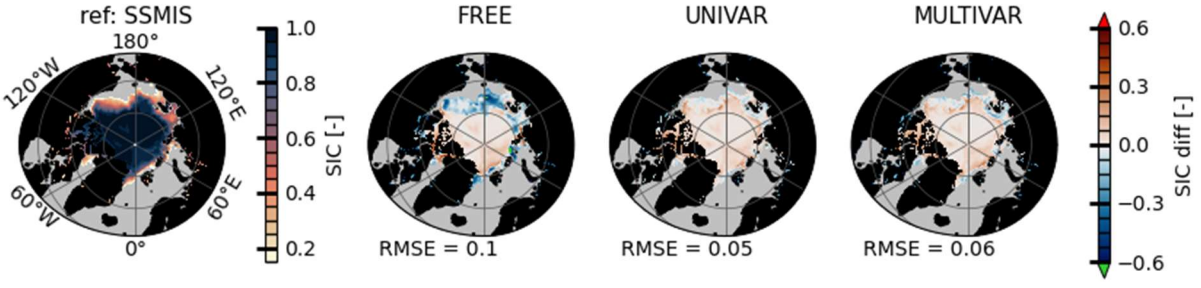

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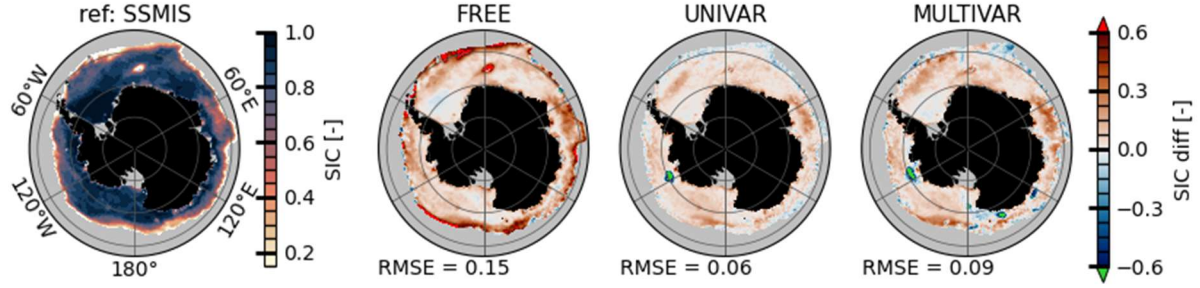

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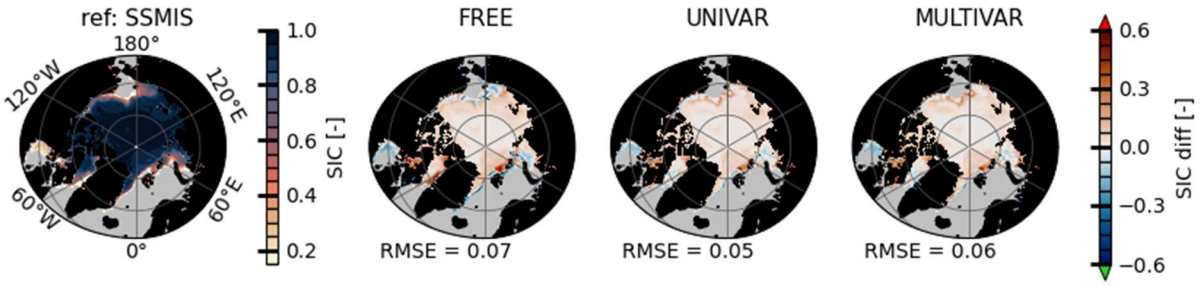

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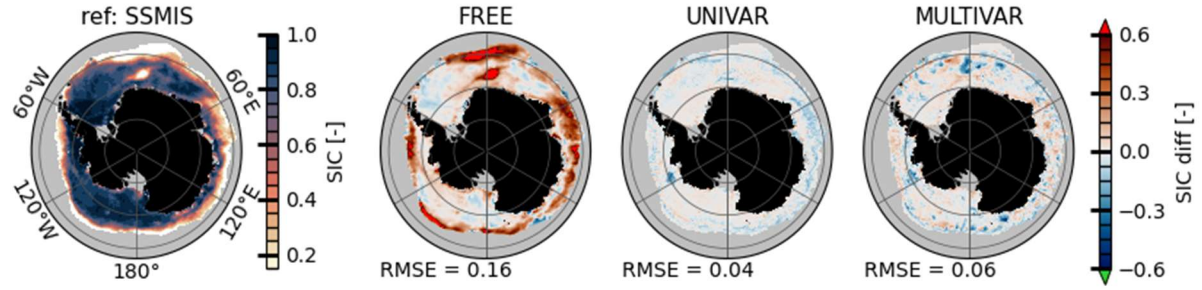

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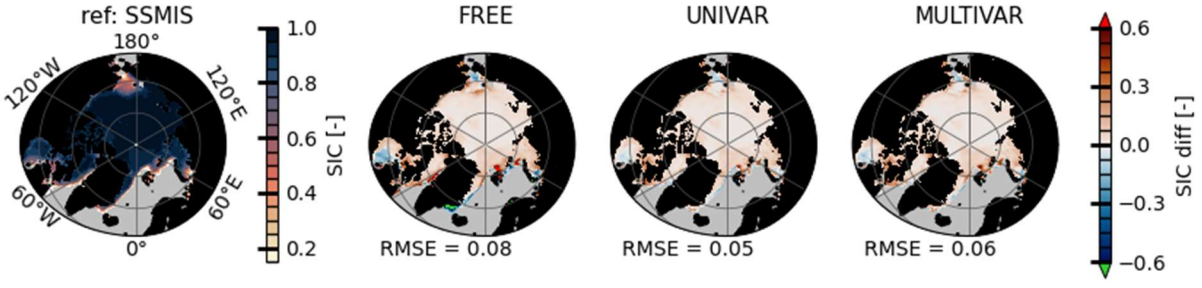

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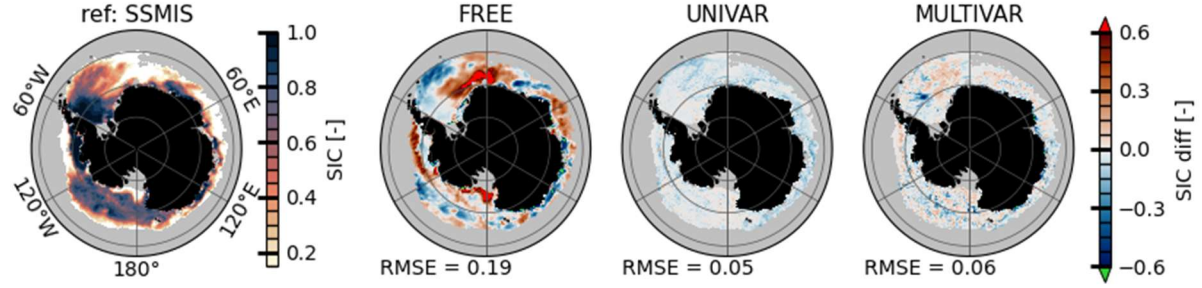
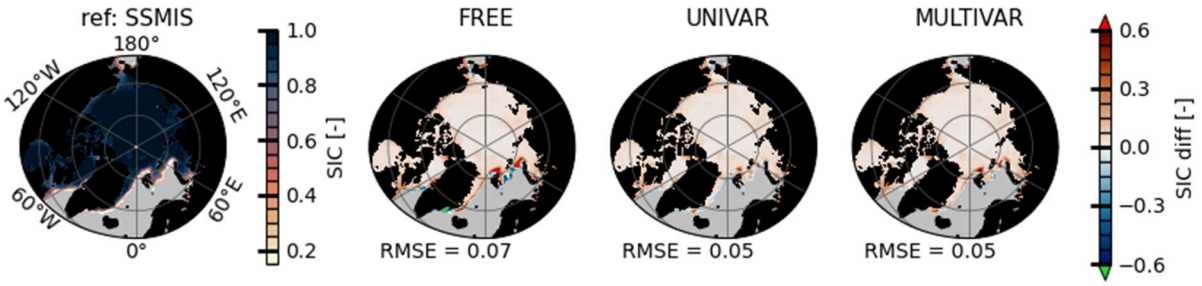


(a) January 2018 Arctic SIC differences relative to OSISAF SSMIS



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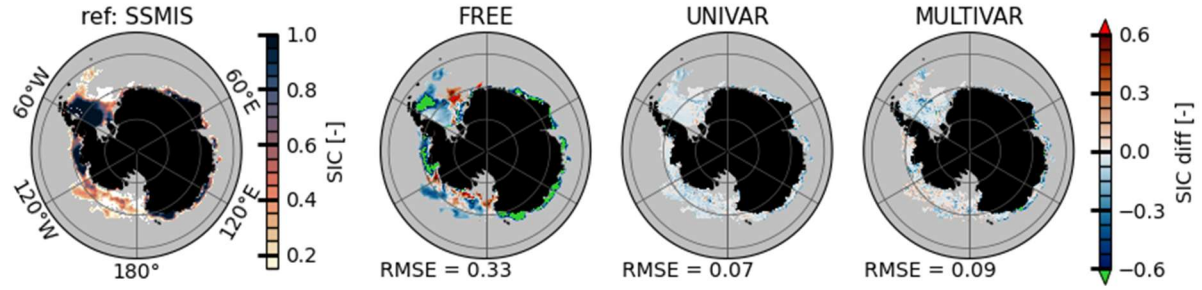
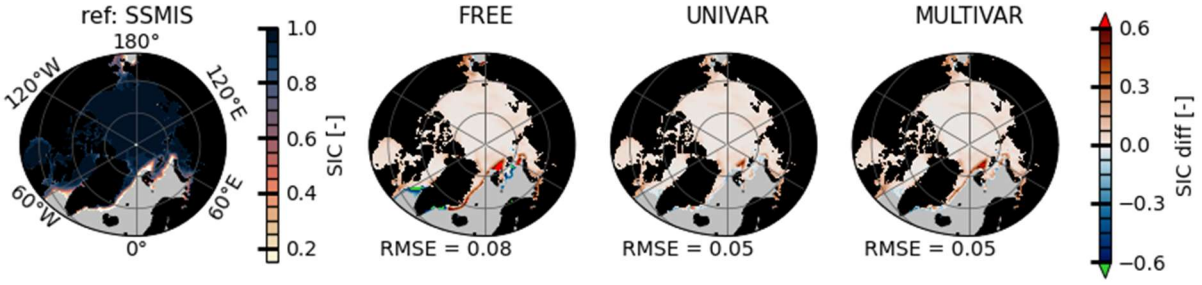


(a) February 2018 Arctic SIC differences relative to OSISAF SSMIS



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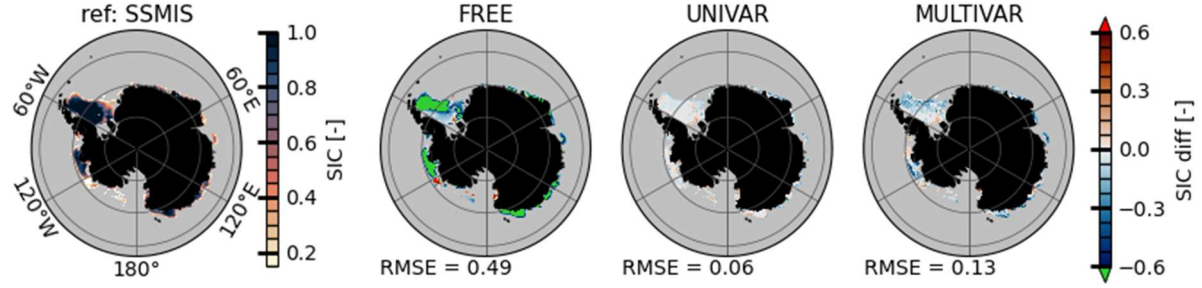
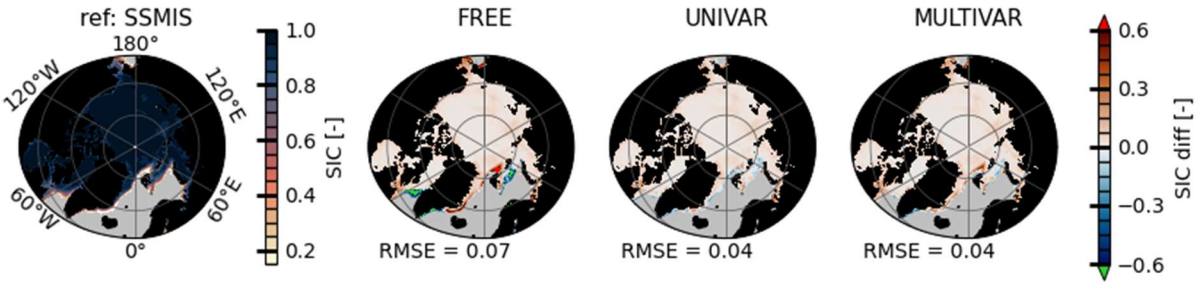


(a) March 2018 Arctic SIC differences relative to OSISAF SSMIS



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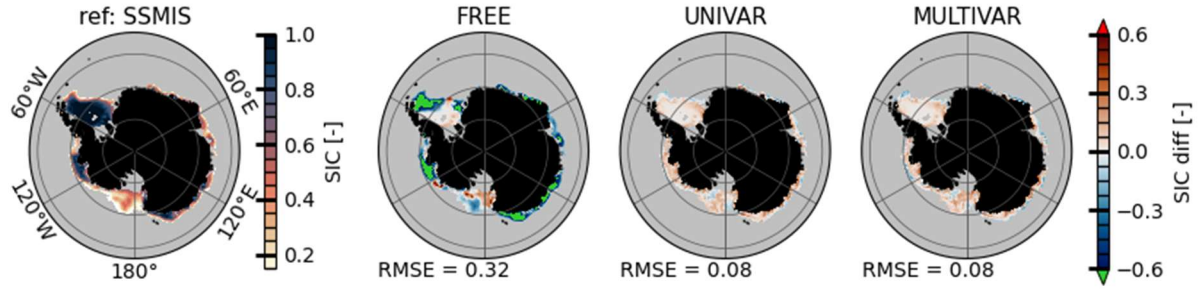

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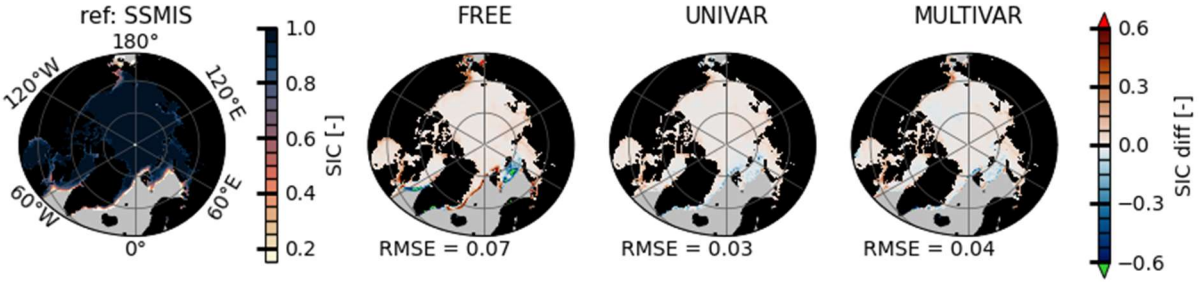

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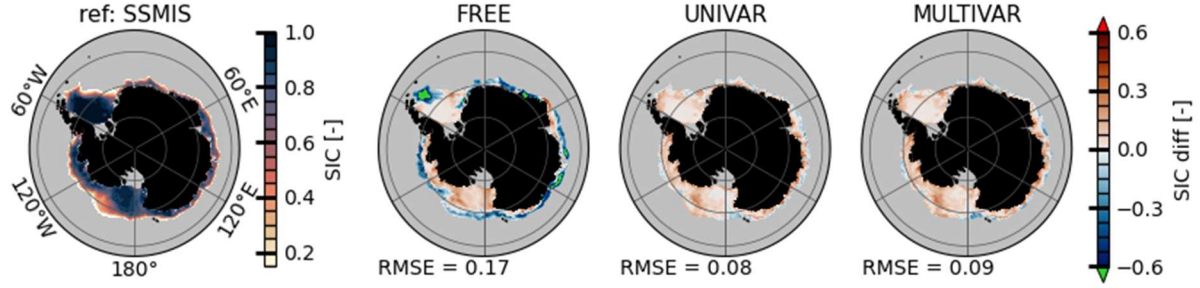

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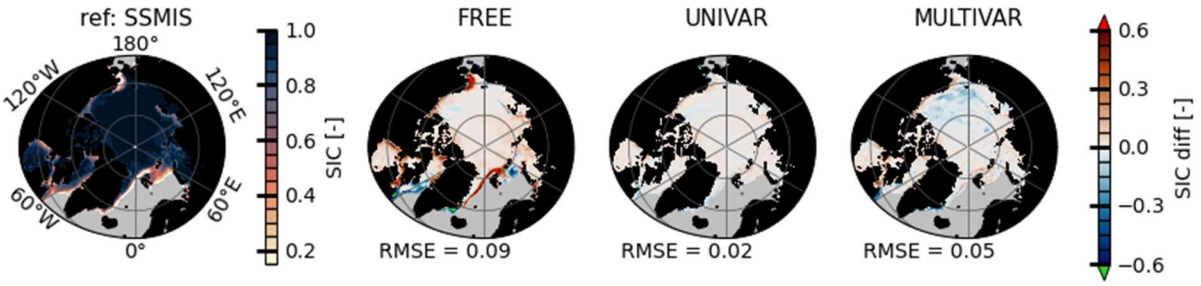

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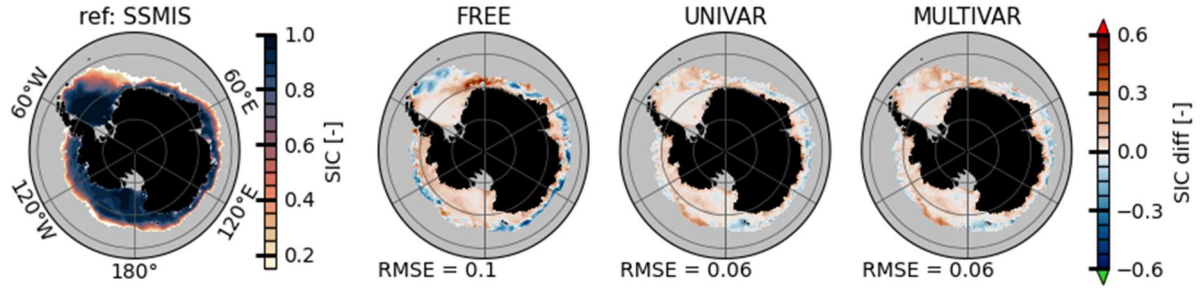
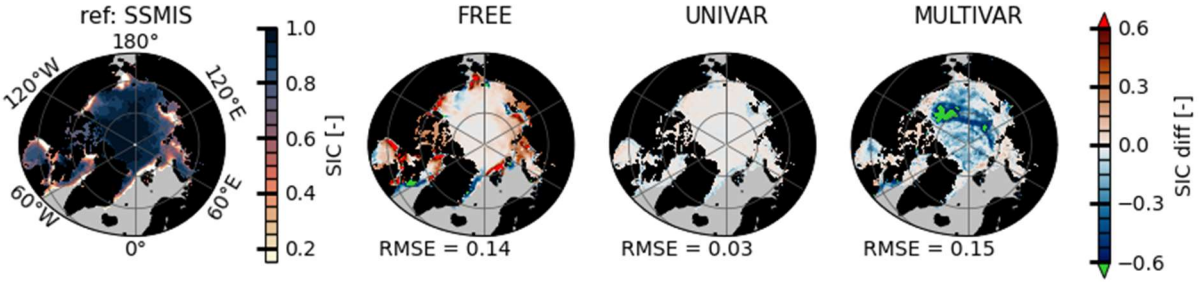


(a) June 2018 Arctic SIC differences relative to OSISAF SSMIS



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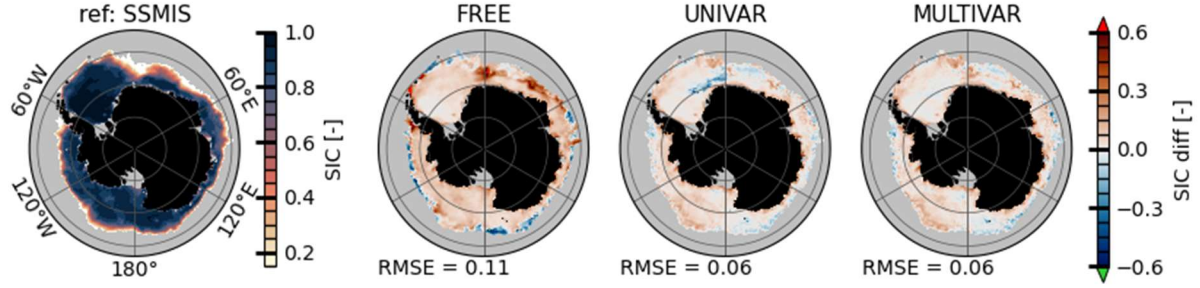
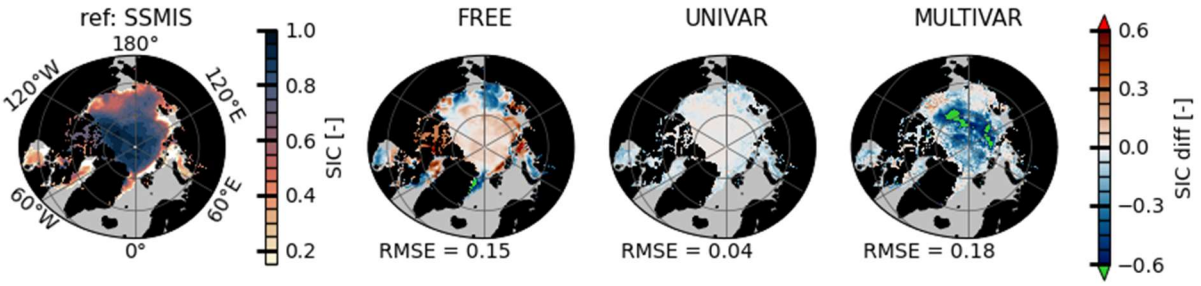


(a) July 2018 Arctic SIC differences relative to OSISAF SSMIS



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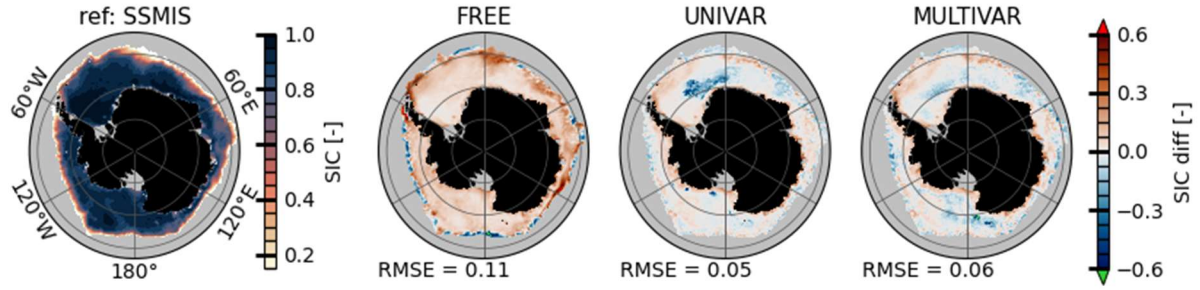
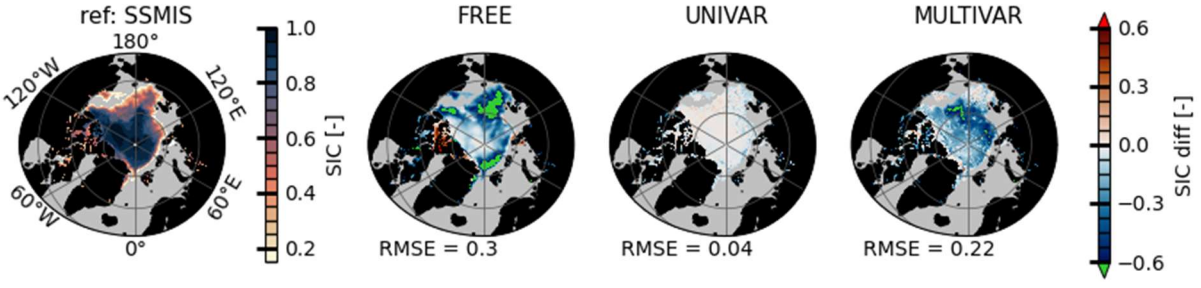


