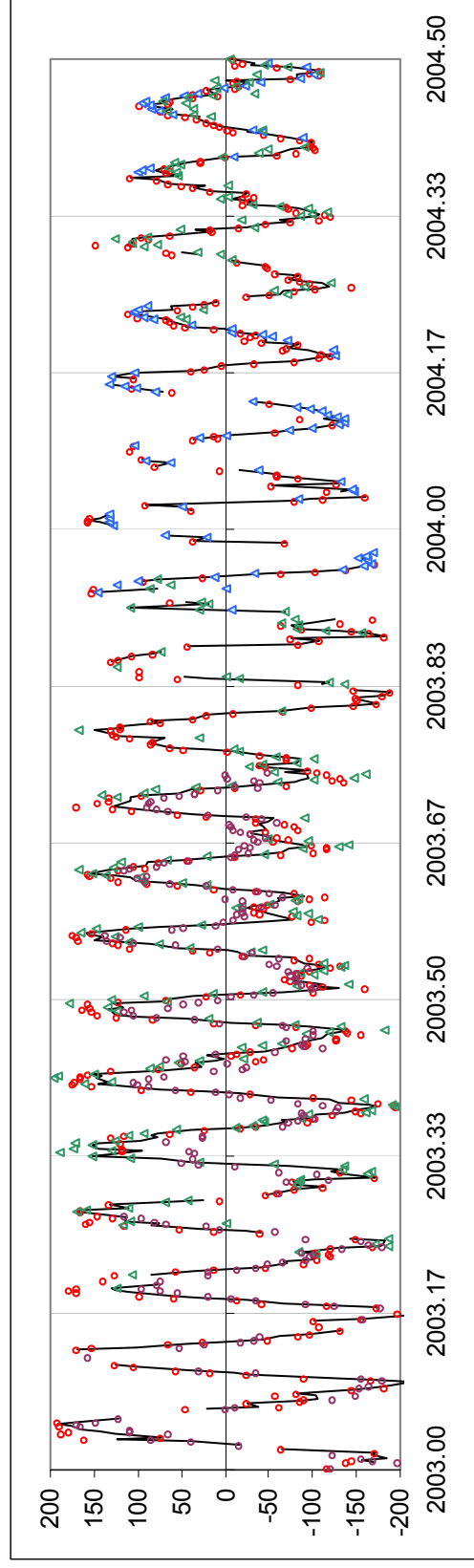
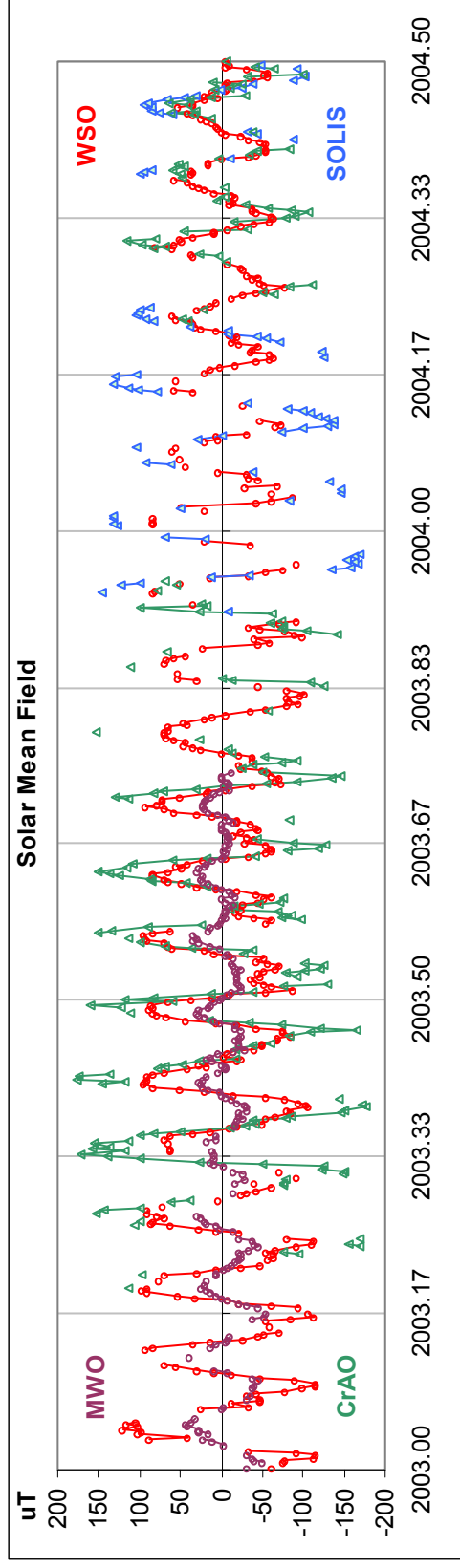


