"The need of revising the good old Wolf numbers"

The issue is not the good old Wolf Numbers. They are basically still approximately good. The revision is mostly a simple change of scale, removing the artificial 0.6 factor.

The real issue is the revision of the bad old *Group Sunspot Number* that not even one of its 'creators' believe in anymore
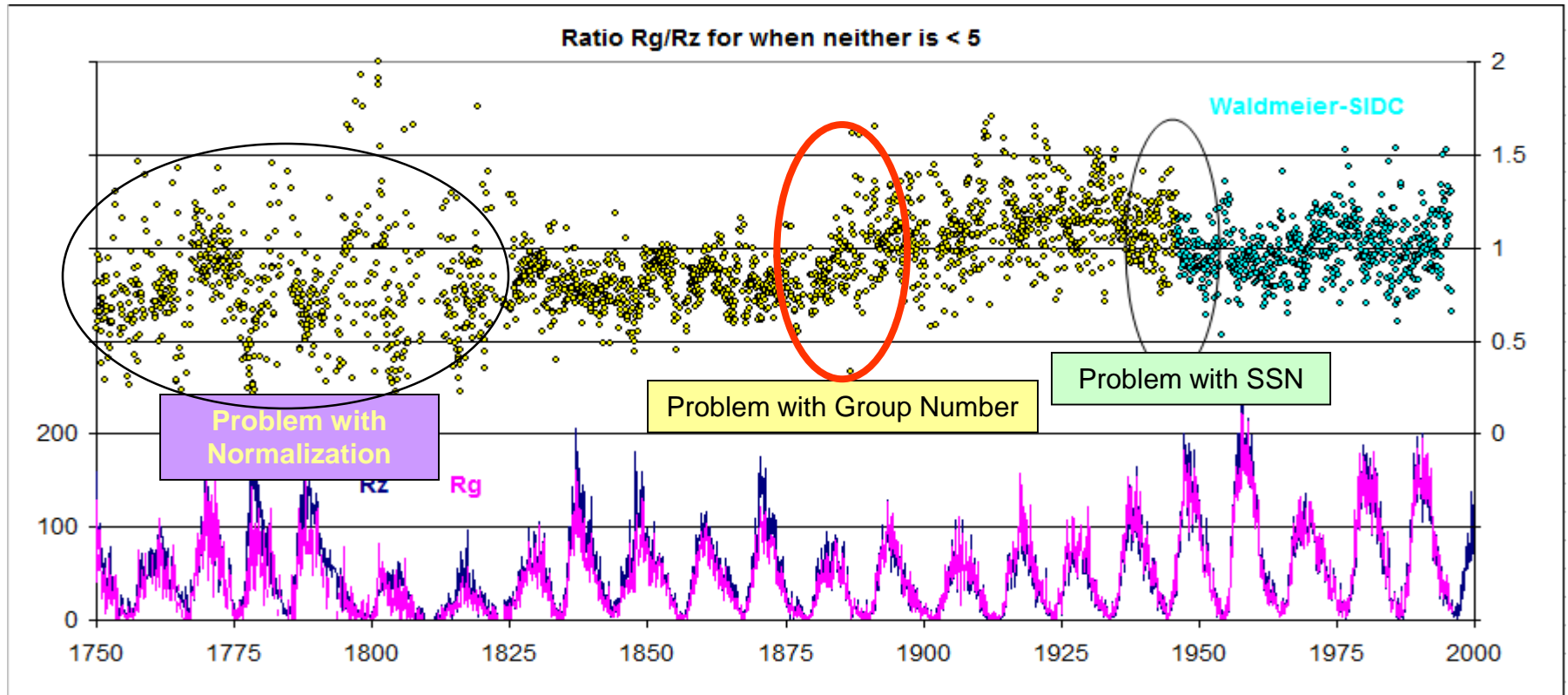
Leif Svalgaard

Ken H. Schatten

The Antique Telescope Society

6th Space Climate Symposium, Levi, April 2016

The Ratio *Group/Zürich SSN* has Two Significant Discontinuities

Ratio Rg/Rz for when neither is < 5

Waldmeier-SIDC

Problem with SSN

Problem with Group Number

Problem with Normalization

Rz Rg

At ~1947 (After Max Waldmeier took over) and at 1876-1910 (Greenwich calibration drifting)

As we found problems with the H&S normalization, we (Svalgaard & Schatten) decided to build a new Group Series 'from scratch'
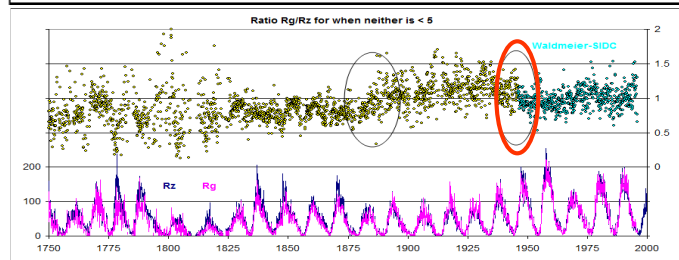
2

