Supporting Information for "Interannual variability of the 12-hour tide in the mesosphere and lower thermosphere in 15 years of meteor-radar observations over Rothera (68° S, 68° W)"

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Introduction

In this supporting information document, we give additional information to justify our methods and results.

S1. Use of QBO10 and QBO30.

In our study, we have used both the QBO index at 10 hPa and also 30 hPa. Our justification for this is that they are sufficiently different for us to expect a different

response from each. In Figure S1, we present the correlations between monthly-mean zonal-mean equatorial (5°S - 5°N) winds in the ERA5 reanalysis model. Correlations between the 10 hPa and 30 hPa levels are near-zero (highlighted by a black outline). This Figure shows that the two indices are not correlated and in fact have a near-zero correlation coefficient. Therefore, we are valid in saying that these indices are orthogonal.

S2. Correlation coefficients of climate indices

In this section, we present correlation coefficients of each of the climate indices used against the other climate indices, Table S1. We have also included ozone in this table to demonstrate the correlation present. Most of the values in this table are low enough that we can be happy that there is no correlation. However, there are two values which are cause for concern, specifically ENSO against Ozone and Ozone against Time. These values are 0.3537 and 0.2344, respectively. They imply a correlation between these two indices. This correlation is one of the justifications for not including an ozone term in our linear regression model, which we discuss in more detail in our main manuscript.

	Solar	ENSO	QBO10	QBO30	SAM	Ozone	Time
Solar		0.1052	0.0123	-0.1498	0.1053	-0.0081	0.0029
ENSO			-0.0827	-0.0046	0.0457	0.3537	0.1701
QBO10				-0.0425	0.1469	-0.0089	0.0031
QBO30					0.0175	-0.0144	0.1776
SAM						0.0891	0.0054
Ozone							0.2344
Time							

Table S1. Correlation coeffficients of the climate indices used in the linear regression model against the other climate indices. From this table, we can see that the majority of values are below 0.2 which means that most of the pairings are not correlated. However, for ENSO and ozone (and vice-versa) there are correlations present. This is justification to exclude ozone from the present study.

S3. Lomb-scargle Analysis of QBO10 and QBO30

In order to identify any periodicities present in the QBO10 and QBO30 indices, we use a Lomb-Scargle analysis to extract the periods present in the indices. This is presented in Figure S2. There are peaks in both at around 22 months, a period that is apparent by eye in the data. Further there are further powers at 27 months and 32 months in the QBO10 index and at 32 months in the QBO30 index.

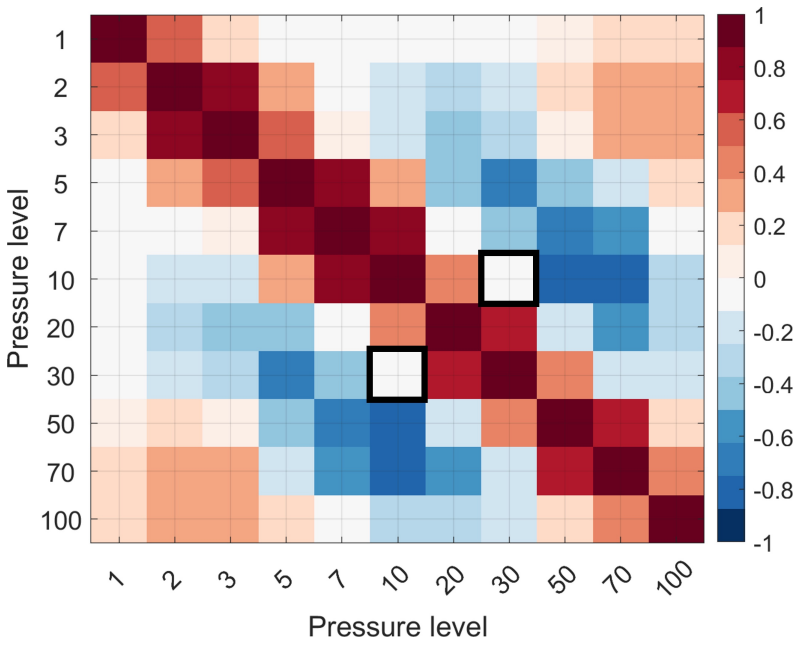

Figure S1. Correlation matrix for QBO zonal mean winds for selected pressure levels in the stratosphere and mesosphere, derived from 63 years of monthly-mean ERA5 reanalysis model output. Note the zero-correlation between the 30 hPa and 10 hPa time series, highlighted with a black outline.

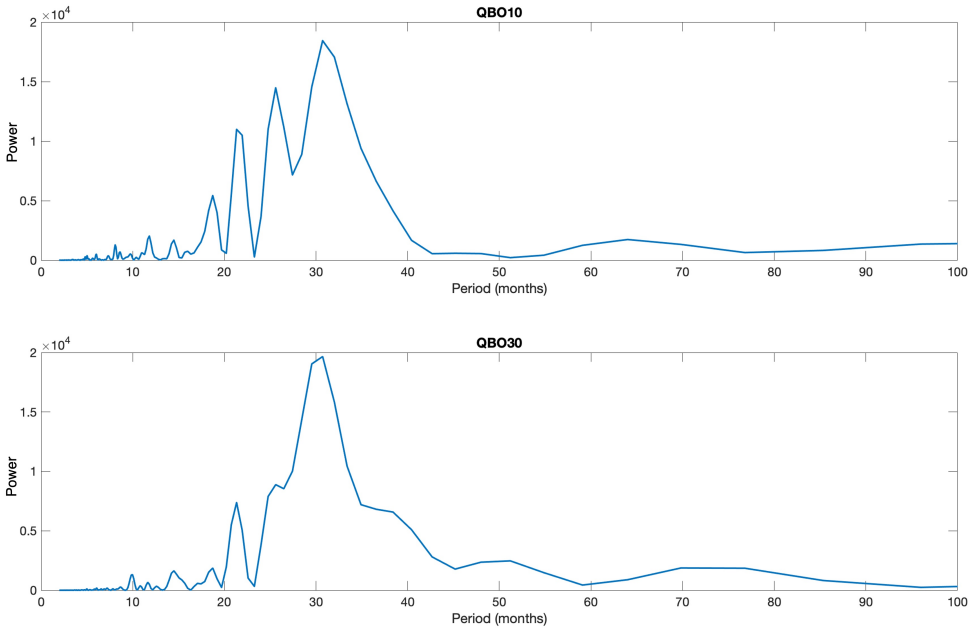

Figure S2. Lomb-Scargle Periodogram Analysis of the QBO10 and QBO30 indices to identify any periods present in them. There are peaks in both at around 22 months, a period that is apparent by eye in the data. Further there are further powers at 27 months and 32 months in the QBO10 index and at 32 months in the QBO30 index.