



Weighting of Sunspot Counts

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Osservatore: S. Cortesi

Immagini: 3 (SIDC: 3)

$\Delta p = +24.4$

SPECOLA SOLARE TICINESE
LOCARNO MONTI

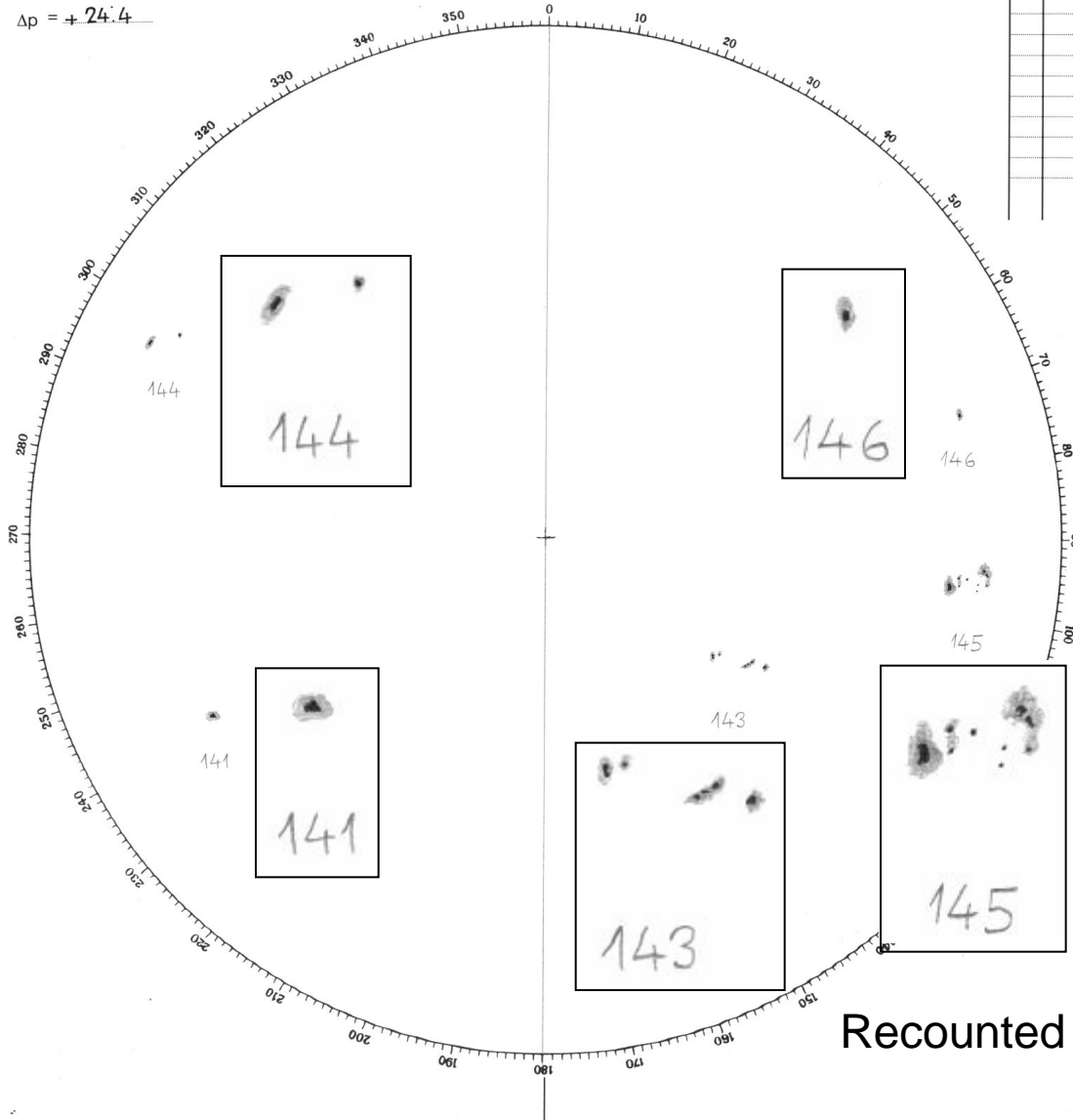
$L_0 = 69.7$

$B_0 = -4.4$

$p_0 = -24.4$

g	f	t	B
141	3	J	-23
143	15	D	-18
144	6	G	+20
145	17	D	-7
146	3	J	+12
5	44		

Counting with Weighting



g	f
141	3
143	15
