Interactive comment on "Late Holocene vegetation changes in relation with climate fluctuations and human activities in Languedoc (Southern France)" by J. Azuara et al.

The manuscript presents a new pollen record from a coastal lagoon located in southern France (Palavas) spanning the past 4500 years. Sediments from the same core had already been studied to reconstruct the frequency of storm events and the link between variations of past storm frequency and mechanisms causing climate changes. The lagoon is located in a region that has been settled several millennia ago, and has archeological and environmental-archaeology records that are sufficiently vast to get an, at least, qualitative picture of settlement history and past land-use changes. The authors use pollen percentages, pollen-percentage ratios of selected taxa, and storm frequency as inferred from sedimentology to investigate the links between storminess in Palavas and changes in vegetation composition in the surroundings of the lagoon.

They also compare the records from the sediment core to glacier advances in central Italy and to ice-rafted debris records from the N-Atlantic (Bond events). A substantial part of the manuscript deals with vegetation history in relation to land-use changes during the Antiquity and Historical times.

The data presented in this manuscript seem interesting but the manuscript itself could be substantially improved. At some points it is sloppy under several aspects (interpretation, structure, figure quality, captions). I therefore invite the authors to revise the manuscript profoundly and invite them to consider the few suggestions here below:

Thank you very much for your comments and advices. We answer below each of your comments.

General comments:
1. Writing style should be revised. I found it particularly disturbing to read at times that Fagus decreased", or "increases in Quercus：". The authors should take care of making a clear distinction between the evidence (pollen percentages) and the interpretation (population-size changes, vegetation composition).
Corrected

2. The hypotheses that are going to be addressed should be clearly declared in the Introduction. The aim of the study, as declared in the Intro, is to "deciphering climatic and human causes of environmental changes". However, when I arrived at the end of the manuscript I could neither figure out if this was actually achieved nor could I understand how it had been done.
Corrected. We modified the introduction in order to make our aims clearer.

The authors first discuss (5.1) the effects of the "long-term aridity trend" on vegetation, which caused the disappearance of Fagus and Abies stands in the warmer lowlands near the lagoon. However, surprisingly they state that variations of Fagus pollen % after 1084 cal BP (AD 866) are independent of climate changes "they cannot be interpreted in term of climate fluctuations because of the strong human influence". Later (6.1) they discuss the effects of the long-term aridity in relation to evergreen-oak-forest development: they arrive at the conclusion that the evergreen oak were favoured by anthropogenic activities already starting from at 4000 cal BP. The reader is therefore confronted with an interpretation envisaging that some trees (Abies and Fagus) migrated northwards because climate became drier, while other species (Quercus ilex) established and expanded because of human activities.

I wonder two things here: first, how was the date 1084 cal BP found? There is a dating precision in this age estimate that suggests it has not been determined based on the pollen record;
Corrected. This very precise age is in reality the estimated age (cal BP) of the last sample before the important deforestation recorded during the 10th century. So we replaced it by an approximate age which is much more appropriate (around 1100 cal BP).

second, how can the authors reject a theoretically possible alternative hypothesis, which envisages that changes in vegetation composition were favoured by the combined effects of both climatic changes and anthropogenic activities? Regardless, I found that the discussion could be improved, particularly concerning the palaeoecological records of evergreen Quercus. There's some recent literature that could be useful. One paper to start with: Henne et al. (2015).
We are not rejecting the hypothesis that the variations described in the article could be the result of both climatic and human influences. We just pointed out that variations in Fagus proportions (and Abies to a lower extend) are highly correlated with climate fluctuations and not with human activities. At the same time, the variations in arboreal taxa and evergreen Quercus proportions don't match with climatic records while they are in good agreement with the archeological and historical record. Therefore, even if the environments are influenced by both climatic and human factors, some pollen taxa are good proxies of climate changes while others are better to evidence anthropogenic impact.

