Supplementary Material for Autumn Pauses in Arctic-Wide Sea Ice Expansion

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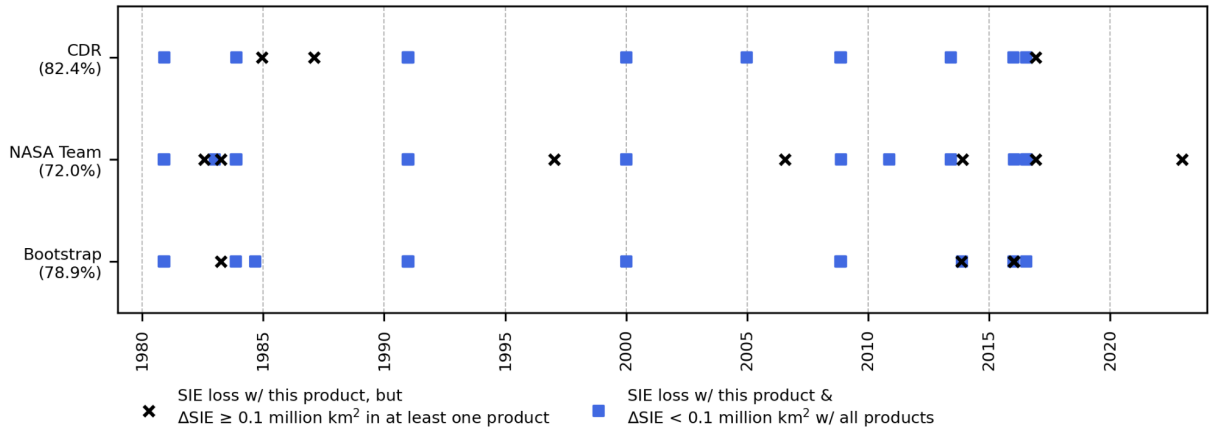
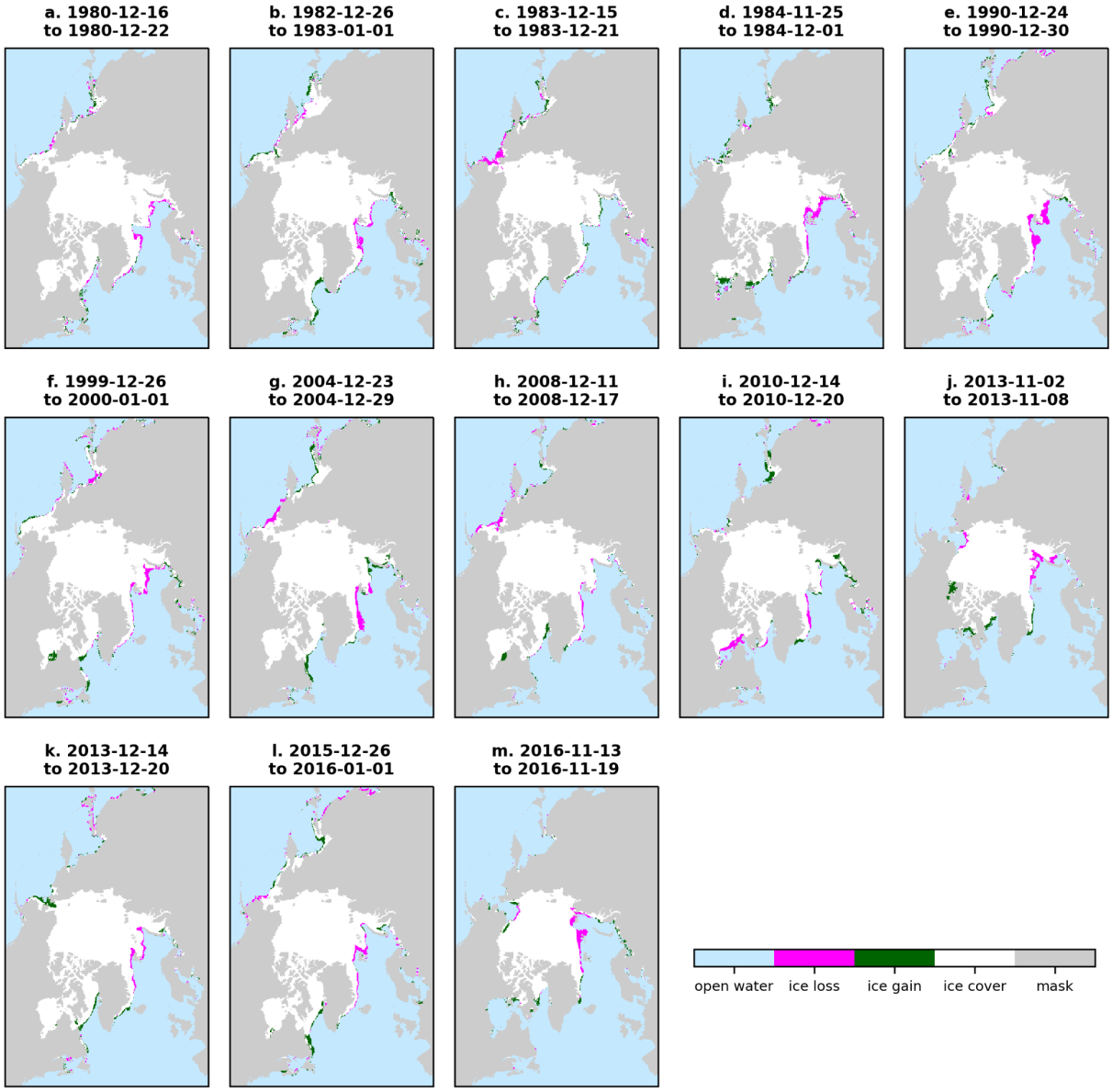
