

# [Editorial: paleoceanographic conditions in high northern latitudes during quatern...](https://assignbuster.com/editorial-paleoceanographic-conditions-in-high-northern-latitudes-during-quaternary-interglaciations/)

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Editorial on the Research Topic
[Paleoceanographic Conditions in High Northern Latitudes During Quaternary Interglaciations](https://www.frontiersin.org/research-topics/7003/paleoceanographic-conditions-in-high-northern-latitudes-during-quaternary-interglaciations)

The northern subpolar regions and the Arctic are particularly important for global climate, as they are considered critical for the Atlantic Meridional Overturning Circulation (AMOC) intensity which strongly depends on the behavior of Atlantic Water advected into the high northern latitudes (e. g., [Sévellec et al., 2017](#B25) ). Geological data and modeling experiments have shown that the AMOC can considerably weaken or even completely shutdown in response to fresh water input ( [Bond et al., 1993](#B5) ; [Rahmstorf, 1995](#B22) ; [Clark et al., 2002](#B7) ). The modern rapid atmospheric and ocean water temperature rise in the Arctic and the subpolar regions (e. g., [Chylek et al., 2009](#B6) ; [Screen and Simmonds, 2010](#B24) ) promotes sea-surface freshening through a chain of feedback mechanisms such as an enhanced seasonal sea-ice loss (e. g., [Comiso et al., 2008](#B8) ; [Stroeve et al., 2008](#B26) ), the drastic diminishing of the Greenland Ice Sheet ( [Rignot et al., 2011](#B23) ; [Applegate et al., 2015](#B1) ), and enhanced Arctic river runoff ( [Wagner et al., 2011](#B29) ). A longer-term perspective obtained through reconstructing past interglacial climates helps to assess and model ongoing changes in the high northern latitudes.

Reconstructions of various sea-water parameters in the high latitudes are especially challenging, however conventional paleoceanographic methods reach the limits of their sensitivity due to: (1) strongly reduced biogenic material; (2) reduced diversities in some faunal groups used in paleoceanography; and (3) the large volume of fresh water at the sea surface. Furthermore, these limitations can affect chronology and stratigraphic correlations of Arctic sediments. Planktic foraminiferal assemblages, ubiquitously used as a sea-(sub-)surface temperature proxy, often become almost monospecific in the Nordic Seas and the Arctic ( [Kellogg, 1980](#B15) , [1984](#B16) ) in the size fraction > 150 μm recommended for research ( [Kucera et al., 2005](#B17) ) and, therefore, can hide subtle temperature fluctuations in the high northern latitudes ( [Kandiano and Bauch, 2002](#B13) ). Also, the traditional application of stable oxygen isotopes in calcareous shells as a proxy for temperature is hampered by the huge impact of fresh water to the sub-Arctic and Arctic Ocean as it overrides the temperature signal in the stable oxygen isotopes record.

In the last few decades, a number of new methods and approaches have been developed to refine the paleoceanography state-of-the-art in high latitudes. It has been demonstrated that planktic foraminiferal assemblages in mesh-size fractions smaller than 150 μm reveal changes in the intensity of Atlantic Water advection and sea- (sub-) surface temperatures in the Nordic Seas and the Arctic ( [Hebbeln et al., 1994](#B11) ; [Dokken and Hald, 1996](#B10) ; [Nørgaard-Pedersen et al., 2007](#B21) ; [Taldenkova et al., 2010](#B27) ; [Husum and Hald, 2012](#B12) ; [Werner et al., 2016](#B30) ). Moreover, the analysis of smaller-sized foraminiferal fractions unveiled drastic differences in the character of Atlantic Water advection in the Nordic Seas during the Holocene climate optimum and the Marine Isotope Stages (MIS) 5e and 11—which are the interglacial time periods suggested as close analogs for the forthcoming climate ( [Bauch et al., 2011](#B2) ; [Cronin et al., 2013](#B9) ; [Kandiano et al., 2016](#B14) ). The biogeochemical marker IP 25 /PIP 25 is now being applied by many research groups to identify the extent of the sea-ice cover in the past ( [Belt et al., 2007](#B4) ; [Müller et al., 2009](#B18) , [2011](#B20) ; [Müller and Stein, 2014](#B19) ; [Belt, 2018](#B3) ). Changes in stable nitrogen isotope composition (δ 15 N) of bulk sediment are used as a proxy for nitrate utilization related to the depth-level of Atlantic Water inflow in the Nordic Seas ( [Thibodeau et al., 2017](#B28) ). This Research Topic comprises articles focusing on new approaches for deciphering paleoclimates in the Nordic Seas and the Arctic that brings our understanding of climate evolution and mechanisms to a new level. It represents a collection of original research papers and a review describing the last achievements in reconstructing past interglacial conditions in high northern latitudes.

