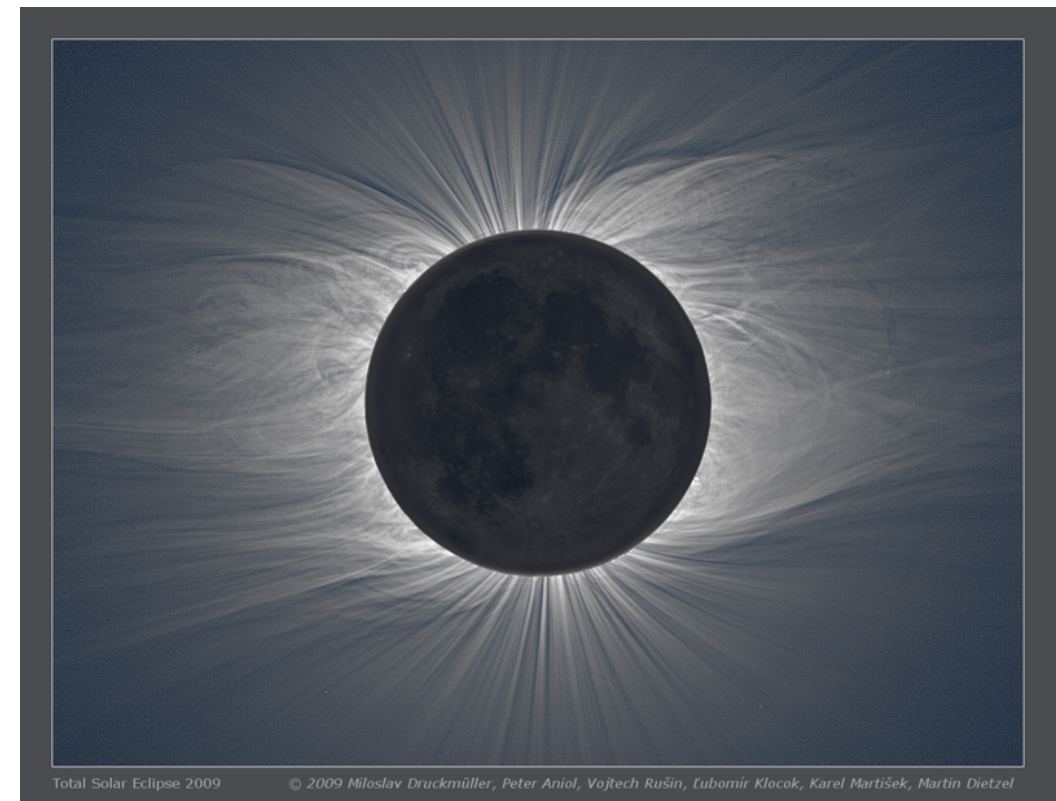


Historic eclipses and the current solar minimum corona

P. Judge, J. Burkepile, G. de Toma
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Brno University, Czech Republic



September 2009



NCAR

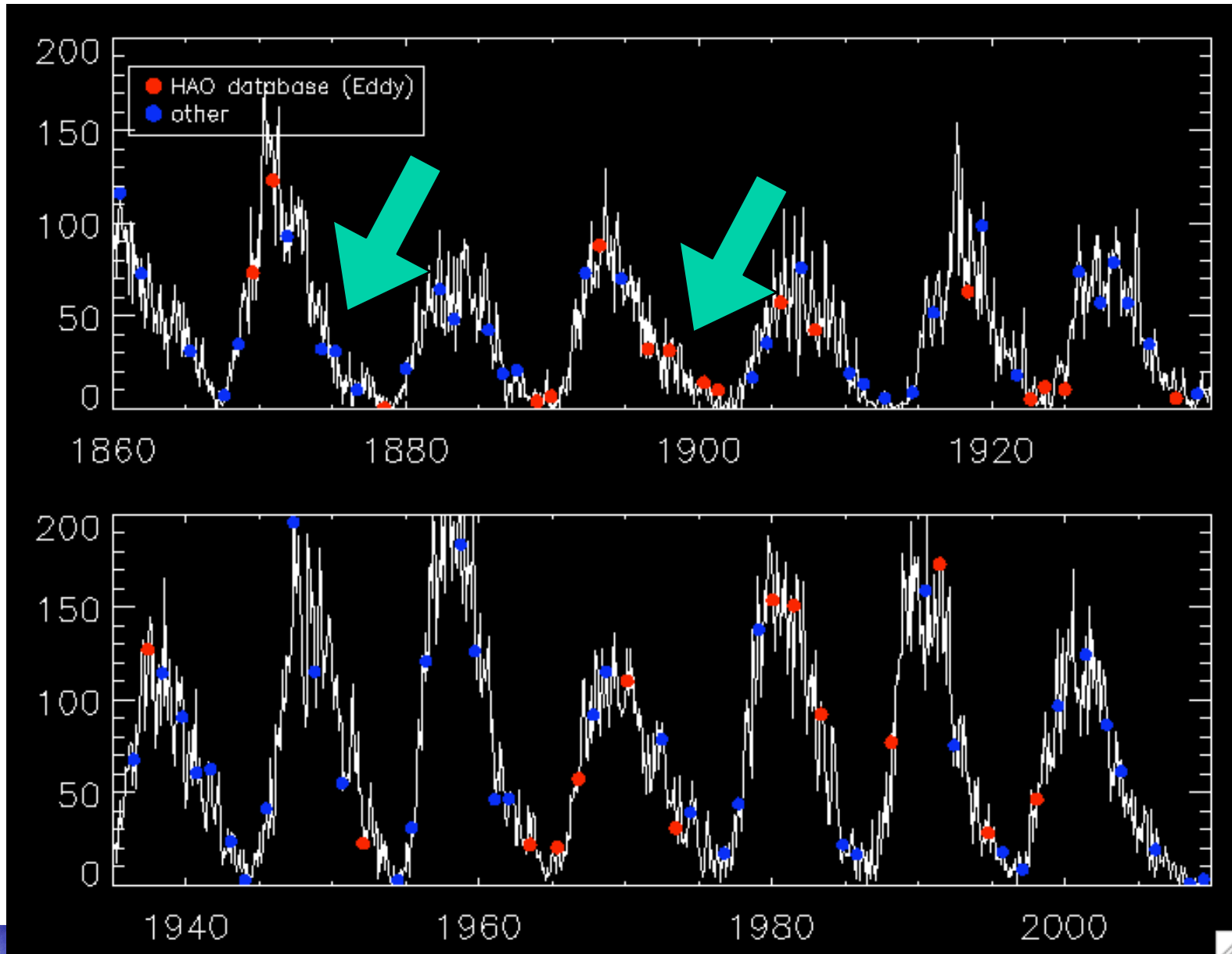
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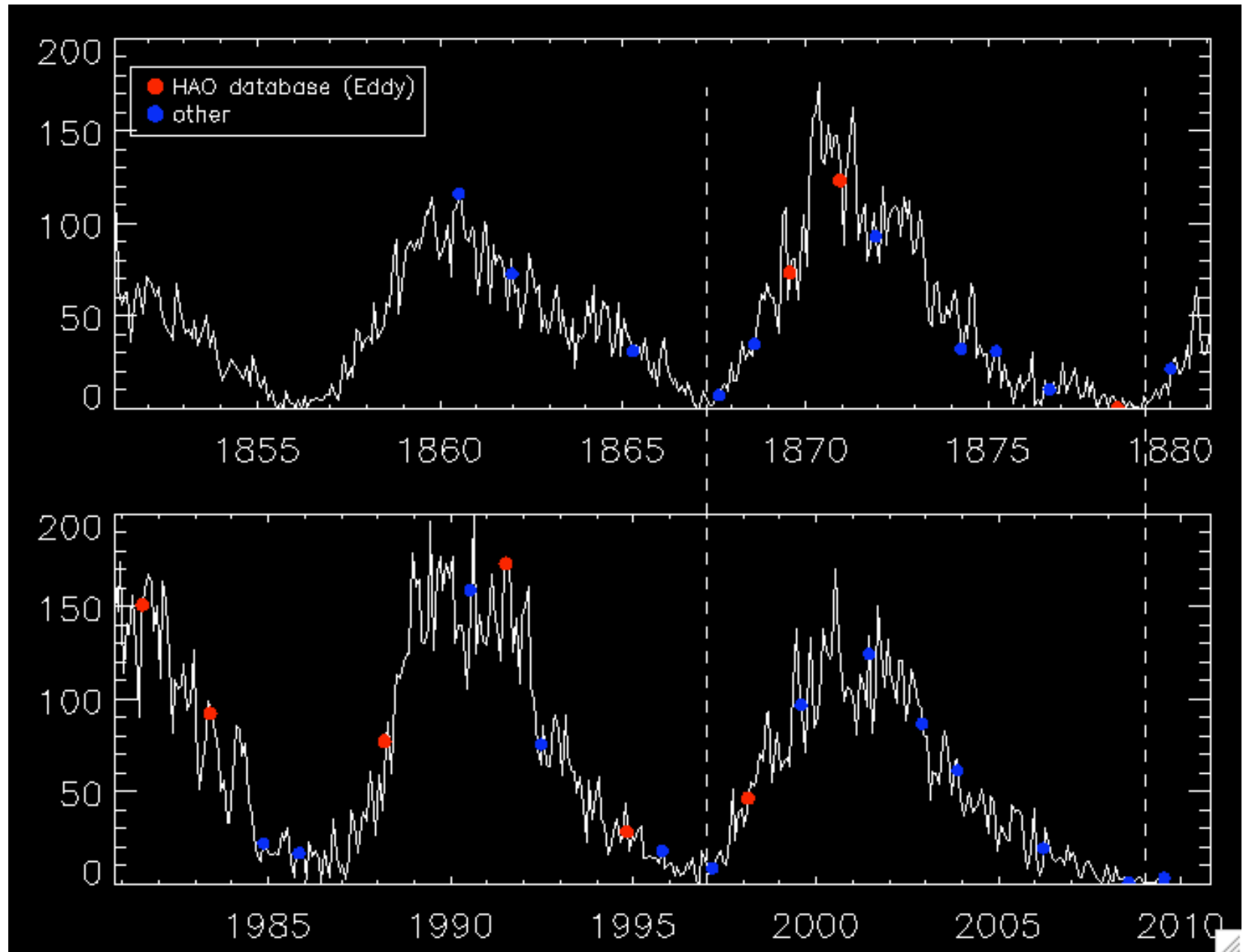
motivations, methods, limitations

