Interactive comment on "Historical Climate off the Atlantic Iberian Peninsula" by Fátima Abrantes et al.

Anonymous Referee #1

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Review of Abrantes et al. 'Historical Climate off the Atlantic Iberian Peninsula'.

Abrantes et al present a regional reconstruction of hydroclimatic variability during the last 2ka in the Western Iberian margin. The results of three new cores, in combination with previously published records located across a latitudinal transect in the Western Iberian Peninsula, are used to generate new regional stacks of sea surface temperature (SST) and precipitation/river discharge. They find evidences of an interplay between several atmospheric circulation patterns (NAO, EA and SCAND) driving the climate variability over this region during the MWP, and a stronger oceanic influence since 1800 AD. The scientific approach, combining pollen and biogeochemical data (alkenones and n-alkanes) is correct, although I have concerns about the interpretation of some proxies.

The manuscript papers shows new data together with other published recrods. However I would like to know the reasons to exclude some published records from Ria de Vigo and Muros (see below). Overall, the presentation of datasets and figures could be improved. Some paragraphs should be moved to the methods section, and the current format of results and discussion is not very easy to follow. There are many typos in the references, and figures should be thoroughly revised and reorganized. I have several comments which are detailed below. In summary, the manuscript will be of interest for a wide audience of Climate of the Past and I recommend publication after major revisions.

Specific comments:

A comment is about the use of Trouet et al. (2009) NAO reconstruction in figures 4 and 5. This data should be fundamental for following the discussion in section 5.3. However, it has been demonstrated by Lhener et al. (2012) that the methodology used in NAO reconstruction by Trouet 2009 (using two proxy records) is flawed. Instead, Ortega et al. 2015, using more advanced methods, made a newer and more robust NAO reconstruction, with slightly different results. I therefore suggest using Ortega et al. (2015) NAO reconstruction in the discussion and figures.

Moreover, I am missing reconstructions of the EA and SCAND compared to the records showed in this paper, to support the discussion of section 5.3. How relevant are these atmospheric circulation patterns, together with NAO, for the precipitation and temperature regimes at the selected locations? Is there any significant connection? For the NAO, the authors can use the above mentioned reconstruction by Orgeta et al. 2015. For the EA and SCAND, to my knowledge, there is no any reconstruction covering the last 1-2ka. However, the authors can use, for example, Scandinavian air temperature reconstructions (see Gouirand et al. 2007) to compare with their records. It would be expected that higher temperatures in Scandinavia, related to anticyclonic blocking, would correlate to higher precipitacion and colder temperatures in southern Europe, if the SCAND pattern had influence over the Western Iberian margin during some peri-

ods of the last 2ka.

Alternatively, to demonstrate the importance between those atmospheric patterns in the region, would be interesting to show the relationship between winter precipitation and temperature from the locations of the study sites (Porto, Minho, Targus, Algarve) and the NAO,EA and SCAND atmospheric teleconnection patterns for the 1951-2010 period. This relationship could be shown as a map showing the Spearman correlation between the instrumental data and the indices. Examples of this spatial correlation map can be found in the figure 1 in Roberts et al. (2012), figure 9 in Sanchez-Lopez (2016), or numerically in table 3 in Hernández et al. (2015).

I am missing some records from the Ria de Ria de Vigo (Alvarez et al. 2005; Diz et al. 2002; Desprat et al. 2003) and Ria de Muros (Lebreiro et al. 2006). Diz et al. (2002) and Desprat et al. (2003) studied core Vir-18 core, which among other proxies, analyzed molecular biomarkers (including SST-alkenone) and pollen, both also used in Abrante et al. Paradoxically, these were included in the other climatic synthesis for the Iberian Peninsula carried out by Sanchez-Lopez et al. (2016) and Moreno et al. (2012).

The high sedimentation rate of Vir-18 core allowed for high-resolution analyses, with sampling intervals ranging from 9 to 70 y (Desprat et al. 2003. Similarly, Alvarez et al. (2005) shows micropaleontological and molecular biomarker analyses at a temporal resolution of about 30 years on average. Lebreiro et al. (2006) although does not use any molecular biomarker or pollen analyses, shows other datasets with quite high temporal resolution which could be used to support the interpretations from this study. If the purpose of the study by Abrantes et al. is to investigate the latitudinal and temporal variation of precipitation and SST along Western Iberia, I do not know why the authors decide to exclude the above mentioned dataset, which in my opinion, fit the criteria (high-resolution; hydro/climatic proxies for at least the last 2ka; Western Iberian margin) to be included in this regional synthesis.

