Centennial time scales: A brief update on sunspot observations

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ISSI Team 373

Towards a unified solar forcing input to climate studies

Meeting 1: 20-23 February 2017

Sunspot Areas

- Cross-calibration of RGO and post-RGO spot areas

  Factors of roughly 1.4-1.5 derived by Hathaway, Balmaceda. Agrees with Nagovitsyn (Kislovodsk), Baranyi (Debrecen)

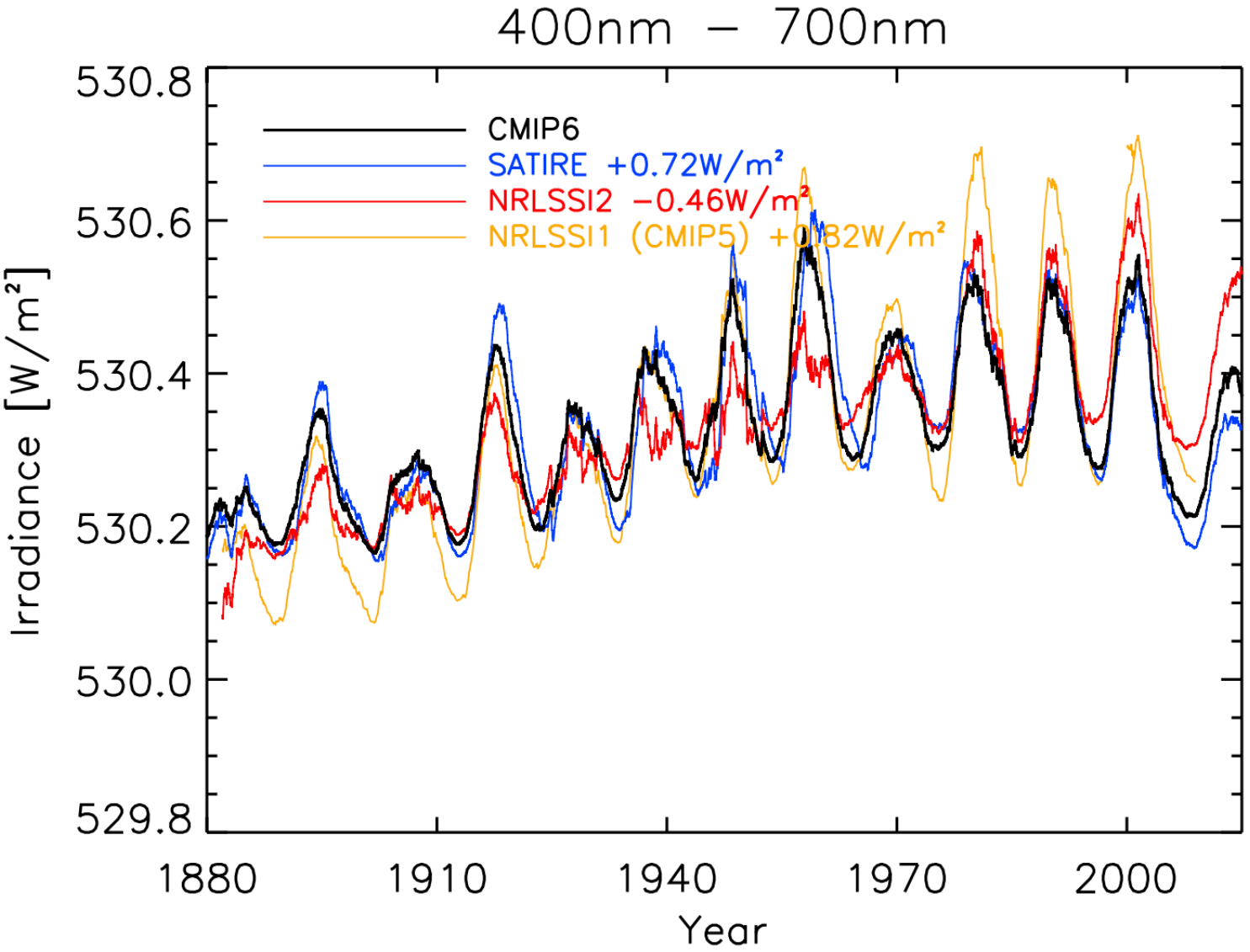
  Using this factor brings SA in good agreement with SN (which is an independent record)

- NRLSSI-2 uses a factor of 1.25

  This reduces the amplitudes of cycles before 21

  The problem is particularly severe in the visible, where the spot contribution is important.