- *How does the Sun's global magnetic field evolve during deep sunspot minima?* Answering this
 - may have implications for the dynamo,
 - perhaps even the Maunder Minimum?
- Approach:
 - place the present corona in an historical context
 - mine and *process* historic data of corona
 - add eclipse data from 2008, 2009 (Druckmüller)
- Limitations
 - broad band images constrain just morphology
 - just snapshots
 - early photographic quality

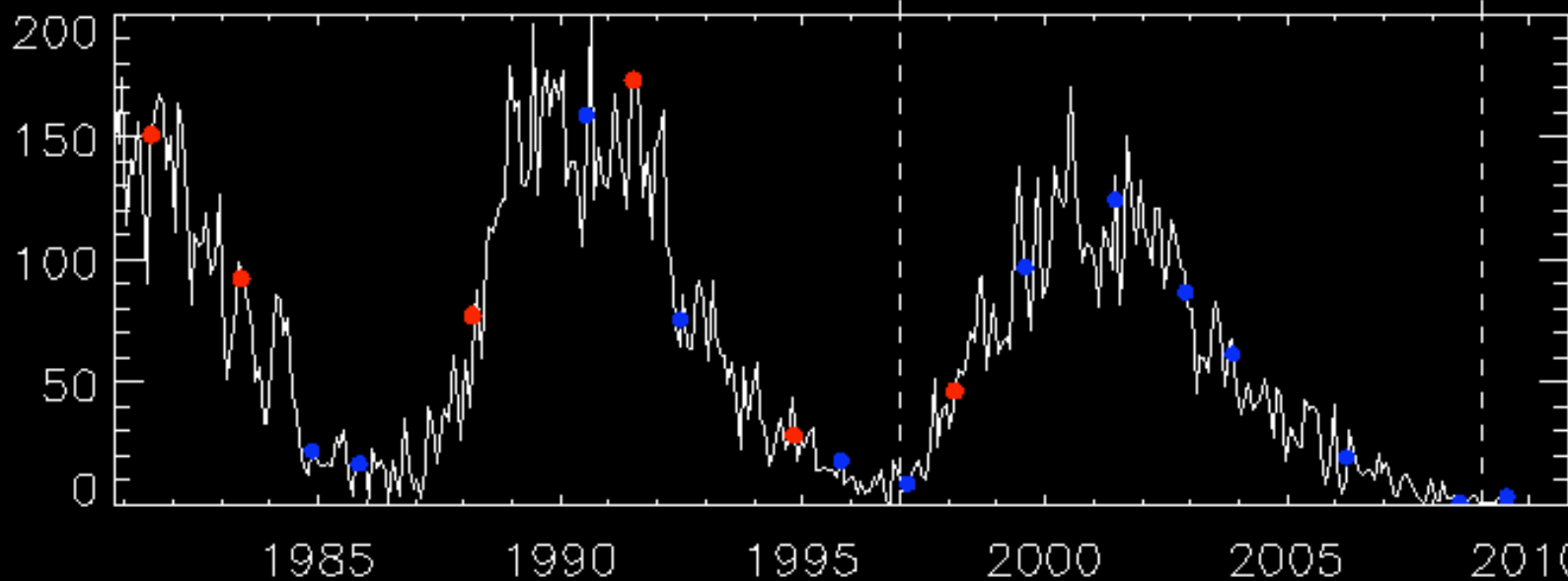
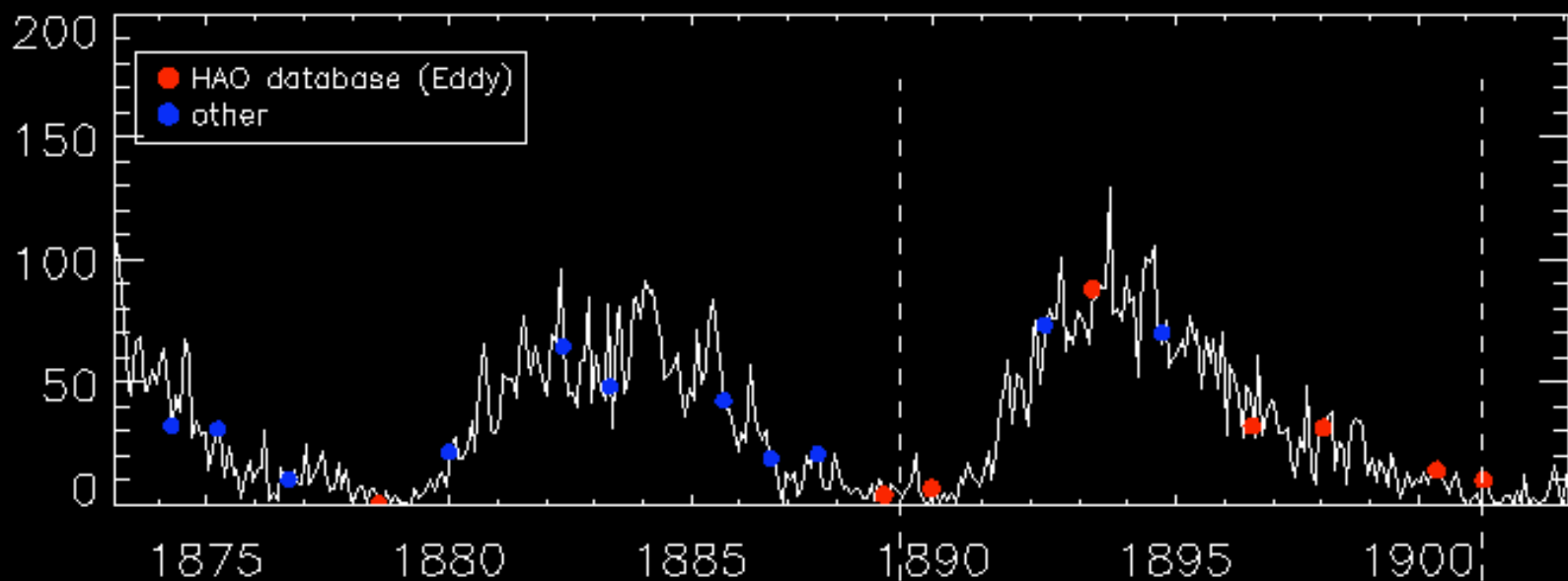
monthly avg. sunspot numbers and eclipses 1860-present



