WSO Magnetic Fields are Suddenly Cut in Half [Again?]

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March 21, 2017

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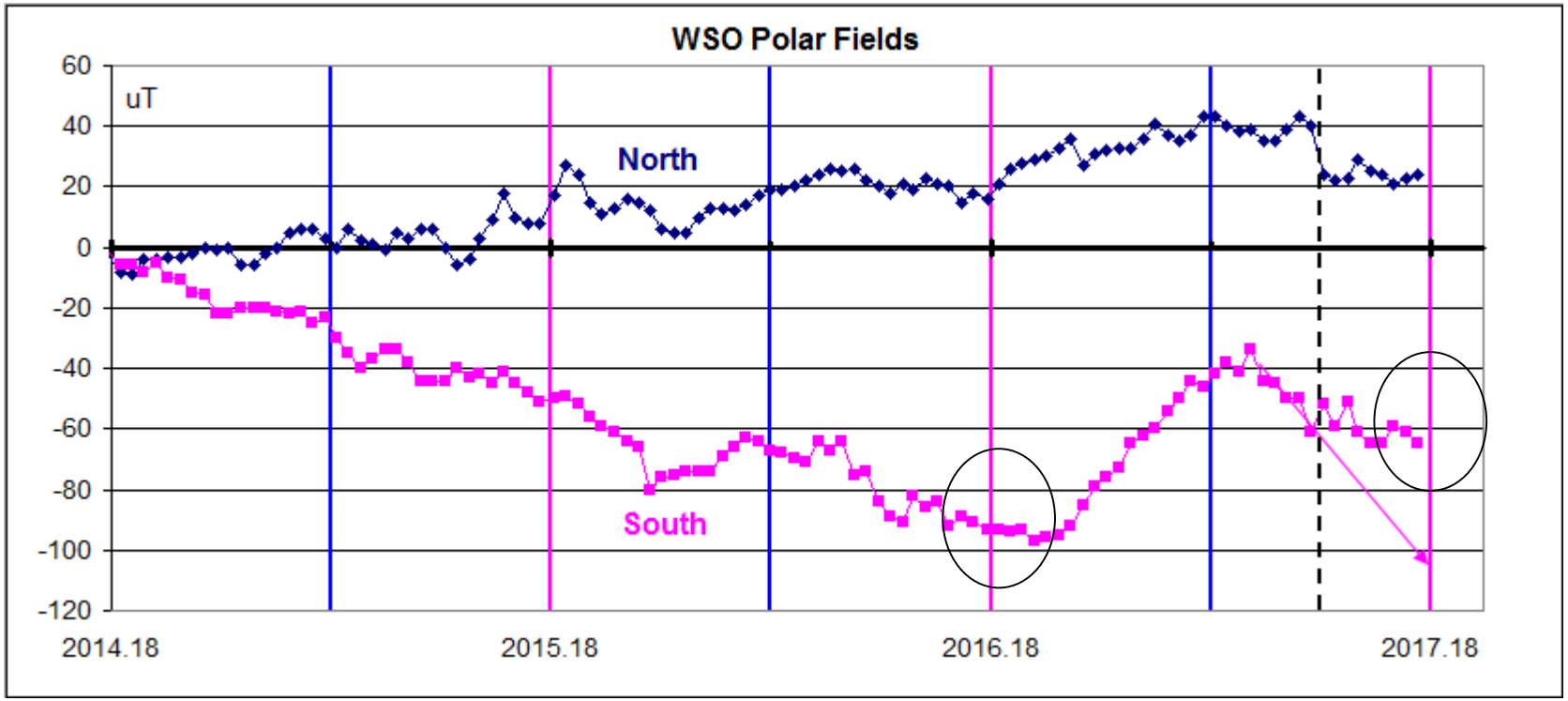
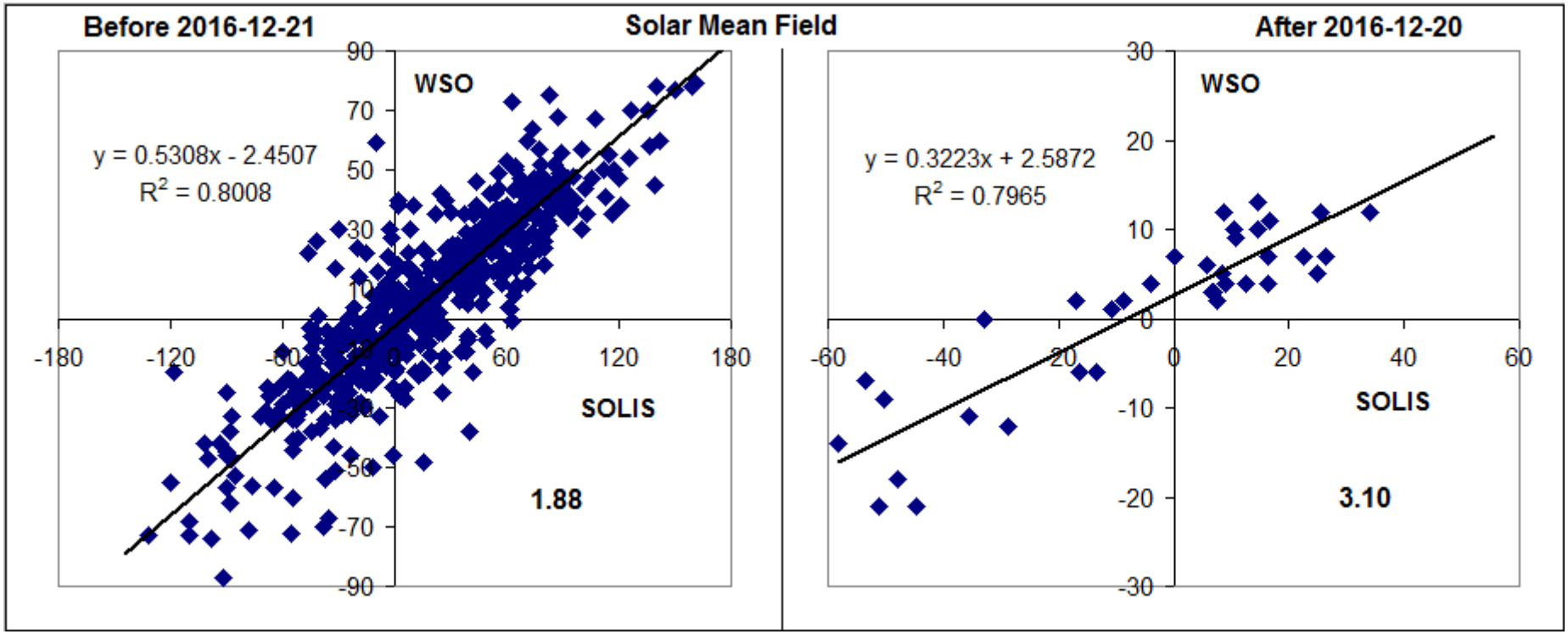
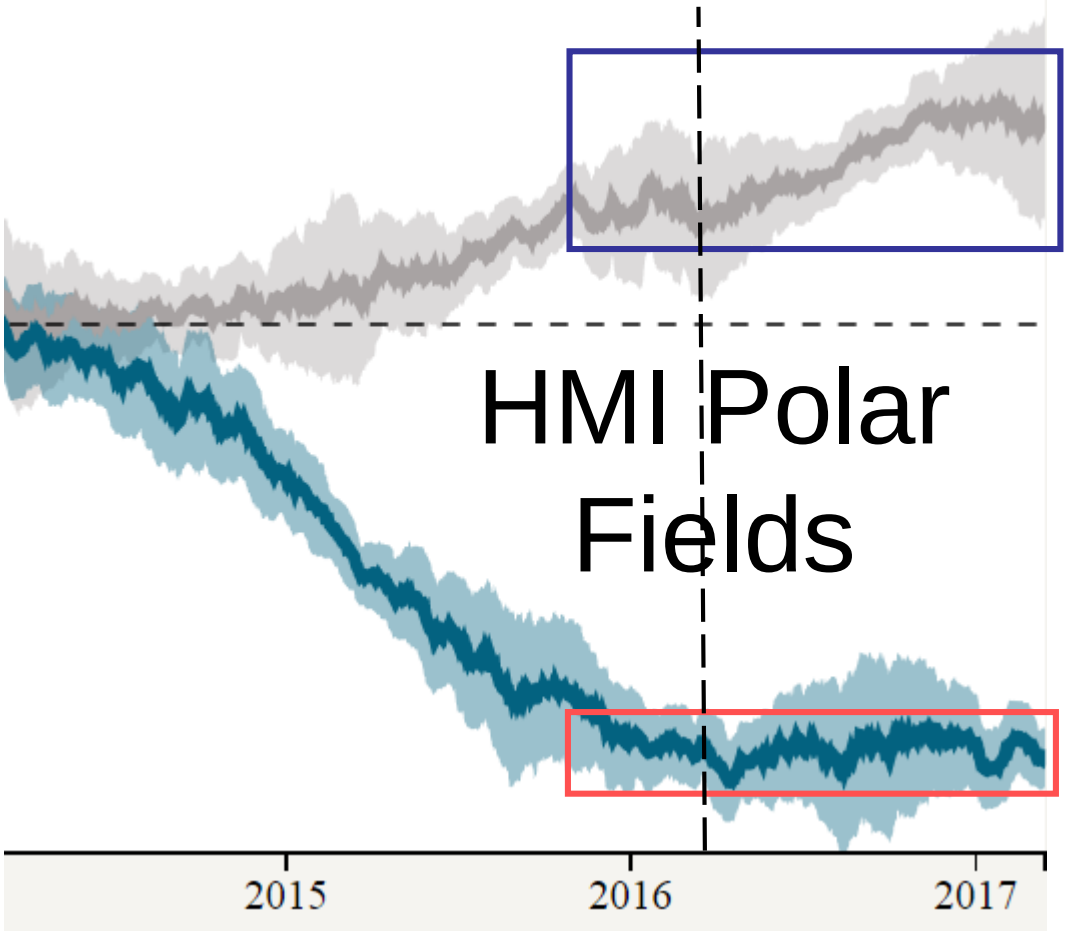
Since December 2016 the Southern Polar Field Measured at WSO has not Increased as Expected as We are Getting a Better View of the Pole in March