Sunspot Areas



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  The problem is particularly severe in the visible, where the spot contribution is important.

  In particular, cycle 19 is NOT the strongest cycle on the record

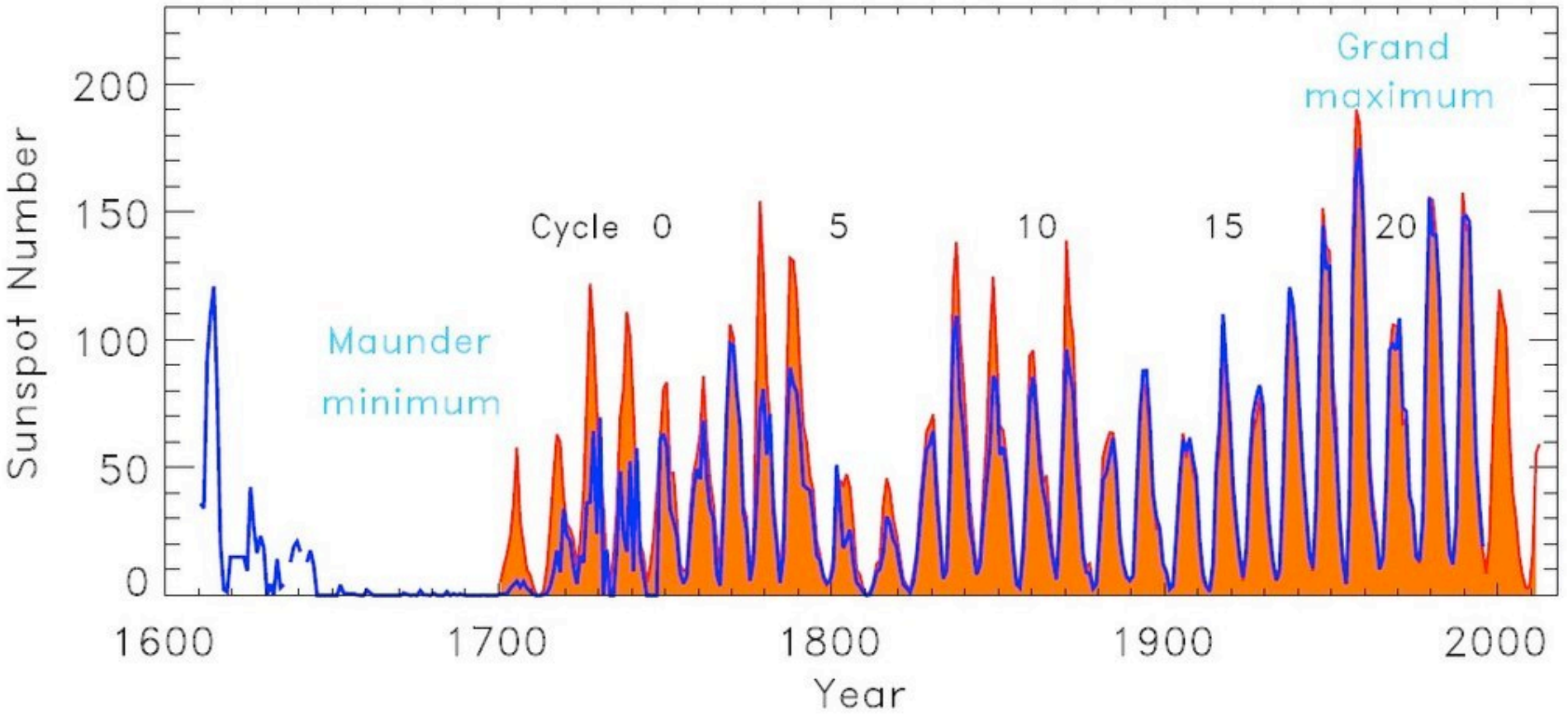
  Various independent observations suggest it WAS

Sunspot Areas

- Apparently solved in rev 2 that is provided to CMIP6
- Question: what is actually used (as the plot is from the last week draft)?