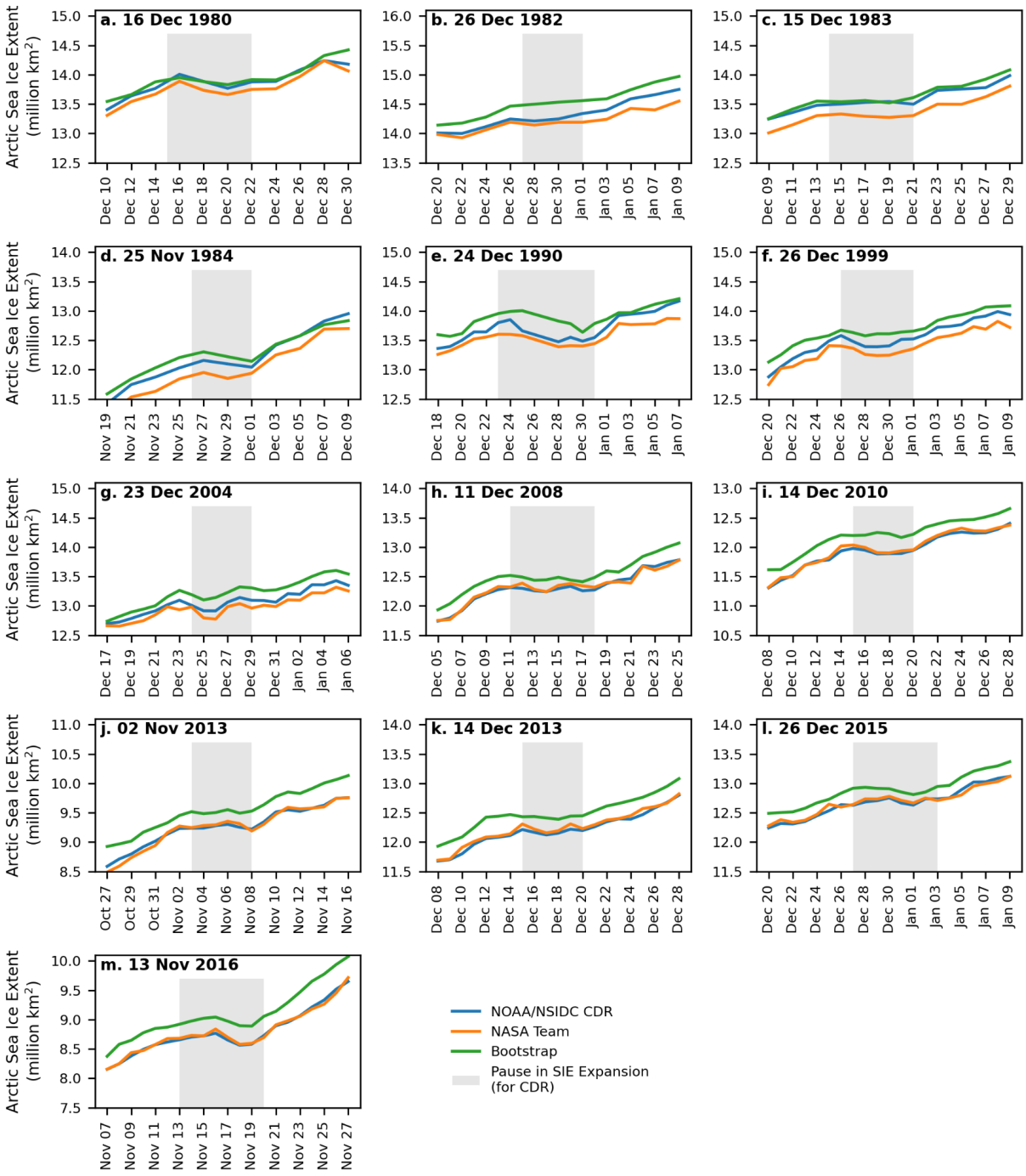


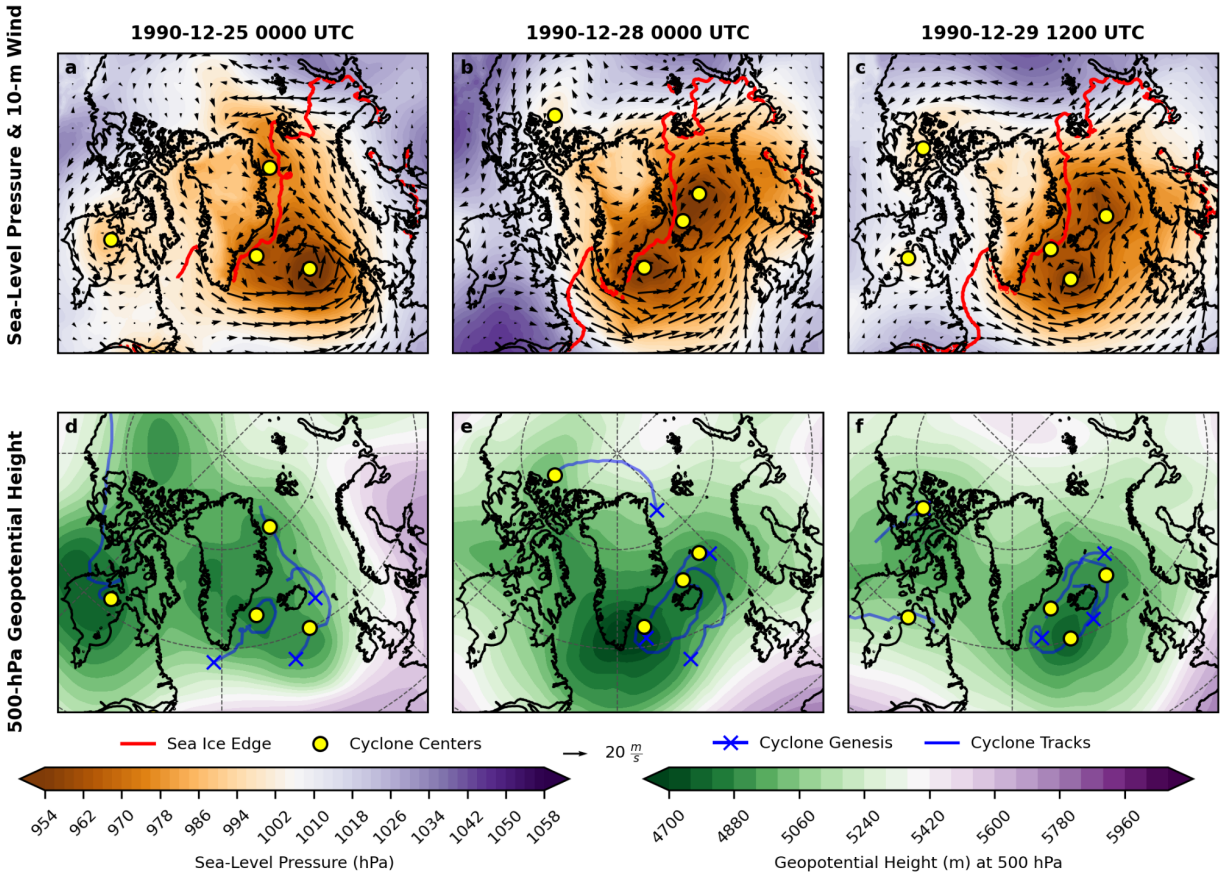
Supplementary Fig. S1: **Impact of requiring that 6-day ΔSIE < 0.1 million km^2 in all three SIE products on results**. The percentage of