[Doherty and Thibodeau](https://doi.org/10.3389/fmars.2018.00251) devote their article to the most intriguing late Quaternary interglacial, the MIS 11, and reviewed recent literature to reconcile enhanced AMOC but with freshened and relatively cold ocean surface in the Nordic Seas during this period. This controversy might be explained by a persistent subduction of saline and relatively dense Atlantic waters below a freshwater cover in the Nordic Seas. Further analysis by the authors led to the conclusion that the formation of the freshwater lid might neither be due to iceberg discharge nor to Greenland ice-sheet melting, but likely had an external origin. Elevated Arctic sea-ice export and an enhanced Eurasian river runoff were suggested by the authors as potential external sources of melt water in the Nordic seas.

[Risebrobakken and Berben](https://doi.org/10.3389/feart.2018.00166) describe changes in water-mass circulation in the Barents Sea during the last late deglaciation and the Holocene, since 12, 000 years (12 ka) to the present. The reconstructions are based on planktic foraminiferal diversities in the > 150 μm size fraction but also smaller size fractions of the studied sediment cores. Emphasis is on the Arctic Front migration from its submeridional western position during the late deglaciation to the present position which the Arctic Front reached at ca 7. 4 ka.

[Ye et al.](https://doi.org/10.3389/feart.2018.00236) analyze paired manganese (Mn) and cerium (Ce) distribution in a sediment core taken from the Alpha Ridge covering the time period from MIS 3 to MIS 10, and in near-modern surface sediments from the western Arctic Ocean and adjacent shelves. The authors showed that Mn contents and Ce anomalies follow a distinct stratigraphic pattern with overall low and high values in glacial and interglacial intervals, respectively. This was linked to glacial-interglacial sea-level changes. Transportation of Mn was related to cross-shelf and mid-depth oceanic currents. The co-variation in the distribution of both elements Mn and Ce has been demonstrated here for the first time.

[O'Regan et al.](https://doi.org/10.3389/feart.2019.00071) establish a consistent Pleistocene stratigraphy of six sediment cores taken along 575 km of the Lomonosov Ridge. In two of them, stratigraphic occurrences and the morphology of subpolar planktic foraminiferal genus *Turborotalita* were analyzed in small-sized sediment fractions. The invasions of *Turborotalita* were attributed to MIS 5. 1 and 5. 5, MIS 9/10, and MIS 11. All found planktic foraminifer specimens resemble the species *T. quinqueloba* despite the fact that in the western Arctic environment another morphological type of *Turborotalita, T. egelida* , is considered as a stratigraphic marker for MIS 11.

## Author Contributions

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

## Conflict of Interest Statement

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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## References

Applegate, P. J., Parizek, B. R., Nicholas, R. E., Alley, R. B., and Keller, K. (2015). Increasing temperature forcing reduces the Greenland Ice Sheet's response time scale. *Climate Dyn.* 45, 2001–2011. doi: 10. 1007/s00382-014-2451-7

[CrossRef Full Text](https://doi.org/10.1007/s00382-014-2451-7) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=P.+J.+Applegate&author=B.+R.+Parizek&author=R.+E.+Nicholas&author=R.+B.+Alley&author=K.+Keller+&publication_year=2015&title=Increasing+temperature+forcing+reduces+the+Greenland+Ice+Sheet's+response+time+scale&journal=Climate+Dyn.&volume=45&pages=2001-2011)

