Comment on Section 2.1

Indeed, the length of possible data acquisition time does change throughout the month of July. To give the reader a better indication as to how much of the each night is covered by the observations, the following has been added:

On P23406, L26,

> Due to scattered light, data could only be acquired whenever the sun was more than 5^o below the horizon. This gave from ~3.5 to ~5.5 hours of observation time each night over the course of July.

In addition, P23407, L18, now reads:

> This averaging, as well as the monthly averaging described below, had the effect of smoothing out the variations caused by short-period gravity waves. However, during individual nights, the OH temperature can vary by 3-5% due to both photo-chemical and tidal effects (Lowe et al., 1996). Therefore, in order to prevent data gaps caused by cloudy periods during the night from skewing the average, nights with less than 100 minutes of data were not included in the analysis. On average, each night used in the analysis covered 89-93% of the possible observation time, with a minimum data coverage of 30%.

We believe this new formulation details both the temporal extent of the nightly data requested by the reviewer, as well as indicates the average and worst-case data coverage of the nights used in the analysis. While 100 minutes might not average out all the gravity waves present during a night, the average over the month should.

Comment on Section 2.2

We agree that the correlation analysis using the winds directly would be more convincing as it would remove the proxy. The Baldwin and Dunkerton (1998) work showed the average maximum wind difference between QBO phases to be 6 m s^{-1}. Given the large latitudinal gradients in the southern hemisphere zonal wind field, a simple zonal mean shows large year-to-year variability driven by changes in the centre of the vortex and small asymmetries in its shape. This artificial variability reduces the correlation coefficients by ~30% Since the temperature field is more uniform, it is less affected by vortex variations, and we have therefore have kept this as the main variable in the correlation analyses.

We prefer the correlation analysis as it shows directly how well the two variables track each other. However, it is also possible to stratify the zonal wind data by either QBO or mesospheric temperature anomaly phase and take the differences in the average (rather than a correlation analysis), as was done by Baldwin and Dunkerton. In doing this, we find that on average the zonal wind between 40 and 60^{o}S is slower during the easterly QBO and warm temperature anomaly years. The magnitude of the difference is approximately equal to the average of the Baldwin and Dunkerton results, and, as in those results, we find the effect to maximize for the zonal winds at 5 hPa. We have therefore added a statement to section 2.2 explaining our use of the temperature proxy, and a section in the results detailing the aforementioned result for the zonal wind. We feel that this addresses the referee’s comments, and that the wind results strengthen the present analysis without adversely affecting the correlation analysis.

We have therefore changed the beginning of section 2.2 to read:

> Karlsson et al. (2007) used the lower stratospheric temperatures in the winter hemisphere as a proxy for the residual circulation. It should be noted that the mechanisms proposed for inter-hemispheric coupling rely on changes in the

zonal wind field, not the temperature. However, the zonal wind has a very large latitudinal gradient compared to the temperature field. Thus, the zonal average of temperature is more stable against year-to-year variations in the location and asymmetry of the vortex than that of the zonal wind. For that reason, and in keeping with the Karlsson et al (2007) analysis, we use the zonally averaged, monthly mean, lower stratospheric temperatures from the ECMWF ERA-40 re-analysis (Uppala, S., et al., 2005) as the primary characterization of the dynamic state of the winter stratosphere during the mesospheric data period: July 1991 through July 2000.

And have added the following paragraph to the end of the analysis and results section (p23411 after L26):

> Baldwin and Dunkerton (1998) observed that due to the relatively weak southern hemisphere planetary wave field, the QBO-induced variations in the zonal wind occur mainly at the vortex edge (~40-60^{o}S) at altitudes near 5 hPa. To check whether the temperature proxy for the residual circulation used here captures the behaviour of the wind field, we have compared the northern hemisphere mesospheric temperatures to zonal averages of the ERA-40 zonal wind over the same latitudinal range, 40 to 60^{o}S. Despite the increased variability mentioned previously, we find that these zonally averaged ERA-40 zonal winds are on average 3.4 m s^1 slower during years with the warm mesospheric temperature anomaly that is associated with the easterly phase of the QBO. We also find that the effect maximizes at 5 hPa, in agreement with the Baldwin and Dunkerton (1998) results.

Comment on P23409, L3

Though not the primary focus of the paper, the solar signal was 2 +/- 0.4 e-2 K/SFU. This has been added to the paper as follows:

> Thus, a regression analysis between the individual nightly-mean temperatures and the corresponding F10.7 flux (in solar flux units) was performed, and the resulting solar attributable signal, $2.0 \pm 0.4 x 10^{-2}$ K/sfu, was removed from the data before the monthly means for July were formed.

Comment on P23411, L16

Indeed, it was a glaring omission not to cite these references, and we thank the referee for pointing this out. Both references have now been added to this section at line 16.

Comment on P23413, L18-16

We by no means wish to suggest that the solar signal seen by many authors (including ourselves) is a result of this non-linear interaction. Rather that a few authors (in fact, we know only of the two cited in the text) who have stratified their temperature data according to the phase of the QBO, risk artificially amplifying the strength of the solar signal. Again, since the focus of this paper is the QBO and not the solar-cycle signal, we believe that an extended discussion is not warranted. However, it is important to make clear that very few authors have examined the solar signal in this way, and thus the statement has been changed to read:

> This would mean that if the data were stratified according to the QBO phase, this nonlinear interaction would produce an 11-year oscillation in the two data sets even if none were present in the original signal. In the few cases where

mesospheric temperature data have been biennially sampled (Neuman, 1990; Nikolashkin, 2001), this sampling artefact could have enhanced the inferred solar-cycle signal.

Additional comments
Abstract L7: corrected
P23406 L7 now reads: provide furthern mechanistic evidence
P23408, L22: “preset” corrected to “present”
Caption to Fig 1 now reads: temperature around 60N.