(a) August 2018 Arctic SIC differences relative to OSISAF SSMIS



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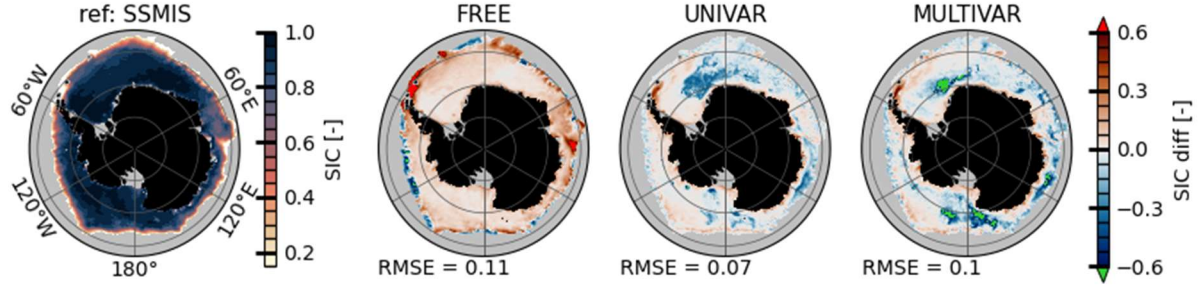
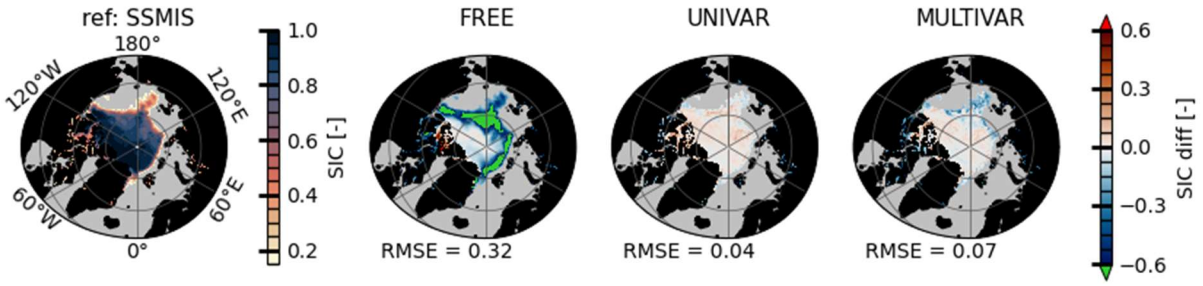


(a) September 2018 Arctic SIC differences relative to OSISAF SSMIS



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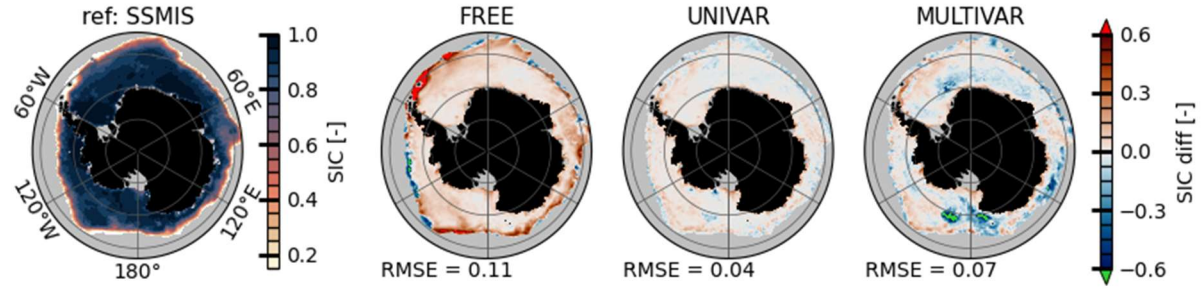

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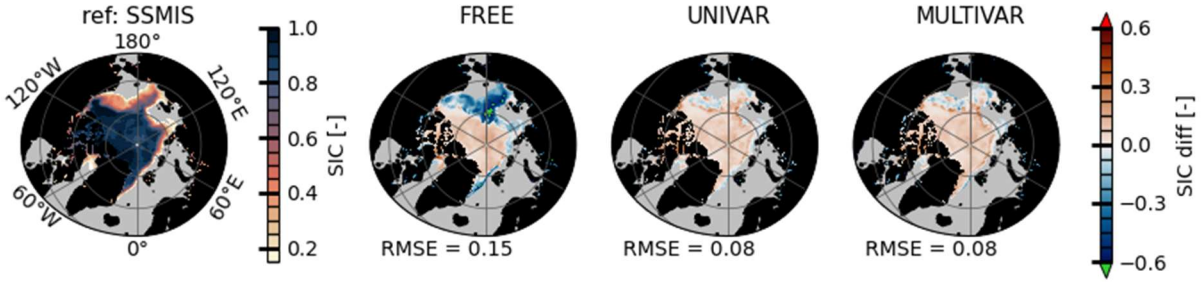

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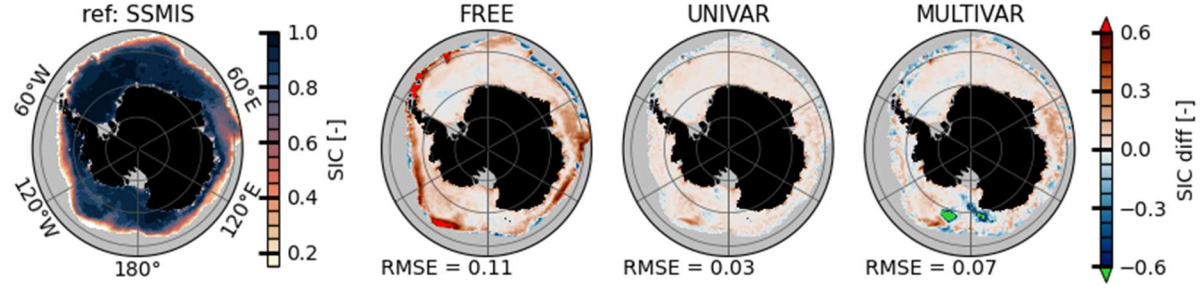
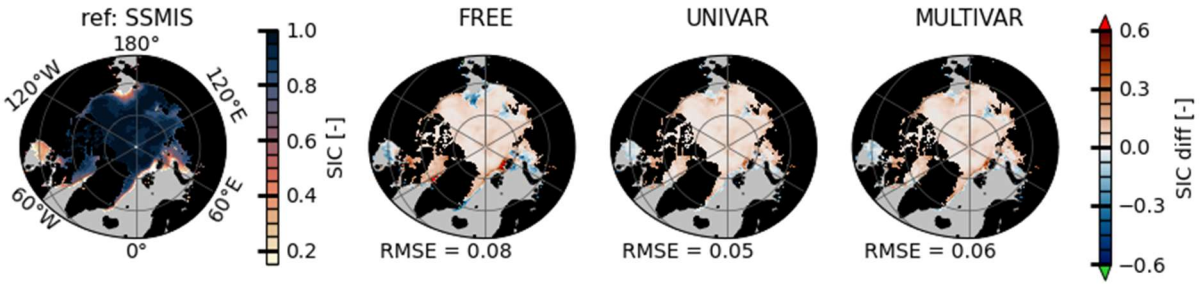
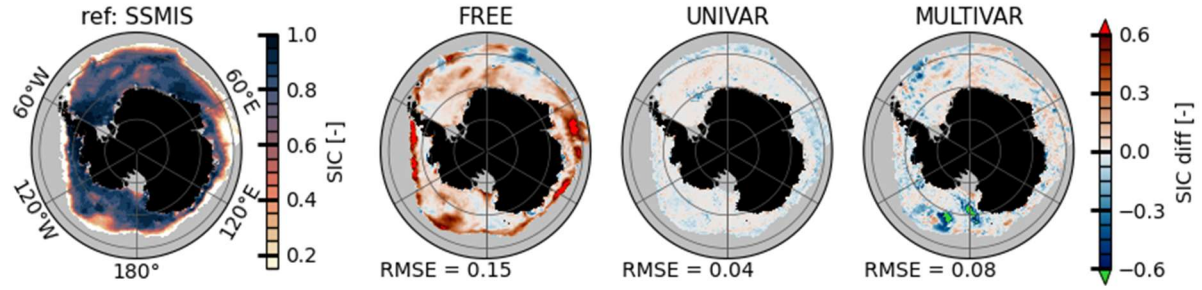


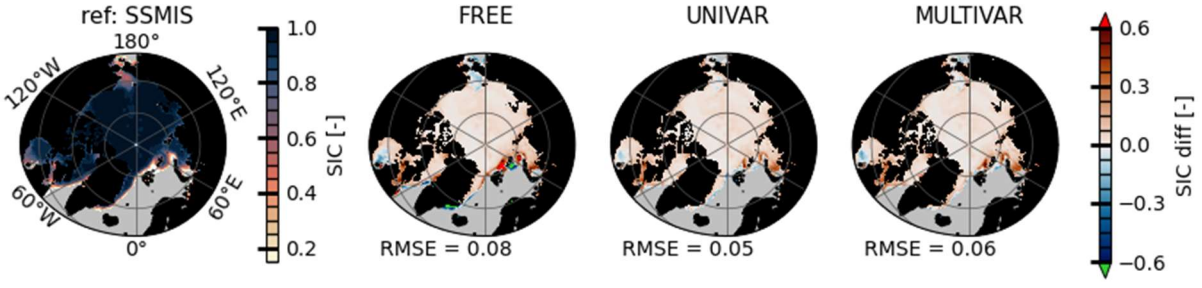
(a) November 2018 Arctic SIC differences relative to OSISAF SSMIS



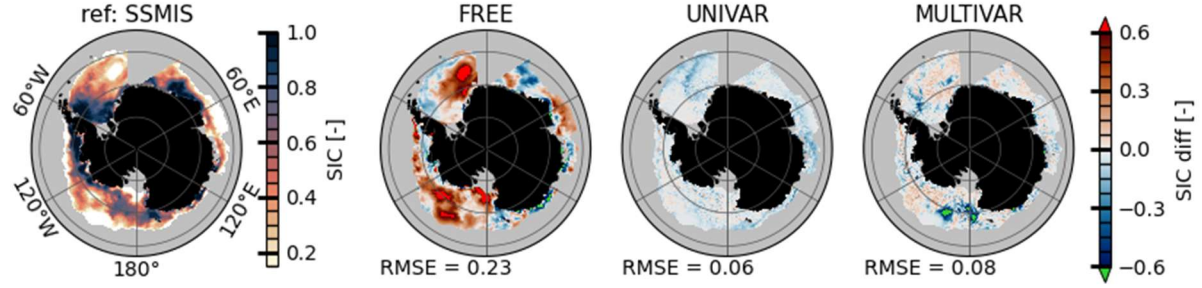
(b) November 2018 Antarctic SIC differences relative to OSISAF SSMIS

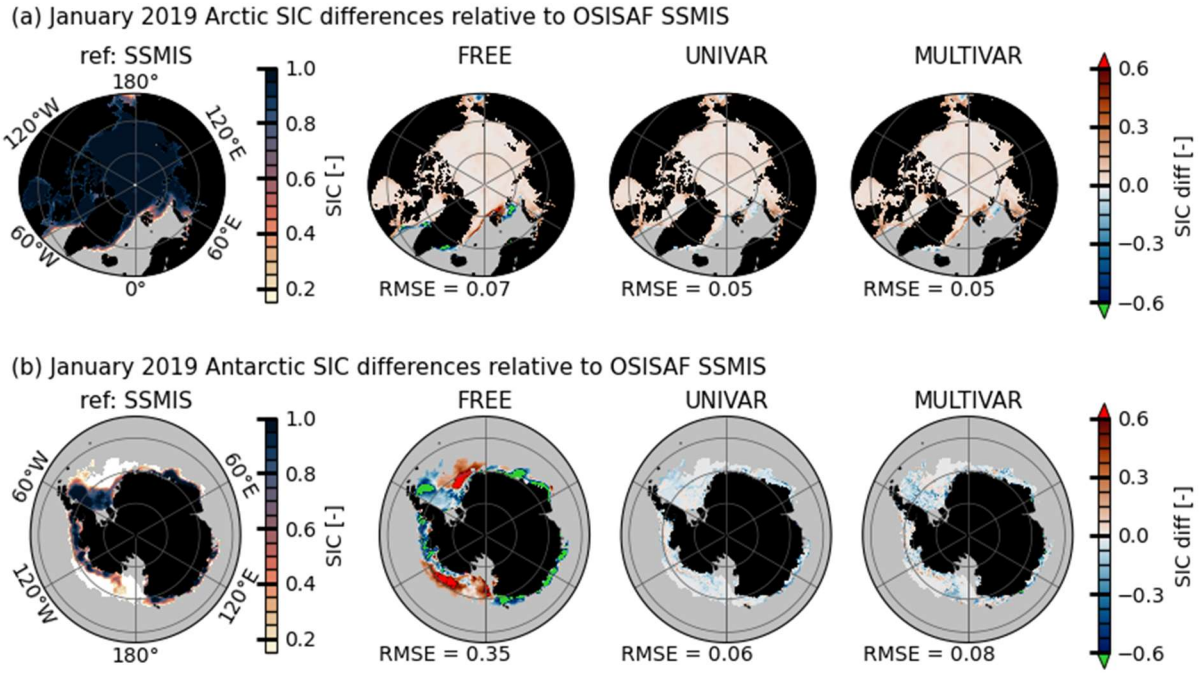


(a) December 2018 Arctic SIC differences relative to OSISAF SSMIS



(b) December 2018 Antarctic SIC differences relative to OSISAF SSMIS

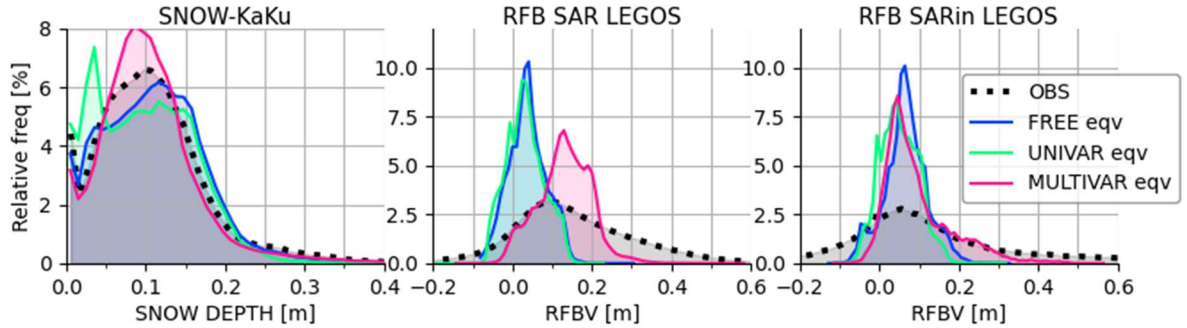



(a) January 2019 Arctic SIC differences relative to OSISAF SSMIS
ref: SSMIS
FREE
UNIVAR
MULTIVAR
180°
120°W
120°E
60°W
60°E
0°
1.0
0.8
0.6
0.4
0.2
SIC [-]
RMSE = 0.07
RMSE = 0.05
RMSE = 0.05
0.6
0.3
0.0
−0.3
−0.6
SIC diff [-]
(b) January 2019 Antarctic SIC differences relative to OSISAF SSMIS
ref: SSMIS
FREE
UNIVAR
MULTIVAR
60°W
60°E
120°W
120°E
180°
1.0
0.8
0.6
0.4
0.2
SIC [-]
RMSE = 0.35
RMSE = 0.06
RMSE = 0.08
0.6
0.3
0.0
−0.3
−0.6
SIC diff [-]

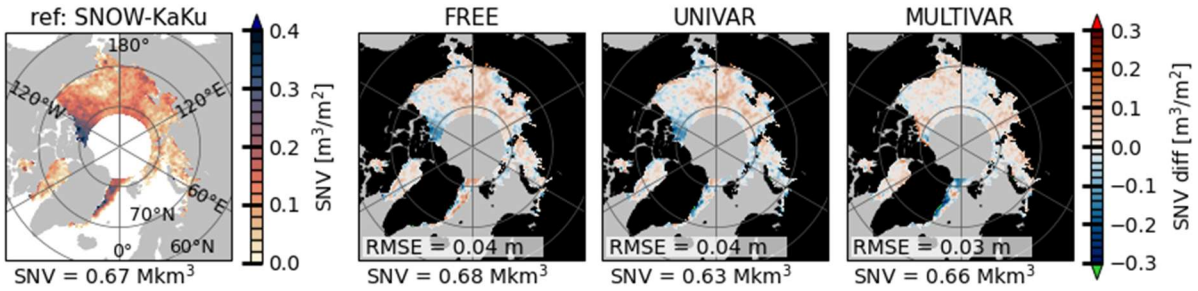
Radar Freeboard, snow thickness and probability density functions in the Arctic.

The following figures, similar to Figure 3 in the manuscript, display radar freeboard, snow thickness and probability functions in the Arctic for the periods January 2017-April 2017, November 2017-April 2108 and November 2018-January 2019. Top panels (a): Probability density functions (%) of the snow thickness, the radar freeboard SAR and radar freeboard SARin observations (dotted black) and their model equivalent for the FREE (blue), UNIVAR (green) and MULTIVAR (pink) experiments in the Arctic. Middle (b), resp. bottom (c), row panels: snow volume per unit area [$m^3/m2$] , resp. radar freeboard volume per unit area, from SNOW-KaKu, resp. RFB LEGOS, (first column) and differences with FREE, UNIVAR and MULTIVAR experiments. Total snow and RFB volumes values and root mean squared difference (RMS) are provided under each map.

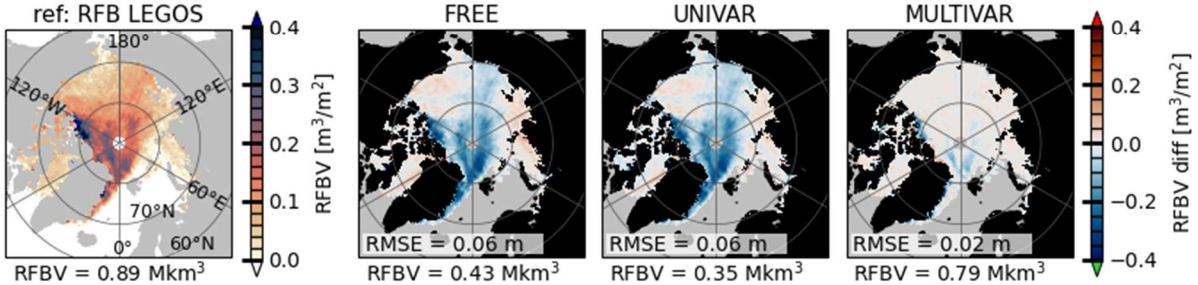
(a) January 2017 Arctic distributions



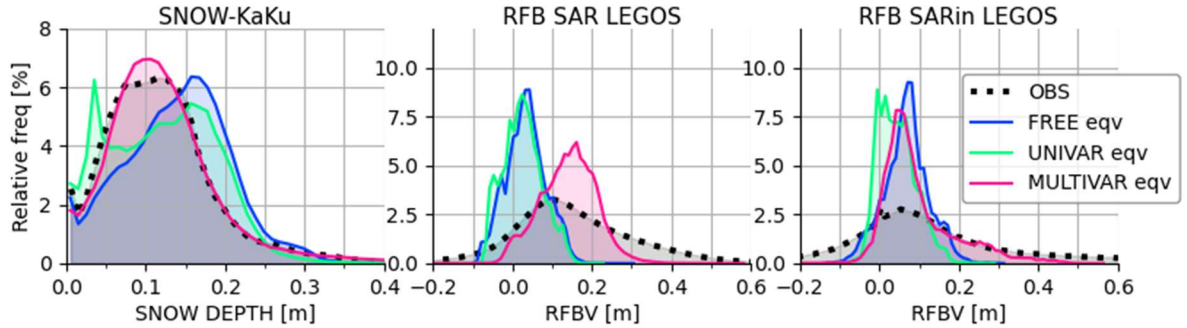
January 2017 Arctic snow volume differences relative to SNOW-KaKu



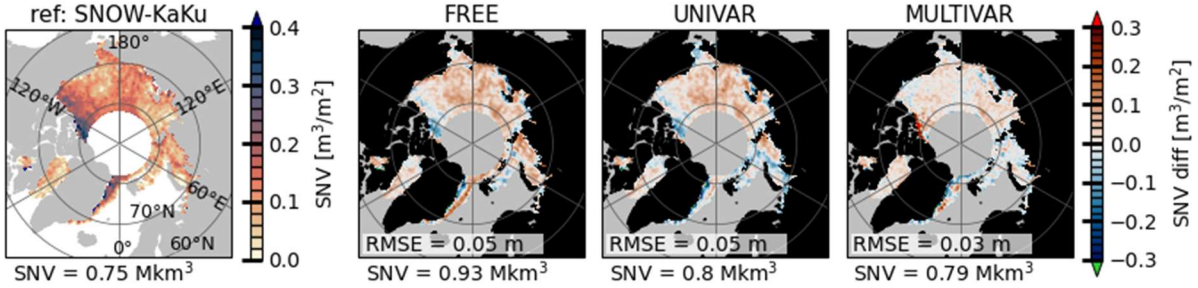
January 2017 Arctic radar freeboard volume differences relative to RFB LEGOS



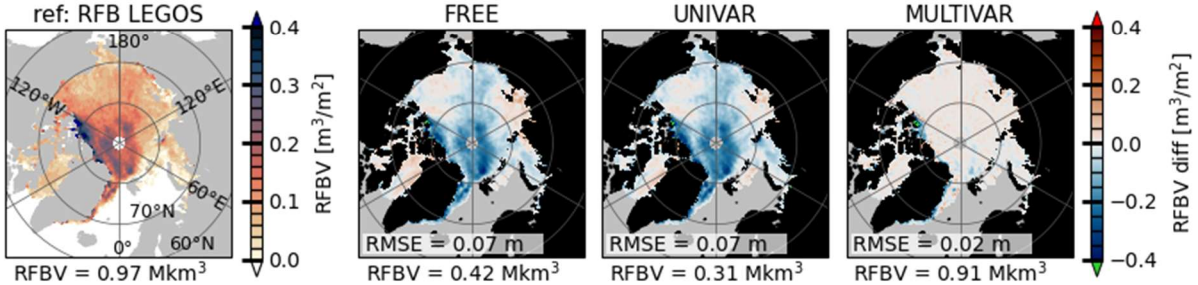
(a) February 2017 Arctic distributions



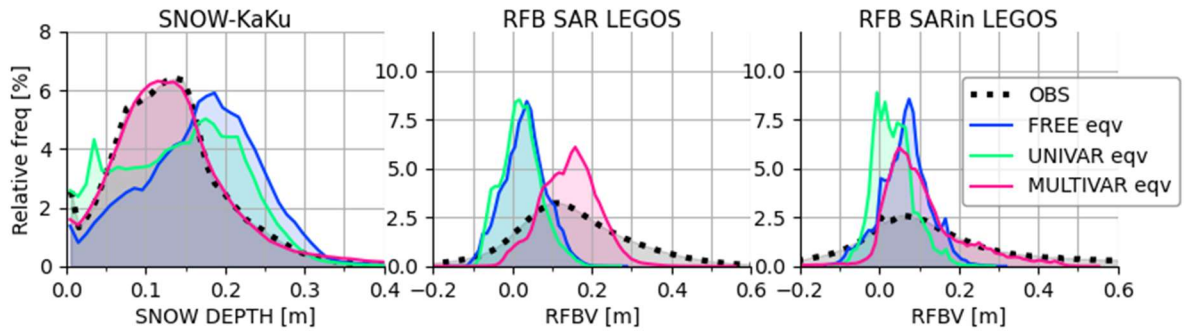
February 2017 Arctic snow volume differences relative to SNOW-KaKu



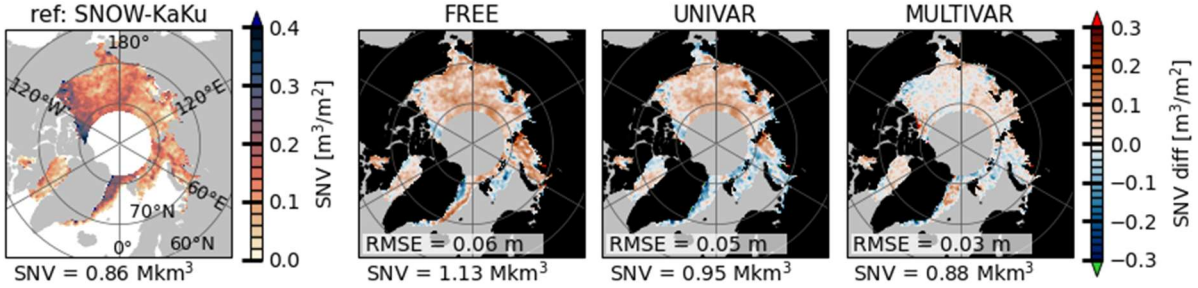
February 2017 Arctic radar freeboard volume differences relative to RFB LEGOS