days for which SIE loss is recorded in the given product that also have ΔSIE < 0.1 million km^2 in all products is noted on the left. The x axis only shows days in autumn (October-December) for each year.



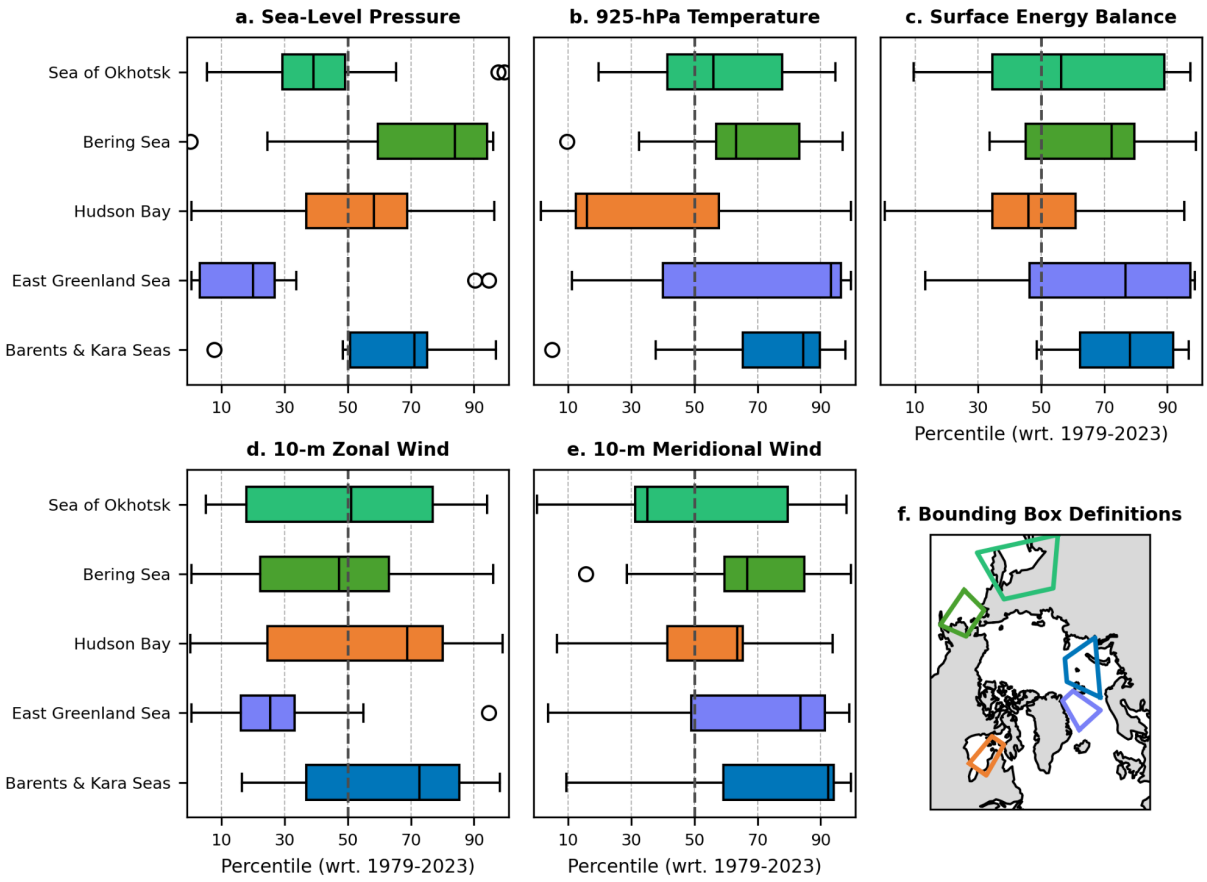
Supplementary Fig. S2: Change in sea ice extent for each 6-day SIE expansion pause, according to the CDR, highlighting regions that experienced sea ice gain (green) or loss (magenta).