Bauch, H. A., Kandiano, E. S., Helmke, J. P., Andersen, N., Rosell-Mele, A., and Erlenkeuser, U. H. (2011). Climatic bisection of the last interglacial warm period in the Polar North Atlantic. *Quat. Sci. Rev.* 30, 1813–1818. doi: 10. 1016/j. quascirev. 2011. 05. 012

[CrossRef Full Text](https://doi.org/10.1016/j.quascirev.2011.05.012) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=H.+A.+Bauch&author=E.+S.+Kandiano&author=J.+P.+Helmke&author=N.+Andersen&author=A.+Rosell-Mele&author=U.+H.+Erlenkeuser+&publication_year=2011&title=Climatic+bisection+of+the+last+interglacial+warm+period+in+the+Polar+North+Atlantic&journal=Quat.+Sci.+Rev.&volume=30&pages=1813-1818)

Belt, S. T. (2018). Source-specific biomarkers as proxies for Arctic and Antarctic sea ice. *Organic Geochem.* 125, 277–298. doi: 10. 1016/j. orggeochem. 2018. 10. 002

[CrossRef Full Text](https://doi.org/10.1016/j.orggeochem.2018.10.002) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=S.+T.+Belt+&publication_year=2018&title=Source-specific+biomarkers+as+proxies+for+Arctic+and+Antarctic+sea+ice&journal=Organic+Geochem.&volume=125&pages=277-298)

Belt, S. T., Massé, G., Rowland, S. J., Poulin, M., Michel, C., and LeBlanc, B. (2007). A novel chemical fossil of palaeo sea ice: IP25. *Organic Geochem.* 38, 16–27. doi: 10. 1016/j. orggeochem. 2006. 09. 013

[CrossRef Full Text](https://doi.org/10.1016/j.orggeochem.2006.09.013) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=S.+T.+Belt&author=G.+Massé&author=S.+J.+Rowland&author=M.+Poulin&author=C.+Michel&author=B.+LeBlanc+&publication_year=2007&title=A+novel+chemical+fossil+of+palaeo+sea+ice%3A+IP25&journal=Organic+Geochem.&volume=38&pages=16-27)

Bond, G. C., Broecker, W., Johnsen, S., McManus, J., Labeyrie, L., Jouzel, J., et al. (1993). Correlations between climate records from North Atlantic sediments and Greenland ice. *Nature* 365, 143–147. doi: 10. 1038/365143a0

[CrossRef Full Text](https://doi.org/10.1038/365143a0) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=G.+C.+Bond&author=W.+Broecker&author=S.+Johnsen&author=J.+McManus&author=L.+Labeyrie&author=J.+Jouzel+&publication_year=1993&title=Correlations+between+climate+records+from+North+Atlantic+sediments+and+Greenland+ice&journal=Nature&volume=365&pages=143-147)

Chylek, P., Folland, C. K., Lesins, G., Dubey, M. K., and Muyin Wang, M. (2009). Arctic air temperature change amplification and the Atlantic multidecadal oscillation. *Geophys. Res. Lett.* 36: L14801. doi: 10. 1029/2009GL038777

[CrossRef Full Text](https://doi.org/10.1029/2009GL038777) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=P.+Chylek&author=C.+K.+Folland&author=G.+Lesins&author=M.+K.+Dubey&author=M.+Muyin+Wang+&publication_year=2009&title=Arctic+air+temperature+change+amplification+and+the+Atlantic+multidecadal+oscillation&journal=Geophys.+Res.+Lett.&volume=36&pages=L14801)

Clark, P. U., Pisias, N. G., Stocker, T. F., and Weaver, A. J. (2002). The role of the thermohaline circulation in abrupt climate change. *Nature* 415, 863–869. doi: 10. 1038/415863a

[PubMed Abstract](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=ShowDetailView&TermToSearch=11859359) | [CrossRef Full Text](https://doi.org/10.1038/415863a) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=P.+U.+Clark&author=N.+G.+Pisias&author=T.+F.+Stocker&author=A.+J.+Weaver+&publication_year=2002&title=The+role+of+the+thermohaline+circulation+in+abrupt+climate+change&journal=Nature&volume=415&pages=863-869)