XRF Fe counts are described in the methods section, and again appear in section 5.2. Why so much discussion about Fe if finally is not shown in the manuscript? The relationship between n-alk and Fe is really dubious. If A (XRF Fe) and B (river discharge) are correlated (let's say R= 0.6), and C (n-alc) and A are somehow correlated (R=0.4), but C and B are not correlated, why do you assume that you can be used C as a proxy for B? This is what the authors try to explain. In my opinion this is a very flawed argument.

In Abrantes et al. 2011 Fe is correlated with winter/spring precipitation (R=0.6) but n-alkanes do not show any correlation to precipitation or river discharge. In Abrantes et al. 2005b, Fe and river are also correlated (R=-0.5), while n-alkanes are slightly correlated to summer river discharge (only R=0.25, I doubt it is significant). Based on this weak correlation between n-alkanes and any river/precipitation time-series, I have serious concerns about the use of the n-alc for this purpose, regardless of its weak correlation (R=0.47) to Fe. This has to be changed and explained better.

Other minor comments:

Page 1

L. 16: Use the IP acronym for Iberian Peninsula.

L. 17: Add something that explains the importance of the IP for climate reconstructions, and remove the 'Iberian Peninsula' from P 2, L 10.

L. 21: I am not fully convinced about the idoneity of the term Historic period when referring to the last 2ka (this also applies to the 'Historic climate' in the title). Why the historic period refers only to the last 2ka and not before or after?

L. 25: Place comma after 'Within this long term', and change the following sentence by 'multi-decadal/centennial scale SST variabiliy'.

L. 25: 'along the latiduinal transect' or 'Western Iberian margin', instead of Iberia, as it is more correct.

Page 2

L 1: 'the last' before 1300 yr.

L 4: The sentence should be 'with a SST rise to pre-LIA levels'

L. 7: What do you mean with 'intermediate seasons'?

L. 8: Spell-out NAO, EA and SCAND.

L. 20: Change 'accompanied' by 'consisting'.

Page 3 L 23-22: Stick to symbol (+,-) or word (positive, negative) when referring to the diffent phases of the NAO and other atmospheric patterns, but be consistent through the manuscript.

L. 24-27: This sentence is too long.

L. 33: Place 'climate' after'several'. Change 'main climatic drivers' by 'atmospheric patterns'.

Page 4

L. 6-9: Long sentence, very difficult to follow. Maybe break into two sentences, with a full stop after 'mountainous interior'? When you say that Sanchez-Lopez (2016) study has a poor representation of the ocean, with only 2 reconstructions, you could indicate which ones are those.

L. 20: The sentence should start with 'Two climatic reconstructions from the. . ..'

L.25: Rewrite the sentence, difficult to understand.

L. 32: Which 5 new records? I only counted 3 (Galiza, Minho and Algarve). Moreover, five plus two makes seven records, but later it is said that the synthesis is made using eight records. Change 'spanning' by 'located', and 'margin, spanning from . . .'

Please, be consistent in the terminology, there are multiple terms for referring to the

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last 2000 years; 2 millennia, 2,000 years, 2000 years, 2000 yr, 2kyr. . . Same for the names used for the study sites, it is really confusing: Porto/Oporto; Tagus/Tejo/Lisbon etc. . .

Page 5

L. 3: Should be 'spring-summer (April to October)'.

L. 8: Delete the first 'Waters'.

L. 14: Change by 'water alternates'.

Page 6

L. 6-7: The XRF Fe counts, which are described in the methods section, are not shown in any figure, neither discussed in the manuscript.

L. 15: remove the web address and substitute for something more formal (a reference?) in a similar way to Naughton et al. (2015). 'Sample preparation technique follows de Vernal et al. (1996), modified at EPOC (http://www.ephe paleoclimat.com/ephe/Pollen%20sample%20preparation.htm).'

L. 24: I do not agree with the argument of reduction of individual noise. What the authors call 'individual noise' can be local features. I suggest to change the sentence.

