individual comments:

1) Question: Section 2.3, p10466: please show the appropriate T-S diagrams

Answer: In the revised manuscript the T_{pot}-S diagram of vertical water column profiles measured during MSM17/3 in the NBUS region was implemented (as Fig. 2). The O_2 concentration is indicated by colour shading and the end points of Eastern South Atlantic Central Water (ESACW) and South Atlantic Central Water (SACW) specify the definition source water types given in the text.

2) Question: Section 3, p10467, line 6-8: this sentence is too long and not very clear; please reformulate.

Answer: We made the following changes, lines 200-206: "It has been shown that on a global scale the distribution of N : P is characterized by a relative deficit of N towards P as indicated by the intercept and slope of global N : P correlation. The intercept indicates a P excess of ~ 0.18 µmol kg^{-1} in the global surface ocean (Gruber and Sarmiento, 1997). The mean slope suggests a ratio of N : P = 14-15 : 1 and is below the classical Redfield correlation of N : P = 16 : 1 (Redfield et al., 1963) due to a net loss of fixed N that occurs e.g. within the OMZ on the Namibian shelf (Kuypers et al., 2005; Nagel et al., 2013)."

3) Question: 3.1, p10469, line 1: This is in line (is was missing).

Answer: was corrected in the revised manuscript

4) Question: 3.1, p10469, line 4-11: this section is not very clear. Make clear what causes the PO4 maximum where. Do the authors suggest that the PO4 max in the Kunene section originates from PO4 efflux? Also maybe redraw Figure 5 by showing the ODV plots of NO3 and PO4 with O2 iso-lines superimposed instead of the opposite.

Answer: We agree that the section is confusing. Off Kunene there are no indications for P efflux between the sediment water interface compared to the Walvis Bay transect. Fig. 5 was redrawn according to the suggestions, i. e. NOx and PO4 represented by colour and O2 superimposed by black lines. Additionally, we deleted the Rocky Point transect to make the Fig. 5 less confusing and to increase the size of the graphs. The main message of the spatial decoupling of NOx_{max} and $PO4_{max}$ becomes apparent also with the 2 transects presented.

In the revised manuscript we made the following reformulation, lines 253-265: "Accordingly, the impact of NO_x loss and benthic PO_4^{3-} fluxes on the suboxic bottom layer should be observable by a spatial decoupling of NO_x and PO_4^{3-} maxima, i.e. $NO_{x\ max}$ is expectable outside and $PO_4^{3-}{}_{max}$ inside of the OMZ. This is in agreement with our observations of PO_4^{3-} and NO_x maxima along the Namibian shelf and slope (Fig. 5; exemplary for the MSM17/3 cruise in February 2011). The OMZ was positioned between 300 and 400 m water depth off Kunene (17.25 °S) (Fig. 5a) stretching from the slope towards the open ocean. The NO_x and PO_4^{3-} maxima ($NO_{x\ max}$ = 45 µmol kg $^{-1}$; $PO_4^{3-}{}_{max}$ = 2.8 µmol kg $^{-1}$) where observed at the same depth ranges slightly below the OMZ. In contrast, off Walvis Bay the OMZ was restricted to the shallow shelf region (23°S) (Fig. 5b) overlying the diatomaceous mud belt where the large sulphur bacteria occur (Goldhammer et al., 2011). In fact, PO_4^{3-} was strongly elevated ($PO_4^{3-}{}_{max}$ = 4.8 µmol kg $^{-1}$) and measured inside the OMZ while the $NO_{x\ max}$ had decreased to 35 µmol kg $^{-1}$ and was observed outside the OMZ."

5) Question: Section: 3.2, p10470, line 15: "...the decomposition of organic matter exported locally from the surface..."; lines 18-19: "This variability was.." be more explicit here.