Also, concerning the expansion of evergreen oaks, the authors conclude that (last sentence of Conclusion) that "evergreen Quercus expansion is related to coppicing and the increase in fire frequency". However, the authors have no data for fire frequency at Palavas and base their conclusion on studies focusing on fire disturbances in eastern Spain (Pinol 1998) and in Europe (Schelhaas et al 2003). The Schelhaas reference does, however, not support the authors' statement because Schelhaas et al. (2003,page 1629) wrote that "Figure 3 shows a fast increase in the number of forest fires over time. This apparent trend is most likely also influenced by the aforementioned increase in forest fire detection and alertness. However, it is impossible to separate this trend into a real increase and an apparent increase due to better detection methods." Hence the conclusion that "evergreen Quercus expansion is related to fire frequency" seems unsupported by data.
Corrected, we moderate our conclusions.

In this paper there are also other hypotheses that have been addressed: (i) the potential effect of climatic changes that occurred in correspondence with Bond events on vegetation in Palavas (and thus on the S-French coast); (ii) the vegetation history of the surroundings of Palavas in relation to land-use changes during the Antiquity and Historical times. The latter part reads differently than the former one because the text follows a different narrative style, it is more focussed on describing historical facts and their link with vegetation history. I found this part interesting but could not figure out what research question the authors wanted to address. Again, the Introduction failed to introduce the goals and aims of the paper. In summary, the authors should declare in the Intro the aims of the study, thus also including hypothesis (i) and the more descriptive part (ii). What where the expectations (hypotheses) of the authors? Which hypotheses were rejected? Also, it would be useful to summarize the land-use changes that are discussed in the text in a table, giving age limits for each period.
Corrected, we completed the introduction according to you suggestions and ages have been added to the table describing the main vegetation changes.

3. The link between changes in vegetation composition and storminess is unclear. The authors should better declare their hypothesis in the Introduction.
Corrected we modified the introduction to clarify the aims of the paper.

Which effects do they expect from storminess on vegetation composition?
No direct effects of storminess on the vegetation were expected and actually no such effects were observed. We compared our data with the storminess record because it is an interesting and complementary climate proxy available in the same core which make the comparison more reliable, especially for correlation with Bond events.

In section 5.2. one can see that the storminess record was compared to the Fagus/Quercus ratio. The authors explain that Fagus is at the southern distribution limit in this region and that it therefore may be sensitive to variations in moisture availability (besides, the authors could support this basic assumption with references to studies showing this). Hence decreases of the F/Q ratio are interpreted as indicating "arid events" related to Fagus pollen decreases. What is unclear is: why did they use the F/Q ratio rather than just the Fagus % record?
Arid events are highlighted by Fagus proportions minima coinciding with deciduous Quercus proportions maxima. Doing the ratio of these two variables was the easiest way to represent their variations with just one curve.

Also, in which season of the year do storms occur at present? Does the season of occurrence of storms coincide with the drier season for Fagus (a deciduous tree)? Further, what is most striking is that the duration of low F/Q-ratio values is rather short compared to the duration of low storminess. One may thus wonder why Fagus population would recover after few centuries although the climatic conditions remain dry?
The storms occur in winter while the dry season is summer. The link between storminess and aridity/humidity is not straightforward. Fagus proportions and storminess are two different proxies linked with the atmospheric circulation in the north-Atlantic. We compared them in order to find common patterns. The closeness in time of arid events and high storm activity periods suggest that this variability is linked with changes the atmospheric circulation. However these two proxies are probably also influenced by other factors and that's why their fluctuations are not completely consistent. In the future, a detailed statistical analysis need to be done when the palynological data will be available for the last 7500 years to better understand the link between aridity and storminess.

4. The Fagus pollen decreases are interpreted as "northward migration of Fagus at higher altitudes". I'm rather surprised and puzzled by this interpretation and invite the authors to think better at what "migration of plants" means. For example, this interpretation implies high dispersal rates and dispersal distances, and low ages to reach reproductive maturity for Fagus trees. Have the authors done such calculations? Are the figures obtained realistic? There are possibly other, more realistic alternatives to this interpretation, and I would invite the authors to explore other interpretations.
Corrected. We modified this conclusion. We choose to interpret decreases in Fagus pollen proportions in term of "contraction range" that may also have been amplified by drops in pollen productivity due to environmental stress.