L. 25: What do you mean with 'without previous alignment'?

L. 26: You mean 'record', not cores? And 'standardize', not centered?

L. 30: Change by 'Given the different temporal resolution of the sediment cores'.

L. 32: why 30yr filter? Provide a better explanation. A suggestion: '30-yr period was chosen because it is considered as a standard period for climate classification (references of Ahmed and Luterbacher). This bin allows to filter out decadal internal variability driven by random pehonema, but is short enough to allow the detection of decadal variability in response to external forcings' .

C6

I do not fully understand the purpose of figure 2 and making 3 different stacks for SST and n-alc. I think the multiple stacks add confusion to the discussion, and are not particularly interesting, in particular for the southernmost one, which only has one record (Algarve).

Page 7 L. 25: This paragraph is very confusing, specially the last sentence about the 'blender effect'. What do you mean with 'determining the seasonality'? I think it is not clear what is meant here. Do you mean that is necessary to understand the physical, chemical and biological processes involved in the proxy signal (rather than only determining the seasonality)? Please explain better.

L. 31: Remove Sea Surface Temperature, the acronym SST was already spelled out in page 6 L. 13.

L. 32: What do you mean with 'reduces the difficulties in temporal correlation'?

Page 8

L. 1-3. These sentences belong to methods

L. 4-13. Very confusing, rewrite.

L. 19. Remove second 'Rogrigues et al.,'.

L. 30 : Why is Masson-Delmotte et al. 2013 cited here, if there is no any record from that publication in figure 4C-E ?

Page 9

L. 3: 'cold conditions in Western Iberia' would be more accurate, as the records are only located in that region, and extrapolating to the whole peninsula would be incorrect.

L. 16-19: Rephrase this paragraph, does not make sense as it is written.

L. 22: Which rivers do you refer to? Make a full stop after Trigo and DaCamara, 2000.

L.. 23: Change 'revealed sediment' by 'have used'.

Page 10

L. 4: 'shows the lowest'.

L. 5: Douro or Porto? Please, be consistent in the name used for the study sites.

L. 5-10: This argument is not clear to me. Only Douro/Porto shows higher n-alc, but this can not be extrapolated to the entire northern IP, as the Minho and Galiza have similar values to the Algarve site. There must be an alternative explanation for the highest values at Douro (and not in Minho and Galiza).

L. 22. TPC is already spelled-out in page 9, and the interpretation of TPC is also said in the same page.

L. 26-27: What do you mean with 'the two records are not equivalent'?

L. 31: The n-alc are compared to independent records of flooding events in the different basins in order to assess the reliability of the n-alc as extreme precipitation and flood proxies. This is a bit confusing, since in the page 9 authors already interpret their n-alc as river discharge proxies based on the comparison to XRF Fe from different cores (Abrantes et al. 2005; 2011). This comparison itself is a bit dubious.

Page 11

L. 30: Which 'both groups' do you mean? Specify.

L. 33: Change 'T' by 'temperature'

Page 12

L. 4-6: Rephrase this sentece, very difficult to understand.

L. 14: Again, I do not find any reference or data from Masson-Delmotte et al. 2013 in Figure 4.

Page 13

L. 14: Change 'climacteric' by climatic

Page 14

L. 5-12: This part should be summarize, extremely long and complicated to follow, and not essential for understanding the changes in precipitation in the study sites.

L. 16-29: Showing the spearman correlation maps suggested above to demonstrate the relationship between NAO, EA and SCAND and precipitation along the Western Iberian margin would give credibility to the discussion, more than using example of Lake Sanabria by Hernandez et al. (2015).

Page 15

L. 33-35: Rephrase this paragraph.

Page 16

L. 1-3: There are 3 NAO reconstructions in Figure 4I, which one are you referring to? They are not completely similar...

L. 2-4: The matching between the AMO index and Oporto SST are difficult to evaluate considering the size of the plots and the short time period (1850-2000).... And please refer in the discussion to the Fig. 4 A; H.

L. 24. Should be 'eight' sites, not six.

L. 26. Change by' Furthermore, the construction of new regional stacks for SST and river discharge provide a ...'

L. 30. A decreasing trend, in which variable?

Figures and bibliography:

Figure 1 should have some information about the surface hydrography and SST (maybe one map for spring-summer, other for winter?), would help to follow the description of the oceanographic conditions from section 2. What means the black dot?

