We are thankful to Professor Leif Svalgaard for his comments and criticism.

We re-discuss inhomogeneity of Wolf numbers on page 17, lines 22-29.

The homogeneity of the *ISSN*-series is a long debated question. Svalgaard (2010, 2012) points to an abrupt increase of *ISSN* in ~1945 and argues that this increase is caused by changes in the measurement rules. The NASA web-site (http://solarscience.msfc.nasa.gov/greenwch.shtml) also notes that the sunspot series is not uniform; abrupt changes occurred in 1941-1942 (sunspot numbers) and 1976-1977 (sunspot areas, not used in our paper). However, our conclusions about regime changes are not seriously affected by such events, because we use ratios (equation 4). Moreover, the date of the ~1930 singularity is remote from 1941-1942 (or 1945); page 18. lines 22-29.

Following the reviewer's suggestion, we have applied our algorithm to the group sunspot numbers (GSN) introduced by Hoyt and Schatten and find that the behavior of the computed lambda corresponds to the regime changes found in our previous paper (Shapoval et al, ApJ, 2013 = P1). Computing the irregularity index of GSN with delay 8 and different embedding dimensions (Figure 1 of this response), there is a clear change in the regime of solar activity, approximately between 1915 and 1940. According to the graphs corresponding to large values of *m* (greater than or equal to 8), one regime of lambda continued during cycles 12, 13, 14, up to the very strong peak of lambda that occurred at the minimum between cycles 14 and 15. Graphs with a smaller *m* (4-8) indicate a possible continuation of the first regime up to the minimum between cycles 16 and 17. The regime change evidenced by Figure 1 exactly corresponds to the regime change exhibited by the irregularity index of the sunspot numbers (ISSN) and reported in P1 (compare Figure 1 and Figure 2). This provides additional evidence that our methodology reveals some "hidden" properties of solar activity and answers the reviewer's concerns. We are grateful for this suggestion and have introduced a new paragraph and figure in the paper to show these strengthening results (strengthening both P1 and the present paper). The new analyses involving GSN are added and discussed in Page 9, lines 22-28; Page 18, lines 8-18; Page 21, lines 17-27 (Appendix B), Figures 12 and 13.

The discontinuity of GSN in ~1880 highlighted by Leif Svalgaard is not based on just a multiplicative factor. Indeed, our irregularity index, which reflects the *ratio* of distances (page 17, lines 26-28) and is conserved under multiplication, suggests a regime change of GSN in the 1870s, not seen in the irregularity index of *ISSN* (Figure 1 vs. Figure 2).

Half-Schwabe variations (HSV) debated in our paper are seen for GSN as such with large embedding dimension (*m* larger than or equal to 16, Figure 1) and partly for GSN first pre-smoothed with 162 and 648 day averaging (Figure 3). However, the change of HSV with smoothing, the main observation of the paper, is absent in the case of GSN. We link this absence to a certain smoothness of GSN.

We retain the term "quasi-biennial" oscillation, since other authors mention QBO when they a 600-700 day variation is involved.