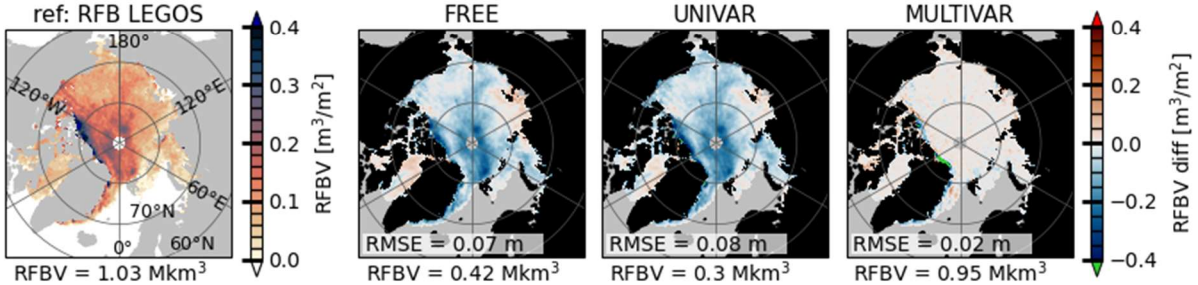
(a) March 2017 Arctic distributions



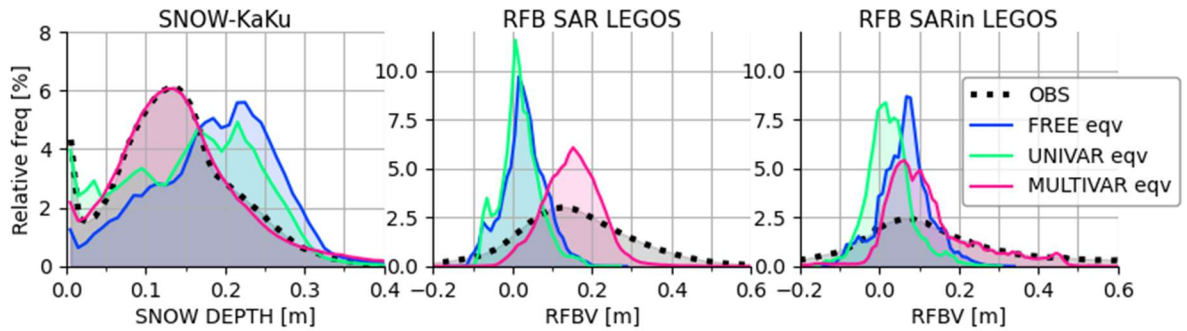
March 2017 Arctic snow volume differences relative to SNOW-KaKu



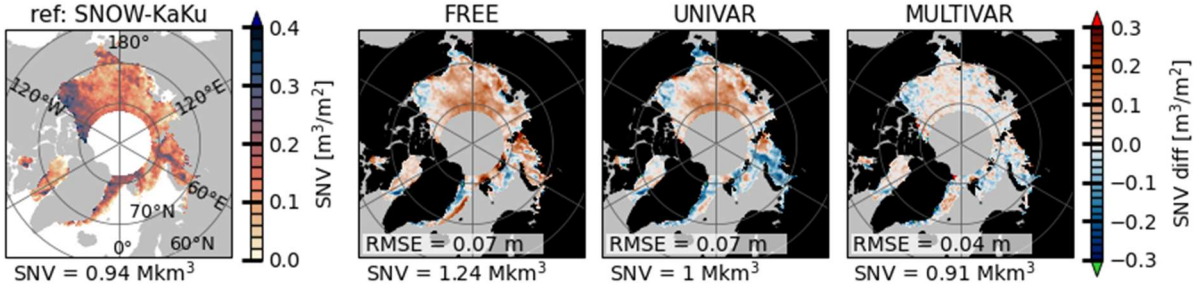
March 2017 Arctic radar freeboard volume differences relative to RFB LEGOS



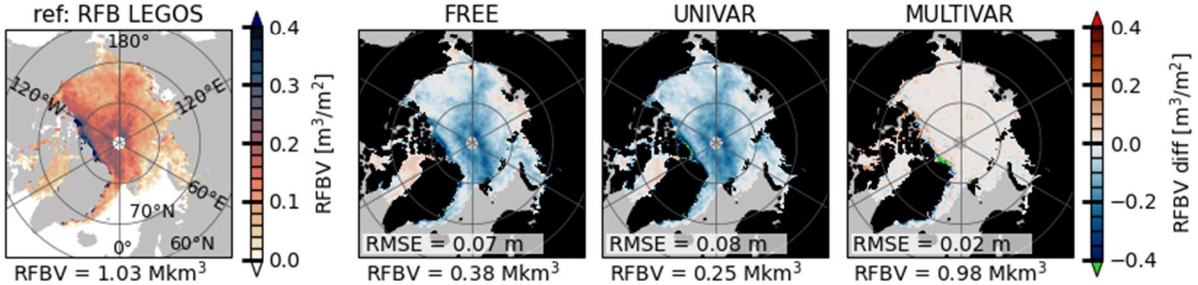
(a) April 2017 Arctic distributions



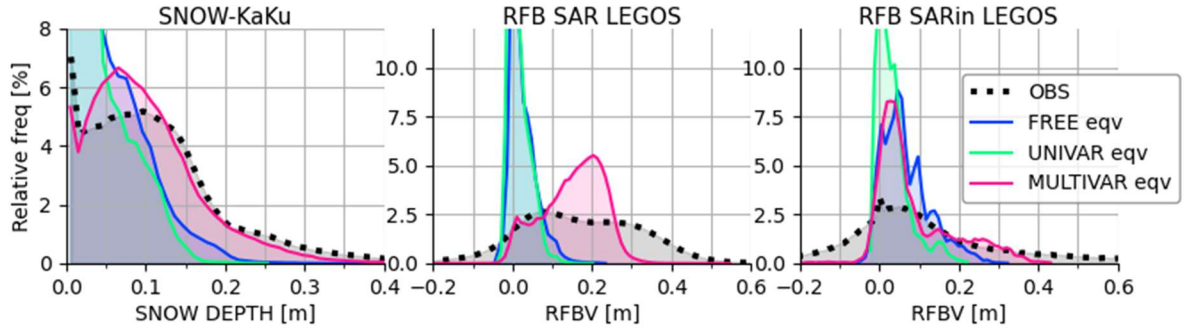
April 2017 Arctic snow volume differences relative to SNOW-KaKu



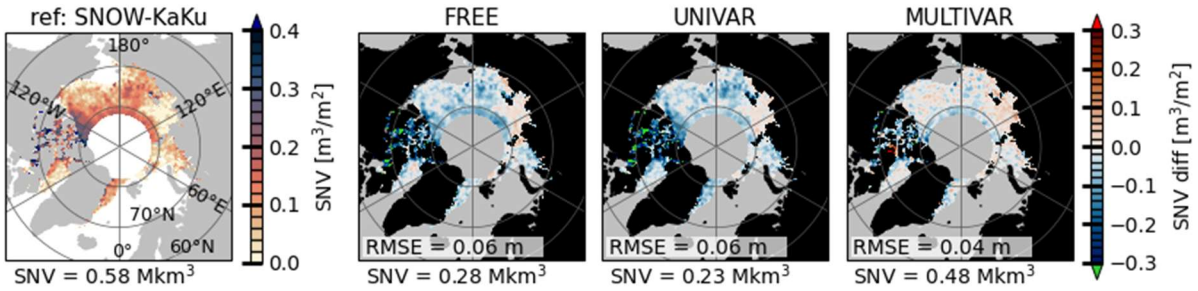
April 2017 Arctic radar freeboard volume differences relative to RFB LEGOS



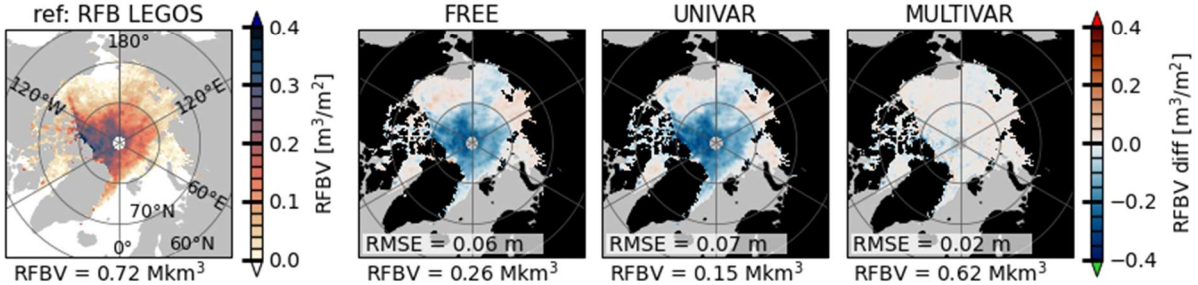
(a) November 2017 Arctic distributions



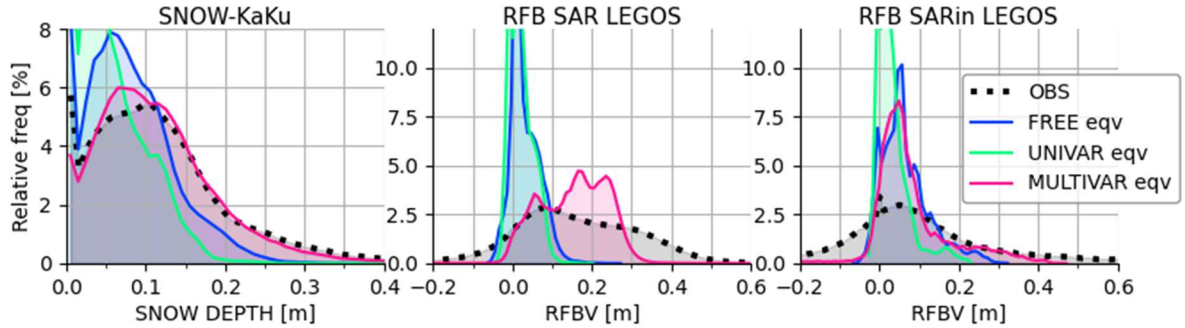
November 2017 Arctic snow volume differences relative to SNOW-KaKu



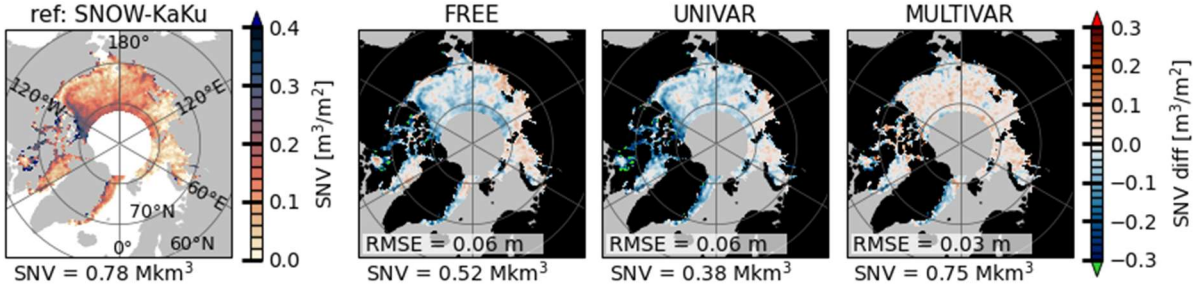
November 2017 Arctic radar freeboard volume differences relative to RFB LEGOS



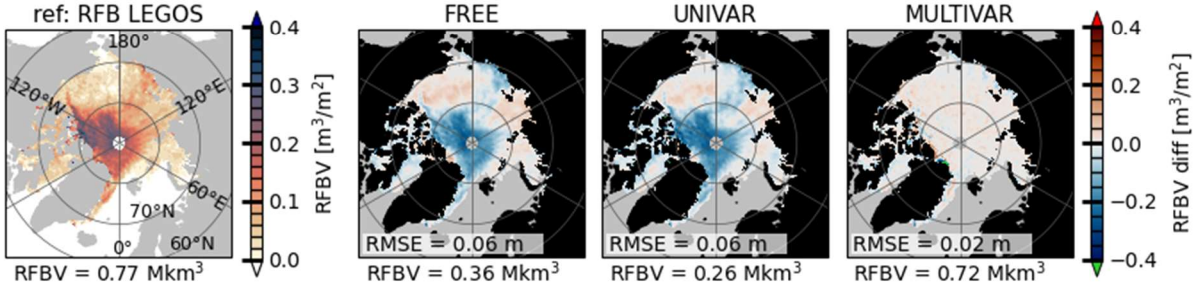
(a) December 2017 Arctic distributions



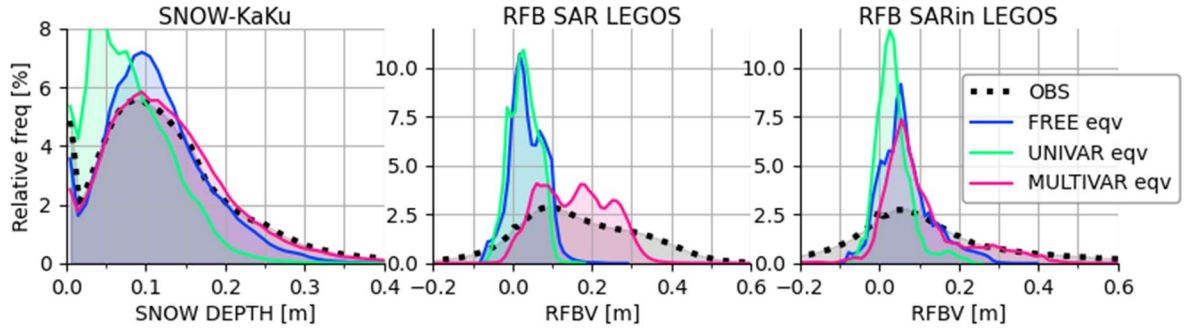
December 2017 Arctic snow volume differences relative to SNOW-KaKu



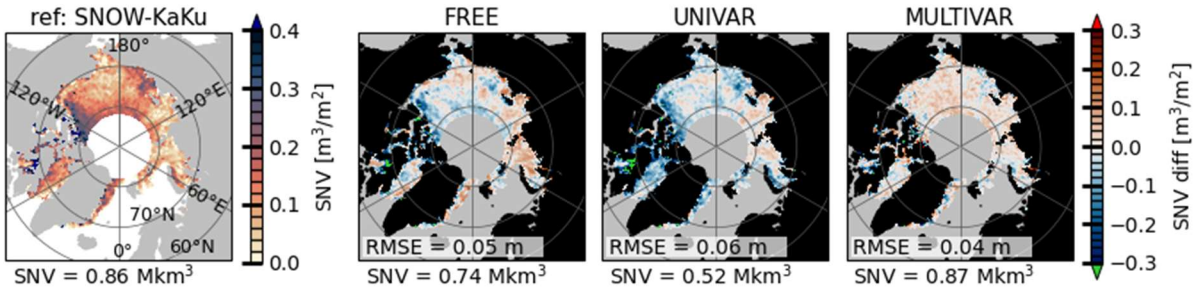
December 2017 Arctic radar freeboard volume differences relative to RFB LEGOS



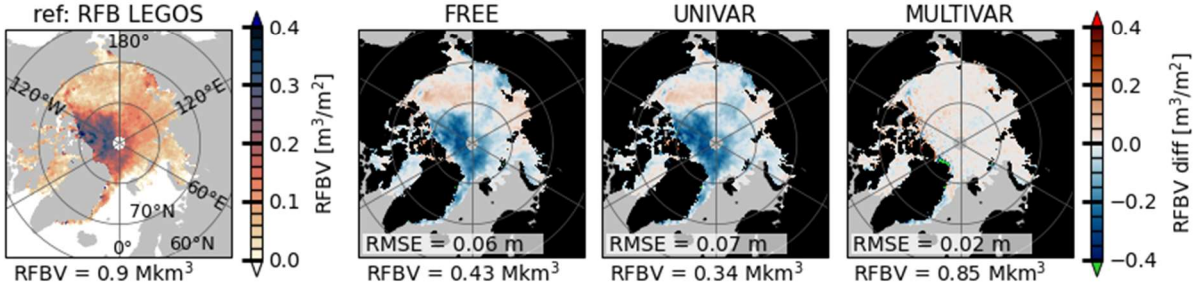
(a) January 2018 Arctic distributions



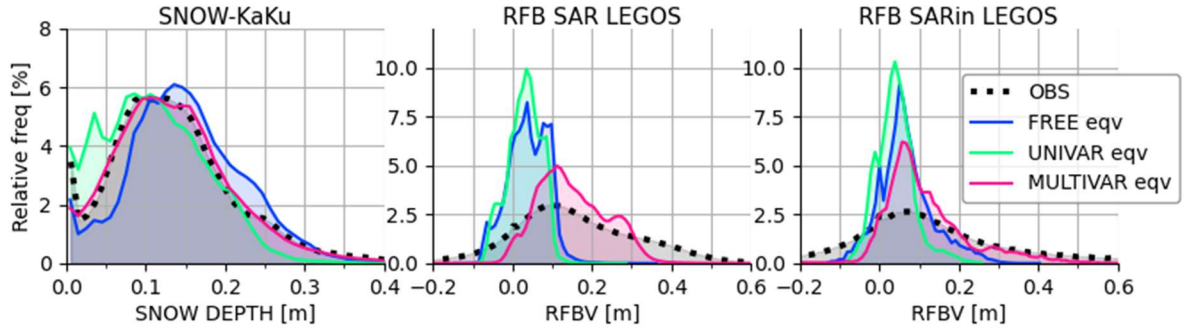
January 2018 Arctic snow volume differences relative to SNOW-KaKu



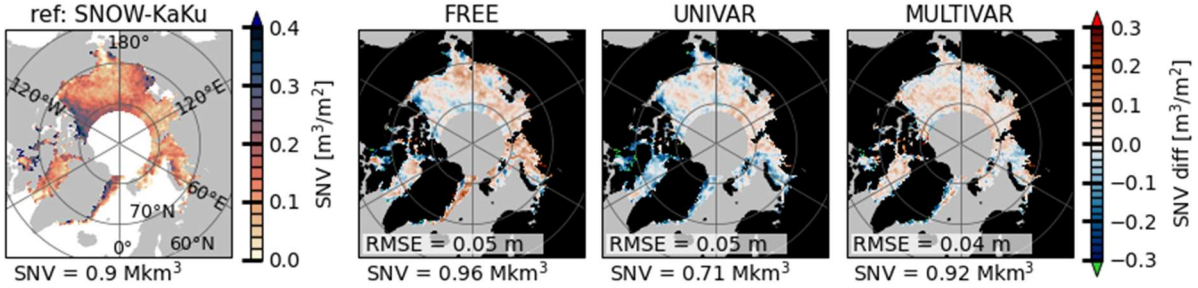
January 2018 Arctic radar freeboard volume differences relative to RFB LEGOS



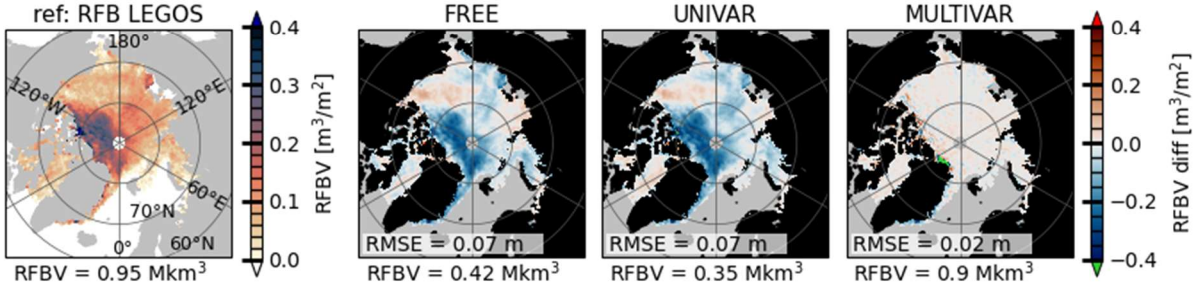
(a) February 2018 Arctic distributions



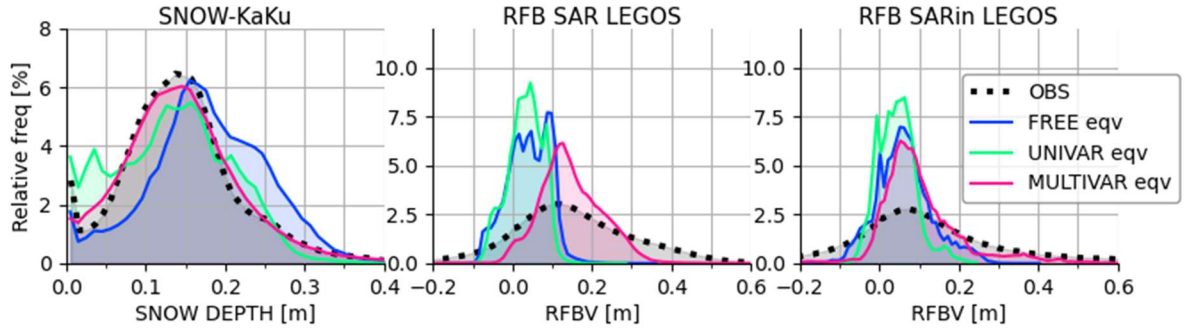
February 2018 Arctic snow volume differences relative to SNOW-KaKu



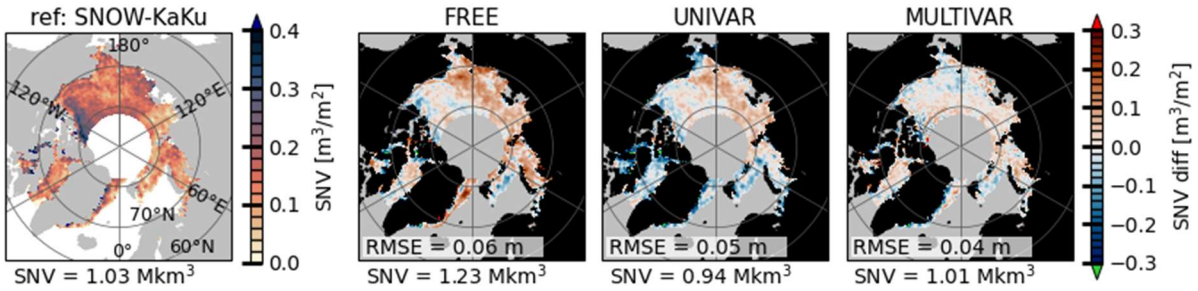
February 2018 Arctic radar freeboard volume differences relative to RFB LEGOS



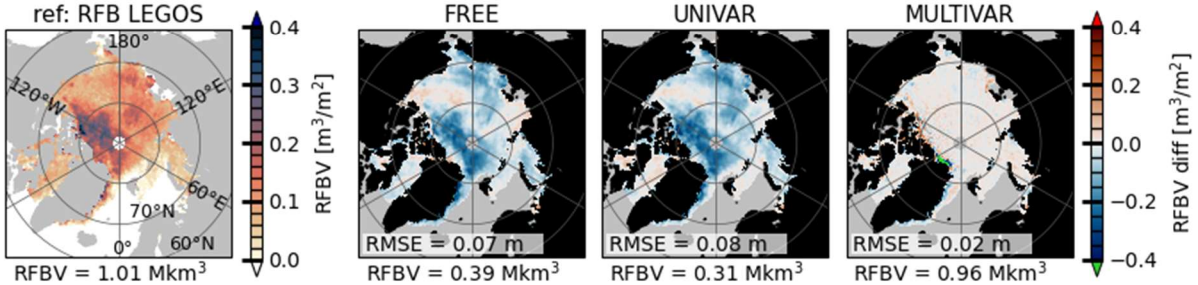
(a) March 2018 Arctic distributions



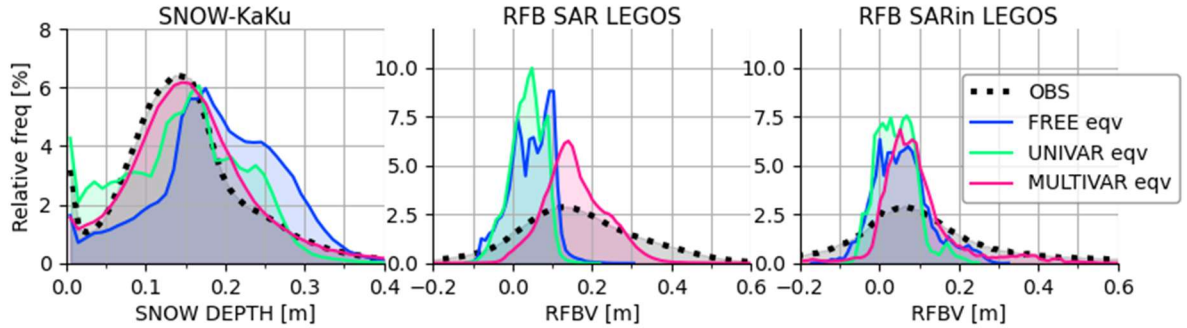
March 2018 Arctic snow volume differences relative to SNOW-KaKu