SSN with/without Weighting
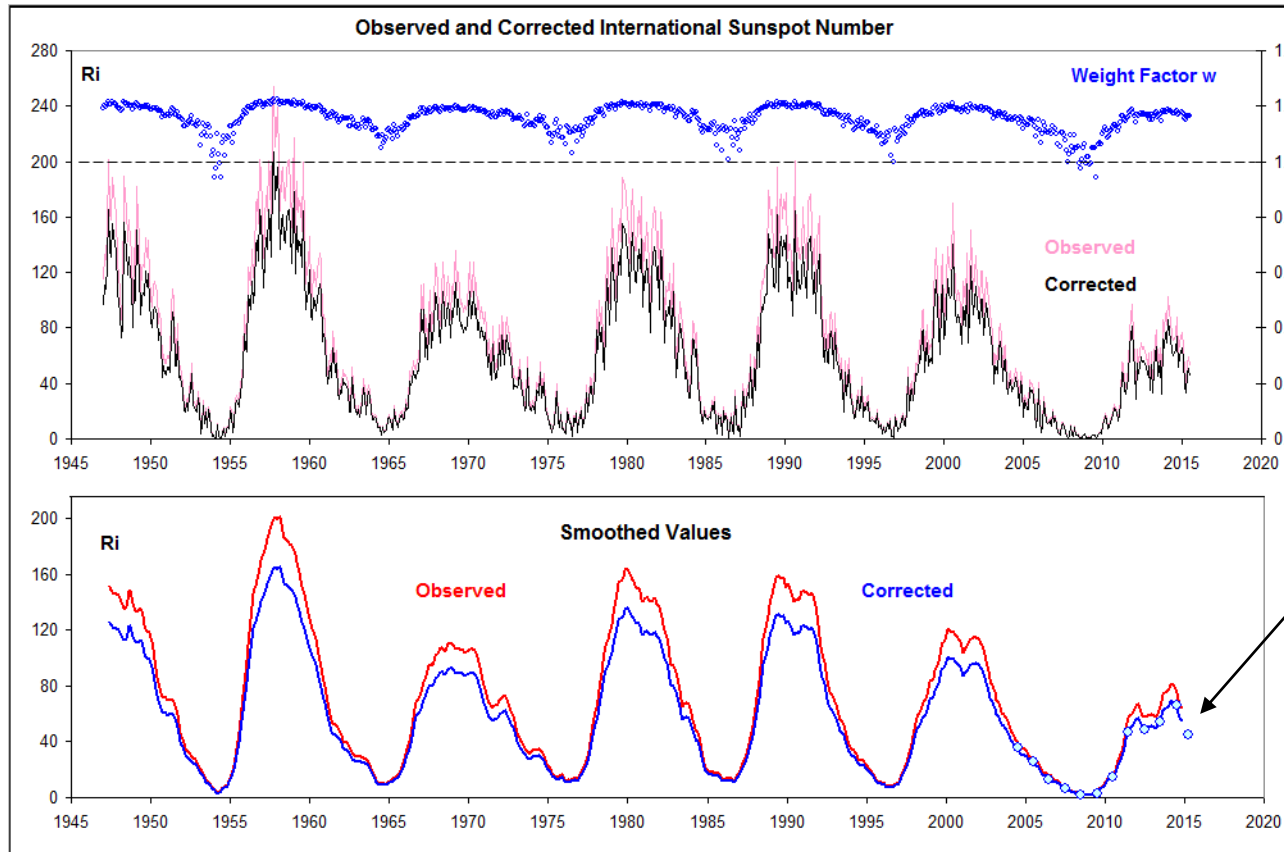
The weight (inflation) factor

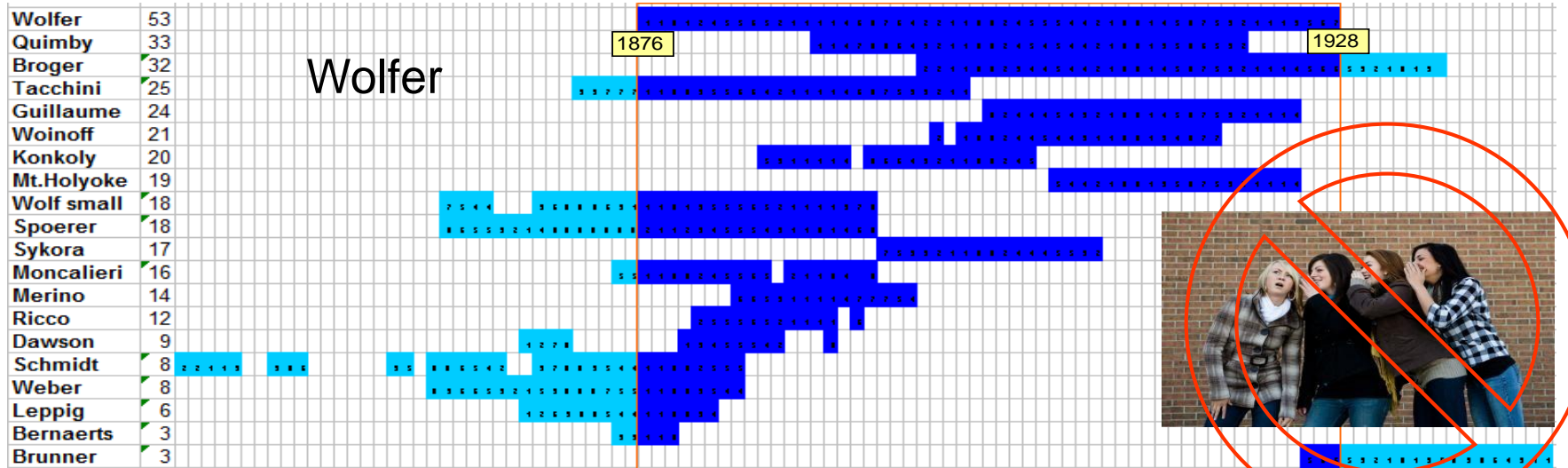The observed (reported) SSN (pink) and the corrected SSN (black)

