Granada, 20th December 2019

Dear Dr. McClymont,

Thank you very much for your positive comments. We have made all the changes you suggested in the PDF (red font in the new version of the manuscript), and we have submitted our raw data to the Pangaea website in order to store them properly. Below we answer to the most important points of your minor revisions:

1. Title: After discussing with the coauthors, we finally conclude that a good title would be: *Algal lipids reveal unprecedented warming rates in alpine areas of SW Europe during the Industrial Period.*

2. Point 1 of editor comments: Extrapolation. We totally agree with your concerns. So, we have added a short paragraph at the end of the section 3.2 (results: where we described the reconstruction of the LCD-derived temperatures): "*The application of the obtained calibration to the LDI values of LdRS (Eq. 2) produced the first temperature reconstruction for the Common Era in this alpine area. Nevertheless, a potential challenge of using this kind of down-core proxy calibrations is that the uncertainty of the reconstructed variables (temperature in this case) would increase when data fall outside the calibration data-set (e.g., during the LIA). Further studies on the local LCD production in this alpine area will contribute to extend the range of temperatures in the calibration, reducing the uncertainties of the LCD-derived temperatures.*" We think that this is the best location for this observation (result section 3.2: lines 478-486) since we explain the obtained results and their potential uncertainties.

3. Point 2 of editor comments: Fig. 5 smooth comments. We are aware of other different simulations to compare time-series such as the running/moving means. The problem we found regarding the application of running means in our dataset were: 1) the time-averaging is not always the same in our record (from 5 to 7 years in the short core); so, the best approach using running means would consider both endmembers, 5 and 7-yr running means; and 2) the graphical results of running means depends on the constrains you use, e.g., running means from the top of the record, or from the bottom (see Fig. 1). Therefore, we can have the same problems of non-alignment with the original data as the ones noted by Rev#1 in our simulation using the specific time-averaging of LdRS shc (see 7-yr running mean of TSI data: Fig. 1). We have also compared the simulations obtained using 7-yr running means in some variables with the approach performed in the previous

version of the manuscript (using the same time-averaging as LdRS shc) and the correlations were certainly similar (see some examples in Table 1). In addition, if we compare the 7-yr running mean simulation for the TSI data and the one obtained with the same time-averaging as LdRS shc, both simulations are certainly similar (r=0.98 p<0.0001) (Fig 2). So, we would prefer our approach since it includes the different changes in the time-averaging (5, 6, and 7 years), as in the studied record. It does not mean that we are putting a lot of emphasis on our age model accuracy and precision, since continuous data from 2008 to 1821 are compared in both approaches (the 7-year running means and our simulation) eventually. Anyway, if Editor prefers a 7-yr running mean simulation for this figure, we can include so, but it will not show a big difference respect to our simulation using the same time-averaging as LdRS shc.
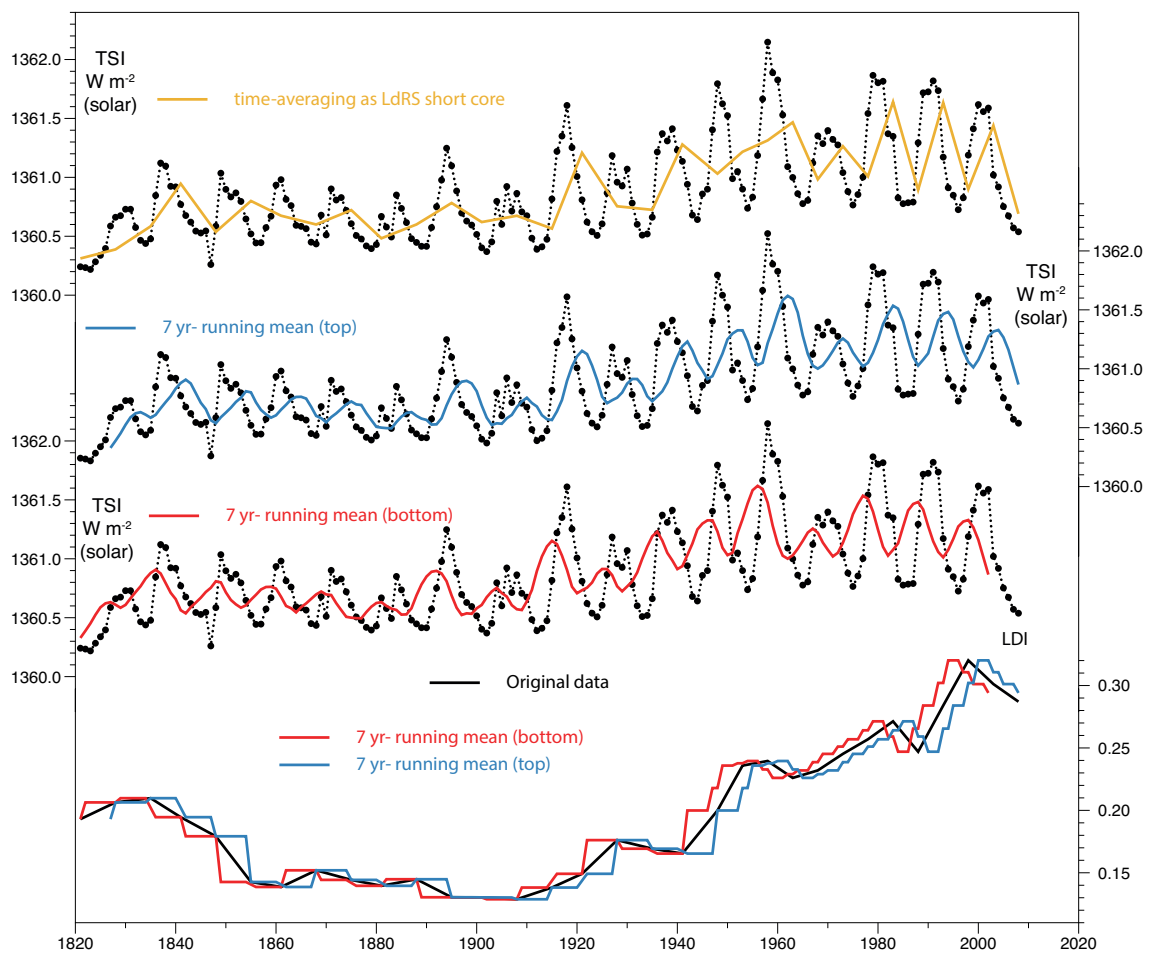