# Comparison of Solar Mean Field between Observatories

Leif Svalgaard  
2009

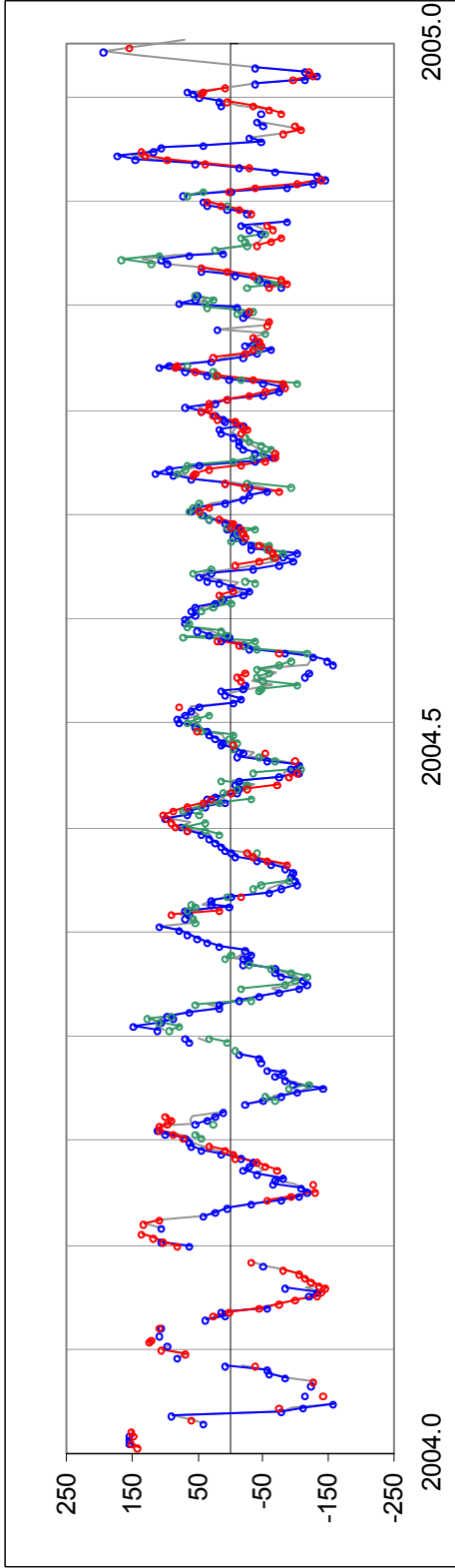
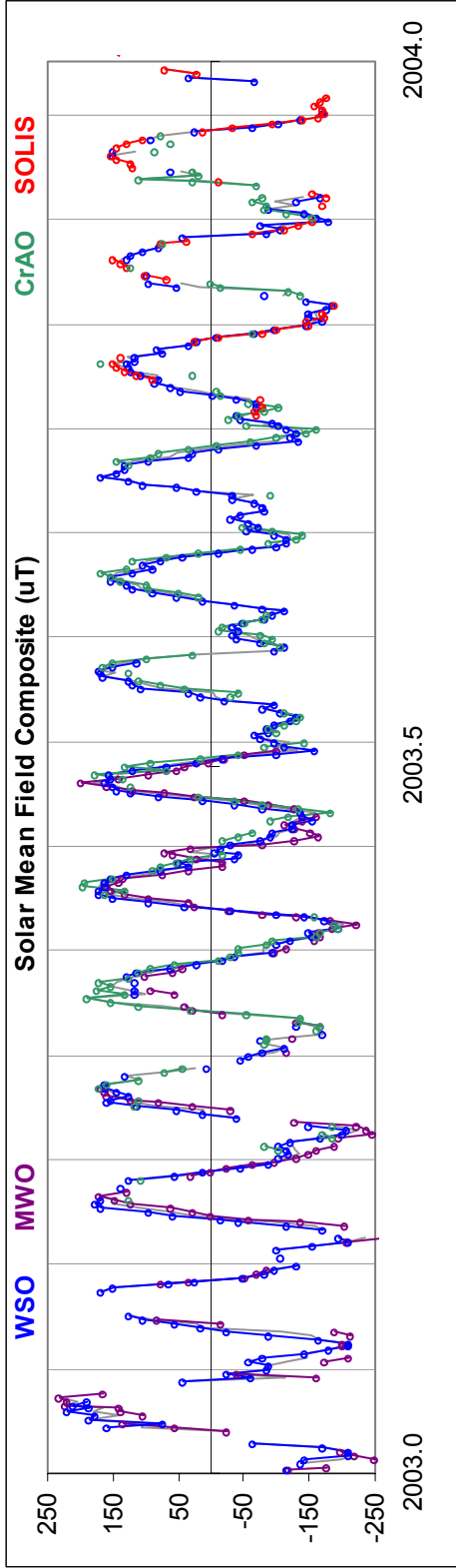
UCLA Workshop

Measuring the solar magnetic in sun-as-a-star mode [the Mean Field] gives rather different results:

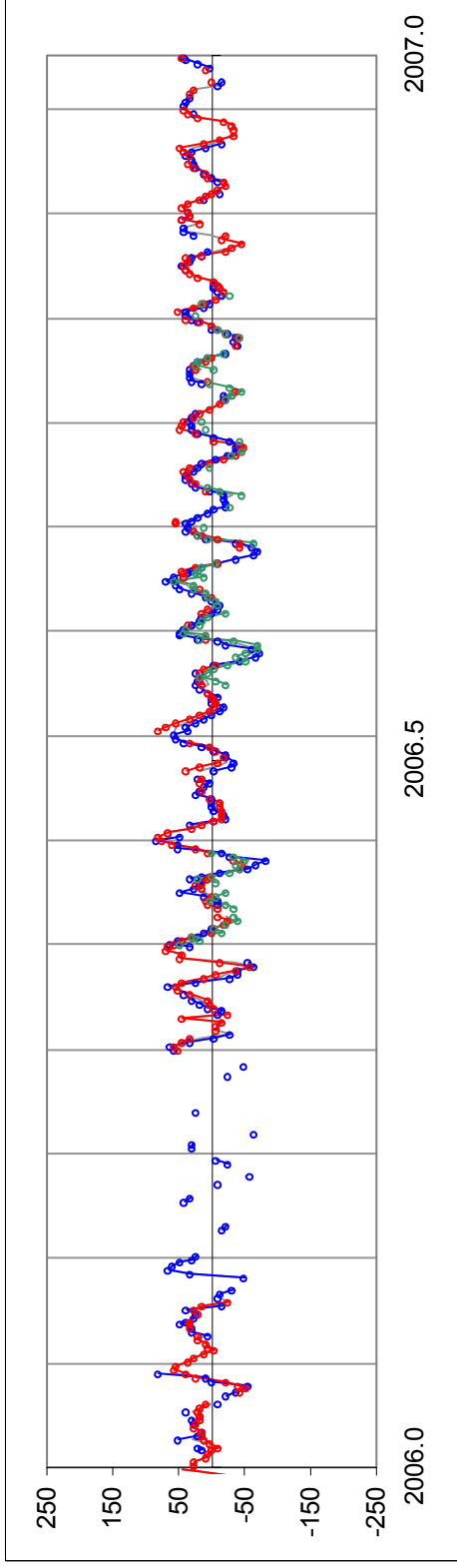
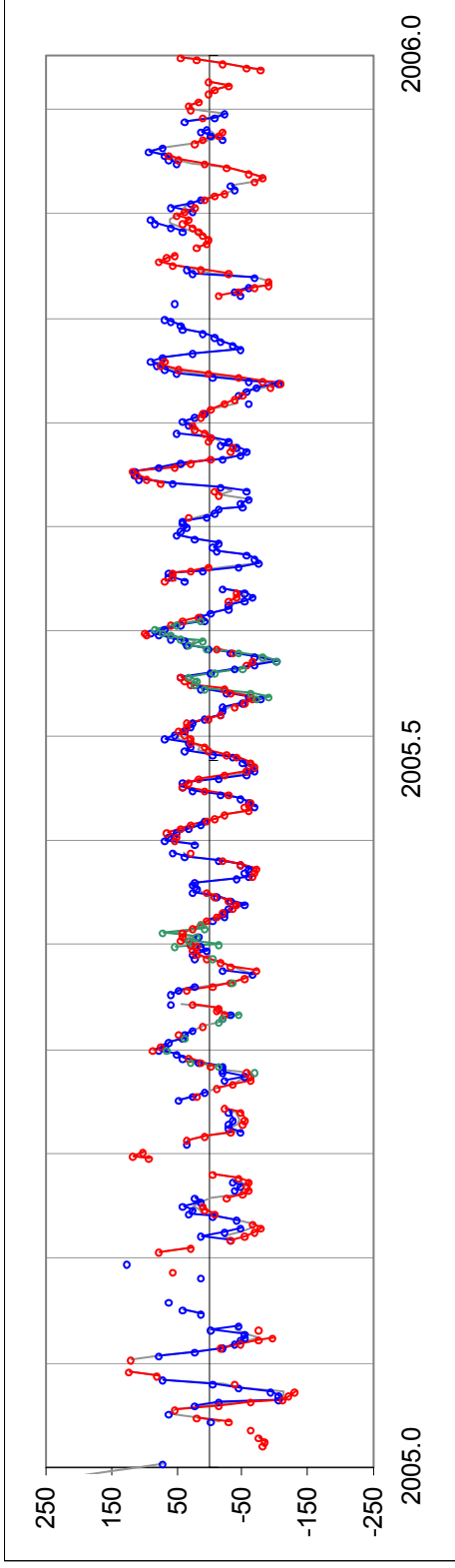


