Ocean Sci. Discuss., 11, C1274–C1276, 2015
www.ocean-sci-discuss.net/11/C1274/2015/

Ocean Science
Discussions

Interactive comment on "Transient tracer applications in the Southern Ocean" *by* T. Stöven et al.

Anonymous Referee #2

Received and published: 20 January 2015

This simple paper follows the inverse Gaussian – Transit Time Distribution method (IG-TTD, Hall et al., 2002; Waugh et al., 2004) using ocean measurements of the transient tracers SF6 and CFC-12 made in 1998 and in 2012 to examine changes in ventilation between 44S and 60 S at ∼2-5W in the Atlantic sector. While the method is well-established, the 2012 data quality is regrettably affected and the 1998 SF6 concentrations are low. This contributes to high uncertainty (table 3) and the results appear suspect. The cause of the reported changes is not explored and this is disconcerting as results are not consistent with recently published work (Waugh et al., 2013) and there is also a difference with the time lag analysis. I'd also like to see some additional context with respect to water masses instead of depth references for the reported changes in ventilation. Finally the overview on different transient tracers and the IG-TTD method feels long compared to the data and results sections (i.e 3He and C14 not used for

results). In summary I cannot recommend publication in the present form. A larger high quality data set would help to produce a manuscript of much better quality.

Comments Title: Transient tracer applications in the Southern Ocean. The use of Southern Ocean in the title is disconcerting. The authors say: 'The 25 Subantarctic Front (SAF) at 46_ S denotes the application limit of the IG-TTD'. This limitation has also been reported by Waugh et al. (2013). The Subtropical Front is considered the northern limit of the Southern Ocean.

Abstract: Typo in abstract - 39Ar data are from the eastern Atlantic Ocean, not western.

Equations 4 and 5 are not mentioned in the text.

Sections 2 to 3.3 are mostly a review of relevant transient tracers. Some (3H and C14) are not used in the study . The cruise report indicates measurements of 3H during Polarstern Cruise ANT-XXVIII/3. It would probably help to compare the 3H results to the SF6 results.

Page 2301, line 1 and 2; could you explain why the decrease of CFC-12 in the atmosphere has no limiting influence within the TTD model.

Figure 2: This figure simply reproduces the application limits of the couple CFC-12 SF6 from their atmospheric history through the GF for the northern hemisphere. Fig.2 could be removed; it has many graphs with small numbers difficult to read. Fig.8 shows the same thing adapted for the data set (time of the cruise and south hemisphere). Fig.8 is a good visual tool.

Figure 3: This will be helpful to have the 39Ar data location in the figure.

Page 2302, line 16 and 16: "a pure advective flow at Δ/Γ= 0 directly corresponds to the tracer age". This was missing from sectiion3.1 where the authors described the different ratios i.e. high ratio infers higher mixing.

Page 2304: Could the authors calculate the bubble effect to discard a problem with the

analytical system. Do they use the same GC for SF6 and CFC-12? If not did both GC had the wave height effect?

Table A2: Could the authors explain how sigma=0 from 450 to 1300m.

Table 3: Mean concentrations could be added to the table for synthesis. How was the final mean age calculated from the SF6 and CFC-12 mean age? How were the ratios determined (search of ratios matching the measured concentrations?) ? Was the temporal evolution of the surface saturation taken into account as recommended in the overview section? Error bars larger than the difference between 1998 and 2012.

Page 2309; the TTD constrained error range all the way between 300 to 1000m is only +-2? Fig 7: Will benefit of error bars on the graphs. Fig 10: I understand that the interpolation is guided by the SF6 and CFC-12 profiles. Could those go in the same graph? The 39Ar presented results are not exploited and consequently conclusions about its use are unclear. (page 2310 line 19-21 and page2311 line7 to 10 and page 2310)

Interactive comment on Ocean Sci. Discuss., 11, 2289, 2014.