Reviewer 2:

We want to thank the reviewer for the time spent on the text and for the spotting of errors and unfortunate formulations, and for the many suggestions on how to improve the manuscript.

Major Comments:

The major comments raised by the reviewer are all, except the last, related to the structure of the manuscript and it is perhaps best to first consider the last point, what is the purpose of this review. Our intension was, and is, to give a comprehensive discussion of the Arctic Mediterranean that describes the processes and the water mass transformations in the different parts of the area and how these parts are connected by the circulation of the different waters. The manuscript should also highlight how our knowledge of the geography and our understanding of the physical oceanography of the Arctic Mediterranean have evolved over time.

Our aim is to provide an integrated view of the Arctic Mediterranean in contrast to a manuscript consisting of a mere collection of standalone sections, which the reviewer recommends. We will consider the suggested reorganizations of the text and if we find they will improve the narrative, we will make changes accordingly.

We have mainly referenced to original and to older publications to provide a sense of the historical developments to the readers. We are aware of the sparseness of references to recent studies, and we appreciate the reviewer's suggestions of articles that should be referred to and could correct this bias. We shall do our best to incorporate these studies in the text.

We are, however, rather reluctant to describe how the present study differs from other existing reviews and also from some of our own earlier work. We consider that all reviews have their own values and think it is impertinent to quickly summarize their content in a few sentences, and will rather concentrate on making the present review informative and readable.

With respect to the last major point, “Indigenous peoples’ knowledge”, we must confess that we have close to nothing to contribute, and we will not address this major point.

Minor comments:

L 92: The two gyres meant are the cyclonic gyre extending from the Nordic Seas into the Barents Sea and the Eurasian Basin and the anticyclonic gyre in the Amerasian Basin centered at the Beaufort Sea. The latter is the only large-scale anticyclonic gyre in the Arctic Mediterranean.

L 102: The sentence has been clarified to: “This is perhaps the area where the effects of a warming climate on the water column have been the strongest.”

L 139-140: Figure 3 in the Fritz’s article on solar radiation in Compendium of Meteorology (1951), showing the energy input at the top of the atmosphere as function of latitude and time of the year, indicates that the energy input in summer is larger at the North pole than at the Equator.

L 187-188: This sentence has been expanded to: “a convoluted channel connecting the upper layer of the stratified and stagnant North Pacific to the convectively ventilated North Atlantic.”

L 656-669: The Bering Strait inflow is now described in more detail and more as well as more recent references have been added.

L 666: The heat transported into the Arctic Ocean through Bering Strait derives from the local seasonal heating in the Bering Sea and is not transported by the ocean from lower latitudes.

L 716-717: The sentence will be rewritten as: "Sea water with salinity S>24.7, by contrast, is densest at its freezing point and the water column has to be convectively cooled to freezing temperature down to the bottom, or down to a density gradient caused by the presence of a deep, more saline, and denser water mass, before sea ice can form."

Section 7.1: The Dorr et al. paper will be included. We appreciate the authors' constructive use of T-S diagrams.

L 930-931: The formation of the upper melt water layer in two different locations is discussed. Sea ice melting on colder water (in the Barents Sea) creates a more saline melt water layer than sea ice melting on warmer water (north of Svalbard).

L 970: This refers to waters in juxtaposition, and is changed to: "the intrusions penetrate across the front into the opposite water masses only as long as an unstable density distribution of the driving component remains."

Figure 9: The data are from two expeditions with RV Polarstern, one in 2007 and the other in 2011. Maps showing the station position will be added and the final sentence clarified.

L 1082: The increase of both temperature and salinity in the bottom layer indicates that the boundary plume, initially at the freezing point, has entrained warm Atlantic water during its descent. Part of the initial brine enriched salinity excess, however, still remains.

L 1154-1155: The sentence has been expanded to: "The East Siberian Sea, in contrast to the Laptev Sea, receives a considerable amount of sea ice from the central basins and acts more as an ice sink than an ice source for the inner Arctic Ocean.

L 1162-1166: More results related to ice thickness from satellite observations will be added in the revised text, including the one suggested and other papers by Kwok.

L 1171-1172: A discussion of the Sumata et al. (2024) paper will be included in the revision.

L 1205-1209: The speculation of a possible Sverdrup balance in the Beaufort Gyre will either be discussed in the context of Yang et al. (2015) or removed.

L 1287-1290: A discussion of the possibility that a combination of earlier, more saline boundary convection and geothermal heat input from below could generate the observed temperature and salinity structures in the deeper layers will be included, as will an inclusion of Arroyo and Timmermans (2026).

L 1393: This has been corrected.

L 1404-1409: The discussion of the transports through Fram Strait will be expanded and more and more recent references to inverse methods will be examined and discussed.

Figure 15: The RV Hudson station (1982) is located at 75^{0}02'N 005°11'W and the RV Valdivia station (1993) at 74°00'N 004°20'W.

L 1769-1773: The overflow in Denmark Strait will be discussed in more detail in the revision, including reference to von Appen et al. (2017, JPO).

Figure 19 The southernmost section is shown

L 1858: This is an unfortunate formulation. What is meant is that the northward flowing North Irminger Current comes at the sill in almost direct contact with southward flowing overflow water, and if the main mixing takes place here, a mixing ratio of Irminger Current water to overflow plume water of one to four would be sufficient to explain the temperature increase of about one degree in the overflow plume observed in the deep Irminger Sea. This is much less than if the entrainment takes place during the descent down the slope into the Irminger Sea. The Denmark Strait overflow plume would then comprise more original overflow water and less entrainment, perhaps only 25%. This will be clarified in the rewrite.

L 1999-2004: Thanks for these corrections. Equation 5, the transport in the upper layer, should read:

$$M_A + F = \frac{3g\beta(S_2 - S_1)H_1^2}{2f}$$

and Equation 6, the thickness of freshwater m in the upper layer becomes:

$$m = \frac{(S_2 - S_1)}{S_2}H_1$$

The salinity of the upper layer can be written as:

$$S_1 = \frac{M_2 S_2}{(M_2 + F)}$$

Introducing this in the expression for the outflow gives

$$(M_2 + F) = \left(\frac{3g\beta F S_2}{2f}\right)^{\frac{1}{2}} H_1$$

and m becomes:

$$m = \frac{S_2(M_2 + F) - (M_2 S_2)}{S_2(M_2 + F)} H_1 = \frac{F H_1}{(M_2 + F)} = \left(\frac{2fF}{3g\beta S_2}\right)^{\frac{1}{2}}$$

The derivation is from Rudels (2010).

Figure 23: We will remove figure 23 and instead expand the text somewhat.

L 2186: “normalized” will be inserted. We are aware of different NAO definitions but prefer this simpler definition.

Figure 25: We will remove this figure.

Typos etc.: All typos have been corrected. In figure 1 we left YM in the figure and made the change YP to YM in the caption. It was simpler that way. We acknowledge the reviewer of such a thorough editorial eye.