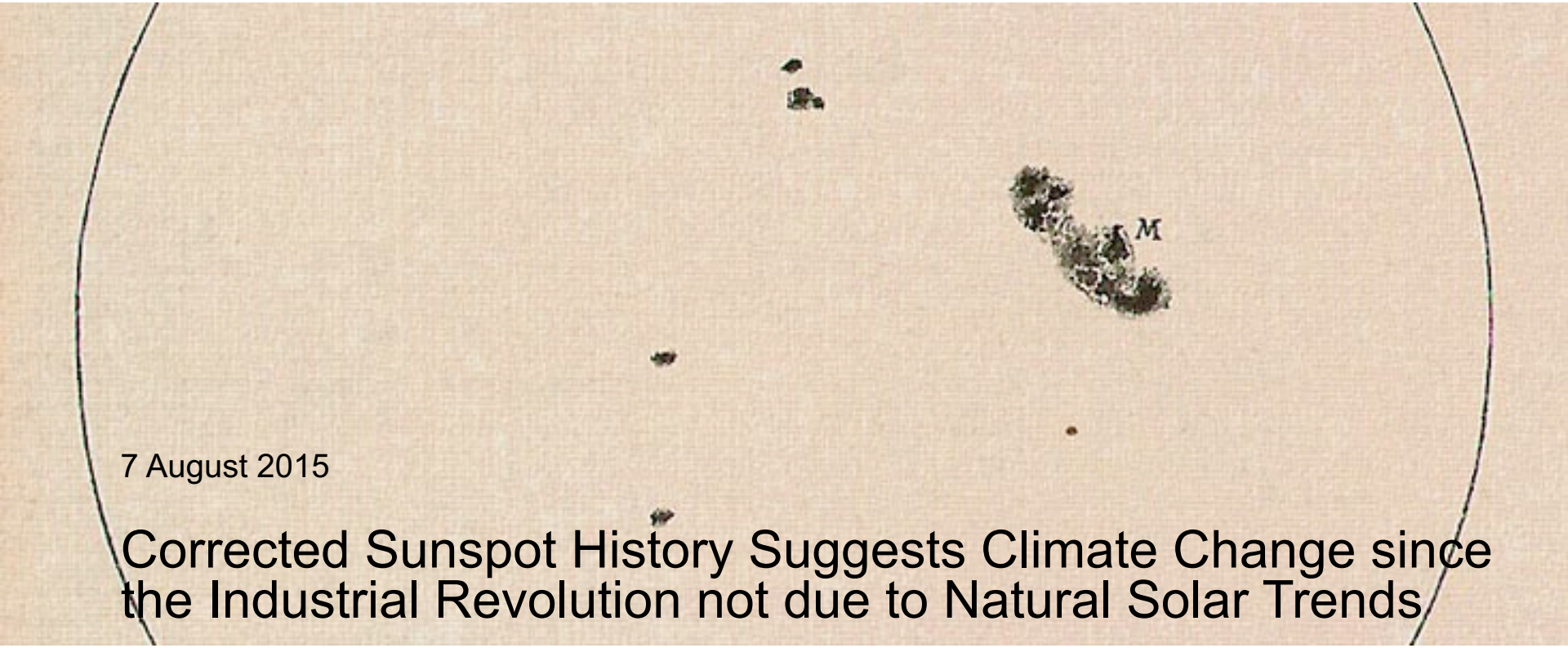
Sunspot Number

- Nice time of just two records, R_z and GSN, … is over



Sunspot Number

- **iau1508 — Press Release**



7 August 2015

Corrected Sunspot History Suggests Climate Change since the Industrial Revolution not due to Natural Solar Trends

Sunspot Number

Topical Issue of Solar Physics on “Recalibration of the Sunspot Number”

May 8, 2015, from **John Leibacher**

Sunspot Number

Volume 291, Issue 9-10, November 2016

Sunspot Number Recalibration / Guest Editors: F. Clette, E.W. Cliver, L. Lefèvre, J.M. Vaquero, and L. Svalgaard

ISSN: 0038-0938 (Print) 1573-093X (Online)

