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Ocean Science Discussions

Interactive comment on "On the Atlantic cold tongue mode and the role of the Pacific ENSO" *by* R. A. F. De Almeida and P. Nobre

Anonymous Referee #2

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The paper analyzes different remote sensing and in-situ data sets of the tropical Atlantic. It is based on statistical methods mainly utilizing EOF techniques. The main results are 1) the Bjerknes feedback is active and is seasonal dependent, 2) there is a negative feedback associated with oceanic heat advection, and 3) there is an impact of the Pacific ENSO on the Atlantic cold tongue mode. All three points are discussed in the literature. Important references are not discussed or cited in the present manuscript. In this way it is not possible to see the advantages of the present study compared to previous studies.

The first point, which is discussed in detail in Keenlyside and Latif (2007), Okumura and Xie (2006) and other papers and which can be hardly accepted as a new result, is probably meant is an introduction. This point makes more than half of the abstract.

The authors clearly have to state, where they obtain just the same results as others and what can be considered as new results.

It is true that the negative feedback required for a climate mode is less discussed in the literature. However there are a few old, but also very recent publications particularly analyzing the negative feedback including studies based on data (e.g. Jansen et al, 2009; Ding et al. 2010). For example, Ding et al. (2010) noted that equatorial averaged SSH acts as a delayed negative feedback for the zonal mode, as a strong anticorrelation occurs when SST variations lead SSH fluctuations by 6 months. They conclude that this phase relationship is in accord with model results (Zebiak, 1993) and the delayed action/recharge oscillator mechanism (Jansen et al., 2009).

There is a large amount of publications discussing the influence of the Pacific ENSO on the SST variability in the tropical Atlantic through atmospheric teleconnections (Sutton et al., 2000, Huang, 2004 and others). A discussion on that topic can be found for example in Chang et al. (2006). What are the new results? Several authors recently discussed the impact of the Atlantic on the Pacific, which should be at least mentioned (e.g. Rodriguez-Fonseca et al. 2009).

In conclusion, the paper requires substantial rewriting to be published. This includes a thorough literature review as well as a more detailed description of the statistical methods. There is room to add a validation of the different steps in the statistical analysis, e.g., what is subtracted, what is remaining, why it is useful to do?

Other points:

“only few studies based on direct observations” This is not the case. There is a large number of studies, including Okumura and Xie (2006) studying the Bjerknes feedback during Nov/Dec as well as Keenlyside and Latif (2007), Ding et al. (2010). A thorough literature review is required. Further references

Besides the references mentioned above, there are important papers missing in the

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reference list, like e.g. Carton and Huang (1994). The statement that "the Bjerknes feedback is responsible for the cold tongue mode" (end of page 166) is not necessarily the whole story. Caniaux et al. (2011) studied the mechanisms for the onset of the Atlantic cold tongue and its role for the onset of the West African Monsoon. Meridional wind fluctuations as well as shear driven diapycnal mixing events can play an important role (Marin et al. 2009). Internal deep ocean dynamics, i.e. upward propagating equatorial deep jet energy, may trigger SST variability, too (Brandt et al. 2011). Statistical method:

The statistical analysis requires a more detailed description and explanation/validation of the different steps: Why it is necessary to remove the interannual and decadal modes of variability? What would be the result if this variability would not be removed? Are there other types of variability, which are not Bjerknes-like? What is the remaining standard deviation (please give the values used for the normalization) that is used to normalize the different fields or how large is the signal that is discussed? I am not able to follow the calculation that was done to project the NINO3 index onto Atlantic SST and wind data. Was it projected for each day of the seasonal cycle meaning that there is a different time lag throughout the year? This must be explained in more detail and justified.

Use of ADCP and PIRATA data: The usefulness of calculated temperature transport must be shown. First the data are differently analyzed compared to other data (SST, wind, Argo), for example the interannual variability is not subtracted. What does this mean? However more important is the large variability of the equatorial flow field on intraseasonal to inter-annual time scales (Kelvin- and Rossby waves and even the deep jet cycle) that is not related at all with the Bjerknes feedback. With the presented ADCP dataset it seems to be very unlikely that it will just capture the velocity anomaly associated with a weak flow response from the ocean atmosphere interaction. Another point is the calculation using a fixed depth assumption for calculating horizontal temperature gradients. While this calculation cannot take into account the inclination of isopycnal

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surfaces along the equator (as discussed by the authors), it would also depend on the interannual variation of this inclination. I doubt that the in-situ data presented here can be used to show a negative feedback. Anyway, the calculation of a temperature transport and its relevance (compared to other terms) could be tested using high-resolution ocean simulations.

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