Answer: In the revised manuscript we made the following reformulation, lines 288-303: "SACW is characterized by much lower O_2 concentrations than ESACW (Mohrholz et al., 2007) and is also evident from our data (Fig. 2). In fact, the dominance of SACW was reflected in mid-water O_2 deficits, so that samples with ≥80 % SACW were associated with ≤

50 µmol kg^{-1} O_2 (Fig. 7). However, during strong and weak upwelling alike and regardless of the SACW contribution, the O_2 concentrations on the shelf off Walvis Bay were < 20 µmol kg^{-1} during all cruises. It likely reflects the strong O_2 demand caused by the organic-rich mud belt area and is in line with previous studies showing that SACW sets the precondition for anoxia in bottom waters off Walvis Bay but that the local sedimentary O_2 demand plays a decisive role as well (Monteiro et al., 2006; van der Plas et al., 2007).

The N : P deviation from Redfield (as indicated by N*) varied during the different expeditions and upwelling states (Fig. 8) revealing strong N* deficits in coastal bottom waters (Fig. 8a-c) comparable with reported values (Tyrrell and Lucas, 2002; Nagel et al., 2013). However, the range of N* varied strongly especially at offshore sites, e.g. off Rocky Point and Kunene where SACW dominates (Fig. 7d-f) indicating that the N* signature of SACW differs."

6) Question: What is it you want the reader to discover from Fig. 7?

Answer: The intention of Fig. 7 is to show that less upwelling "intensity" (reference to Fig. 6) is reflected in stronger extension of O_2-depleted SACW on the NBUS shelf also evident from the distribution of O_2 over the shelf. As suggested in **1) Question** we added the T-S plot to indicate SACW and ESACW including their O_2 concentration (Fig. 2 in the revised manuscript). Hence, the differences of O_2 concentration between ESACW and SACW are also visible from Fig. 2 now. We kept Fig. 7a-c because it shows that at the coastal stations off Walvis Bay the O_2 concentrations were < 20 µmol kg^{-1} independent of SACW contributions. It emphasises that in addition to the amount of SACW, the local sedimentary O_2 demand plays a decisive role for anoxia in bottom waters off Walvis Bay.

7) Question: Line 17, p10470 till the end of section 3.2: The discussion about N*: Subsurface positive N* values are attributed to nitrate remineralised from OM produced by N2-fixers and advected southward with SACW. The nice coincidence of subsurface water N* max with the

O2 min waters (Fig.9; Kunene section; offshore stations) thus reflects the remineralisation, right? But nothing is said here about the negative N* values in the very surface waters (due to Ekman transport of upwelled water?) and in deeper water where O2 is plentiful. Maybe the use of the global equation to calculate N* is not fully appropriate here, and regional, local variations in the NO3/PO4 ratios need to be taken into account; see paper by Singh et al. (DSR I, 93, 2013). This needs to be discussed further.

Answer: In the revised manuscript we considered the above suggestions and made the following changes: line 317-318: "The impact of mineralization is reflected in minimum O_2 concentrations that coincide with maximum N* values within the SACW fraction."

line 325–331: "N_2 fixation is particularly facilitated by PO_4^{3-} and the availability of micronutrients, e. g. iron (Fe) (Mills et al., 2004). The low N_2 fixation in the South Atlantic has been attributed to a lack of iron (Fe) supply rather than phosphate availability (Moore et al., 2009). This is supported by the negative N* observed in the surface water offshore of Kunene (Fig. 9) caused by PO_4^{3-} concentrations that ranged between 0.17 - 0.28 µmol kg^{-1} and exceeded NO_3^- concentrations resulting in the surface water N* deficits. The very low NO_x concentrations further suggest that atmospheric deposition that is assumed to be another significant N source to the ocean (Duce et al., 2008; Baker et al., 2013) is negligible."

line 339-347: "This time period is comparable to a time lag of ~2 months that was observed between the occurrence of *Trichodesmium* and the response in N* (Singh et al., 2013). Although the N_2 fixation rates were relatively low (22-85 µmol N m^{-2} d^{-1}) (Sohm et al., 2011b), it was proven that N_2 fixation occurs north of the ABFZ, probably also at higher rates suggesting that N_2 fixation is a feasible input source that caused the observed N excess in the SACW in 2008. Furthermore, proceedings in methodology (Großkopf et al., 2012) and the broadening range of identified species involved in N_2 fixation (Moisander et al., 2010; Zehr, 2011) suggest that rates and regions of N_2 fixation may have been considerably underestimated so far."