- **Over 30 articles**

Including more recalibrations

Sunspot Number Series

Series	Type	Built	Method	Reproduc	features
ISN (v2)	SN	Based on WSN. A few jump-like corrections. Full daisy-chain.	Ordinary Lin. Sq (OLS) regression	Not before 1980s	Low >1940s (Waldmeier), high <1850. Weak trend.
GSN (HS98)	GSN	GSN databse. There are several later corrections (Vaquero et al., 2011, 2015)	OLS, cumulative G (overlap. days)	Yes	Low in 18-19 centuries. Strongest secular trend.
SvSc16	GSN	Based on HS98 database. Composite of ”backbone” (after DM), ”high-low” (18th cent.) and ”brightest star” around MM	OSL on annual data.	Should be but not always.	Low after 1940s, too high in 19th cent., by far too high during MM
L14	GSN	GSN with some extra-corrections	As GSN	Yes	Similar to GSN
UEA16 (WEA17)	GSN	Revised GSN database (Vaquero et al., 2016)	Active Day Fraction	Yes	Close to GSN in 19-20 cent., between GSN and SvSc16 in 18th cent.
ChEA17	GSN	”Backbone” method, based on revised GSN database.	Direct calibration matrices	Yes	Similar to UEA16 but slightly higher in early 19th century.