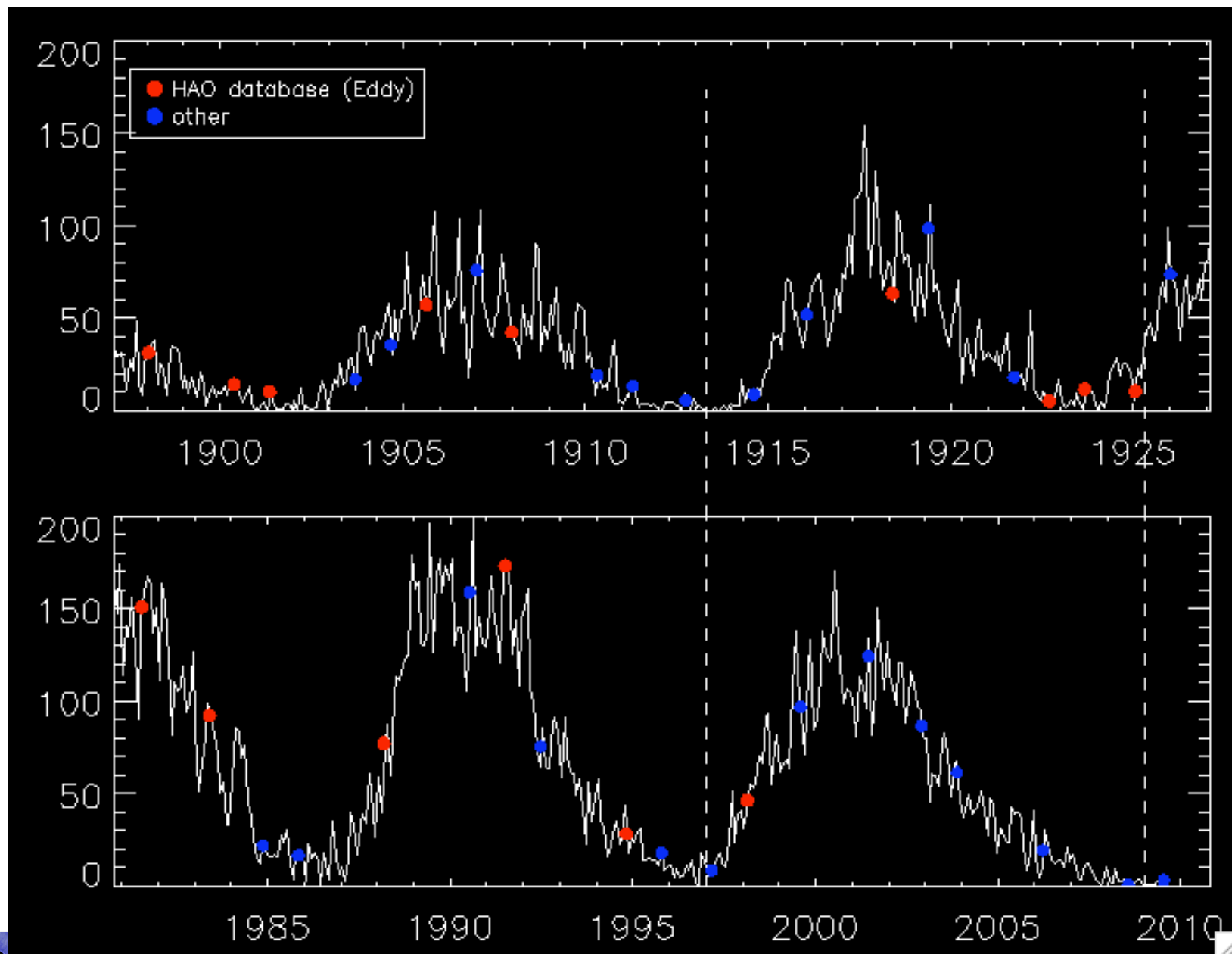
SSN: 1878 vs. present



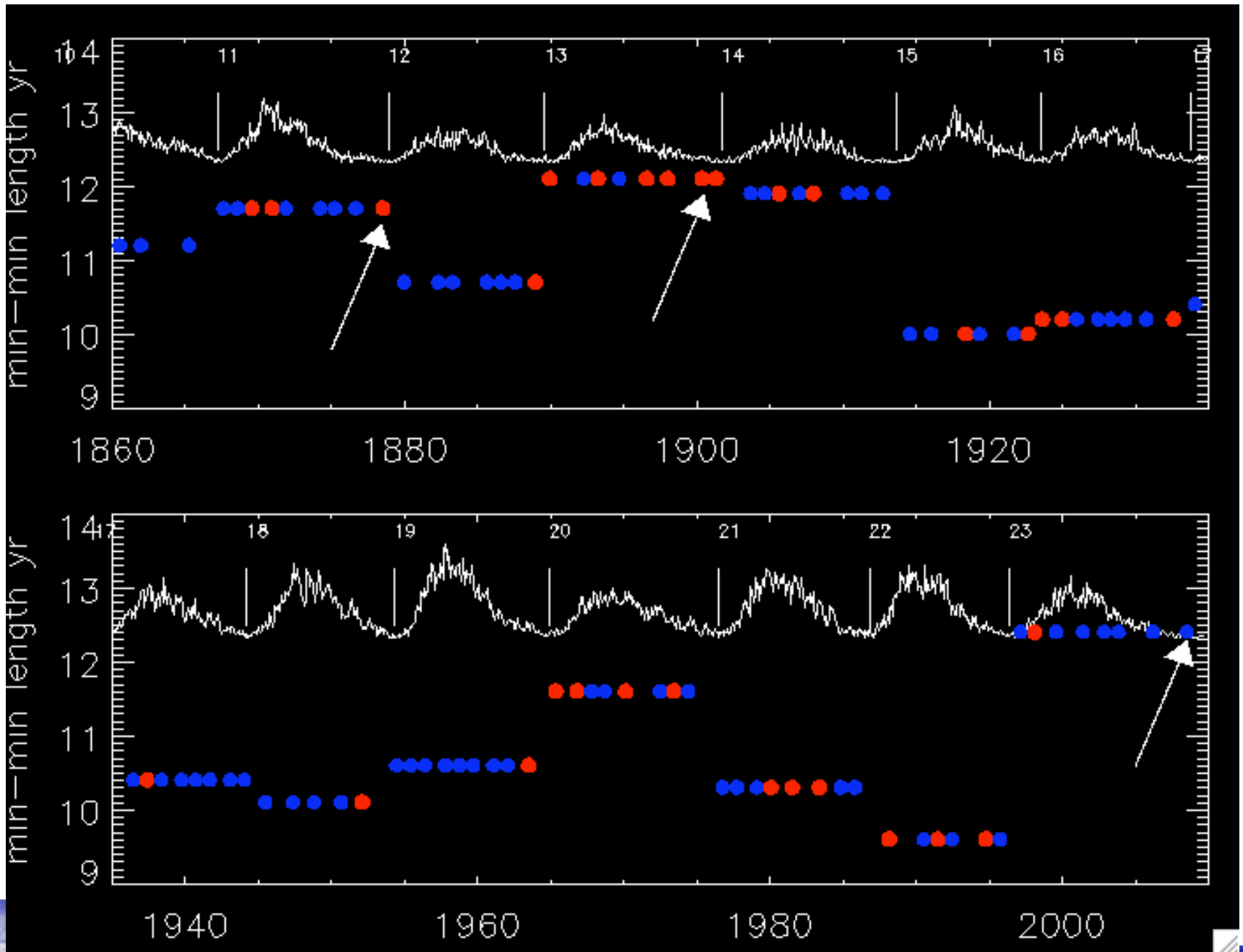
SSN: 1900, 1901 vs. present



SSN: 1922, 1923, 1925 vs present

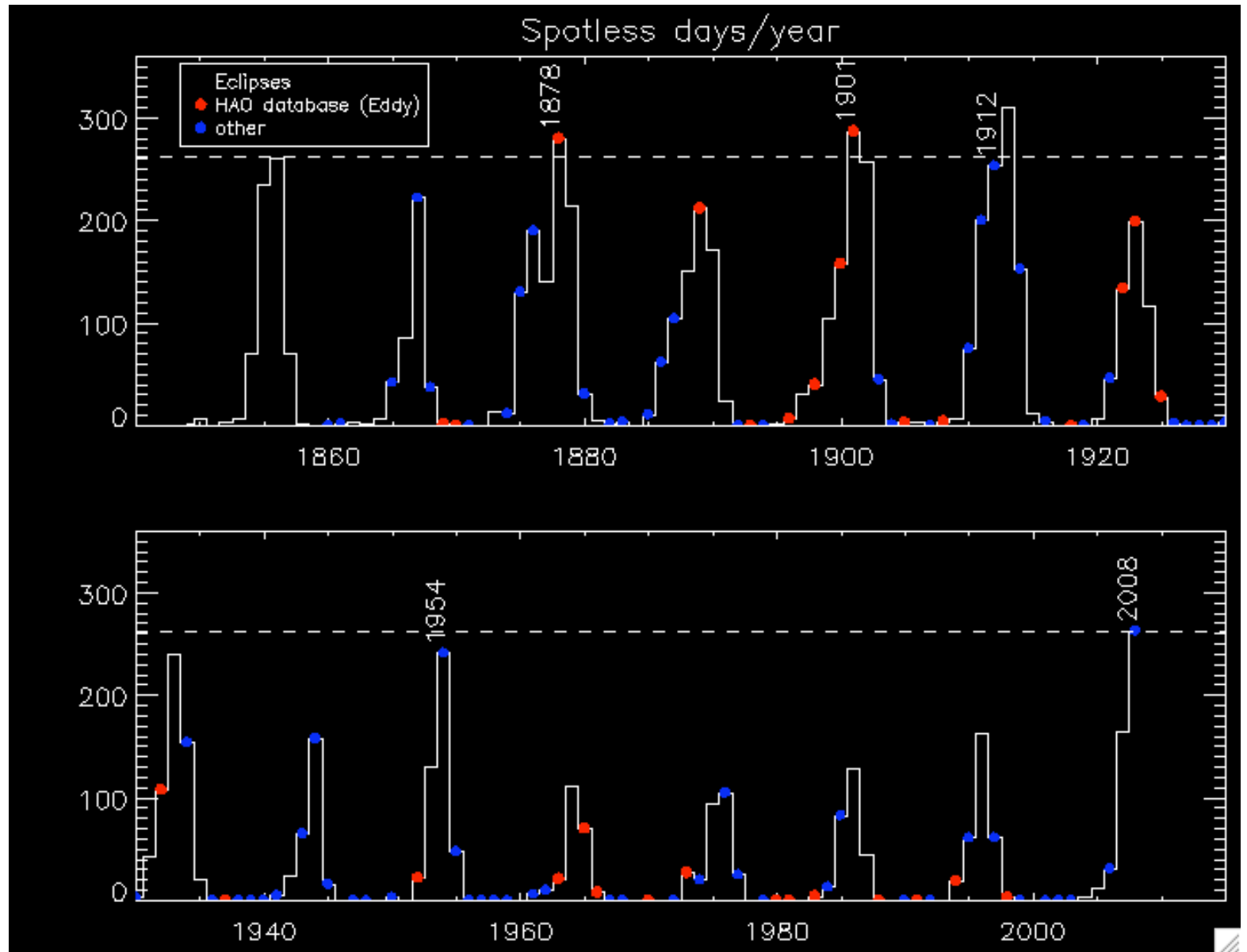


cycle lengths 1860-present

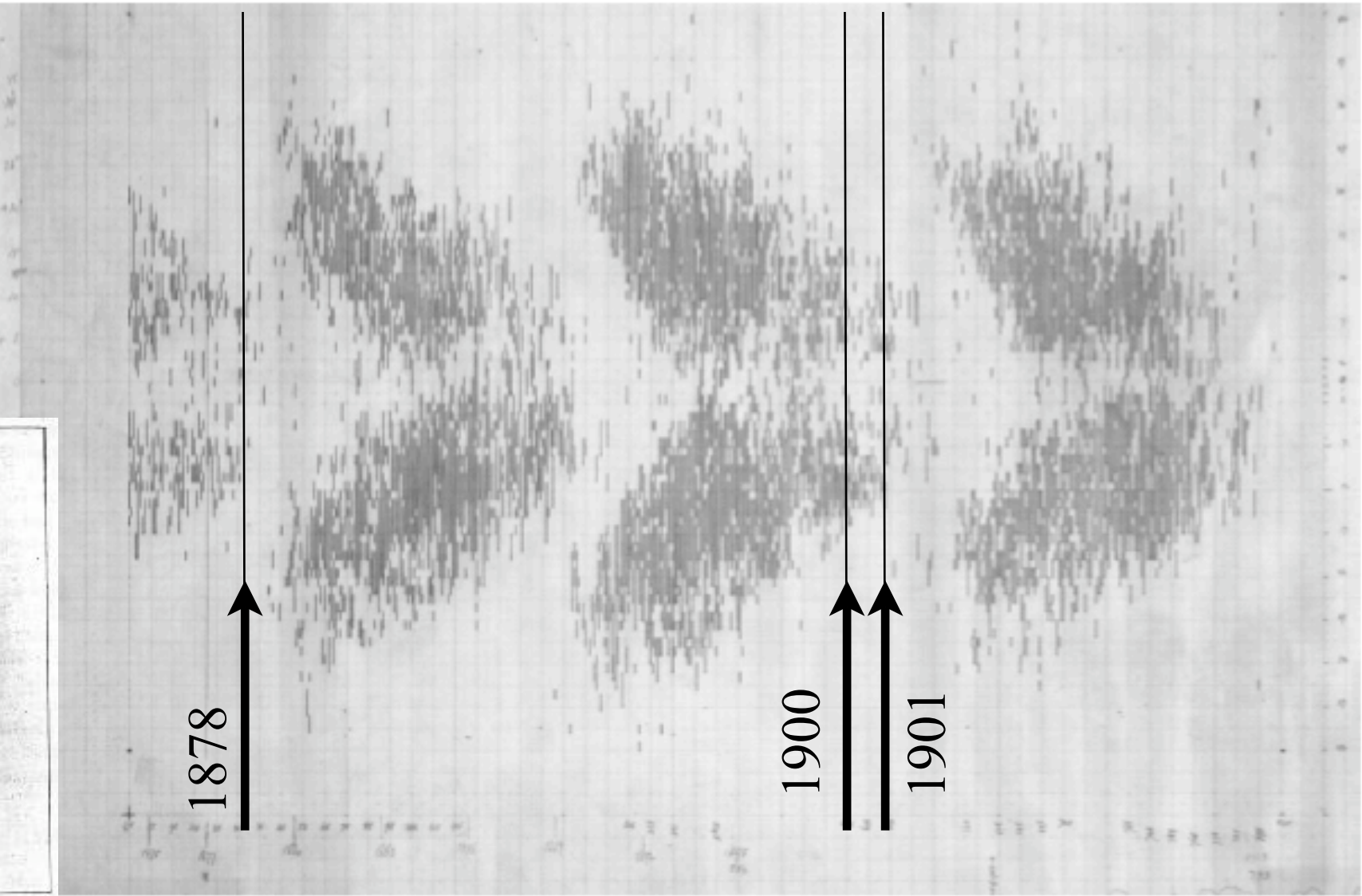


spotless days and eclipses

**no
eclipse
in 1913**