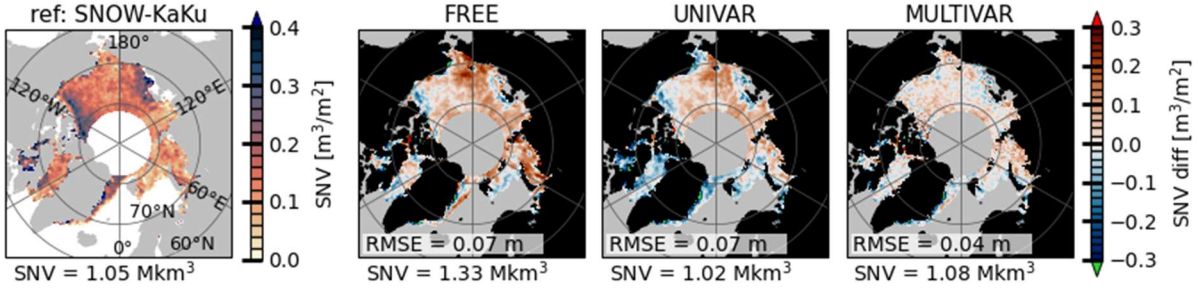
March 2018 Arctic radar freeboard volume differences relative to RFB LEGOS



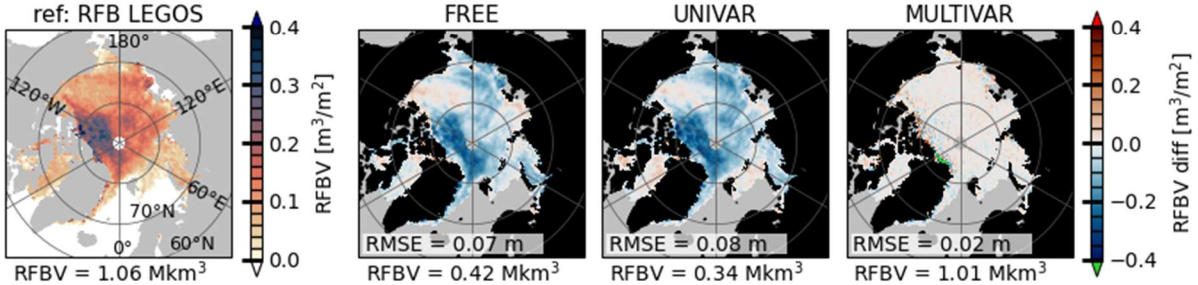
(a) April 2018 Arctic distributions



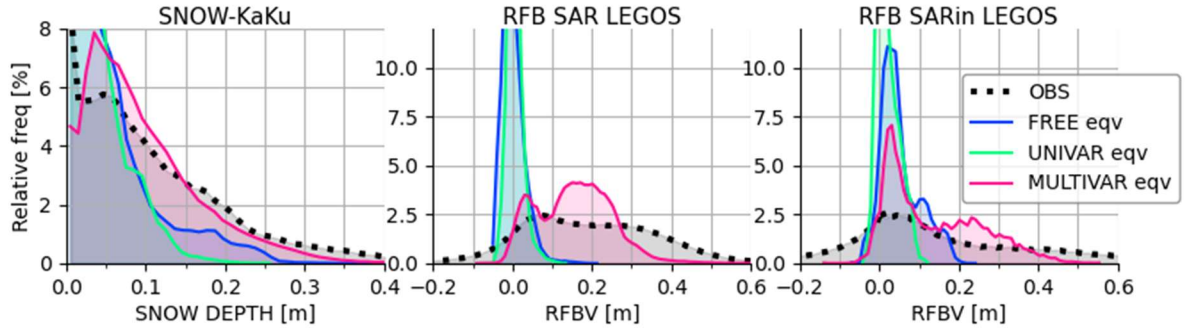
April 2018 Arctic snow volume differences relative to SNOW-KaKu



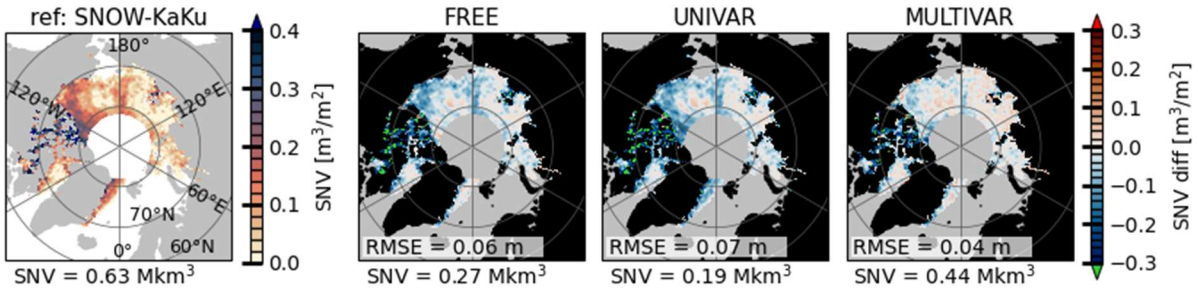
April 2018 Arctic radar freeboard volume differences relative to RFB LEGOS



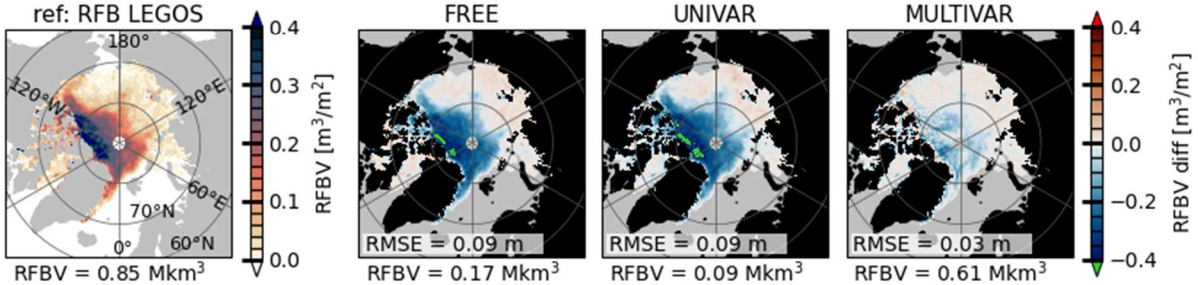
(a) November 2018 Arctic distributions



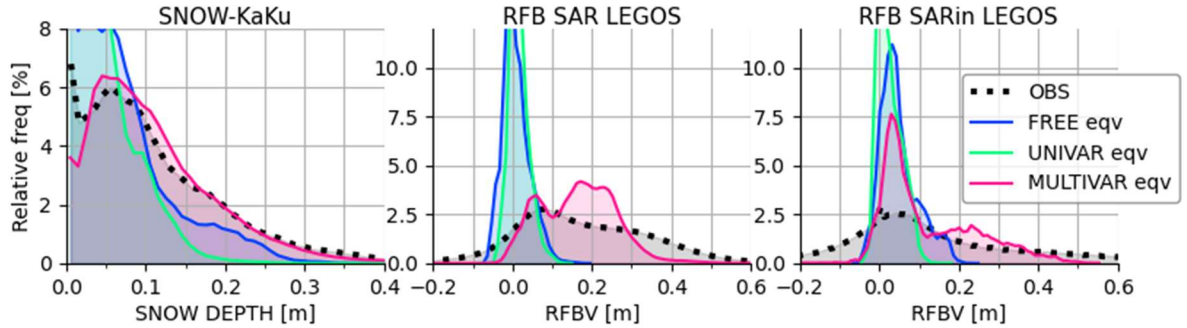
November 2018 Arctic snow volume differences relative to SNOW-KaKu



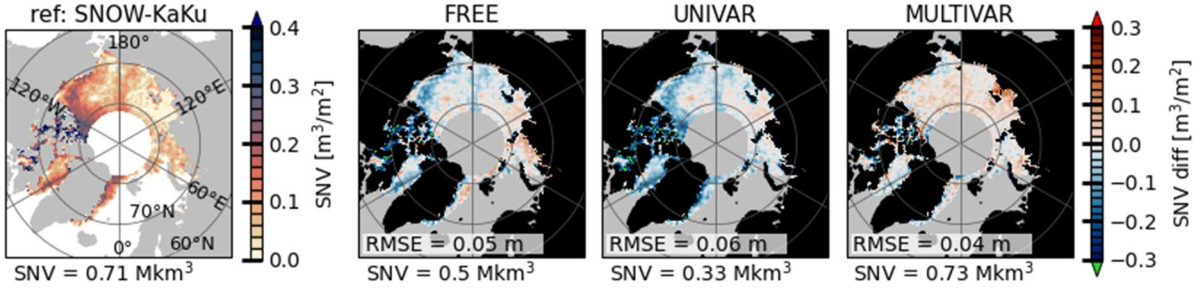
November 2018 Arctic radar freeboard volume differences relative to RFB LEGOS



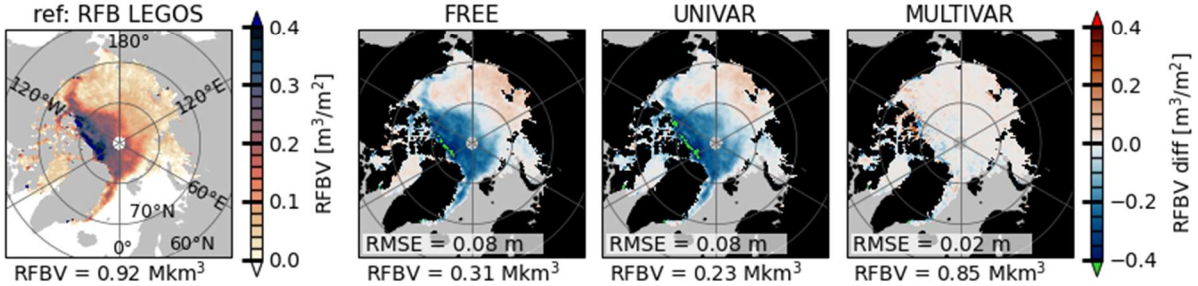
(a) December 2018 Arctic distributions



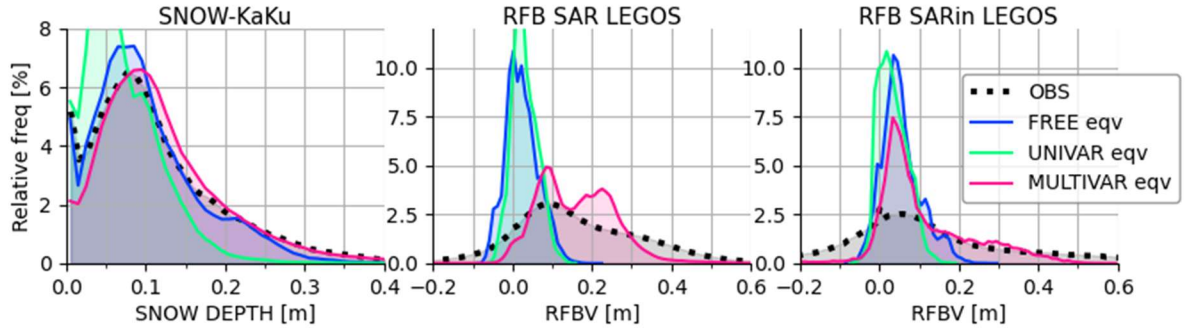
December 2018 Arctic snow volume differences relative to SNOW-KaKu



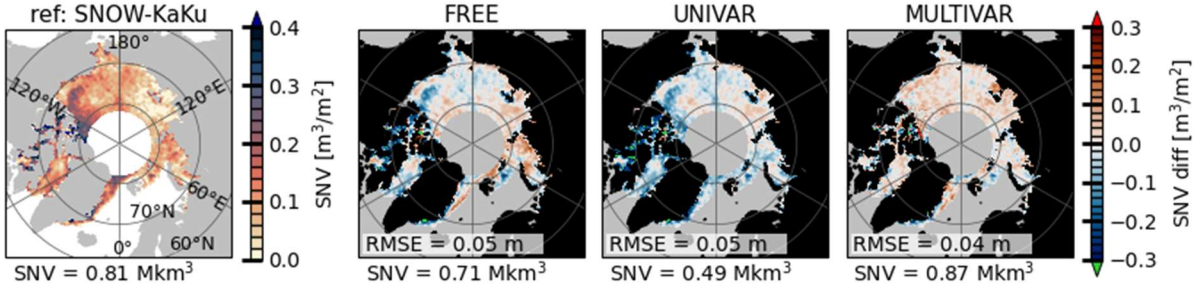
December 2018 Arctic radar freeboard volume differences relative to RFB LEGOS



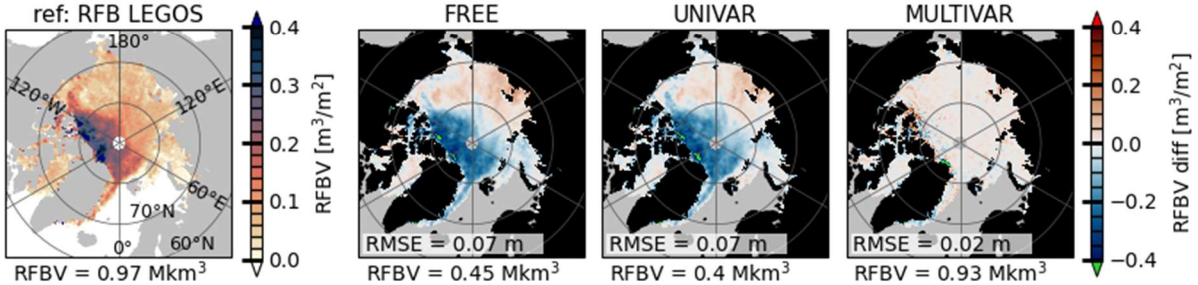
(a) January 2019 Arctic distributions



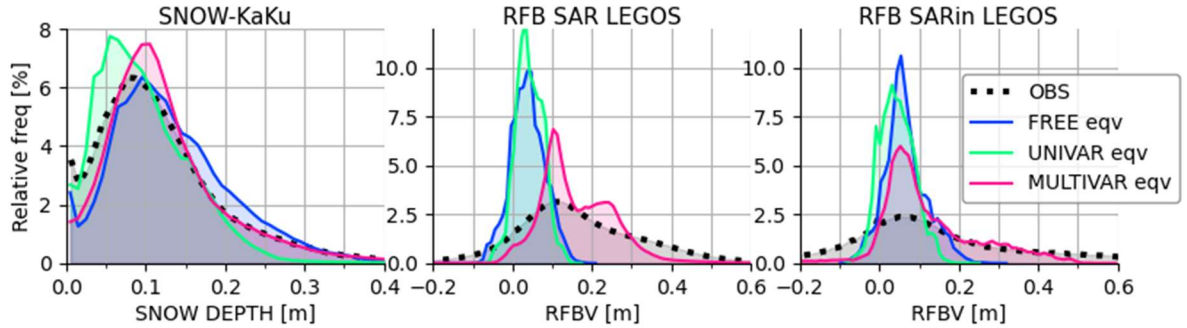
January 2019 Arctic snow volume differences relative to SNOW-KaKu



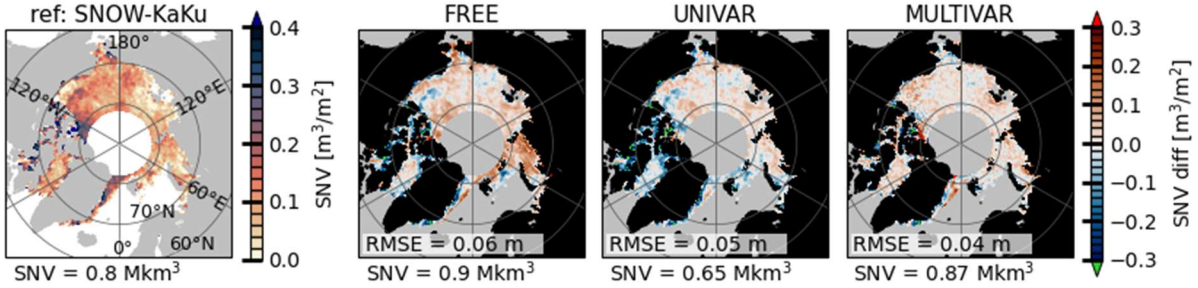
January 2019 Arctic radar freeboard volume differences relative to RFB LEGOS



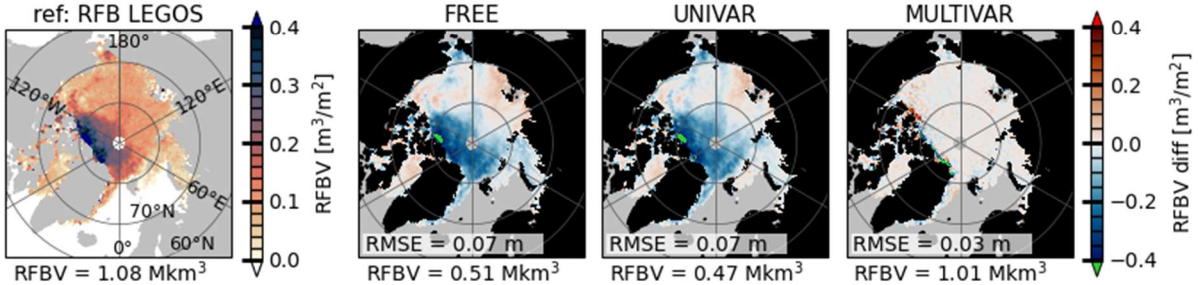
(a) February 2019 Arctic distributions



February 2019 Arctic snow volume differences relative to SNOW-KaKu



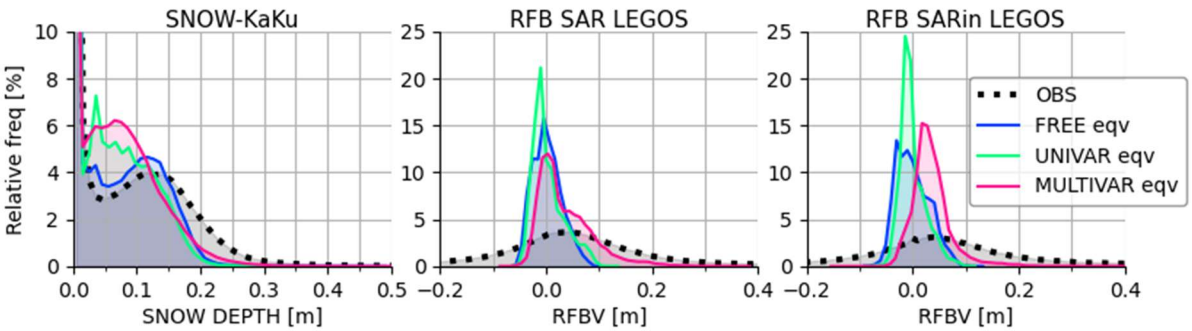
February 2019 Arctic radar freeboard volume differences relative to RFB LEGOS



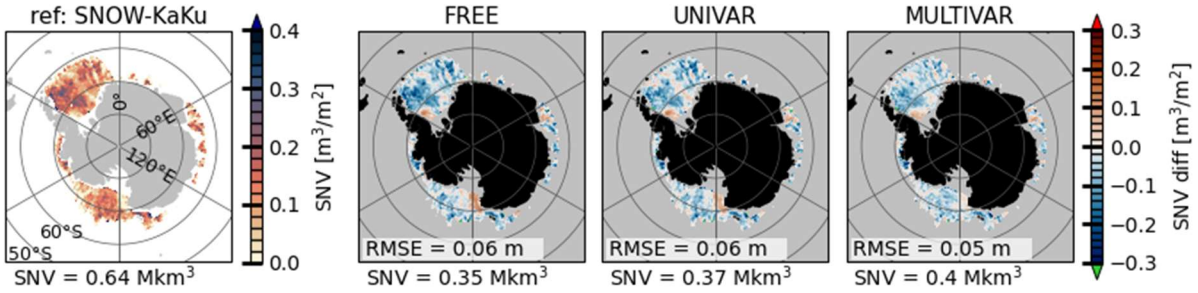
Radar Freeboard, snow thickness and probability density function in the Antarctic.

The following figures, similar to Figure 4 in the manuscript, display radar freeboard, snow thickness and probability functions in the Antarctic for the periods May 2017-October 2017 and May 2018-October 2018. Top panels (a): Probability density functions (%) of the snow thickness, the radar freeboard SAR and radar freeboard SARin observations (dotted black) and their model equivalent for the FREE (blue), UNIVAR (green) and MULTIVAR (pink) experiments in the Arctic. Middle (b), resp. bottom (c), row panels: snow volume per unit area [$m^3/m2$] , resp. radar freeboard volume per unit area, from SNOW-KaKu, resp. RFB LEGOS, (first column) and differences with FREE, UNIVAR and MULTIVAR experiments. Total snow and RFB volumes values and root mean squared difference (RMS) are provided under each map.

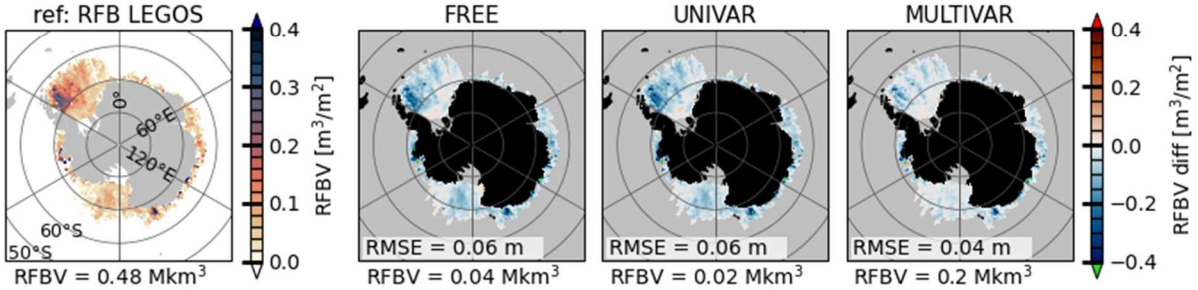
(a) May 2017 Antarctic distributions



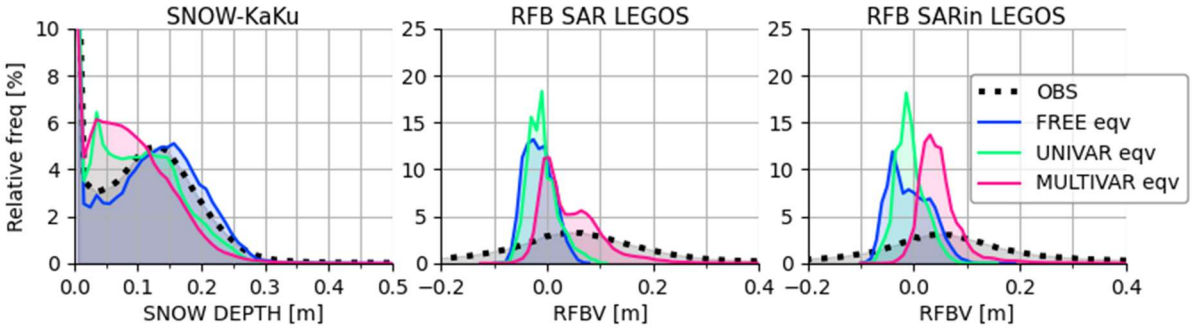
May 2017 Antarctic snow volume differences relative to SNOW-KaKu



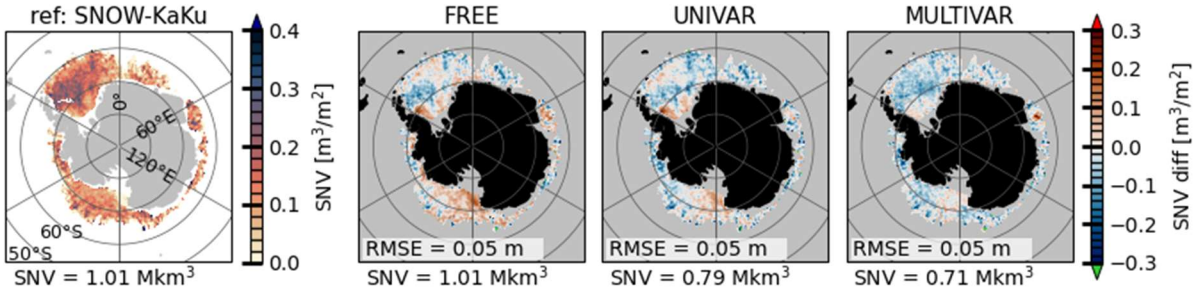
May 2017 Antarctic radar freeboard volume differences relative to RFB LEGOS



