

## ***Interactive comment on “Differences between the QBO in the first and in the second half of the ERA-40 reanalysis” by H. J. Punge and M. A. Giorgetta***

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General Comments: This paper makes a useful contribution to our understanding of how observing techniques affect our perception of phenomena, in this case the time mean temperature in the upper tropical stratosphere. It clearly shows that in the post-satellite era the time-mean winds in the upper stratosphere are more westerly, but that the range in QBO winds hasn't changed much. While a full explanation of the time mean difference in the early and late periods would require careful exploration, it may be possible to gain some further insight by considering the occurrence of tropical rocketsonde profiles as a function of year, examining the temporal dependence of the

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-20 m/s bias within the early period, and by considering sampling of the SAO in the two periods. A recent study of the NCEP reanalysis by Huesmann and Hitchman also focussed on the pre 1978 and post 1978 period differences in the QBO. It might be beneficial to briefly state any relevant results of theirs for this paper.

Specific Comments: Huesmann, A. S., and M. H. Hitchman, 2003: The 1978 shift in the NCEP reanalysis stratospheric quas-biennial oscillation. *Geophys. Res. Letts.*, 30, 1048. This work showed that the QBO in temperature is significantly reduced in amplitude after 1978, but that the QBO in winds is similar in amplitude for the two periods. They argued that radiosonde and rocketsonde profiles more accurately sense the vertical temperature variations near the tropopause and in QBO shear zones than the more vertically-deep nadir satellite weighting functions. (They felt that zonal wind observations were given more weight in the assimilation scheme for the whole data record, as an explanation for the change in relationship between temperature and wind for the QBO.) The relevance for the present work is that the more recent period in the ERA-40 reanalysis might be \*less\* accurate than the first period, especially for the lower stratosphere where radiosondes are reasonably plentiful. Thus, even if the QBO were entirely uniform in time, from the vertical smoothing effect of nadir sounders, one might expect the result in the lower half of Fig. 2: the range for the early period is slightly bigger.

It would seem from Fig. 4a that, since the range in QBO has not changed much, rocketsondes did not do poorly relative to satellites for range of QBO. The substantial difference in time mean winds, however, should be relatable to systematic differences in time mean meridional gradients of temperature. Due to the sparseness of rocketsonde observations, it is possible that the time mean meridional temperature gradient is poor in the tropics in the early period. Conversely, there could actually be a bias in vertically integrated meridional temperature gradients in the satellite data.

The -20 m/s bias is interesting. Is it present throughout the entire early period or does this vary considerably in time? The authors point out that the SAO may not be removed

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entirely. Can the timing of the QBO relative to the SAO for the composites be examined to answer this question more completely? Is the SAO actually blunted in the recent, satellite period? This seems unlikely, given the stronger six month periodicity in Fig. 1c relative to Fig. 1b. This would argue in favor of a better representation of the SAO during the satellite era.

It may also be the case that the time mean wind actually shifted somewhat near 1978. There are a variety of tropospheric indices that show a regime change at about that time, perhaps related to the state of the North Pacific.

Technical corections: Caption for Fig. 3: should the two labels be reversed, so that the solid line (less easterly) corresponds to the late composite? p9260,l4: well -> good p9260,l19: 1950ies -> 1950s p9262,l17: are \*a\* result p9262,l22: monotonous -> monotonic p9263,l13: amplitude -> range p9263,l25: from westerlies to easterlies p9265,l23: artifacts (more common spelling)

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