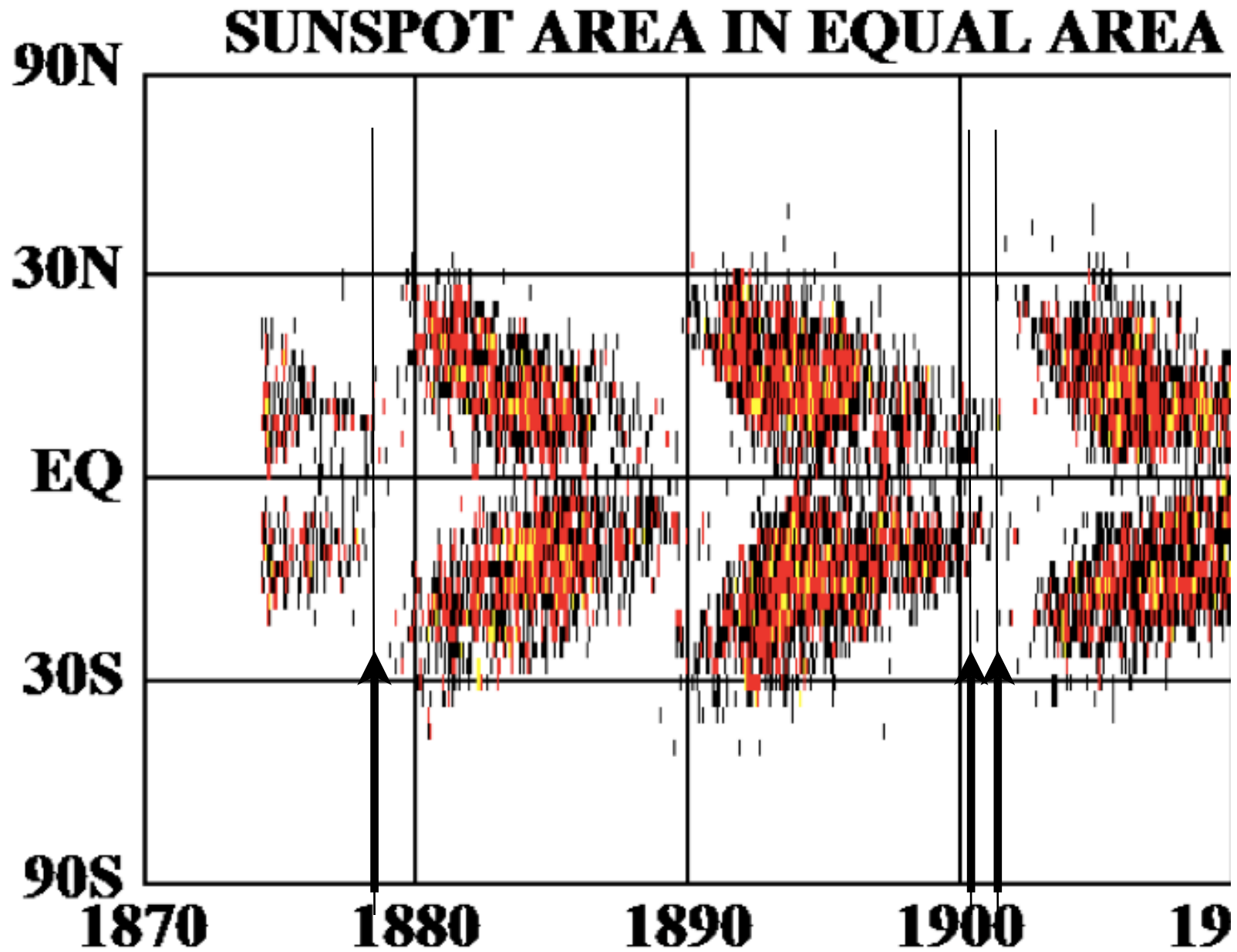


Maunder's original plot



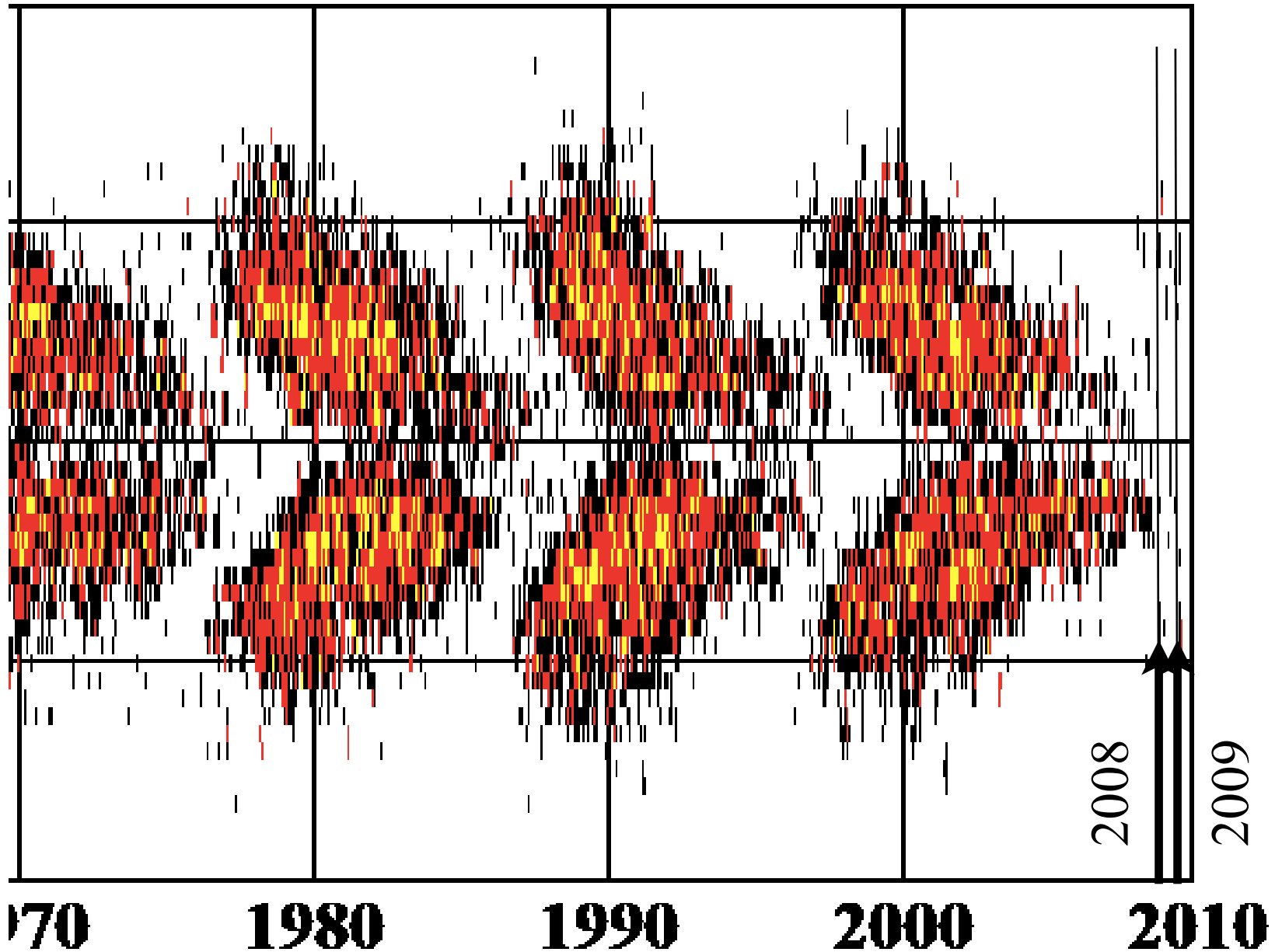
Original "Butterfly Diagram" of sunspot distributions during the progression of solar cycles from 1874 to 1914, by E. W. and A. S. D. Maunder, originally prepared c. 1902, and updated c. 1914. The original was a gift from A. S. D.

Marshall (Hathaway)



Marshall (Hathaway)

■ > 0.0% ■ > 0.1% ■ > 1.0%



from sunspot numbers, spotless days, Butterfly diagrams, cycle lengths

- Historically, 1878, 1900, 1901 epochs are “close” to 2008 & 2009
- Naively:
 - 1878, 2008 & 2009 eclipses occur *after* new cycle
 - 1900, 1901 were also still in declining phases

