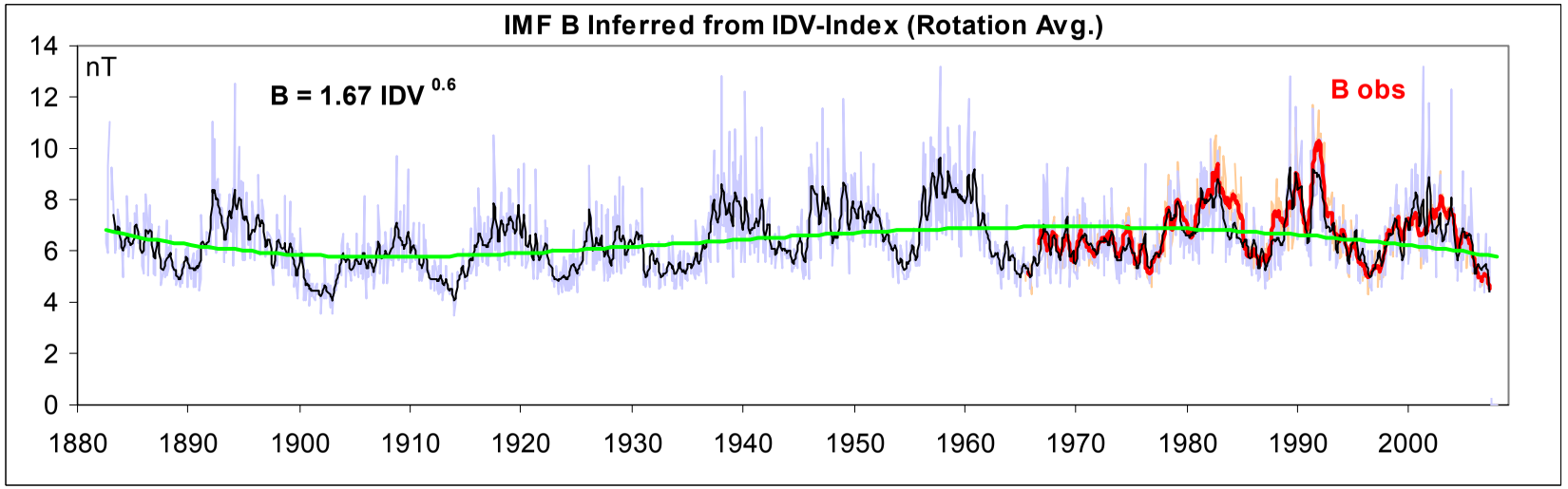
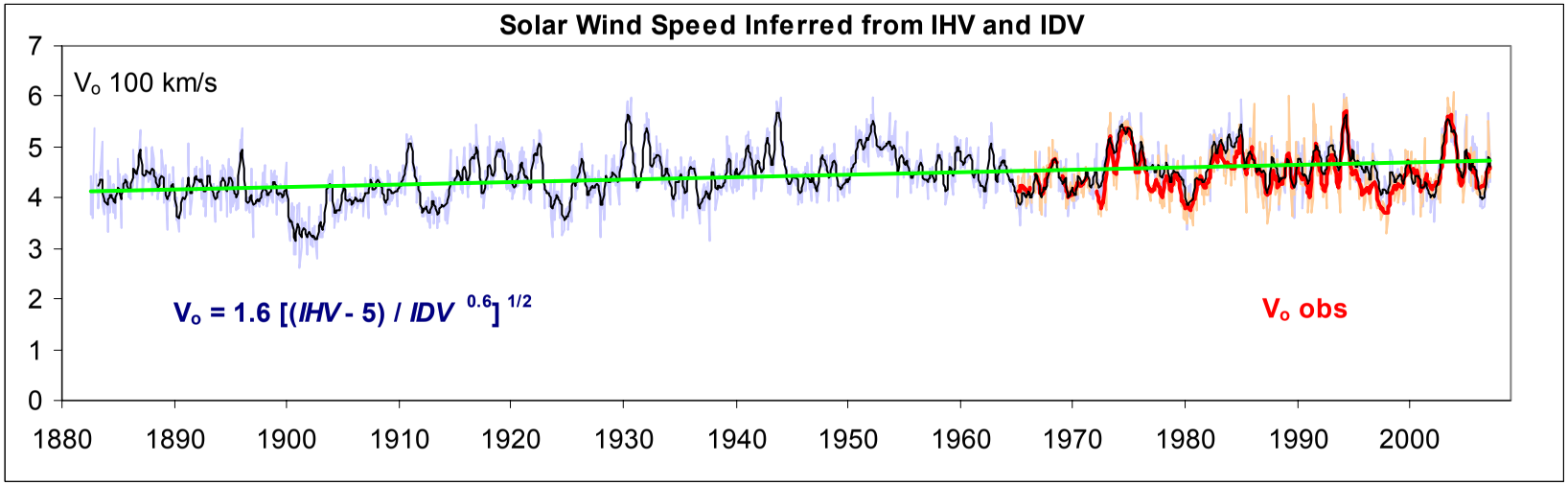