8) Question: Section 3.3, p10472, line 12; sentence starting with: "Since the mud belt is a geological feature..." what is the reader supposed to deduct from that statement? Please be more explicit. Further down sentence "..variability of that P source depends..." authors mean P* source?

Answer: We rephrased this part, lines 355-361: "As shown before the bottom water off Walvis Bay was low in O_2 independent of the upwelling situation (Fig. 8) leading to strongly elevated PO_4^{3-} and reduced NO_3^- maxima off Walvis Bay (Fig. 6). It implies that especially the mud belt of the shallow central Namibian shelf is a region of continuous P* generation via N loss and P efflux. It is assumed that the inter-annual variability of P* in the surface (Fig. 10) depends mainly on the N excess in the SACW that is produced probably by N_2 fixation north of the ABFZ."

9) Question: Fig. 1: ESACW is defined as Eastern South Atlantic Central Water, but in the text at p10463 it is called Eastern South Atlantic Water..please check for other typos

Answer: Correction was made in the revised manuscript, line 103: "... Eastern South Atlantic Central Water (ESACW)..."

10) Question: Fig.3: please use different symbols which eventually also are visible in a black and white print out; avoid grey shadings; correct inserted legend of 3a: Benguela

Answer: The legend in panel a) was corrected. The shading in panel c) was replaced by open squares. The red filling representing the samples associated with $O_2 \leq 20$ µmol kg^{-1} is kept in the revised manuscript because two more symbols (shelf and offshore samples with $O_2 \leq 20$ µmol kg^{-1}) would complicate the graph.

11) Question: Fig. 4 lots of typos here; please check; the legend mention 'lines' but these are arrows of which only two of the 3 are explained in the legend.

Answer: In the revised manuscript Fig. 4 was included in former Fig. 3 representing Fig. 4d now. The typos were corrected.

12) Fig. 5: Increase size of the graphs. Suggestion: inverse the representation: show ODV plots of NO3 and PO4 and superimpose O2 isolines.

Answer: please refer to the answer given to **4) Question**

13) Fig. 6: How was the gridding obtained for the December cruise between Rocky Point and Walvis Bay (since the central part of the area was not sampled)? Idem for the offshore region in February.

Answer: For gridding of SST the kriging method was applied (Golden Software, Surfer 10) that uses trends in the map to extrapolate into areas of no data. In the revised manuscript we included a short note in the captions of figures where gridding was applied, e. g. line: 631-633: "The gridding was performed on the basis of data points represented by the black line (cruise track) and black dots (sampled stations); areas of no data were extrapolated (kriging method)."

14) Fig. 10: Specify the months and indicate in the figure caption this is the section off Walvis Bay.

Answer: The suggested modifications were made in the revised manuscript.

15) Fig. 11: blue dashed line and grey shadings are barely visible.

Answer: In the revised manuscript the shadings where deleted because is it not important for the main message of the graph, the dashed lines were intensified.

