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Why the Sunspot Number Bears Re-examination

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It’s used

Evolution of the solar irradiance during the Holocene[⋆,⋆⋆]

L. E. A. Vieira[1,2], S. K. Solanki[1,3], N. A. Krivova[1], and I. Usoskin[4] **(2011)**

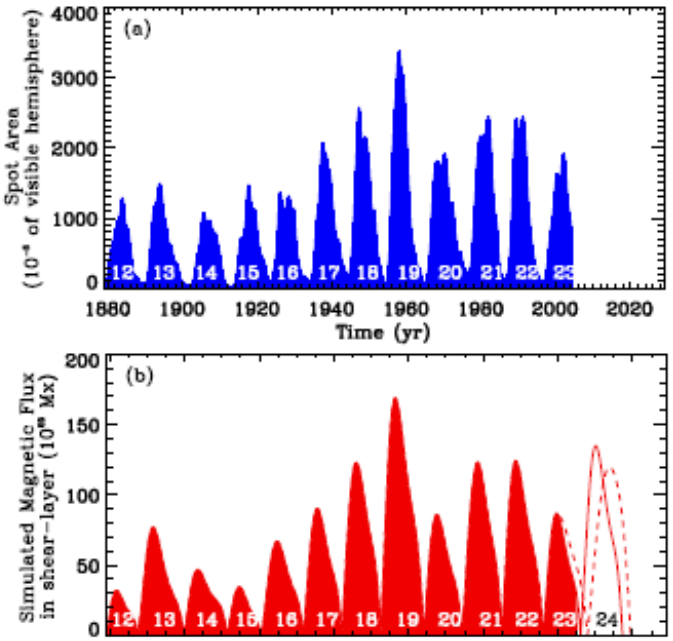
We compute the sunspot area, i.e. the fraction of the disk covered by all sunspots on the solar disk, by making use of a linear relationship to the sunspot number (*R) (Fligge & Solanki 1997; Balmaceda et al. 2009*; *Hathaway 2010*):

$$\alpha s = A1R + A2$$

Predicting the strength of solar cycle 24 using a flux-transport dynamo-based tool

Mausumi Dikpati,[1] Giuliana de Toma,[1] and Peter A. Gilman[1]

(2006)

