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Climate of the Past Discussions

Interactive comment on "Atlantic Multidecadal Oscillation (AMO) forcing on the late Holocene Cauca paleolake dynamics, northern Andes of Colombia" *by* J. I. Martínez et al.

Anonymous Referee #1

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This paper presents a "ria lake" sedimentary sequence from the northern Andes of Colombia where a 70-yr cycle during the last 3500 years is detected in the sediment colour and associated to the Atlantic Multidecal Oscillation (AMO) forcing. The sequence presented here, San Nicolás-1 core, comes from the Cauca paleolake (Santa Fe–Sopetran pullapart basin) in the middle Cauca Valley, northern Colombia. The sedimentological description, some geochemical information (d13C, C/N, d15N) and the chronological framework were published in the Journal of Paleolimnololgy by Martínez et al. (2013) where the main conclusion was an important change in the type of sedimentation at about 3000 yrs BP associated to the intensification of the ENSO forcing. San Nicolás-1 core is 24 m long and is made of the alternation of clay and silts with

variable content of organic matter (mostly reworked) and some sandy layers towards the top. There are several problems associated to ria lake environments as paleoclimatological sites, but importantly here is the presence of erosional surfaces (Fig. 2 and 3) meaning the sedimentation was interrupted and some material was lost by erosion. This is typical in an environment mostly controlled by fluvial activity, such as this one (Garcia et al., 2011), and adds a high complexity when elaborating the age model that must be taken into account.

Although this manuscript has the scientific interest of (1) providing a record from an area where paleoclimate information is yet scarce and (2) tackling the study of the AMO influence in the late Holocene (eg. Knudsen et al., 2011), the type of sedimentary archive, the proxy selected and the poorly constrained chronology may not be sufficient to support the hypothesis of an AMO forcing for late Holocene in the northern Andes.

Major comments

1. Selected proxy: image analyses and wavelet spectrum.

The new proxy presented here is the gray scale of the sediments. The authors recognize several difficulties to obtain such a record due to the sediment preservation (cracks, core voids) and the retrieval technique. But to me, the most important pitfall is the lack of interpretation of that proxy. What is the meaning of lighter colours in these sediments? Are they related to more precipitation but. . .throughout which process and how? More flood layers? Coarser grain-size? The interpretation of the gray scale is fundamental in this study since its cyclicity is later related to AMO variability. And more, why the authors first use gray scale and later red colour? I am missing a detailed explanation of those proxies in these sediments.

The wavelet spectra obtained from the red colour profile shows clearly the presence of the 70 yr cycle, but not continuously. It is important to highlight that in the manuscript and think about the process that may cause it. Is the AMO only forcing sedimentation here for some time intervals? Why? In order to compare with Cariaco or Chichancanab

sequences, it is fundamental to better define the time intervals where the 70 yr cycle is important.

2. Significance of climatic oscillations (PDO, AMO, ENSO, NAO) in the precipitation regime

Several climatic oscillations are named and described both in the introduction and climatological sections of this manuscript, including PDO, AMO, ENSO and NAO but, although all have an influence in the precipitation in the northern Andes, they are confusely described in the manuscript. In the first lines in page 2653 it is described that, in this particular basin, precipitation takes place in September and October when the ITCZ is in the north. Then, which is then the relationship, at present, among precipitation in the study area and PDO, ENSO, AMO, etc?

Besides, ENSO influence is not clear, neither at present-day or during the Holocene in the studied sequence, and, withoud discussing it in detail, an ENSO-AMO correlation for a particular time interval (2000-1500 yr BP) is included as a conclusion. This is not justified by the presented data.

Additionally, the location map of Fig. 1 is too simple for all the complex climatological interferences in the study region and only the ITCZ is represented.

I suggest rewriting this part of the manuscript (maybe a combination of the introduction and climatological sections), including a more detailed explanation of ENSO influence (based on the interpretation of the wavelet spectra) and a new location figure with more climatological information.

3. Chronological framework

I outlined above the issue of erosional surfaces regarding the construction of a reliable chronological model. But beside the presence of erosional surfaces (not constrained by dating here), many dates were rejected as supposed to be reworked (organic remains were probably transported by the river and corresponded to older material than the

sediment where they stored).

The chronology has not improved from Martínez et al. (2013) publication. Up to 14 samples were dated (not shown in this new manuscript) and only 7 were used for the age model (Fig. 3). The age model is obtained by a regression line that does not cross any date (in fact, it has a R2 of 0.0926). The age model could be completely different if the authors reject other dates. . . so the chronology is really very poorly constrained here. Additionally, the lack of good dates for the upper and lower sections of the sequence (there are only “good” dates from 8 to 20 meters) lead the authors to consider a stable and linear sedimentation rate for the whole sequence (highly questionable in this environment).

Therefore, it is not known the age of the top or bottom of the sequence and this record may cover a very different time interval and, more importantly, with very different sedimentation rates. With such a chronology is not justified (to me) to perform frequency analyses. Improving the chronological framework with (1) more dates or (2) throughout replication of the signal in other sequences (in Martínez et al. (2013) publication there are two more sequences from the same area) would be required to accept this manuscript.

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