Figure 2. Please label the different pannels with letters (a, b and c), and include them in the caption. Change 'Popei' by Algarve.

Figure 4. In B), leave only the total stack, and remove the other SST records (which are already in A). It is very confusing. In the figure caption, D) and C) are wrong. It should be 'Volcanic forcing' not 'vulcanic activity'. Why do you need the TSI and volcanic forcing, if these are not used in the discussion? Simplify the figure and remove those curves which are not used in the discussion. In the figure caption I), identify which color is each one, and Cook et al. 2002 is missing.

Figure 5. I would suggest to make a figure including all the records (SST, n-alk, pollen) for all the sites, or at least the stack curves (but 'total stacks', not 'regional'). Label C) is missing in the total pollen plot. In B) I do not see the point of the Porto/North stack, as said in the general comments, I think there should be only one regional stack. Information about the flood events is missing in the figure caption. Revise the figure caption, there are errors in F).

Why is the total pollen concentration in the figure 5 together with the n-alk and other records? I do not see the point, neither the records from 5D-G, they are not used in the discussion.

Figure 6. Label A) is not visible. Touchan et al. 2005 in H) is not even mentioned in the manuscript.

Table 3. The shades of blue and pink indicate colder and warmer periods..., but relative to what? To the instrumental perdiod (1950-2000)?. The authors should explain which criteria they have followed to make this table.

References cited in the manuscript need to be revised. There are many 'extra' brackets, or the author's name is inserted between brackets, while only the year should be in brackets.

Abrantes et al. 2005b is cited multiple times in the manuscript, although this reference

does not appear in the reference list, only Abrantes et al 2005.

References:

Álvarez, M. C., Flores, J. A., Sierro, F. J., Diz, P., Francés, G., Pelejero, C., & Grimalt, J. (2005). Millennial surface water dynamics in the Ría de Vigo during the last 3000 years as revealed by coccoliths and molecular biomarkers. Palaeogeography, Palaeoclimatology, Palaeoecology, 218(1), 1-13.

Diz, P., Francés, G., Pelejero, C., Grimalt, J. O., & Vilas, F. (2002). The last 3000 years in the Ría de Vigo (NW Iberian Margin): climatic and hydrographic signals. The Holocene, 12(4), 459-468.

Gouirand, I., Moberg, A., & Zorita, E. (2007). Climate variability in Scandinavia for the past millennium simulated by an atmosphereâĂŘocean general circulation model. Tellus A, 59(1), 30-49.

Hernández, A., Trigo, R. M., Pla-Rabes, S., Valero-Garcés, B. L., Jerez, S., Rico-Herrero, M., ... & Giralt, S. (2015). Sensitivity of two Iberian lakes to North Atlantic atmospheric circulation modes. Climate Dynamics, 45(11-12), 3403-3417.

Lehner, F., Raible, C. C., & Stocker, T. F. (2012). Testing the robustness of a precipitation proxy-based North Atlantic Oscillation reconstruction. Quaternary Science Reviews, 45, 85-94.

Lebreiro, S. M., Francés, G., Abrantes, F. F. G., Diz, P., Bartels-Jónsdóttir, H. B., Stroynowski, Z. N., ... & Nombela, M. A. (2006). Climate change and coastal hydrographic response along the Atlantic Iberian margin (Tagus Prodelta and Muros Ría) during the last two millennia. The Holocene, 16(7), 1003-1015.

Moreno, A., Pérez, A., Frigola, J., Nieto-Moreno, V., Rodrigo-Gámiz, M., Martrat, B., ... & Belmonte, Á. (2012). The Medieval Climate Anomaly in the Iberian Peninsula reconstructed from marine and lake records. Quaternary Science Reviews, 43, 16-32.

Ortega, P., Lehner, F., Swingedouw, D., Masson-Delmotte, V., Raible, C. C., Casado, M., & Yiou, P. (2015). A model-tested North Atlantic Oscillation reconstruction for the past millennium. Nature, 523(7558), 71-74.

Roberts, N., Moreno, A., Valero-Garcés, B. L., Corella, J. P., Jones, M., Allcock, S., ... & Türkeş, M. (2012). Palaeolimnological evidence for an east–west climate see-saw in the Mediterranean since AD 900. Global and Planetary Change, 84, 23-34.

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