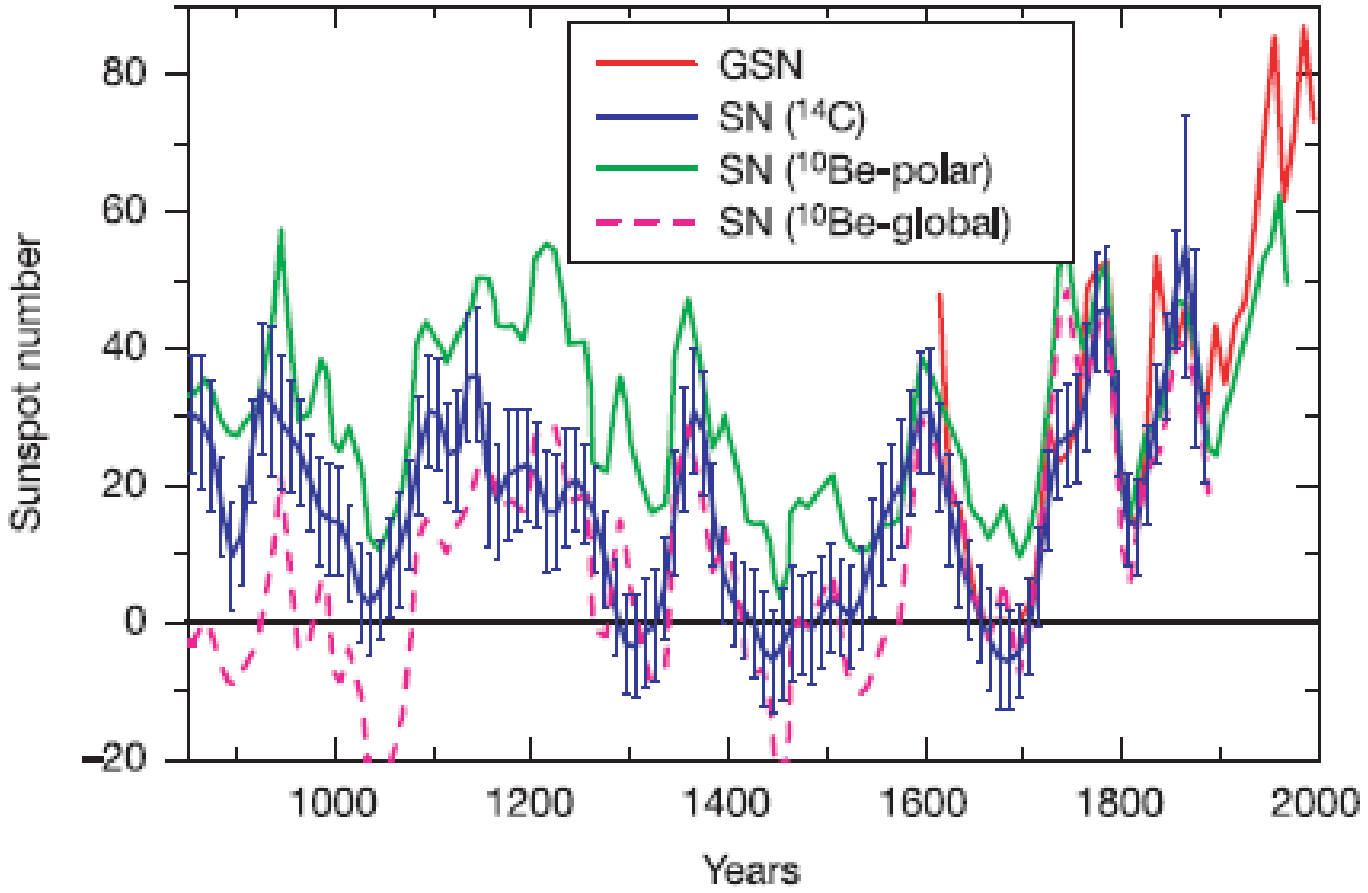


It may also be possible to extend the simulation of past cycles all the way back to cycle 1, which began around 1750. Although we do not have spot area data prior to about 1880, there is a good correlation between sunspot area and the classical Wolf sunspot number, which is available back to about 1700 from *Waldmeier* [1961]. A forthcoming paper will report on this simulation in the near future.

Unusual activity of the Sun during recent decades compared to the previous 11,000 years

(2004)

S. K. Solanki[1], I. G. Usoskin[2], B. Kromer[3], M. Schüssler[1] & J. Beer[4]



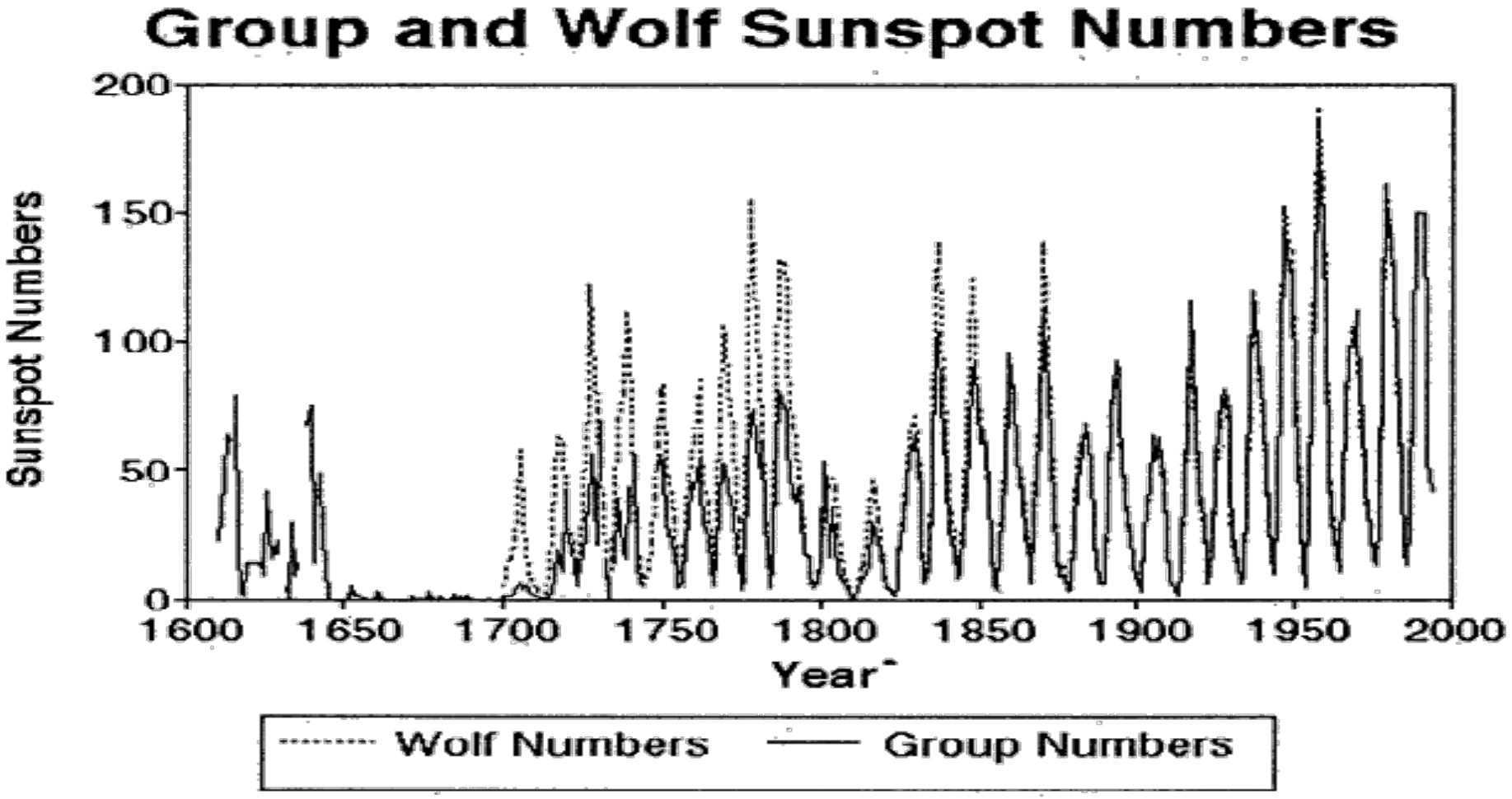
It’s used for important applications

- Climate change

- Solar dynamo modelling

- Long-term solar variability

We have two sunspot numbers



Hoyt & Schatten, GRL *21*, 1994

With no consensus on which is more accurate

-Vieira et al. (2011) **G** (1610-1700); **I** (1700-present)