Figure 1. Comparison between TSI data using the same time-averaging as LdRS short core and 7-year running mean simulations from the top and the bottom of the time-series. Variables: Total Solar Irradiance (TSI) and LDI record of LdRS short core. Original data in black.

LDI vs.	7-yr running mean		Our model: LdRS time-averaging	
	r	*p*	*r*	*p*
TSI	0.64	<0.001	0.56	<0.001
CH4	0.83	<0.001	0.86	<0.001
CPS Summer temperatures	0.59	<0.001	0.58	<0.001
NAO	-0.10	0.1792	-0.03	0.883
U$^{K'}_{37}$-SST Gol-Ho1B	0.70	<0.001	0.76	<0.001
AMO	0.57	<0.001	0.61	<0.001

Table 1. Comparison between the correlations of LDI vs. other variables using a 7-yr running mean simulation and the same time-averaging as LdRS short core.
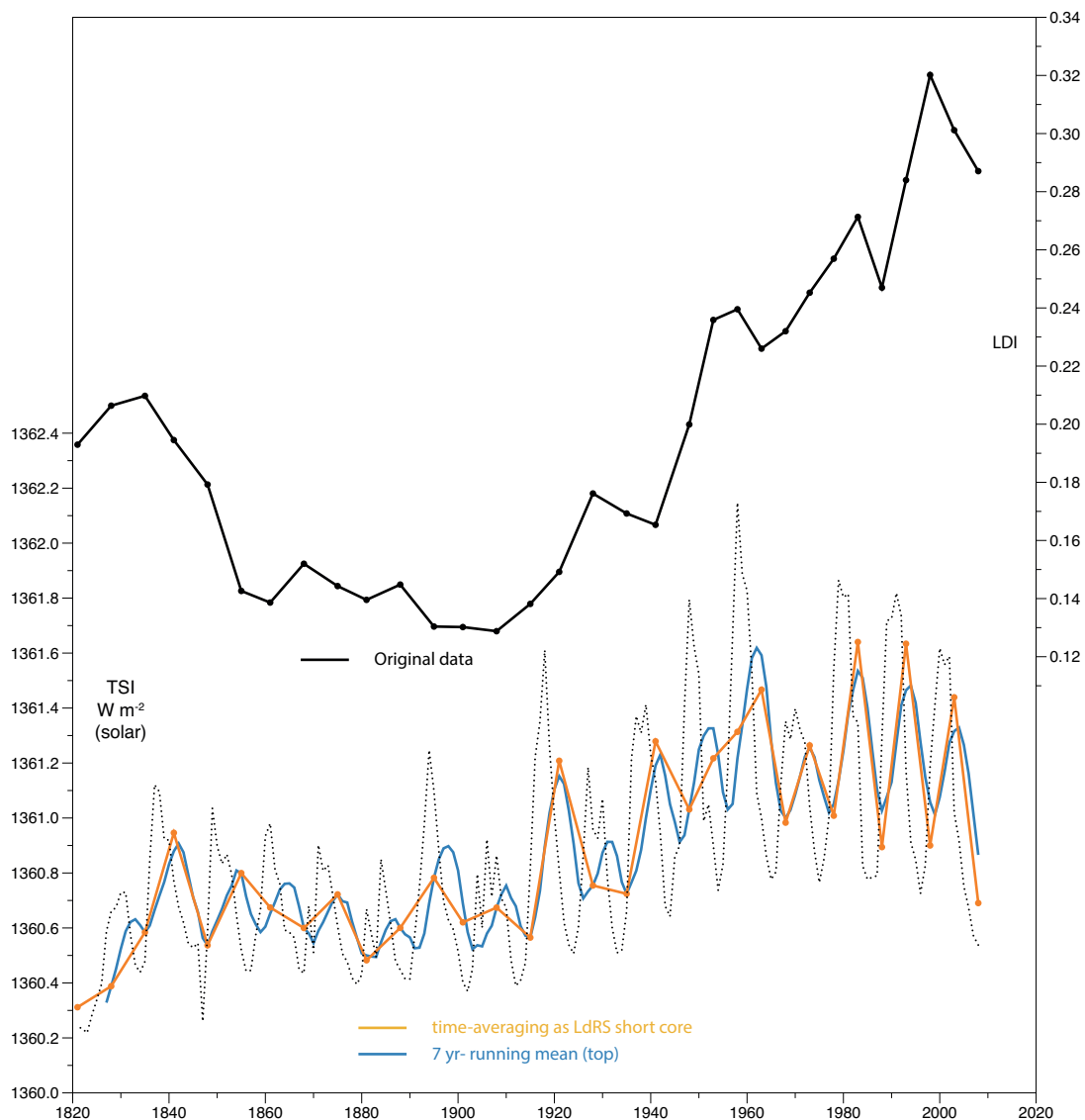

Figure 2. TSI data comparison between a 7-year running mean simulation from the top of the time-series and another simulation using the same time-averaging as LdRS short core for the Total Solar Irradiance (TSI). Original TSI data in black dots.