

Interactive comment on “The influence of the geo-morphological and sedimentological settings on the distribution of epibenthic assemblages on a flat topped hill on the over-deepened shelf of the Western Weddell Sea” by B. Dorschel et al.

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Dear Editor, dear Katrin Linse, thank you very much for your comments on our manuscript. In the following we will address the comments and update our manuscript accordingly. Most specific comments (e.g. missing references) will be followed and only the more relevant comments are addressed in the following.

Comment Page 1636 Line 16: This section could be shortened. Reply: The first paragraph of chapter 2.1.1 ‘Data acquisition’ will be considerably shortened to: “The

C1297

bathymetric data was acquired with an Atlas Hydrosweep DS 3 deep-water multibeam echosounder operated in ‘equal footprint’ mode with 313 hard beams and a maximum of 920 soft beams. In the operated water depths, the horizontal position accuracy was 2-5 m. The vertical accuracy of the Atlas DS3 hydrosweep multibeam system was better than 0.2% of the water depth according to the manufacturer’s specification.”

Comment Page 1639 Line 14: Is the OFOS set-up and deployment different to Bergmann & Klages 2012 (Marine Pollution Bulletin 64: 2734-2741) or could the deployment be referenced to another publication? Was a telemetry system used to define the start and end of the OFOS transects or were the positions taken from GPS fixes and water depth? Reply: The chapter 2.3 ‘Seabed imagery’ will be extended to: “Seabed imaging surveys were carried out with the Ocean Floor Observation System (OFOS) of the AWI deep-sea group. The OFOS set-up and deployment were similar to those described by Bergman and Klages (2012). OFOS is a surface-powered, deep-towed gear equipped with a high-resolution (21 MPix), wide-angle CANON EOS 1Ds Mark III camera system. Towed behind the ship at a speed of 0.5 kn, OFOS was operated at a preferred height of 1.5 m above the seabed. For positioning, GPS fixes and water depth information were used. Water depth information was taken from an OFOS mounted depth sensor and from the bathymetry data. . .”

Comment Page 1644 Line 6: Please mention why there are no photographs, e.g. no seabed images are available as the preferred height of 1.5 m from the seabed was not achievable along the steeper slopes. In the methods you wrote what reasons for rejecting images from analysis were. Reply: From this seabed class, no OFOS images exist in the first place. To clarify, the following sentence will be added to the paragraph: “Unfortunately, no seabed images are available for groundtruthing of this seabed class. Due to the prevailing ice conditions at the time of the OFOS surveys, these parts of the Nachtgaller Hill were inaccessible and thus not covered by any OFOS transect.”

Comment Page 1649 Line 1: Compared to the other sections, the local hydrography is not well described. There is no mentioning of the water masses (like Weddell Sea

C1298

Bottom Water, Warm Deep Water, Weddell Sea Deep Water) present in the region or of the currents (in the influence of the Weddell Gyre?). A general southwest to northeast flow pattern is mentioned, is this linked to any named current? Line 11: What are the strong influences of the regional oceanography? Line 13: How is this statement supported? Which water masses are interleaving? Line 16: I would like to see a statement that station 165-1 is lower in oxygen content than the other 3 CTD stations, why is this the case? Reply: The chapter 3.5 'Local hydrography' will be extended and additional information will be, if available; provided. It will read: "All water column profiles (fig. 7a) show strong local effects due to the influence of Nachtigaller Hill acting as obstacle to the general southwest to northeast flow patterns in the area (Absy et al., 2008; Schröder et al., 2002). This influence decreases with increasing distance to the hill. The hydrographic conditions around Nachtigaller Hill are dominated by low saline and cold shelf waters, which affect the top 500 m of the water column (Absy et al., 2008). Depending on the local winter conditions and sea ice cover, the influence of the Winter Water (WW) is detectable in the top 100m to 150 m in some profiles (fig. 7). The profile from station 189-2 represented the local hydrography above the plateau. Despite some highly variable surface effects, all measured parameters show a well-mixed water column above the plateau at the time of the cruise (fig. 7b-d). The stations 165-1 and 185-5 represent the hydrographic regime above the downstream slopes of the hill. These profiles display the perturbation of the hydrographic regime above the hill flanks. Station 190-1 already shows strong influences of the regional oceanography expressed by a perturbation of the background water column structure by the Nachtigaller Hill acting as an obstacle to the general flow patterns in the area (fig. 7 c-d). At this station, between 100 and 200 m wd, the excursions in the potential temperature clearly display the interleaving of local and mechanically disturbed water at the hill site with the undisturbed background waters of the surrounding shelf setting (fig. 7c). Also the mixed layer, deepening from station 165-1 to 185-5 and to 190-1, indicates the decreasing effect of the local hydrography away from Nachtigaller Hill (fig. 7c-d)." Page 1649 Line 16: As for the last comment on chapter 3.5 'Local hydrography';

C1299

The data represent the top 80 m of the water column. In this depth interval, variations in oxygen levels can be caused by different processes (e.g. ice coverage, primary productivity). Unfortunately, it is not possible to identify these processes on the basis of only 3 water column profiles that were recorded within a short time interval. In addition, a variability of oxygen concentrations of 10 $\mu\text{mol/kg}$ is quite normal for the upper water column and close to the detection limit.