144	6
145	17
146	3
5	44

No weighting

1

6

2

9

1

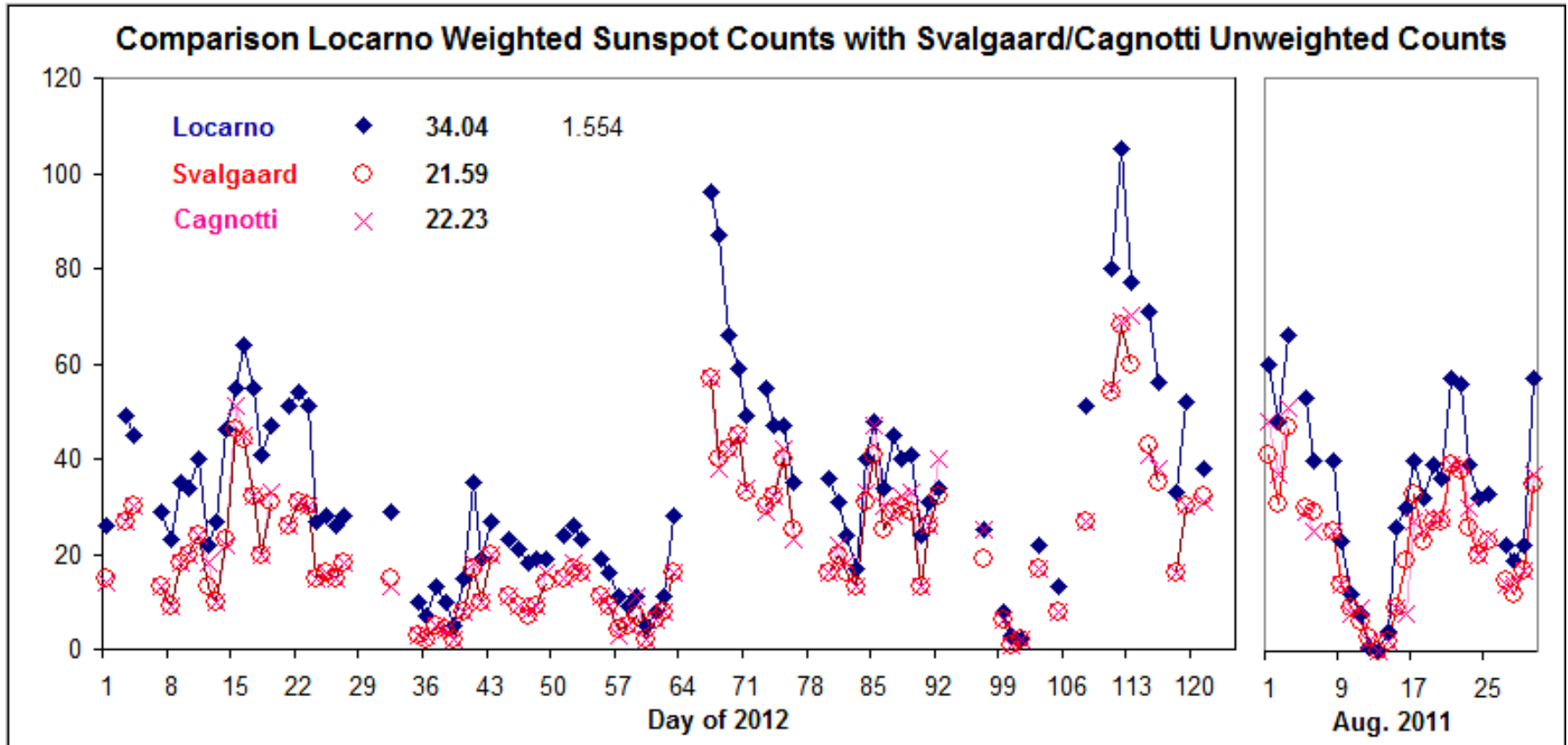
19

$5 \times 10 + 44 = 94$ $5 \times 10 + 19 = 69$

$94 / 69 = 1.36$

Recounted 2003-2014: ~55,000 spots

Double-Blind Test of My Re-Count

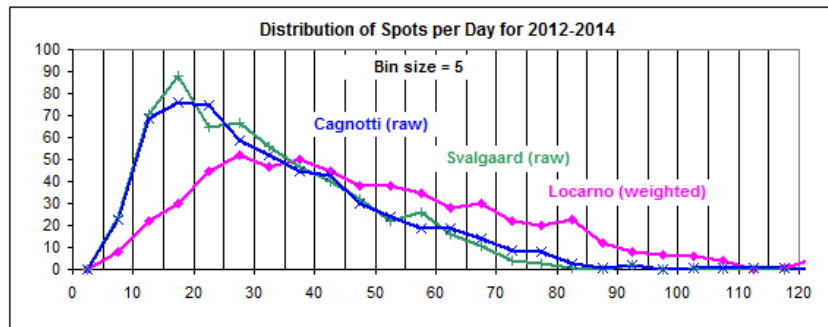
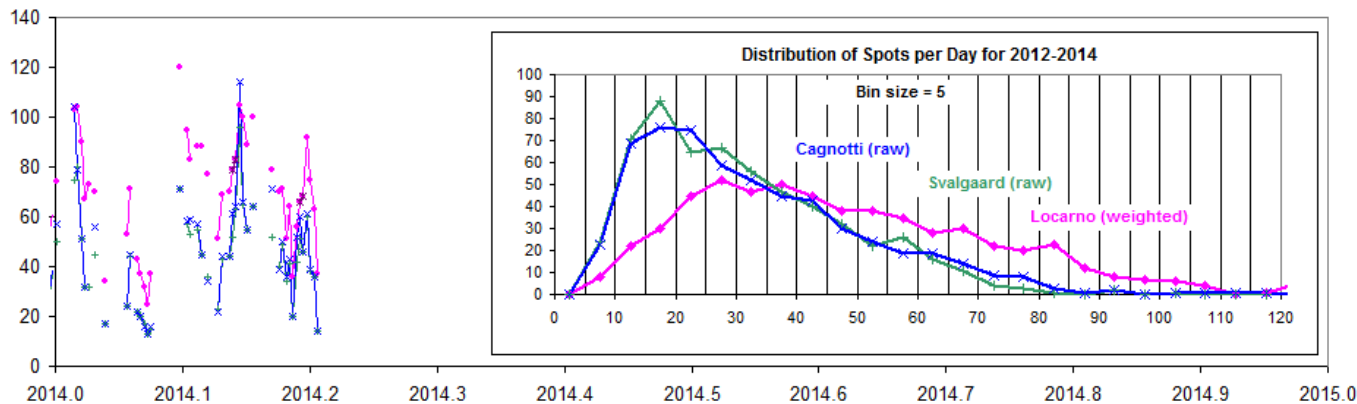
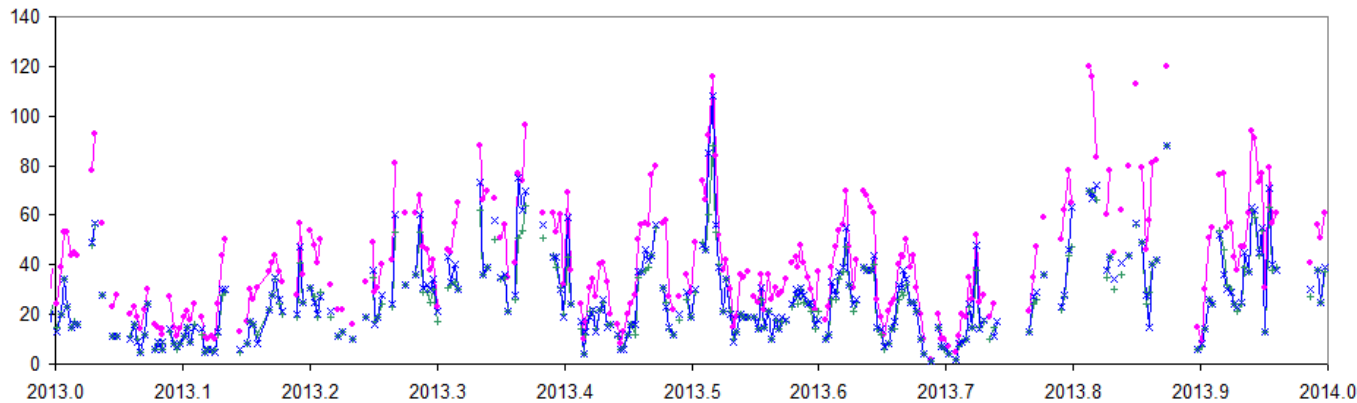
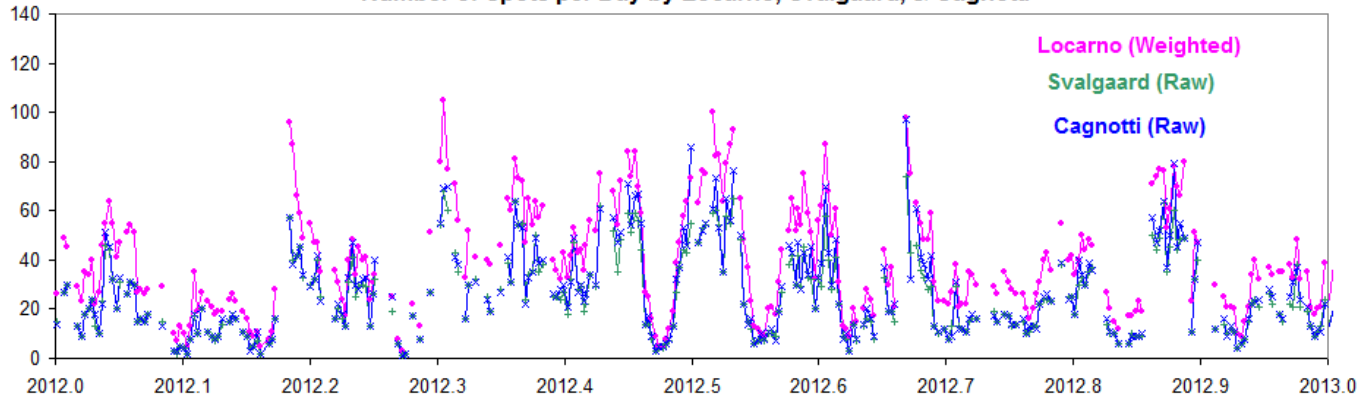


