

## ***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 #1**

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In this paper, the authors present a statistical analysis (EOF) of the variability (from seasonal to interannual) of the equatorial mode (sometimes also called “El Nino mode” or “cold tongue mode” by the authors) in the tropical Atlantic Ocean. Their statistical analysis is done through the anomalies of the zonal wind velocity (in the western part of the basin), the sea surface temperature (SST) and depth of the 20°C isotherm (associated to the thermocline depth), as being the three main parameters involved in the Bjerknes dynamical process. Their results confirm the seasonality of the Atlantic cold tongue mode in boreal summer. The authors also suggest that the Pacific Ocean Nino events have a consequent impact of the equatorial mode. a) General remarks: This manuscript is far to be clear in its objectives, arguments and developments. Statistical results are presented in a very confuse way, and the use of Argo profilers and ADCP Pirata data (with very short duration of exploitable data) is not well justified. Recent other

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studies related to similar objectives are not referenced and discussed enough, which gets the originality of the results very badly evidenced. Therefore, this manuscript cannot be published in the actual format and I do suggest its rejection. I also suggest a complete rewriting and reorganization before an eventual resubmission. ěČř Principal Criteria : FAIR (3)

b) Detailed remarks/suggestions: Abstract: Authors write that their results confirm the “robustness and seasonality of the Atlantic cold tongue mode”. I do not think such a result to be new. . . The analyzed time scales have to be specified. Also, I do not think that the results concerning the dynamical Bjerknes mechanism is very new, moreover when obtained from EOF analysis. . . Other processes are also in play, that are not, or very sparsely, mentioned. 1 Introduction: - the so-called ‘cold tongue mode’ is, to my knowledge, rather called “equatorial mode” or “zonal mode” in most of the literature. The name “cold tongue” is more a SST seasonal signal in the eastern equatorial that is amplified or reduced during equatorial mode events. The authors could better explain which phenomena (and associated time scale of variability) they precisely want to focus on. - the general presentation of the topic deserves more references to previous works. Presently, the Bjerknes dynamical process/feedback has been recently analyzed in the tropical Atlantic by several authors (eg Carton, Ding,. . .) and potential influence of the Pacific ENSO too (eg Saravanan, Giannini. . .). - it is stated that “the Atlantic cold tongue has been studied. . . with only a few studies based on direct observations” ! a few references would be useful, and presently several studies have been published from in situ data (Servain, Foltz,Wade. . .). About model bias, reference to Davey would be appropriate! And for better understanding of the ocean atmosphere interactions and potential importance of waves, several recent studies have been published too (Marin, Caniaux, Wade, Jouanno. . .). I provide a list of references below. - when mentioning the Argo floats, the reference is Smith 2000. The relationship between Argo profilers and this paper is not clear. . . . Presently, the deployment of profilers in the frame of the Argo program was initiated in 2000 and the Smith paper is more dedicated on assimilation data needs for operational purpose (GODAE)! It would be better to provide

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the Argo web site address of a reference of a technical/scientific paper. Furthermore, a discussion on these data accuracy would be valuable (eg, Figure 1c suggests that it is difficult to trust time series got before 2002/2003!). - editing/typing pb: (PIRATA) then reference (Bourlès et al. 2008) without parenthesis. - EOF: precise (when written for the first time in the paper and even if well known. . .) this acronym. Reference would also be useful.

2 Data and Methods: - The first sentence suggests that the Bjerknes feedback would be the only process responsible for the generation of the cold tongue. . . This has to be justified! (eg Caniaux, Jouanno, Marin. . . among others also suggest other local processes and importance of vertical mixing due to current shears!). - That the winds are only considered in the western tropical Atlantic is never justified. . . Even well known by specialists of the topic, this has to be justified and referenced. - About the Z20 estimated from the Argo profilers. Some words about the data sources would be useful, along with associated errors. How many profilers were available and used? Authors write that the Z20 is short, noisy and with gaps, but more information would be useful. . . from the Z20 plot (figure 1c), it seems that data from 1996 to 2002 are far to be valuable and exploitable. . . See eg Wade et al about Argo profilers in the area. Comparison with a Z20 estimated from the PIRATA data would be interesting! (at 23W and 10W). - About ADCP data at 23W: it is difficult to be convinced that such short time series are “sufficient to illustrate how the ocean dynamics impacts the Atlantic Ninos. . .”. Refer to Hormann and Brandt 2009 for more details on this data set! - How are obtained the seasonal cycles shown in Fig 1 (average of all available year/months -to be précised-)? Same remark for interannual (average of all months/year. . .?). Even if some explanation are provided after in the text (2.2 EOF method) that should be explained when the Figure is introduced. In the legend of Fig 1, maybe precise that it is a “mean” seasonal cycle (lower plots). - 365 points = daily data! - “Due to the sparcity of the PIRATA data. . .”: I really do not understand how to fill gaps (using linear adjustment) to get seasonal cycles from such a reduced data set (form Fig 1d, we see that only one cycle seems complete in 2008). This point deserves more explanations!