ChEA17 = Chatzistergos et al., AA, 2017, in press.
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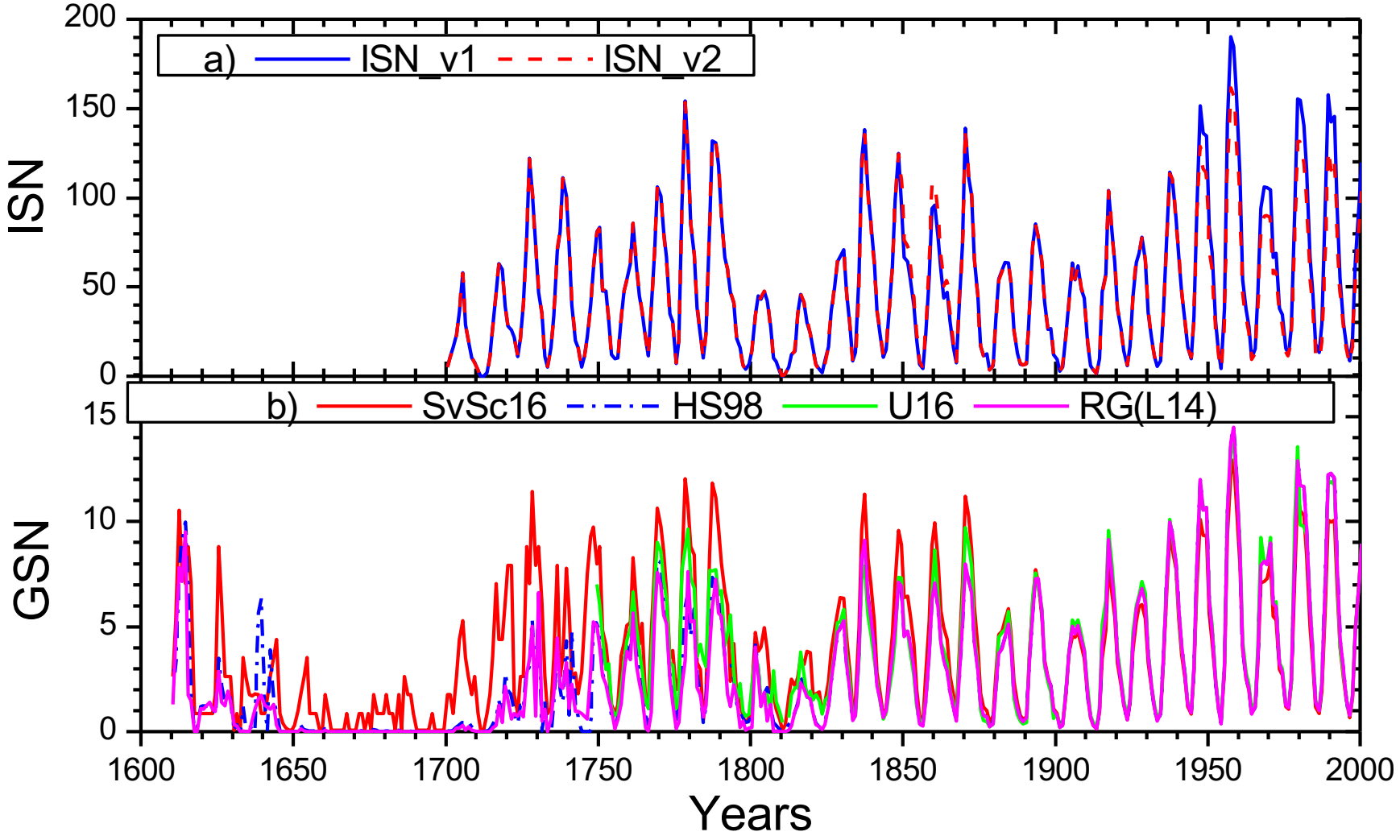
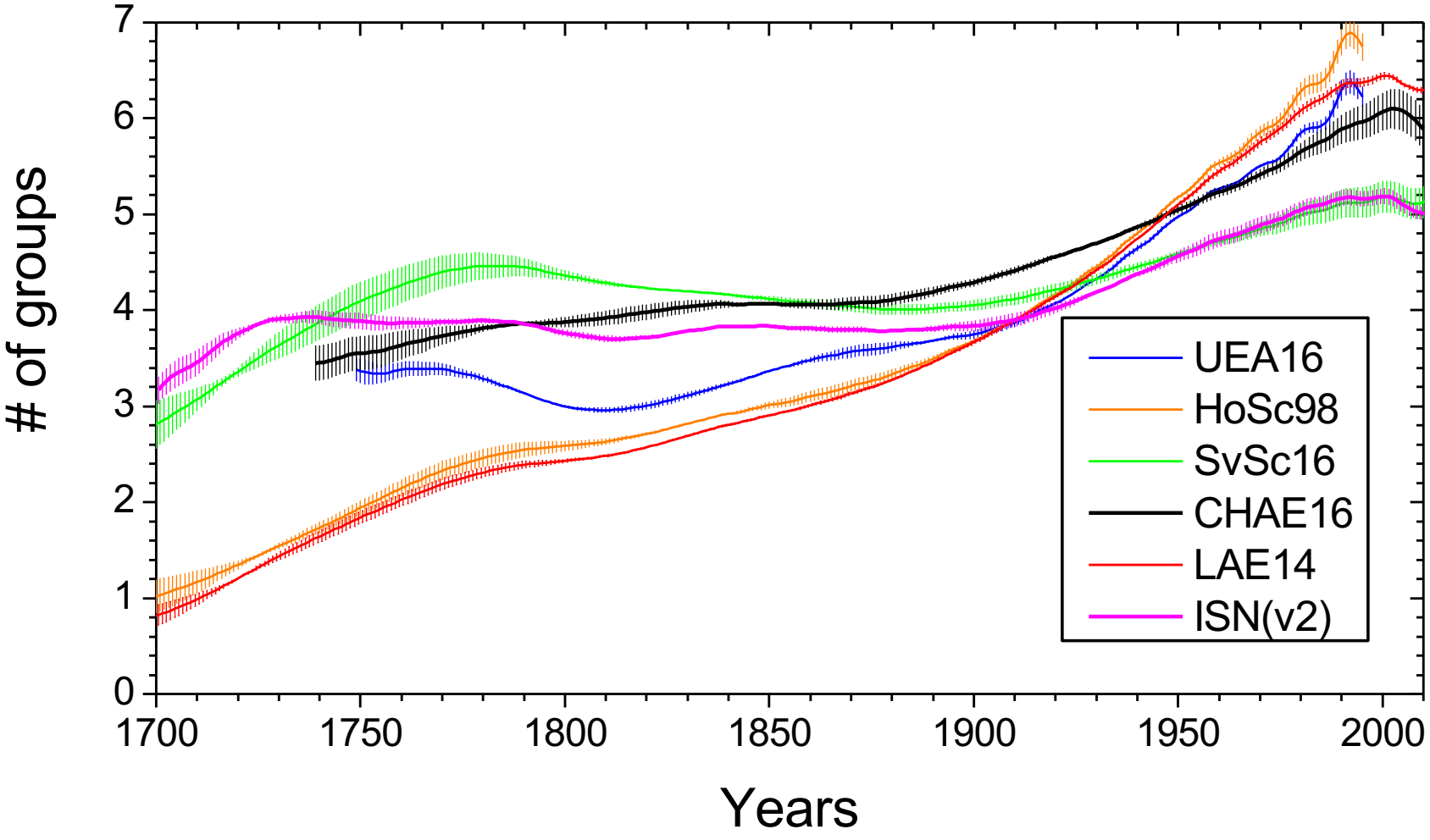
Sunspot Number