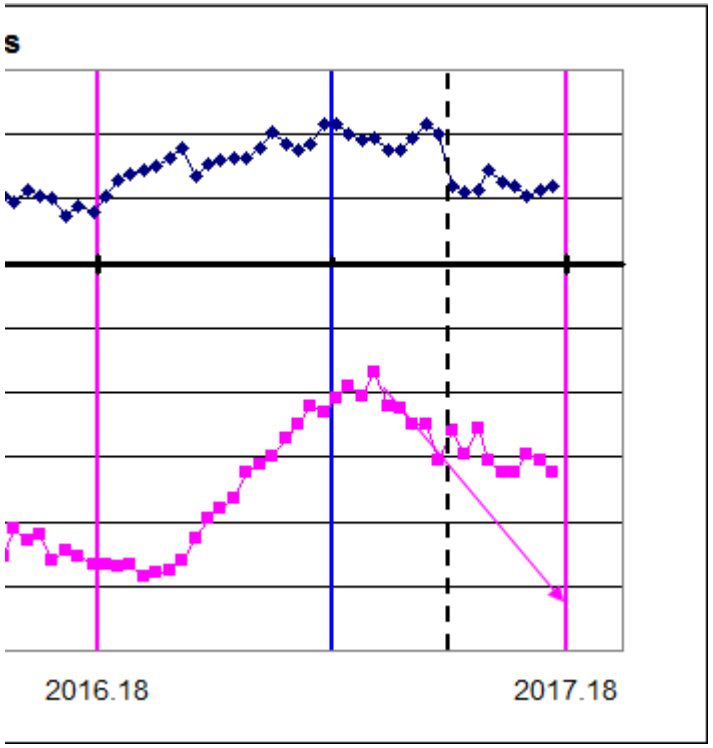


The Mean Field has been cut [roughly] in Half Compared to SOLIS





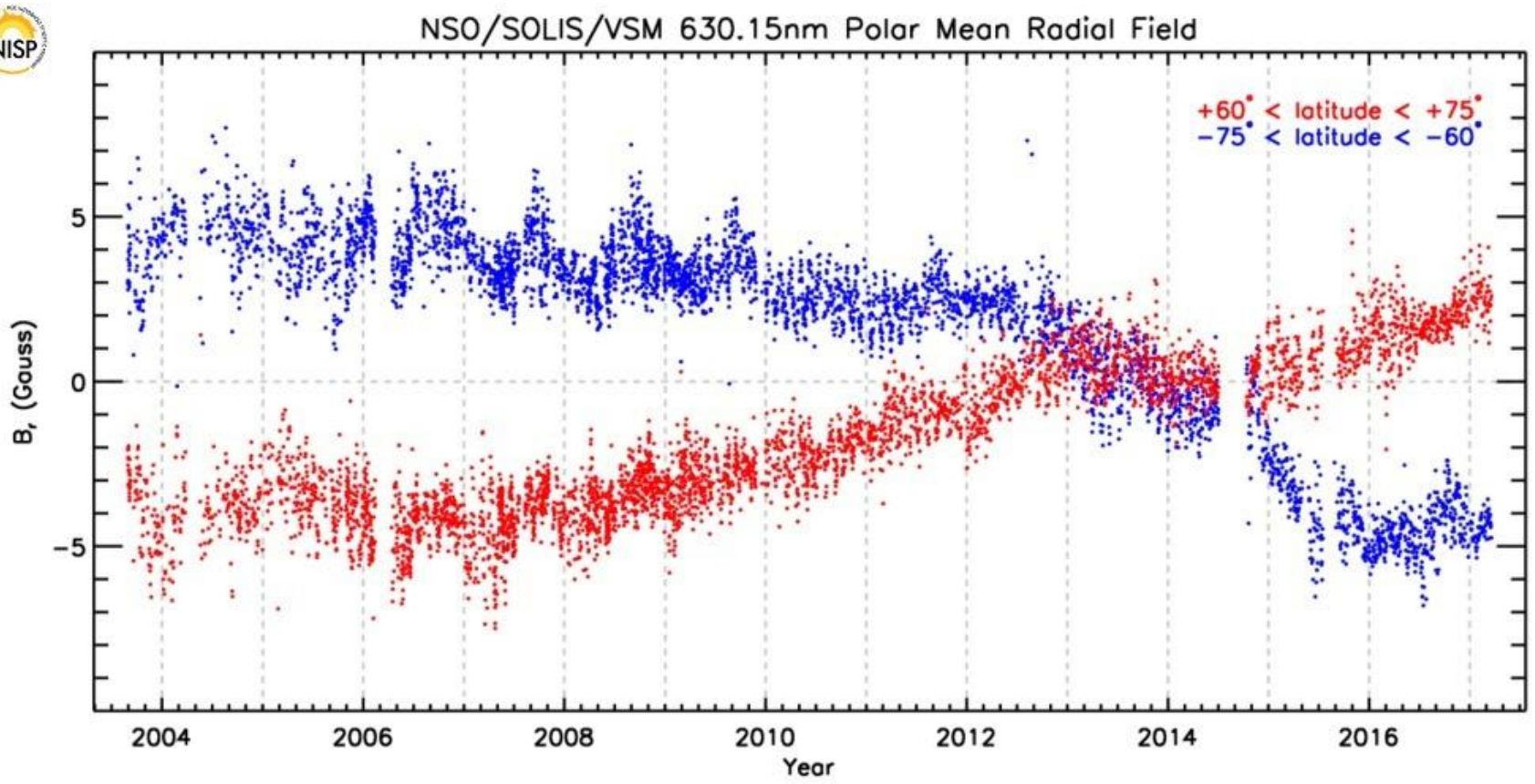
WSO Polar Fields



The HMI polar field at the South Pole has been stable for more than a year so we should now see the same field as we saw a year ago. We don't at WSO. We see only about half.

Similarly, the HMI North Polar fields have increased, while the WSO North Polar field has been cut in half.

SOLIS also show Stable South Polar Fields Since the Start of 2016



And increasing North Polar fields into 2017 unlike WSO.

We have Seen this Before

Failure of the KDP modulator?

