# Why the Sunspot Number Needs Re-examination

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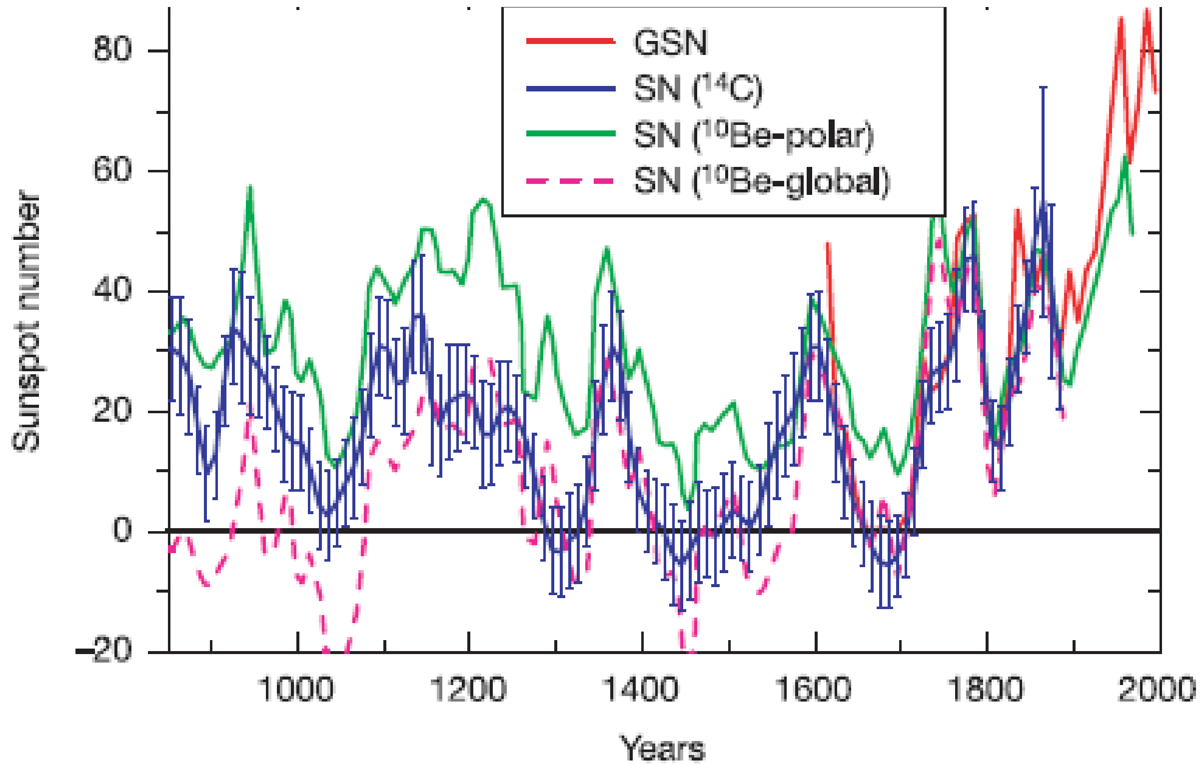
# It’s used

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

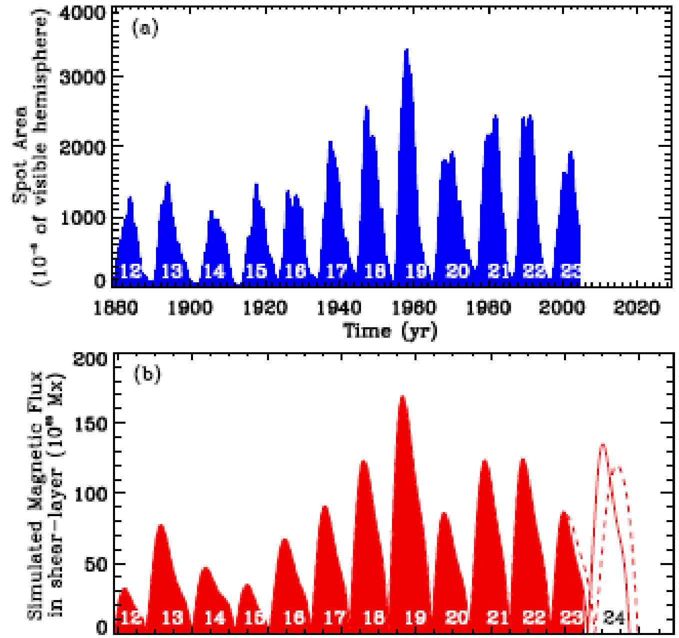
S. K. Solanki[1], I. G. Usoskin[2], B. Kromer[3], M. Schüssler[1] & J. Beer[4] (2004)



