Reply to the invited review by anonymous reviewer #1

We thank the reviewer for critically evaluating the manuscript and sharing his opinion. We hope our answers are to his satisfaction.

- Throughout the manuscript, it is quite unclear which data are new and which are instead from previous published studies. For instance, in the abstract the authors claim that “two well dated palaeoecological records... provide a first relatively detailed record of vegetation dynamic from late Roman times”, but at least one sediment core used (Gravgaz site, SA06EP1) appears to be the same as in Bakker et al., 2012 (The Holocene), where also pollen, charcoal and sediment properties data are presented. The site Bereket is also mentioned in another paper from the same authors (Veg. Hist and Archeobotany, 2012, Table 2). Which are the new data, then?

The record from Bereket which is presented in the present manuscript does not feature at all in the Vegetation History and Archeobotany article or in any other paper. The Bereket record mentioned in Veg. History and Archaeobot was published in Kaniewski et al (2007a,b, 2008). The paper in Veg. Hist. And Archaeobotany itself is a review paper in the special issue on ‘Human landscapes and climate change during the Holocene’. It presents the first comprehensive overview of vegetation change in the territory of Sagalassos during the whole of the Holocene based on former studies. As we explain for Bereket in our manuscript at page 3385, lines 8-11: **“***Late Holocene deposits have been previously studied by Kaniewski et al. (2007a, 2007b, 2008). Unfortunately, the limitations of the chronology in the upper part of their core BKT1/2 made it impossible to study the vegetation and sediment history from the 7th century onwards in any detail*”. The record from Bereket presented in the present manuscript is entirely new and covers a period from the Late Roman period until the present on a location where the historic deposits reached a thickness of 6m. Where it overlaps with the detailed part of Kaniewski’s earlier record, the integration of both cores, , is necessary to address specific sedimentological and chronological characteristics and problems, as was done in section 5.1 of the present study, and to obtain a higher resolution.
Part of the analyses and research presented in the current paper use the same data also used for the article published as Bakker et al. (2012) in the Holocene. As we explain on page 3382 of the present manuscript (line 9 onward): **“***Bakker et al. (2012) revealed the presence and timing of several late Holocene wet and dry bioclimatic periods in southwest Turkey, coinciding with well known climatic periods such as the Medieval Climate Anomaly (MCA) and the Little Ice Age (LIA). Although some attention was given to the driving processes behind vegetation change, Bakker et al. (2012) was primarily a technical paper demonstrating the methods by which climatic periods were distinguished in pollen data***”**. Apart from demonstrating the validity of that technique, a comparison with different independent climatic proxies in that paper reveals that these bioclimatic periods are indeed linked with major Late Holocene climatic periods. However, the discussion in the Holocene article does not go beyond this.
The present paper builds upon the data presented in the Holocene article. While the Holocene article established the presence and timing of multicentennial climatic periods, the present paper goes further, exploring the interrelatedness of human impact, vegetation, and climate. This is done by presenting a detailed overview of changes in the natural environment through time, and by presenting a historical background of the territory of Sagalassos, based on the most recent archaeological findings in the study area, enabling a detailed discussion involving all factors that determine the shape of the landscape; vegetation, geomorphic processes, human impact, and climate.
The paper presents a completely new record from the Bereket basin, providing the first relatively detailed overview of local and regional vegetation change and a detailed sedimentological record for that basin. The integration of the two (Gravgaz and Bereket) records enables us to properly distinguish between the regional/local impact of anthropogenic activity and climate change on the environment.
The present paper presents a new detailed sediment study for Bereket, enabling a more proper interpretation of the local and regional pollen signal, and a proper analysis of local and regional environmental change. The extant sediment analysis for Gravgaz (based on Six, 2004) is more closely studied and reinterpreted in light of the new data presented here, as well as more recent external climatic proxies, revealing for the first time how local geomorphic processes at Gravgaz closely follow regional multidecadal to multicentennial climatic shifts. The new insights from studying both sediment records provide additional evidence to support the climatological record first presented in the Holocene article, and further strengthens the chronological framework of both records. Finally, the present article

presents a detailed discussion concerning post (human impact or climate driven) disturbance succession of the vegetation. The presence of fires is not just detected, but the role of fire in vegetation change is addressed using multiple numerical techniques.
Nevertheless, based on the comments of reviewer #1 concerning which part of the research is new, and which part isn't, we shall alter the introduction chapter to more clearly indicate the nature and role of the Holocene article in the creation of the present manuscript.

- Please also note that in many parts of the discussion section (i.e. "vegetation dynamics") you seem to explain the observed changes with the role of climatic variability, which in turn is inferred from pollen data (Bakker et al. 2012; even same data?). Even assuming that the climate fluctuations that you infer from pollen data are realistic (which for me is a long bow to draw, considering the human impact), you can't explain vegetation dynamic using climate data inferred from pollen, but you can instead focus on the reliability of other (independent) climatic proxies.

This question has essentially been answered in the above text. In the present article, we do not infer climatic variability from our raw pollen data. The presence, timing, and nature of climatic change was previously established by implementing a number of numerical and multivariate statistical analyses on the raw pollen data, separating the human component from a bioclimatic wet/dry component, and critically comparing these results with independent climatic proxies. The present article then expands and strengthens our knowledge by adding new pollen and sediment data, and addresses how climatic change effectively influenced environmental change in all the manners listed in our previous answer.

- It is important to understand that microscopic and macroscopic charcoal likely reflects biomass burning at different spatial scales (local vs regional), so it is advisable to interpret them separately. Most importantly, the identification of charcoal peaks is limited to the local fire proxy and requires contiguous sampling, not to miss any fire events; this is normally achieved on contiguous (sieved) samples, rather than from pollen slides. If you inferred charcoal concentrations from 50 (and 44) pollen slides, and every ca 7 or 14 cm, evidently you don't have the resolution for peak detection analysis. What you are showing instead is a limited number of charcoal peaks detected by chance along the record. If this is the case, the estimation of fire frequency and their implication for the records should be avoided.

Both reviewers have stated similar objections and we have to agree that in its present form, the CHAR analysis cannot be used to establish a complete fire history, and the mentioning of a fire frequency in the figures is in error. CHAR is best suited for records with contiguous sampling, the chances of missing a fire event growing larger as sampling resolution decreases. However, even if some individual, especially regional fire events (microscopic charcoals) are missed, a longer 50-100 yr period characterized by many fires (as occurred at several times during the Bronze and Iron Age at the study area -see Kaniewski et al., 2008) may still be detected. The average sampling interval for the Gravgaz record is of 6.7 cm or 46.6 year per cm. For the Bereket record, the average sampling interval is 13.5 cm or 56.9 year per cm.
CHAR analyses may also help prove or disprove hypotheses concerning erosion events or rapid changes in vegetation by detecting and verifying the presence of fire events at selected crucial parts of the pollen/sediment record. The real question here should rather be how discontinuous a record may be before the results become too untrustworthy. We consider the current record to be too discontinuous to provide a complete overview of each local and regional fire event, but detailed enough to support our hypothesis that fire activity was negligible during the most recent 2000 years. This hypothesis is also supported by the Neighbour Joining analysis. A visual description in the field also did not reveal any charcoal layers, further supporting the notion that no local fires occurred at either sample site.
Nevertheless, the materials and methods chapter will be rewritten to better reflect the problems concerning the CHAR analysis, and the discussion chapter (more specifically section 5.2.) will be rewritten to focus more on the general post-disturbance vegetation succession, and the numerical (NJ, CC) analyses. Any notion of an average fire frequency is removed from figure 5, as we agree such a value cannot be calculated based upon the data used.