Light blue dots show yearly values of un-weighted counts from Locarno, *i.e.* not relying on the weight factor formula. The agreement is excellent
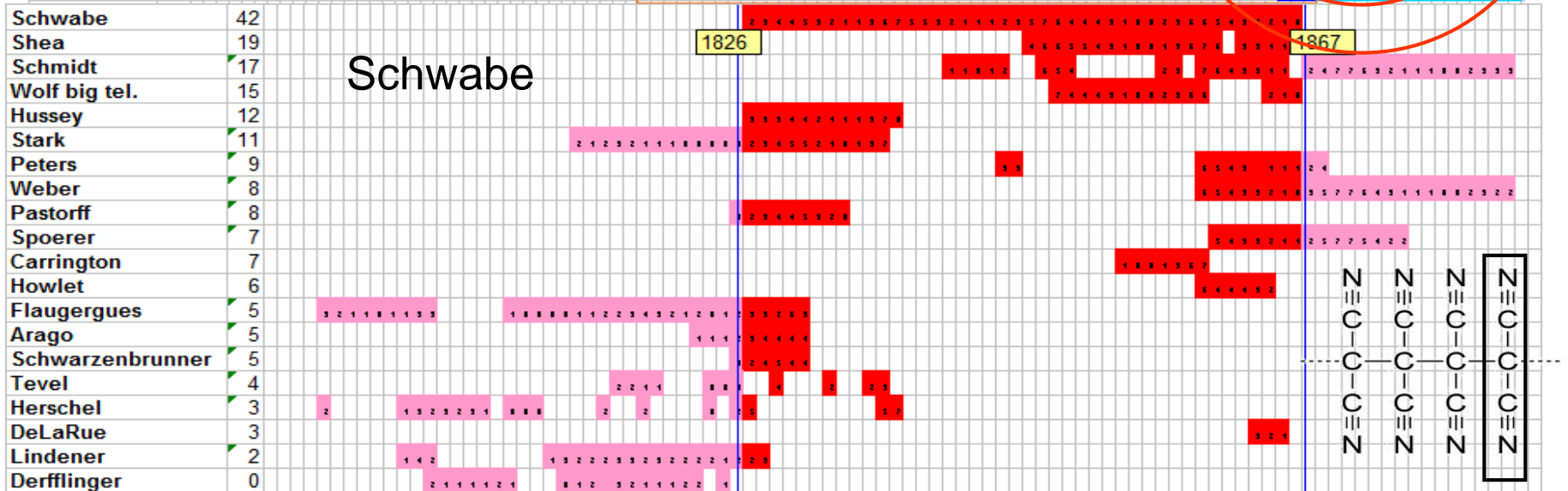
The inflation due to weighting largely explains the second anomaly in the ratio between the GSN and the SSN
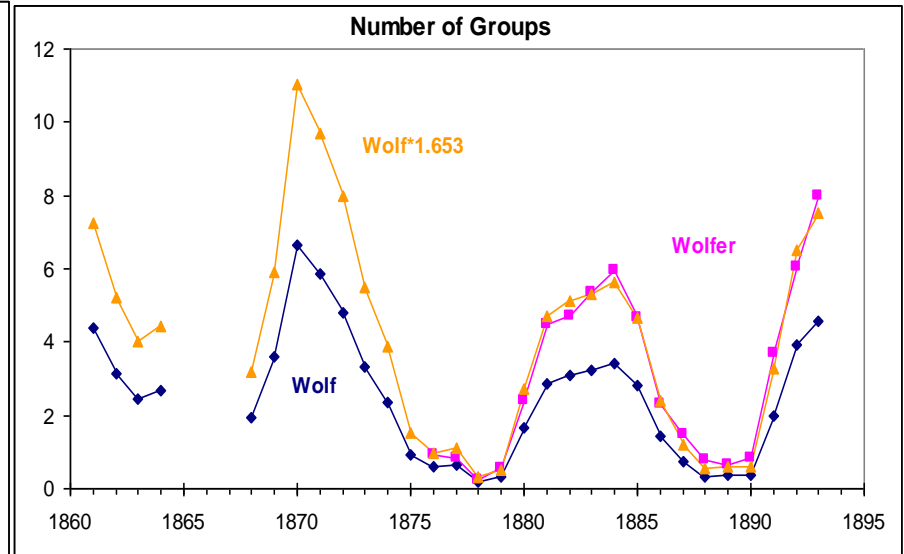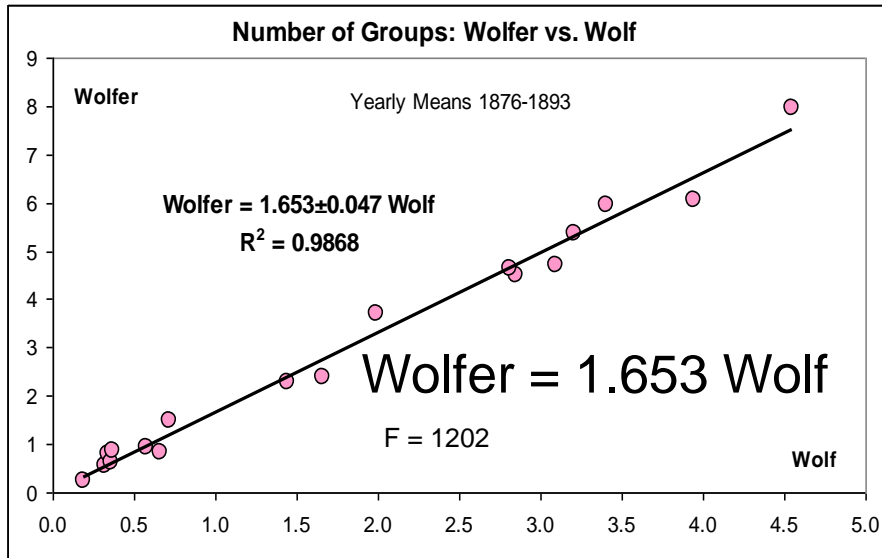
A New Approach: The Backbones

