

# Re-evaluating the role of solar variability on Northern Hemisphere temperature trends since the 19<sup>th</sup> century – Supplementary Information

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## 1. Rural China

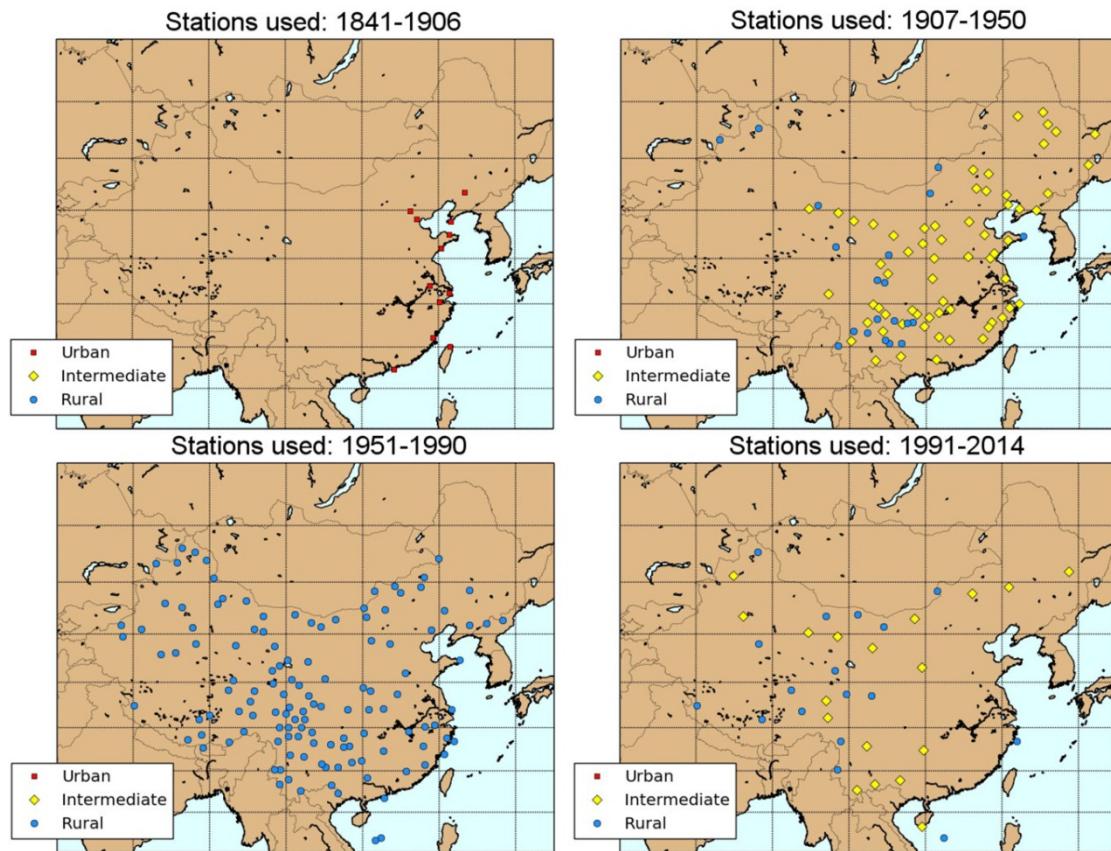


Figure S 1. Stations used for constructing Chinese composite.

