

Interactive comment on “Increasing transports of volume, heat, and salt towards the Arctic in the Faroe Current 1993–2013” by B. Hansen et al.

B. Hansen et al.

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Received and published: 29 August 2015

We thank the Referee 1 for very helpful comments, which we respond to below:

Referee comment: The authors claim on page 1016 that “the main aim is to resolve, whether any of the transport series exhibit long-term trends, and to quantify them”. The authors do not provide evidence for any long term trend that can be distinguished from natural variability. The time series are probably still too short to make such statements. Our response: We agree that our wording may be misunderstood and have modified it so that “long-term trends” is replaced by “overall trends over the observational period” in the revised manuscript p. 3, l. 25. We have also changed the word “long-term” to either “interannual” or “overall” in several other places to avoid this misunderstanding.

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Referee comment: The authors also state that “The increased heat and salt transports are partly caused by the increased volume transport and partly by increased temperatures and salinities of the Atlantic inflow, attributed mainly to the weakened subpolar gyre” which implies that the trends calculated may well be caused by natural variations in the subpolar gyre that are known to have decadal variability. This should at least be discussed in the paper. Our response: Again, our wording may be misunderstood and we have added a paragraph at the end of the discussion, in the revised manuscript p. 21, l. 3–5, stating: “Although our time series are long compared to many other transport series, they are still within the time scales of natural variations. Thus, it should be emphasized that the trends observed may well be caused by natural processes in the climate system.”

Referee comment: The manuscript is heavily dependent on the technical report which is part of the gray literature: Hansen, B., Larsen, K. M. H., Hátún, H., Kristiansen, R., Mortensen, E., and Østerhus, S.: Monitoring volume, heat, and salt transports in the Faroe Current 1993–2013, Faroe Marine Research Institute Technical Report No. 15-01, 53 pp., available at: www.hav.fo/PDF/Ritgerdir/2015/TecRep1501.pdf, 2015. It is actually quite difficult to read the paper and almost impossible to review it without having also this report. I leave it to the editor to decide whether this is acceptable. Our response: We have followed the suggestions by the referees to submit a supplementary pdf document with the contents of the technical report, modified according to referee suggestions and now refer to that instead of the technical report.

Comments:

Referee comment: Change the title to “Transports of volume, heat, and salt towards the Arctic in the Faroe Current 1993–2013” or it might be also be “Improved estimates of transports of volume, heat, and salt towards the Arctic in the Faroe Current 1993–2013”. From Fig. 6. b) it seems that the volume transport is lower in 2013 than it was in 1993. Our response: We have changed the title to: “Transports of volume, heat, and salt towards the Arctic in the Faroe Current 1993–2013”

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Referee comment: Something should be said about how the gaps during summer are treated? Our response: It is not quite clear to us, what specifically the referee is asking for, but we have added the sentence "One advantage of this is that we now have transport estimates also for the summer months with the ADCPs on land for servicing, especially for June" in the revised manuscript p. 17, l. 20-22.

Referee comment: A more extensive discussion on how the AW is defined is needed. How do the authors account for the mixing with the Arctic water? Part of the reason for lower salinities and temperatures over the northern part of the section might be due to mixing with Arctic water. This was the way the proportion of Atlantic water was calculated in Hansen et al. (2003). Our response: We agree that our method for isolating the Atlantic water components of the transports has probably not been sufficiently well described and justified. In the revised manuscript p. 9, we have changed the heading for Sect. 3.2.2 and added two paragraphs in its beginning, defining and motivating our choices of AW boundary.

Referee comment: Also a discussion of how changes in the properties of the source water i.e. water south of the IFR is accounted for should be included. Our response: In the revised manuscript, we have added a paragraph to the end of Sect. 3.2.2: "As elaborated in Sect. 3.6, the choice of boundary for Atlantic water extent is a dominant source of uncertainty for average transport estimates. Since the regression equations for $Dj(t)$ include mainly altimetry parameters (Supplement, Table 4.2.2), our results are not, however, very sensitive to changes in the Atlantic water properties. Thus, this choice should not introduce appreciable uncertainties to the temporal variations and trends of the transport series."

Minor comments:

Referee comment: Page 1014, line 12: "has made it difficult to identify trends". This indicates that the authors are convinced that there should be a trend. But is that justified? I suggest rephrasing this sentence. Our response: In the revised manuscript p.

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1, l. 21, the sentence has been replaced by "has made it difficult to establish whether there are trends"

Referee comment: Page 1014, line 19: Change "trend" to "increase". Our response: This has been done in the revised manuscript p. 1, l. 27.

Referee comment: Page 1015, line 19 (should be 14, probably): change "profilers" to "Profilers". Our response: This has been done in the revised manuscript p. 2, l. 18.

Referee comment: Page 1016, line 3-4: change "After some initial experimentation, an ADCP array with three moorings (NA, NB, and NC) started monitoring in summer 1997" to "After some initial experimentation, monitoring started in summer 1997 with an ADCP array with three moorings (NA, NB, and NC)". Our response: This has been done in the revised manuscript p. 3, l. 3-4.

Referee comment: Page 1016, line 10: change "in 2003 (Hansen et al., 2003)" to "in Hansen et al., 2003". Our response: In the revised manuscript p. 3, l. 11, it now says "in Hansen et al. (2003)"

Referee comment: Page 1016, line 11: change "in 2010 (Hansen et al., 2010)" to "in Hansen et al., 2010". Our response: In the revised manuscript p. 3, l. 12, it now says "in Hansen et al. (2010)"

Referee comment: Table 1, page 1039: the headings in the table might include more information, (e.g. Bottom depth instead of just Depth), so the reader does not have to rely on reading all the figure text for understanding the table. Our response: In the revised manuscript, the text and table have been modified accordingly (the table with track changes disabled, but coloured red).

Referee comment: Figure 1 should be enlarged. Our response: The original figure has a width of 16.9 cm, designed to fit the width of the final OS paper. The figure has apparently been reduced in size to fit the OSD format.

Referee comment: The figures for the two EOFs and PCs that are Figures 2.4.1. and

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2.4.2 in the technical report should be included in the paper. Our response: In the revised manuscript, this has been added as Figure 3.

Please also note the supplement to this comment:

<http://www.ocean-sci-discuss.net/12/C629/2015/osd-12-C629-2015-supplement.pdf>

Interactive comment on Ocean Sci. Discuss., 12, 1013, 2015.