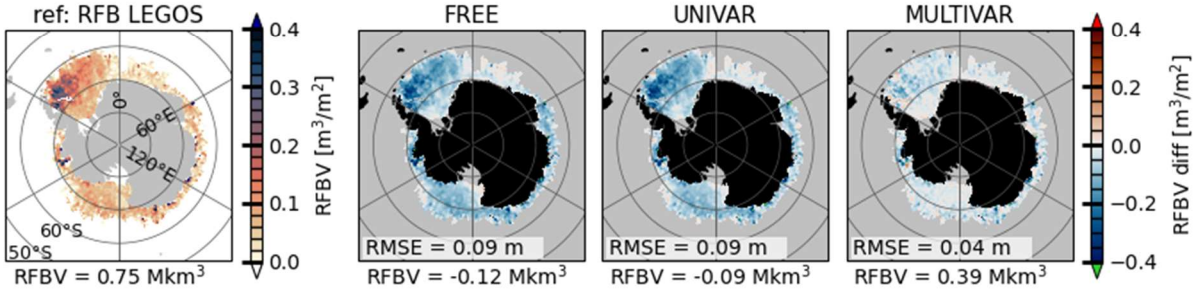
(a) June 2017 Antarctic distributions



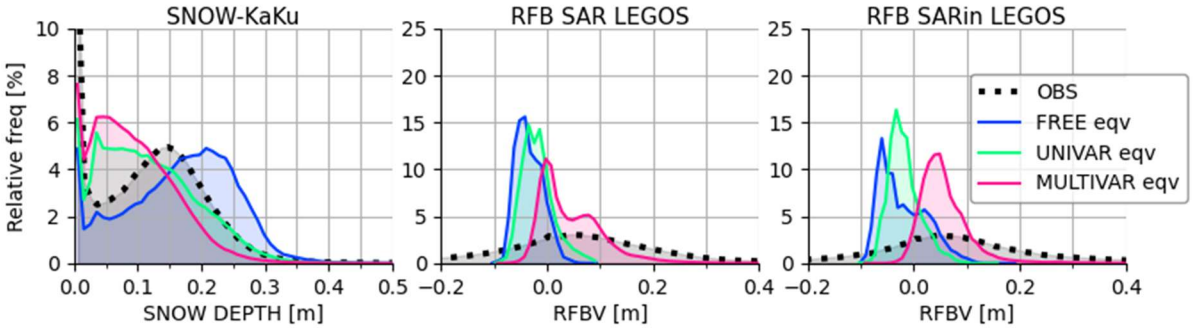
June 2017 Antarctic snow volume differences relative to SNOW-KaKu



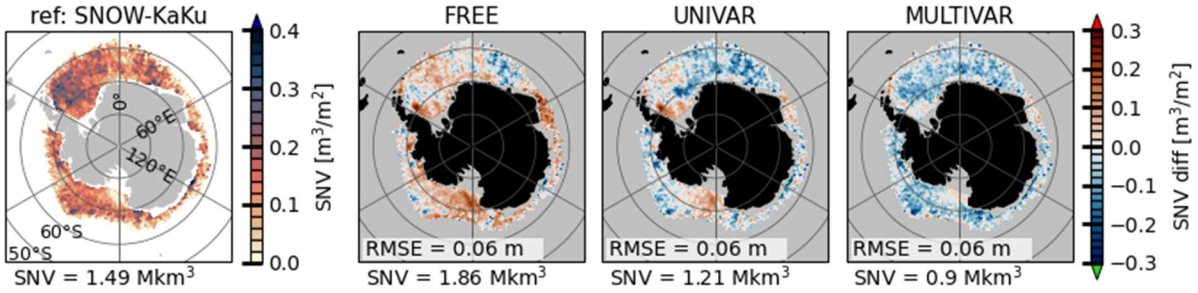
June 2017 Antarctic radar freeboard volume differences relative to RFB LEGOS



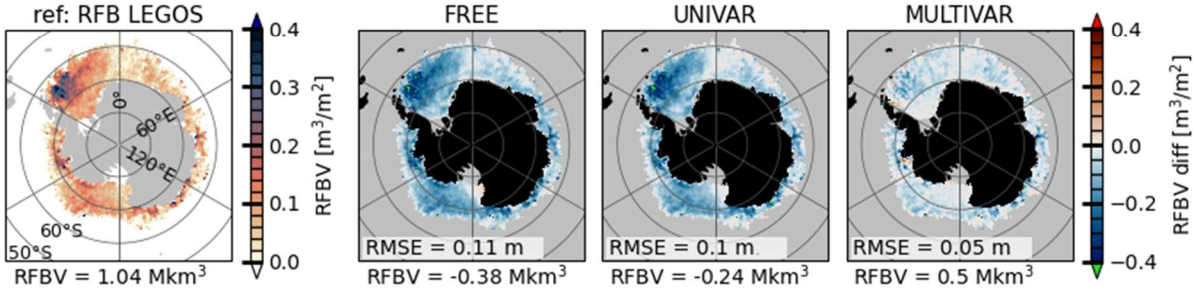
(a) July 2017 Antarctic distributions



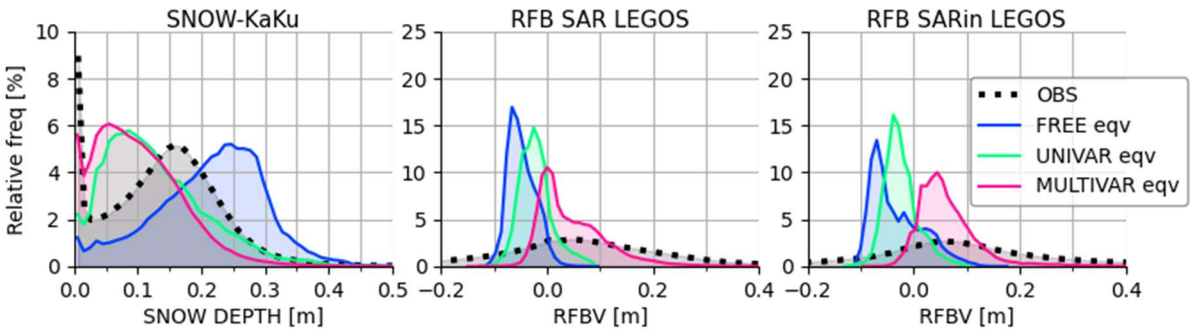
July 2017 Antarctic snow volume differences relative to SNOW-KaKu



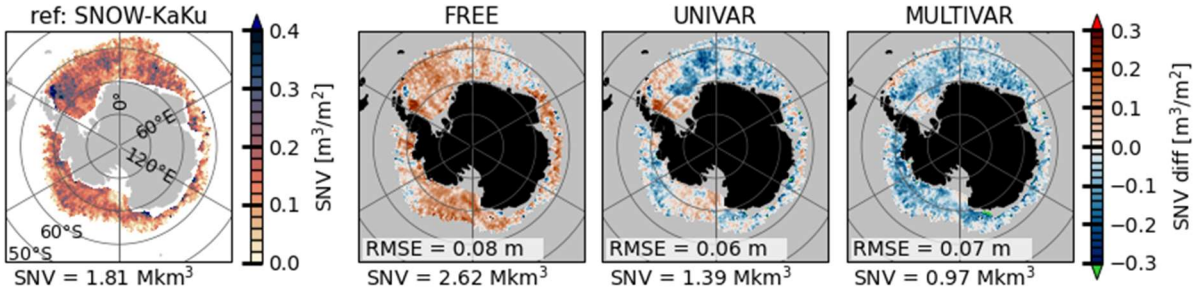
July 2017 Antarctic radar freeboard volume differences relative to RFB LEGOS



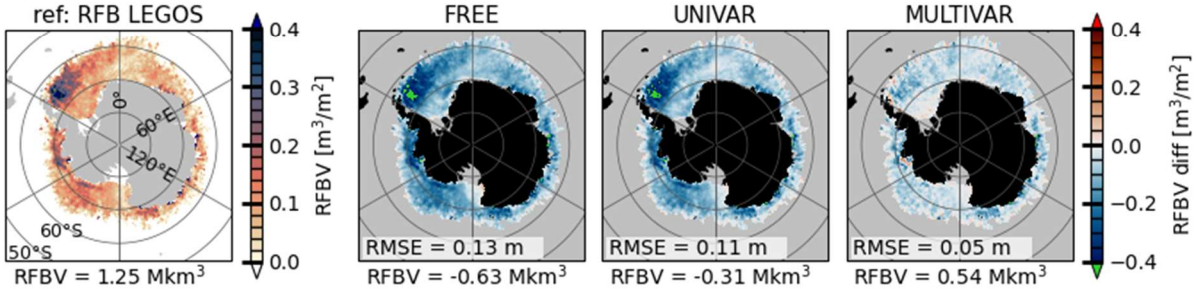
(a) August 2017 Antarctic distributions



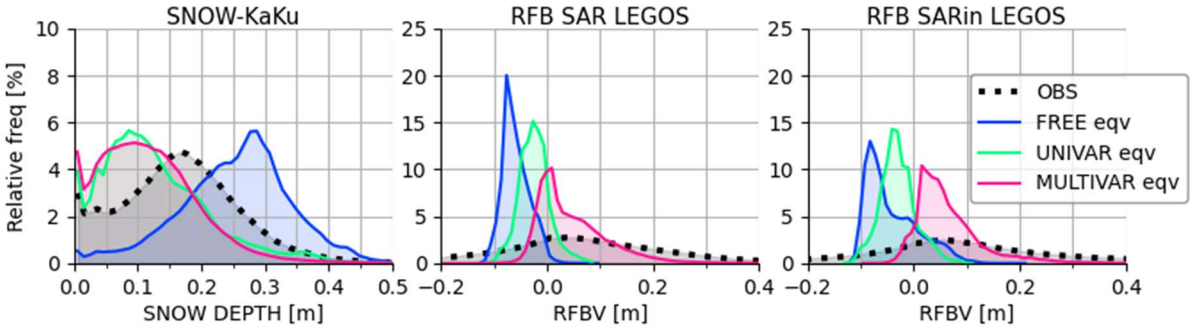
August 2017 Antarctic snow volume differences relative to SNOW-KaKu



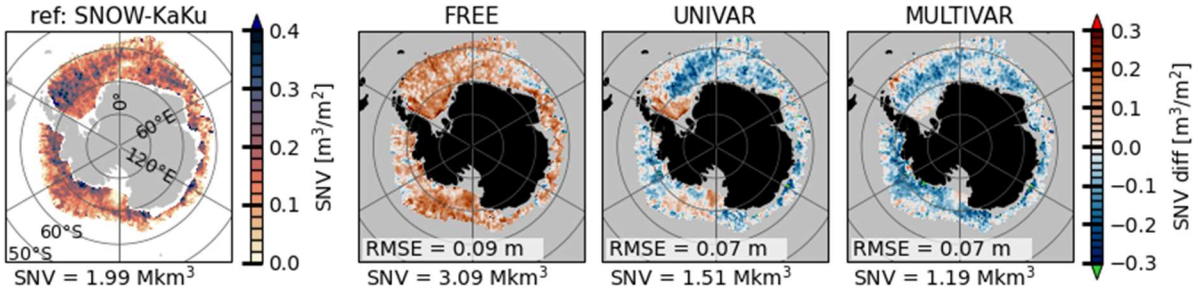
August 2017 Antarctic radar freeboard volume differences relative to RFB LEGOS



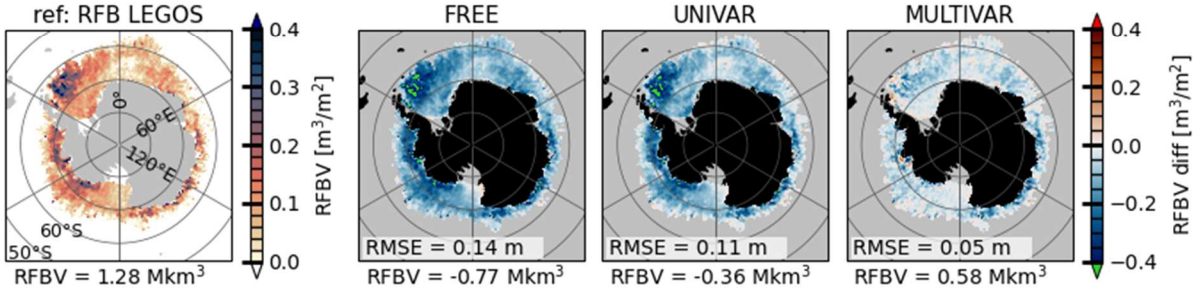
(a) September 2017 Antarctic distributions



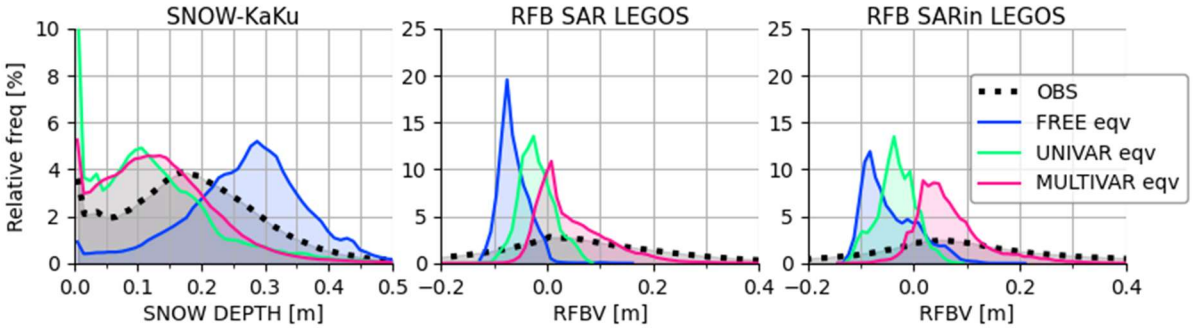
September 2017 Antarctic snow volume differences relative to SNOW-KaKu



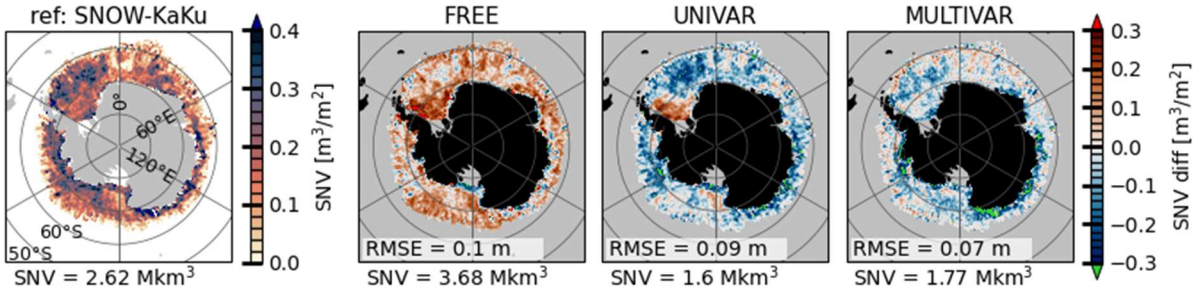
September 2017 Antarctic radar freeboard volume differences relative to RFB LEGOS



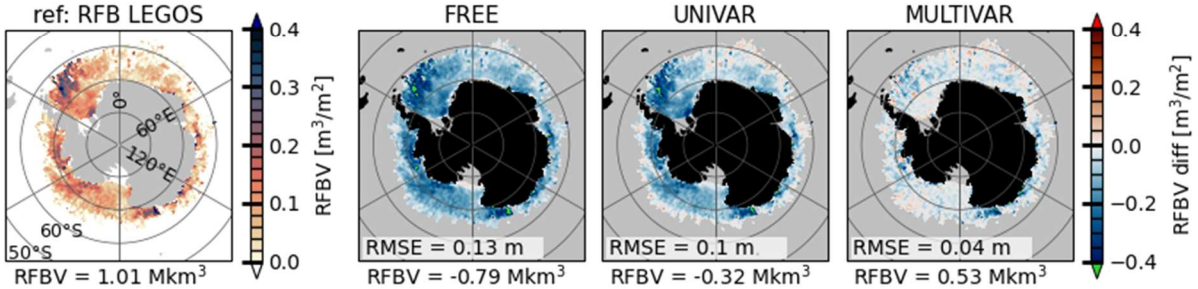
(a) October 2017 Antarctic distributions



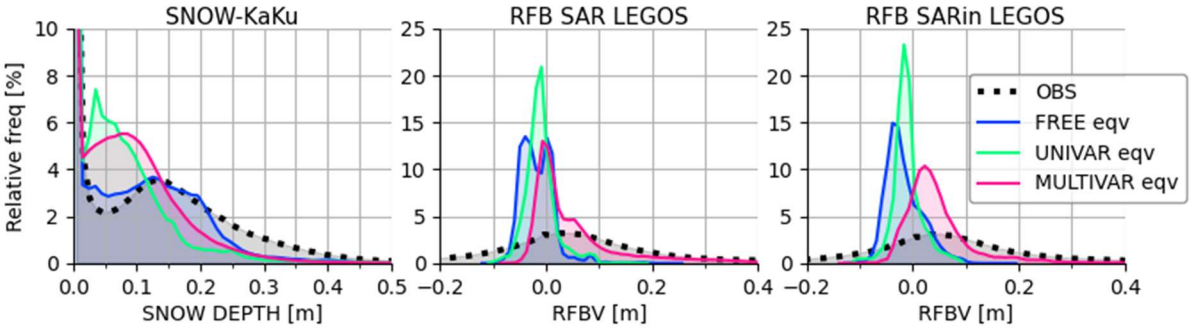
October 2017 Antarctic snow volume differences relative to SNOW-KaKu



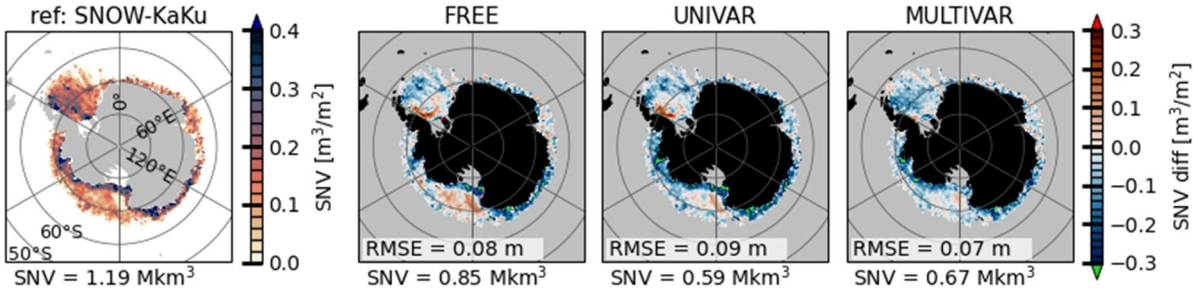
October 2017 Antarctic radar freeboard volume differences relative to RFB LEGOS



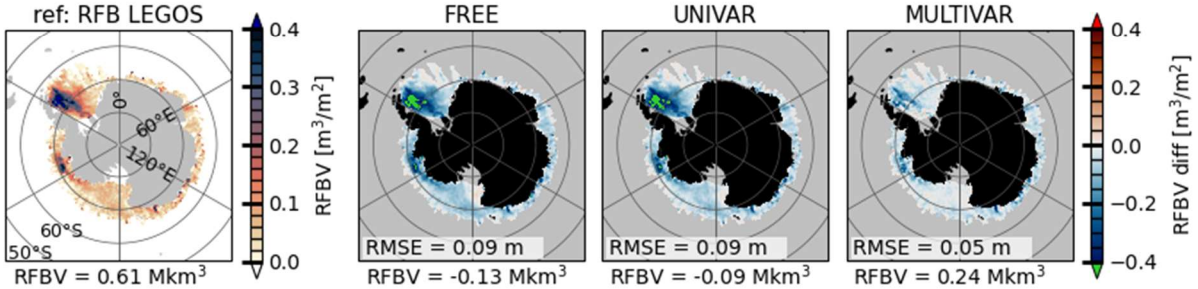
(a) May 2018 Antarctic distributions



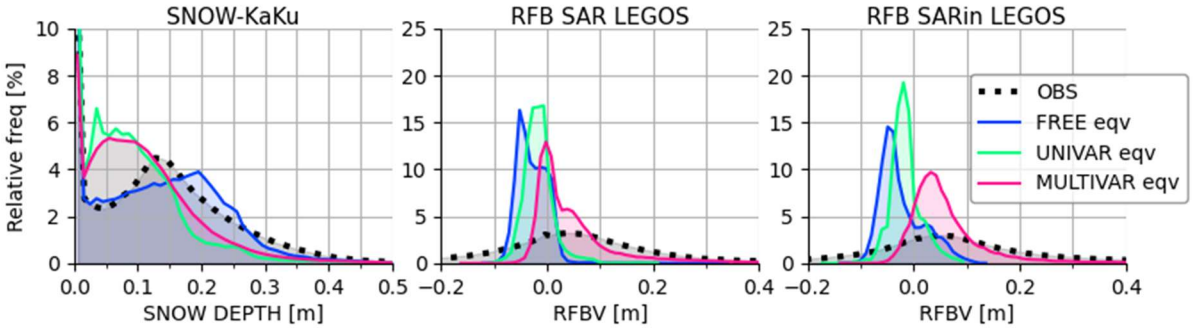
May 2018 Antarctic snow volume differences relative to SNOW-KaKu



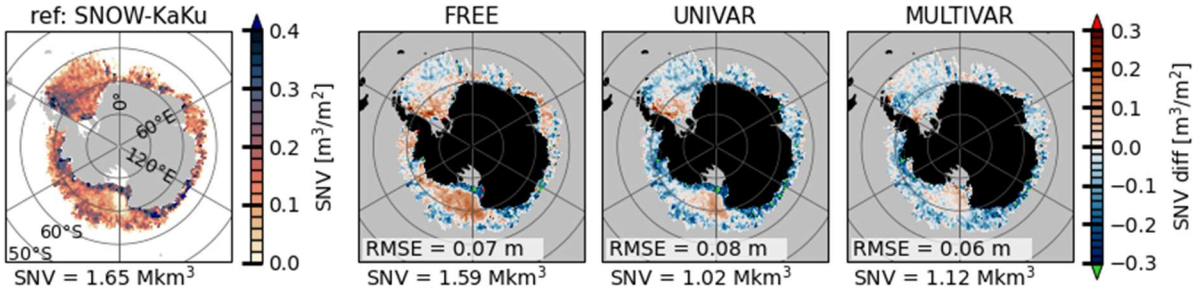
May 2018 Antarctic radar freeboard volume differences relative to RFB LEGOS



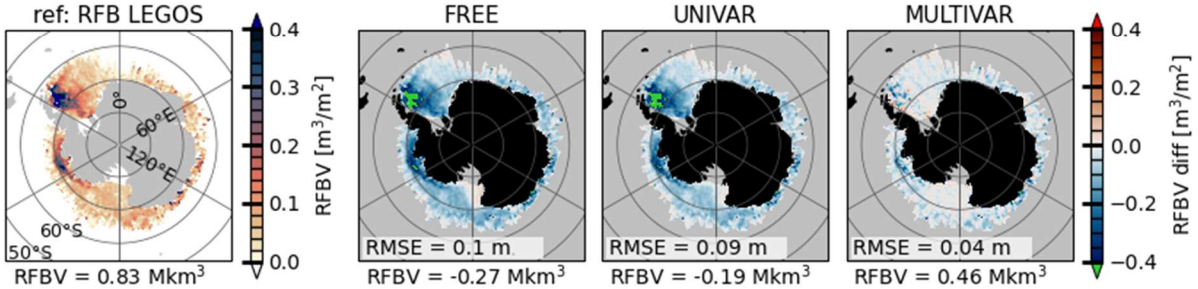
(a) June 2018 Antarctic distributions



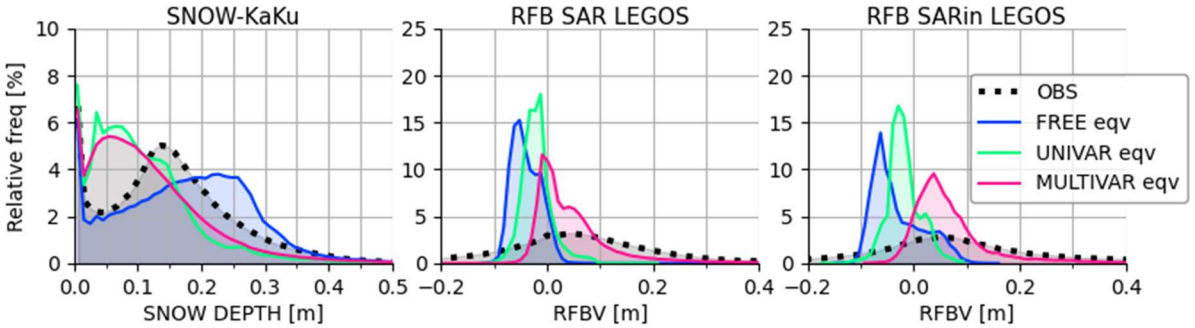
June 2018 Antarctic snow volume differences relative to SNOW-KaKu



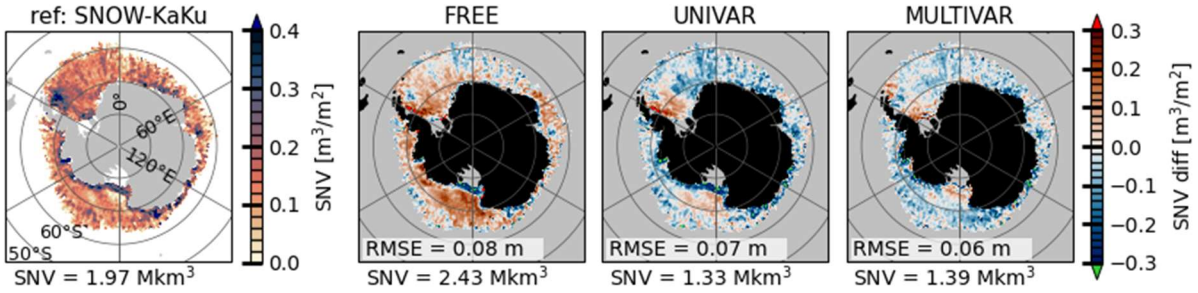
June 2018 Antarctic radar freeboard volume differences relative to RFB LEGOS