4

Normalization Procedure

Number of Groups: Wolfer vs. Wolf

Wolfer

Yearly Means 1876-1893

Wolfer = 1.653±0.047 Wolf

$R^2 = 0.9868$

Wolfer = 1.653 Wolf

F = 1202

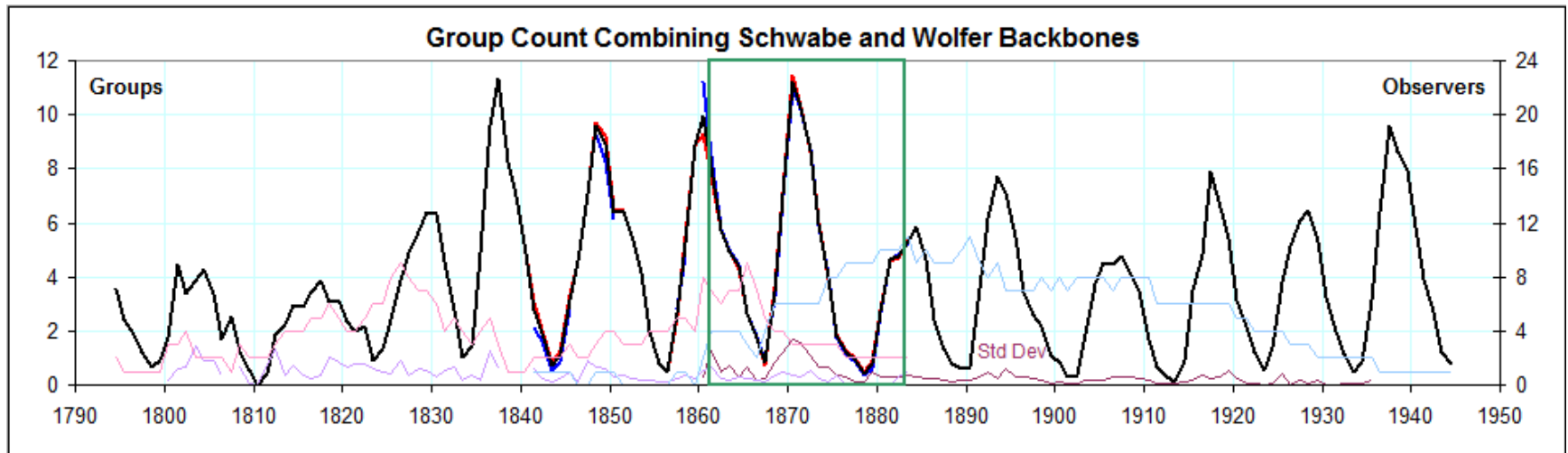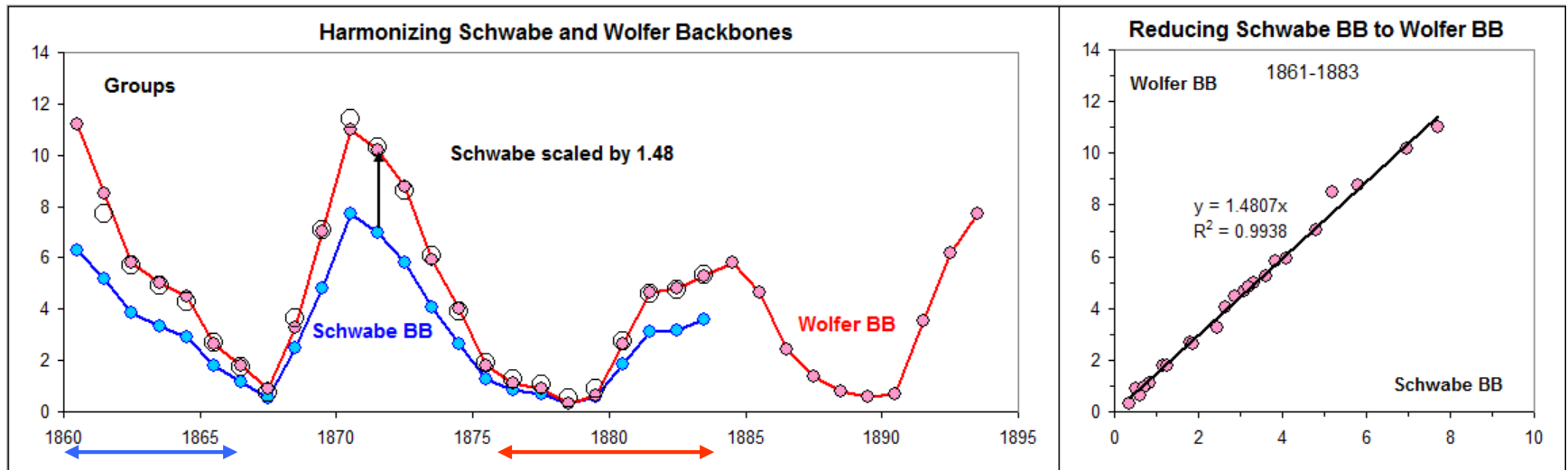Wolf