I proposed to the Locarno observers that they should also supply a raw count without weighting



For typical number of spots the weighting increases the 'count' of the spots by 30-60%

Number of Spots per Day by Locarno, Svalgaard, & Cagnotti

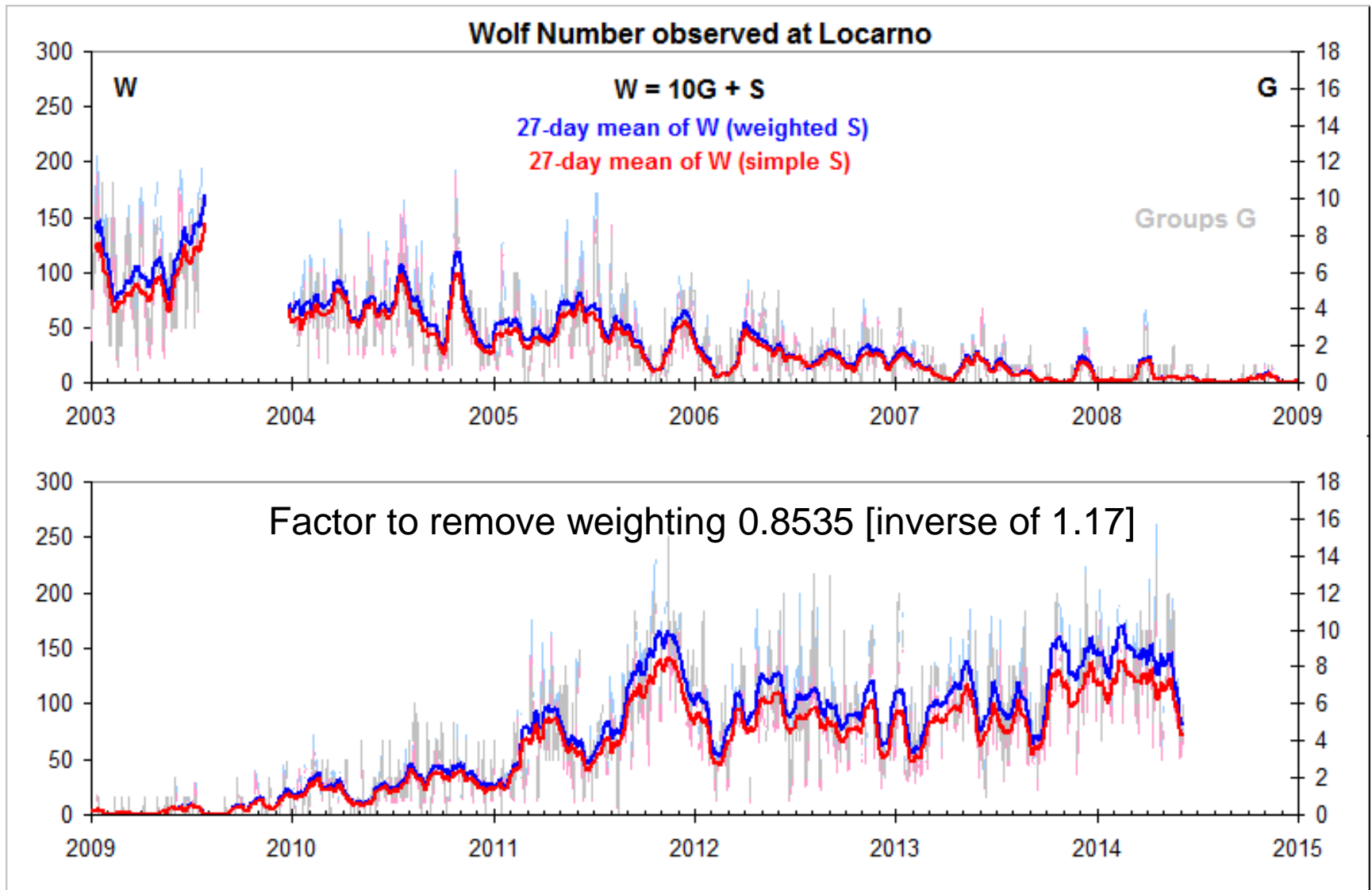


Compare Cagnotti & Svalgaard

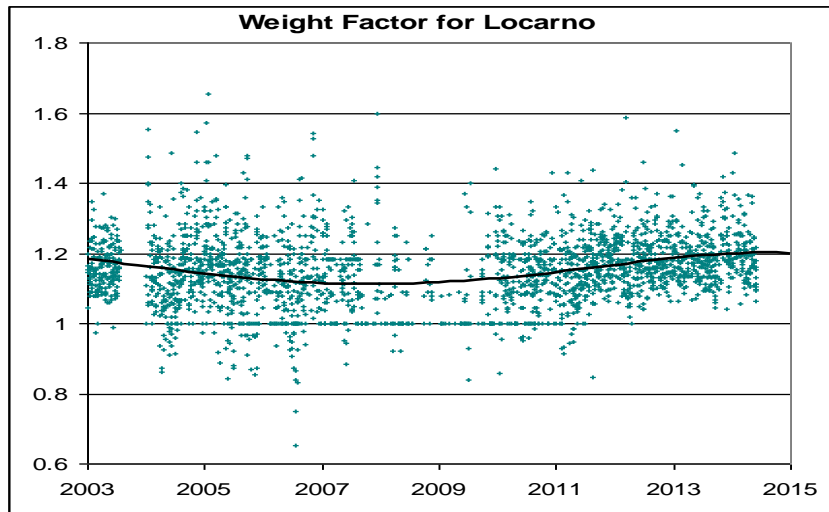
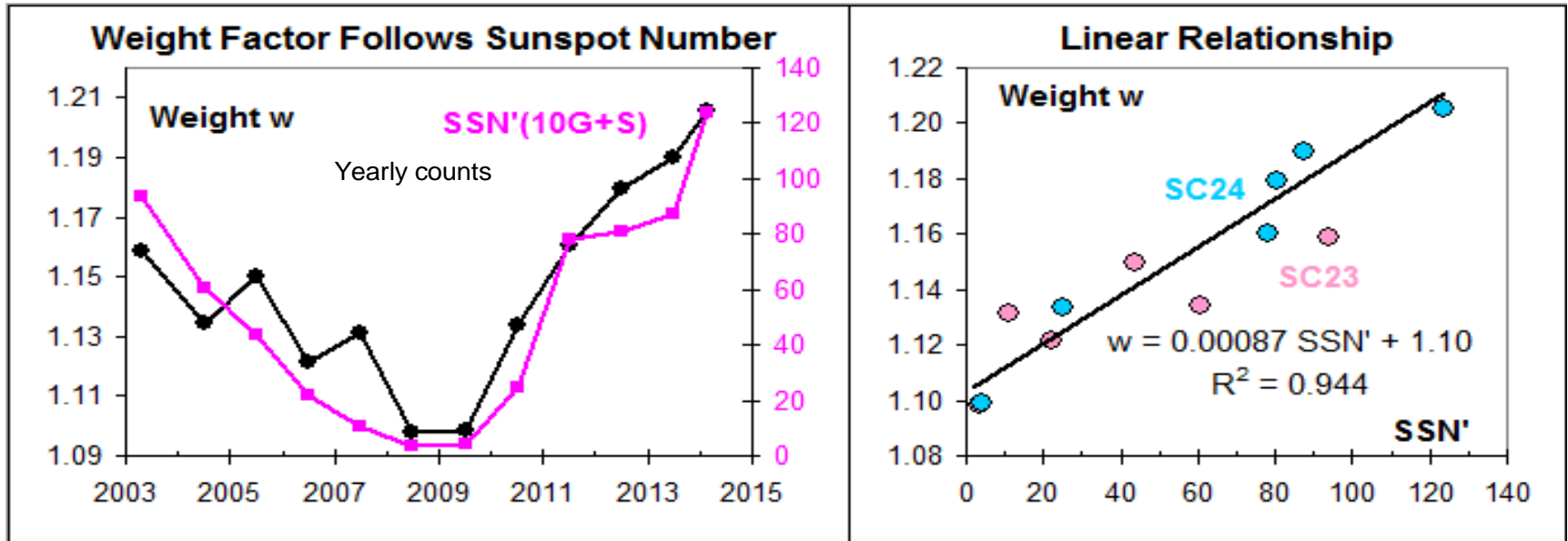
My raw counts match Marco's very well

I have recounted the spots for all observations since 2003 and the Locarno observers are now taking that back to the start of their series (1957).