2. The authors discuss the changes in storminess and vegetation composition in terms of "NAO-like" climatic patterns. However, to do this consistently they might also discuss, in my humble opinion, the following aspects in order to give the reader a complete picture: the NAO index describes weather patterns in winter (Nov-Mar), and thus a link between Fagus and NAO would imply that Fagus needs precipitations in winter. Do the authors have any evidence to support this hypothesis? Wouldn't Fagus need moisture during the dry summer months (say July-August)? What is the link between NAO and July-August precipitation?
In the Mediterranean region Fagus forests can grow outside their optimum area and support the lack of precipitation in summer getting water from localized fogs. Because Fagus is able to get water without precipitations it is difficult to link Fagus repartition with summer precipitations. Spring precipitation are probably more crucial.

We are aware that the relation between the arid events and the NAO-like climatic pattern remain unclear. We choose to present this mechanism as an hypothesis because it is an explanation often found in the literature which is consistent with some aspects of our study. More data are needed to fully understand the mechanism that explain the observations made in Palavas. The aim of this paper was just to separate climatic and human influence. In the future, we want to dedicate an entire survey to the climate variability in the southern France including a longer record, a more extensive comparison with other data and a careful mathematical analysis.

3. The link between Bond events, 14C production, storminess, and changes in vegetation composition is explored in Chapter 5.2. Concerning this chapter it is a pity that the reader hardly gets to know that the comparison between Bond events, 14C production, and storminess had already been discussed and published in a previous paper (Sabatier et al. 2012). This should have been mentioned in the Introduction.
Corrected. We added a sentence in the introduction

Also, the last paragraph of this chapter (dealing with wavelet analyses and solar forcing) seems out of place, or has not been sufficiently introduced.
We just wanted to put into perspective our results with the forcing factors of Holocene climate variability. We modified the paragraph to make it clear.

4. The authors conclude that the variations of the "deciduous Quercus/evergreen Quercus" pollen % ratio might be the evidence of anthropogenic activities", which therefore caused evergreen oaks to replace deciduous oaks. Here again, as in the case of the F/Q ratio, I wonder if the Q/Q-ratio has been validated and/or calibrated to show that it can be used to infer 'aridification' or 'anthropogenic activities'. Following questions arise: is the ratio not influenced by variations of other pollen taxa as well? Is the ratio representative of which anthropogenic activities? If so, it would make the interpretation stronger. If not, I would suggest to omit the Q/Q-ratio curve. But regardless, it would be useful to plot the simple pollen percentages of Fagus, deciduous Quercus, evergreen Quercus in Figure 3.
The Q/Q-ratio is use by Jalut (in Jalut et al 2009) on a wide range of palynological data from the Mediterranean area as an indicator of the late Holocene aridification. We wanted to compare our data with these results to show that in Palavas region, this ratio is unlikely related with climate. Archeobotanical and ecological studies suggest that in our case, evergreen Quecus forest dynamic seems much more related to human activites. Even if this ratio don't represent a specific type of activities, we think that this comparison is important to assess that the interpretation of a same indicator (in this case Q/Q-ratio) can be different from an area to another.

Methods are not sufficiently explained:
- There are several issues with the chronology (see detailed comments for Page 4128);
Corrected
- The use of ratios of pollen percentages is not justified;
Corrected. We added a sentence to justify into the article the use of ratios.
- which pollen keys were used to identify pollen grains?
Corrected

- On what data is the vegetation map based? Please cite the source or explain the method used to draw the Figure 1c (see further comments below)
Corrected

Figures are sloppy (see detailed comments for Figures below). A Table with 14C datings and other control points (storm events) used to establish the age-depth model should be added.

We added a table with all the dates and control points as an annex of the article.

Detailed comments:

Abstract:
- 2nd sentence: separating the effects is not needed to "reconstruct paleoenviron-ments". Please rephrase sentence
Corrected

- L10: why are arid events also periods of "climatic instability"? Did all other periods
have a stable climate?
Corrected. "Climatic instabilities" was not appropriate so we replaced it by "periods of high frequency climate variability" in reference to the two phases pattern observed in these very short time periods.