Number of Groups

Wolf*1.653

Wolfer

Wolf

For each Backbone we regress each observers group counts for each year against those of the primary observer, and plot the result [left panel]. The slope gives us what factor to multiply the observer's count by to match the primary's.

The right panel shows a result for the Wolfer Backbone: blue is Wolf's count [with his small telescope], pink is Wolfer's count [with the larger telescope], and the orange curve is the blue curve multiplied by the slope.

The Backbone is then constructed as the average normalized counts of all observers that are part of the backbone

5

Harmonizing Schwabe and Wolfer Backbones

Harmonizing Schwabe and Wolfer Backbones

Groups

Schwabe scaled by 1.48

Schwabe BB

Wolfer BB

Reducing Schwabe BB to Wolfer BB

Wolfer BB   1861-1883

$y = 1.4807x$
$R^2 = 0.9938$

Schwabe BB

Group Count Combining Schwabe and Wolfer Backbones
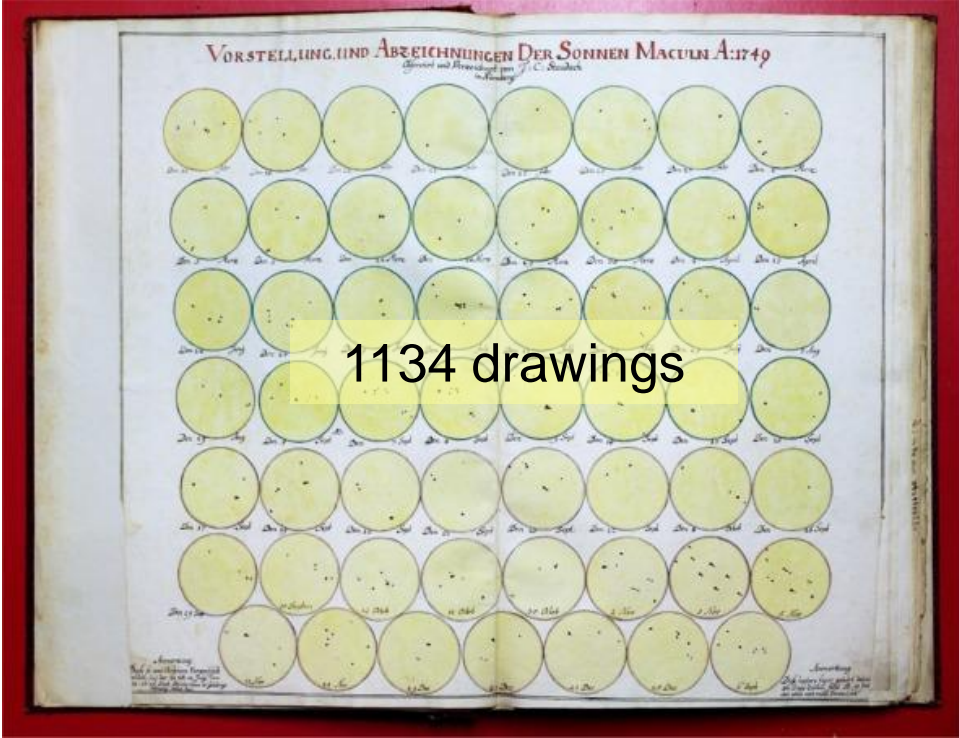
Groups