Effect on the Wolf Number

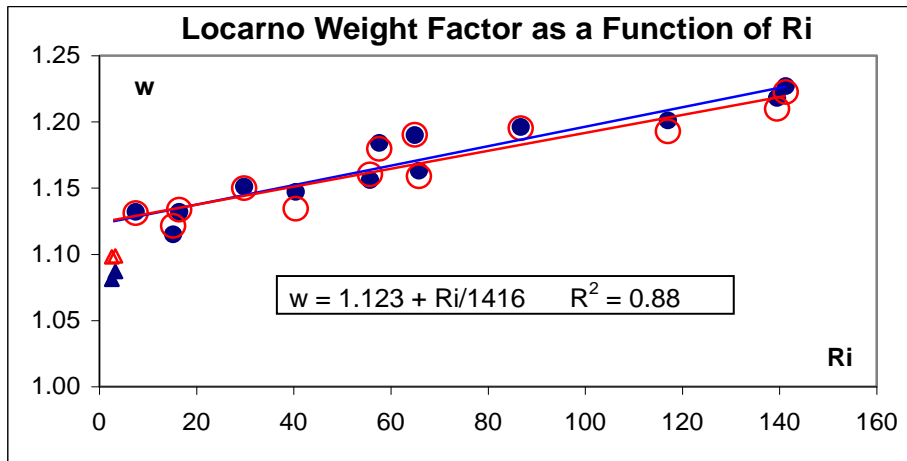


Weight Factor depends on SSN



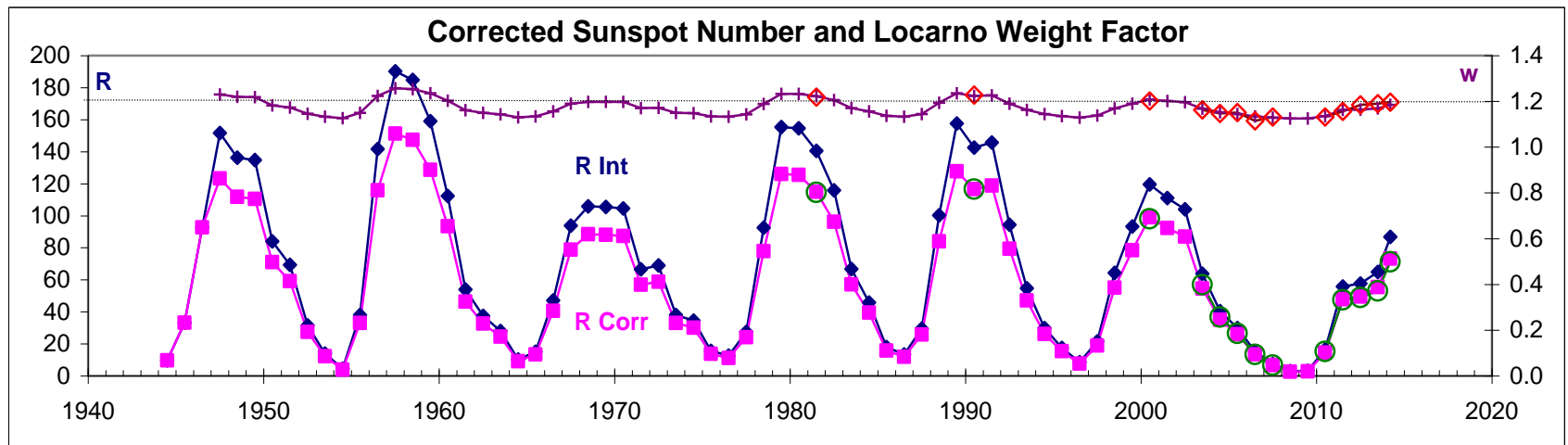
Counting 4554 [real] spots in 1981 [the first year where drawings from Locarno are readily available on the Internet at <http://www.specola.ch/e/drawings.html>] when the sunspot number was 140 yielded a weight factor of 1.22

Correcting the Sunspot Number

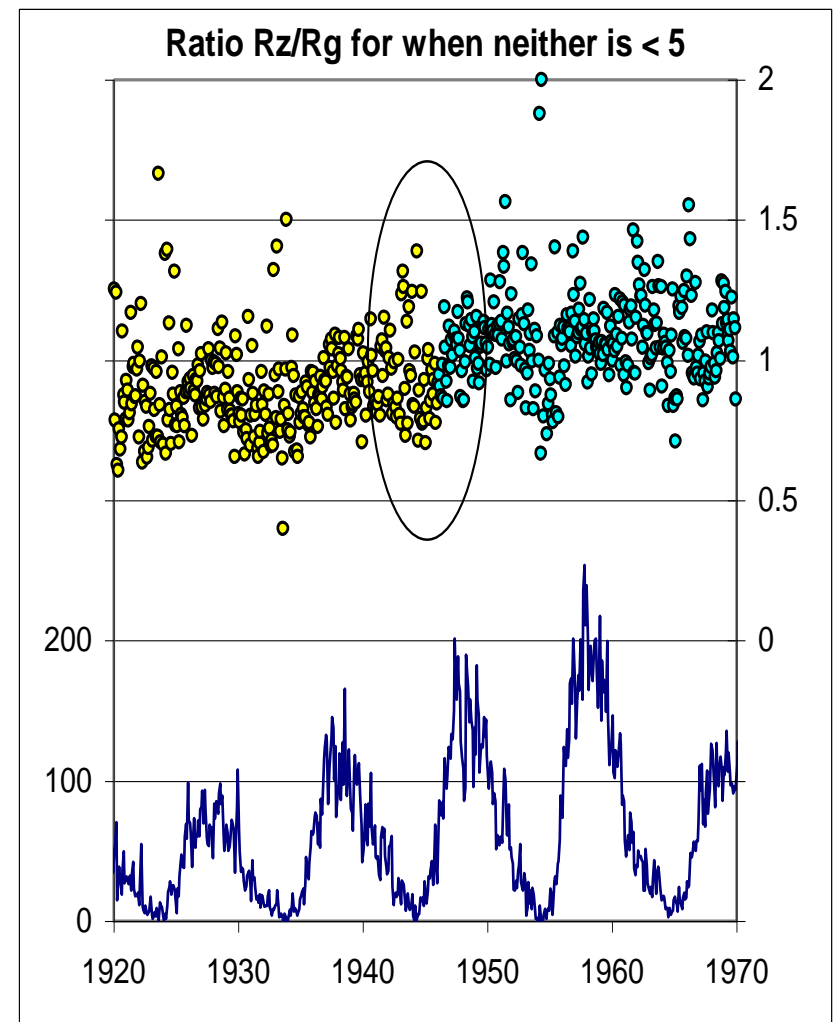
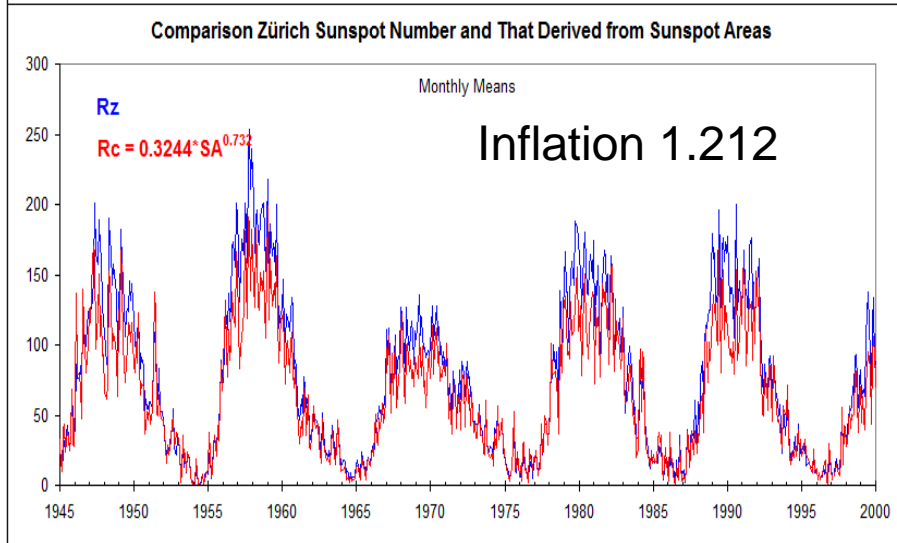
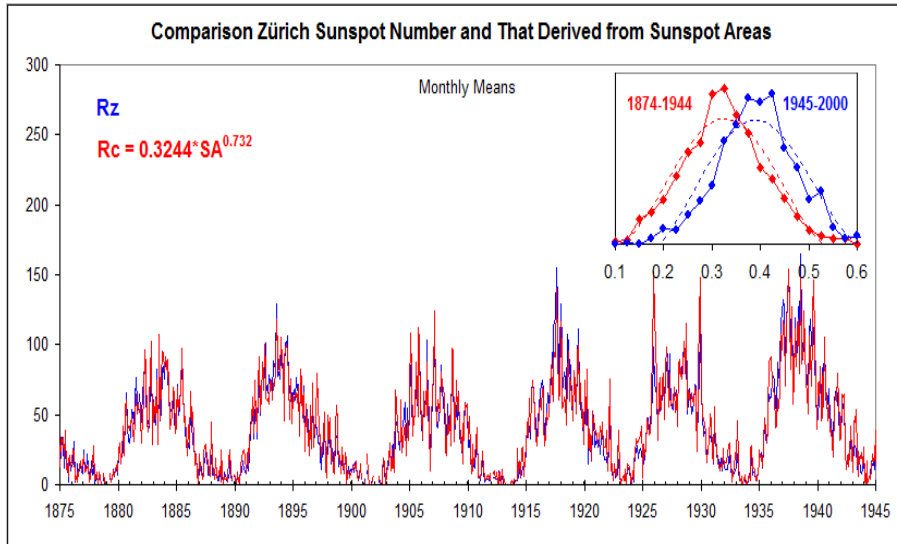