No, probably not (added 2017/04/24)

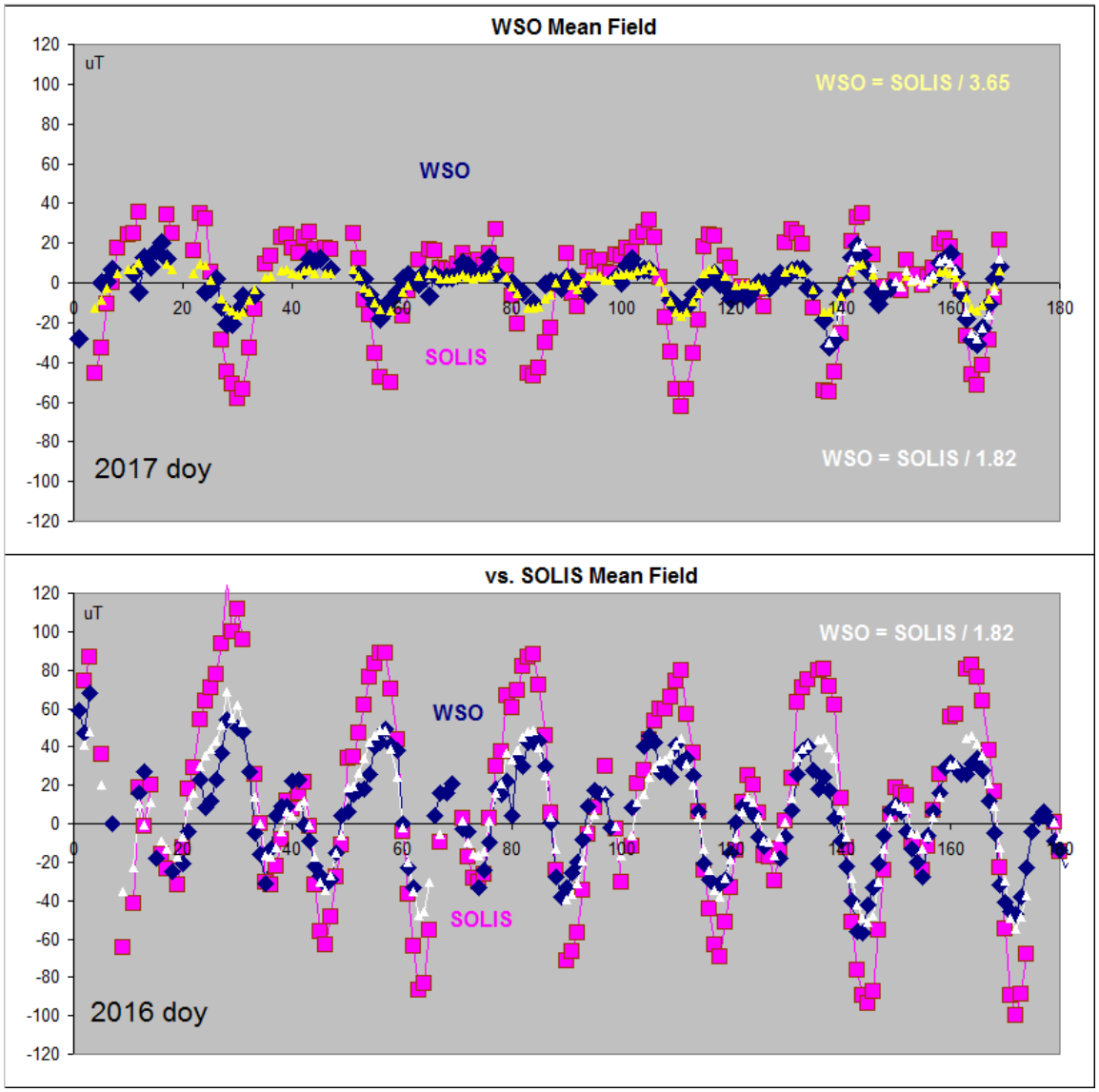
Email from Phil:

Usually one of the KDP controller supply grid drivers.
Seldom one of the tubes.
Takes High Voltage care to check.

It will be in the LCP side if the pre-observation cal check passed.
That test checks only the RCP phase.

Should be fixed ASAP and data recalibrated and Website updated

More on SOLIS/WSO Mean Fields

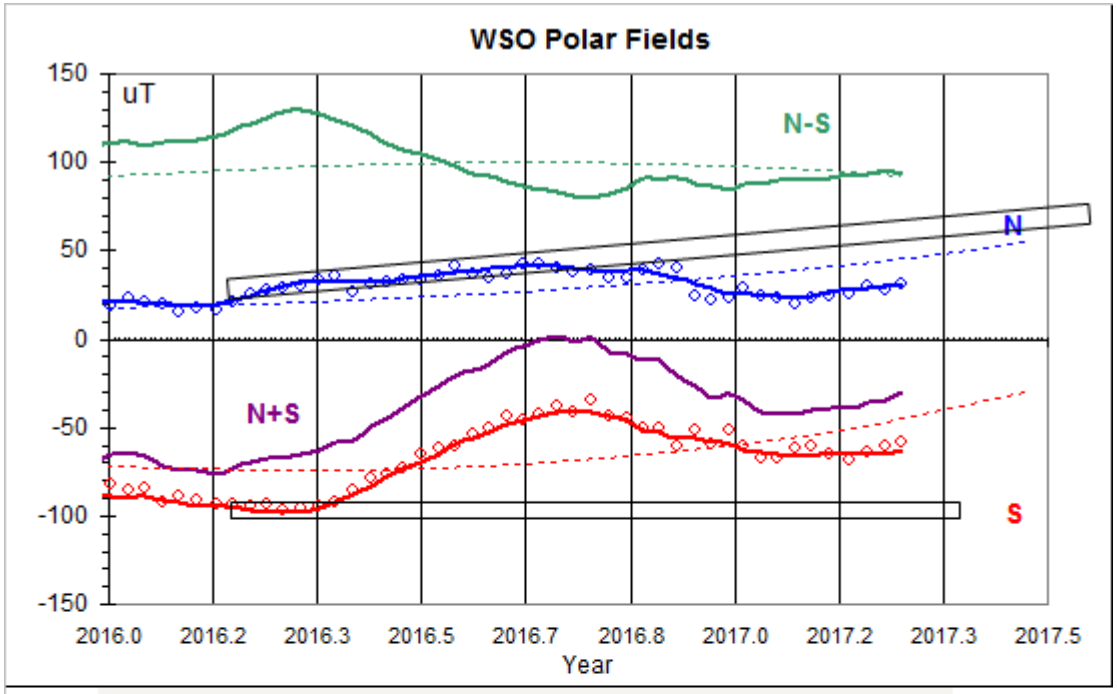


Since 2017/01/01 doy 1

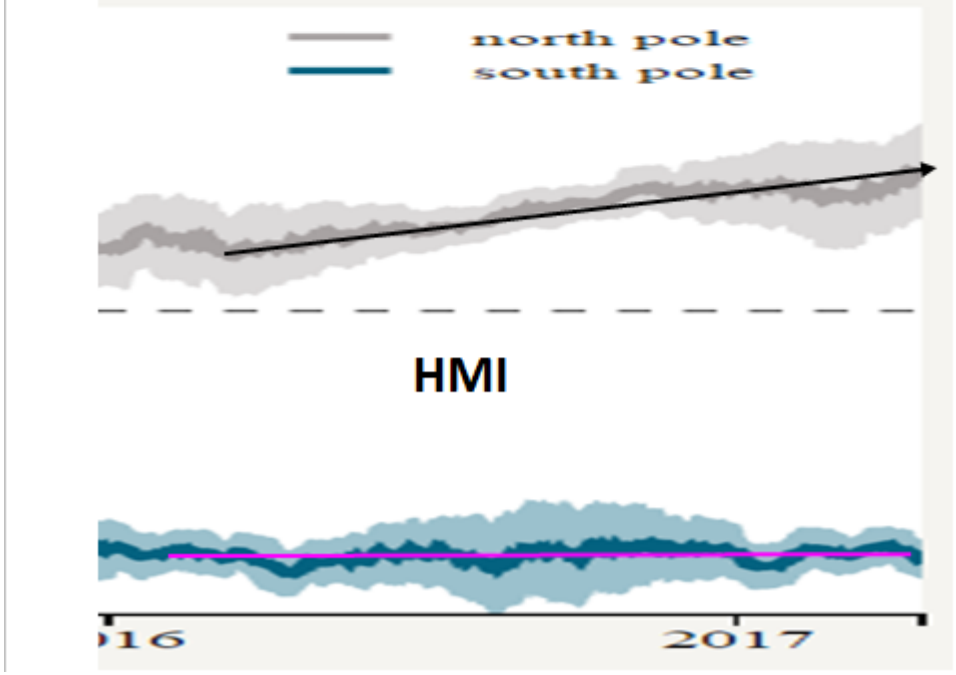
Up to 2017/05/17: WSO saw only ~1/4 of what SOLIS saw

So only sees half of what it did a year ago:

2016: WSO saw 1/2 of what SOLIS saw. This is the normal factor (1/1.82) because of saturation of the 525 nm measurements [used by WSO]