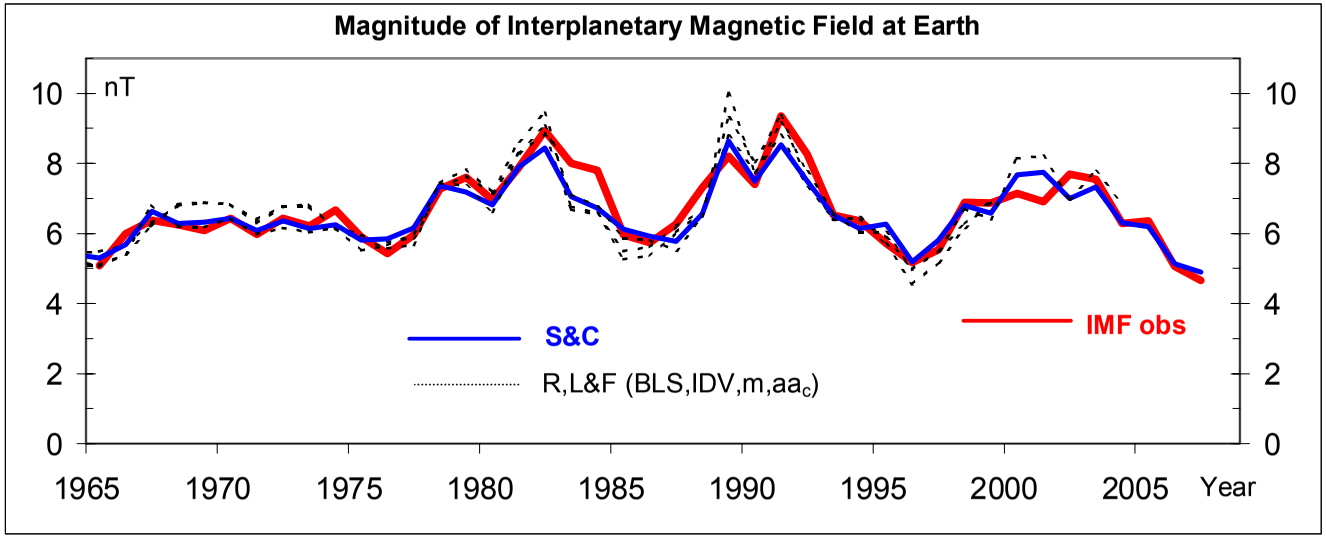
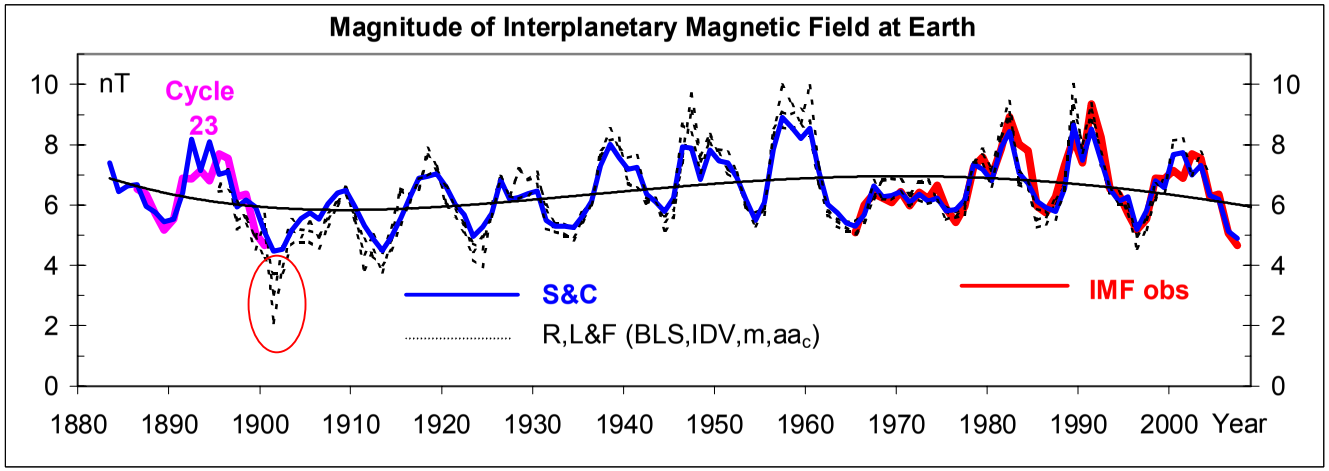
Solar Wind at Earth 1883-2007