It is, however, possible to find factors for each observatory that bring them all into agreement with each other [e.g. with SOLIS – as it was in 2003]. Roughly SOLIS = 1 CrAO = 2 WSO = 4 MWO.

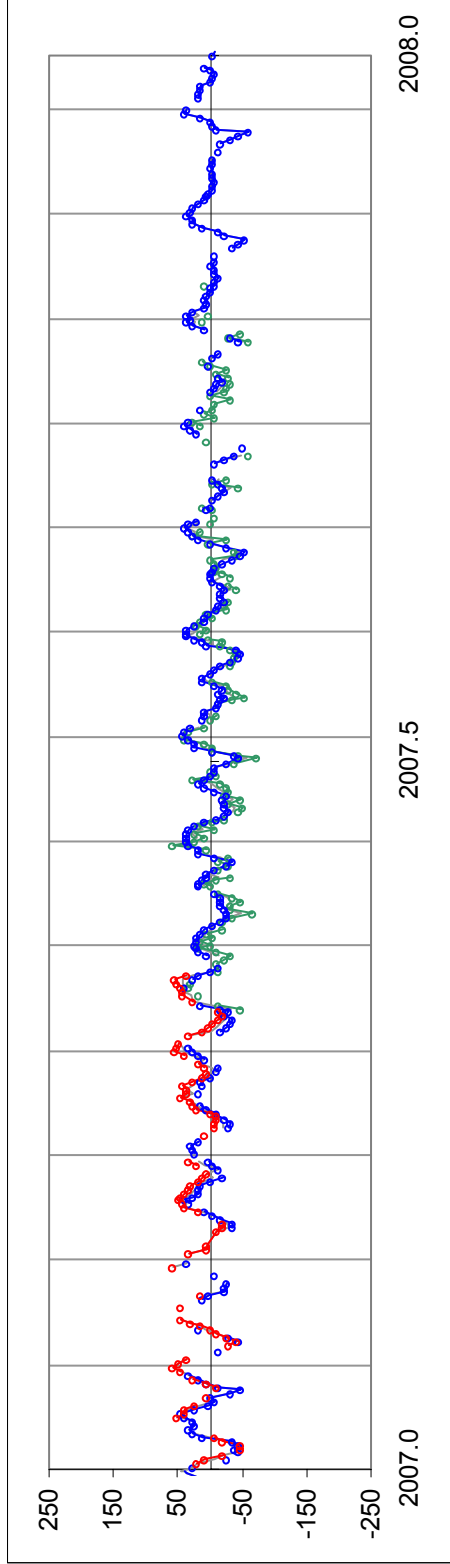
This seems to hold up year after year [even as the Mean Field got smaller and smaller]:



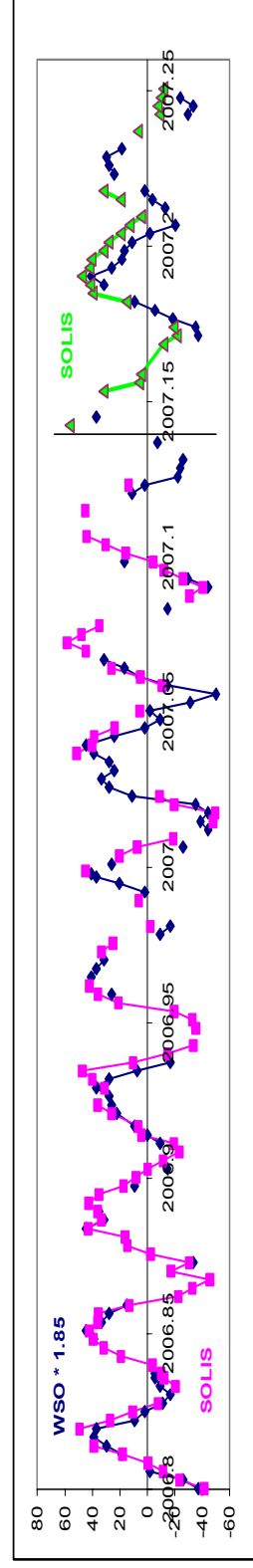
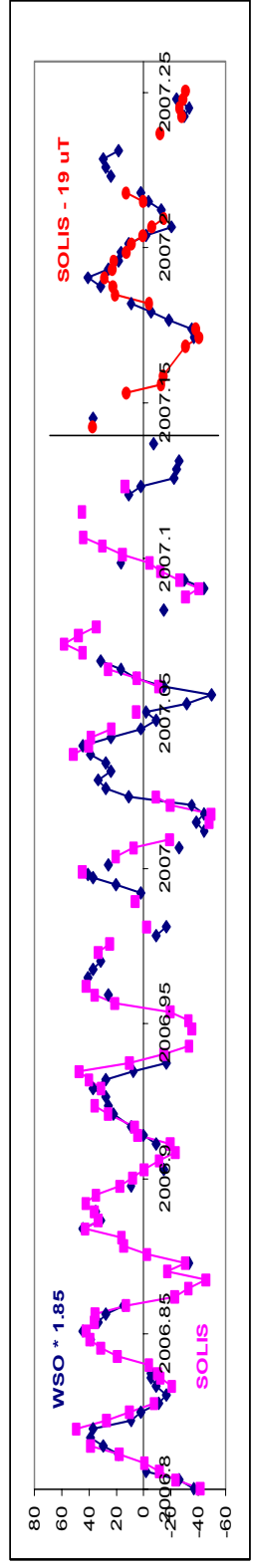
For SOLIS the average net flux over the disk is calculated by them rather than observed in MF mode.

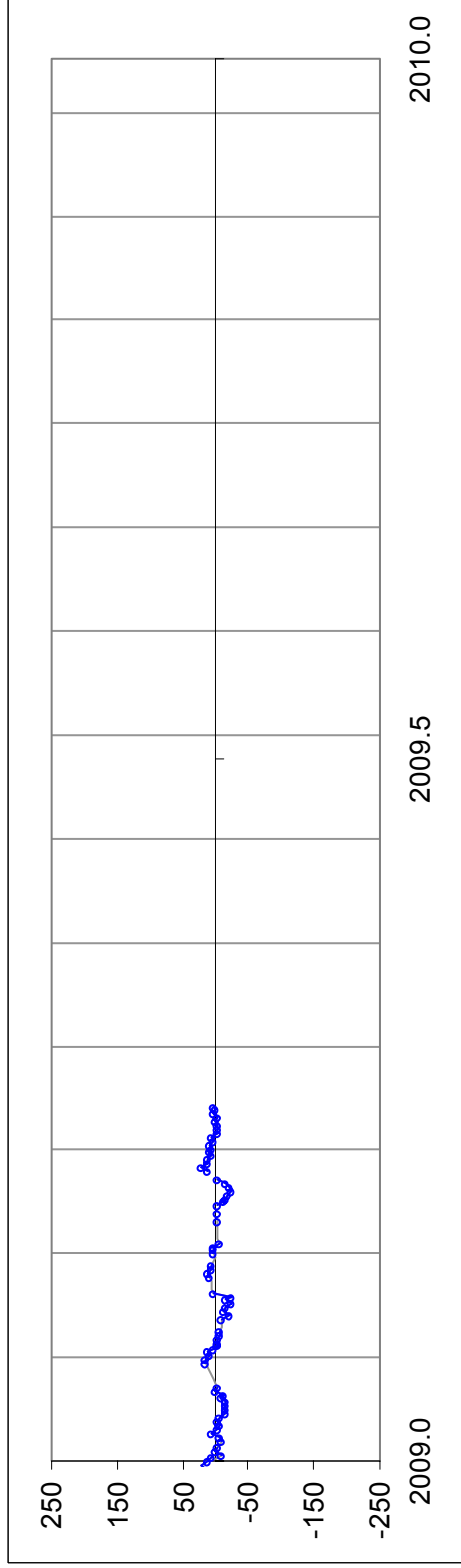
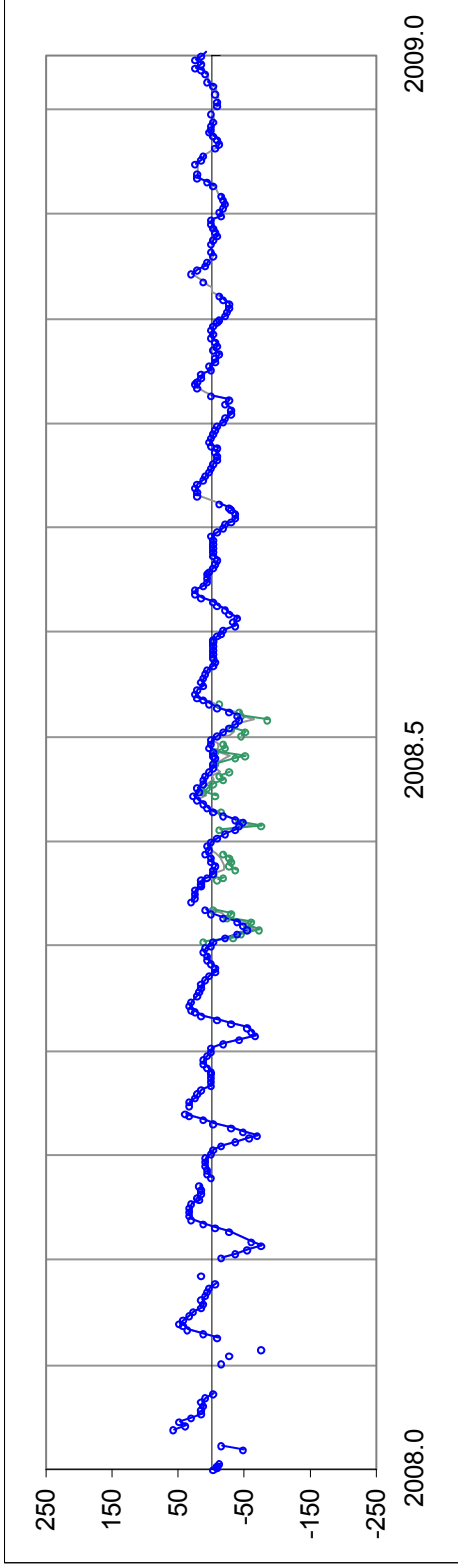


CrAO is only observing during their local summer. And MWO stopped measuring the Mean Field in the fall of 2003.