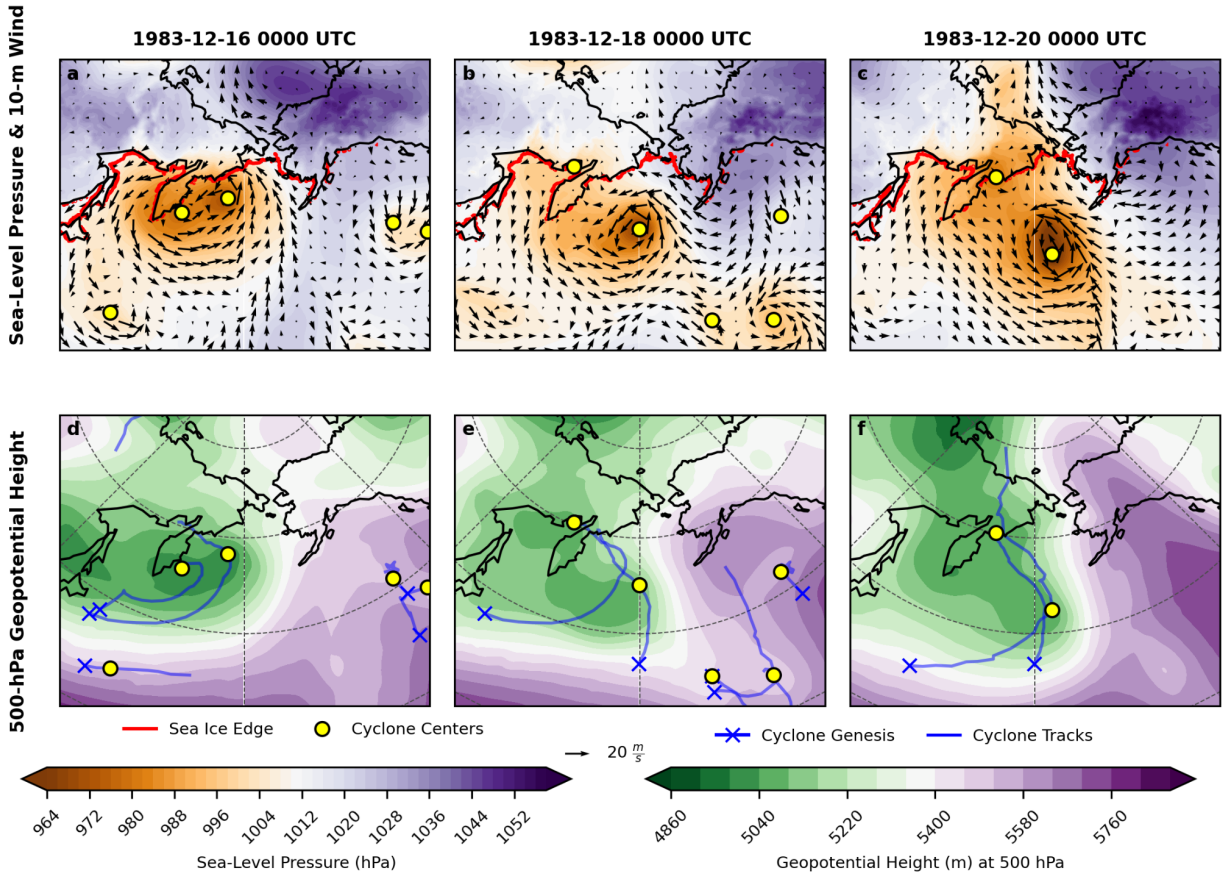
Supplementary Fig. S3: Time series of Arctic-wide sea ice extent from three passive microwave retrieval algorithms (colored lines) for the thirteen SIE expansion pauses of at least six days that occurred in Oct-Dec 1979-2022 (gray shading). Note that although the CDR is derived from a combination of the NASA Team and Bootstrap retrievals, those retrievals, which are processed at NSIDC, involve different quality assurance steps than the versions of NASA Team and Bootstrap applied at the Goddard Space Flight Center.