Comiso, J. C., Parkinson, C. L., Gersten, R., and Stock, L. (2008). Accelerated decline in the Arctic sea ice cover. *Geophys. Res. Lett.* 35: L01703. doi: 10. 1029/2007GL031972

[CrossRef Full Text](https://doi.org/10.1029/2007GL031972) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=J.+C.+Comiso&author=C.+L.+Parkinson&author=R.+Gersten&author=L.+Stock+&publication_year=2008&title=Accelerated+decline+in+the+Arctic+sea+ice+cover&journal=Geophys.+Res.+Lett.&volume=35&pages=L01703)

Cronin, T. M., Polyak, L., Reed, D., Kandiano, E. S., Marzen, R. E., and Council, E. A. (2013). A 600-ka Arctic sea-ice record from Mendeleev Ridge based on ostracodes. *Quat. Sci. Rev.* 79, 157–167. doi: 10. 1016/j. quascirev. 2012. 12. 010

[CrossRef Full Text](https://doi.org/10.1016/j.quascirev.2012.12.010) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=T.+M.+Cronin&author=L.+Polyak&author=D.+Reed&author=E.+S.+Kandiano&author=R.+E.+Marzen&author=E.+A.+Council+&publication_year=2013&title=A+600-ka+Arctic+sea-ice+record+from+Mendeleev+Ridge+based+on+ostracodes&journal=Quat.+Sci.+Rev.&volume=79&pages=157-167)

Dokken, T. M., and Hald, M. (1996). Rapid climatic shifts during isotope stages 2-4 in the Polar North Atlantic. *Geology* 24, 599–602. doi: 10. 1130/0091-7613(1996)024 <0599: RCSDIS> 2. 3. CO; 2

[CrossRef Full Text](https://doi.org/10.1130/0091-7613%281996%29024%20%3C0599%3A%20RCSDIS%3E%202.%203.%20CO; 2) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=T.+M.+Dokken&author=M.+Hald+&publication_year=1996&title=Rapid+climatic+shifts+during+isotope+stages+2-4+in+the+Polar+North+Atlantic&journal=Geology&volume=24&pages=599-602)

Hebbeln, D., Dokken, T., Andersen, E. S., Hald, M., and Elverhøi, A. (1994). Moisture supply for northern ice-sheet growth during the Last Glacial Maximum. *Nature* 370, 357–360. doi: 10. 1038/370357a0

[CrossRef Full Text](https://doi.org/10.1038/370357a0) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=D.+Hebbeln&author=T.+Dokken&author=E.+S.+Andersen&author=M.+Hald&author=A.+Elverhøi+&publication_year=1994&title=Moisture+supply+for+northern+ice-sheet+growth+during+the+Last+Glacial+Maximum&journal=Nature&volume=370&pages=357-360)

Husum, K., and Hald, M. (2012). Arctic planktic foraminiferal assemblages: implications for subsurface temperature reconstructions. *Mar. Micropaleontol.* 96–97, 38–47. doi: 10. 1016/j. marmicro. 2012. 07. 001

[CrossRef Full Text](https://doi.org/10.1016/j.marmicro.2012.07.001) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=K.+Husum&author=M.+Hald+&publication_year=2012&title=Arctic+planktic+foraminiferal+assemblages%3A+implications+for+subsurface+temperature+reconstructions&journal=Mar.+Micropaleontol.&volume=96–97&pages=38-47)

Kandiano, E. S., and Bauch, H. A. (2002). Implications of planktic foraminiferal size fractions for the glacial-interglacial paleoceanography of the polar North Atlantic. *J. Foraminiferal Res.* 32, 245–251. doi: 10. 2113/32. 3. 245

[CrossRef Full Text](https://doi.org/10.2113/32.3.245) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=E.+S.+Kandiano&author=H.+A.+Bauch+&publication_year=2002&title=Implications+of+planktic+foraminiferal+size+fractions+for+the+glacial-interglacial+paleoceanography+of+the+polar+North+Atlantic&journal=J.+Foraminiferal+Res.&volume=32&pages=245-251)