Polar Fields Again

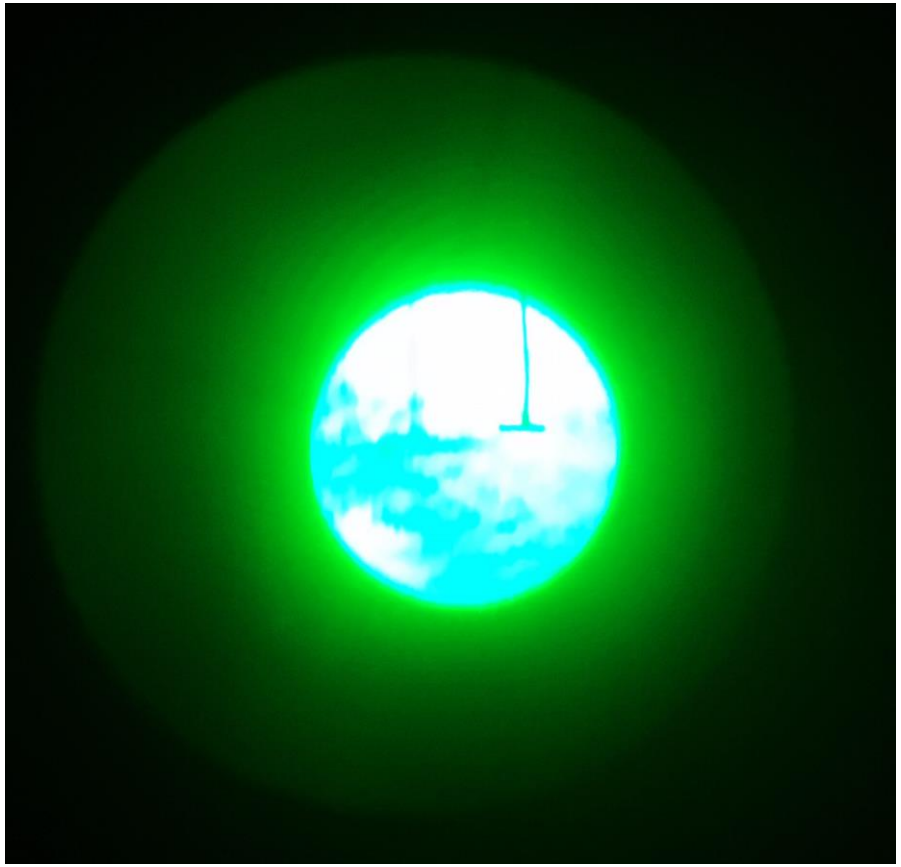


South Polar Fields (HMI) have stabilized, but WSO sees only little more than half of HMI.

North Polar Fields (HMI) are still growing, but near the end of 2016 were cut in half at WSO

The annual variation (B_0) is also only half at WSO (the N+S)

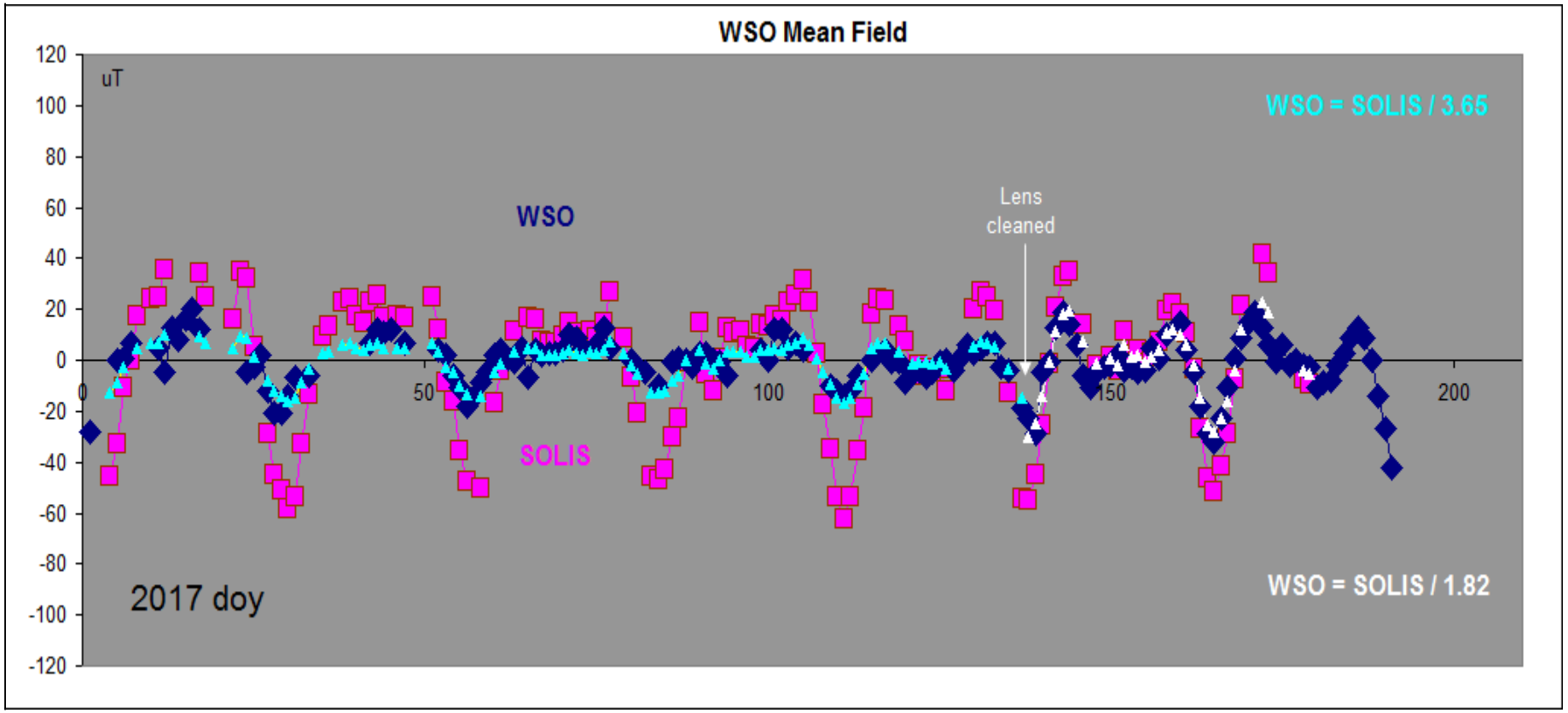
Image of the Littrow Lens



There is a lens in front of the grating in the pit. The lens makes the incoming light rays parallel before they hit the grating and collimates the dispersed light to focus at the sensors in the observing room. Todd Hoeksema pointed his iPhone at the lens and imaged it. The image showed that the lens was very dirty.

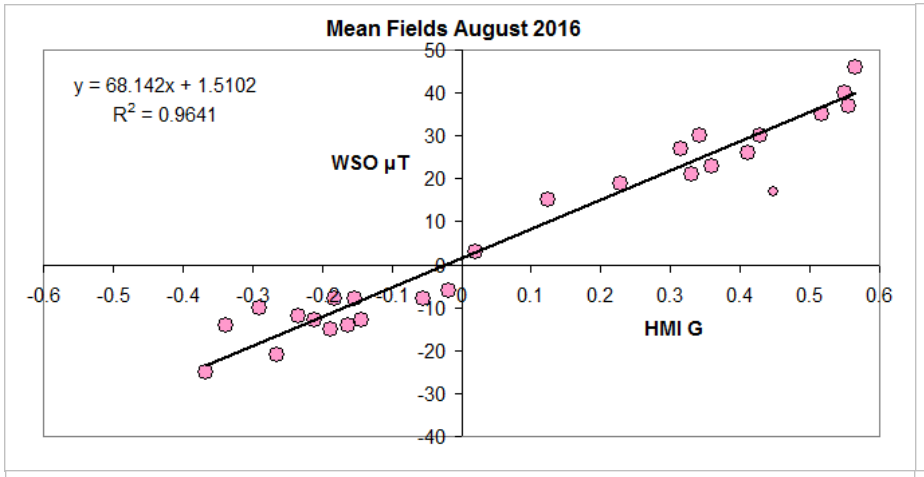
Cleaning the Littrow Lens

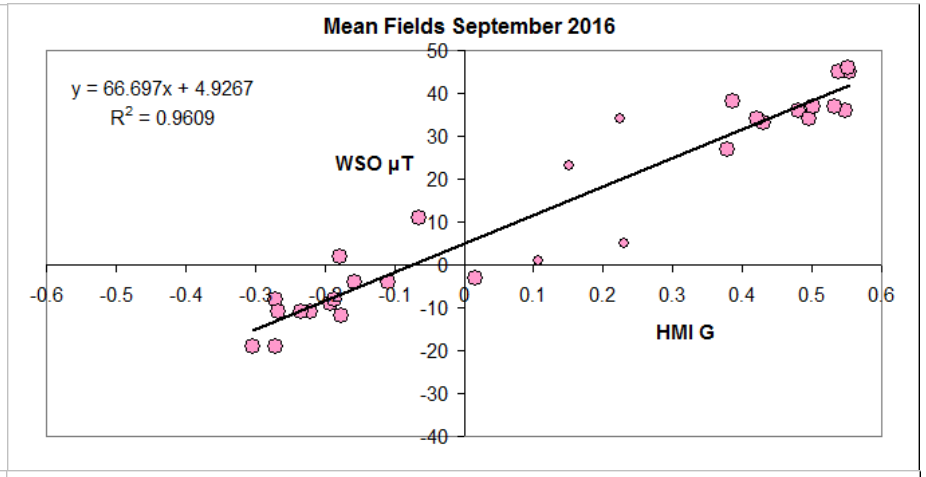
Cleaning the lens seems to have solved the problem