- L13-14: few lines above you said that there was a "long-term aridification". Now you say that spread of evergreen taxa and loss of forest cover result from anthropogenic impact. The two statements are not consistent with each other because a shift to drier climate conditions might also have caused loss of forest cover and a spread of evergreen angiosperms.
It is true that anthropogenic impact also could have led to deforestation and spread of evergreen Quercus. This is why it is so difficult to separate human activities consequences from climatic impact on the vegetation. However in Palavas region, the comparison of our palynological data with climate proxies and archeological and historical archives demonstrate that evergreen Quercus forest dynamic is probably more related with anthropogenic impact.

Please note here (and elsewhere in the text) that the term "evergreen taxa" also includes many conifers, such as Abies...which in your interpretation decreased due to aridification. Hence, please change the term 'evergreen taxa' unless you want to include most conifers.
Corrected

- L4-5: Why is this relevant? If Capestang had a well-dated pollen record, why is it necessary to be mentioned here? Is it because you plan to compare your results with the Capestang record? Or are there other reasons?
It is relevant to introduce Capestang because we compared our results with these sequence (part 5.1).

- L6: I'm not really sure that a sampling resolution of 2-10 cm can be truly termed "high resolution". But I know that many use the term in a generous way.
The time-interval between each sample is around 50 years or even smaller for most of the samples, which can be termed "high resolution" dealing with pollen analyses and vegetation history.

- L22: in the previous paragraph you mentioned the "lagoons", in this sentence there's
only one lagoon, hence the question: which one?
Corrected

Page 4127
- Lines 1-19: the description of the distribution of the dominant taxa is very useful. However, the source of the information given in this paragraph and in Figure 1b is unknown to the reader. Is it a result of the current study? If so please explain in the Method section what has been done. If not, please cite the source.

Corrected. We used the vegetation maps of the national forestry inventory.

Also, Ericaceae are also abundant in some environments. Given that Ericaceae pollen % show an interesting pattern, could the authors also introduce the distributions of species belonging to that family in this paragraph and in Figure 1b?
Corrected. The national forestry inventory maps we used in order to draw the map presented in Figure 1 are mostly interested in trees. Thus, they contain few information about Ericaceae distribution. We know by by field experience from other works that many Ericaceae are present in all the region such as Erica arborea, E. multiflora, E. cinerea, E. scoparia, Calluna vulgaris, Arbutus unedo. We completed the vegetation description.

Further, for Figure 1b following questions seem relevant to me: - what do the circles indicate? Vegetation surveys in a plot? A tree? A minimum abundance/density of the species? - sometimes the circles are so well connected to each other that a line appears. What do the lines indicate? Surveys along a track?
Each spot represent a forest patch according to the maps of the National Forestry Inventory.

-L13-14: distinguished in routine pollen analysis, "which limits the interpretation of Pinus pollen variations in terms of…" ?
Corrected. We added "in terms of vegetation changes and climate variations"

Page 4128
L5: here you mention "the last 5 millennia" but at the end of the paragraph you mention "the last 7000 years". Please correct one of the them.
Corrected

L13: eight, not height in PB06
Corrected

L22: Cerastoderma glaucum
Corrected

L23 and following: it is unclear to what extent the present chronology of PB06 coincides with the chronology of the same core as published in previous papers. The authors refer to Sabatier & Dezileau (2010) and Sabatier et al (2012). I looked at those two papers and noted some inconsistencies that would be worth to address in the current manuscript: The authors mention that 14C ages were calibrated with Calib 5.2 as in Sabatier & Dezileau (2010). However, in Sabatier & Dezileau (2010) only the top 300 cm of the core where published, the chronology was shorter than in the present manuscript, and Calib 5.0.2 was used, not Calib 5.2. On the other hand, in Sabatier et al. (2012) one can read that the chronology was obtained using an age-depth model software (Clam) but nothing is said concerning the calibration software or calibration dataset. Please clarify which software, which calibration dataset, which reservoir age, and which storm events were used to build the age-depth model. Please add that as a table as supplementary material because otherwise it will be very difficult to understand in the future what has been done in this study.
Corrected

Page 4129:
L 7: "average time resolution is around 50 years". 50 years is not a resolution, 50 years tells the duration in time of something (as number of years). Resolution can be defined as years/sample (i.e. years between samples), or as "deposition time" (i.e. years within sample). Please clarify.
Corrected

L9-10: could you better explain what is meant with "insufficient" pollen concentration? Insufficient is a rather vague term.