Kandiano, E. S., van der Meer, M. T. J., Bauch, H. A., Helmke, J., Damste, J. S. S., and Schouten, S. (2016). A cold and fresh ocean surface in the Nordic Seas during MIS 11: significance for the future ocean. *Geophys. Res. Lett.* 43, 10929–10937. doi: 10. 1002/2016GL070294

[CrossRef Full Text](https://doi.org/10.1002/2016GL070294) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=E.+S.+Kandiano&author=M.+T.+J.+van+der+Meer&author=H.+A.+Bauch&author=J.+Helmke&author=J.+S.+S.+Damste&author=S.+Schouten+&publication_year=2016&title=A+cold+and+fresh+ocean+surface+in+the+Nordic+Seas+during+MIS+11%3A+significance+for+the+future+ocean&journal=Geophys.+Res.+Lett.&volume=43&pages=10929-10937)

Kellogg, T. B. (1980). Paleoclimatology and paleo-oceanography of the Norwegian and Greenland Seas: glacial-interglacial contrasts. *Boreas* 9, 5–37. doi: 10. 1111/j. 1502-3885. 1980. tb01033. x

[CrossRef Full Text](https://doi.org/10.1111/j.1502-3885.1980.tb01033.x) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=T.+B.+Kellogg+&publication_year=1980&title=Paleoclimatology+and+paleo-oceanography+of+the+Norwegian+and+Greenland+Seas%3A+glacial-interglacial+contrasts&journal=Boreas&volume=9&pages=5-37)

Kellogg, T. B. (1984). Paleoclimatic significance of subpolar foraminifera in high latitude marine sediments. *Canad. J. Earth Sci.* 21, 189–193. doi: 10. 1139/e84-020

[CrossRef Full Text](https://doi.org/10.1139/e84-020) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=T.+B.+Kellogg+&publication_year=1984&title=Paleoclimatic+significance+of+subpolar+foraminifera+in+high+latitude+marine+sediments&journal=Canad.+J.+Earth+Sci.&volume=21&pages=189-193)

Kucera, M., Weinelt, M., Kiefer, T., Pflaumann, U., Hayes, A., Weinelt, M., et al. (2005). Reconstruction of sea-surface temperatures from assemblages of planktonic foraminifera: multi-technique approach based on geographically constrained calibration data sets and its application to glacial Atlantic and Pacific Oceans. *Quat. Sci. Rev.* 24, 951–998. doi: 10. 1016/j. quascirev. 2004. 07. 014

[CrossRef Full Text](https://doi.org/10.1016/j.quascirev.2004.07.014) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=M.+Kucera&author=M.+Weinelt&author=T.+Kiefer&author=U.+Pflaumann&author=A.+Hayes&author=M.+Weinelt+&publication_year=2005&title=Reconstruction+of+sea-surface+temperatures+from+assemblages+of+planktonic+foraminifera%3A+multi-technique+approach+based+on+geographically+constrained+calibration+data+sets+and+its+application+to+glacial+Atlantic+and+Pacific+Oceans&journal=Quat.+Sci.+Rev.&volume=24&pages=951-998)

Müller, J., Massé, G., Stein, R., and Belt, S. T. (2009). Variability of sea-ice conditions in the Fram Strait over the past 30, 000 years. *Nat. Geosci.* 2, 772–776. doi: 10. 1038/ngeo665

[CrossRef Full Text](https://doi.org/10.1038/ngeo665) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=J.+Müller&author=G.+Massé&author=R.+Stein&author=S.+T.+Belt+&publication_year=2009&title=Variability+of+sea-ice+conditions+in+the+Fram+Strait+over+the+past+30, 000+years&journal=Nat.+Geosci.&volume=2&pages=772-776)

Müller, J., and Stein, R. (2014). High-resolution record of late glacial and deglacial sea ice changes in Fram Strait corroborates ice–ocean interactions during abrupt climate shifts. *Earth Planet. Sci. Lett.* 403, 446–455 doi: 10. 1016/j. epsl. 2014. 07. 016

[CrossRef Full Text](https://doi.org/10.1016/j.epsl.2014.07.016) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=J.+Müller&author=R.+Stein+&publication_year=2014&title=High-resolution+record+of+late+glacial+and+deglacial+sea+ice+changes+in+Fram+Strait+corroborates+ice–ocean+interactions+during+abrupt+climate+shifts&journal=Earth+Planet.+Sci.+Lett.&volume=403&pages=446-455)