Comment Page 1651 Line 4: Please explain this statement, what is meant with similarly? Similar in size, in biomass, in abundance, in distance from each other? "As a consequence" might not be the correct wording. What is meant with the phrase? Please reword the sentence. As I understand it, you want to state that the Nachtigaller Hill epibenthic communities resemble those of the Antarctic Peninsula based on community similarity rather than those communities of the Eastern Weddell Sea. Would it be possible to strengthen this statement with an analysis/test comparing the 4 epibenthic communities: 1) eastern Ant Pen, 2) western Ant Pen, 3) eastern Weddell Sea and 4) Nachtigaller Hill using comparable UW photos from all 4 areas? Reply: The paragraph will be rephrased and read: "Typical high-latitude gorgonians (e.g. the genera *Thouarella* and *Dasystenella*) show distribution pattern similar to the sponges. They generally occur on both sides of the Antarctic Peninsula with locally high specimen densities and show a more regional distribution in the eastern Weddell Sea (Gutt et al., 2013b; Lockhart and Jones, 2008). On the Nachtigaller Hill, epibenthic communities resemble those of the Antarctic Peninsula based on community similarity rather than the communities of the Eastern Weddell Sea. In this case, (short-distance) dispersal between Nachtigaller Hill and the Antarctic Peninsula must have happened perpendicular to the prevalent current from the south." A comparison of the west and east Antarctic Peninsula, the east Weddell Sea and the Nachtigaller Hill as suggested would certainly be a very interesting study. It goes however beyond the scope of this publication and would be sufficient as a future publication on its own.

Comment Page 1651 Line 9/10: I am not an expert in the local/regional current sys-

C1300

tem of the area to the west or the Antarctic Peninsula. Are there currents that flow from the western Ant Pen towards Nachtigaller Hill? My very general knowledge of currents is aware of the current flowing out of the Weddell Sea into the Bransfield Strait, which would be the opposite direction. Please back up these oceanographic statements/hypotheses with references. Reply: The last part of the paragraph will be rephrased and read: "Nachtigaller Hill is however located in the extension of the Antarctic Sound. This could facilitate recruitment with larvae from the western side of the Antarctic Peninsula. Although this remains speculative as it would be in the opposite direction of the general current direction, it can however not be ruled out due to the turbulent hydrographic conditions in the Antarctic Sound (Sangrà et al., 2014). Larval drift, from the southeast and south Weddell Sea must have happened over a longer distance with the Weddell Gyre."

Comment Page 1651 Line 12: This section (4.2 Habitat distribution characterisation and distribution) describes the habitat distribution of Nachtigaller Hill very well and what might be the reasons for it. What I am missing is the comparison to other habitat characterisation studies, e.g. if the authors' statement p1652, line 25 is not specific for this habitat but has been found elsewhere, too. Reply: References to e.g. Bowden et al., 2010; Genin et al., 1986 in the discussion will explain our findings on Nachtigaller Hill in relation to studies in other more or less similar settings.

Comment Page 1651 Line 20: Please add reference for this general statement on macroalgal distribution and it would be beneficial if a statement on the distribution depth of Antarctic macroalgae can be added. Work by Wiencke and others should provide this information. This would inform the reader if the depth of Nachtigaller Hill in which the macroalgae were observed are typical or deep for macroalgal distributions in the continental Antarctic. Reply: The part on macroalgae will be rephrased and read: ". Light levels are a function of the water depth and turbidity and, in polar regions, also of ice cover (Wulff et al., 2009). In addition, the presence of macroalgae can be used to indicate the light level critical for photosynthesis (Gómez et al., 1997). In general, off

C1301

the Antarctic Peninsula large macroalgae like *Himantothallus grandifolius* have been found at water depths up to 90 m, and smaller foliose and filamentous algae can occur at even greater depths (Wiencke et al., 2007)."

Comment Page 1652 Line 29: Reference publications on photic zone in Antarctic waters so readers can see if these observed depth are "normal" or special. Please set your findings into context. Reply: The following sentence will be added: ". . . within the photic zone. This depth distribution of the macroalgae is in good agreement with findings published Gómez et al. (1997) from King Georg Island. Although there, most occurrences were limited to <40 m wd. Fischer and Wiencke (1992), however reported occurrences of macroalgae down to 90 m wd in this area based on dredge samples."

Comment Page 1653 Line 3: Again for this and the following paragraphs on the geomorphology, how are these findings comparable with other Antarctic seamounts, e.g. Bowden et al 2010 DSRII 58:119-127. Reply: The studies of Bowden et al., 2010 MORE will be included in the introduction and referenced in the discussion.

Comment Page 1655 Lines 3-8: In this paragraph I miss references to Clarke & Tyler 2008 *Current Biology* 18:282-285 to significant numbers of krill in abyssal depth of the SO and to work by Grange and Smith 2013 *PLoS One* 8, e77917 Please also comment on that krill is attracted by light and is reported to following marine equipment with light down - see references in publically available Antarctic cruise reports. Reply: The paragraph on krill will be rephrased and extended to: "On a site note, high abundances of krill have been observed at 3 locations on the shelf to the northeast of the hill at 400-420 m wd. The phenomenon that krill can regionally aggregate at unusually deep sites close to the sea-floor is known to occur at some sites in the Weddell Sea and around the Antarctic Peninsula. It has been reported from fjords (Grange and Smith, 2013), the shelf (Schmidt et al., 2011) and abyssal depths (Clarke and Tyler, 2008) west of the Antarctic Peninsula and the deep shelf of the southeast Weddell Sea (Gutt and Siegel, 1994). Along the remaining transects, krill has only occurred sporadically and in low numbers. This krill might have been attracted by the light of the OFOS but

C1302

must have been in the vicinity in first place.”

Comment Page 1655 Line 21: On page 1647 line 15 this correlation is called "moderate"; how can it be called "good" now? Please explain or change in one of the paragraphs. Reply: 'good' will be changed to 'moderate' as is correct.

Dear Ms Linse thank you again very much for these extremely helpful comments on our manuscript.

Interactive comment on Biogeosciences Discuss., 11, 1631, 2014.

C1303