Long-term trend (SSA)



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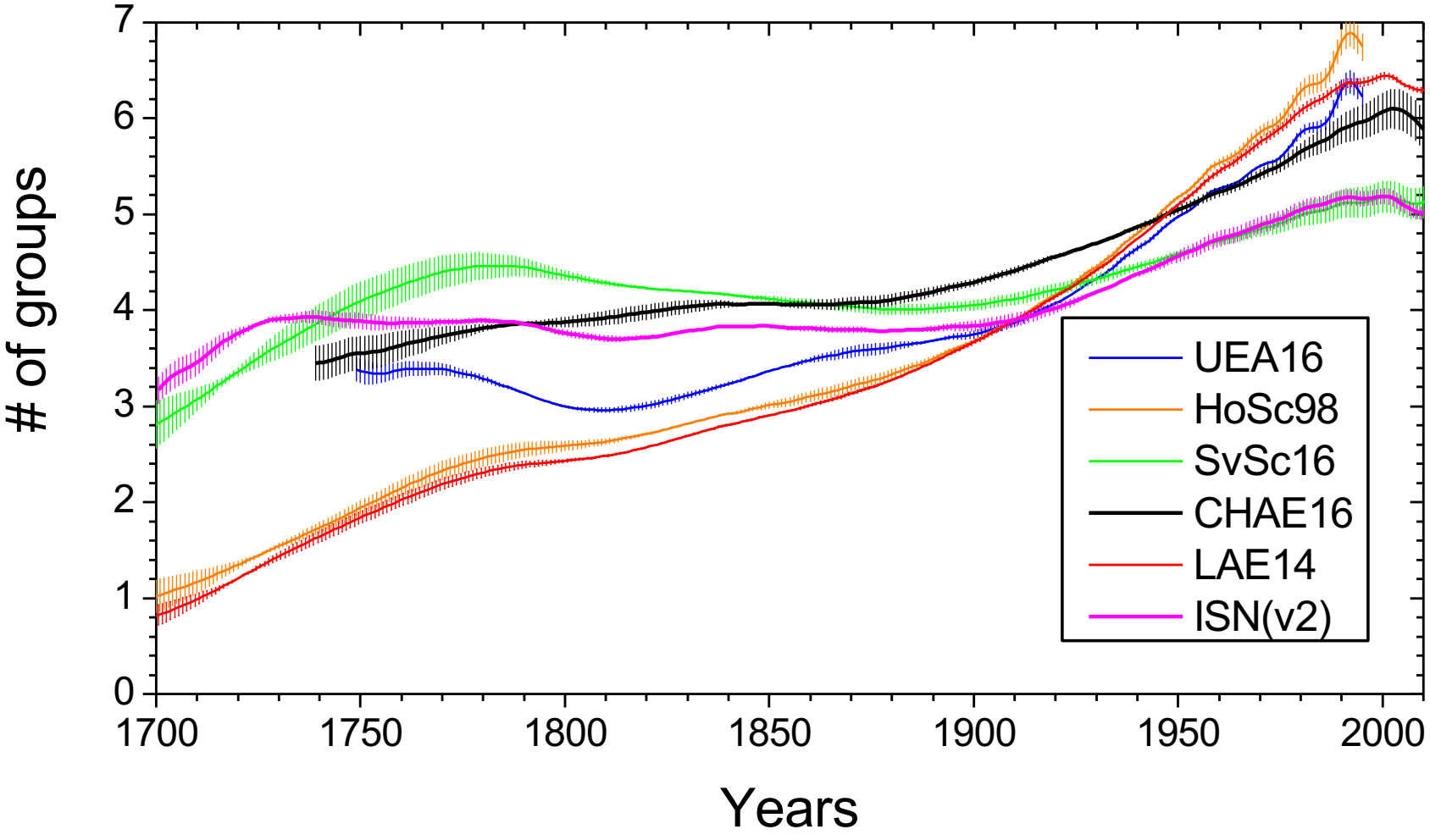

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- MM and pre-mm: Vauero et al. (2011, 2015)
- Most uncertain: 1712-1749
  - use Lea14 if needed
  - use isotopes for irrad. recs

Conclusions:

Keep working