The MDI instrument is capable of producing images of the Sun with a resolution of 1024x1024 at a cadence of one minute. However, due to telemetry constraints, these images are usually smoothed by a Gaussian, cropped at 90% of the solar radius, and sampled every 5x5 pixels. Dopplergrams obtained in this way are called vector weighted and are the usual input for the MDI medium-l program. Every year for some months, however, there is telemetry available to send down the full disk images in addition to the lower resolution ones. These are the dynamics runs. The full disk images can be run through the pipeline in almost exactly the same way as the vector weighted images. But not only is the spatial resolution higher, the data goes closer to the limb. Specifically, vector weighted images are usually apodized with a cosine curve from a fractional image radius of 0.83 to 0.87, while the full disk images are usually apodized in the same way from 0.90 to 0.95. For this work, the remapping for the spherical harmonic decomposition uses updated values for the P-angle and Carrington inclination and makes corrections for the plate scale of the instrument, cubic distortion and CCD tilt. The resulting timeseries are then detrended and gapfilled, and all of our peakbagging takes into account the Woodard effect and horizontal displacement.

To examine the effect of using the full disk data versus the vector weighted data, we analyzed these 13 periods in three different ways. First, we ran the regular full disk processing. Second, we used the same full disk data but used the apodization that is used for the lower resolution data. Third, we performed our usual analysis of the vector weighted data on these periods. In the first case we used the native window function for the full disk data. In the latter two cases we used a common window function as input to the gap-filling. This is necessary because the full disk data usually has a lower duty cycle than the vector weighted, and we wanted to eliminate this variable from our comparison. The results are shown in the surrounding figures. Left panels show the difference between the regular full disk analysis and the same using the tighter apodization. Right panels show the difference between using full disk and vector weighted data with the same apodization. In other words, the left panels show the effect of the apodization, and the right panels show the effect of the spatial resolution. The sense of subtraction is such that the sum of the two sides gives the difference between the regular full disk analysis and the regular vector weighted analysis.

Clearly the effect of the apodization is greater. However, the differences vary across the dynamics runs. To find out why, we composed the table shown. The columns show the length of the timeseries, the duty cycle before and after gapfilling, the B-angle, the 10.7 cm radio flux, the focus position of the MDI instrument, the difference between the commanded focus and the sharpest focus, the roll angle of the space craft, and statistics on the data used. Data can be made by sampling for either 30 or 60 seconds; the fraction made using 30 second sampling is shown for full disk (fd_V) and vector weighted (vw_V) data. Finally, the vector weighted data can be constructed onboard the spacecraft, or reconstructed from the full disk data on the ground. The fraction reconstructed is also shown.

We also examined the effect of using full disk data on known systematic errors, such as the bump in the a-coefficients and polar jets in the inversions. Results are shown. In both cases the systematic error was reduced if not eliminated entirely. Hence we suspect a problem with the vector weighted processing, which is supported by measures of the quality of the fits, also shown. To check, we repeated the peakbagging of the 2006 dynamics run for the regular data with double the usual fitting interval. If the model is a good fit to the data, this should not change the mode parameters. Unfortunately this is not what we found. The amplitude and linewidths changed for both sets of data, but substantially more for the vector weighted data, as shown. Also shown are the goodness of fit and a-coefficient residuals for the wider fitting interval.