On Group Sunspot Number

Kenneth Schatten
Ai-solutions

Wolf Sunspot # and Group

- The relative sunspot number *R* is computed using the formula (collected as a daily index of sunspot activity):

$$R=k\,(10G+s)$$

- *s* is the number of individual spots,
- G is the number of sunspot groups, and
- *k* is the *observatory factor* or the *personal reduction coefficient K*).
- Wolf # (1849) based Rz (Zurich SSN) from R values from various telesopes, and so it has continued.
- The Hoyt & Schatten Group # basically just uses G.

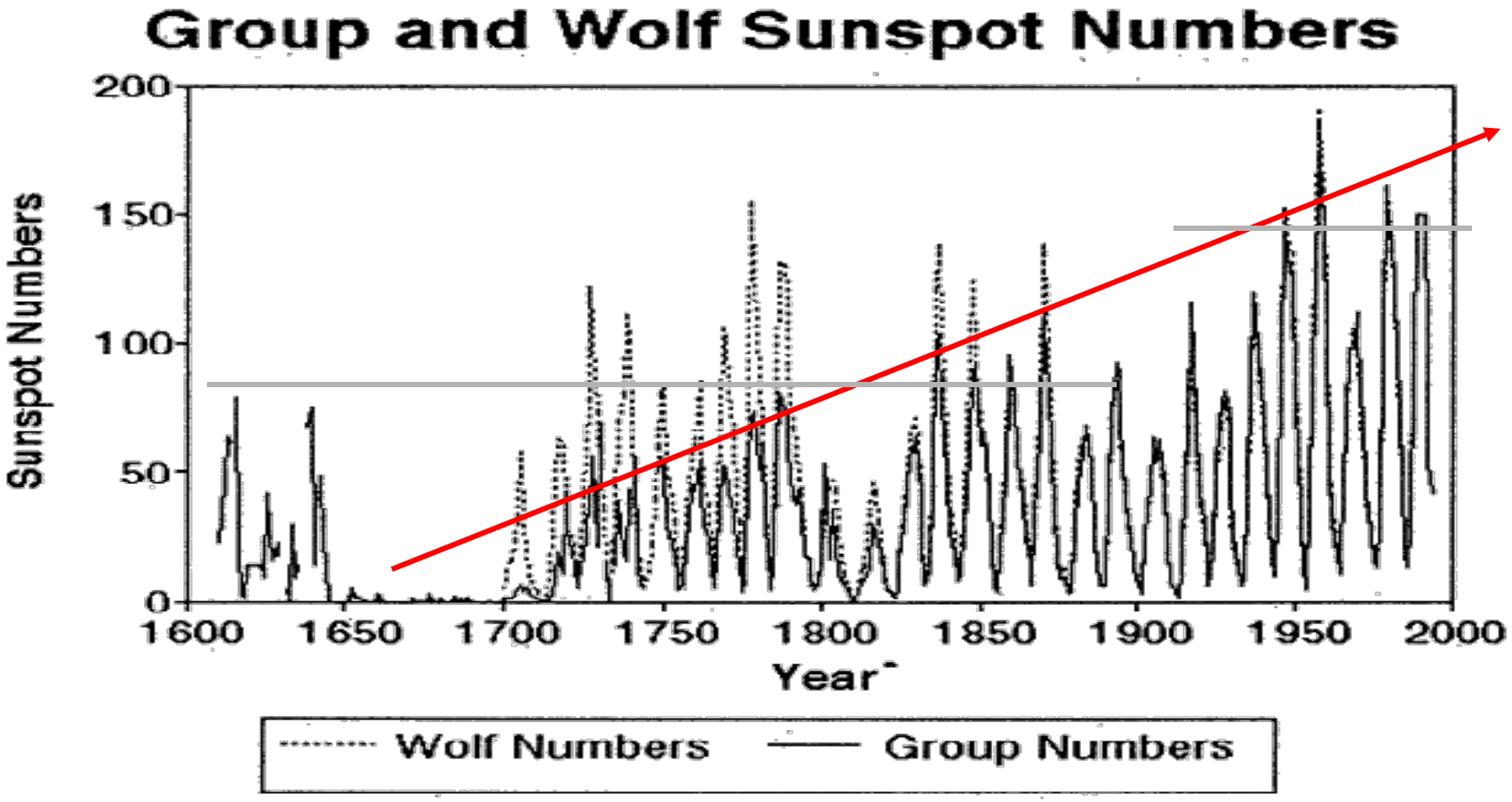
On Group Sunspot
& Cliver/Svalgaard work

