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Interactive comment on "Two-dimensional distribution of living benthic foraminifera in anoxic sediment layers of an estuarine mudflat (Loire Estuary, France)" *by* A. Thibault de Chanvalon et al.

Anonymous Referee #1

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This manuscript reported about the new sampling and measurement method for surface sediments, which enable us to measure some dissolved phase chemical species using gel and subsequently sample sediments for desired purpose: in this study, foraminiferal vertical and lateral distributions. The obtained results were cross-checked with conventional methods based on core sampling. The method presented here is interesting, considering the fact that different chemical compositions can be measured in near future. The mosaic (or cubic) sampling of foraminifera further suggest their lateral patchiness in 1 cm scale, although the dissolved iron has 3 to 4 cm patchiness.

The manuscript is generally well written, however, I think that some discussions should be added before its acceptance. Also, I think the re-organization of figures must be considered.

1. Effect of the thickness of sediments The authors need to discuss more on the fact that the cubic sediments collected with jaw device has a 1cm thickness. The comparison between foraminiferal distribution and other environmental factors, namely, dissolved iron concentration, dissolved reactive phosphorous, polychaete tube distribution, must be considered with this thickness effect. The Moran's index analysis indicated that the foraminiferal distribution has a patchiness of 1cm scale. This suggests that the foraminiferal distributions on the sectioned side, which the iron, phosphorous and polychaete tube distributions were examined, may differ from that the other side (1 cm behind). The direct comparison of the foraminiferal distribution and other environmental factors should be

2. Lowest TOC values at 1 to 2 cm depth The authors interpret that the lower A. tepida abundances at the depth of 1 to 2 cm are caused by the upward migration of A. tepida to oxygenated surface layers. On the other hand, interestingly, the TOC concentrations in sediments also showed lowest values at the 1 to 2 cm depth in sediments. Although there was only one TOC profile in this study, if we assume that the profile is common at this area, the profile suggests characteristic sedimentation/mixing/production of organic matters in sediments at the site. The distribution of organic matter may also explain foraminiferal distribution in the sediments. However, there was no discussion on this TOC profile in the manuscript.

3. Vertical distribution of H. germanica There is no discussion on the distribution of H. germanica, which showed deeper distribution than A. tepida (Fig 5a). The deeper distribution means either they have low mobility or low sensitivity to go back toward surface, or they have low productivity at the surface, based on the interpretation on A. tepida (Fig. 11). The authors could add some discussion on this, or at least describe the results, otherwise the authors can omit the H. germanica from the Fig. 5a.

Figures re-organization Figure 1 can be omitted. Figure 4 can be presented with Figure 7, together with Figure 5b. If the authors will not mention about the H. germanica, data in Fig. 5a is sufficient to be presented in Fig. 8a, so the Fig. 5 can be arranged into new Fig. 7 and Fig. 8. Figure 10 could be omitted.

Additional minor comments and corrections.

In the introduction, the authors referred some studies that describes controlling factors of foraminiferal patchiness such as organic carbon, grain size, etc. It is pity that these parameters were not quantified from the jaw samples (I know that the cubic cm is not sufficient to perform all these parameters, though).

Page 10317, line 2 “the” appears twice.

Page 10317, line 15 Are there any references here?

Page 10318, line 5 It is better to describe Hediste diversicolor is Polychaeta (or Annelida) and Scrobicularia plana is Bivalvia.

Page 10319, line 1 Please add the description on vertical depth step of the oxygen profiling.

Page 10320, line 9 Microtopography must also have larger impact on 2mm-thickness slice of the core samples. The authors can add some description on this.

Page 10322, line 3 It is better to say “burrow distributions” or something instead of “visual observation”, because Fig. 4b does not indicate other visual observations such as sediment color etc. except burrows.

Page 10322, line 17 First 6 millimeters, or surface 6 millimeters

Page 10322, line 22 The explanation on vertical distribution described here may need to refer Fig 8a.

Page 10324, line 13 Fig. 7b? line 17 must be Fig. 7a.

Page 10325, line 1 Fig. 7a

Page 10325, line 3 If you refer the numbering of the burrow again, it is better to present the numbering in Fig. 7a.

Page 10325, line7 globally ==> generally

Page 10326, line 14 When the surface 0 to 3 cm data are included, how the Moran’s index look like?

Page 10327, line 4 A possible reason of this could be the thickness of the sediments, as I mentioned earlier.

Page 10328, line 20 Is “waiting time” means “interval”?

Page 10329, line 3 Not only the frequency, but also the “extent of bioturbation” may need to be considered.

Page 10331, line 17 Another unfavorable reason for A. tepida to deeper sediments may be food availability, since they prefer algae over bacteria (Pascal et al. 2008). The authors can add some of these discussion in the manuscript.

Page 10331, line 22 Is “If” at the beginning necessary?

Page 10331, line 29 Fig. 11?

Page 10332, line 11 Dyingin ==> Dying in

Page 10332, line 12 The increasing trend of A. tepida abundances below 3 cm Accumulation, depth of bioturbation, life time of Ammonia tepida.

Page 10332, line 20 This explanation somewhat contradicted with above explanations. Burrows which is not visible in the cutting side is not included in the discussion, which also affect to the foraminiferal density of the 1cm thick sediments.

Page 10333, line 20 The authors can refer Fig. 7c here to indicate clear vertical zonation of dissolved iron.

Page 10333, line 22 DOM and pCO2 should be discussed in the different context to NO3, Mn2+ and Fe2+.

Page 10334, line 11 The patchiness of the foraminiferal density, and input of organic matter, may be caused by the same events.

Page 10334, line 20 centime ==> centimeter?

Page 10338, line 20 de Nooijer 2007 is not available at the AWI website now, but available at the website of the Utrecht Univertisy. http://dspace.library.uu.nl/handle/1874/19240

Figure 5. A. tepida must be in italics.

Figure 11 Two dotted lines must be presented in different way (e.g. different dot intervals, different thickness, etc.).

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