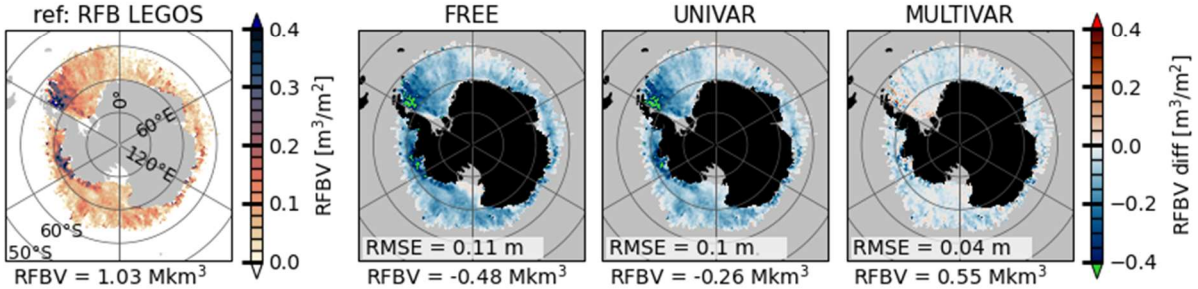
(a) July 2018 Antarctic distributions



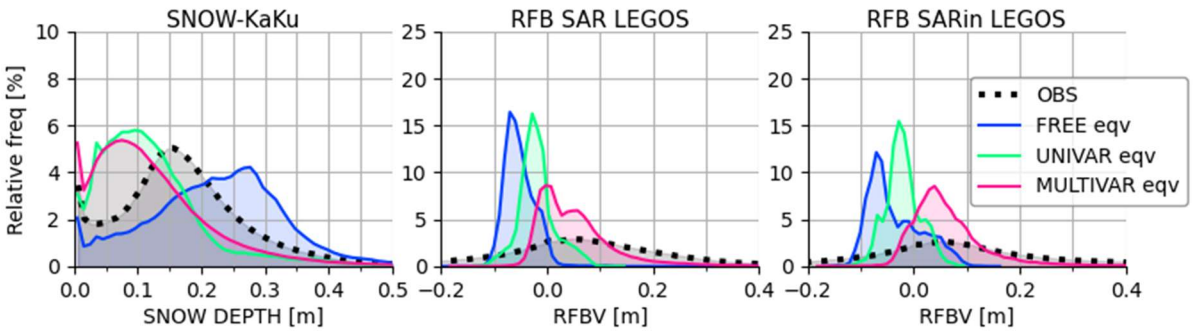
July 2018 Antarctic snow volume differences relative to SNOW-KaKu



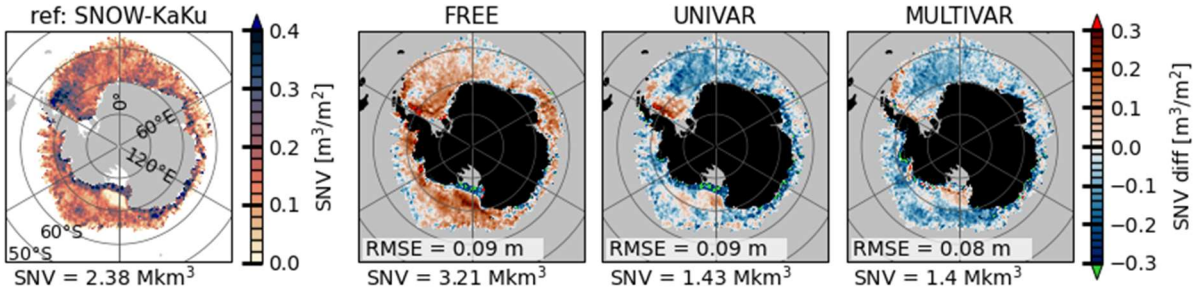
July 2018 Antarctic radar freeboard volume differences relative to RFB LEGOS



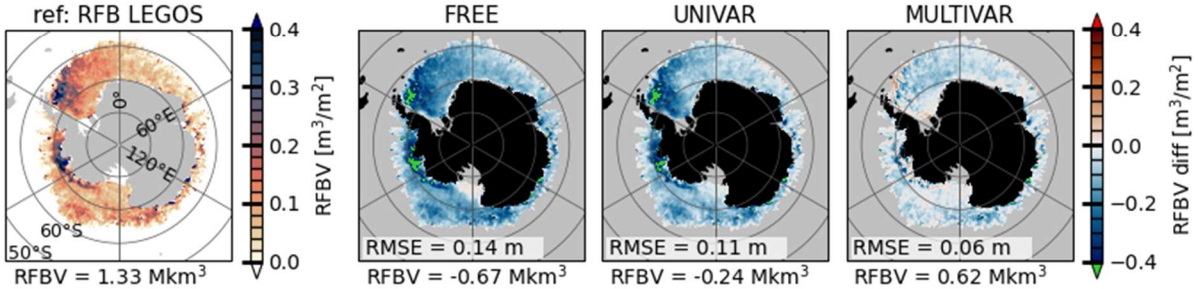
(a) August 2018 Antarctic distributions



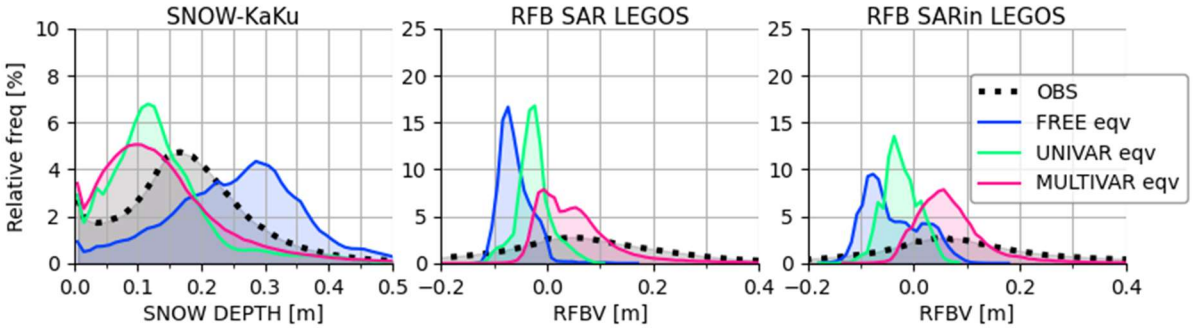
August 2018 Antarctic snow volume differences relative to SNOW-KaKu



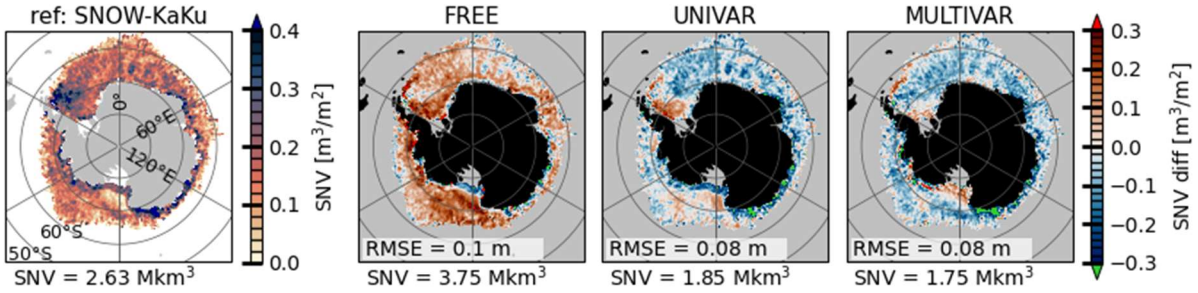
August 2018 Antarctic radar freeboard volume differences relative to RFB LEGOS



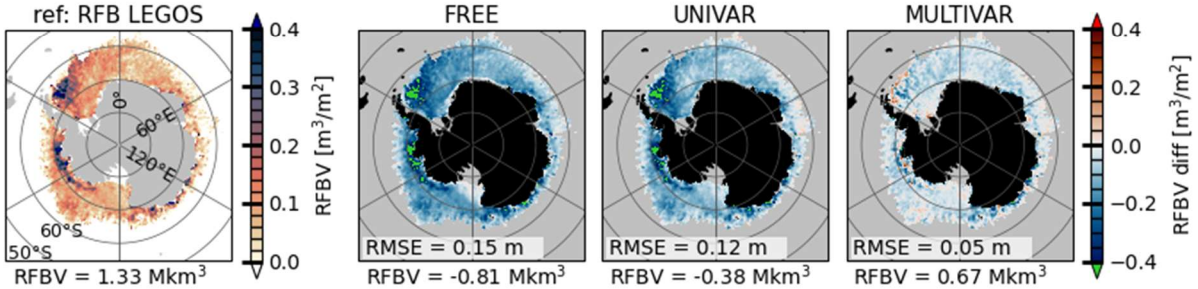
(a) September 2018 Antarctic distributions



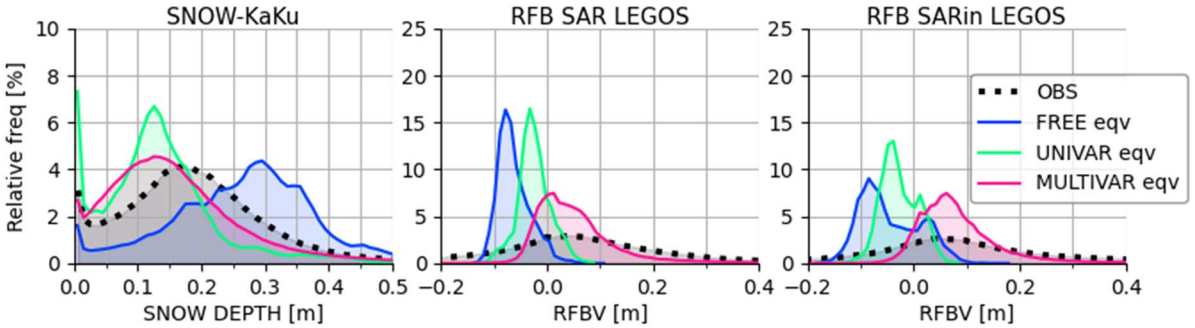
September 2018 Antarctic snow volume differences relative to SNOW-KaKu



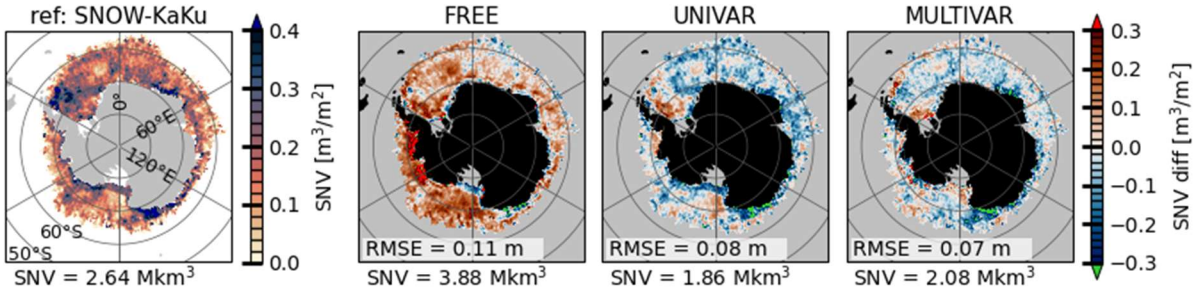
September 2018 Antarctic radar freeboard volume differences relative to RFB LEGOS



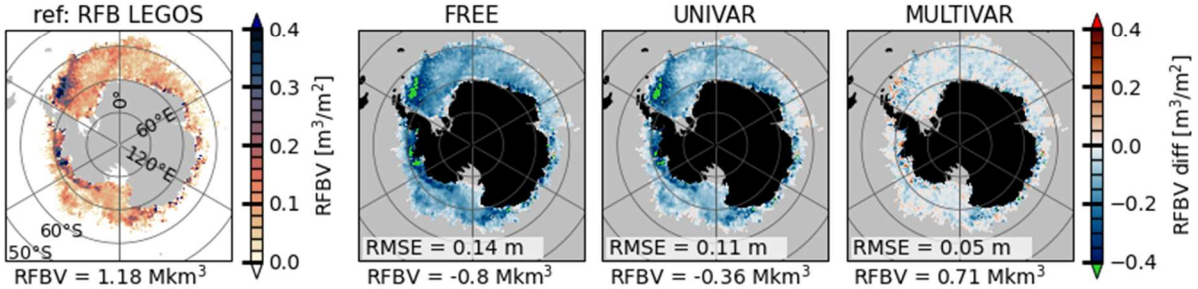
(a) October 2018 Antarctic distributions



October 2018 Antarctic snow volume differences relative to SNOW-KaKu



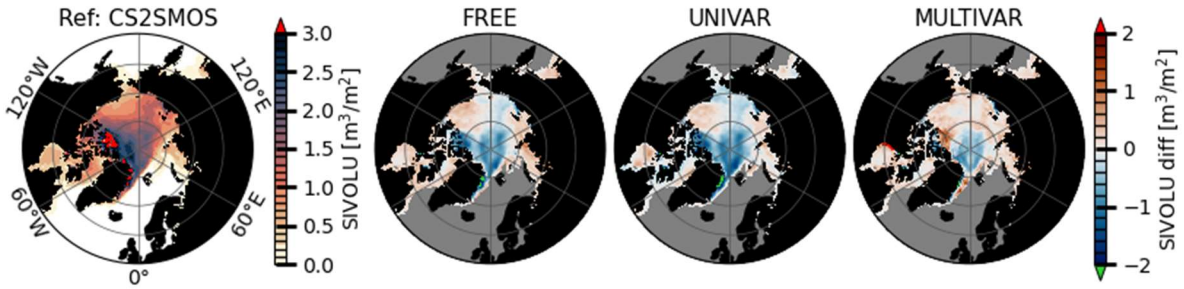
October 2018 Antarctic radar freeboard volume differences relative to RFB LEGOS



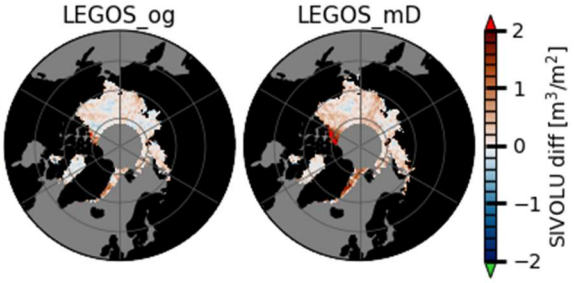
Sea ice volume in the Arctic

The following figures, similar to Figure 8 in the manuscript, display monthly sea ice volume with tables of statistics in the Arctic for the periods January 2017-April 2017, November 2017-April 2018 and November 2018-February 2019.. Monthly sea ice volume for CS2SMOS dataset (reference) and its difference with the FREE, UNIVAR, and MULTIVAR experiments (first line) and the observations LEGOS_og (original) and LEGOS_mD (with model constant densities). Table: root mean square error (RMS) and mean difference (MD) between FREE, UNIVAR, MULTIVAR, LEGOS_og, LEGOS_md and CS2SMOS data, calculated on the LEGOS zone and outside the LEGOS zone and for CS2SMOS sea ice thickness of less than or greater than 1m. The table colors highlight the values close to 0 (white) and the extremes (green for the RMS, and blue/red for the negative/positive MD).

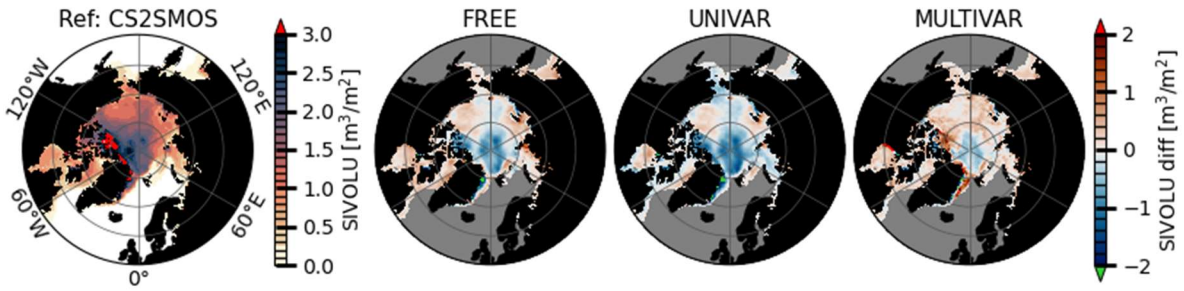
January 2017 Arctic sea ice volume



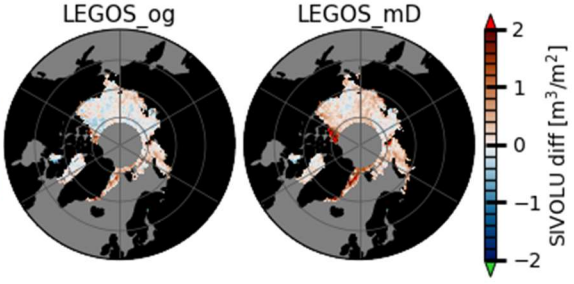
	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.29	-0.18	0.21	0.17	0.59	-0.57	0.19	0.16
UNIVAR	0.33	-0.25	0.16	0.01	0.71	-0.71	0.13	-0.01
MULTIVAR	0.26	0.19	0.16	0.13	0.44	-0.37	0.18	0.16
LEGOS_og	0.21	0.11	0.19	0.1	-	-	-	-
LEGOS_mD	0.42	0.39	0.23	0.16	-	-	-	-



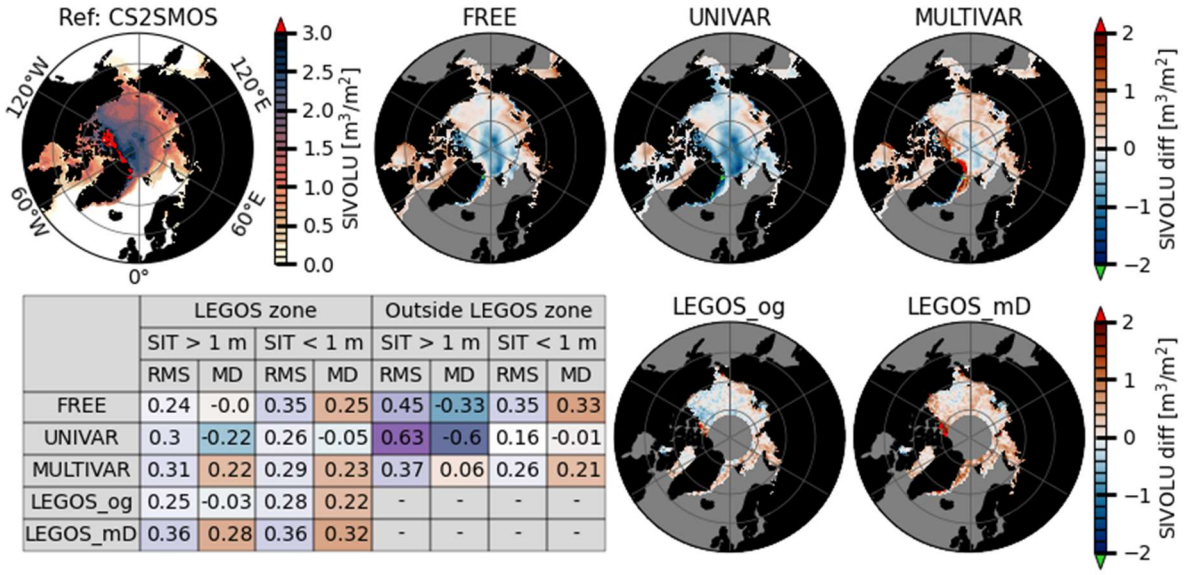
February 2017 Arctic sea ice volume



	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.24	-0.01	0.25	0.18	0.52	-0.46	0.25	0.23
UNIVAR	0.27	-0.16	0.22	-0.08	0.69	-0.68	0.15	-0.03
MULTIVAR	0.31	0.25	0.21	0.16	0.37	-0.11	0.23	0.2
LEGOS_og	0.22	0.04	0.24	0.15	-	-	-	-
LEGOS_mD	0.36	0.3	0.29	0.23	-	-	-	-

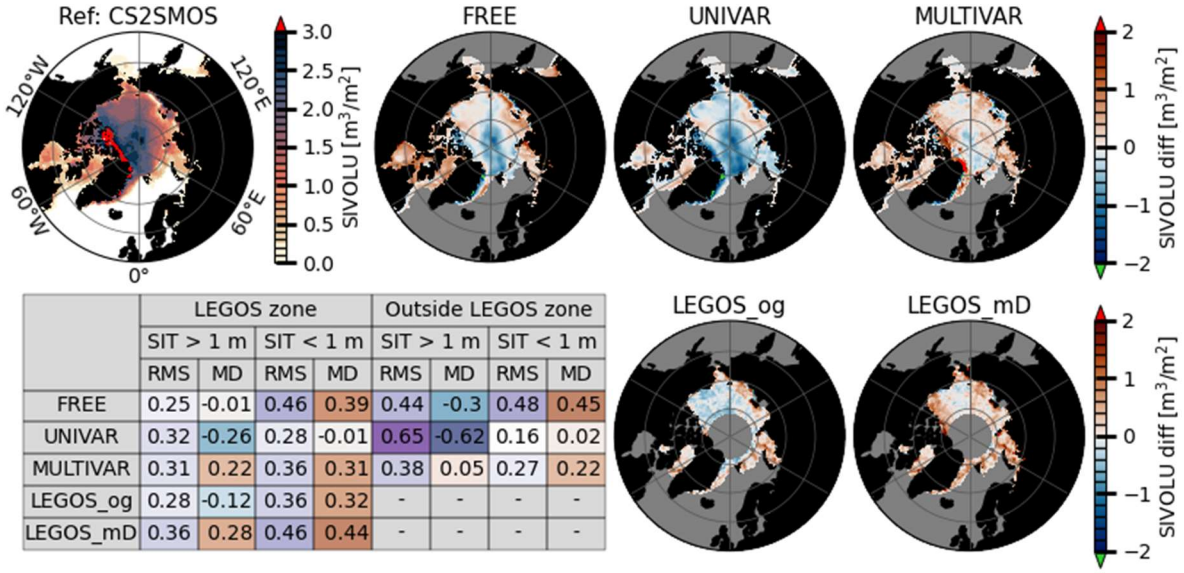


March 2017 Arctic sea ice volume



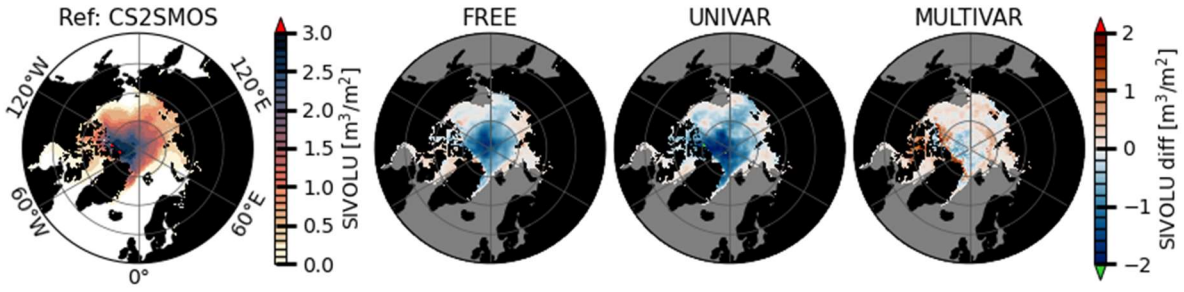
	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.24	-0.0	0.35	0.25	0.45	-0.33	0.35	0.33
UNIVAR	0.3	-0.22	0.26	-0.05	0.63	-0.6	0.16	-0.01
MULTIVAR	0.31	0.22	0.29	0.23	0.37	0.06	0.26	0.21
LEGOS_og	0.25	-0.03	0.28	0.22	-	-	-	-
LEGOS_mD	0.36	0.28	0.36	0.32	-	-	-	-