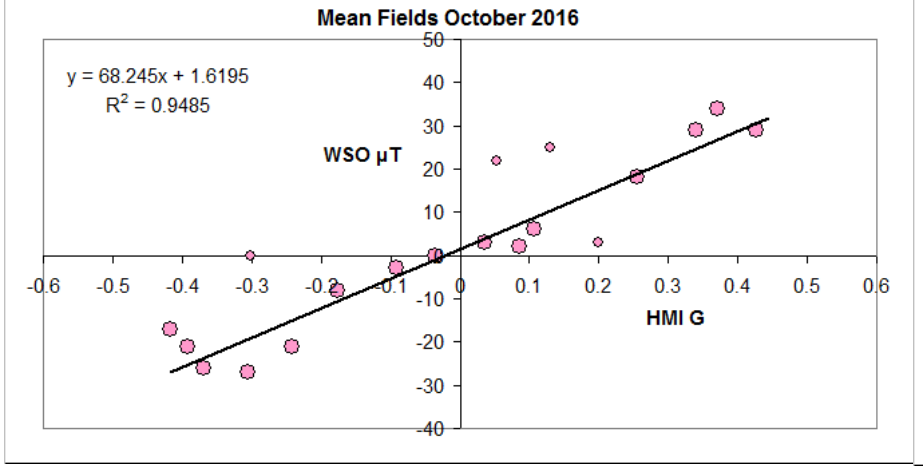


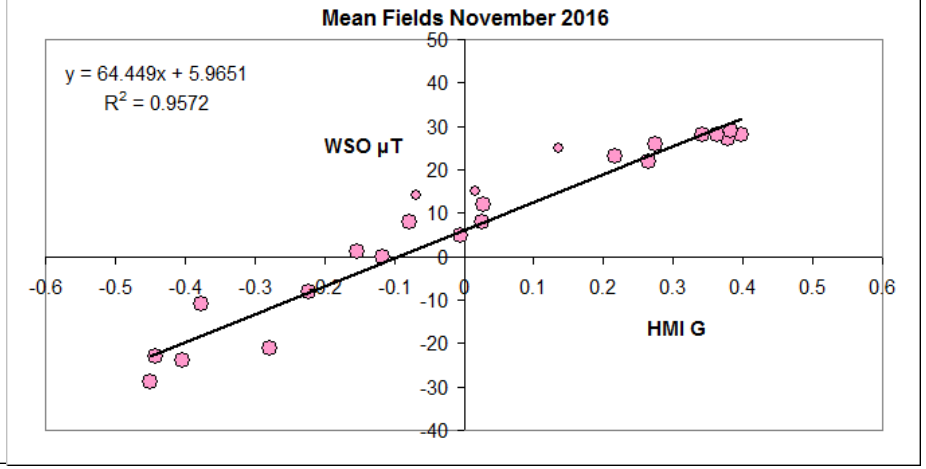
The Mean Field after the cleaning [marked with white triangles] are now again following the SOLIS measurements with the usual factor of 1.82 instead of the ~4 we had when the lens was dirty.

Compare with HMI



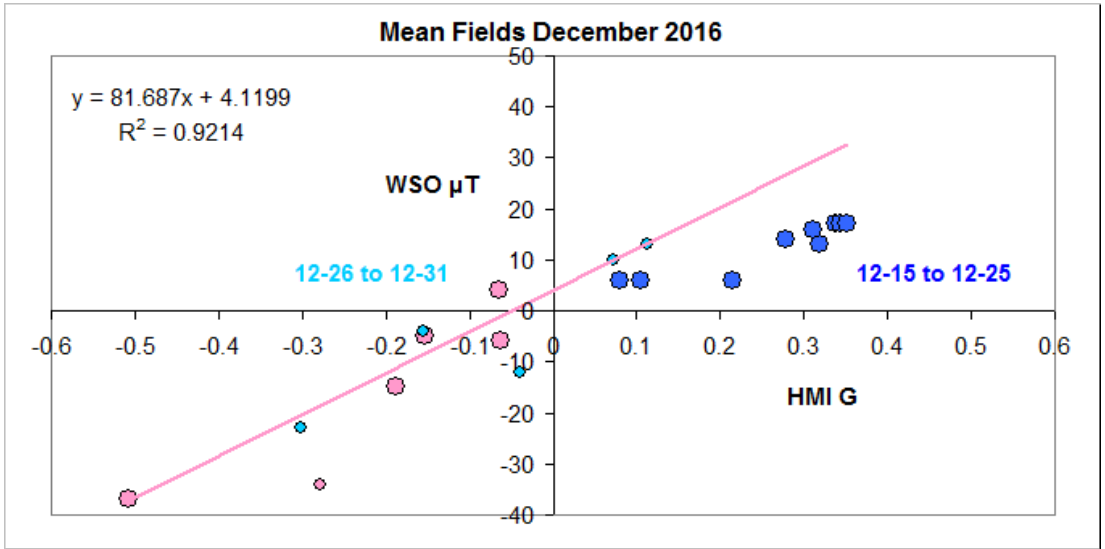


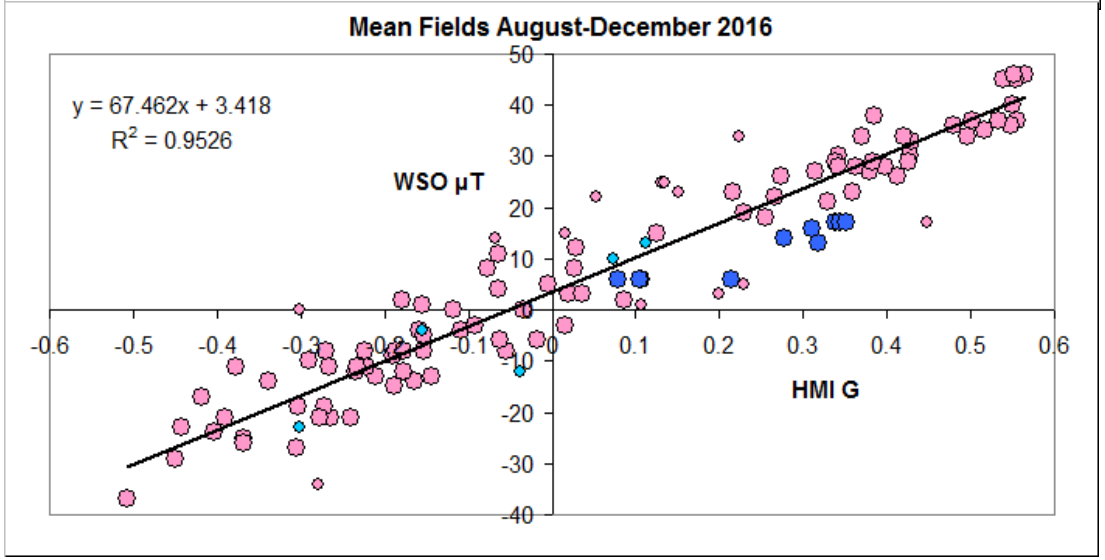




For each month plot WSO vs. HMI [omitting a few outliers, small symbols] and determine the slope and offset.

