We are grateful to the two referees for their comments. We address here the major issues they raise: if these clarifications allow them to feel more comfortable with the fundamentals of the paper we would, of course, address in detail in a revised manuscript all of their specific comments and suggestions.

Neither referee has appreciated the links between the three parts of the paper and we have clearly been amiss in explaining the underlying philosophy. The first part, a discussion of the impact of solar variability and the phase of the QBO on polar stratospheric temperatures, is intended to provide a justification for the approach used in the second, in which is investigated the combined solar*QBO influence on zonal mean temperatures throughout the lower atmosphere and how this compares with a purely solar signal. These two approaches produce different patterns of response in the lower troposphere (greater in mid-latitudes with pure solar and in high latitudes with solar*QBO) so in the third part of the paper we again use the two to look at the signals in a surface parameter, viz sea level pressure.

Perhaps the word "inconsistency" to describe the apparent difference between the results of Labitzke and van Loon (1987, LvL87, or 1988, LvL88) and Camp and Tung (2007, CT07) is not well-chosen but we find that the conclusion of CT07 that "the same polar warming by the solar cycle is found regardless of the phase of the QBO" depends on the pressure level chosen to define the phase of the QBO. It is not clear why CT07 chose to use 30hPa, rather than the 45hPa of LvL, but this choice means that their results are not directly comparable. Specifically we consider that the significant warming shown in Fig.9 of CT07 between SC-min/wQBO and SC-max/eQBO would not be present if the 45hPa level had been used. Other authors (e.g. Naito & Hirota JMetSJ 1997, Gray et al JAS 2004) use the 40-50hPa level to define the phase of the QBO and find that SC-min/eQBO and SC-mx/wQBO are warmer than both SC-min/wQBO and SC-max/eQBO.

We are concerned about the value of the pressure level because our solar*QBO time series is premised on the observation that the solar influence on polar temperatures is different in the two QBO phases. The background to this approach is given by Haigh & Roscoe (2006) – as stated on p.30460 l.20 of our manuscript. The technique has subsequently been used to good effect by Roscoe & Haigh (QJRMS 2007), Haigh & Roscoe (JClim 2009) and Camargo & Sobel (JClim 2010). The idea is, instead of using two independent time series for the Sun and the QBO in a multiple linear regression analysis, that one new time series is used. This is constructed by subtracting the means of each of the solar and QBO indices from their respective time series and then forming the product. In this way the QBO series is inverted when the Sun is below mean activity – see the Figure from Camargo&Sobel below [which is essentially identical to components of Fig 1 and Fig 3 of Haigh & Roscoe (2006)]. Note that in the regression the combined index is used instead of the other two so that there is no dependence between indices and no non-linearity introduced.

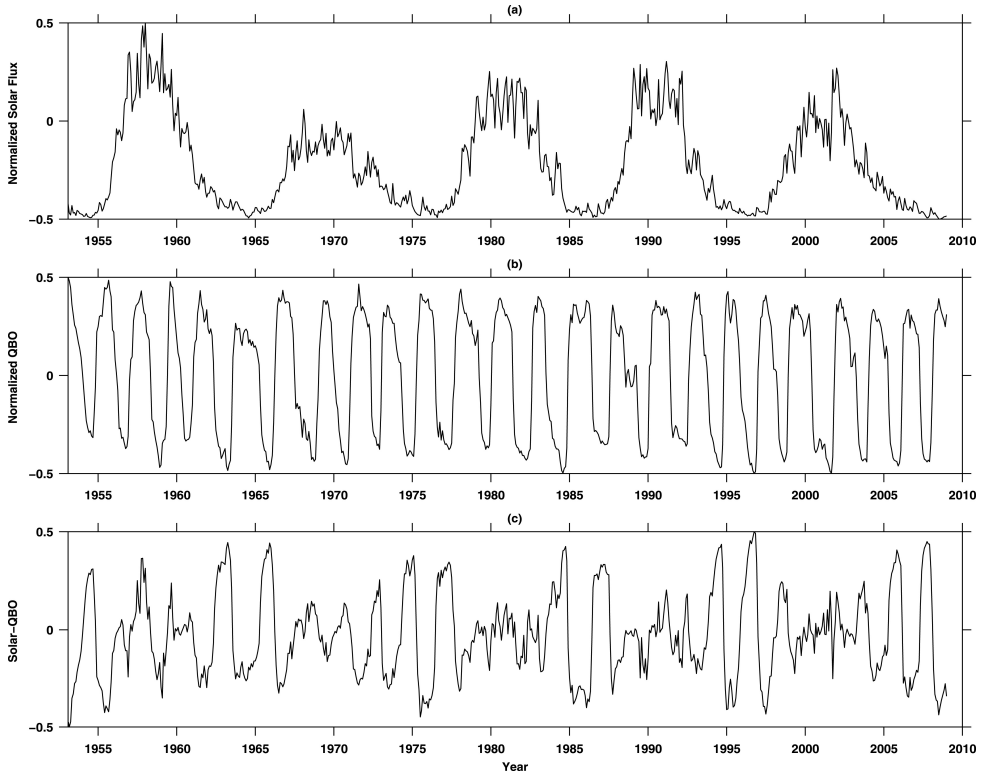

Fig. 7 of Camargo & Sobel (J Clim, 23, 5810-5825, 2010). Time series of (a) the normalized solar flux index, (b) the normalized QBO index and (c) the combined normalized solar-QBO index in the period 1953-2008.