Observers

Std Dev

Rectifying the ~1885 Discrepancy

Hoyt & Schatten used the Group Count from RGO [Royal Greenwich Observatory] as their Normalization Backbone. Why don't we?
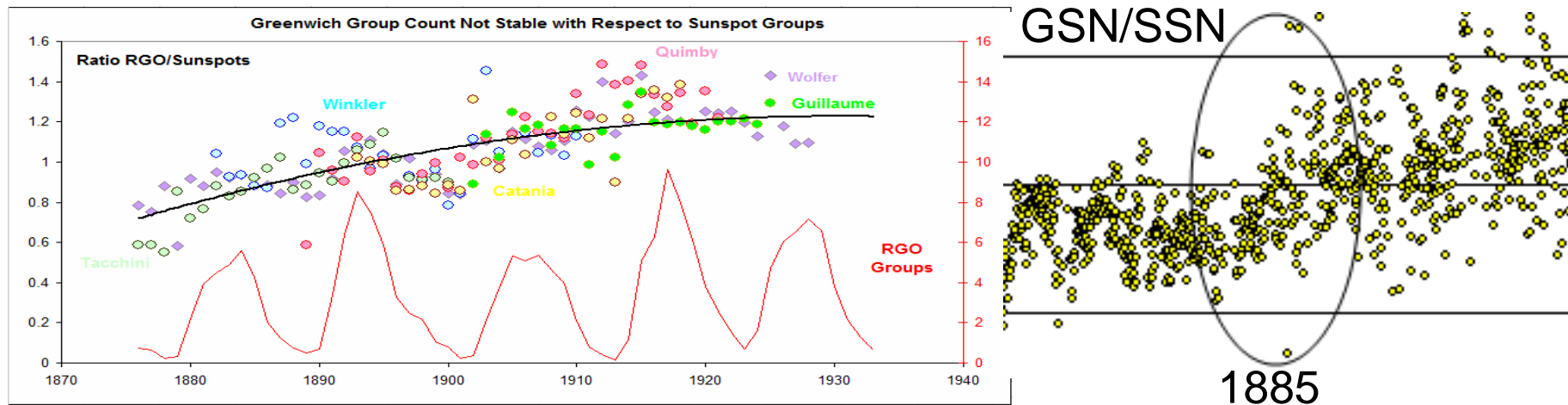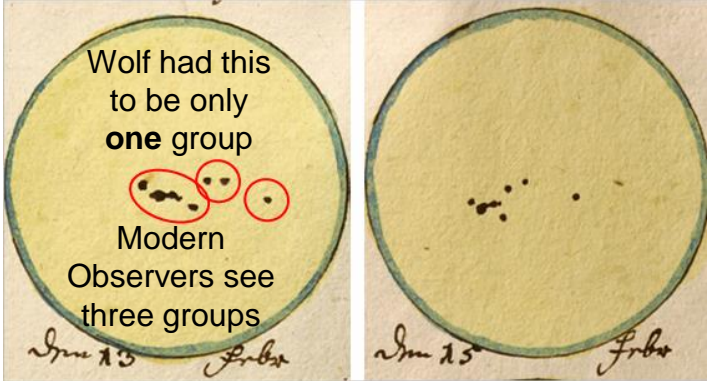

Because there are strong indications that the RGO data is drifting before ~1900. And that is a major reason for the ~1885 change in the level of the H&S Group Sunspot Number
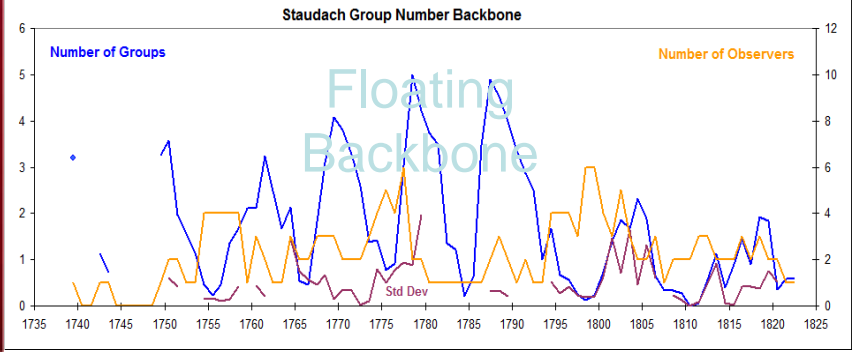
J.C. Staudach's Drawings 1749-1799


1134 drawings

Wolf had this to be only **one** group

Modern Observers see three groups

Staudach Group Number Backbone

Number of Groups

Number of Observers

Floating Backbone

Std Dev

		1749		1799	
Staudach (LS)	50				
Horrebow	14				
Lalande	9				
Bode	9				
Zucconi	6				
Schubert	6				
Ende	6				
Mallet	5				
Herschel	5				
Flaugergues	5				
Kayser	5				
Hagen	2				
Fritsch*	2				
Lievog	2				
Bugge	2				