April 2017 Arctic sea ice volume

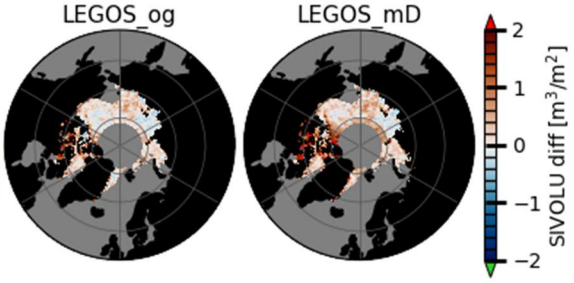


	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.25	-0.01	0.46	0.39	0.44	-0.3	0.48	0.45
UNIVAR	0.32	-0.26	0.28	-0.01	0.65	-0.62	0.16	0.02
MULTIVAR	0.31	0.22	0.36	0.31	0.38	0.05	0.27	0.22
LEGOS_og	0.28	-0.12	0.36	0.32	-	-	-	-
LEGOS_mD	0.36	0.28	0.46	0.44	-	-	-	-

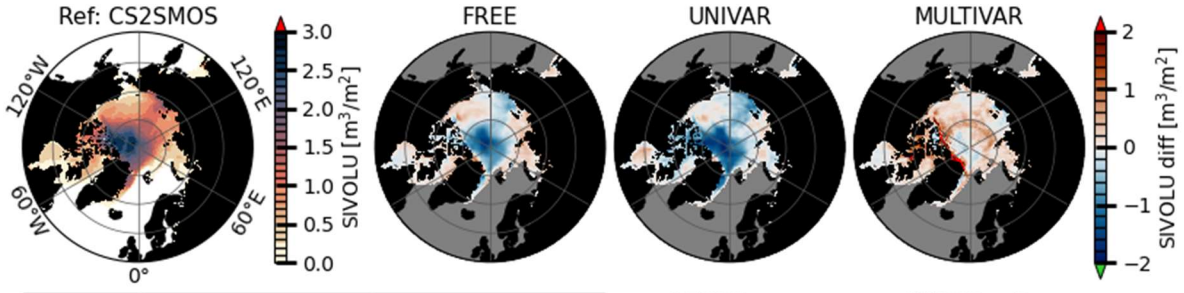
November 2017 Arctic sea ice volume



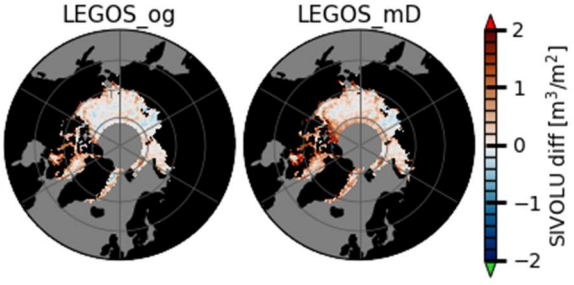
	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.48	-0.45	0.13	-0.04	0.97	-0.96	0.12	-0.01
UNIVAR	0.71	-0.7	0.2	-0.16	1.16	-1.16	0.13	-0.1
MULTIVAR	0.36	0.24	0.16	0.12	0.29	-0.09	0.13	0.1
LEGOS_og	0.27	0.17	0.29	0.22	-	-	-	-
LEGOS_mD	0.64	0.62	0.38	0.32	-	-	-	-



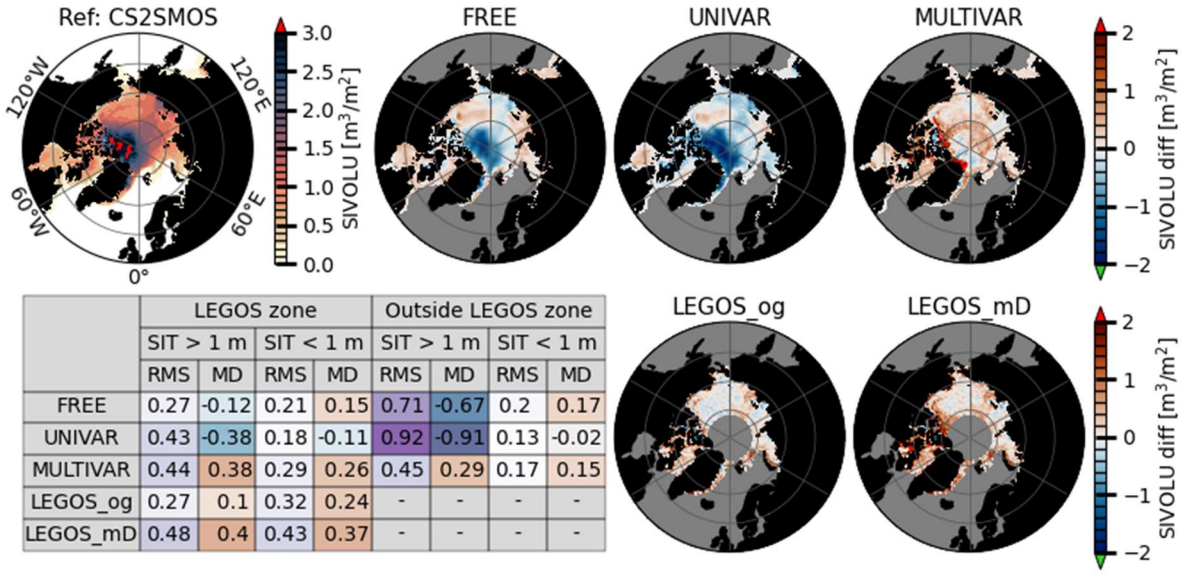
December 2017 Arctic sea ice volume



	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.36	-0.31	0.17	0.09	0.79	-0.75	0.11	0.03
UNIVAR	0.61	-0.59	0.16	-0.11	0.99	-0.98	0.13	-0.03
MULTIVAR	0.49	0.44	0.22	0.19	0.34	0.18	0.12	0.08
LEGOS_og	0.24	0.11	0.29	0.22	-	-	-	-
LEGOS_mD	0.53	0.48	0.38	0.33	-	-	-	-

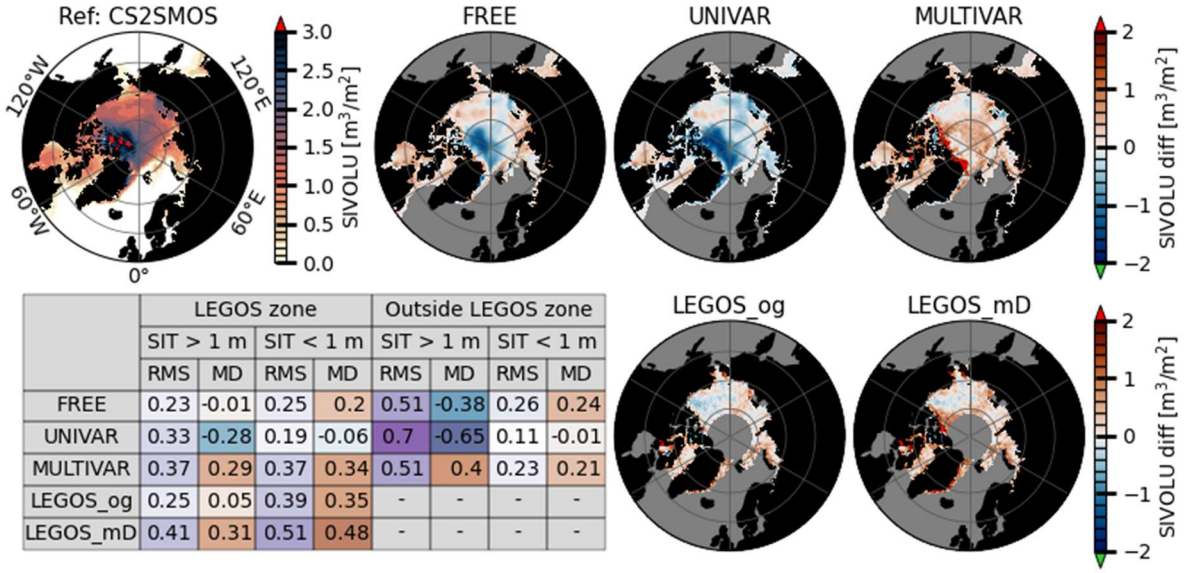


January 2018 Arctic sea ice volume



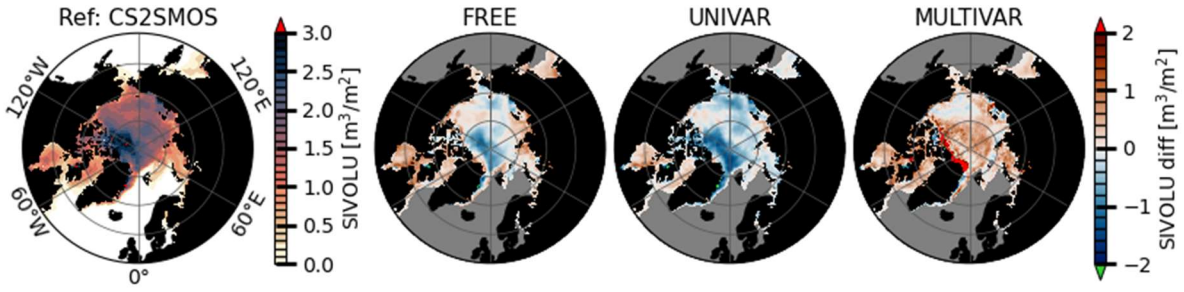
	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.27	-0.12	0.21	0.15	0.71	-0.67	0.2	0.17
UNIVAR	0.43	-0.38	0.18	-0.11	0.92	-0.91	0.13	-0.02
MULTIVAR	0.44	0.38	0.29	0.26	0.45	0.29	0.17	0.15
LEGOS_og	0.27	0.1	0.32	0.24	-	-	-	-
LEGOS_mD	0.48	0.4	0.43	0.37	-	-	-	-

February 2018 Arctic sea ice volume

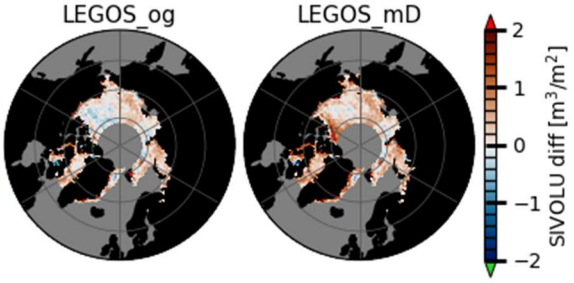


	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.23	-0.01	0.25	0.2	0.51	-0.38	0.26	0.24
UNIVAR	0.33	-0.28	0.19	-0.06	0.7	-0.65	0.11	-0.01
MULTIVAR	0.37	0.29	0.37	0.34	0.51	0.4	0.23	0.21
LEGOS_og	0.25	0.05	0.39	0.35	-	-	-	-
LEGOS_mD	0.41	0.31	0.51	0.48	-	-	-	-

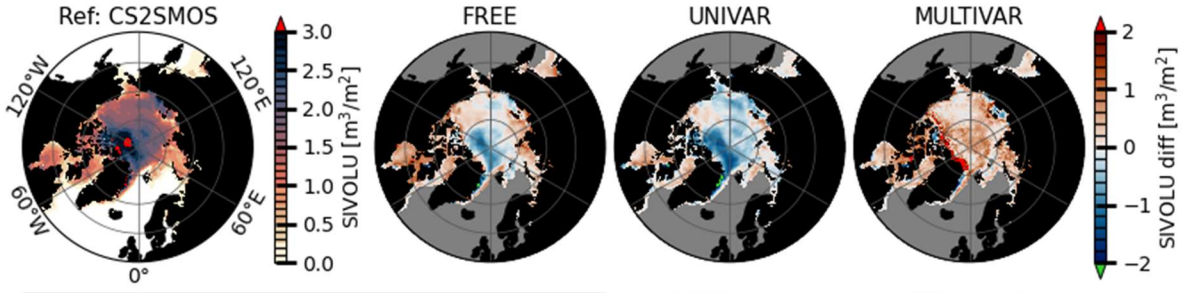
March 2018 Arctic sea ice volume



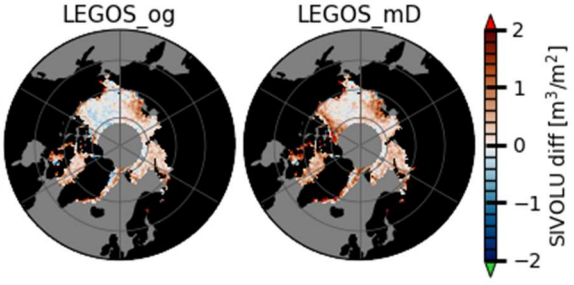
	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.24	-0.02	0.28	0.22	0.45	-0.26	0.36	0.35
UNIVAR	0.37	-0.33	0.22	-0.04	0.63	-0.56	0.15	0.03
MULTIVAR	0.4	0.3	0.4	0.37	0.61	0.52	0.28	0.26
LEGOS_og	0.27	0.09	0.39	0.36	-	-	-	-
LEGOS_mD	0.42	0.35	0.52	0.5	-	-	-	-



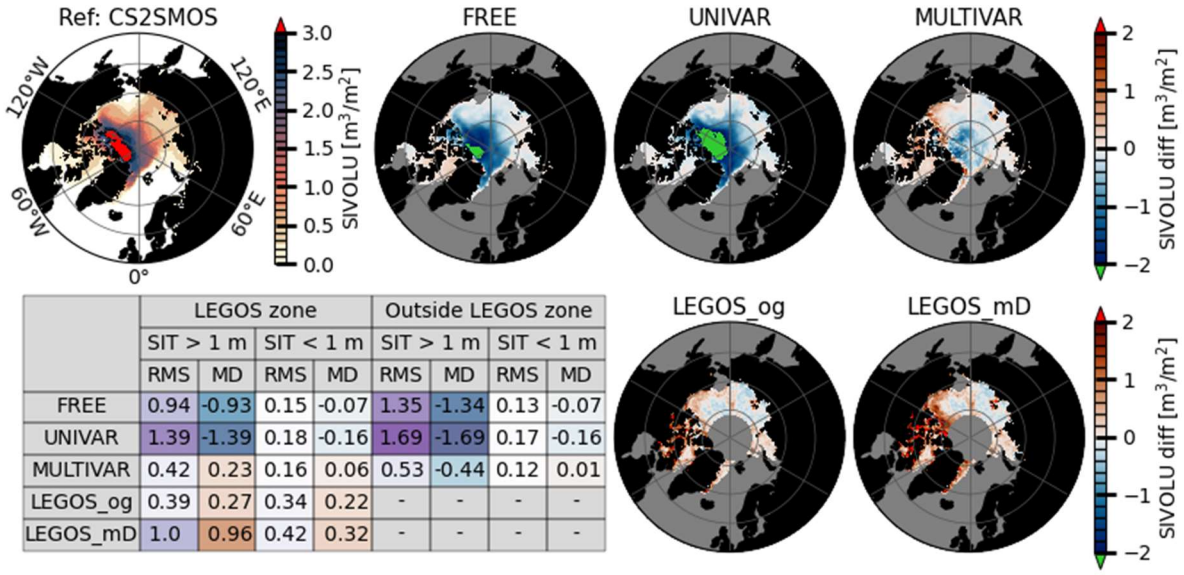
April 2018 Arctic sea ice volume



	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.27	0.08	0.42	0.36	0.48	-0.19	0.44	0.42
UNIVAR	0.34	-0.25	0.26	0.1	0.62	-0.51	0.14	0.06
MULTIVAR	0.43	0.35	0.47	0.45	0.61	0.49	0.28	0.24
LEGOS_og	0.28	0.1	0.45	0.42	-	-	-	-
LEGOS_mD	0.43	0.36	0.58	0.56	-	-	-	-

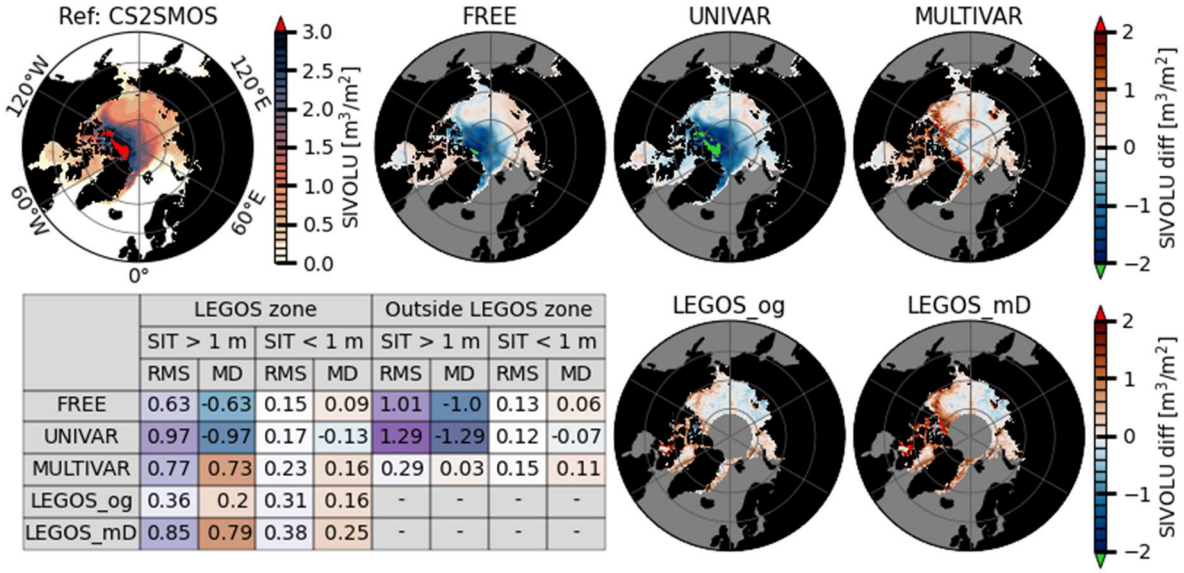


November 2018 Arctic sea ice volume



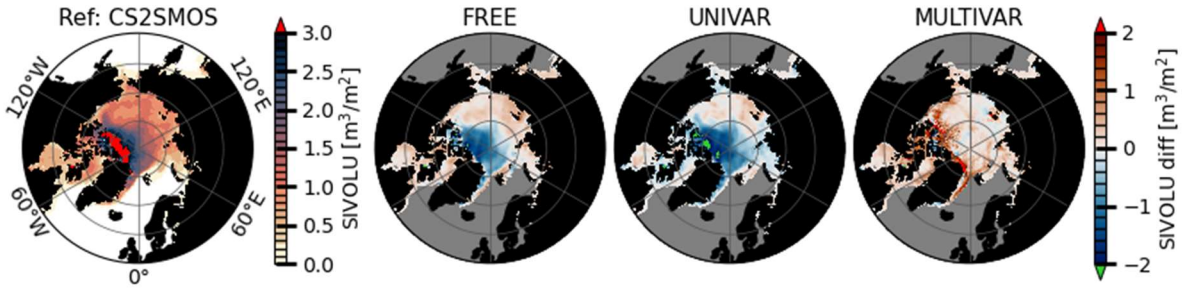
	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.94	-0.93	0.15	-0.07	1.35	-1.34	0.13	-0.07
UNIVAR	1.39	-1.39	0.18	-0.16	1.69	-1.69	0.17	-0.16
MULTIVAR	0.42	0.23	0.16	0.06	0.53	-0.44	0.12	0.01
LEGOS_og	0.39	0.27	0.34	0.22	-	-	-	-
LEGOS_mD	1.0	0.96	0.42	0.32	-	-	-	-

December 2018 Arctic sea ice volume

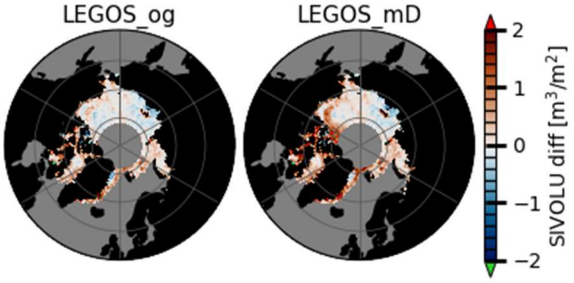


	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.63	-0.63	0.15	0.09	1.01	-1.0	0.13	0.06
UNIVAR	0.97	-0.97	0.17	-0.13	1.29	-1.29	0.12	-0.07
MULTIVAR	0.77	0.73	0.23	0.16	0.29	0.03	0.15	0.11
LEGOS_og	0.36	0.2	0.31	0.16	-	-	-	-
LEGOS_mD	0.85	0.79	0.38	0.25	-	-	-	-

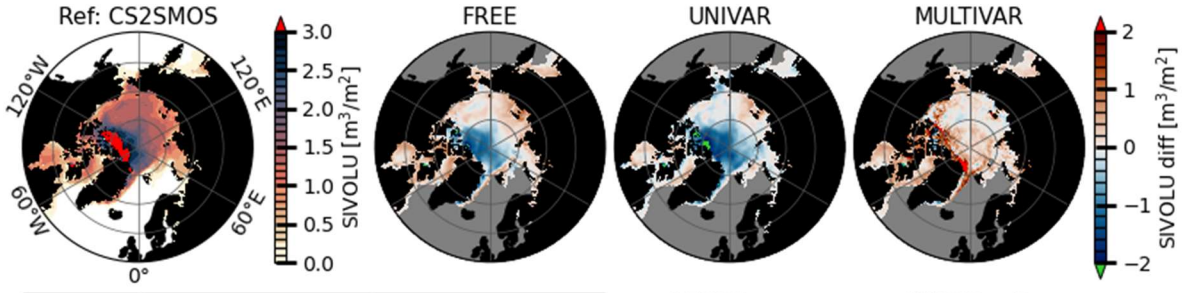
January 2019 Arctic sea ice volume



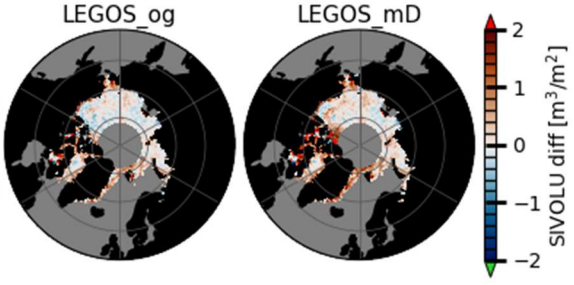
	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.32	-0.16	0.24	0.2	0.78	-0.76	0.17	0.14
UNIVAR	0.46	-0.4	0.17	-0.04	1.04	-1.04	0.11	-0.05
MULTIVAR	0.48	0.42	0.31	0.26	0.38	0.29	0.17	0.15
LEGOS_og	0.25	0.05	0.35	0.22	-	-	-	-
LEGOS_mD	0.48	0.37	0.44	0.34	-	-	-	-



February 2019 Arctic sea ice volume



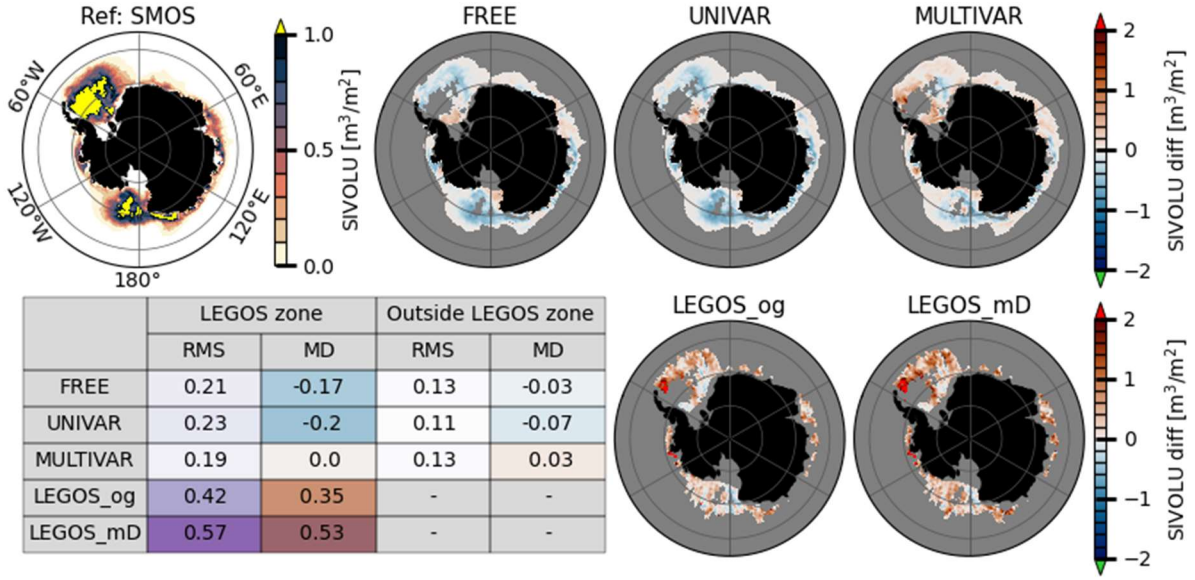
	LEGOS zone				Outside LEGOS zone			
	SIT > 1 m		SIT < 1 m		SIT > 1 m		SIT < 1 m	
	RMS	MD	RMS	MD	RMS	MD	RMS	MD
FREE	0.27	-0.01	0.33	0.26	0.64	-0.54	0.26	0.24
UNIVAR	0.33	-0.26	0.17	-0.01	0.85	-0.81	0.11	-0.02
MULTIVAR	0.33	0.24	0.39	0.34	0.47	0.4	0.23	0.2
LEGOS_og	0.25	0.04	0.41	0.33	-	-	-	-
LEGOS_mD	0.38	0.26	0.51	0.44	-	-	-	-



Sea ice volume in the Antarctic

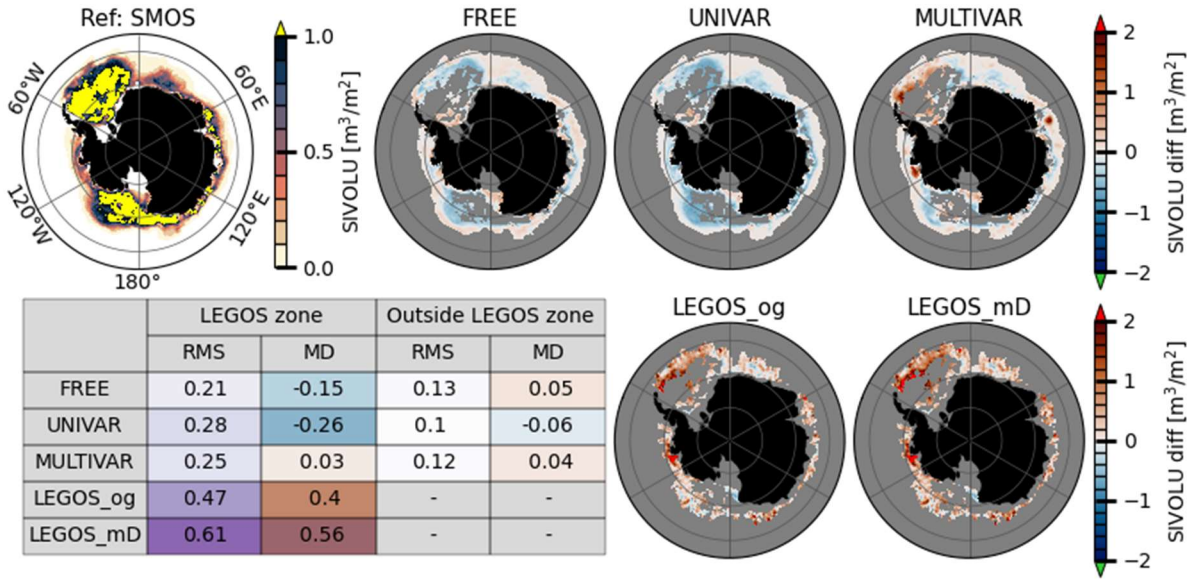
The following figures, similar to Figure 9 in the manuscript, display monthly sea ice volume with tables of statistics in the Antarctic for the periods May 2017-September 2017 and May 2018 – September 2018. Monthly sea ice volume for SMOS dataset (reference) and its difference with the FREE, UNIVAR, and MULTIVAR experiments (first line) and the observations LEGOS_og (original) and LEGOS_mD (with model constant densities). Table: root mean square error (RMS) and mean difference (MD) between FREE, UNIVAR, MULTIVAR, LEGOS_og, LEGOS_md and CS2SMOS data, calculated on the LEGOS zone and outside the LEGOS zone and for CS2SMOS sea ice thickness of less than or greater than 1m. The table colors highlight the values close to 0 (white) and the extremes (green for the RMS, and blue/red for the negative/positive MD).

