

Interactive comment on “The influence of solar variability and the quasi-biennial oscillation on sea level pressure” by I. Roy and J. D. Haigh

Anonymous Referee #1

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General comments:

This study investigates the influence of the 11-year solar cycle and the QBO on temperatures in the polar winter stratosphere, on zonal mean temperatures in NCEP-NCAR reanalysis from 1958 to 2004 and on sea level pressure from the Hadley Centre from 1900-2004. In the first part of the paper an apparent inconsistency between previously published results by Labitzke and van Loon (1994) and Camp and Tung (2007) in polar winter temperatures is linked to a different pressure level to define the QBO. Then the combined solar-QBO impact on atmospheric temperatures is investigated by using a multiple linear regression analysis where either solar and QBO forcing are taken as independent basis functions or as a combined solar*QBO basis function. These investigations are expanded to sea level pressure in the last part of the paper.

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These results are very interesting and represent a number of new aspects. However the central theme of the paper needs to be focused and highlighted more. The title only includes “sea level pressure” while a large part of the paper deals with temperature impacts and the uncovering of the inconsistency between two published results. In particular the overall motivation of this study and links to other papers (in the introduction as well as in the discussion of the results) have to be expanded as outlined in more detail in my specific comments below. I can recommend publication after the authors have taken my comments into account.

Specific comments:

Abstract: The abstract should be restructured to highlight the central goal of the paper. Is the focus on the inconsistency? Or on the temperature structure using the combined solar*QBO index or on the sea level pressure (as can be expected from the title)?

Page 30455, line 22ff (P30455L22ff): Lu et al. (2009) were not the first to remark this, please cite original work here.

P30456L13: which period of NCEP/NCAR do you use? 1958-2001 or up to 2004 at different parts of the paper different number of years are indicated, please adjust.

P30457L20ff: please shorten the description of the QBO time series. Which one did you use? The one from the CCMVal website is indeed based on the FUB Berlin QBO data from Naujokat (1986) but has been extended above 10hPa.

P30458L8: the QBO period is 28 months

P30458L11: please include some references

P30459L1: LvL use the JF solar and QBO mean. Did you use the DJFM mean for both, the LvL and the CT QBO level definition?

P30460L4: It would help to put an introductory motivation sentence here in order to make clear to the reader what the goal in this further investigation is.

P30560L5: 1958-2004 (or 2001?), see comment above

P30461L8: Sentence starting with “Thus using the compound index...”. Could you please explain in more detail what this means and what the advantage of this index is. Also, including a figure of the combined solar*QBO index would be very useful.

P30461L24: Please motivate in more detail why the analysis from Roy and Haigh (2010) is extended. It is not only including the QBO in the regression but also the combined solar*QBO index, isn't it?

P30462L5ff: Please explain in more detail the response to the different forcings (solar, ENSO, QBO) and relate this to other recent work. Why is the combined solar*QBO results in an extra subsection, a connection to the results above would be helpful to highlight the topic of the paper.

P30462L18ff: Sentence starting with “It indicates a weakening...” Here again it would be useful to have time series of the combined solar*QBO index and to highlight what a positive and negative signal means with respect to the solar and the QBO phase. Please explain in more detail.

P30463L5: What is the DLR QBO dataset? Please be consistent in the description, see comment on QBO data above. Why don't you show the ENSO signal for the extended period? The description and possible implications for the longer time period should be extended.

P30463: The summary and conclusion section is very well written and can be used to reformulate the abstract and parts of the paper indicated above.

P30464L4: “. . .consistent with previous studies. . .” Here, it would be very nice to mention a few of those studies and integrate this study into the existing work.

Technical comments:

Page 30454, line 18 (P30454L18): “. . . by the phase of the QBO. . .”

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P30454L20: ...affects sea level pressure...

P30456L22: These include solar variability and the phase of...

P30458L22: combined

P30459L27: please reword "longish period"

Figures 4, and 5: these figures are too small and hard to read. Please include subtitles for the four panels (Solar, ENSO, QBO, etc.) and may be only include shading for the largest values, leaving the smaller ones white. The axis labeling and the contour labeling needs to be resized as well.

P30462L6/7: Please reword sentence "Overwhelmingly, ... unsurprisingly..."

P30463L2: "... the role of the QBO..."

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 30453, 2010.

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