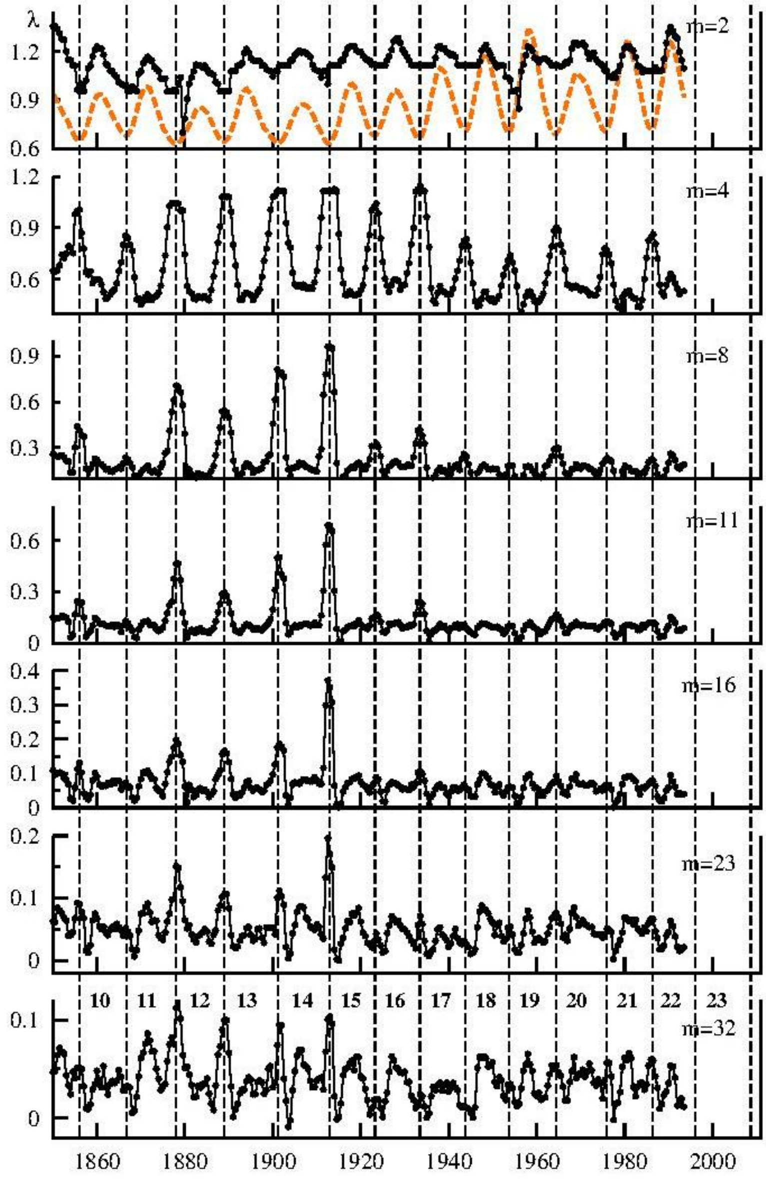

Figure 1. The irregularity index λ computed for GSN within 4-year sliding windows; the embedding dimension *m* is indicated; vertical lines are at solar cycle minima.