Müller, J., Wagner, A., Fahl, K., Stein, R., Prange, M., and Lohmann, G. (2011). Towards quantitative sea ice reconstructions in the northern North Atlantic: a combined biomarker and numerical modelling approach. *Earth Planet. Sci. Lett.* 306, 137–148. doi: 10. 1016/j. epsl. 2011. 04. 011

[CrossRef Full Text](https://doi.org/10.1016/j.epsl.2011.04.011) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=J.+Müller&author=A.+Wagner&author=K.+Fahl&author=R.+Stein&author=M.+Prange&author=G.+Lohmann+&publication_year=2011&title=Towards+quantitative+sea+ice+reconstructions+in+the+northern+North+Atlantic%3A+a+combined+biomarker+and+numerical+modelling+approach&journal=Earth+Planet.+Sci.+Lett.&volume=306&pages=137-148)

Nørgaard-Pedersen, N., Mikkelsen, N., and Kristoffersen, Y. (2007). Arctic Ocean record of last two glacial-interglacial cycles off North Greenland/Ellesmere Island — Implications for glacial history. *Mar. Geol.* 244, 93–108. doi: 10. 1016/j. margeo. 2007. 06. 008

[CrossRef Full Text](https://doi.org/10.1016/j.margeo.2007.06.008) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=N.+Nørgaard-Pedersen&author=N.+Mikkelsen&author=Y.+Kristoffersen+&publication_year=2007&title=Arctic+Ocean+record+of+last+two+glacial-interglacial+cycles+off+North+Greenland%2FEllesmere+Island+—+Implications+for+glacial+history&journal=Mar.+Geol.&volume=244&pages=93-108)

Rahmstorf, S. (1995). Bifurcations of the Atlantic thermohaline circulation in response to changes in the hydrological cycle. *Nature* 378, 145–149. doi: 10. 1038/378145a0

[CrossRef Full Text](https://doi.org/10.1038/378145a0) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=S.+Rahmstorf+&publication_year=1995&title=Bifurcations+of+the+Atlantic+thermohaline+circulation+in+response+to+changes+in+the+hydrological+cycle&journal=Nature&volume=378&pages=145-149)

Rignot, E., Velicogna, I., van den Broeke, M. R., Monaghan, A., and Lenaerts, J. (2011). Acceleration of the contribution of the Greenland and Antarctic ice sheets to sea level rise. *Geophys. Res. Lett.* 38: 46583. doi: 10. 1029/2011GL046583

[CrossRef Full Text](https://doi.org/10.1029/2011GL046583) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=E.+Rignot&author=I.+Velicogna&author=M.+R.+van+den+Broeke&author=A.+Monaghan&author=J.+Lenaerts+&publication_year=2011&title=Acceleration+of+the+contribution+of+the+Greenland+and+Antarctic+ice+sheets+to+sea+level+rise&journal=Geophys.+Res.+Lett.&volume=38&pages=46583)

Screen, J. A., and Simmonds, I. (2010). The central role of diminishing sea ice in recent Arctic temperature amplification. *Nature* 464, 1334–1337. doi: 10. 1038/nature09051

[PubMed Abstract](http://www.ncbi.nlm.nih.gov/sites/entrez?Db=pubmed&Cmd=ShowDetailView&TermToSearch=20428168) | [CrossRef Full Text](https://doi.org/10.1038/nature09051) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=J.+A.+Screen&author=I.+Simmonds+&publication_year=2010&title=The+central+role+of+diminishing+sea+ice+in+recent+Arctic+temperature+amplification&journal=Nature&volume=464&pages=1334-1337)

Sévellec, F., Fedorov, A. V., and Liu, W. (2017). Arctic sea-ice decline weakens the Atlantic meridional overturning circulation. *Nat. Climate Change* 7, 604–610. doi: 10. 1038/nclimate3353