The Case of December 2016





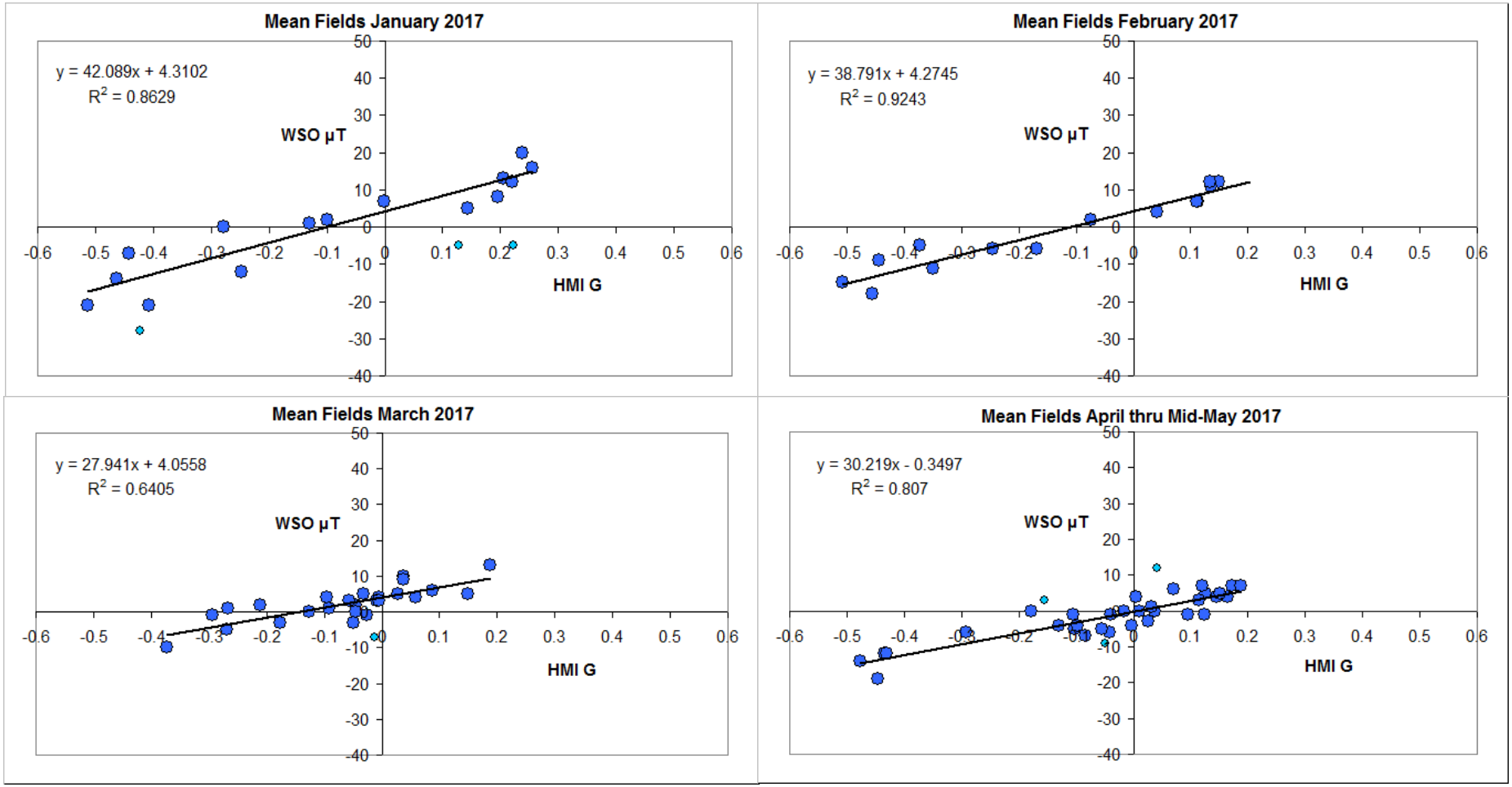
In December 2016 the weather was not cooperating and WSO had only a few observations.

The WSO Mean Field versus HMI seems to have only about half the slope as before (blue symbols) during Dec. 15 to 25.

On the other hand the data the following week seemed to have the same slope as before Dec. 15. Perhaps this is just noise.

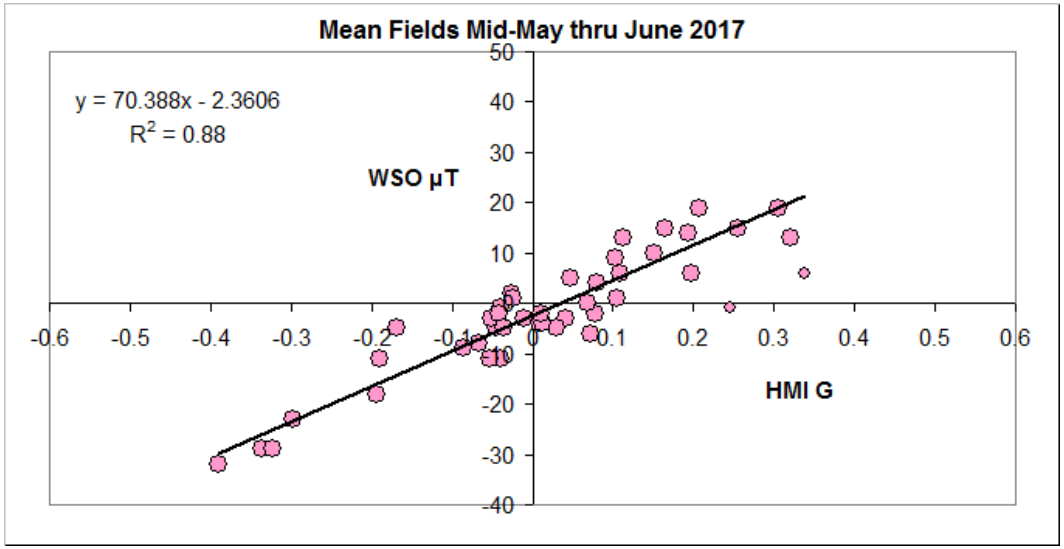
The Dec. 15-25 data do look 'out of place' compared with the rest of the data. So when did the change of slope happen? Should we adopt Dec. 15?

