

# Recent Development of the COIN method in assimilating AMSR2 sea ice concentration in NorHAPS

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## HIGHLIGHT

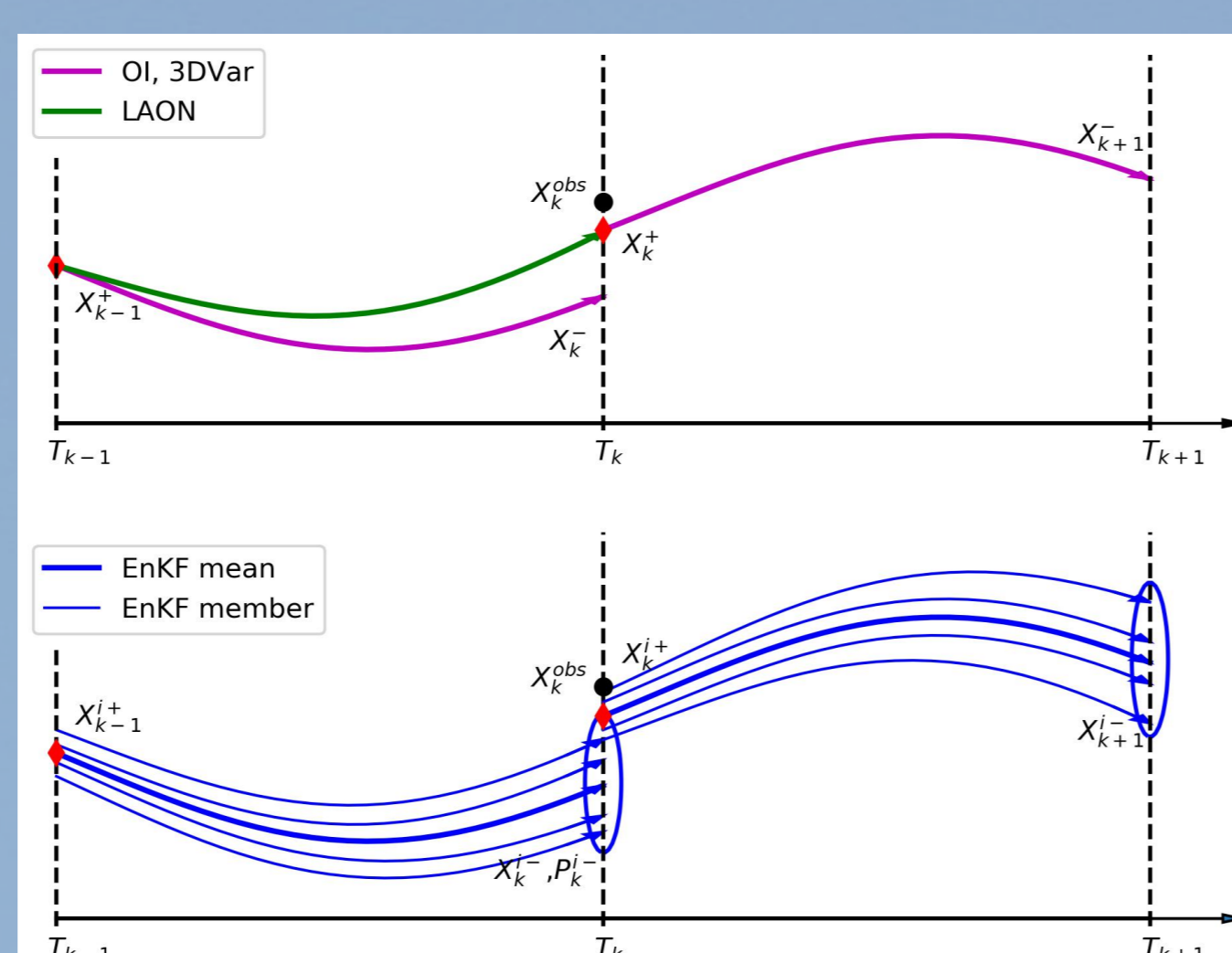
When evaluated against the Norwegian ice chart, NorHAPS produces significantly more accurate sea ice edge (SIE) and marginal ice zone (MIZ) than the AMSR2 observation that is assimilated, as well as than the CMEMS operational SIC analyses from TOPAZ4, NEMO and neXtSIM.