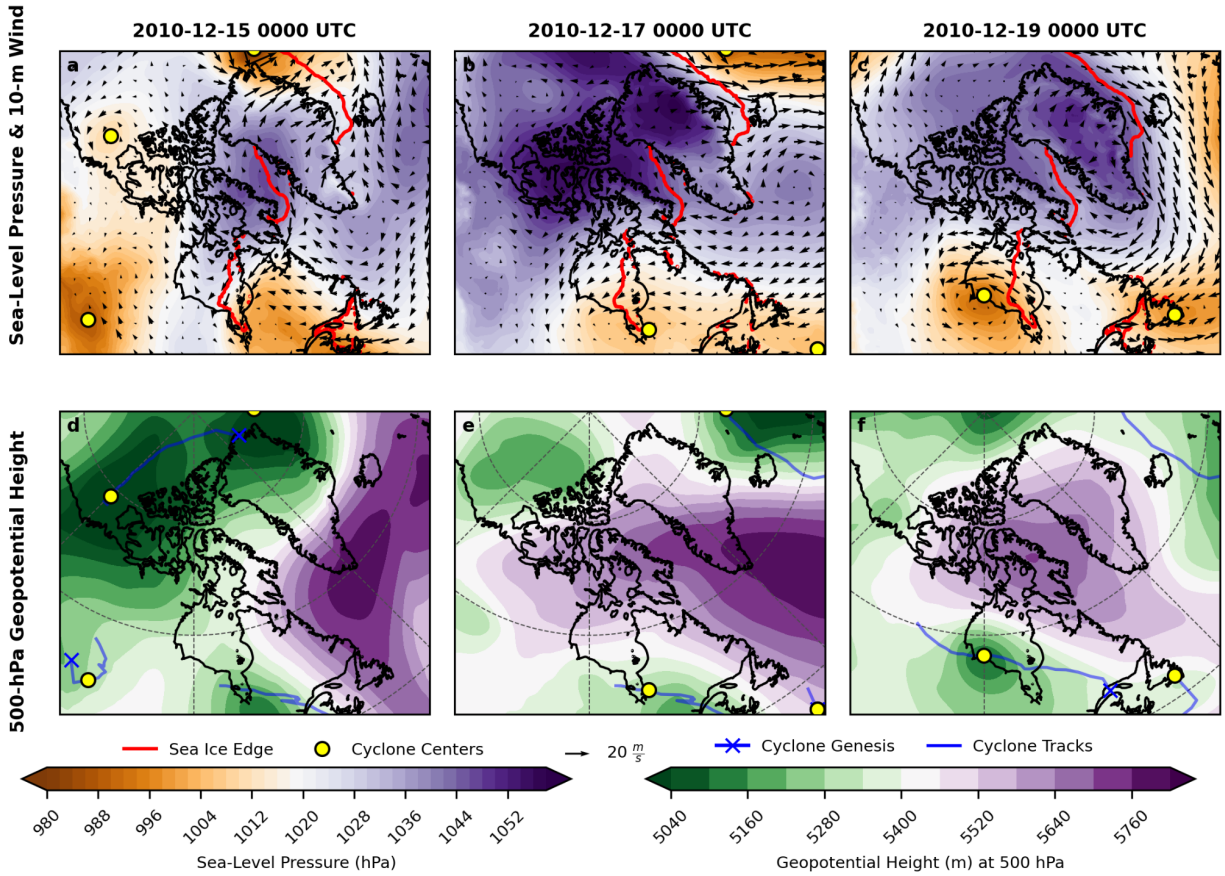
Supplementary Fig. S4: Synoptic-scale circulation during the 24-30 Dec 1990 SIE expansion pause, represented by instantaneous fields of (a-c) sea-level pressure (shading) and 10-m wind vectors and (d-f) 500-hPa geopotential height. Red lines indicate the sea ice edge (SIC < 15%) for the given day. Yellow dots mark the location of cyclone centers (some of which are part of multi-center cyclones) at the given synoptic time, blue x's indicate the genesis locations for each storm, and blue lines indicate the entirety of each cyclone center's path.