With Dirty Littrow Lens

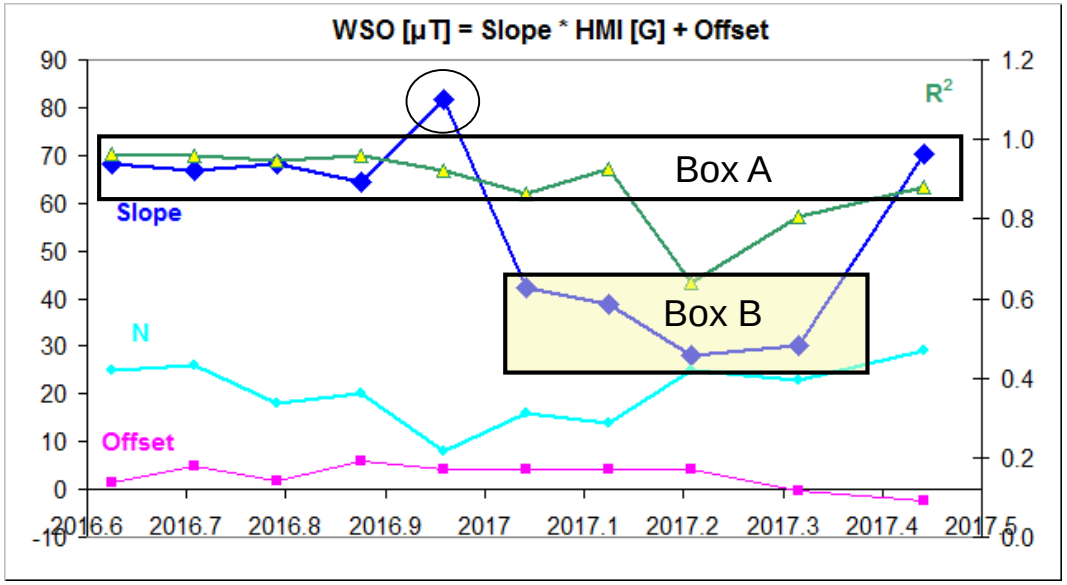


The relationship varies a bit more than is comfortable

After Cleaning the Littrow Lens



The slope returns to normal after May 18, 2017

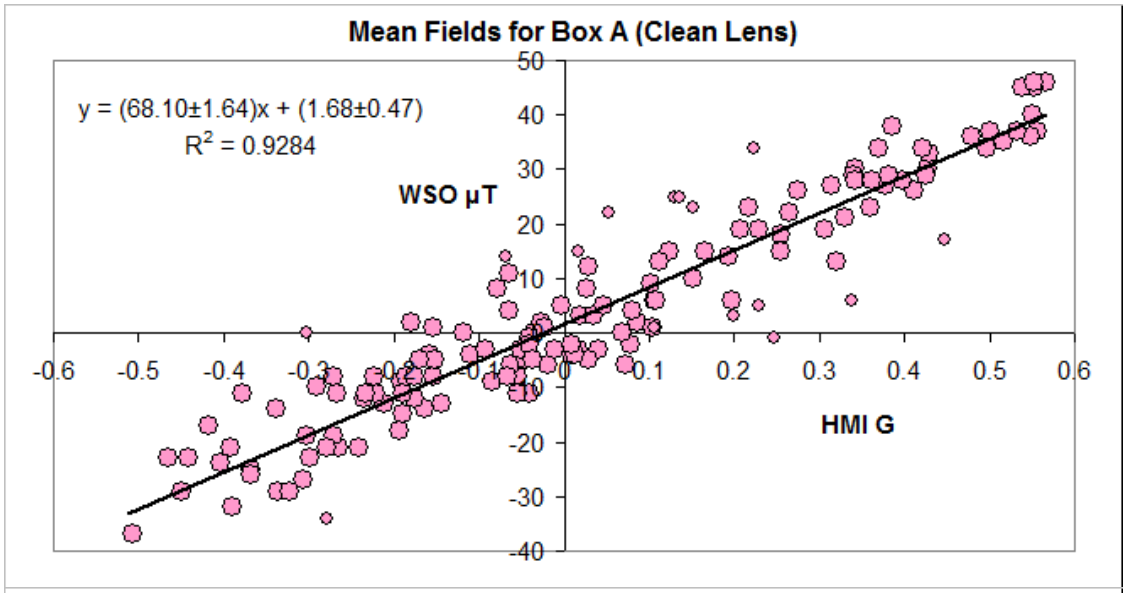


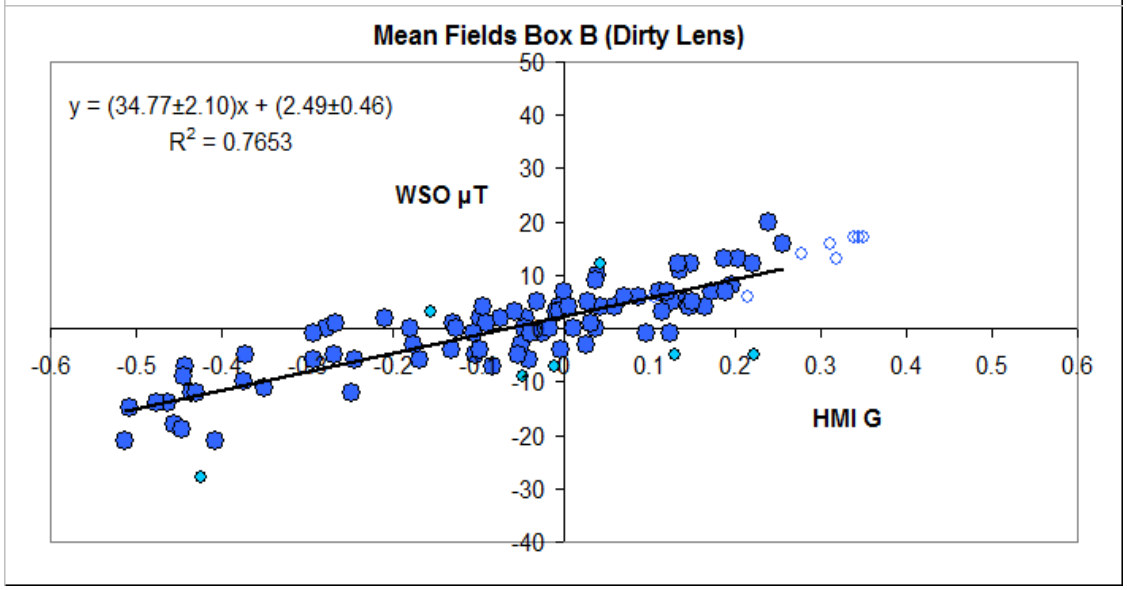
Overview of WSO vs. HMI

	slope	offset	R^2	N
2016.625	68.142	1.5102	0.9641	25
2016.708	66.697	4.927	0.9609	26
2016.792	68.245	1.6195	0.9485	18
2016.875	64.449	5.9651	0.9572	20
2016.958	81.687	4.1199	0.9214	8
2017.042	42.089	4.3102	0.8629	16
2017.125	38.791	4.2745	0.9243	14
2017.208	27.941	4.0558	0.6405	25
2017.316	30.219	-0.3497	0.807	23
2017.442	70.388	-2.3606	0.88	29

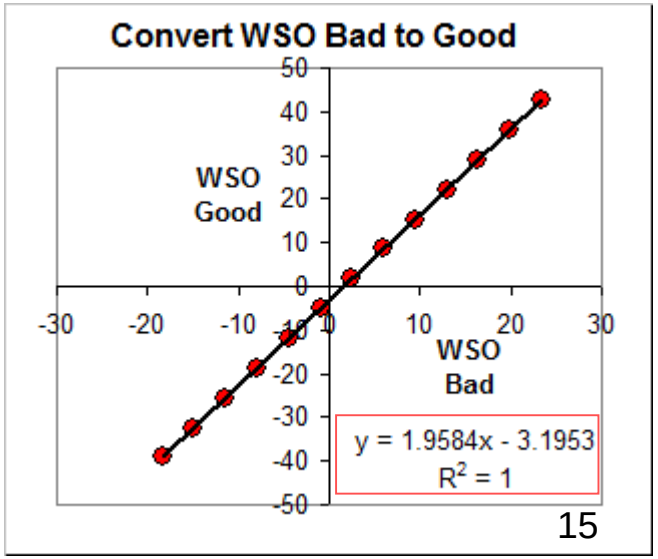
We identify two ‘boxes’ A & B

Finding Correction Relation





Slope	34.772	68.098
Offset	2.4916	1.6843
HMI	WSO bad	WSO good
-0.6	-18.3716	-39.1745
-0.5	-14.8944	-32.3647
-0.4	-11.4172	-25.5549
-0.3	-7.94	-18.7451
-0.2	-4.4628	-11.9353
-0.1	-0.9856	-5.1255
0	2.4916	1.6843
0.1	5.9688	8.4941
0.2	9.446	15.3039
0.3	12.9232	22.1137
0.4	16.4004	28.9235
0.5	19.8776	35.7333
0.6	23.3548	42.5431

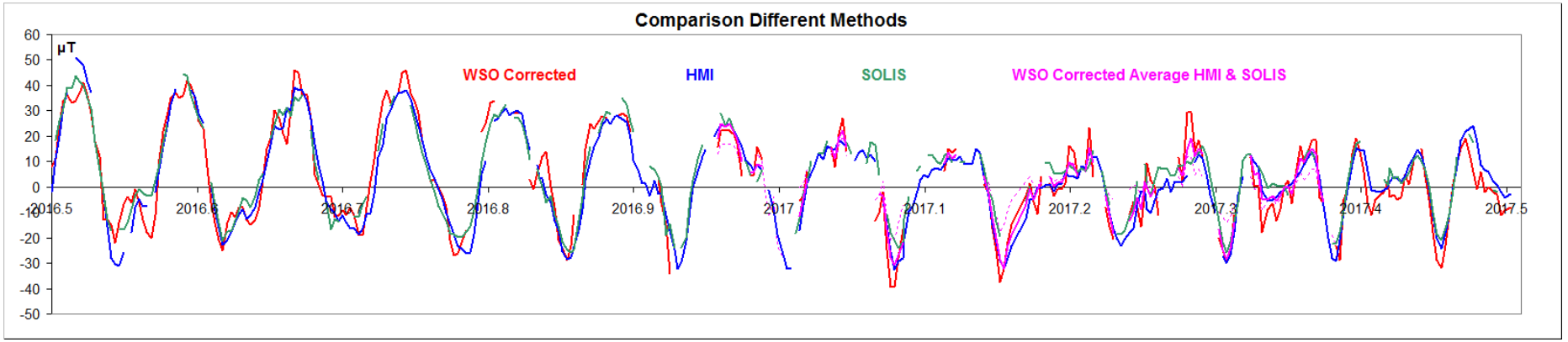


Which Correction Method to Use?