### 1 Method

NorHAPS: Norwegian High-resolution pan-Arctic ocean and sea ice Prediction System:

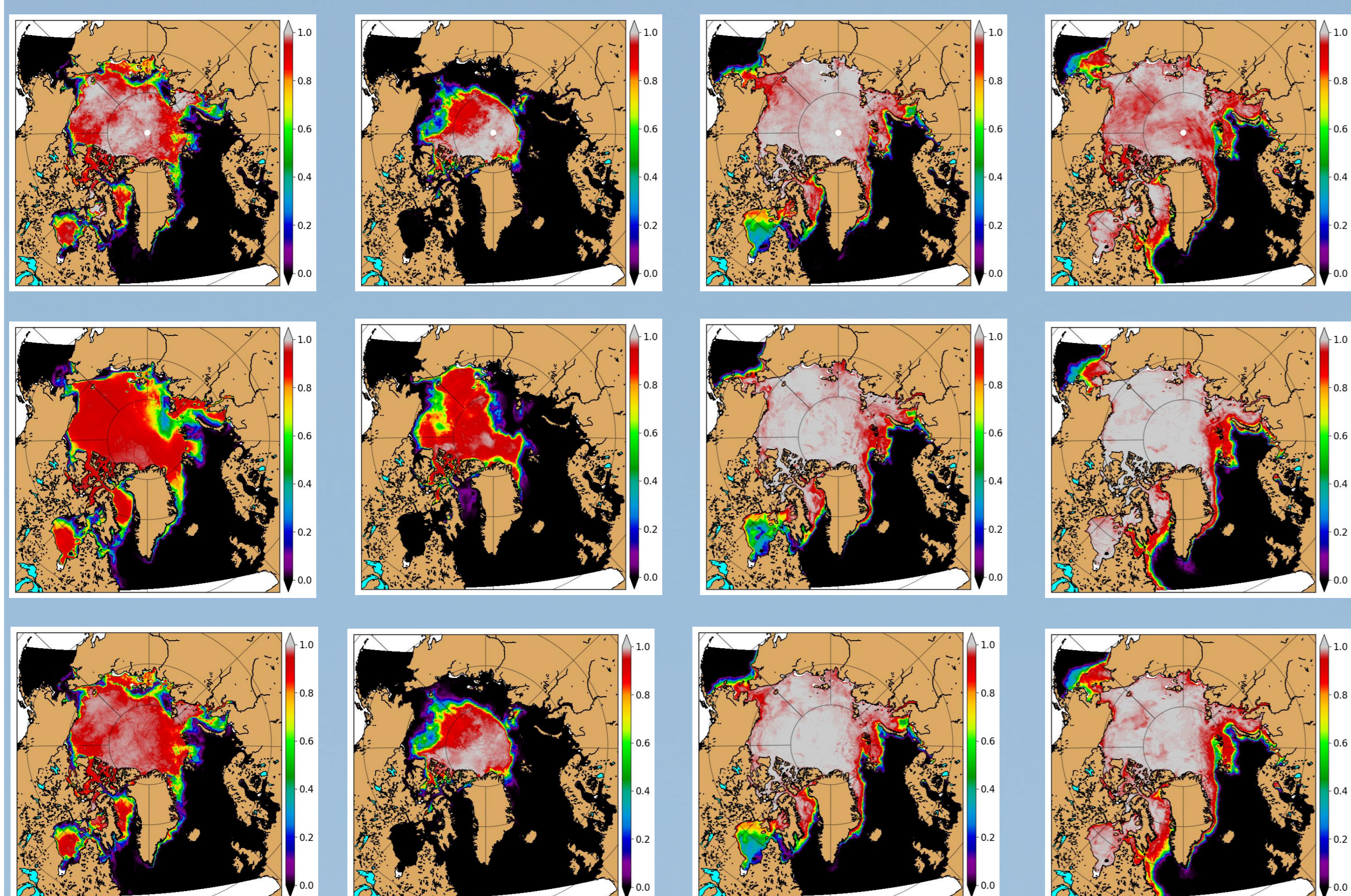
1. HYCOM 2.2.98
2. CICE 5.1.2
3. COIN (LAON) assimilation
4. High-resolution (3-5 km)
5. ECMWF HIRES atmosphere forcing
6. NEMO open boundary