Determining the weight factor, w , for 1981, 1990, 2000, 2003-2014 allows us to quantify the relationship between w and the sunspot number. Treating the values for the deep minimum 2008-2009 as outliers (as also the weight factor for very low sunspot numbers doesn't matter)

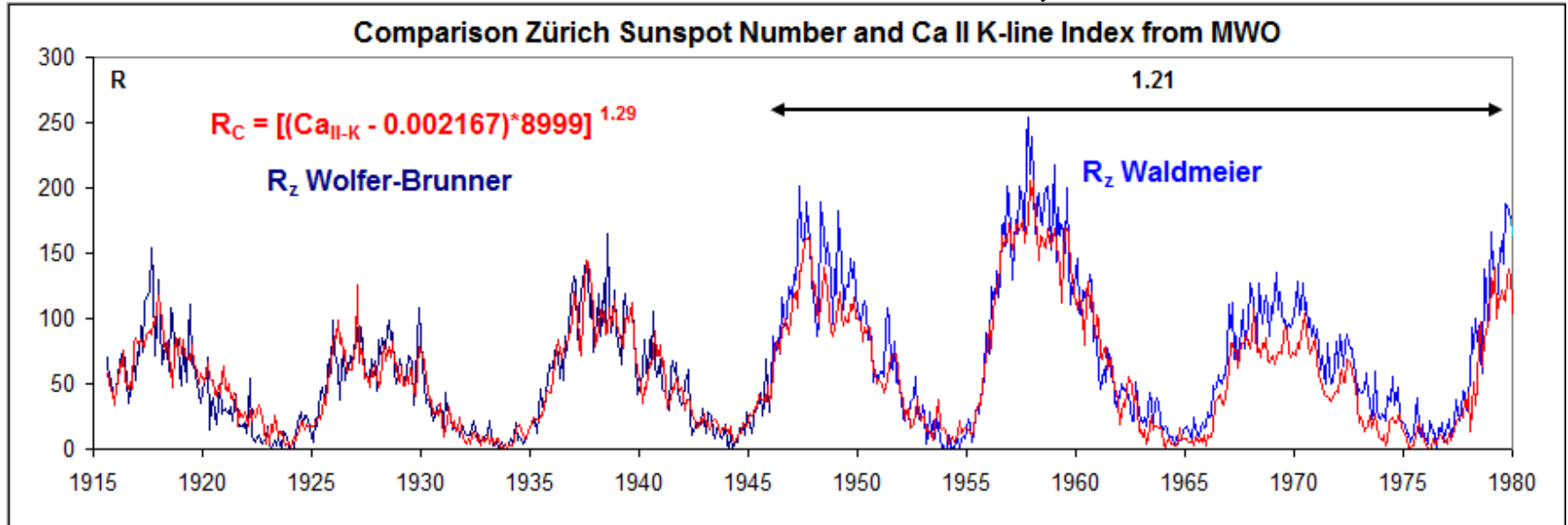
yields $w = 1.123 \pm 0.006 + Ri/(1416 \pm 140)$, with a range of 1.123-1.264 for Ri in the range 0-200. The average weight factor for 1947-2014 then becomes 1.20.



