

When is Minimum?

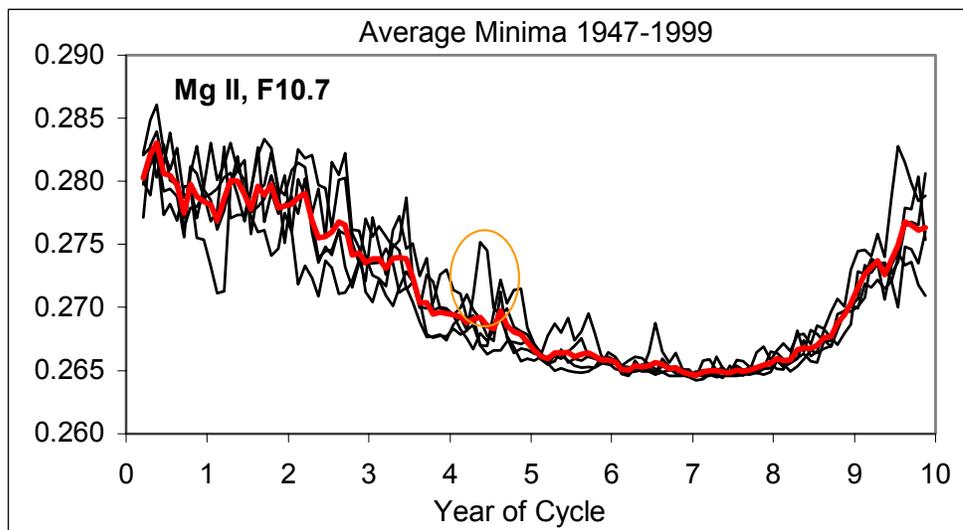
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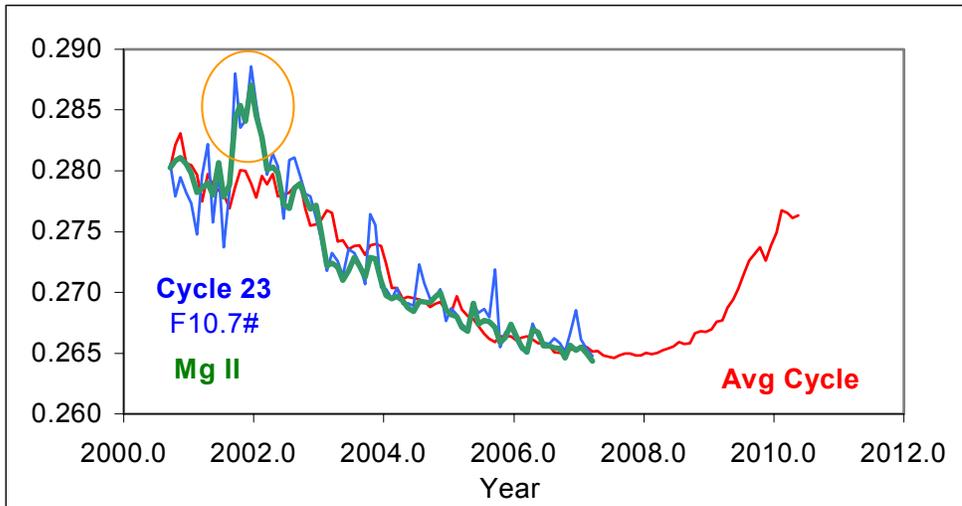
I'll try to guess when minimum between cycles 23 and 24 will be using the method of "analogues". I'm using F10.7 and MgII assuming that they are reliable indicators of solar activity (first correcting MgII by subtracting 1.1% after Jan. 01, 2002, of course :-). There are several steps in the analysis:

- 1) Convert F10.7 to the MgII scale $MgII = 0.25614 + 0.00012114 F10.7$, ($R^2 = 0.9661$)
- 2) Normalize each cycle to have the same strength at maximum (MgII = 0.280),
 $MgII \text{ norm} = a + (MgII - a) * (0.280 - a) / (\text{smoothed cycle max} - a)$, where $a = 0.2645$.
- 3) "Line up" all minima. This is done by moving a cycle one 27-day rotation at a time relative to another cycle and find the lag that minimizes the sum of the squares of the differences between the two cycles.
- 4) Do a superposed epoch around the minima to get the average cycle. The result is this:



Black lines are individual cycles and the red curve is the average cycle spanning the minimum. Note that the declining phase of cycle 23 is not used yet.

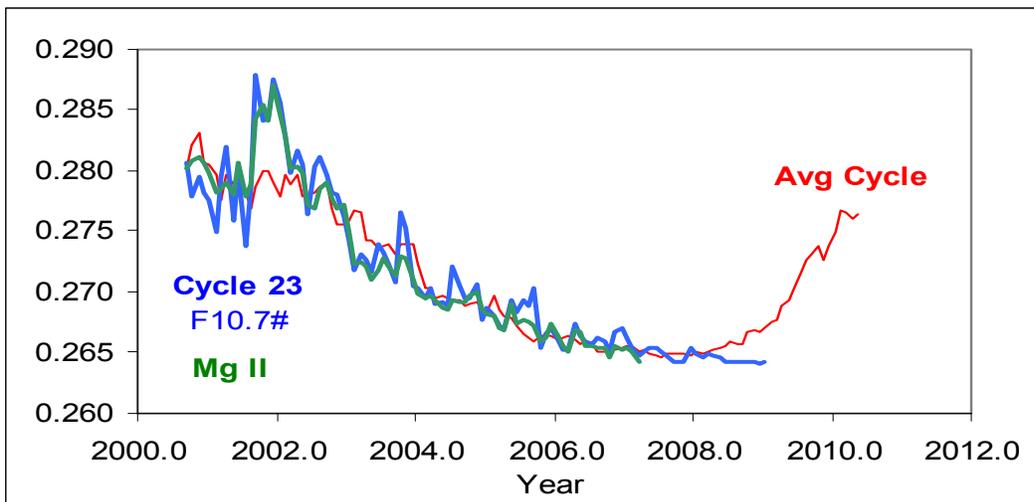
Now do the "sliding least-squares" fits between the red average cycle and cycle 23 from 2000.0 on. We can this both for converted F10.7 (thin blue curve) and observed (but corrected) MgII, (green curve) and plot the result in the same Figure:



If cycle 24 is an average cycle ($R_{max} \sim 147$ for cycles since #17), minimum might come in 2008.0 or in the very last months of 2007. If cycle 24 were to be higher than 147, we might expect the new cycle lying above the average rising part of the curve and minimum might occur earlier than 2008.0. If cycle 24 were to be a low cycle, minimum will likely occur later than 2008.0. My guess would be 2008.5 $(-0.5+0.25)$.

The nasty excursion (marked by the orange oval) around 2002.0 was due to an influx of much magnetic flux. This helped open up the big coronal holes in 2003, causing the geomagnetic peak that some people like to use as a precursor. This is not an uncommon phenomenon; similar excursions happened in 1972 prior to the “Skylab” coronal holes, in 1952, and 1929. All of these excursions were clearly “old cycle” phenomena and do not seem to be clear harbingers of the next cycle.

An *updated* version [for F10.7] of the above Figure appears below. It is clear that solar cycle 24 has not yet begun its rise in a clear way:



Minimum may have been in August 2008, and everything points to a low solar cycle 24, but since it has not shown any signature in F10.7 yet, one can only speculate at this point.