Assuming that the contamination problem was unchanged while the lens was dirty we found Corrected WSO [uT] = 1.96 WSO Bad – 3.2. We could relax that assumption and correct month-by-month using the varying relationship for each month:

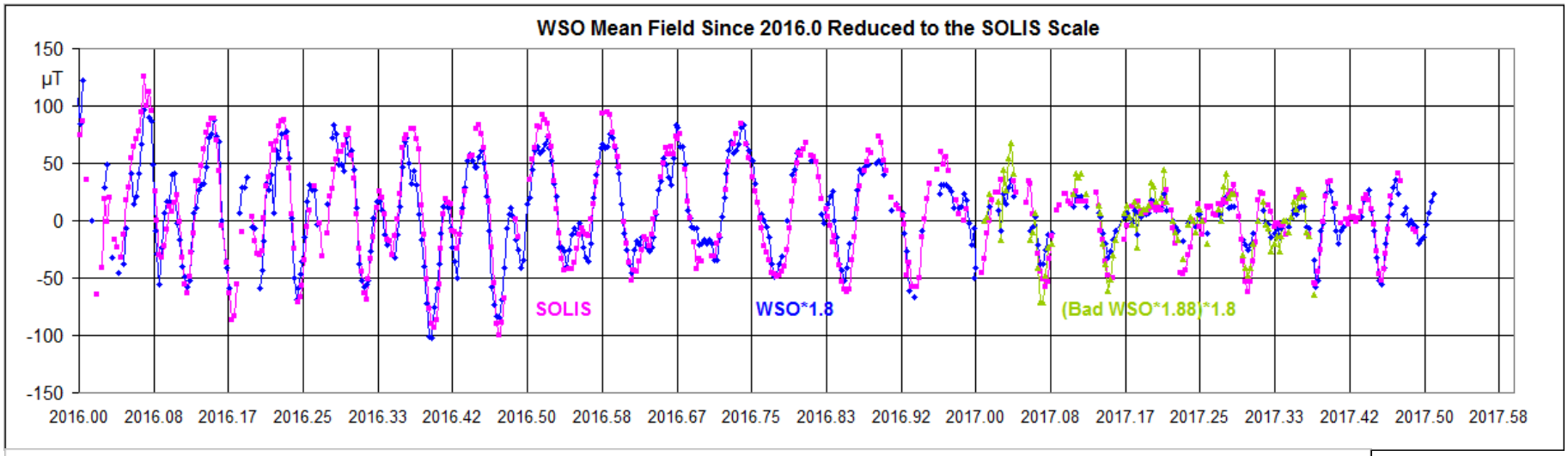
Corr WSO = 1.62 WSO bad - 5.3 January 2017
= 1.76 WSO bad - 5.9 February 2017
= 2.44 WSO bad - 8.2 March 2017
= 2.25 WSO bad + 2.5 April 2017

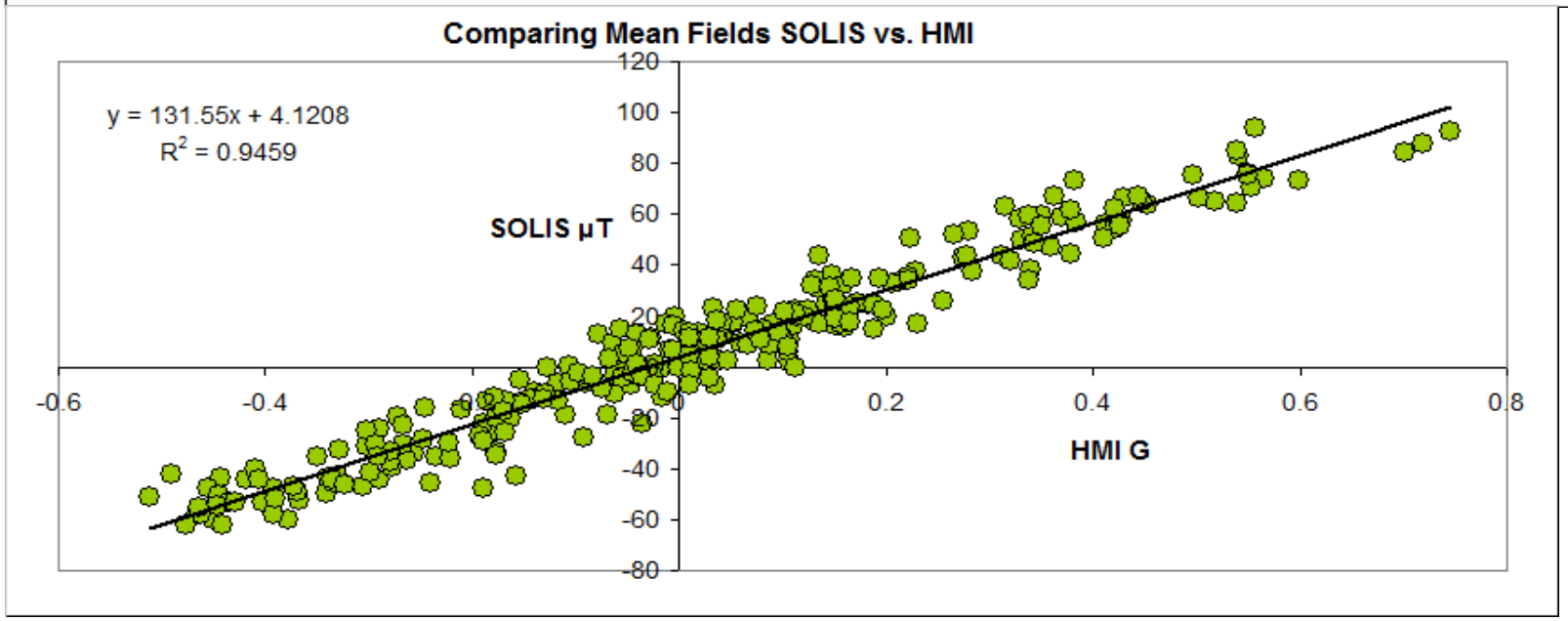
That makes the result a bit less 'spiky', but also makes WSO looks more like HMI. If we correct week-by-week the result looks even more like HMI, etc, but then we could just use HMI [on the WSO scale]. We need to decide what to do.



Using SOLIS also works but has more data gaps.

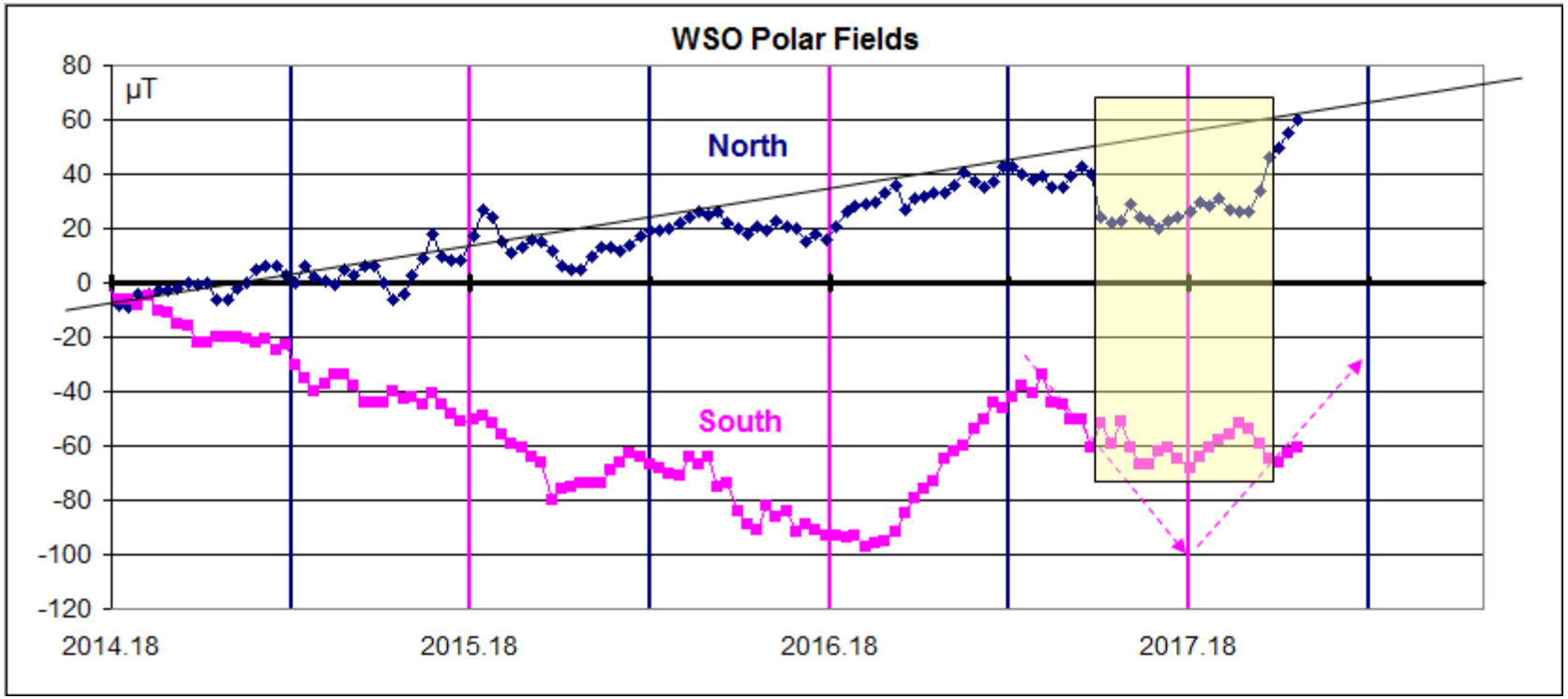
Using SOLIS the Same Way





The 1.8 factor is the well-known 5250Å WSO saturation correction

The Bite Out of the Polar Fields



Now that the lens has been cleaned and the correct field measurements have been restored we can clearly see the ‘bite’ taken out of the values due to the dirty lens [yellow box].