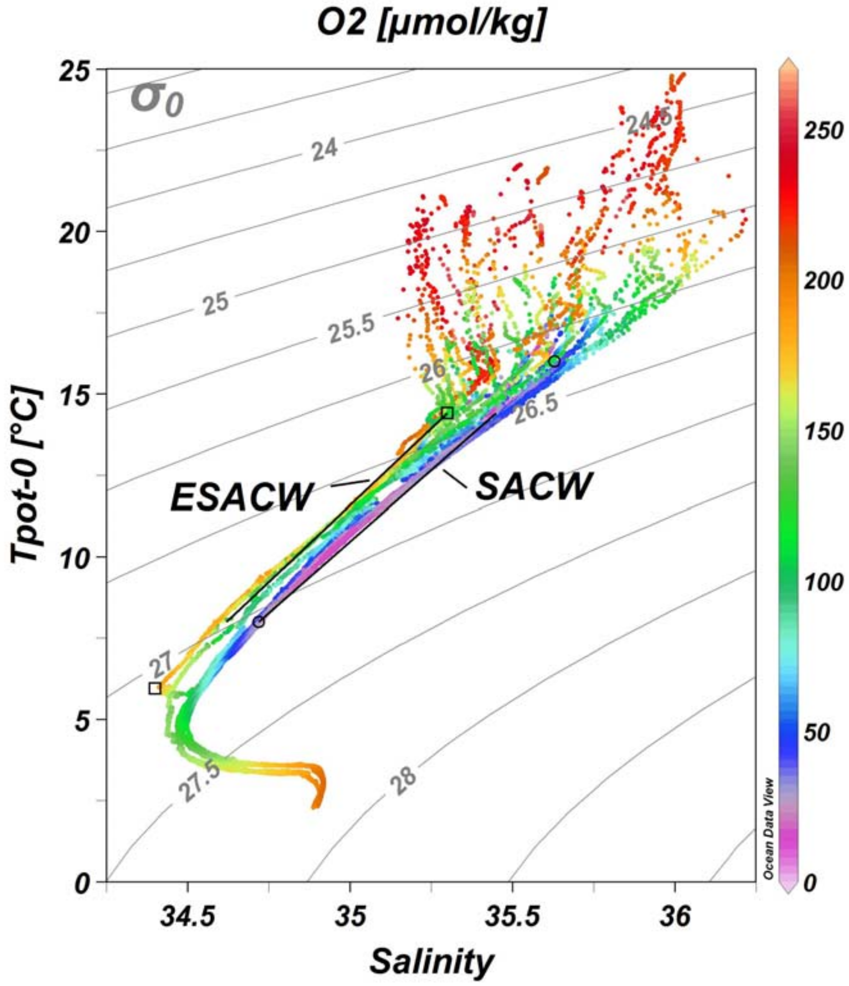

Fig. 2: T_{pot}-S diagram of vertical water column profiles measured during MSM17/3 in the NBUS region. The O_2 concentration (µmol kg^{-1}) is indicated by colour shading and isopycnals (kg m^{-3}) are given by the grey lines. The end points of Eastern South Atlantic Central Water (ESACW, open squares) and South Atlantic Central Water (SACW, open circles) specify the definition source water types given in the text. The T_{pot}-S range that was used to calculate their relative contribution in water samples from > 100 m water depth is indicated by the black lines.

