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Atmospheric Chemistry and Physics Discussions

Interactive comment on "The role of the QBO in the inter-hemispheric coupling of summer mesospheric temperatures" *by* P. J. Espy et al.

Anonymous Referee #1

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This paper discusses the role of the coupling between the southern hemisphere winter stratosphere and the temperature of the summer high-latitude mesopause region through the modulation of the meridional circulation driven by the interaction between planetary waves and gravity waves. It confirms a result previously published by Karlsson et al (2007) using PMC observations as a proxy for summer mesospause temperatures. This work uses direct passive measurement of the mesopause temperature, and a longer time series than the Karlsson paper and therefore offers further evidence for the PW/GW interaction mechanism proposed by Karlsson. In addition this paper reveals that the interaction is modulated by the phase of the equatorial QBO as expected of an inter-hemispheric coupling. The paper is timely, well written, clear and concise. The references, title and abstract are all appropriate and I would recommend publication in ACP after addressing the following minor points.

Section 2.1 I think some indication of the length of a night of observations at 60N during July would be helpful here. As the observations are restricted to a solar depression angle of 5 degrees or greater, around mid-summer surely this gives a very small window for data collection. Are some nights in early July actually shorter than the 100 minute cutoff used in the averaging? The authors also state that averaging the 5 or 15 minute temperature values has the effect of "smoothing out the variations caused by short-period gravity waves". This smoothing would only occur if the data window is sufficiently large.

Section 2.2 The strength of this paper is that it uses direct temperature measurements of the summer mesopause rather than the temperature proxy of mean PMC radius. However, the authors choose to compare their data against stratospheric zonal mean temperature which in this paper is in effect a (inverse) proxy for wintertime stratospheric zonal mean zonal wind. It is not the temperature of the stratosphere that filters the gravity waves but the zonal winds. Some discussion as to why the authors choose zonal mean stratospheric temperatures rather than winds would be helpful given that the ECMWF data includes zonal wind data.

P23409, L3: How large and significant was this solar signal in the data?

P23411, L16: Discussion of the MQBO would be helped by a reference to Burrage, M. D., R. A. Vincent, H. G. Mayr, W. R. Skinner, N. F. Arnold, and P. B. Hays, Long-term variability of the equatorial middle atmosphere zonal wind, J. Geophys. Res., 101, 12,847–12,854, 1996, or maybe even Baldwin et al., The Quasi-biennial oscillation, Rev. Geophys. 39(2), 179–229, 2001.

P23413, L18-26: I think this para needs expanding and quantifying. If the authors are suggesting that the main cause of the solar signal seen by many authors in mesopause temperatures is due to this non-linear interaction which is independent of the state of the solar flux, then this is a significant claim worthy of more discussion than is provided here.

Abstract L7: "time-lagged"

P23406 L7: perhaps "provide further mechanistic evidence" rather than "indicate" would be more appropriate here?

P23408, L22: "present" rather than "preset"?

Caption to Fig1: "temperature around 60N"

Interactive comment on Atmos. Chem. Phys. Discuss., 10, 23403, 2010.