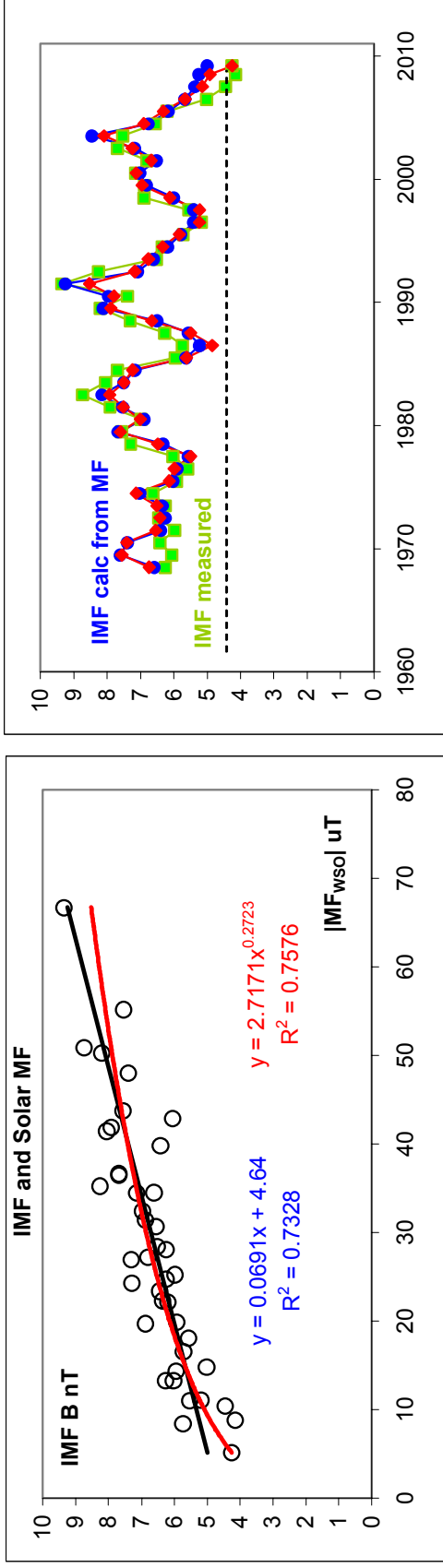
In early 2007, SOLIS began to deviate from WSO by some +19 uT. When I pointed that out to them they simply stopped reporting the MF.





The MF is now very small [and WSO is the only one left standing]:

Does the MF have any meaning? Why measure [or compute] it?



The MF correlates well with the Interplanetary [ $\sim$ Heliospheric] Magnetic Field: low-latitude fields [disk center portion] riding on polar fields? Is not proportional to IMF as was once thought.

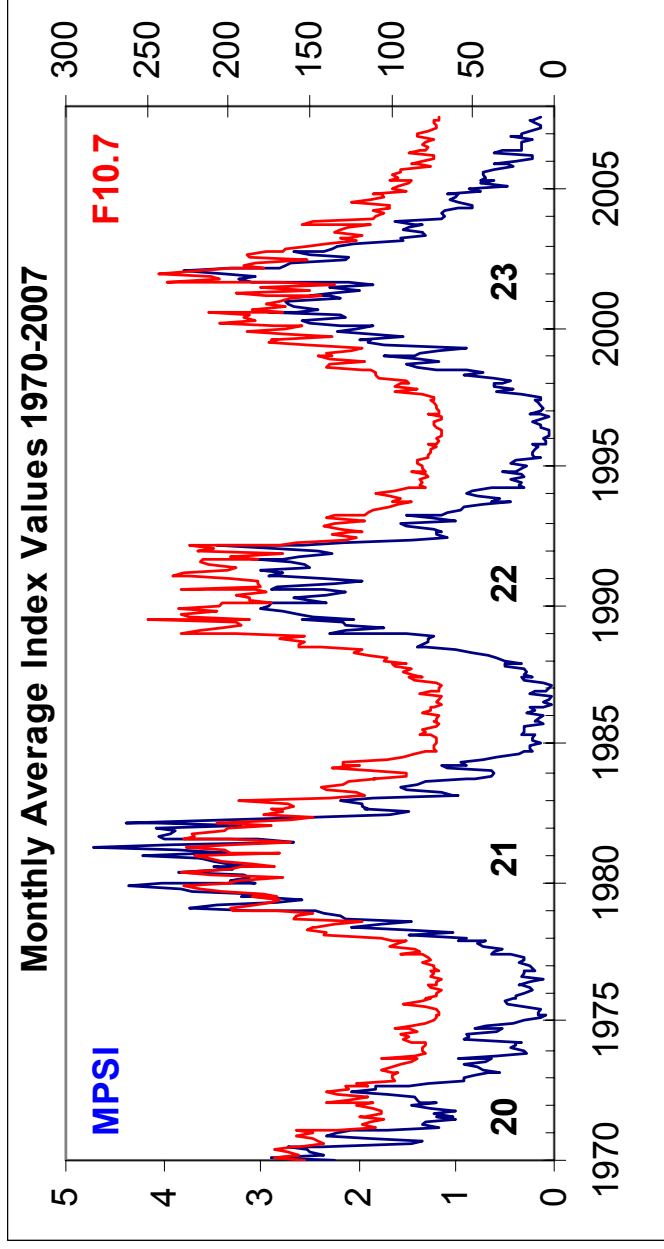
Questions:

**Shouldn't the various observatories measure the same MF? Why don't they?**

**Shouldn't the same observatory have the same field calibration over time?**

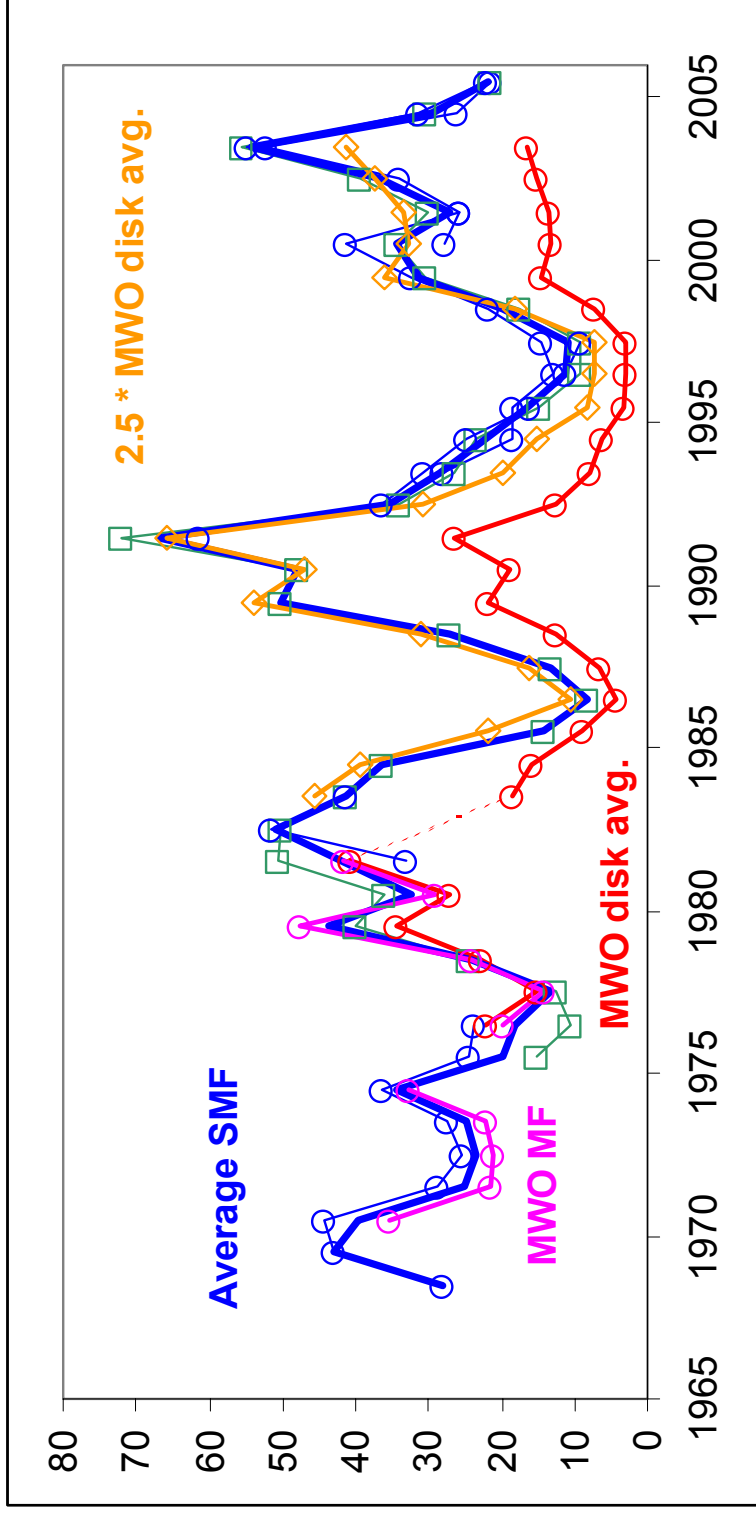
For each magnetogram taken at the 150-Foot Solar Tower at Mount Wilson Observatory (MWO), a Magnetic Plage Strength Index (MPSI) value is calculated. To determine MPSI, the magnetic field strengths for all pixels where the absolute value of the magnetic field strength is between 10 and 100 gauss are summed. This number is then divided by the total of number of pixels (regardless of magnetic field strength) in the magnetogram. The average MPSI for every day with observed data since 1970 is available at [ftp://howard.astro.ucla.edu/pub/obs/mpsi\\_data/index.dat](ftp://howard.astro.ucla.edu/pub/obs/mpsi_data/index.dat).

Here I plot the MPSI values as a function of time and compare them with the F10.7 radio flux:

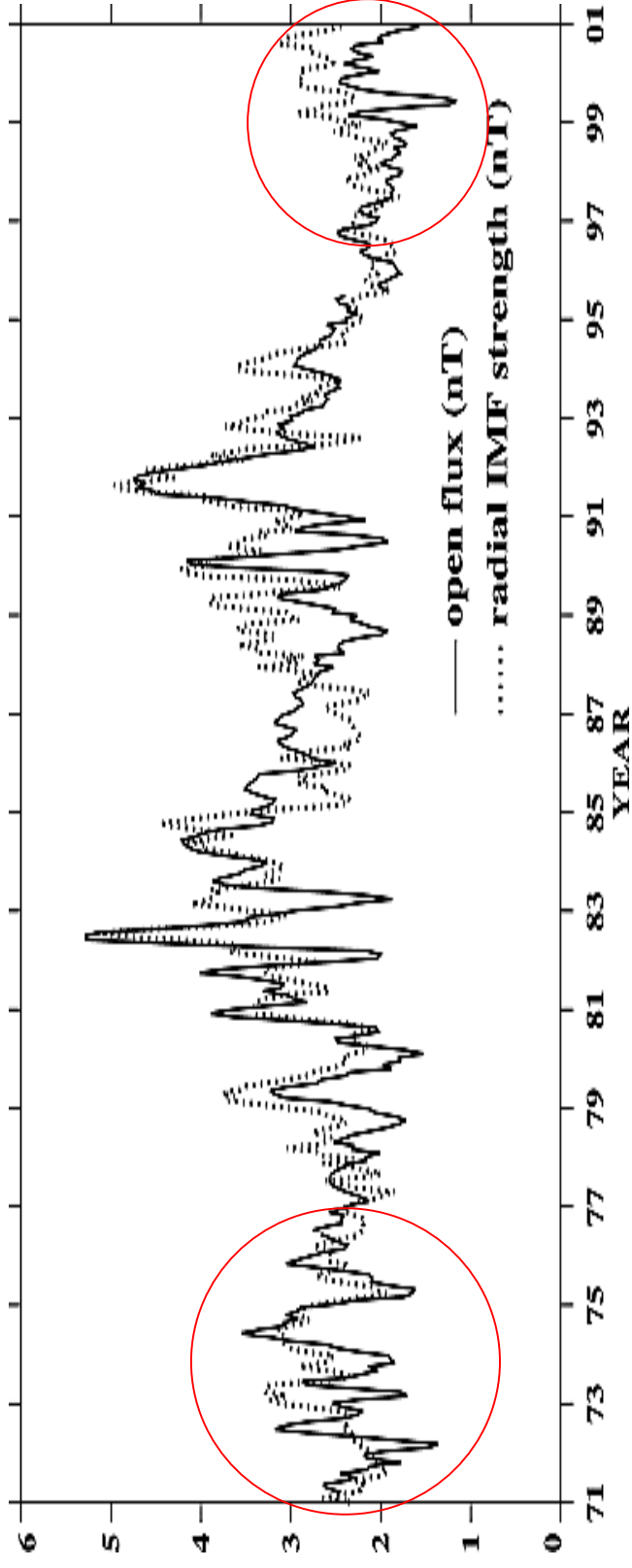


It is clear that there was a calibration change in 1982. [40% Difference between cycles 21 and 22].



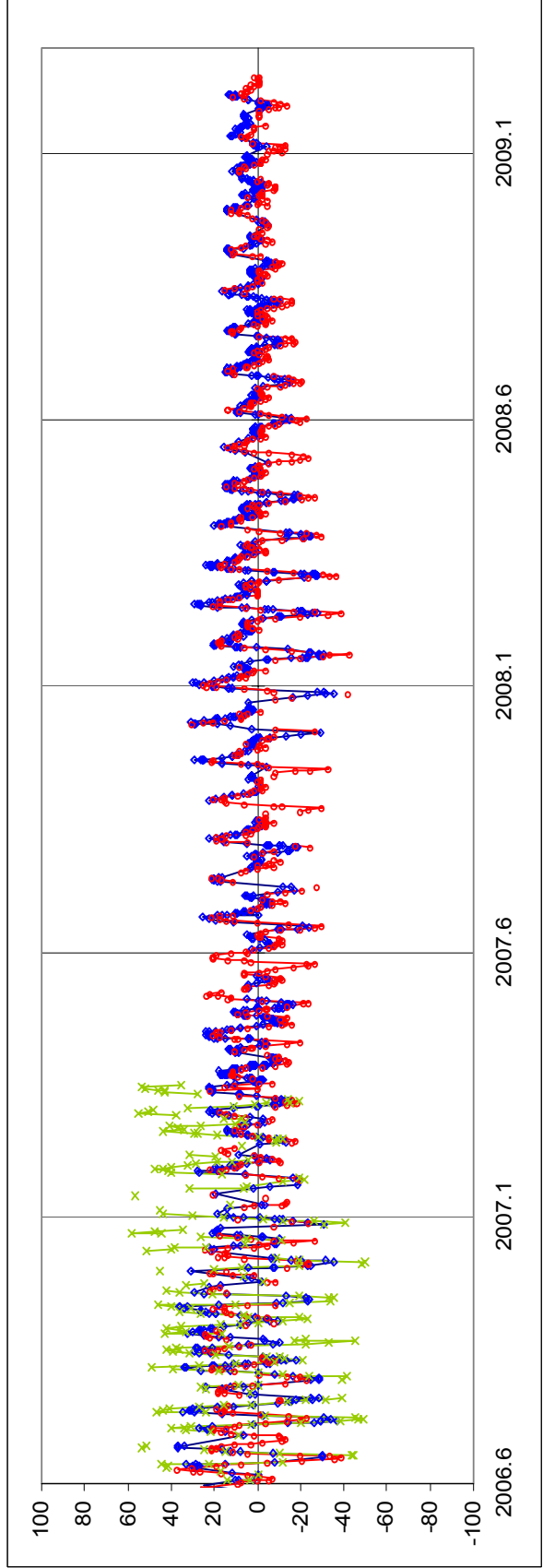
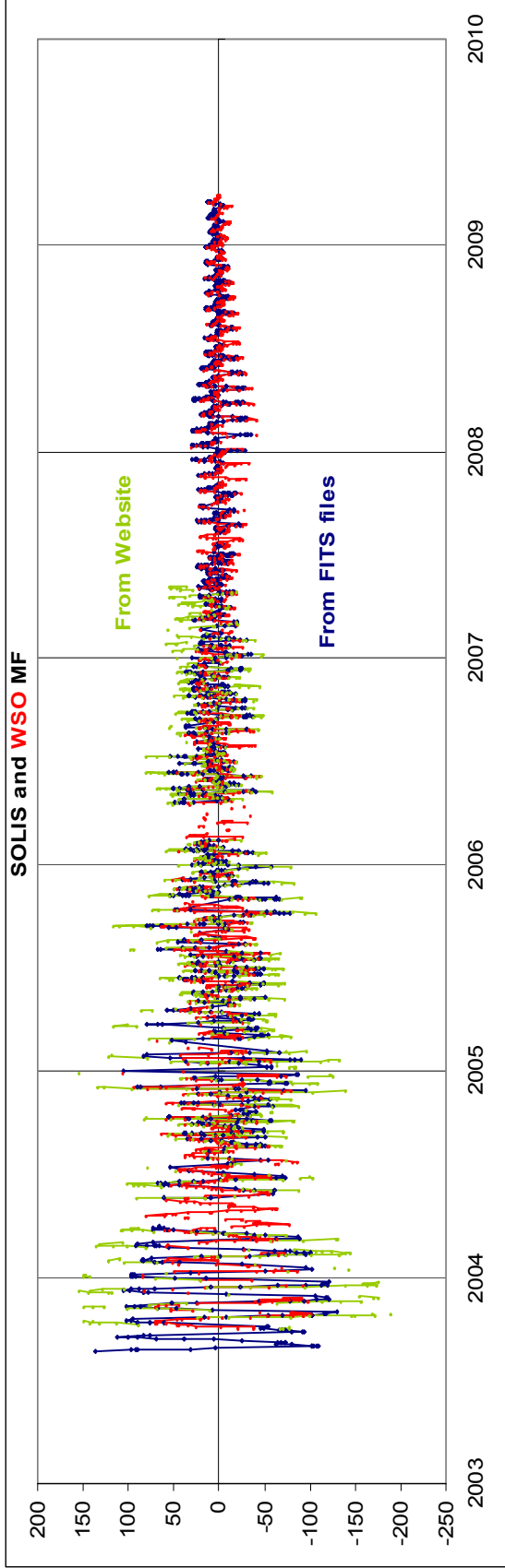