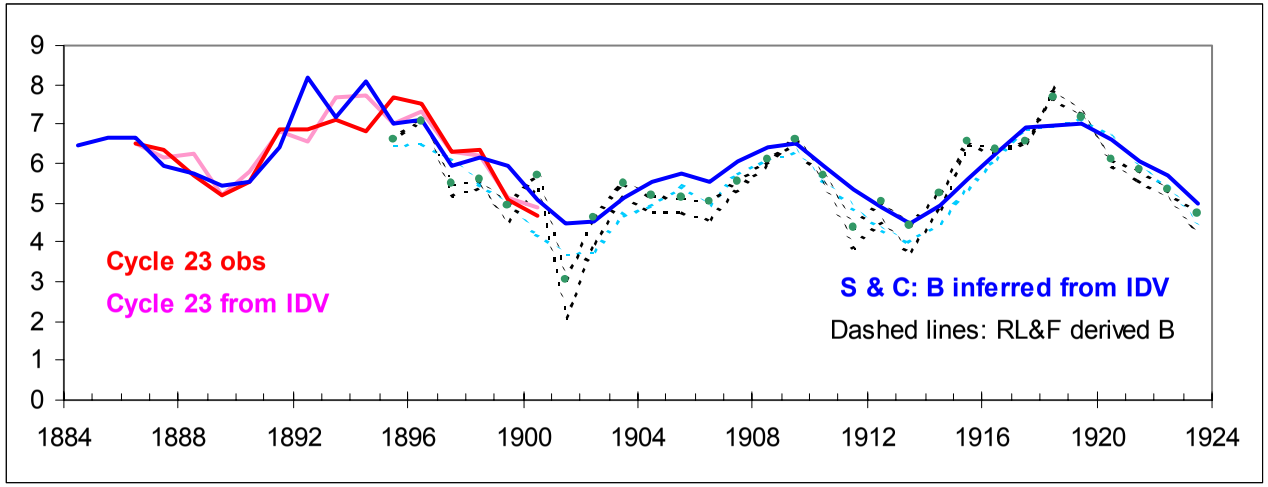




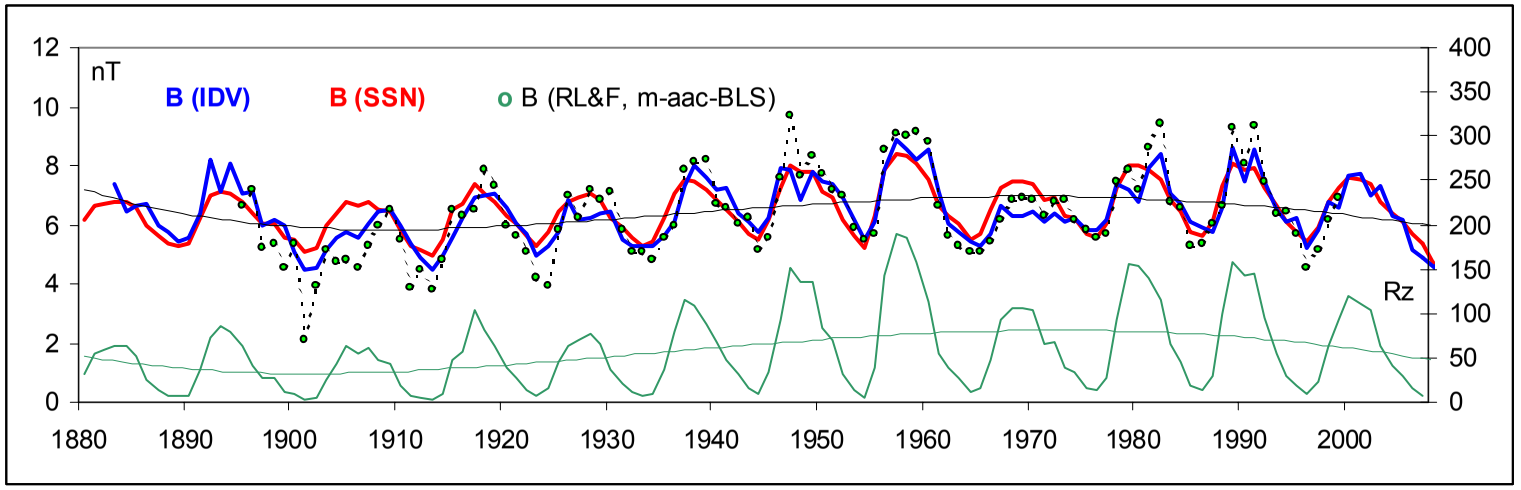
Yearly average IMF *B* determined by Svalgaard & Cliver (2007) [S&C blue curve), observed in situ (red) and by Alexis Rouillard et al. (2007) [dashed curves] using various combination of methods [BLS=Bayesian Least Squares, our *IDV* index, their *m* and aa_c indices]. Note how the RL&F reconstructions overshoot both high and low: high values are too high, and low values are too low