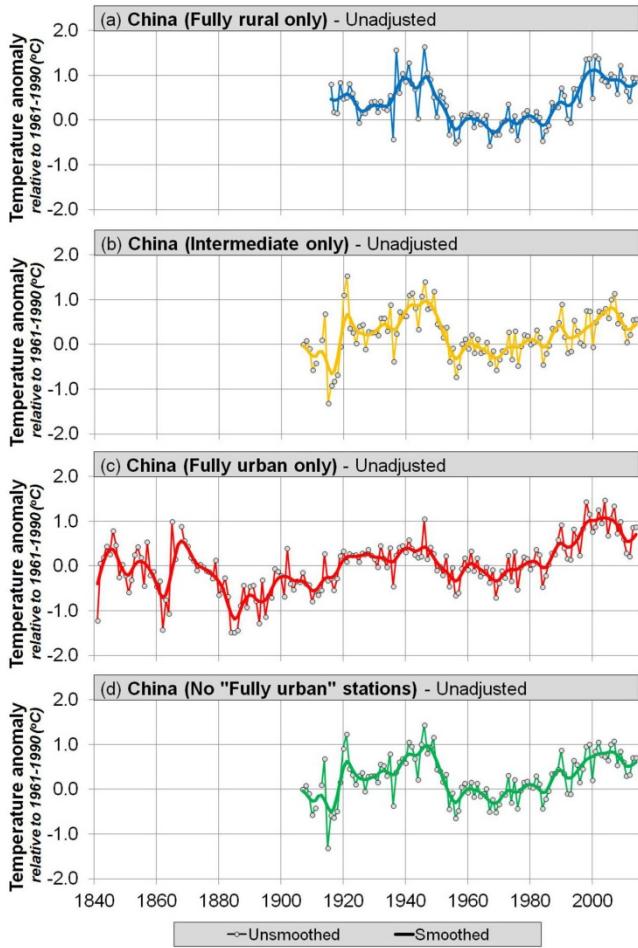


Figure S 2. Chinese temperature trends according to four different subsets of the Global Historical Climatology Network data.

## 2. Comparison with other Northern Hemisphere estimates

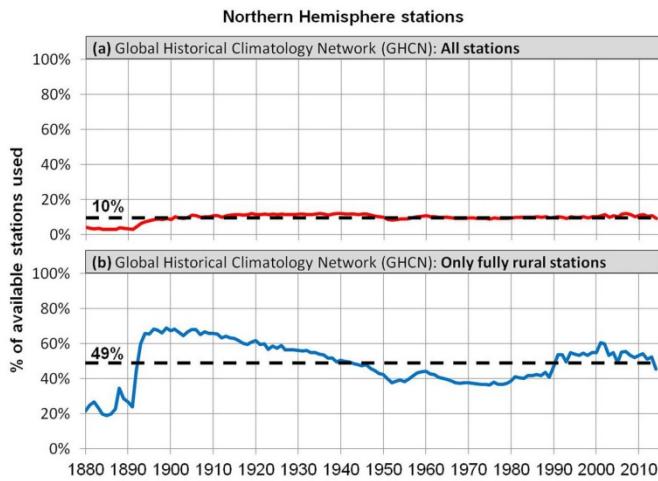


Figure S 3. Percentages of the available Global Historical Climatology Network stations used for our Northern Hemisphere composite on an annual basis.

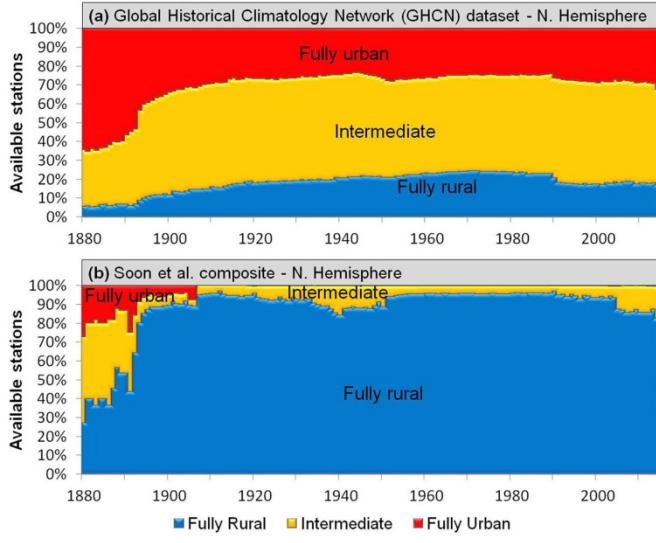


Figure S 4. Ratio of fully rural/intermediate/fully urban stations in the Northern Hemisphere in (a) the Global Historical Climatology Network dataset and (b) our composite on an annual basis.