# 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.

# Evolution of the solar irradiance during the Holocene⋆,⋆⋆

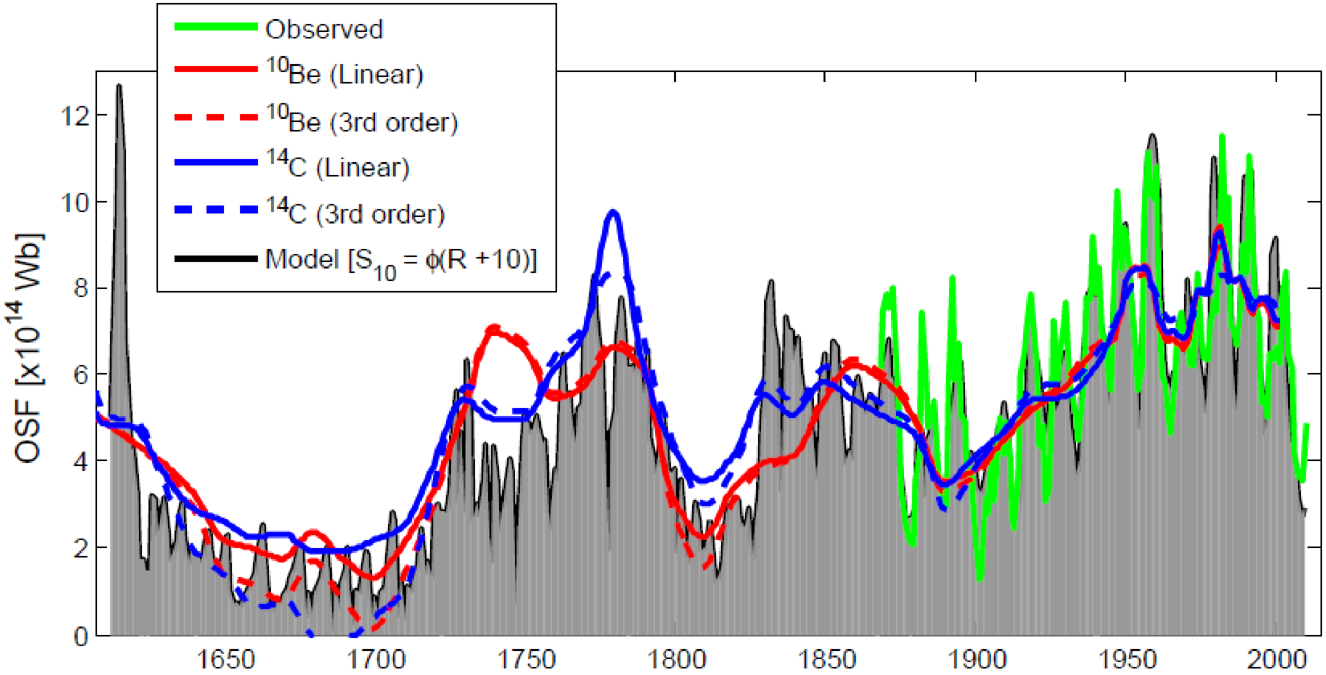
L. E. A. Vieira[1,2], S. K. Solanki[1,3], N. A. Krivova[1], and I. Usoskin[4] (2011)

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*):

$$\alpha s = A1R + A2$$

# Cyclic loss of open solar flux since 1868: The link to heliospheric current sheet tilt and implications for the Maunder minimum

M.J. Owens[1,2], M. Lockwood[1] (2012)




Where possible, we use group sunspot number, RG [Hoyt and Schatten, 1998], as it represents a more complete record than Zurich/International sunspot, RZ, particularly prior to 1850 …