- Dikpati et al. (2006) **I** (1750-1880)

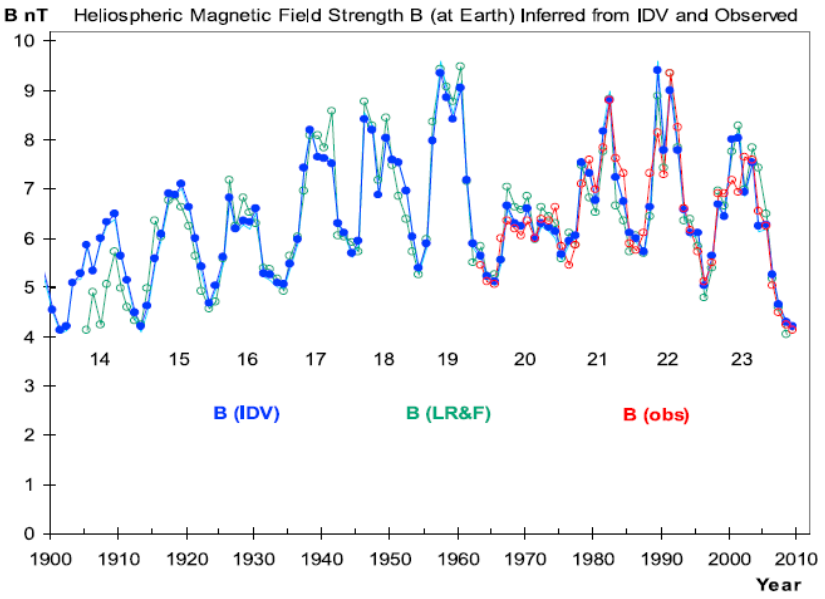
- Solanki et al. (2004) **G** (1610-present)

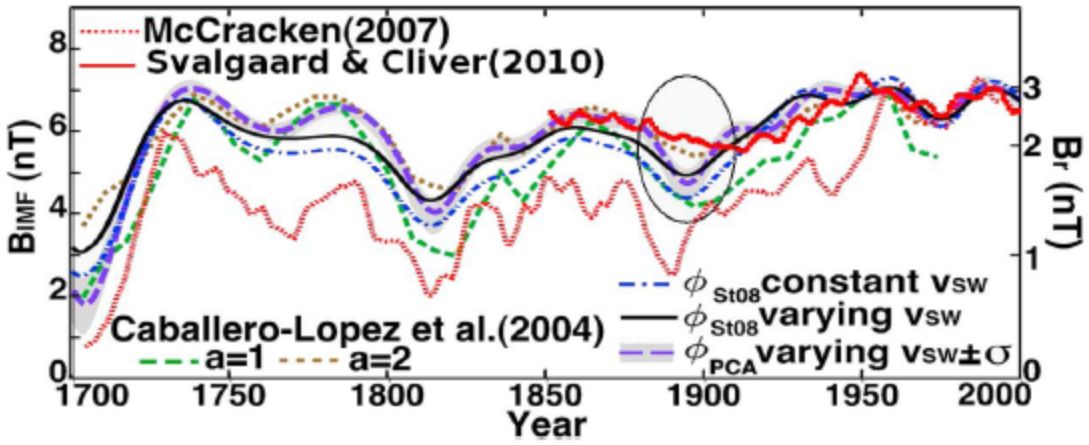
A long-term term parameter is needed to tie space-age measurements of solar & solar wind activity to the cosmogenic nuclide data from tree-rings (14C) and ice cores (10Be)

- Sunspot number (since 1610)

- Geomagnetic data (since ~1720)

Progress is being made …





Svalgaard & Cliver (2010)

Goals of this workshop

- Rectify discrepancy between G & I SSN series during 19th century

- Extend SSN series back in time as far as possible using SS & geomagnetic data

- Document tools that can be used to keep track of the SSN for the forseeable future (regular ionospheric variation, F10, sunspot area)

- Publish a vetted and agreed upon single SSN time series with error bars

Challenges

- Locating, reducing, & archiving early geomagnetic & SSN data

- Incorporating these data into a single SSN time series

- Exploring/understanding the Livingston-Penn effect on historical sunspot data

- Determining the effect of earth's decreasing dipole field strength on the regular ionospheric variation

This will take time

- 2 more workshops over the next two 1-2 years

- Next tentatively at ROB in Brussels next summer