Bottom: Extension back to 1883. The agreement between S&C and RLF reconstructions is good (within one nT), except for the single year 1901 [see next page]

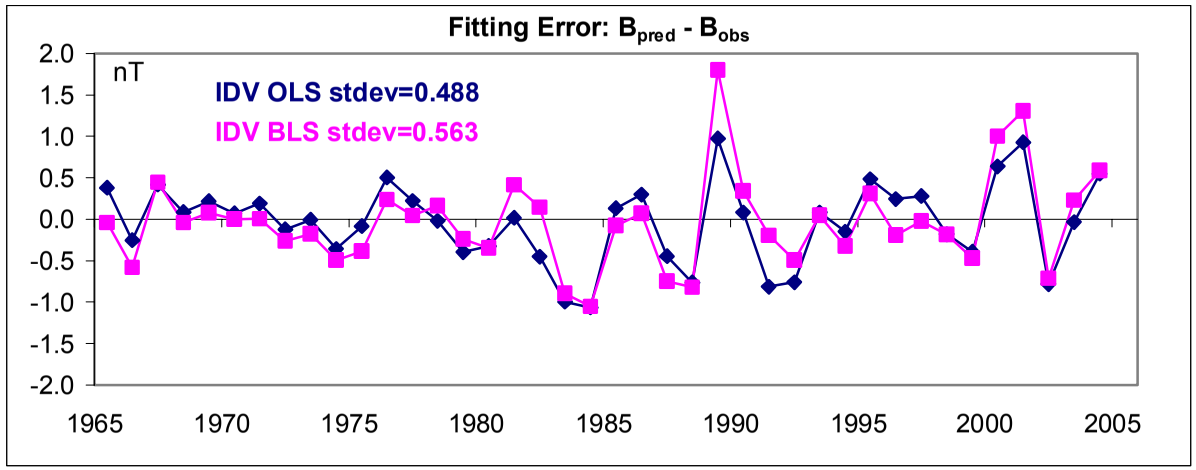
Shifting the current solar cycle 23 by 107 years to the left makes it match nicely with cycle 13, showing that as far as the IMF goes, the Sun is now where is was 107 years ago.

