

## ***Interactive comment on “Water mass distributions and transports for the 2014 GEOVIDE cruise in the North Atlantic” by Maribel I. García-Ibáñez et al.***

**Anonymous Referee #3**

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### General comments

This paper presents a comprehensive description of all water types that cross the OVIDE line, which in itself is informative. If this has not been presented elsewhere in the literature, it is worth publishing. This work also illustrates some important water mass redistributions in 2014, with the more subarctic water masses generally replacing the more subtropical water masses. This is also interesting. But then we get too much information on water mass changes, based on a relatively unclear picture (Fig. 6). This part could be shortened/improved.

With the uncertainty associated with the water mass distribution, and the inherent noise in a single occupation of such an oceanographic section, I did not find all the transport details Section 4.2 interesting.

C1

Much due to all the detail in the latter part of the manuscript, I still find this paper difficult to digest. The additional information on the eOMP and the water types helps to make sense of the paper contents. But still, as I came to the latter part of the Discussion, I really had to stay focused, in order to continue reading.

As it stands, it is mostly interesting to a rather limited inner circle of devoted oceanographers. It could, however, become a nice contribution if shortened and clarified. The writing generally reads well already.

### Detailed comments

I am not familiar with the content in the much cited Zunino et al., which might limit my ability to interpret some of the findings in this manuscript.

The use of a subscript (e.g. SPMW7) for different types of the otherwise well known water masses, is new to me. And this notation is not even introduced in this manuscript. I must admit that this detail hindered me in following this manuscript initially. This confusion might be caused by my lack of knowledge, but this will probably confuse other readers as well. Please give a better introduction to this, and improve the integration with the literature. E.g. how does the SPMW7 associated with the water mass descriptions given in other oceanographic papers?

This work seems to use different – and maybe lower - values for the nutrient concentrations in the SWTs, compared to some other studies. The authors e.g. use a silicic acid concentration of  $6.33 \mu\text{M}$  to represent the MW, while (McGrath et al., 2012) use a silicate concentration of 10-11  $\mu\text{M}$  for the same water mass.

a) Is silicic acid,  $\text{Si}(\text{OH})_4$ , not the same as “silicate”? b) Why use both one and two decimals in Table 1? c) How sensitive is eOMP method to such different choices of the source water silicic acid concentration?

I am a bit confused by the definition and discussion of the ‘Central Water’. On page 5, line 26 (p5,l26) this water mass is defined as ENACW16+ ENACW12, on p5,l29 is

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stated that “The distribution of the Central Waters is associated with the NAC” and on (p3,l6) is stated that the Central Waters is transported with the NAC. How can it be defined by the eastern waters, and be transported with the NAC? Please clarify.

(p5,l6): “An important assumption of the methodology is that the physical and chemical characteristics of the SWTs are considered time invariant and...”

(p9,l31): “...the progressive salinization that classical LSW (our SWT) has been experiencing since its last formation event in the late 1990s...”

So the eOMP method seems to be importantly dependent on the assumption of time invariability of the SWTs, and it is clear that the SWT are not time invariable. At first glance, this appears as a contradiction. Please explain.

(p7,l32): “...measurements and by an overall mass balance of  $1 \pm 3$  Sv northwards...” It is not clear what this means.

(p9,l13) and below: The abbreviation SMPW is often used. I assume this should be SPMW. Section 4.1. The discussion on the water mass changes between the average 2002-2012 state, and 2014 is difficult to follow. This is partly because Fig. 6 could be improved (see comments below), and partly because the patterns are not always clear. Maybe guide the reader better to the mentioned changes (e.g. specify depths levels).

(p9,l27): “The negative anomalies of LSW between 1000 and 2000 dbar coincide with positive anomalies of SPWM7... “

It makes sense that the cooling after 2014 was associated with a replacement of the relatively warm SPWM7 with the colder LSW. But it seems counterintuitive that the opposite occurred below 1000 dbar. Was LSW really replaced by the warmer SPMW at these deeper levels? Please explain. One result of this paper is an unexpectedly high presence of ISOW. It is known that the eOMP is sensitive to the assumption of time invariability of the SWTs, and it is clear that the ISOW SWT became more saline after 2002. Could the unexpectedly high presence of ISOW partly be a result of this

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uncertainty?

Figures

Figures 1-5 are all ok.

The NAC in Fig. 1 is located farther south than where we usually see it (in the literature). Is this because the authors suggest that the NAC is actually located this far south?

Fig. 2d. The silicic acid values span 0-40  $\mu\text{M}$ , probably in order to get the highest values near the seafloor in the eastern part represented as well. But most of the observed silicate variability is seen in the range 2-12  $\mu\text{M}$ , and the figure has a low resolution in this range. Maybe consider using a non-linear color code?

Figure 6

The message in this figure is not clear.

a) Maybe use different software. Although ODV is well suited to scan oceanographic data, it might not be the right choice for making publishable figures. If you still want to use ODV, remove the redundant references to this software.

b) Use the y-axis label, “Pressure (dbar)” only once. The same goes for the other ODV-based figures (Figs. 2 and 4).

c) What does “(on a per one basis)” really mean?

d) Maybe add something like the text in (p9,l4) “Positive (negative) anomalies in the proportion of a water mass imply a gain (loss) in 2014 compared to 2002–2010.” to the caption for Fig. 6.

e) Since the patterns in this figure are quite noisy, one can doubt the usefulness of this figure. The uncertainty about the parameter shown, and the definition of the water types with that subscript (e.g. ENACW16, see comment above), it becomes difficult to

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follow the discussion related to this figure.

Suggestions: a) Show and discuss only the clearest signals (fewer panels in the figure). Patterns with blue and red blobs might too much associated with the inherent variability, which could strongly impact a single transect along the OVIDE line. Or b), improve the figure and the explanation of its content, and integrate the discussion with this figure in a clearer way.

#### References

McGrath, T., Nolan, G., McGovern, E., 2012. Chemical characteristics of water masses in the Rockall Trough. *Deep-Sea Research Part I-Oceanographic Research Papers* 61, 57-73.

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