The magnitude of the solar mean field normalized to WSO from all available ground-based solar observatories shown using various symbols of generally bluish color, with the exception of the directly measured mean fields (MWO  $MF$ ) at MWO during 1970-1981, which are shown in pink (Kotov *et al.*, 1998). The average of all (normalized)  $MF$  measurements at all observatories is shown with a heavy blue line. The un-normalized (i.e. the raw data from the coarse-binned magnetograms) MWO disk averages are shown as a heavy red line, when multiplied by 2.5 as an orange line.

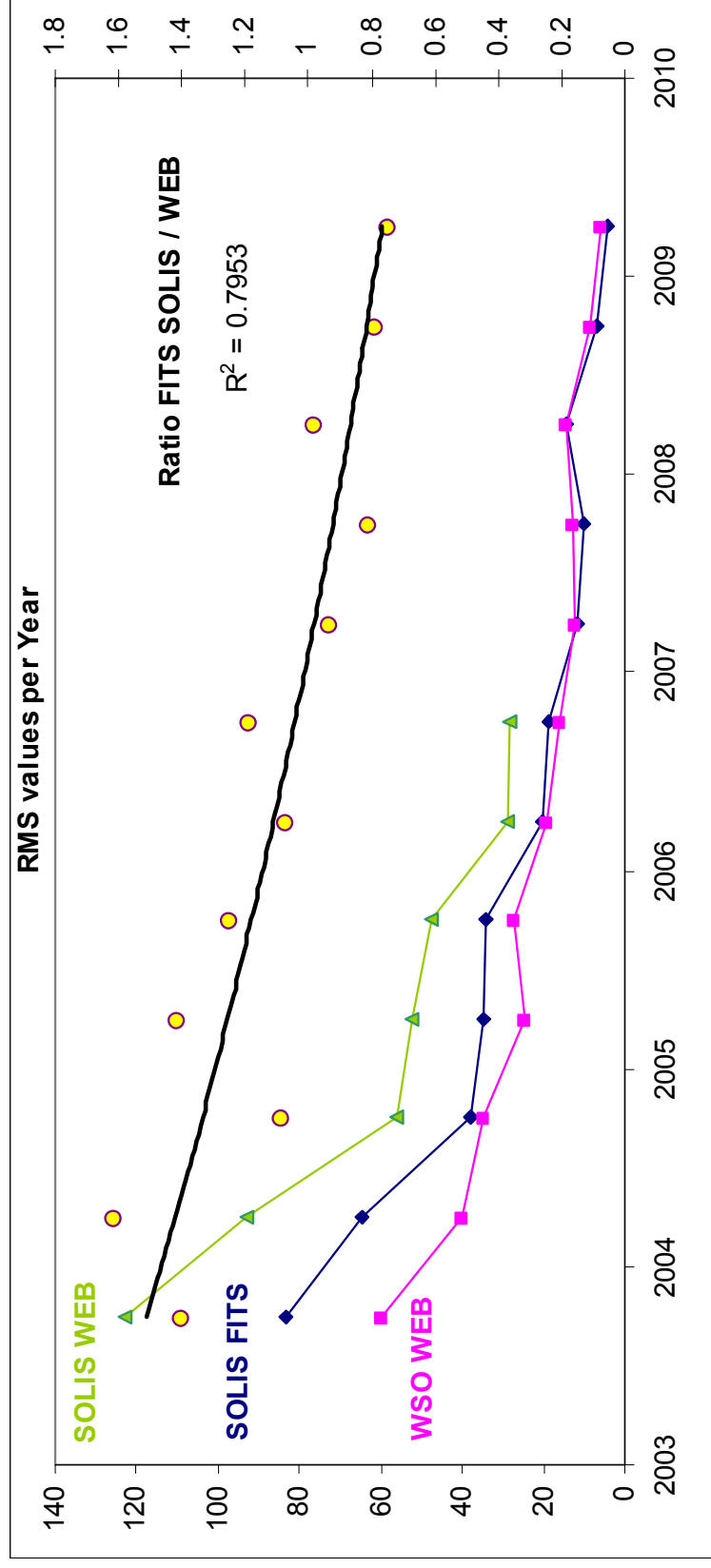


Wang & Sheeley’s famous ‘agreement’ between computed and observed IMF used MWO for the early years and the later years [red circles], and a 40% change in calibration would severely impair the agreement and perhaps make it just fortuitous. [Not to speak about the 4.5 and 1.8 factor issue]

Just as I thought I understood the problems that I have just reported on, I made a fatal ‘mistake’: I downloaded all the FITS files from SOLIS and computed the disk averages [they are also stored in the files, but I’m paranoid ...]. Here is the result, where I compare the mean field over the disk to the WSO mean field:



The ‘calibration factor’ between WSO and SOLIS which was 1.85 in 2003 has now [2009] gotten cut in half:



How can the ratio steadily decrease from more than 1.8 to less than 0.8 over time?

As I see the situation, the whole thing is a big mess. And should be cleaned up, or at least explained on the website and to the users of the data. As a running ‘quality control’ measure I suggest calculating the mean field for each observatory and reporting those every day on the website.