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Climate of the Past Discussions

Interactive comment on "Past African dust inputs in Western Mediterranean area controlled by the complex interaction between ITCZ, NAO and TSI" *by* P. Sabatier et al.

Anonymous Referee #2

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Review of the paper "Past African dust inputs in Western Mediterranean area controlled by the complex interaction between ITCZ, NAO and TSI" by Sabatier et al. – Climate of the Past Discussion

General comments

The authors present a high-resolution mineralogical (XRD) and geochemical (XRF, ICPMS and ICP-OES) study of Lake Bastani sediments (Corsica). Sedimentological results help deciphering sediment sources and indicate that terrigenous supply in this high altitude lake is mainly composed of African dust supply over the last 3 millennia, and confirm that this Lake is an ideal place for reconstructing Saharan dust inputs

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toward the west Mediterranean area over the last 3150 yrs cal. BP.

The well-constrained chronology (14C, 210Pb, 137Cs) of the core allows studying Saharan dust inputs with a millennial to centennial resolution using various statistical analyses (PCA, wavelet analysis, cross wavelet). The authors evidenced that long-term migration of the Intertropical Convergence Zone (ITCZ) appears to be the main forcing of the observed variations at millennial scale, probably affecting the dust availability over north and west Africa. During the last millennium, when the ITCZ is in its southward position, the North Atlantic Oscillation (NAO) seems to become the main climatic forcing, affecting both the pattern and the intensity of African dust transport. The authors also argued that the Total Solar Irradiance (TSI) was the main climatic forcing before 1070 yr cal BP when the ITCZ was in its northern position, through modifications of pressure gradient over Africa.

This paper deals with important scientific questions and highlights some new findings. The methods are adequate and assumptions are clearly outlined. The results mainly give support to the interpretations (see comments below) even if result tables are absent.

However some points are not completely clear, and minor corrections are needed:

1. The sediment sources paragraph (§4.1) is not totally convincing since some contrasting results are not discussed. Important data are missing, as the proportion of palygorskite in the 3 main potential source areas (PSA). Moreover, according to Figure 4:

- the I/K ratio mainly varies between 1 and 1.6, suggesting that Sahara is the main source of dust, pointing out PSA1 (1<I/K<2) as the main provenance (except ca. 2650 yr cal. BP, 2150 yr cal. BP, and between 900 and 700 yr cal. BP when I/K is below 1, suggesting some sahelian supply from PSA3 (0.3<I/K<0.7), and except ca. 2400 yr cal. BP and in the most recent part of the core when some influence of PSA2 (I/K>1.6) cannot be rule out);

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- the C/K ratio varies between 0.2 and 0.8, suggesting western Sahara as the main source, with PSA2 (0<C/K<0.8) (and PSA3 with 0.2<C/K<0.9) being the main dust supplier. The C/K ratio reached 1 in the uppermost part of the core, suggesting potential contribution of PSA1 (C/K=1.5) - why PSA3 is ruled out as a contributor?

- the increase of palygorskite throughout the whole time interval may indicate enhanced contribution of sahelian source as PSA3 which is not consistent with the I/K and C/K ratio;

- How do you reconcile these apparently contrasting results (I/K indicating PSA1 as the main provenance, C/K suggesting PSA2 as the main source)?

- By the way, the main figure with sedimentological results (mineralogy and grain-size) is a supplementary material (Figure S1), which seems weird since the results should appear within the manuscript;

- Also the authors may consider adding the limit between Sahel and Sahara on figure 1;

2. Some of the geochemical data also evidenced contrasting results that deserve to be discussed thoroughly. I do agree that the Fe/Ca vs. Ti/Ca ratio indicate a good relationship between lake sediment and non-carbonated dust (figure 2b top), but this is not obvious when looking at the Fe/K vs. Ti/K ratio diagram: the lake samples plot on a line with a nice negative correlation while dust samples display a positive correlation! Please clarify.

3. The relationship between ITCZ and dust transport/emission is not new, but this study gives additional support using a statistical approach. Similarly the relationship between NAO and dust transport over the Mediterranean is not new but this study nicely documents the impact of NAO on dust input, and evidences NAO as a main forcing since 1070 yr cal. BP. The relationship between TSI and African dust input when the ITCZ is in its northern position is rather new, but as it is written, is not

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completely convincing. I suggest the authors clarifying this paragraph and discussing the negative feedback of dust particles on irradiance.

Please also note the supplement to this comment:
https://www.clim-past-discuss.net/cp-2019-111/cp-2019-111-RC2-supplement.pdf

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