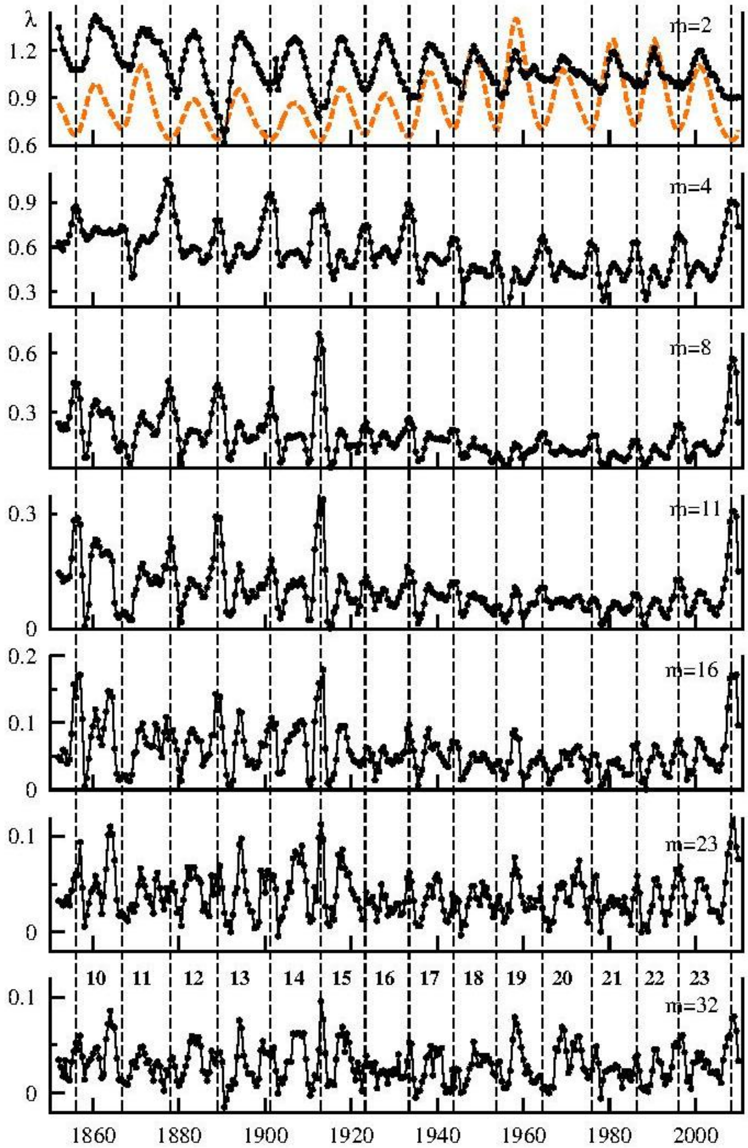

Figure 2. The irregularity index λ computed for *ISSN* within 4-year sliding windows; the embedding dimension *m* is indicated; vertical lines are at solar cycle minima.

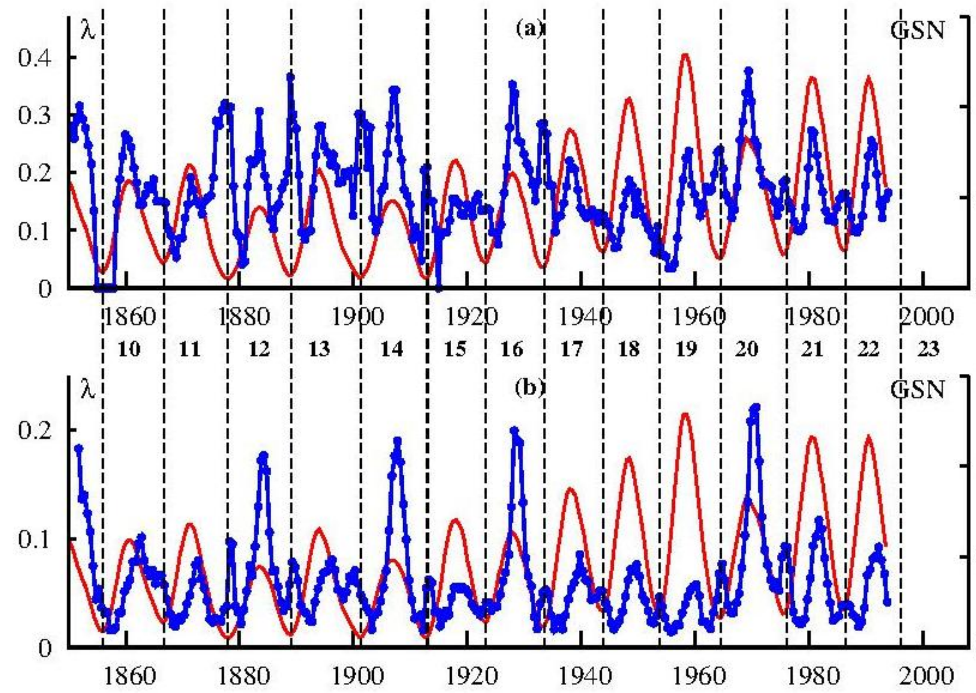

Figure 3. Blue curves: the irregularity index λ computed within 4-year sliding window for GSN averaged over 162 (a) and 648 (b) days; red curves: GSN averaged over 1461 days (4 years); m = 2. Vertical lines are at the minima of 4-y smoothed GSN.