Corrected. According to the taphonomical study done previously on storm layers we define the minimum pollen concentration as 5000 grains/g.

L14: to dissolve Lycopodium spores one generally uses HCl first, then HF later. Please bring correct order.

Corrected

L15: please cite Stockmarr (1971).

Corrected

L17: "minimum sum of 300 grains excluding Pteridpohyta,and dominant taxa". Which dominant taxa were excluded? And why?

Corrected

Sorry this was not clear. We just wanted to explain that we followed the rules of Berglund and Ralska-Jaciewiczowa (1986) for pollen counting but actually there is no dominant taxa in the sequence and thus no taxa was excluded. We corrected to make this sentence clearer.

L19: "Proportions were calculated using the total sum of identified pollen grains". Where also the obligate acquatics such as for example Sparganium/Typha included? Also Pteridphytes? If so, please clarify why the pollen sum was not limited to terrestrial plants.

The pollen sum include aquatic taxa but not Pteridophytes. The cumulated proportions of Typha/Sparganium, Cyperaceae and other marsh taxa are very low (few percents at maximum). There was no point to exclude them.

L21: please explain the rationale for using ratios of pollen percentages. Has such a ratio been used previously by other scientists? For the same pollen taxa? What are the modern evidences that validate the use of such ratios as climate proxies?

Arid events are highlighted by Fagus proportions minima coinciding with deciduous Quercus proportions maxima. Doing the ratio of these two variables was the easiest way to represent their variations with just one curve.

The Q/Q-ratio is use by Jalut (in Jalut et al 2009) on a wide range of palynological data from the Mediterranean area as an indicator of the late Holocene aridification. We wanted to compare our data with these results to show that in Palavas region, this ratio is unlikely related with climate. Archeobotanical and ecological studies suggest that in our case, evergreen Quecus forest dynamic seems much more related to human activites. Even if this ratio don't represent a specific type of activities, we think that this comparison is important to assess that the interpretation of a same indicator (in this case Q/Q-ratio) can be different from an area to another.

L24: delete "with distorted pollen proportions".

A careful taphonomic study allow to demonstrate that pollen proportions in storm events layers are really distorted. It is mentioned in the part "Results"

Page 4130:
L1-12: this paragraph is rather difficult to understand and raises a number of questions:
- the authors say that "pollen analyses from the overwash layers and the samples from immediately underlying sediments with conc. < 5000 grains/g have been discarded from the record to avoid taphonomic perturbations". However, it is unclear if the discarded pollen

samples (not pollen analyses!) were deleted before plotting Figures 2 and 3 or if they were discarded only in Figure 3 or if they are plotted in both Figures (probably not, I assume).
The pollen spectra of the samples with a very low pollen concentration (less than 5000 grains per grams) were discarded in Figure 2 and 3. They were not considered at all.

- Also, I wonder why storm layers were actually sampled for pollen analysis in the first place: the pollen grains in those layers are almost certainly coming from reworked material;
Some samples from the storm layers were analyzed in order to characterize the influence of such perturbations on pollen spectra. It allows us to figure out that some samples above the storm layers were also affected by taphonomic biases.

- Further, it would be important to know how thick (in cm) these storm layers are in the cores. In theory, because the storm layers were deposited in few hours, their thickness should be deleted from the core to obtain a new "corrected depth scale" without the storm layers. The final age-depth model should be based on the new corrected depth scale, not on the original depth scale.
This point is already discussed in Sabatier et al 2012.