Wolf undercounted the number of groups on the Staudach drawings by 25%. We use my re-count in building the backbone (see later)
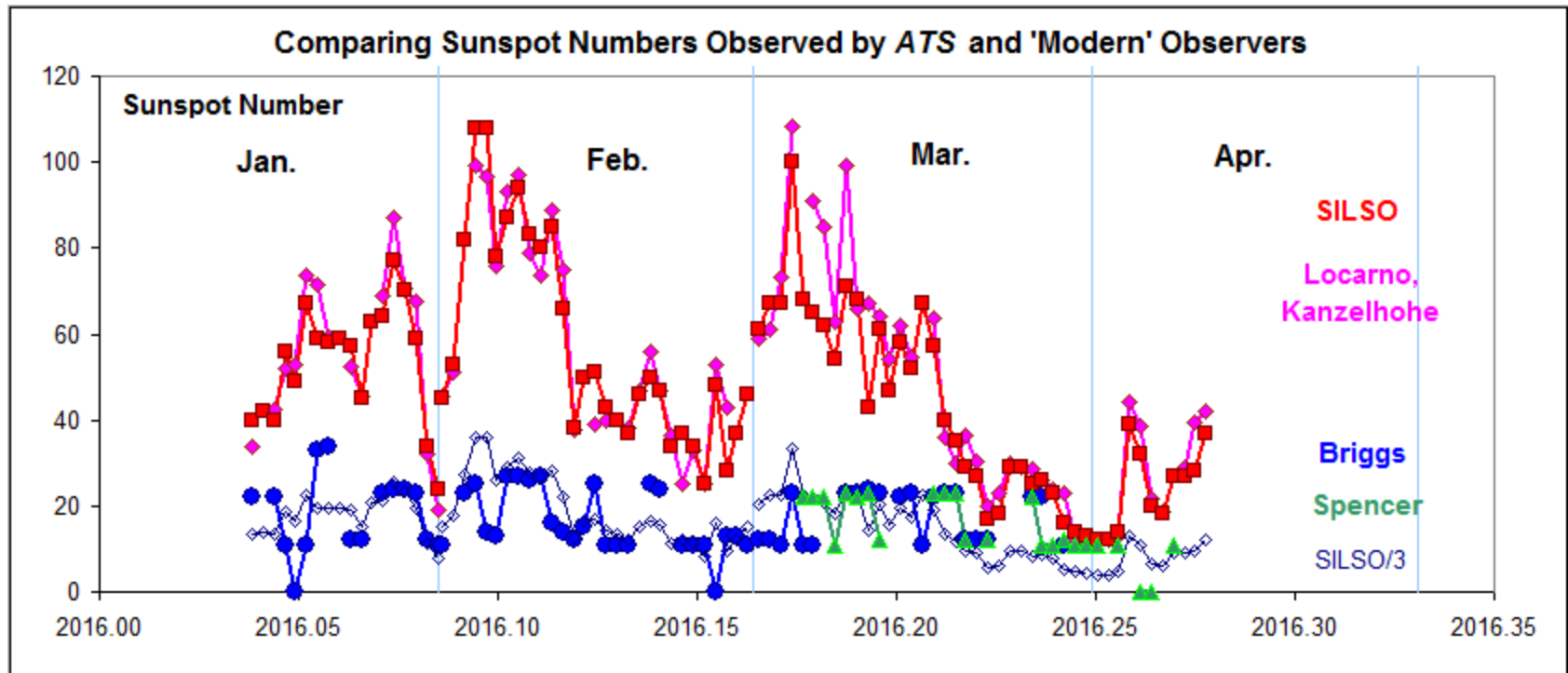
8