treatment of early photographs

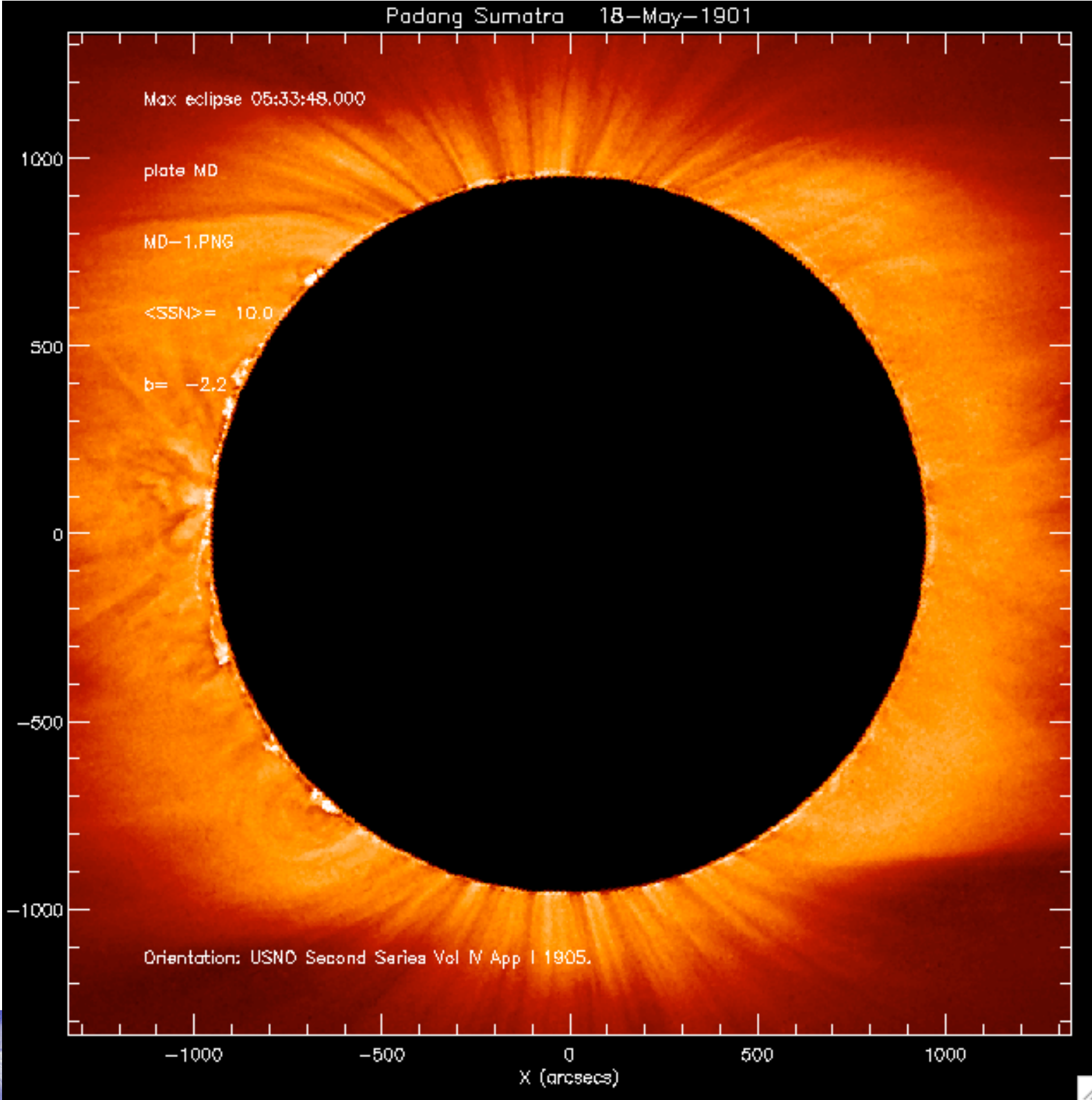
A new numerical method of total solar eclipse photography processing

M. Druckmüller¹, V. Rušin² and M. Minarovjech²

Abstract. A new numerical method of image processing suitable for visualization of corona images taken during total solar eclipses is presented. This method allows us to study both small- and large-scale coronal structures that remain invisible on original images because of their very high dynamic range of the coronal brightness. The method is based on the use of adaptive filters inspired by human vision and the sensitivity of resulting images is thus very close to that of the human eye during an eclipse. A high precision alignment method for white-light corona images is also discussed. The proposed method highly improves a widely used unsharp masking method employing a radially blurred mask. The results of these numerical image processing techniques are