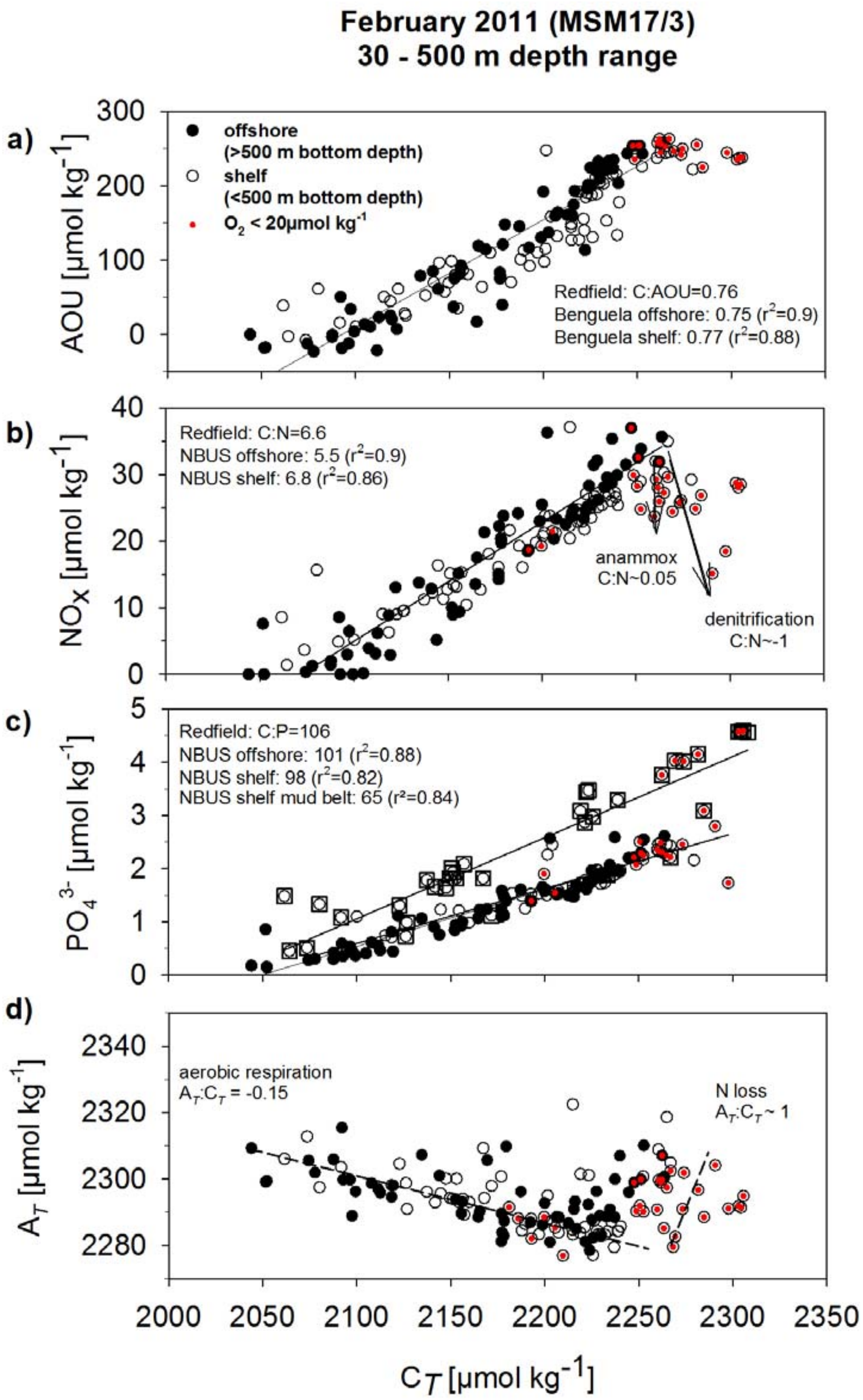

Fig. 4. (a) AOU, (b) NO_x, (c) PO_4^3 and (d) A_T versus C_T (all in μmol kg^{-1}) as measured during the MSM17/3 cruise in February 2011 within the range of 30–500 m water depth. Black filled dots indicate offshore stations and open circles represent slope and shelf stations. Data points associated with O_2 concentrations ≤ 20 μmol kg^{-1} are represented by red filling. The correlations observed for the Benguela are given and indicated by the black line. The reported ratios in panel (a) and (b) are derived by excluding the ≤ 20 μmol kg^{-1} data. The open squares

in panel (c) represent data from the mud belt region. (d) The dashed black lines indicate the expected correlation caused by aerobic mineralization $A_T : C_T$ =-16 : 106 = -0.15 (Redfield et al., 1963) and N loss, e. g. du to denitrification $A_T : C_T$ =104 : 106 ~ 1.0 (Gruber and Sarmiento, 1997).

