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Interactive comment on "Atlantic meridional overturning circulation at 14.5° N and 24.5° N during 1989/1992 and 2013/2015: volume, heat and freshwater fluxes" *by* Yao Fu et al.

Anonymous Referee #2

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General comments

This paper studies about changes of AMOC transports in four full depth basin wide hydrographic sections at 14.5N and 24.5N in 1989/1992 and 2013/2015. A box inverse model is used to derive the mass and salt conserved velocity fields. Authors find the quantified AMOC transports are stronger in 1989/1992 than 2013/2015 at both sections. They show the warmer and saltier signals in Antarctic Intermediate water (AAIW) at 14.5N sections in 2013 than 1989. The quantified four snapshots of the AMOC transports are compared against the RAPID array time series and a data assimilation product, GECCO2. They show the quantified transport differences between

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1989/1992 and 2013/2015 are within range of seasonal and inter-annual variability. They suspect that these natural variabilities may explain the changes in the observed AMOC transports at 14.5N and 24.5N in 1989/1992 and 2013/2015.

Despite the large amount of efforts put into the study, I do not recommend to publish this manuscript in Ocean Science. My fundamental concern is, I do not see any clear scientific findings that advance our knowledge on the AMOC variability from the study. The time variability of the AMOC transports has been well studied based on the RAPID array at the 24.5N at different time scales, in terms of quantification and its driving factors: on seasonal time scale by Kanzow et al. (2010), on inter-annual time scale by McCarthy et al. (2012) and Frajka-Williams et al. (2016), and long-term trend by Smeed et al. (2012). In their figure 16, Kanzow et al. (2010) show that the aliasing of seasonal AMOC anomalies may be the major reason of the inferred slowdown of AMOC transports between 1957 and 2004 as proposed by Bryden et al (2005). Bryden et al. (2005) suggest the 8 Sv AMOC transport decline based on five full depth basin wide hydrographic surveys at 24.5N in 1957, 1981, 1992, 1998, 2004. These series of AMOC transport studies at 24.5N indicate two things. First, as far as I see, results in this study across 24.5N do not provide any new findings on the quantification of the AMOC transports. Authors assume zero reference velocities for both years in 1992 and 2015. This would hamper to quantify better snapshot estimates on AMOC transports than the RAPID mooring measurement. Second, given the lesson by Kanzow et al. (2010), comparing two snapshot estimates on AMOC transports across 14.5N in 10 years apart says little about the decadal AMOC transport change. As authors suspect, this change may be due to the natural seasonal and inter-annual variability. Again, I do not see clear scientific findings from the 14.5N sections.

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