May 2017 Antarctic sea ice volume, comparison with SMOS product



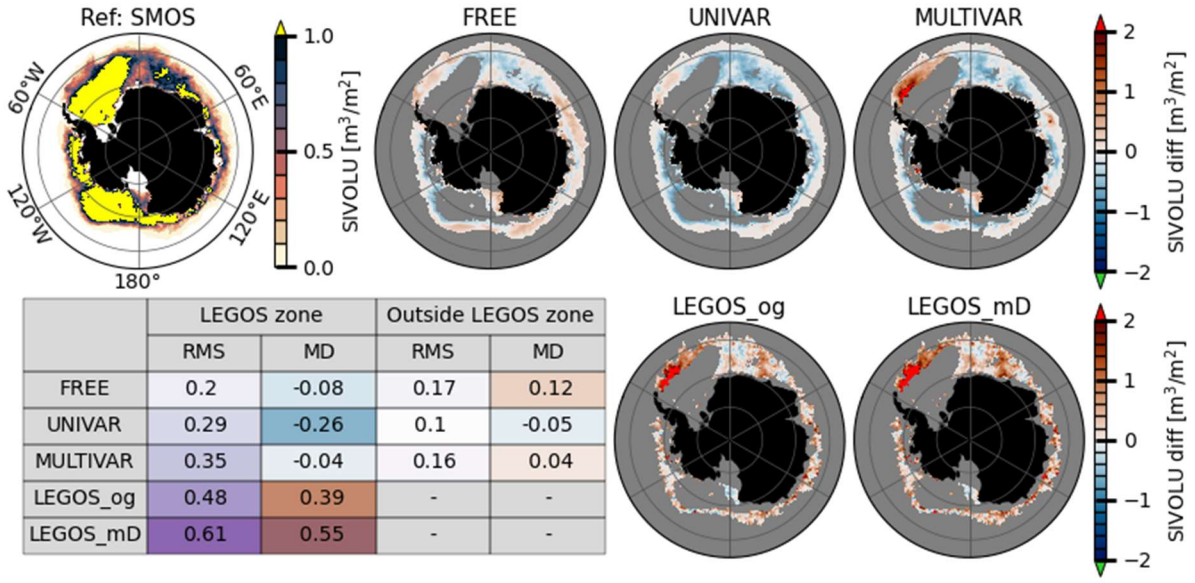
	LEGOS zone		Outside LEGOS zone	
	RMS	MD	RMS	MD
FREE	0.21	-0.17	0.13	-0.03
UNIVAR	0.23	-0.2	0.11	-0.07
MULTIVAR	0.19	0.0	0.13	0.03
LEGOS_og	0.42	0.35	-	-
LEGOS_mD	0.57	0.53	-	-

June 2017 Antarctic sea ice volume, comparison with SMOS product



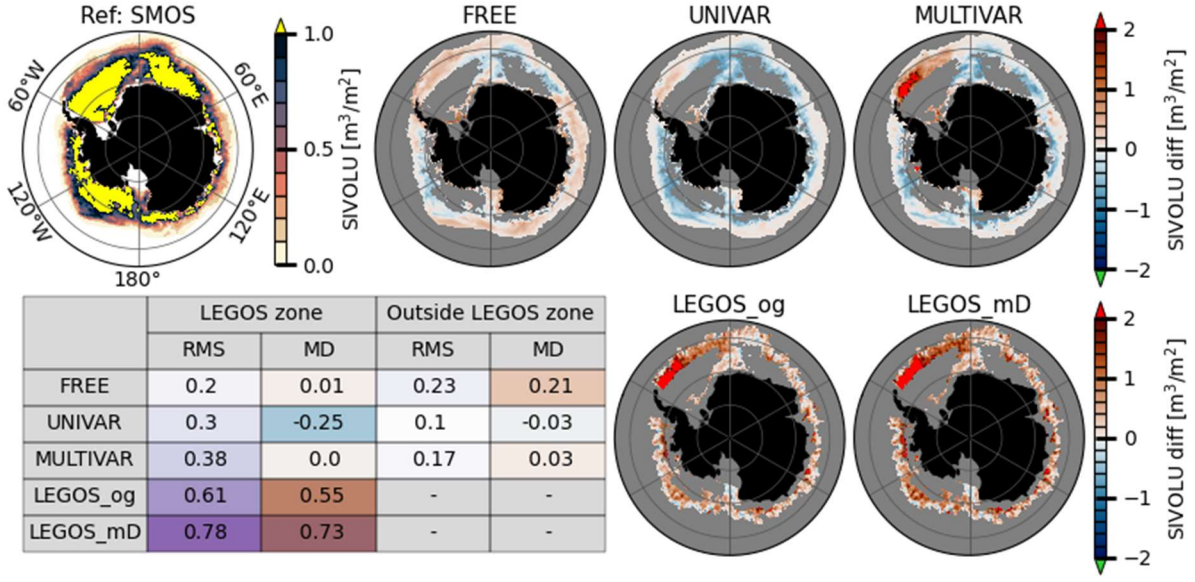
	LEGOS zone		Outside LEGOS zone	
	RMS	MD	RMS	MD
FREE	0.21	-0.15	0.13	0.05
UNIVAR	0.28	-0.26	0.1	-0.06
MULTIVAR	0.25	0.03	0.12	0.04
LEGOS_og	0.47	0.4	-	-
LEGOS_mD	0.61	0.56	-	-

July 2017 Antarctic sea ice volume, comparison with SMOS product



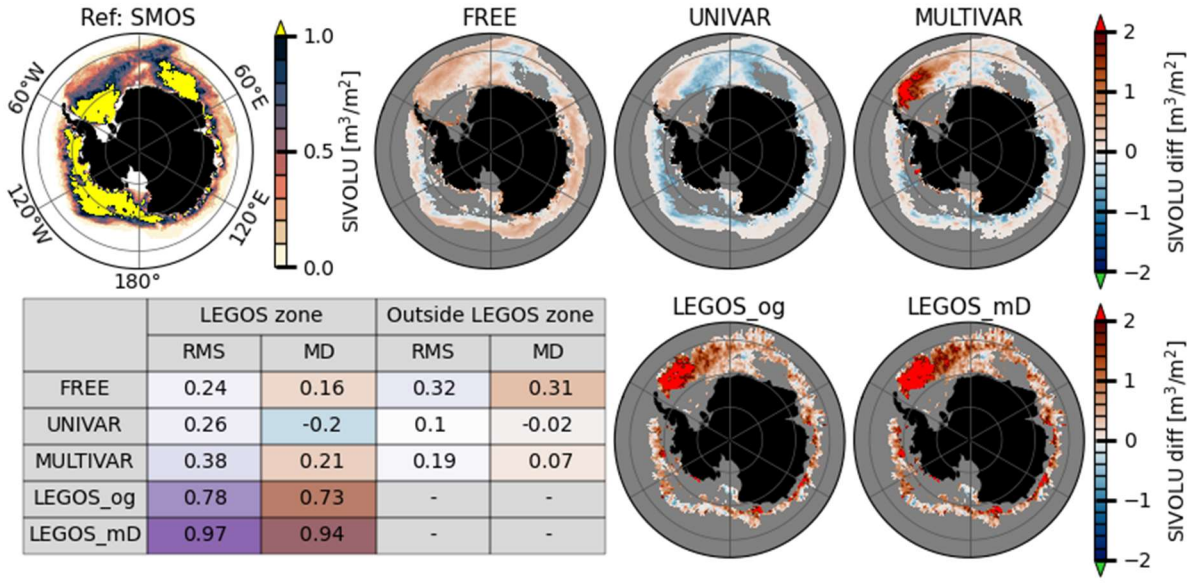
	LEGOS zone		Outside LEGOS zone	
	RMS	MD	RMS	MD
FREE	0.2	-0.08	0.17	0.12
UNIVAR	0.29	-0.26	0.1	-0.05
MULTIVAR	0.35	-0.04	0.16	0.04
LEGOS_og	0.48	0.39	-	-
LEGOS_mD	0.61	0.55	-	-

August 2017 Antarctic sea ice volume, comparison with SMOS product



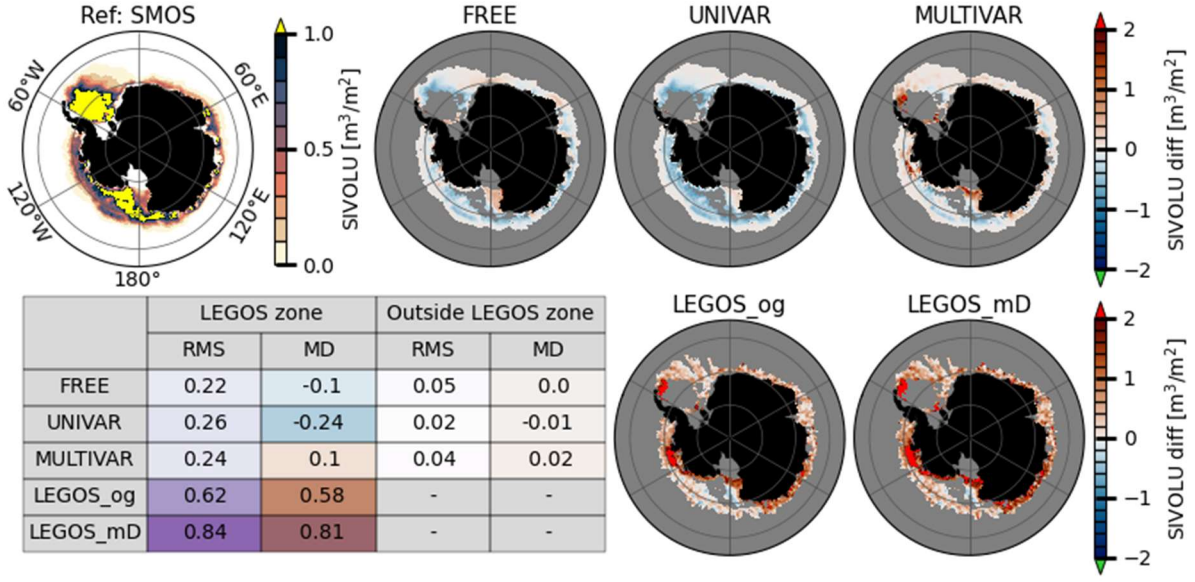
	LEGOS zone		Outside LEGOS zone	
	RMS	MD	RMS	MD
FREE	0.2	0.01	0.23	0.21
UNIVAR	0.3	-0.25	0.1	-0.03
MULTIVAR	0.38	0.0	0.17	0.03
LEGOS_og	0.61	0.55	-	-
LEGOS_mD	0.78	0.73	-	-

September 2017 Antarctic sea ice volume, comparison with SMOS product



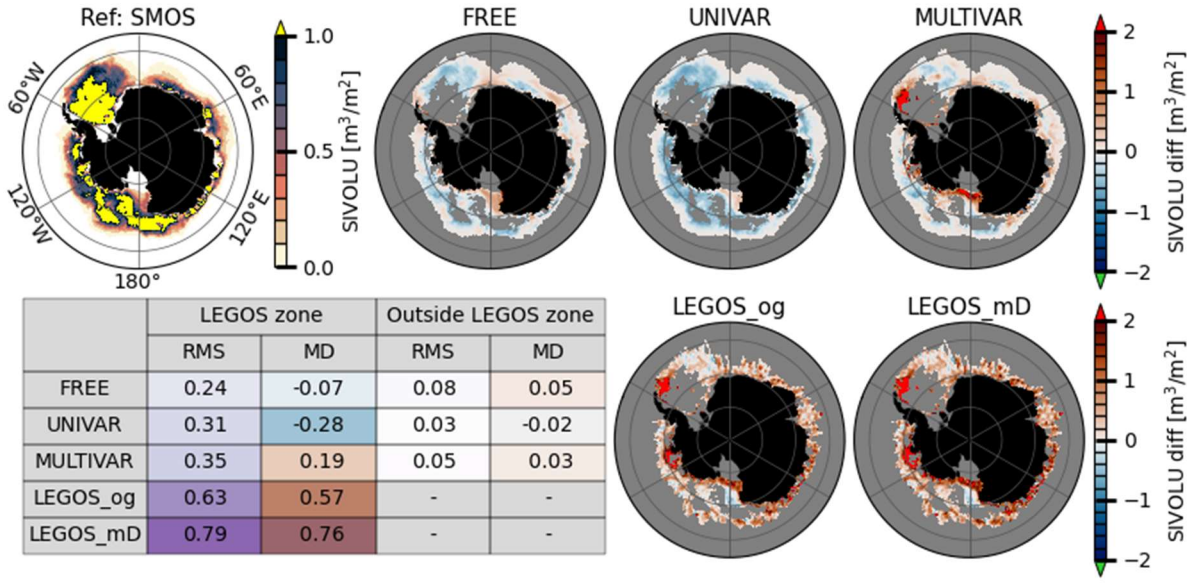
	LEGOS zone		Outside LEGOS zone	
	RMS	MD	RMS	MD
FREE	0.24	0.16	0.32	0.31
UNIVAR	0.26	-0.2	0.1	-0.02
MULTIVAR	0.38	0.21	0.19	0.07
LEGOS_og	0.78	0.73	-	-
LEGOS_mD	0.97	0.94	-	-

May 2018 Antarctic sea ice volume, comparison with SMOS product



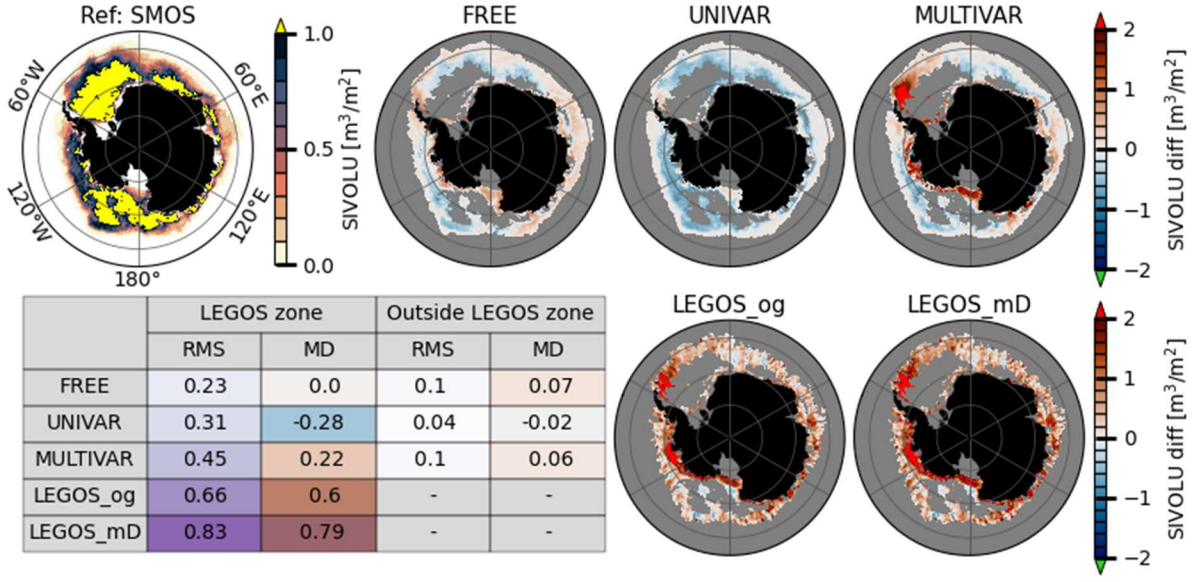
	LEGOS zone		Outside LEGOS zone	
	RMS	MD	RMS	MD
FREE	0.22	-0.1	0.05	0.0
UNIVAR	0.26	-0.24	0.02	-0.01
MULTIVAR	0.24	0.1	0.04	0.02
LEGOS_og	0.62	0.58	-	-
LEGOS_mD	0.84	0.81	-	-

June 2018 Antarctic sea ice volume, comparison with SMOS product



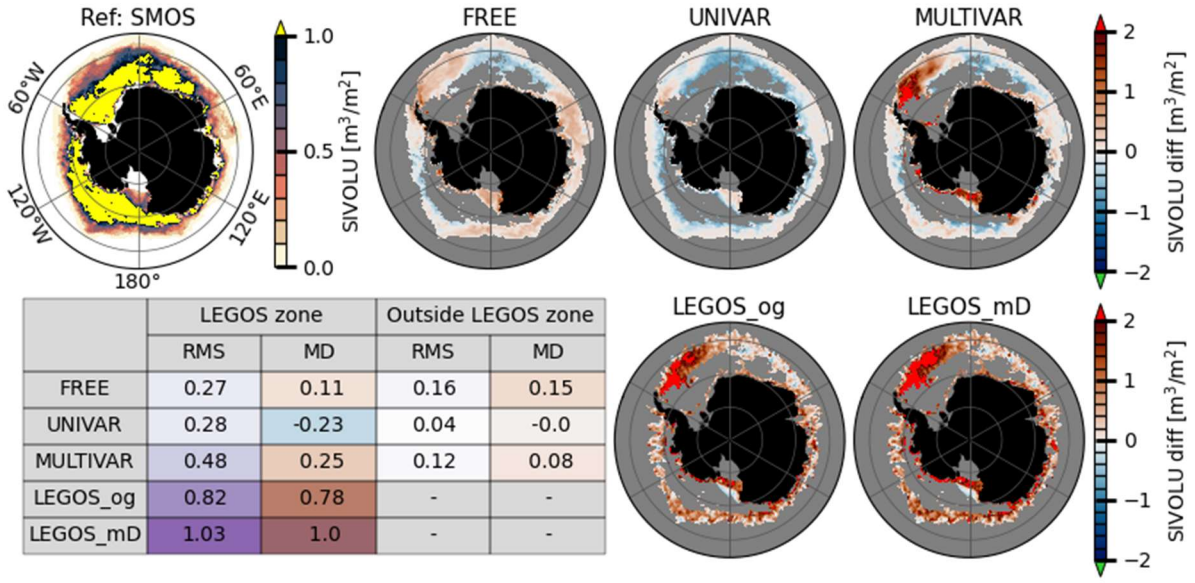
	LEGOS zone		Outside LEGOS zone	
	RMS	MD	RMS	MD
FREE	0.24	-0.07	0.08	0.05
UNIVAR	0.31	-0.28	0.03	-0.02
MULTIVAR	0.35	0.19	0.05	0.03
LEGOS_og	0.63	0.57	-	-
LEGOS_mD	0.79	0.76	-	-

July 2018 Antarctic sea ice volume, comparison with SMOS product



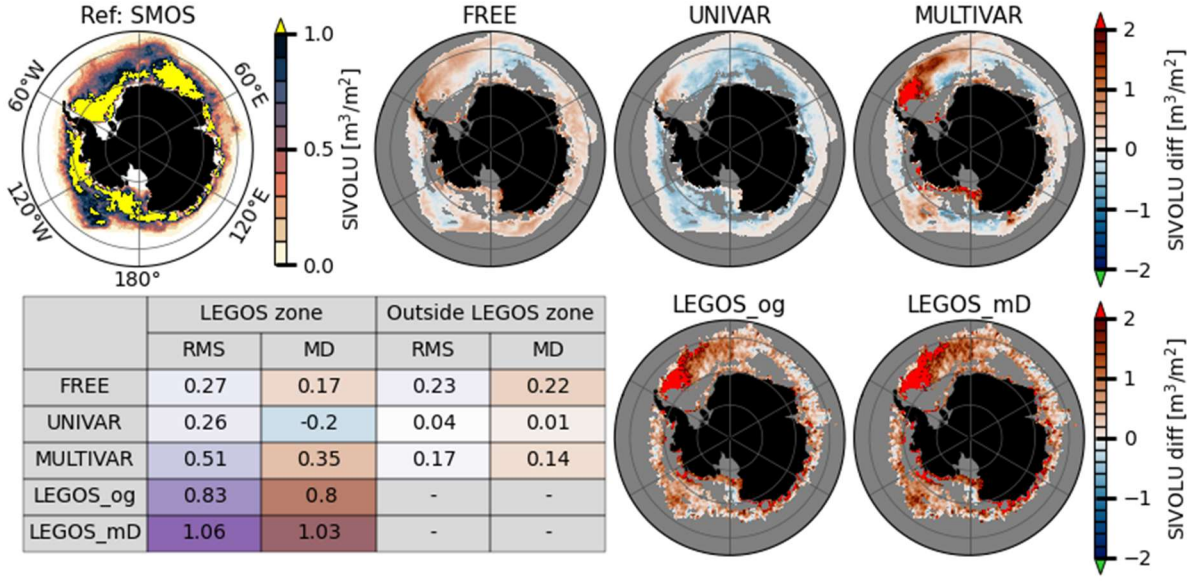
	LEGOS zone		Outside LEGOS zone	
	RMS	MD	RMS	MD
FREE	0.23	0.0	0.1	0.07
UNIVAR	0.31	-0.28	0.04	-0.02
MULTIVAR	0.45	0.22	0.1	0.06
LEGOS_og	0.66	0.6	-	-
LEGOS_mD	0.83	0.79	-	-

August 2018 Antarctic sea ice volume, comparison with SMOS product



	LEGOS zone		Outside LEGOS zone	
	RMS	MD	RMS	MD
FREE	0.27	0.11	0.16	0.15
UNIVAR	0.28	-0.23	0.04	-0.0
MULTIVAR	0.48	0.25	0.12	0.08
LEGOS_og	0.82	0.78	-	-
LEGOS_mD	1.03	1.0	-	-

September 2018 Antarctic sea ice volume, comparison with SMOS product



	LEGOS zone		Outside LEGOS zone	
	RMS	MD	RMS	MD
FREE	0.27	0.17	0.23	0.22
UNIVAR	0.26	-0.2	0.04	0.01
MULTIVAR	0.51	0.35	0.17	0.14
LEGOS_og	0.83	0.8	-	-
LEGOS_mD	1.06	1.03	-	-