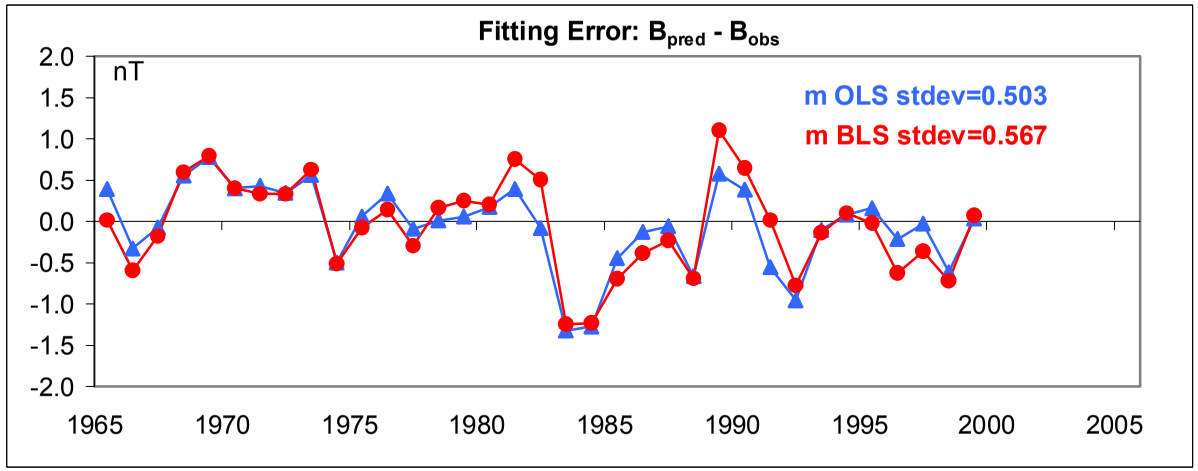


Blowup of the first 40 years of the previous Figure. Note how the year 1901 is a singular outlier, with B falling to less that half of the typical value at solar minimum. This may be a consequence of extrapolating an empirical relationship beyond the domain on which it was based or of the data being beset with systematic errors. Looking closely at the data for 1901 (*e.g.* re-scaling aa) might be a good idea.



This shows that IMF *B* just follows the (square root of the) sunspot number SSN [$B = 4.62+0.273\ SSN^{1/2}$] riding on a floor of ~4.6 nT.

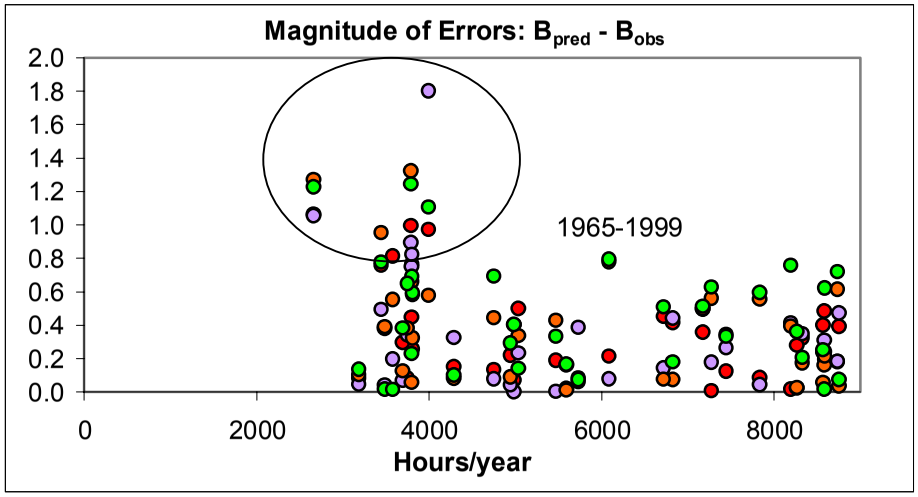




Plot of fitting error B_{pred} - B_{obs} for regressions using *IDV* (top) and *m* (bottom), done separately using Ordinary Least Squares (OLS) and Bayesian Least Squares (BLS). The residuals are generally small, less than 1.0 nT, except for a few BLS or *m*-based values.

The main impression is that it does not make much difference which method is used. The BLS method performs in both cases less well than the OLS method, although not by much.

Most of the larger errors (except for 2001-2002) occur when there is significant missing IMF data. This is seen graphically on the plot on the next page, where the magnitude of the errors is plotted against the number of hours per year with spacecraft data. The different colors correspond to the four different methods used. Unfortunately I do not have data for the *m*-method past 1999, but the pattern seems clear enough: less data more error.


Magnitude of Errors: B_pred - B_obs
2.0
1.8
1.6
1.4
1.2
1.0
0.8
0.6
0.4
0.2
0.0
1965-1999
0
2000
4000
6000
8000
Hours/year