### 3. Attempting to fit Northern Hemisphere surface air temperatures using TSI and GHG calculated radiative forcing

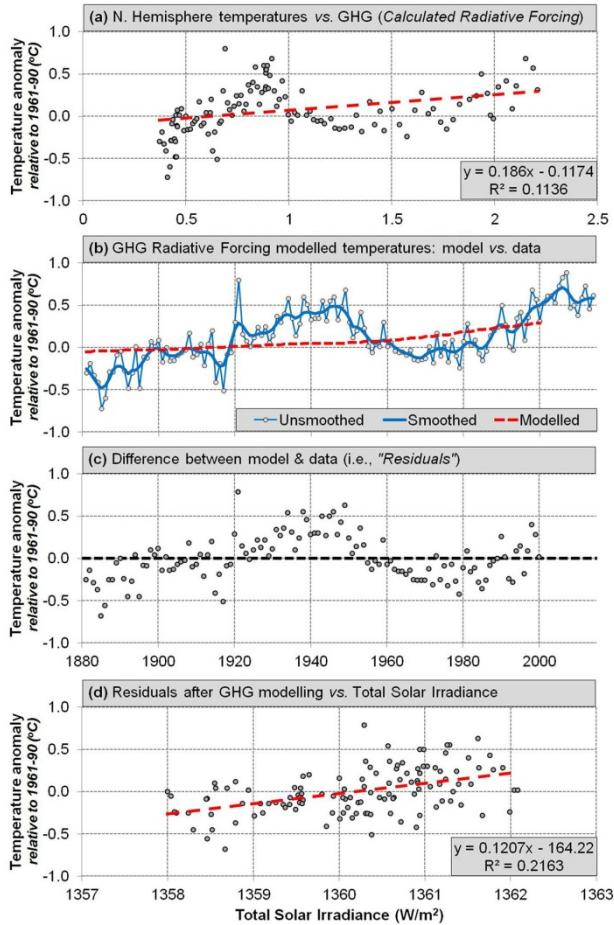


Figure S 5 As for Figure 28, but fitting using the calculated changes in radiative forcing from Well Mixed Greenhouse Gases.

#### 4. Data sources for solar proxies

*Table S1.* Sources for solar proxies used for generating Figure 4. Data for Bard et al., 2000 and Muscheler et al., 2007 were downloaded from <http://www.ncdc.noaa.gov/data-access/paleoclimatology-data/datasets/climate-forcing> and [ftp://ftp.ncdc.noaa.gov/pub/data/paleo/climate\\_forcing/solar\\_variability/muscheler2007solar-mod.txt](ftp://ftp.ncdc.noaa.gov/pub/data/paleo/climate_forcing/solar_variability/muscheler2007solar-mod.txt) respectively.

Period covered	Solar proxy	Source	Data source
1610-1995	Sunspot numbers	Group	Hoyt & Schatten, 1998
1700-2014	Sunspot numbers	Zurich/International/Wolf	<a href="http://sidc.oma.be/html/sunspot.html">http://sidc.oma.be/html/sunspot.html</a>
1700-2014	Sunspot numbers	WDC-SILSO (Clette et al., 2014)	<a href="http://www.sidc.be/silso/">http://www.sidc.be/silso/</a> (version 2.0)
1615-2002	Solar cycle length	Maximum to maximum	Richards et al., 2009 + assuming SC24 peaked in April 2014
1615-2002	Solar cycle length	Minimum to minimum	Richards et al., 2009.
1700-1986	Solar cycle length	Annual differencing	Hoyt & Schatten, 1993 (digitized)
843-1961	Cosmogenic isotopes	Bard et al., 2000	<a href="http://www.ncdc.noaa.gov/">http://www.ncdc.noaa.gov/</a>
1000-2001	Cosmogenic isotopes	Muscheler et al., 2007	<a href="http://www.ncdc.noaa.gov/">http://www.ncdc.noaa.gov/</a>

*Table S2.* Sources for solar proxies used for generating Figure 5.