Local analytical optimal nudging (LAON) is designed to nudge the model analysis to the optimal estimate

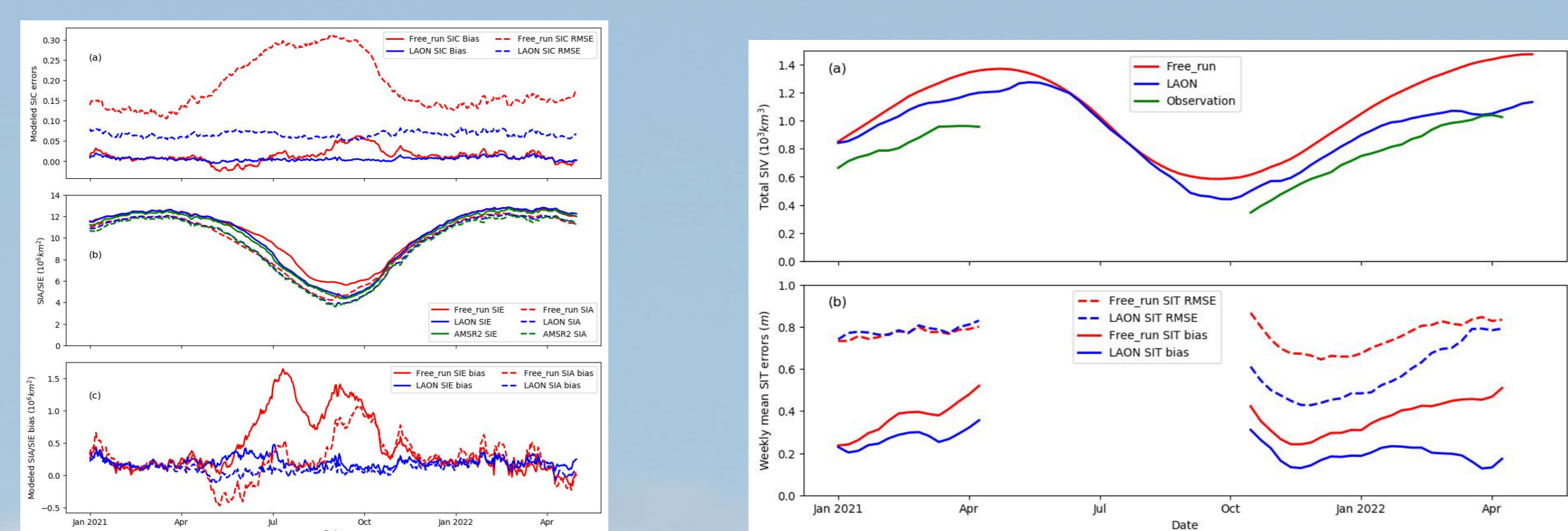


### 2 Twin experiment

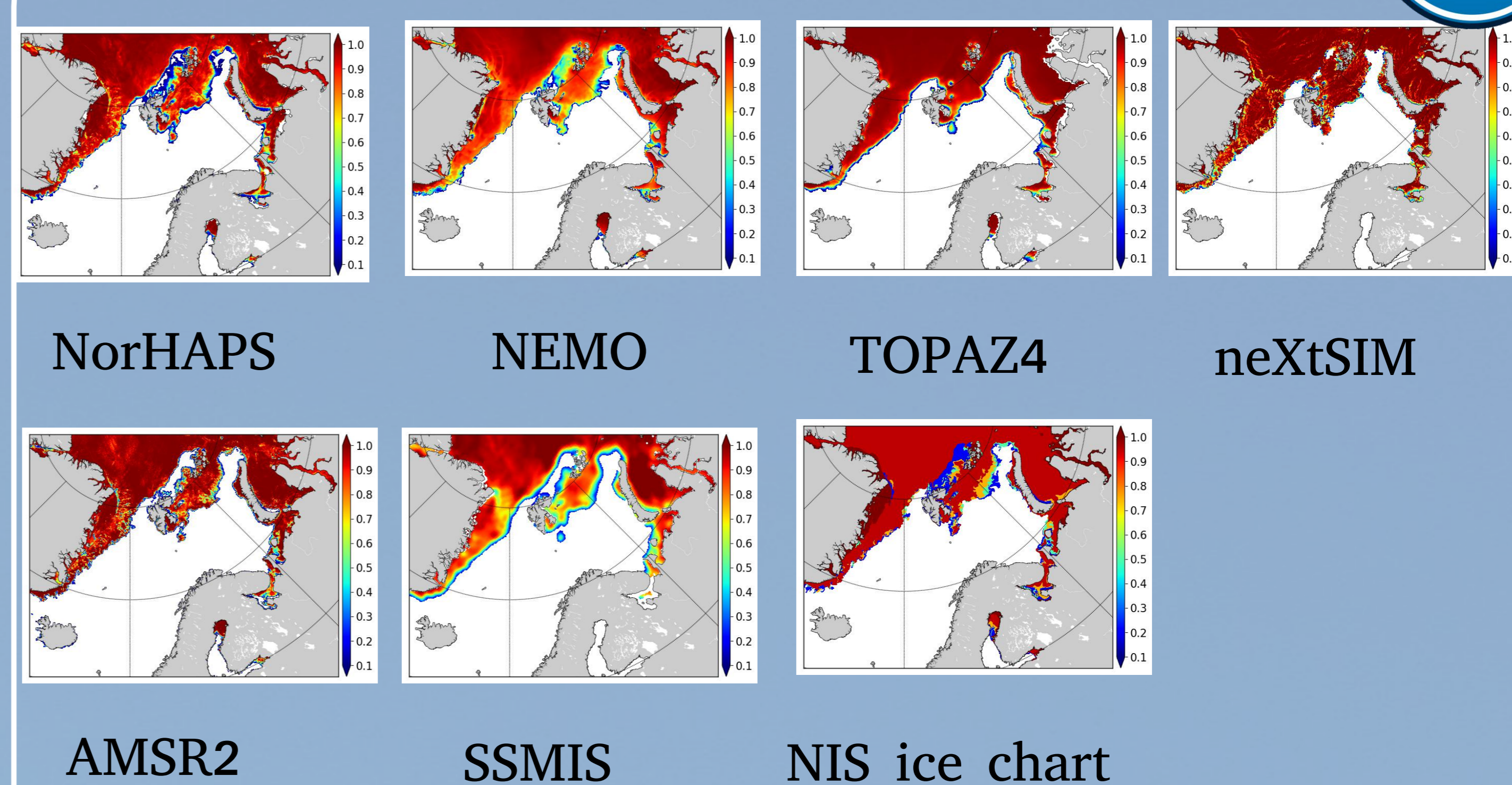
Model experiment with and without data assimilation, from 1 January 2021 - 30 April 2022



AMSR2 (upper), free run (middle), and assimilated (lower) SIC, June 2021, Sept. 2021, Dec. 2021 and Mar. 2022 from left to the right.