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cold tongue mode - The sentence “the high fraction is expected from the way the data was constrained. . . eliminating the seasonal cycle and long-term oscillations” is far to be clear in the context of the presented results (Figure 2), where the seasonal evolution is described! (if I well understand. . . presently, some explanations are very confusing to me). - What does mean “the first mode leaves the Tropical Atlantic in a state different from the beginning of the year”? - What does mean “PC” in the text and PC1&PC2 in the Figure 2 legend (I guess Principal Component. . .?). - The potential modulation of the Atlantic by the Pacific is not only suggested from modeling studies (as stated in the 1st sentence of 3.2), but also from climatologies... See Giannini for ex. - How is chosen the lag of 6 months between ENSO and Atl. Cold tongue? (reference)? “assuming a priori..” is not a scientific argument. - How is defined the “Atlantic cold tongue index”? (Figure 4). - The ENSO of 1997/98 and 1982/83 had either an impact of not on the Atlantic, both in agreement with Chang et al, 2006. How is that explained (I do not well understand the reasoning and arguments. . . - Can the zonal temperature gradient along the equator estimated from 2 buoys separated by 25° of longitude be relevant and significant? - For the event of 2005, see Marin et al. . . (same for the discussion in the conclusion!).

To conclude, I am far to be convinced by this paper in its present form. . . A straightforward review of other papers concerning the variability in the Tropical Atlantic is absolutely needed in order to put better into evidence the scope of this study! In this way, I provide below a list of papers (that should, at least for some of them, be used for argumentations and discussions) : Brandt, et al., Circulation in the central equatorial Atlantic: Mean and intraseasonal to seasonal variability, GRL, 33, 2006

Caniaux et al., Couplings between the Atlantic cold tongue, the St Helena anticyclone, and the African monsoon in boreal spring and summer, JGR, 116, 2011.

Carton and Huang, Warm events in the tropical Atlantic, JPO, 24, 1994.

Davey, et al., STOIC: A study of coupled model climatology and variability in tropical

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ocean regions, *Clim. Dyn.*, 2002

Ding et al., Equatorial Atlantic interannual variability: Role of heat content, *JGR*, 115, 2010.

Foltz and McPhaden, Interaction between the Atlantic meridional and Niño modes, *GRL*, 2010.

Giannini et al., Interannual variability of Caribbean rainfall, ENSO, and the Atlantic Ocean, *J. Clim.*, , 2000

Hormann and Brandt, Upper equatorial Atlantic variability during 2002 and 2005 associated with equatorial Kelvin waves, *JGR*, 114, 2009

Jouanno et al., Seasonal Modes of Surface Cooling in the Gulf of Guinea, *JPO*, 41, 2011

Marin et al, Why were sea surface temperatures so different in the eastern equatorial Atlantic in June 2005 and 2006? *JPO*, 39, 2009

Saravanan and Chang, Interaction between tropical Atlantic variability and El Niño–Southern Oscillation. *J. Climate*, 13, 2000.

Servain et al., Relationship between the equatorial and meridional modes of climate variability in the tropical Atlantic, *GRL*, 26, 1999

Servain et al., Modes of tropical Atlantic climate variability observed by PIRATA, *GRL*, 30, 2003

Wade et al., Variability of the mixed layer heat budget in the eastern equatorial Atlantic during 2005–2007 as inferred using Argo floats, *JGR*, 116, 2011

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