John W. Briggs
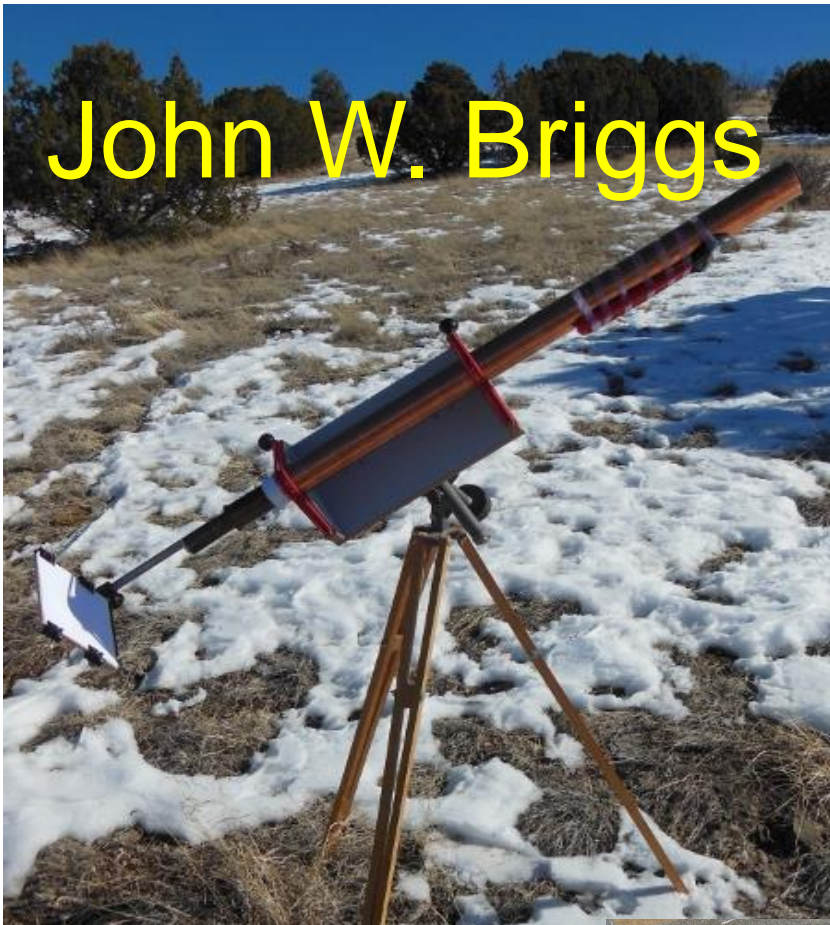
Ken Spencer

Walter Stephani

Help from the Antique Telescope Society

Results so Far for Sunspot Numbers

On Average the Modern Observers see sunspot numbers about 3 times larger than our intrepid observers. This is about what we have found by trying to normalize the old data to modern values, so validating the recent revision of the official Sunspot Number

Putting it All Together (Real Progress!)

Lockwood et al. 2015

Usoskin et al. 2015

Svalgaard & Schatten 2016
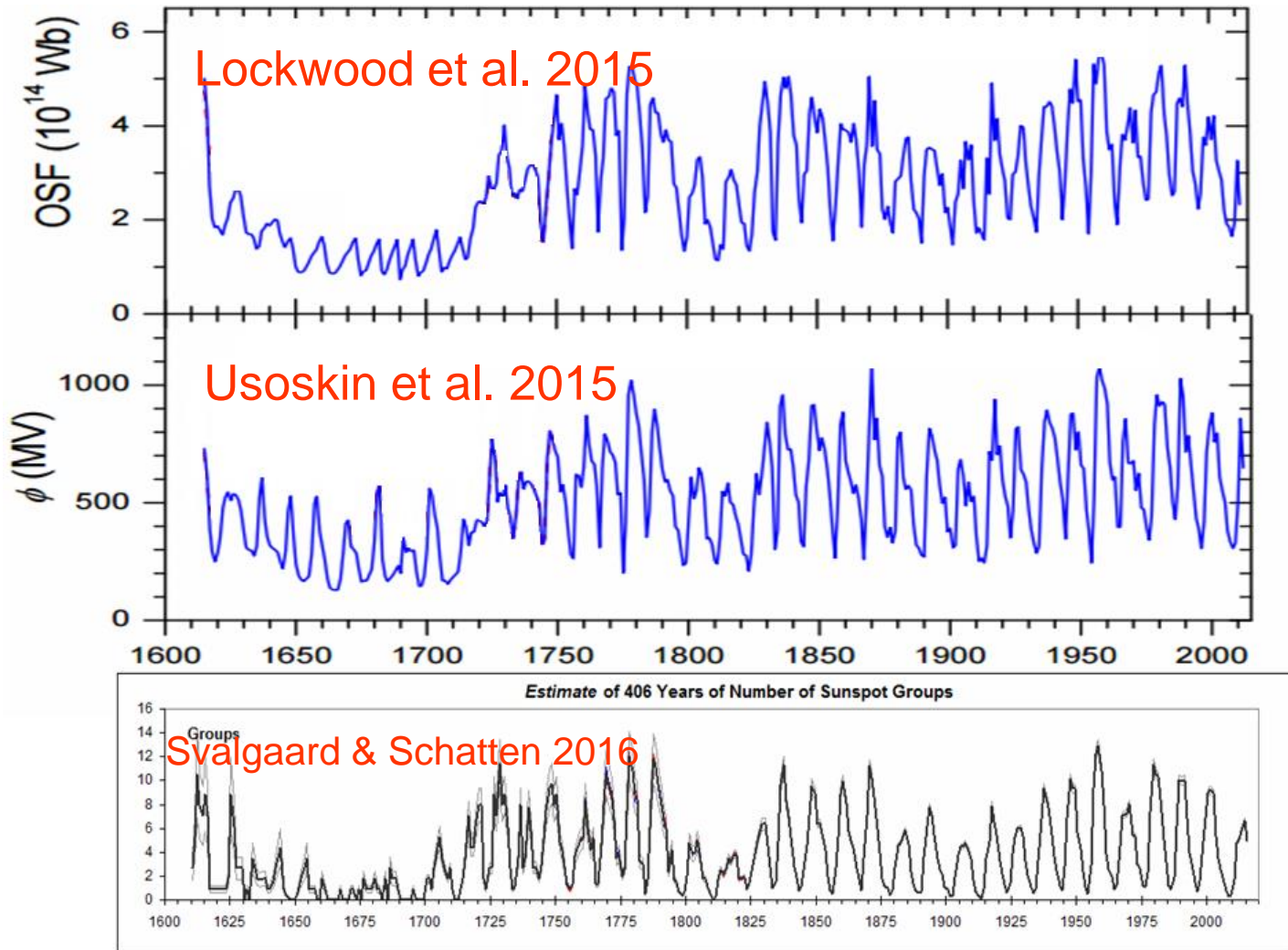
Very good agreement between different reconstructions

Tweedledee's Wisdom

'if it was so, it **might** be; and if it were so, it **would** be; but as it isn't, it **ain't**