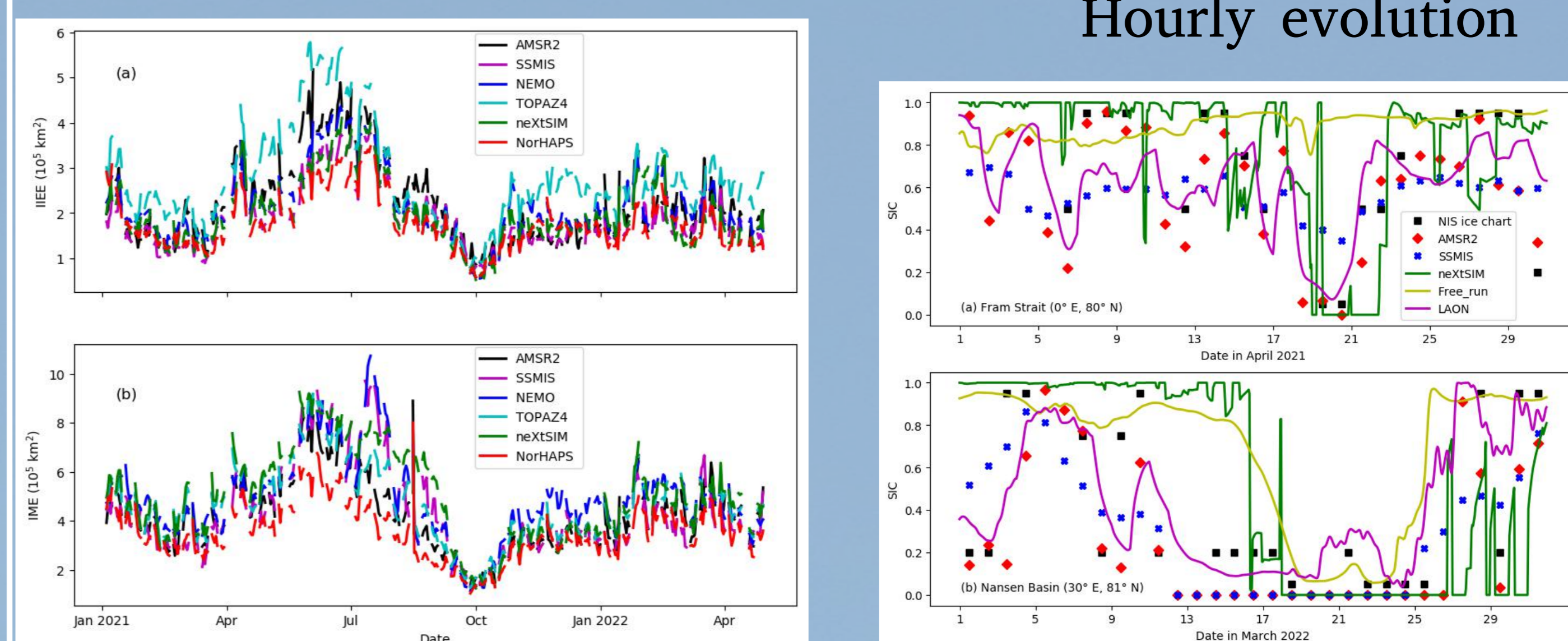


### 3 Comparisons



NorHAPS, NEMO, TOPAZ4, neXtSIM, AMSR2, SSMIS, NIS ice chart

#### Hourly evolution



Product	IIEE			IME		
	mean	STD	p value	mean	STD	p value
AMS2	2.22	0.91	8.04e-13	4.20	1.44	5.47e-11
SSMIS	1.89	0.68	3.02e-2	4.39	1.82	1.07e-12
NEMO	2.16	0.77	2.00e-12	4.89	1.70	1.51e-30
TOPAZ4	2.74	1.03	5.54e-41	4.62	1.56	5.44e-23
neXtSIM	1.99	0.73	6.91e-5	4.99	1.79	3.12e-32
NorHAPS	1.78	0.59	1.0	3.54	1.11	1.0

### 4 References

Wang, K., J. Debernard, A. K. Sperrevik, P. Isachsen, T. Lavergne: A combined optimal interpolation and nudging scheme to assimilate OSISAF sea-ice concentration into ROMS. *Ann Glaciol*, 54(62): 8-12, doi: 10.3189/2013aog62a138, 2013.

Wang, K., A. Ali, C. Wang, A Local Analytical Optimal Nudging for assimilating AMSR2 sea ice concentration in a high-resolution pan-Arctic coupled ocean (HYCOM 2.2.98) and sea ice (CICE 5.1.2) model, submitted to *The Cryosphere*.