

Review of : environmental conditions in the N. Atlantic sector of the Arctic during the HALO-AC3 campaign.
Walbrohl et al.
Egusphere-2023-668

This is a generally well-written presentation on the meteorology experienced during the HALO-AC3. I enjoyed reading it and am confident it will be a useful contribution to the larger research community. I like many of the figures.

My main comment is that I rather wished for more description of how well the ERA5 reanalysis can be trusted for this part of the world. The analysis relies heavily on ERA5, including for cloud and precipitation phase. Has there been any comparison of the ERA5 products to the in-situ data yet? It may still be early stages for this, but some of the drop sonde quantities provided in the manuscript would be very easy to compare against ERA5. A literature review of other assessments is mostly absent, other than some in section 2.4.4. My own cursory web search revealed at least these two: Seethala et al., 2021; Loeb et al., 2022, but I would expect there to be more. I was hoping to see a more systematic assessment of the ERA5 quantities. Was the data assimilation consistent for the entire timespan of the ERA5 climatology, so that statements about 'maximum records' (e.g. line 281) are fair to make?

The other main comment is that in several places there are references to place names whose geography the reader may not be aware of, such as Franz Josef land. Fig. 1 might be a place to add some helpful geographic annotations, also for the ocean basins (Fram Strait, Greenland Sea, Barents Sea), as is section 2.1

Specific comments:

Abstract: The acronym ERA5 is spelled out, but that for HALO-AC3 is not. My guess is that more readers will know what ERA5 is, than HALO-AC3. I'd suggest spelling out HALO-AC3 and seeing if the journal will accept ERA5 as is.

Abstract, line 10: include years of the ERA5 climatology.

Abstract, line 11: not a good idea to expect the reader to know what a 'shapiro-keyser' cyclone is, you can leave out the name reference

Abstract, line 16: 'untypically' => 'atypically'

Intro, line 32: my recollection is that the Francis and Vavrus, 2015, was highly debated after it was published, leading to a US CLIVAR report, and spurring other work by e.g. E. Barnes at CSU. A bit more detailed literature review here would make this portion more impactful.

Line 67: space between performance of

Line 120: Nimbus -> Nimbus

Lines 161-164: this is slightly confusing as written. Do Guan and Wailer use a IVT threshold of 100 kg/m/s and you use 50? Maybe combine those two phrases into one sentence if so.

Line 212: how is the polar low's center determined.

Line 212: using the max 10 m wind gust as opposed to the mean wind assumes ERA5 underestimates polar low wind gusts...do you know this for sure?

Line 218: the drop sonde vorticity calculation: at what time? What was the center of the drop sonde circle? The vorticity calculation should be easy to compare to that from ERA5, how does ERA5 do?

Line 248: southerly winds not obvious for the central region in fig. 3d...would suggest removing 'and central'.

Lines 248-255: it's hard to visualize what you are saying just from fig. 3, would suggest adding in some spatial circulation figures like what you have within fig. 4.

Line 278: the stated maximum IVT_north of 388 kg/s/m doesn't seem consistent w Fig. 2. Is that because the maximum is an hourly-mean?

Line 280-282: what's the difference between 'latitude-averaged' and 'area-averaged' IVT?

Line 283: how are you defining MWAI intensity? Winds?

Line 294: I don't follow "The moisture flux decreased faster than the heat flux". Is this from the atmosphere to the ocean? Or the turbulent fluxes coming off of the ocean?

Line 302: "frontal structure representative of a Shapiro-Keyser cyclone". Better to just describe the frontal structure, as many readers, including myself, will not know what you are talking about.

Line 385: it could be interesting to discuss how the subsidence is evolving as well, as that would also influence the static stability.

Line 415: not fully following how surface conditions explain a high tropopause height. I think you can just say 'vertical advection lifts the tropopause to 12.9 km' and be done with it.

Line 425: these radiosonde profiles are also an opportunity to assess the corresponding ERA5 profiles.

Line 450: '2023) that' => '2023), '

Line 527: it should be relatively straightforward to figure out if the latent heat fluxes are increases because $q_{sat} - q_{air}$ is increasing or because the wind speeds are increasing. How much is the q_{sat} increasing? I would think the SST would not be changing all that much?

Line 565: 'lied' => 'lay'

Line 573: please include a figure comparing the drop sonde vorticity and wind speed profiles to that from ERA5. The drop sonde circle should also give you a divergence profile and updraft speed that can be compared to that from ERA5 in a figure. Please do so.

Line 605: 'a' => 'an' (in front of easterly)

Line 653: insert 'the' before 'absence'

Figures/Tables

Table 1: the northern part of the northern region is hard to understand initially from this table, however, figure 1 shows the study area very well. I had to look down to figure 1 to understand

the table. It might be best to either have the figure before the table, or to add a 4th column to the table for the northern part of the northern region

Fig. 1: spell out what NYA means in the caption.

Fig. 3: the graphic on the left looks a bit odd, as there is no real need for us to know the day of the week I don't think. I would suggest adding a color bar to the top of the right-hand panels that has the identification information.

Fig. 4: include dates in caption.

Fig. 5: are these hourly values? Would be worth putting in caption.

Fig. 8: some strange overlapping of lat/lon labels in a-c, would suggest just removing a few.

Fig. 9, caption: I don't understand the last sentence, and both the top and far right histograms need a basic description. Also, the values shown in here for

Fig. 10: fewer lat/lon labels and bigger plots would be nice. You could just leave most of the lat labels out.

Fig. 13: including the ERA5 vorticity values on panel a would be nice as would be an additional plot showing the wind speeds/divergences. Panel b needs SLP labels.

References:

Loeb et al., 2022: <https://www.frontiersin.org/articles/10.3389/fenvs.2022.866929>

Seethala et al., 2021: <https://agupubs.onlinelibrary.wiley.com/doi/pdfdirect/10.1029/2021GL094364>