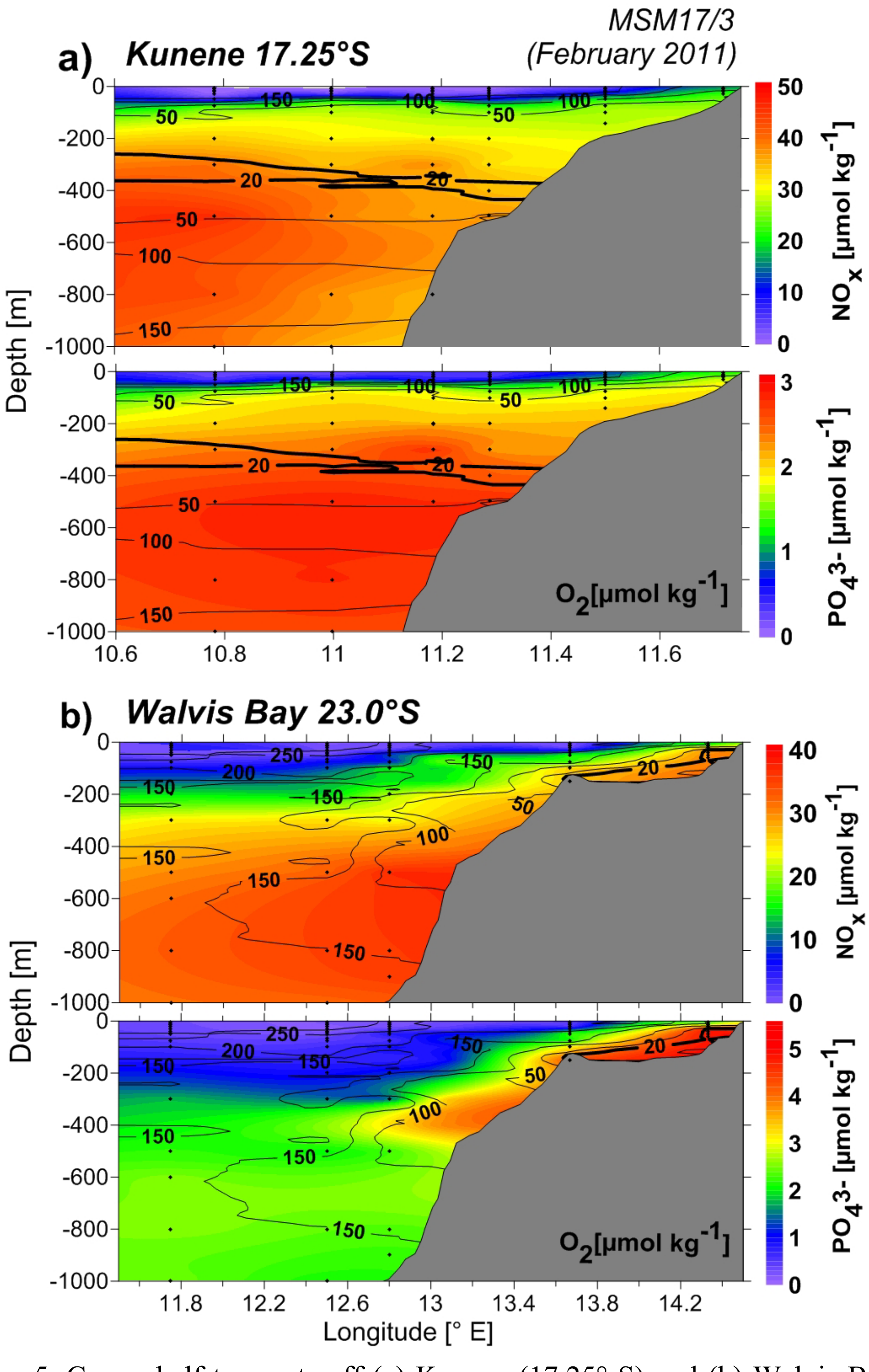

Fig. 5. Cross shelf transects off (a) Kunene (17.25° S) and (b) Walvis Bay (23.0° S) during MSM17/3 cruise showing the spatial decoupling of NO_x and PO_4^{3-} maxima. The NO_x and PO_4^{3-} concentrations (colour shading, in µmol kg^{-1}) are overlain by the O_2 concentrations (black isolines, in µmol kg^{-1}). Low O_2 concentration of < 20 µmol kg^{-1} is marked by the bold black line. The sampled stations used for gridding are indicated by black dots; areas of no data were extrapolated (kriging method).

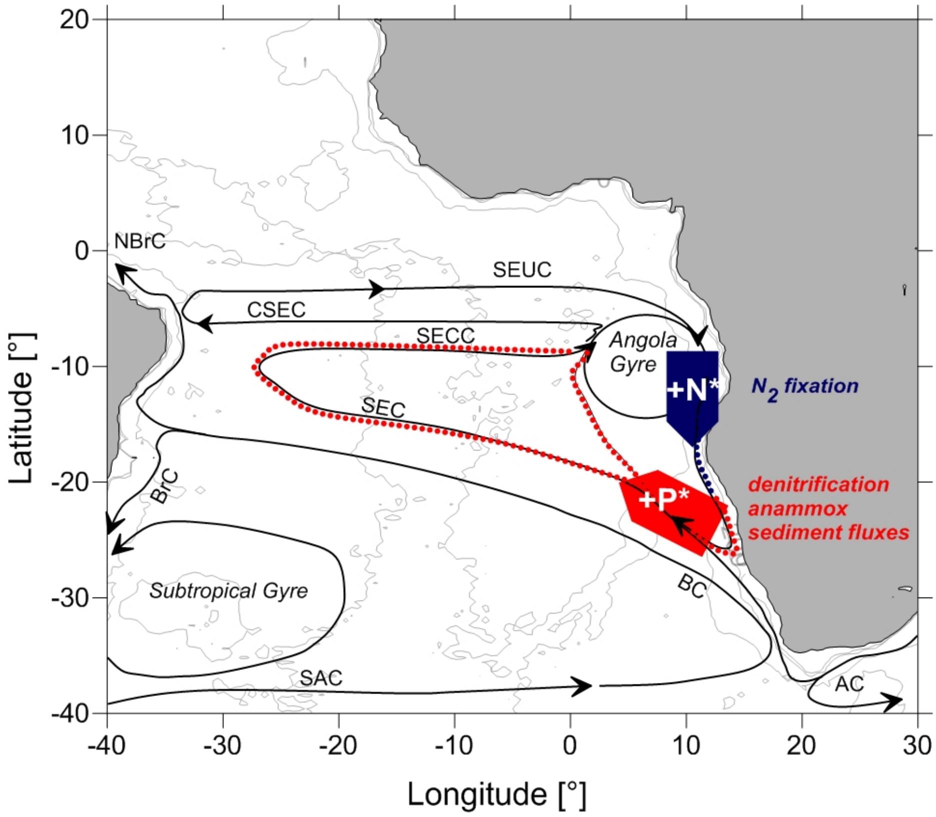

Fig. 11. Map of the wind driven large scale circulation (100-500 m depth range) of the South Atlantic Ocean (adapted from Stramma and England (1999)). The map illustrates the hypothetical advection of the +P* (red dashed line) via SEC and SECC towards the Angola Gyre where it fuels N_2 fixation and in turn results in a relative N excess (+N*, blue dashed line) that is introduced to the NBUS. AC, Agulhas Current; BC, Benguela Current; BrC, Brazil Current; CSEC, Central South Equatorial Current; NBrC; North Brazil Current; SAC, South Atlantic Current; SEC, South Equatorial Current; SECC, South Equatorial Countercurrent; SEUC, South Equatorial Undercurrent.