- L15: Eleven pollen zones in Figure 2. Please correct.
Corrected

- L15:"pollen zones based on pollen assemblages describe" Please change to "pollen assemblage zones were visually determined."
Corrected

Page 4131:
L3: "Abies disappears". Please find another term for 'disappears'. Also, it is the Abies pollen, not the Abies that disappears. Here and in the following sentences the authors should distinguish the subject of the sentences: the pollen (the evidence), the plants and vegetation (the interpretation).
Corrected

L5: tree pollen abundance decreases (tree pollen cannot decrease)
Corrected

L9: What is meant with "Forest taxa"? In figure 3 I see a curve showing Arboreal taxa (pollen %), not Forest taxa? Are Olea, Castanea, Juglans thought to occur as trees in the forests?
Corrected. We replaced the expression "forest taxa by a"arboreal taxa". Olea, Castanea and Juglans are not included in arboreal pollen proportions. We clarified in the material and methods part the definition of all the groups of taxa.

L12: Cerealia-type pollen reach
Corrected

L14: why 'relatively low'? Relatively compared to which other records? Please clarify.
Corrected. We clarified it in the text. We meant relatively low compared to the rest of the sequence.

L16: "while cultivated trees decrease" please rephrase
Corrected

Page 4132
L4: Abies and Fagus pollen...
Corrected

L5: late occurrence compared to which other records? Please clarify
Corrected. We deleted the word "late".

L12: expansion towards the south or simply to lower elevation?
Corrected

L19: where might have the shady slopes and valleys have been? From the map in Figure 1a one can see that the topography is rather flat (0-200 m asl) for more than 10 km around the coring site. Please clarify.
The present pollen spectra and the size of the lagoon suggest that an important part of the pollen rain is regional. Fagus pollen grains are found in the present pollen spectra while the nearest Fagus forest are around 100km away. Thus our data suggest that Fagus forest were present at lower altitudes but not necessary on the coast.

L20: but in Mat & Methods we were told that Pinus pollen could not be determined at species level. Hence, the hypothesis that the decrease of Pinus pollen here occurs because Pinus sylvestris shifted northwards is a statement that is skating on thin ice.
This is why we just mentioned it as an hypothesis.

L20: also, a shift northwards implies that the species was not present in the north. Have you any evidence for this?
Corrected. "shift" was not the appropriate term. We modified the text and replaced it by "contraction range"

Page 4133
L16: see previous comment concerning the interpretation of a "northward shift".
Corrected

L22: Pollen % decreases of Fagus (e.g. the short-term decrease 4600-4300 cal BP) may be linked to "repetitive northward migrations". This interpretation implies that (1) Fagus trees were absent in the hills/mountains north of the Etang before 4600 cal BP, and (2) that they migrated to the north at 4600, stayed there between 4600 and 4300, and migrated back to the south at 4300 cal BP? However, there is no evidence to support hypothesis (1); moreover, hypothesis (2) seems rather striking (and unrealistic) and would imply extremely high dispersal distances and small ages to reach maturity for such trees. Please consider other, potentially more realistic, alternatives.
Corrected

Page 4134
L1: "Such arid events" what is meant with "such events"?
Corrected. We deleted the word "such".

L5-6: "Discrepancies in chronologies are probably due to model uncertainties". Why should arid events in Albania/Montenegro and in southwestern Spain occur simultaneously? Is there any evidence to support this hypothesis? Is this hypothesis actually relevant in the context of this paper?
Arid events in those records don't have to be strictly contemporaneous. However they are close in time and considering the uncertainties of age models it is impossible to address time lags between them.

L1-17: please move this paragraph further below and describe first the relationships between the proxies of your sediment core.
We choose to discuss first the short arid events in our data and other records or proxies, and then their link with the probable variations in atmospheric circulation patterns.

Page 4135
L7-8: "two Bond events might be divided in two phases". I think the authors want to say that the effect of climate changes during Bond events changed over time, with an intial phase at the onset of the event leading to more humid climate in Palavas, and a second rather final phase leading to drier climate with less frequent storms.
Yes

L27-28..: I cannot truly understand the meaning of this last sentence. Please clarify (1) what evidences, and (2) how & why a better understanding of mechanisms involved in these which climatic oscillations have been brought by your study.
Corrected. We changed this paragraph to make it clearer. Our data show that arid events and high storms activity periods are linked in southern France and that Bond events may display a two phases pattern. These observation should be taken into account in future attempts to understand the mechanisms involved in late Holocene climate variability in the Mediterranean.