HAO
eclipse
archive



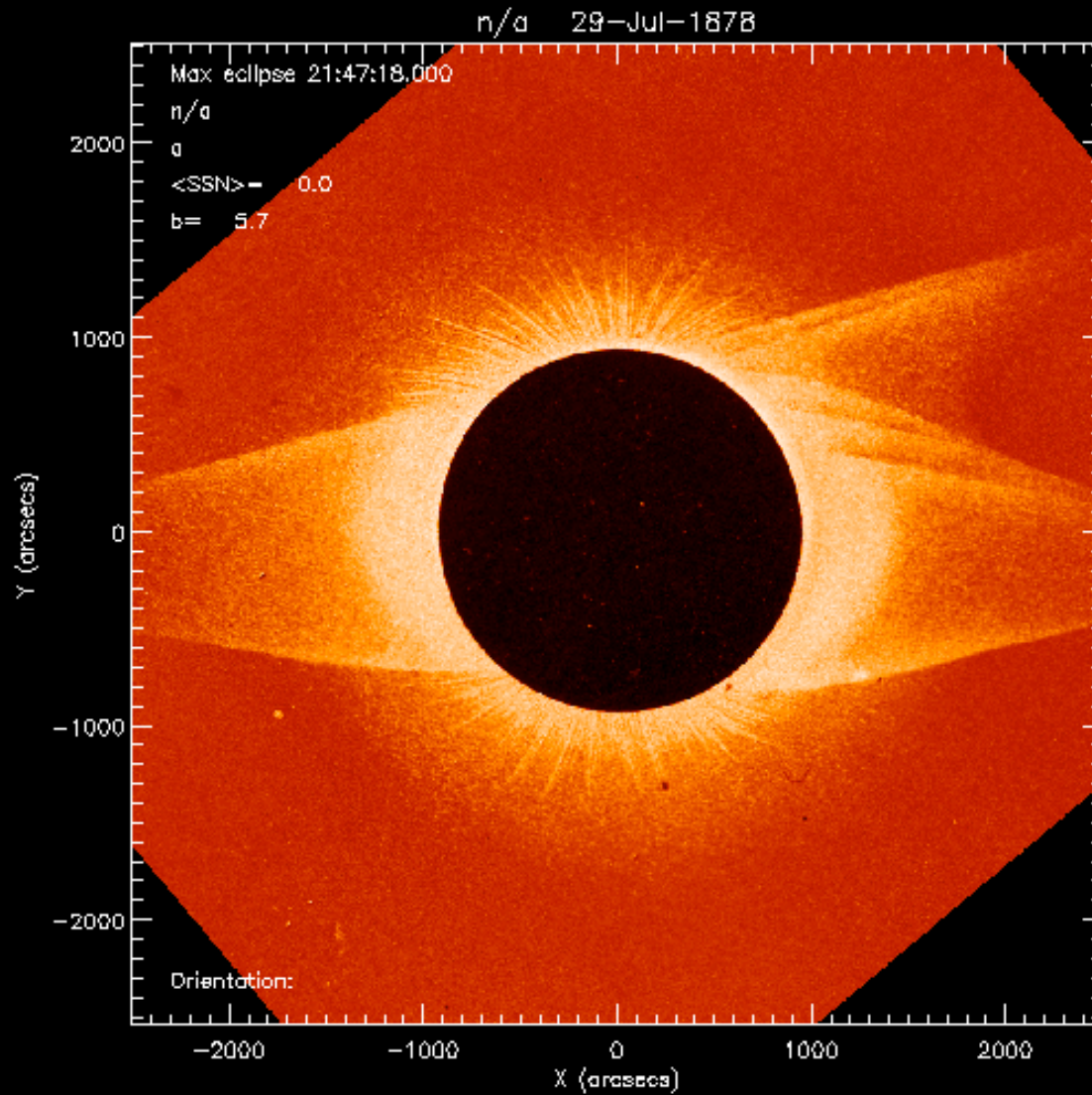
the record



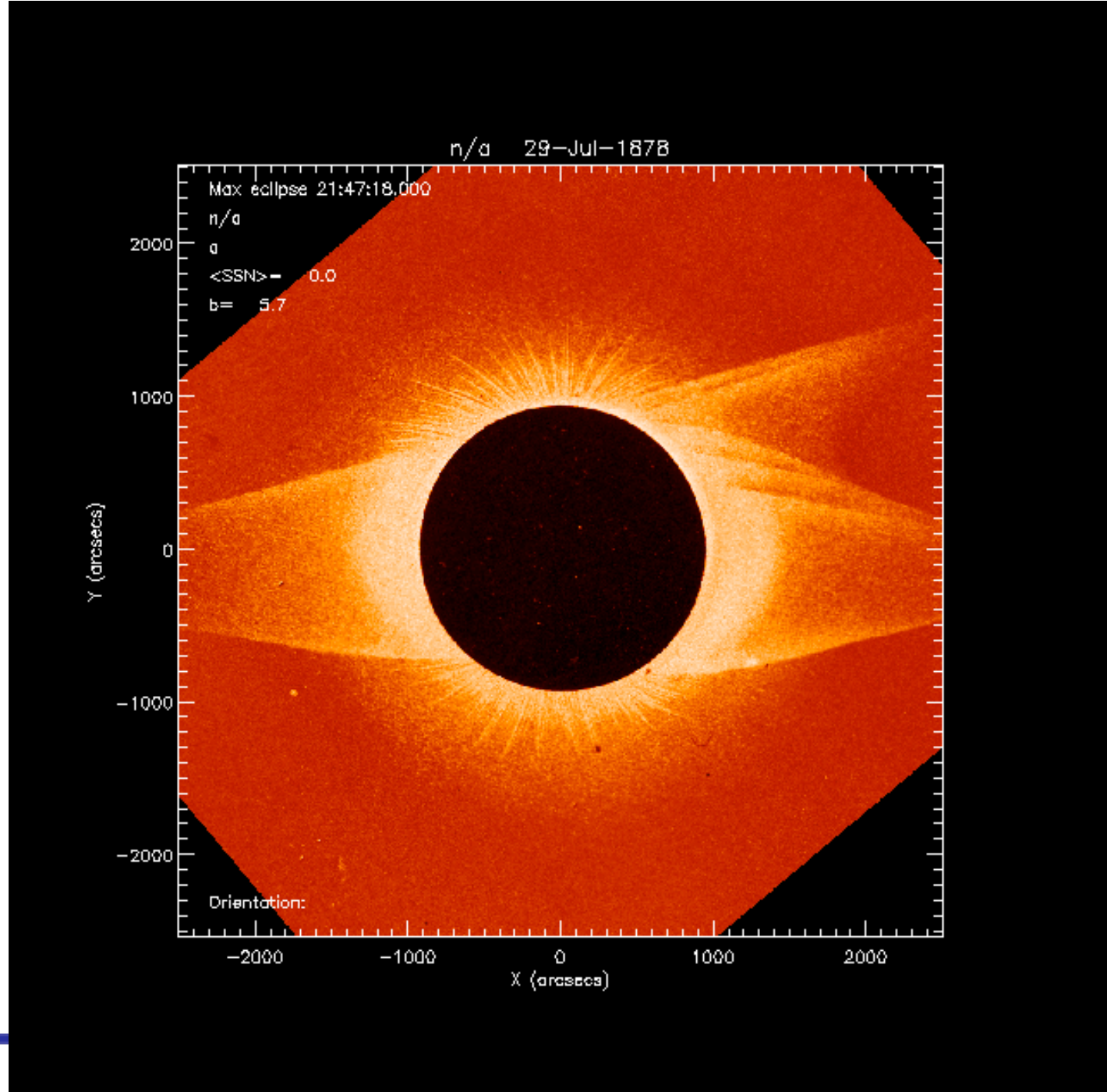


Rawlins, with Thomas Edison second from the right. Sir Norman Lockyer from England

1878 $\langle \text{SSN} \rangle = 0.1$



1901 - 2008 - 2009 - 1995 - 1878



musings

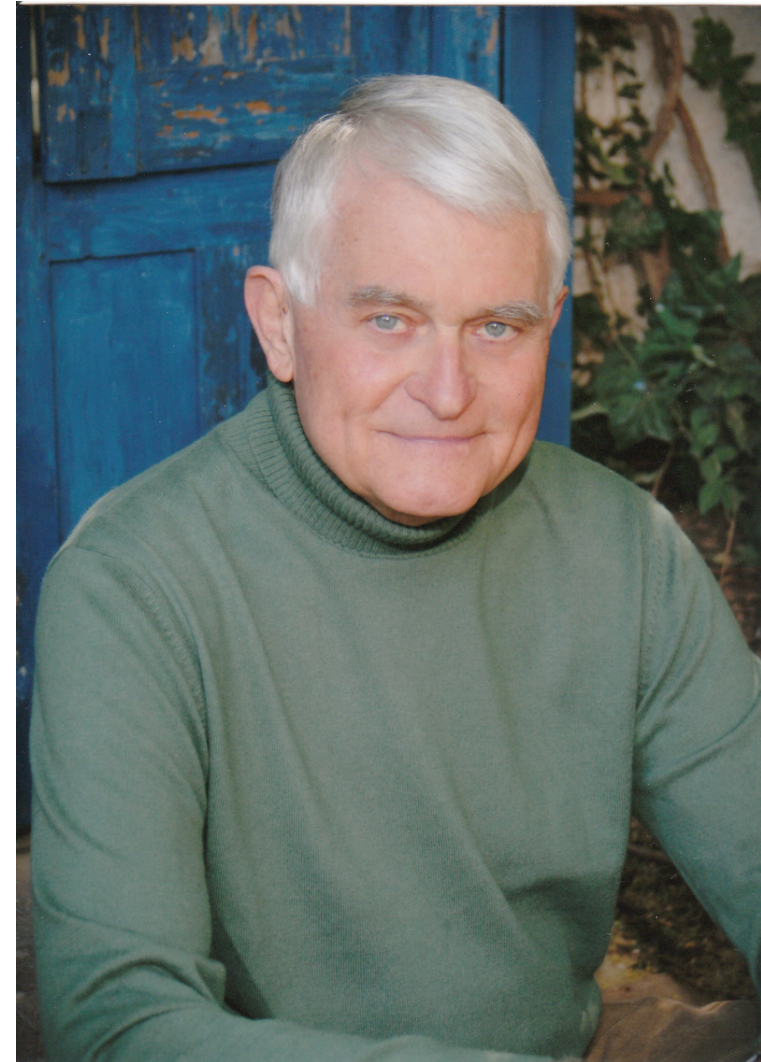
- “old” eclipse plates can be quantitatively compared with “modern data
- coronal morphology for 2008/9 not dissimilar from 1901/1878
- morphology not dipolar+eq. current sheet which may be rare
- “polar crown prominence cavities” (hi-lat neutral lines)
- consistent with talks by Burkepile, Altrock
- see talk by Giuliana de Toma- Geomagnetic effects
- HAO eclipse archive to be put online, contributions welcome!

“Jack” Eddy 1931-2009



Eddy unearthing
piers from the 1878
eclipse expedition
to Separation
Wyoming

The archival data
used here were
painstakingly
collected,
photographed and
documented by
Jack Eddy in
1969-70



another view