1) Purpose of Work Doug Hoyt and I did, on Group #, was to make a solar activity record that was less sensitive to the S value, in previous formula. (changing observers and telescope technology throughout the centuries).
2) Roughly Group Number, Say Rg ~ 12 *k G, where k is a const.*
3) Group# was used ALONE, since groups, it was assumed, would be seen, whereas individual Sunspots (S) depend sensitively upon telescope. Nevertheless, we do NOT KNOW, how different aspects of solar dynamo (e.g. B, Bphi, etc.) are affected by relative proportion of S and G!
4) Since our knowledge of the solar dynamo is limited, we cannot necessarily assume that G is a better indicator of solar magnetic flux, than by using BOTH S and G!

Now on Cliver and Svalgaard: Newer Estimates from Magnetic Needle show the significant changes using R vs G!

- Leif Svalgaard and Ed Cliver have questioned the improvement of H&S Group #, G, compared with the Wolf number, R, and also have interesting findings regarding TSI, etc. based on the “magnetic needle.”
- The mag. needle indeed is a less instrumentally sensitive and more objective measure of the Sun’s magnetic flux at 1 AU in the ecliptic, compared with either of the telescope-based methods (R and G of sunspot viewing). I can only support these efforts.

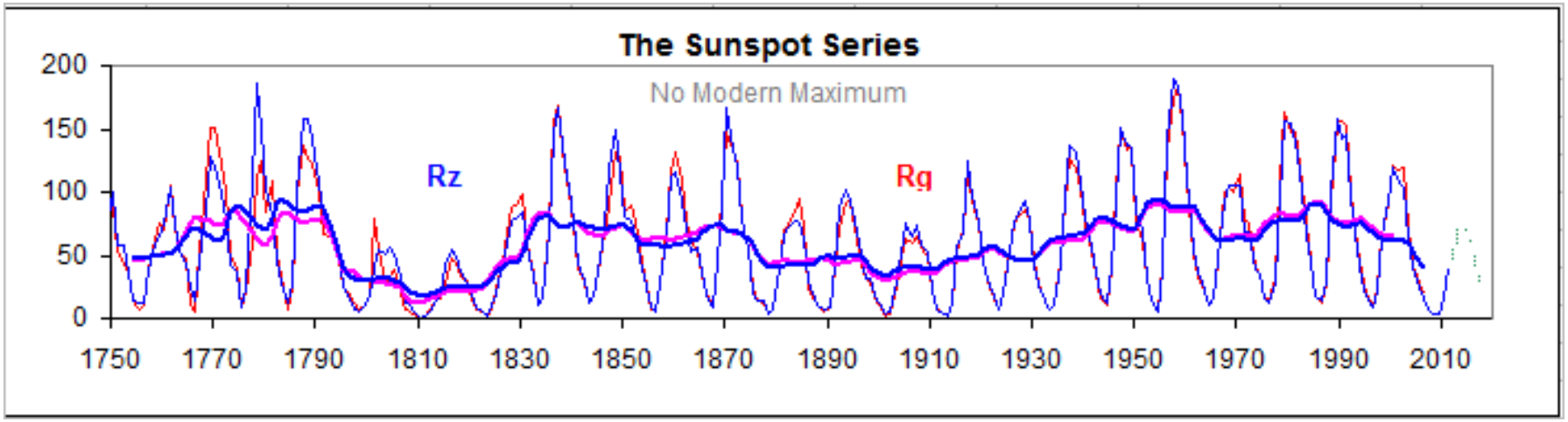
Cliver and Svalgaard show the significant changes using R vs G!



Hoyt & Schatten, GRL *21*, 1994
(Group Numbers)

Cliver/Svalgaard Findings:

- They have a number of important findings:
- Zürich Sunspot Number, Rz, and the Group Sunspot Number, Rg, can be reconciled by making only TWO adjustments
- The first adjustment [20%] is to Rz ~1945
- The second adjustment [~50%] is to Rg ~1885



Discussion & Comments

- The Red line in the earlier graph is not a best fit, but really meant to illustrate the difference between the two curves. The actual curves are NOT step functions, OR a linear upwards line, BUT
- The question remains, what is the best way to use ALL the information available about the distribution of sunspot groups and the number of sunspots on the whole disk, or sunspot areas, etc?