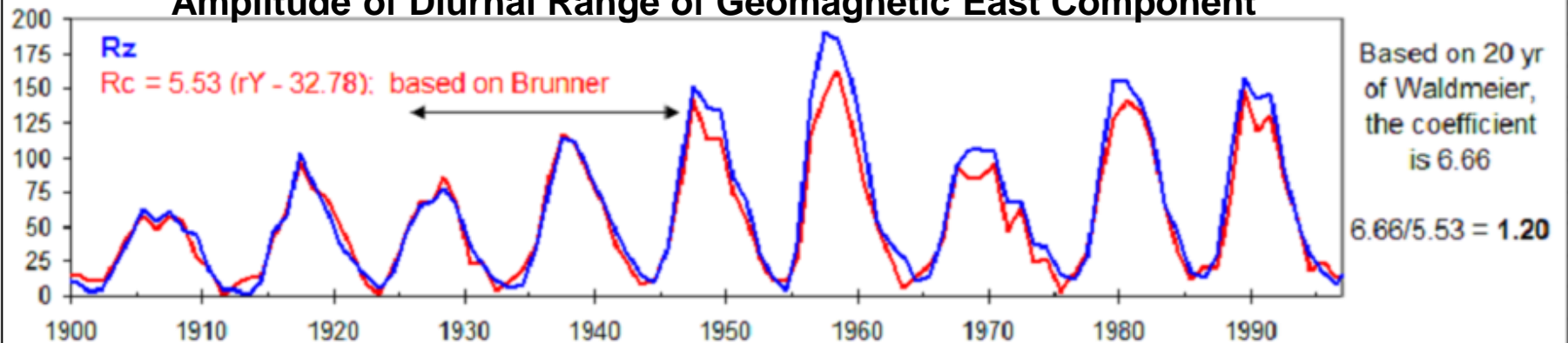
Can we see the Effect of Weighting of Spot Count in other Indices?



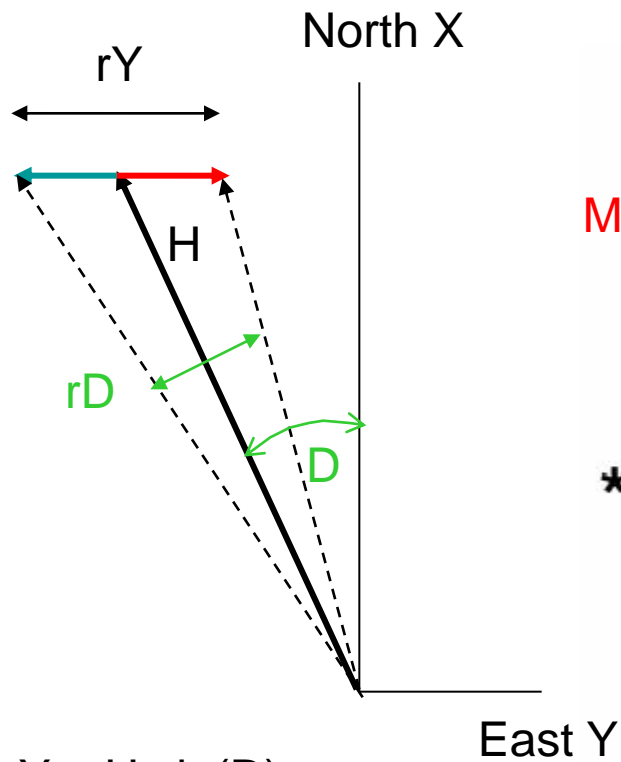
Can we see the Effect of Weighting in other Indices, II?



Amplitude of Diurnal Range of Geomagnetic East Component



Wolf's Discovery (1852): $rD = a + b R_W$

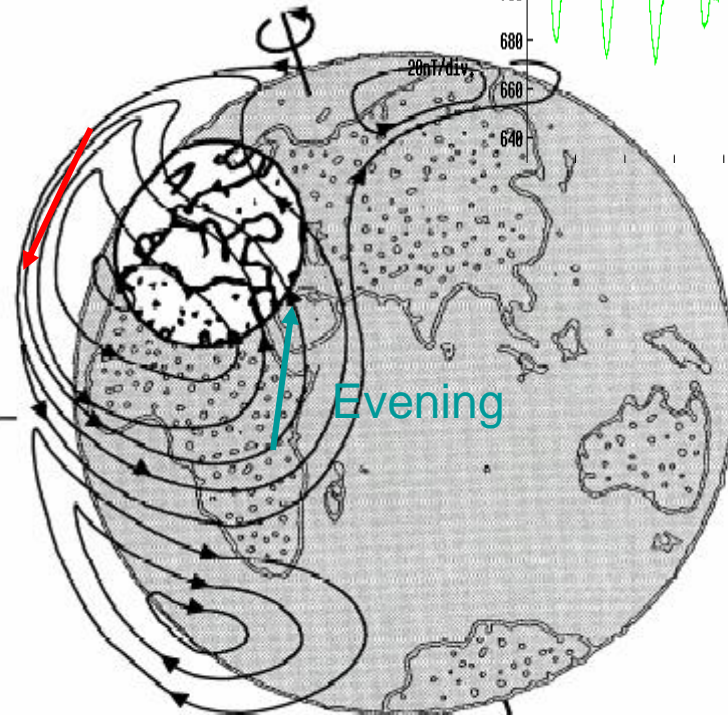


$$Y = H \sin(D)$$

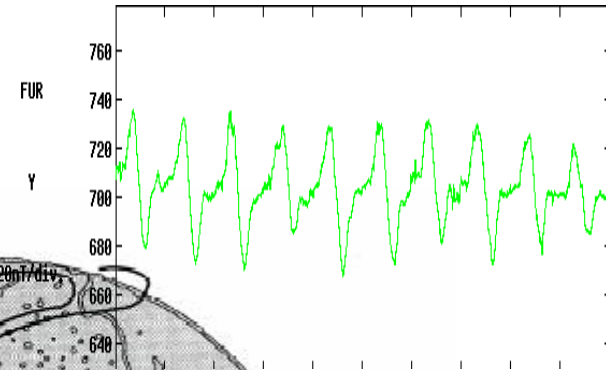
$$dY = H \cos(D) dD \text{ For small } dD$$