Period covered	Solar proxy	Source	Data source
1868-2010	aa geomagnetic index	Canberra, Australia and Hartland, England	<a href="http://www.ngdc.noaa.gov/stp/geomag/aastar.html">http://www.ngdc.noaa.gov/stp/geomag/aastar.html</a>
1874-1976	Faculae area (white light)	Royal Greenwich Observatory	Foukal, 1993 (digitized)
1879-1979	Solar equatorial rotation rates	Hoyt & Schatten, 1993	Hoyt & Schatten, 1993 (digitized)
1874-1989	Sunspot structure	Fraction of sunspots with no umbrae	Hoyt & Schatten, 1993 (digitized)
1874-2014	Sunspot area	RGO (1874-1976); USAF/NOAA (1976+)	<a href="http://solarscience.msfc.nasa.gov/greenwch.shtml">http://solarscience.msfc.nasa.gov/greenwch.shtml</a>
1880-1971	Sunspot structure	Mean umbral fraction of sunspot areas	Hoyt & Schatten, 1993 (digitized)
1915-1984	Ca II (K line) plage area	Mount Wilson Observatory	<a href="ftp://ftp.ngdc.noaa.gov/STP/SOLAR_DATA/">ftp://ftp.ngdc.noaa.gov/STP/SOLAR_DATA/</a>
1947-2013	F10.7 cm radio flux	Ottawa (1947-1991); Penticton (1991+)	<a href="http://lasp.colorado.edu/lisird/tss/noaa_radio_flux.html">http://lasp.colorado.edu/lisird/tss/noaa_radio_flux.html</a>
1958-2010	Galactic cosmic rays	Moscow neutron monitor	<a href="ftp://ftp.ngdc.noaa.gov/STP/SOLAR_DATA/">ftp://ftp.ngdc.noaa.gov/STP/SOLAR_DATA/</a>
1978-2013	Total solar irradiance	ACRIM composite	<a href="http://www.acrim.com/Data%20Products.htm">http://www.acrim.com/Data%20Products.htm</a>
1978-2014	Total solar irradiance	PMOD composite	<a href="ftp://ftp.pmodwrc.ch/pub/data/irradiance/composite/DataPlots/">ftp://ftp.pmodwrc.ch/pub/data/irradiance/composite/DataPlots/</a>

#### 5. Comparison between Northern Hemisphere temperature trends and updated Hoyt & Schatten Total Solar Irradiance (TSI) trends

*Table S3.* Pearson correlation coefficients (*R*) between each of the unsmoothed datasets over their mutual period of overlap.

<i>R</i>	TSI	Rural China	Rural U.S.	Rural Ireland	Arctic Circle	N. Hemisphere
<b>TSI</b>	1	0.42	0.44	0.43	0.71	0.69
<b>Rural China</b>	0.42	1	0.52	0.55	0.38	0.86
<b>Rural U.S.</b>	0.44	0.52	1	0.46	0.52	0.78
<b>Rural Ireland</b>	0.43	0.55	0.46	1	0.49	0.79
<b>Arctic Circle</b>	0.71	0.38	0.52	0.49	1	0.78
<b>N. Hemisphere</b>	0.69	0.86	0.78	0.79	0.78	1

#### References

Richards MT, Roger ML, Richards DSP (2009). Long-term variability in the length of the solar cycle. *Publ. Astron. Soc. Pacific*, 121:797-809. doi: 10.1086/604667.