Supplementary Fig. S5: Distribution of atmospheric percentiles for five key regions during the 13 SIE expansion pauses occurring October-December 1979-2022. Boxes indicate the median and the 1st and third quartiles (Q1 and Q3, respectively), and whiskers extend to the farthest datum within Q1 - 1.5IQR and Q3 + 1.5IQR, where IQR is the interquartile range (Q3 - Q1).



Supplementary Fig. S6: As in Supplementary Fig. S4, but for the 15-21 Dec 1983 event.



Supplementary Fig. S7: As in Supplementary Fig. S4, but for the 14-20 Dec 2010 event.

Supplementary Table S1: Regions used for spatial averaging in this study, including the latitude/longitude bounds and the figures and tables for which they are used.

Region Description	Bounding Box Min. Lat., Max. Lat., Min. Lon., Max. Lon.	Usage in Figures & Tables
Sea of Okhotsk	50°N, 65°N, 130°E, 165°E	Figures 4, 9, S5
Bering Sea	56°N, 64°N, 180°W, 159°W	Figures 4, 9, S5 Table 1: Highs/Blocking
Okhotsk Sea + Bering Sea	50°N, 65°N, 130°E, 160°W	Table 1: Cyclones
Eastern Hudson Bay	55°N, 65°N 85°W, 75°W	Figures 4, 9, S5 Table 1: Cyclones
East Greenland Sea	70°N, 80°N, 15°W, 10°E	Figures 4, 9, S5
Barents Sea + Kara Sea	72°N, 83°N, 20°E, 80°E	Figures 4, 9, S5 Table 1: Highs/Blocking
East Greenland Sea + Barents Sea	65°N, 80°N, 30°W, 30°E	Table 1: Cyclones
Gulf of Alaska	50°N, 60°N, 160°W, 140°W	Table 1: Highs/Blocking
Baffin Bay + Foxe Basin	65°N, 80°N, 90°W, 50°W	Table 1: Highs/Blocking
Western Russia	55°N, 70°N, 40°E, 60°E	Table 1: Highs/Blocking
Central Siberia	55°N, 70°N, 60°E, 90°E	Table 1: Highs/Blocking

Supplementary Table S2: Percentage of years in which an autumn Arctic-wide SIE expansion pause occurred, grouped by phase of several climate indices. A G-ratio test is used to test the null hypothesis that years with SIE expansion pauses are proportionally distributed amongst phases.

Climate Index	Negative $X < -0.5$	Neutral $\lvert X \rvert \leq 0.5$	Positive $X > 0.5$	G statistic	p value
Oceanic Niño Index	31.1%	30.1%	6.7%	3.89	0.14
Arctic Oscillation	33.3%	14.3%	20.0%	1.57	0.46
Pacific Decadal Oscillation	25.0%	0.0%	28.6%	3.42	0.18
Pacific-North America Pattern	20.0%	15.4%	31.3%	1.12	0.57
North Atlantic Oscillation	40.0%	21.1%	13.3%	2.36	0.31
Scandinavian Pattern	36.4%	21.1%	14.3%	1.70	0.43
E. Atlantic-W. Russia Pattern	33.3%	7.1%	26.7%	3.47	0.18