Morning

* ← TO SUN

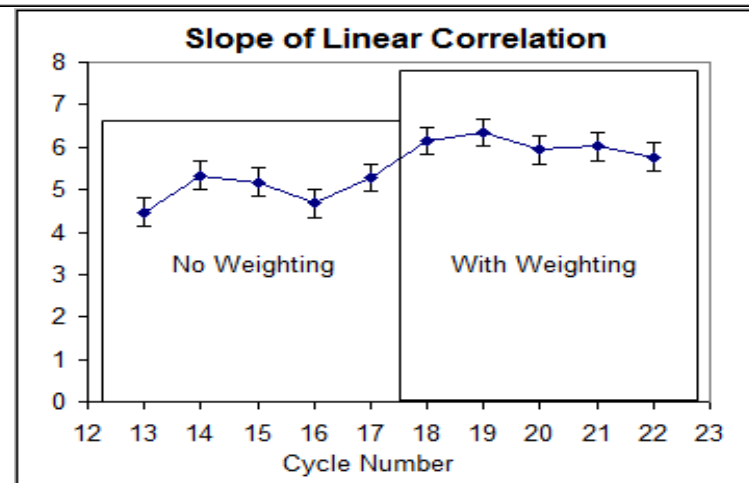
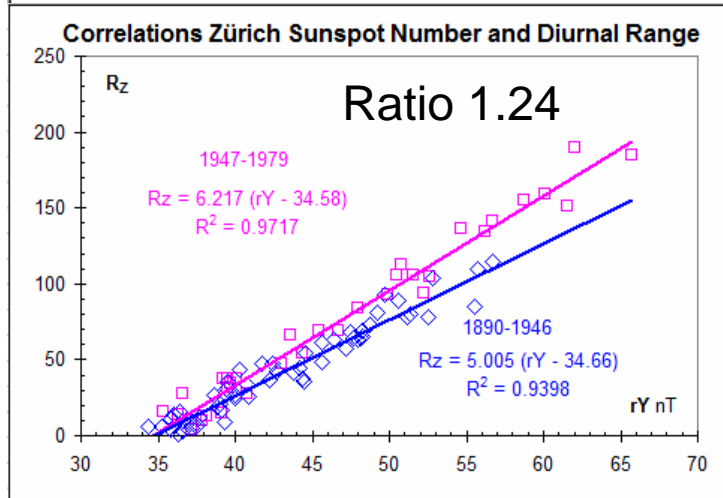
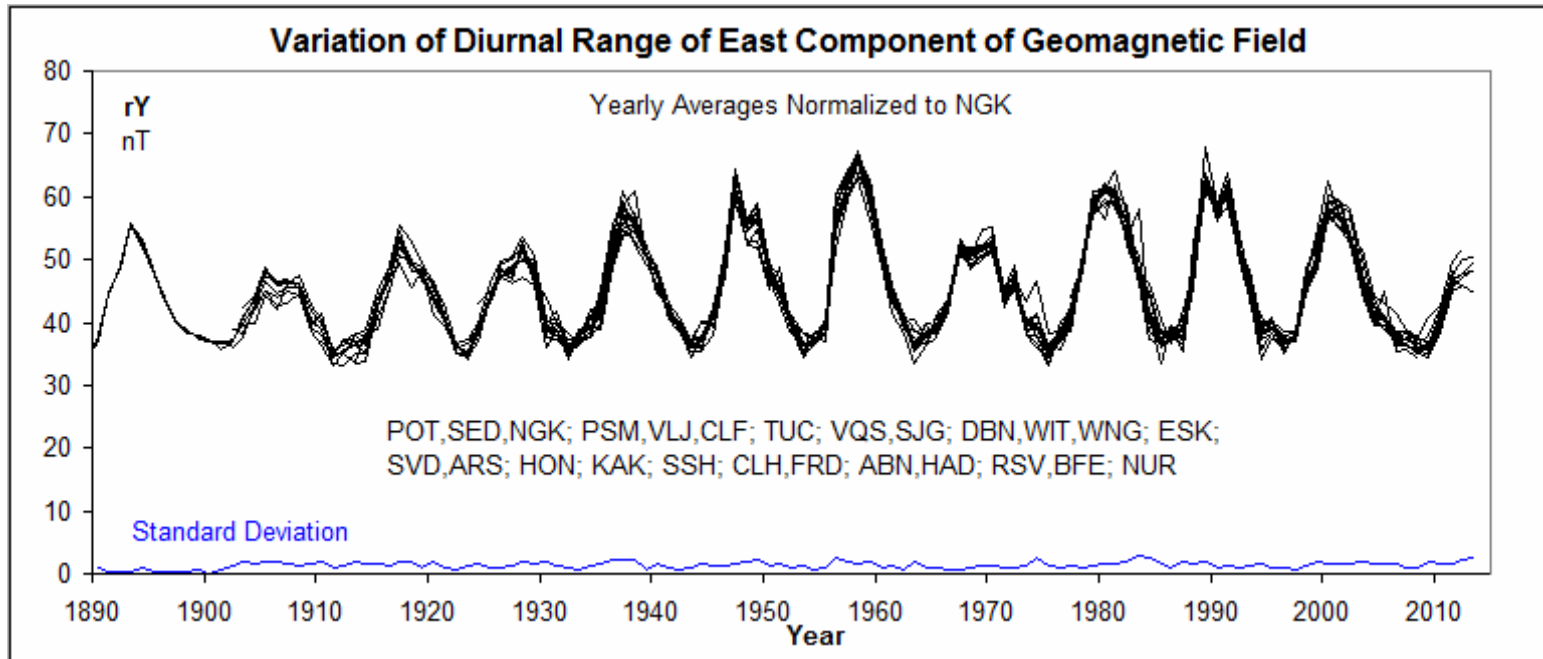


A current system in the ionosphere is created and maintained by solar FUV radiation



The magnetic effect of this system was discovered by George Graham in 1722

The Strong Geomagnetic Connection



Conclusion

- The weight factor depends on the sunspot number itself
- Varies from 1.1 at low activity to 1.25 at high activity
- A good average factor is about 1.20
- This is an observed value, not derived by guesswork
- Weighting seems to be introduced in 1947
- And can be seen in other solar indices too