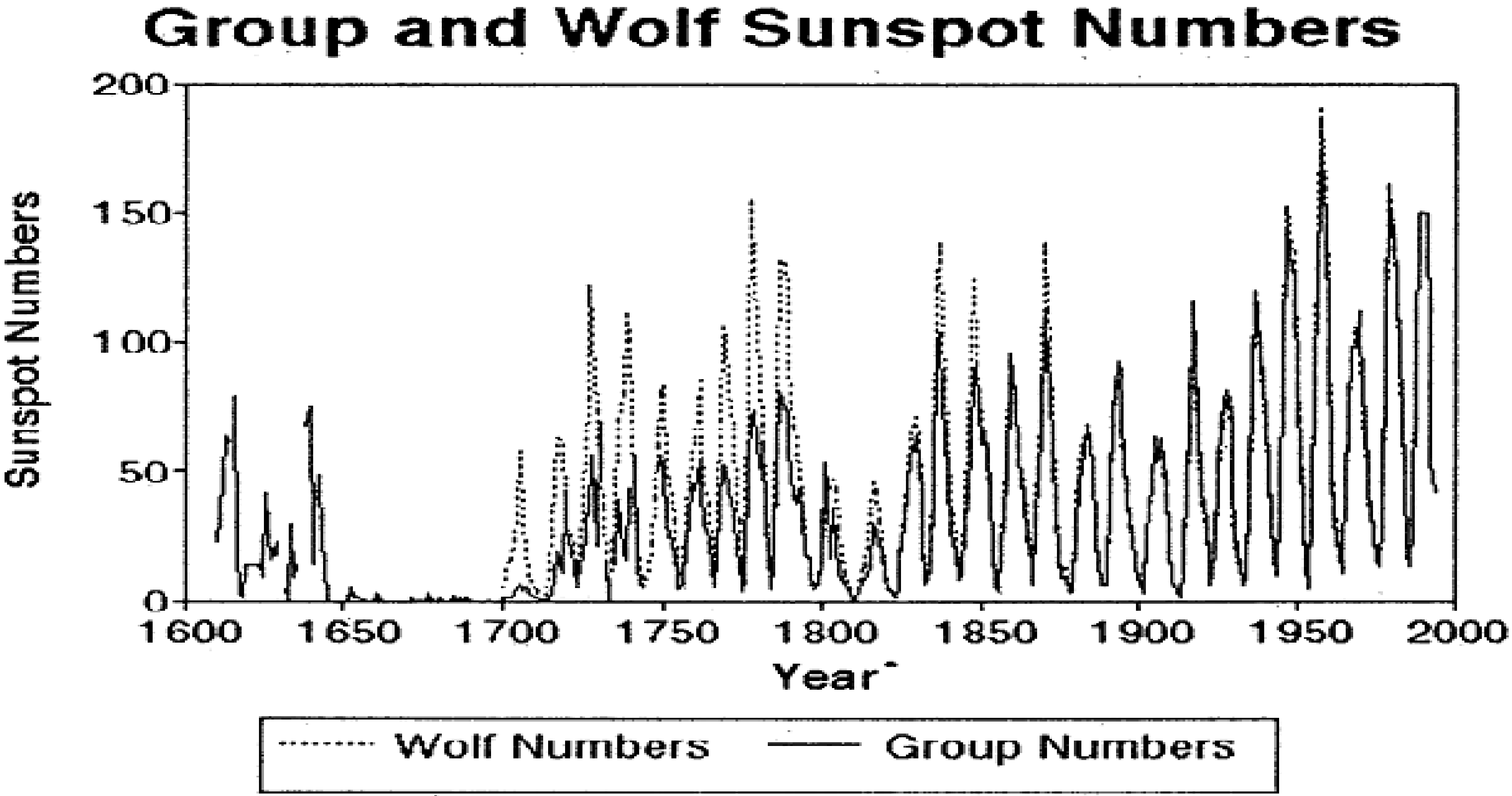
## It’s used for important applications

- Long-term solar variability

- Solar dynamo & solar wind modeling

- Climate change

# We have two sunspot numbers
## (that differ significantly before ~1885)




(I) (G)

