

Interactive comment on “Aluminium in the North Atlantic Ocean and the Labrador Sea (GEOTRACES GA01 section): roles of continental inputs and biogenic particle removal” by Jan-Lukas Menzel Barraqueta et al.

Anonymous Referee #1

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Overview:

This article presents overview of dissolved Al in the North Atlantic Ocean and Labrador Sea along GEOTRACES GA01 section, and discussed about the source and sink of dissolved Al together with particulate Al concentrations in the whole water column. Mainly, authors have discussed that along this section Al values are controlled by the continental input (rivers, glacial flour, and ice melt) but not dust deposition at the surface, the net release of dAl resulting from the remineralization of sinking biogenic opal containing particles in the water column, and dAl releasing from the pore-water due to

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the resuspension of sediment near the sediment-water interface.

The authors did a good job to describe the dissolved Al distributions with hydrographic conditions along the section, and compared to the other data set that previously published by other groups. However, I felt that result section in this paper was relatively hard to understand what the authors express because it is not specified each process at the surface/euphotic zone and/or water column with the proper figures. Although the authors suggested in Section 3.2.2 that the particulate Al was increased resulting from the dissolved Al sorption by biogenic opal based on the dominant phytoplankton species at the surface water, there is no figure in this manuscript to show the relationship between dAl, pAl, pAl/dAl, Chl.a, and/or Silicate. In this section, their discussion seems to be reasonable (dAl scavenged by particles and increased pAl values), but authors have not mentioned any other possibilities of the dAl and pAl input (i.e. freshwater and/or advection). In the following section (Section 3.2.3 and 3.2.4) shows that there is the continental input (high dAl, and high pAl, Fig 1). Since the values near the coast were higher than offshore stations, the freshwater presumably would have transported lithogenic particles and probably the pAl/dAl ratio in the surface water had been influenced by those particles. In case, authors have excluded such coastal stations in this discussion (Section 3.2.2), they need to specify the station number or process in the section. The result of pAl/dAl in the surface/euphotic zone using Fig 6c is very hard to see because not only the figure shows the whole water column (hard to see surface value) but also the artificial calculation effect by ODV masked the open ocean pAl/dAl values. In the water column (Section 3.3.1), it is a good idea to discuss dissolved Al value with bSiO₂, but there is no plot between dAl vs Silicic acid in this manuscript.

Overall, this manuscript is well written and discussed the primary source and sink of dAl along GA01. I would recommend publication after addressing some comments and inserting figures that are listed below. I do believe that this manuscript would be of interest and beneficial to the readers of Biogeoscience, particularly those from the oceanographic community seeking a better understanding of Al cycle in the ocean.

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Specific comments:

1. As mentioned above, authors discussed about the source and sink of the dissolved Al with mainly controlled by remineralization of the biogenic particles because of the positive correlation of the Si and Al concentrations in the water column. However, there is no plots between these parameters in this manuscript. Also, it is not clear that the correlation of these parameters was obtained within the same water depths (Euphotic zone in Section 3.2.2 or water column in Section 3.3.1) and/or same water masses (since it is interesting that the advected water mass (i.e. MOW) showed the different correlation of Si/Al.) Need to clarify this information in this manuscript.
2. Abstract: Line 19. "... and removal by phytoplankton." Dissolved Al is not a bioactive metal (in the current knowledge), thus this sentence is probably misleading readers. This sentence should be rephrased with "removal by biogenic particles (i.e. phytoplankton)".
3. Section 2.2 Dissolved Al analysis. (Page 4, first paragraph) Authors described the analytical method with the loading time (second) only. It is very helpful for readers to add the volume or loading time and the flowrate in this sentence. For example. "The loading time was adjusted to 120 s (flowrate ? mL/sec, or ?? mL) and was extended up to 180 s (flowrate ? mL/sec, or ? mL) for samples...". Same as the rinsing volume and elution volume.
4. Page 5 Line 8. "The blank was subtracted from...". Authors should write the blank value here. Is the value 0.013nM??
5. Page 7. Line 7. Did authors calculate the averaged dAl value (3.1nM) including Station 1, 2, 4? The dAl value at Stations 1, 2, 4 were quite high (>20nM) in the Figure 2. Authors should specify the station number in this sentence. Add the station information for ENAB and IcB as well.
6. Page 8. Line 14. The correlation here was referred to Section 3.3.1. However, this

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section is describing for surface/Euphotic zone, not deeper water. Need to specify or rephrase it.

Technical corrections:

1. Page 5 Line 19. "The Fisher-based test", is this mean "Fisher's exact test"?
2. Page 6. Line 13. "Subarctic North Atlantic Arctic". Is this "Arctic"?
3. Page 6. Line 25 and 26. The numbers should be written as (iv) and (v), not (iiii) and (iiiiii).
4. Page 7. Line 6. "... and 30.99nM (Station 2)." Figure 2 shows the highest dAl value was observed at Station 4. Is this station number 4 in this sentence?
5. Page 9. Line 24. High riverine dAl signal was observed previously in the Bay of Bengal (see the reference of Grand et al (2015).
Grand, M. M., C. I. Measures, M. Hatta, W. T. Hiscock, C. S. Buck, and W. M. Landing (2015), Dust deposition in the eastern Indian Ocean: The ocean perspective from Antarctica to the Bay of Bengal, *Global Biogeochem. Cycles*, 29, doi:10.1002/2014GB004898.
6. Figure 1. Station number in Figure 1b would help reader to understand the figure better. Figure caption "C: Atlantic Arctic (ARCT)" should show "C: Subarctic North Atlantic Arctic (SANRCT)" in order to corresponding the text.
7. Figure 2. Figure caption. "...Green: NAST (A in Fig 1); Orange: NADR (B in Fig 1); SANRCT (C in Fig 1).."
8. Figure 5. It would be better to show "Greenland" in the Figure.
9. Figure 6. (A) why the station 2 was highlighted with red color? (C) It would be better to put the station numbers, black dots and the geographic labels "Newfoundland" etc.. like Fig 6a. In order to help reader, modify the figure 6 with focusing shallower depth or

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add separate figures (see above).

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