[CrossRef Full Text](https://doi.org/10.1038/nclimate3353) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=F.+Sévellec&author=A.+V.+Fedorov&author=W.+Liu+&publication_year=2017&title=Arctic+sea-ice+decline+weakens+the+Atlantic+meridional+overturning+circulation&journal=Nat.+Climate+Change&volume=7&pages=604-610)

Stroeve, J. C., Serreze, M., Drobot, S., Gearheard, S., Holland, M., Maslanik, J., et al. (2008). Arctic sea ice extent plummets in 2007. *Trans. Am. Geophys. Union* 89, 13–14. doi: 10. 1029/2008EO020001

[CrossRef Full Text](https://doi.org/10.1029/2008EO020001) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=J.+C.+Stroeve&author=M.+Serreze&author=S.+Drobot&author=S.+Gearheard&author=M.+Holland&author=J.+Maslanik+&publication_year=2008&title=Arctic+sea+ice+extent+plummets+in+2007&journal=Trans.+Am.+Geophys.+Union&volume=89&pages=13-14)

Taldenkova, E., Bauch, H. A., Gottschalk, J., Nikolaev, S., Rostovtseva, Y., Pogodina, I., et al. (2010). History of ice-rafting and water mass evolution at the northern Siberian continental margin (Laptev Sea) during Late Glacial and Holocene times. *Quat. Sci. Rev.* 29, 3919–3935. doi: 10. 1016/j. quascirev. 2010. 09. 013

[CrossRef Full Text](https://doi.org/10.1016/j.quascirev.2010.09.013) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=E.+Taldenkova&author=H.+A.+Bauch&author=J.+Gottschalk&author=S.+Nikolaev&author=Y.+Rostovtseva&author=I.+Pogodina+&publication_year=2010&title=History+of+ice-rafting+and+water+mass+evolution+at+the+northern+Siberian+continental+margin+(Laptev+Sea)+during+Late+Glacial+and+Holocene+times&journal=Quat.+Sci.+Rev.&volume=29&pages=3919-3935)

Thibodeau, B., Bauch, H. A., and Pedersen, T. F. (2017). Stratification-induced variations in nutrient utilization in the Polar North Atlantic during past interglacials. *Earth Planet. Sci. Lett.* 457, 127–135. doi: 10. 1016/j. epsl. 2016. 09. 060

[CrossRef Full Text](https://doi.org/10.1016/j.epsl.2016.09.060) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=B.+Thibodeau&author=H.+A.+Bauch&author=T.+F.+Pedersen+&publication_year=2017&title=Stratification-induced+variations+in+nutrient+utilization+in+the+Polar+North+Atlantic+during+past+interglacials&journal=Earth+Planet.+Sci.+Lett.&volume=457&pages=127-135)

Wagner, A., Lohmann, G., and Prange, M. (2011). Arctic river discharge trends since 7ka BP. *Global Planet. Change* 79, 48–60. doi: 10. 1016/j. gloplacha. 2011. 07. 006

[CrossRef Full Text](https://doi.org/10.1016/j.gloplacha.2011.07.006) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=A.+Wagner&author=G.+Lohmann&author=M.+Prange+&publication_year=2011&title=Arctic+river+discharge+trends+since+7ka+BP&journal=Global+Planet.+Change&volume=79&pages=48-60)

Werner, K., Müller, J., Husum, K., Spielhagen, R. F., Kandiano, E. S., and Polyak, L. (2016). Holocene sea subsurface and surface water masses in the Fram Strait - Comparisons of temperature and sea-ice reconstructions. *Quat. Sci. Rev.* 147, 194–209. doi: 10. 1016/j. quascirev. 2015. 09. 007

[CrossRef Full Text](https://doi.org/10.1016/j.quascirev.2015.09.007) | [Google Scholar](http://scholar.google.com/scholar_lookup?author=K.+Werner&author=J.+Müller&author=K.+Husum&author=R.+F.+Spielhagen&author=E.+S.+Kandiano&author=L.+Polyak+&publication_year=2016&title=Holocene+sea+subsurface+and+surface+water+masses+in+the+Fram+Strait+-+Comparisons+of+temperature+and+sea-ice+reconstructions&journal=Quat.+Sci.+Rev.&volume=147&pages=194-209)