**Hoyt & Schatten, GRL *21*, 1994**

## With no consensus on which is more accurate

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

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

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

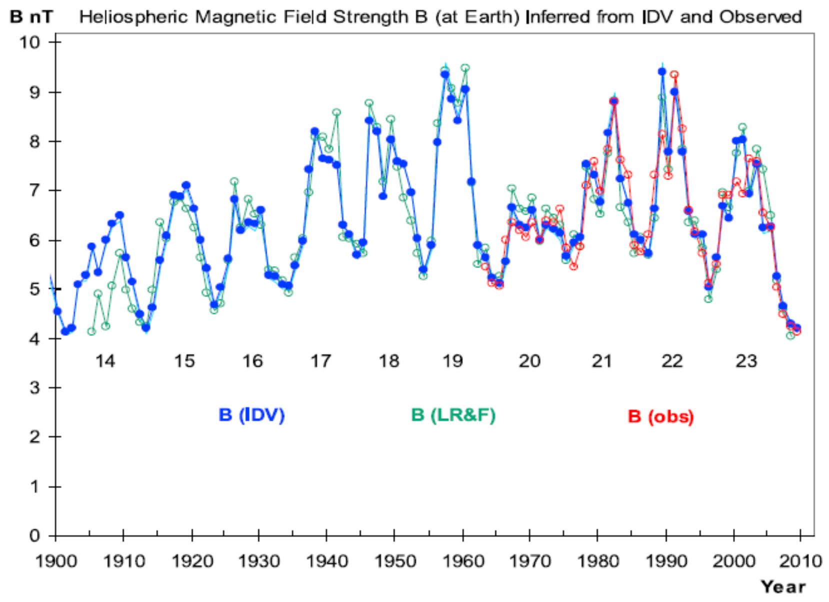
- Owens & Lockwood **G** (1610-1995); **I** (1996-present)

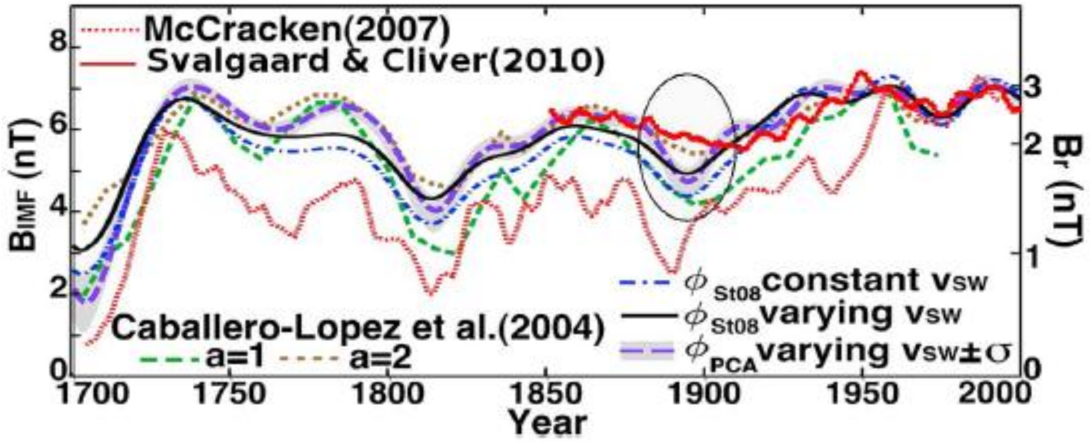
A long-term term parameter is needed to tie space-age measurements of solar & solar wind activity to > $10^4$ years of cosmogenic nuclide data from tree-rings ($^{14}C$) and ice cores ($^{10}Be$)

- Sunspot number (since 1610)

- Geomagnetic data (since ~1720)

# Progress is being made …




Svalgaard & Cliver (2010)

# Goals of this workshop

- Fix Waldmeier Discontinuity in the ISN before ~1945

- Reconcile G & I SSN series before ~1885

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

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

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

# Challenges

- Locating, reducing, archiving, & intercalibrating early SSN, geomagnetic & cosmogenic nuclide data

- 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 workshop in US   (Dates: January 2013?)