Page 4136
L6-9: The first sentences of this paragraph are not consistent with what had been written at the beginning of Chapter 5.1. In the latter the interpretation given, albeit without much discussion, was that vegetation changed due to the long-term aridification. Here instead the authors set out that the interpretation given previously in Chapter 5.1 is actually debated. It is rather striking to read that now.
This paragraph is consistent with the previous ones. The long term aridification was clearly evidenced in Palavas region by the long term decrease in Fagus and Abies pollen proportions. Here we are pointing out that in this region the situation is more complicated for evergreen Quercus fluctuations.

Please restructure text. And please update the references including also more recent studies.
Corrected

L13: "increases in evergreen Quercus pollen and arid events do not correlate". Which increases in evergreen Quercus pollen? No increases were described in the previous sentence. And I can't see a correlation anywhere? What is the correlation coefficient? Please clarify and show the correlation statistics.
Corrected
We just meant that there were no increases in evergreen Quercus proportions corresponding to the arid events.

L14: delete "classic" from 'classic picture' simply because it is not classic. There are different hypotheses (as described in the first few lines of section 6.1), that's all.
Corrected

L19: "arid climate, which is usually expressed by the replacement of deciduous Quercus by evergreen Quercus". Why usually? This is surely not valid for Australia, just to give one example. Also, the argument given by the authors here is not consistent with what had been written on lines 1-5 and with what comes later (lines 24-25 and following); (1: "arid climate is usually expressed by the replacement of deciduous oaks by evergreen oaks"; 2: the deciduous/evergreen oak ratio decreases (thus evergreen oak increases); 3: conclusion: the deciduous/evergreen oak ratio is evidence for anthropogenic activity). please rephrase.
Corrected

L20-23: "therefore climate variability alone cannot explain". Sorry, climate variability from which proxy records? Please specify the subject and objects of the sentences.
Corrected

Page 4142 This whole paragraph is interesting but needs a more balanced discussion. See for example other palaeoecological and vegetation-modelling studies such as Henne et al. (2015).
Corrected. We updated the bibliography and modify this paragraph to make it clearer and more balanced as suggested.

Figure 1a: add names of rivers.
Corrected

Figure 1b:
- what do the circles indicate? Vegetation surveys in a plot? A tree? A minimum abundance/density of the species? sometimes the circles are so well connected to each other that a line appears. What do the lines indicate? Surveys along a track?
Corrected. The national forestry inventory maps we used in order to draw the map presented in Figure 1 are mostly interested in trees. Each spot represent a forest patch according to the maps of the National Forestry Inventory.

Figure 2:
- Why is there a gap in the pollen diagram between 200 and 600 cal BP (i.e. AD1750 to AD1350)?
This gap correspond to a period of high sedimentation rates where the few samples available are below an important storm layer and are affected by taphonical process.

- Y-axis label: Age yr BP cal BP or not cal BP? Please correct
Corrected

- Archeo periods: why are there no horizontal lines marking the limits between the cultural periods? Does the 'Modern period" go back to 800 cal BP (i.e. about AD1200)?
Corrected. We added limits to the archeo periods. The modern period go back to the 15th century.

- What is meant with "Antiquity"? I can't find it in an english dictionary (e.g. http://dictionary.cambridge.org/dictionary/english/antiquity). Or do you mean "Classical Antiquity"?
Corrected

- x-axis label: "Deciduous trees" all deciduous trees? Only some deciduous trees? Please clarify
Corrected. We changed other deciduous trees, that is to say al the deciduous trees except the ones already plotted (Fagus, deciduous Quercus and the riparian). We added a paragraph in order to clarify the definition of all the groups used in the diagram.

- Other Riparian trees not Ripparian. Besides, what does this category include? Please clarify all categories in the Mat & Methods
Corrected

- What is "Sclerophyllous Quercus"? They are never mentioned in the text. Do you mean "Evergreen Quercus"? Please homogenize terminology.
Corrected

- Pollen concentration: correct dimension. should be grains per gram
Corrected

Figure 3:

- what do the green and red histograms indicate?
Corrected

- what do the different vertical shadings indicate?
Corrected