

Solar-Terrestrial-Climate 101

[link to animation](#)

Paul L. Vaughan, M.Sc. — August 4, 2013

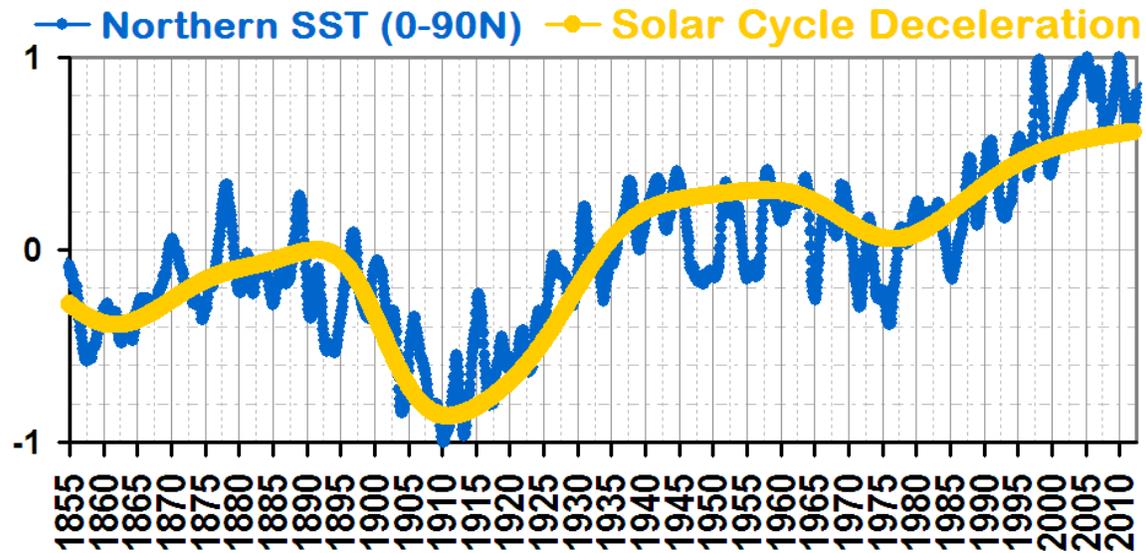
[similar methods](#)

It's all about **pumping rate & persistence**.
(Temperature, mass, & velocity *are coupled*.)

Tachometers measure the rate of coupled mechanical processes, *regardless* of the physical details of those processes.

The Sun's **pulse** has been measured via generalized **wavelet tachometer**.

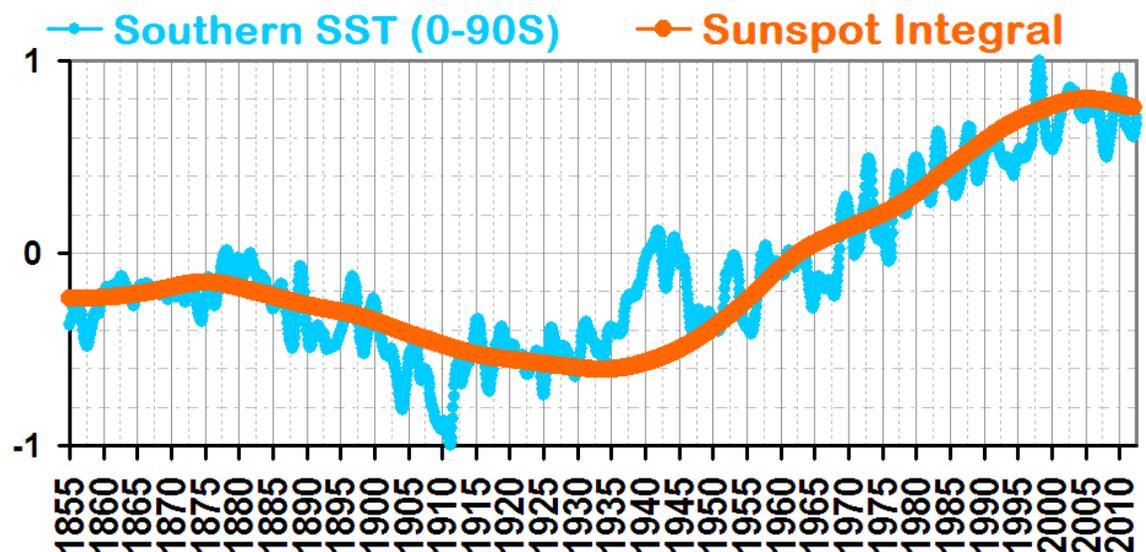
Pumping Rate:



NH = **Northern Hemisphere**

- lots of **land**
- land has **low** heat capacity
- ocean surface *responsive* to land-ocean circulatory pumping rate changes

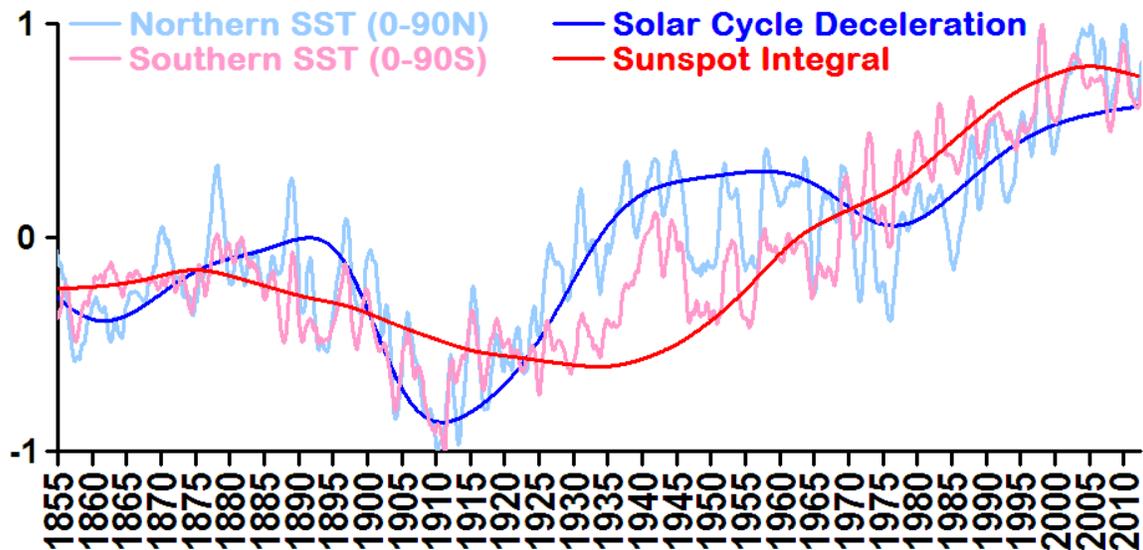
Persistence:



SH = **Southern Hemisphere**

- dominated by **water**
- water has **high** heat capacity
- *delayed* equilibrium (like a pot of water on a heating element)

Where land's abundant – especially where midlatitude western ocean boundary land-ocean flow-driving *gradients* are steep – water gets pumped off the integral track:



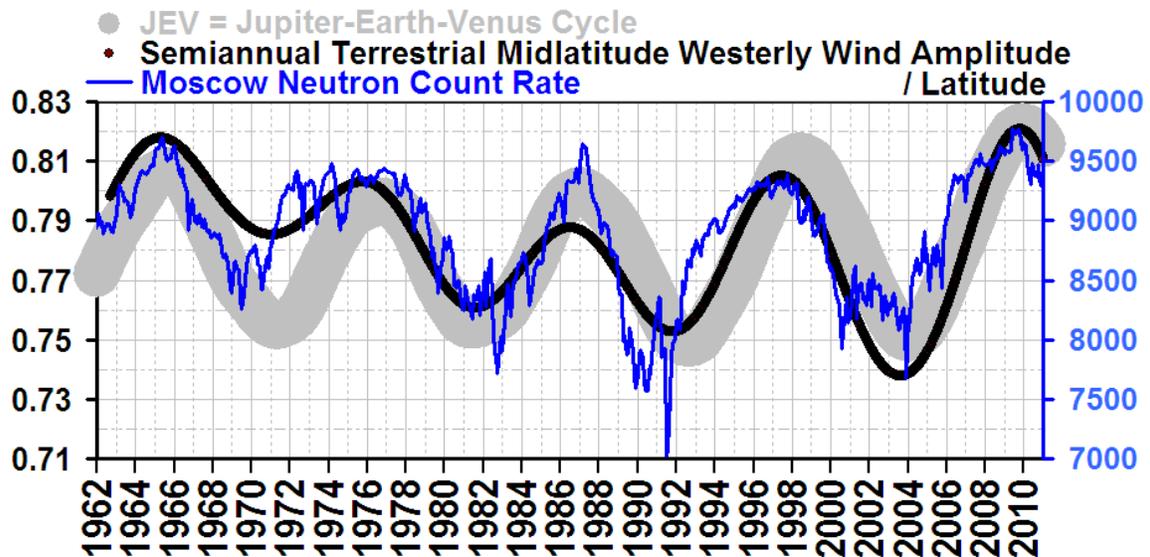
65% of global sea surface temperature (ERSSTv3b2) variation is governed by multidecadal solar *pulse & persistence*. 20%'s interannual. 15%'s linear rise. Due to the current *asymmetric* distribution of continents, Earth's solar pulse / persistence response balance point is the **thermal equator** (~10°N). This has been determined *empirically*.

Obsession with *global average* temperatures has kept *due* focus away from the *key* role of equator-pole temperature *gradients* in *large scale mass flow governance* (wind evaporation, circulatory meridionality, up & down welling, and mixing far more generally).

Solar-Pulsed Decadal Terrestrial Circulation (NOT global average temperature!)

Reproduced below (next 4 graphs) – with additional variables added to provoke careful thinking (and dare hastily prejudiced rejection of this paper as a whole) – is the primary result of a landmark paper:

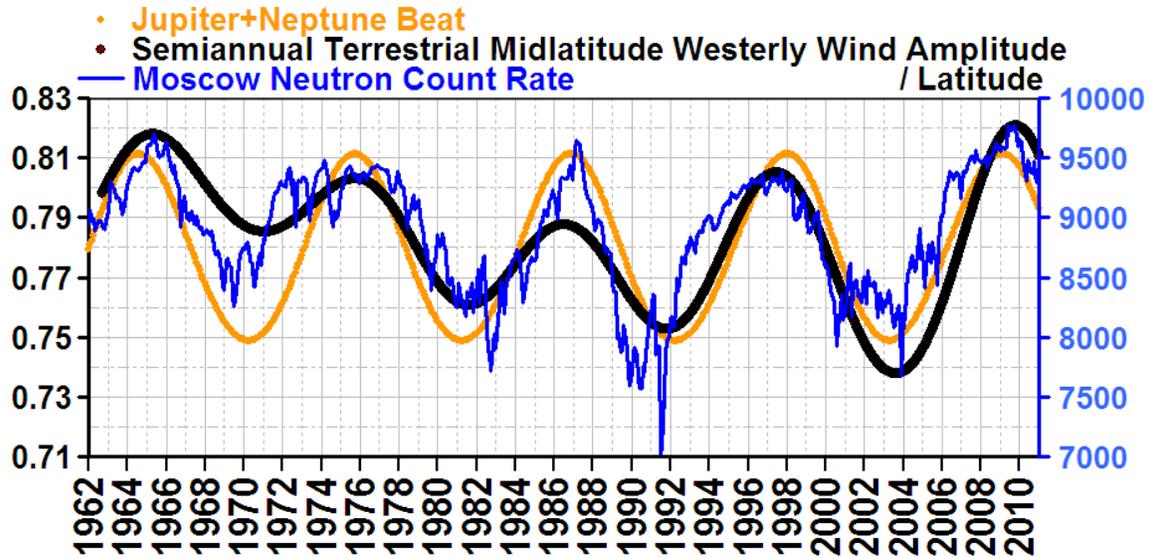
Le Mouél, J.-L.; Blanter, E.; Shnirman, M.; & Courtillot, V. (2010). Solar forcing of the semi-annual variation of length-of-day. Geophysical Research Letters 37, L15307. doi:10.1029/2010GL043185.



Although it wasn't mentioned in the text, the result also appeared *graphically* in this seminal paper:

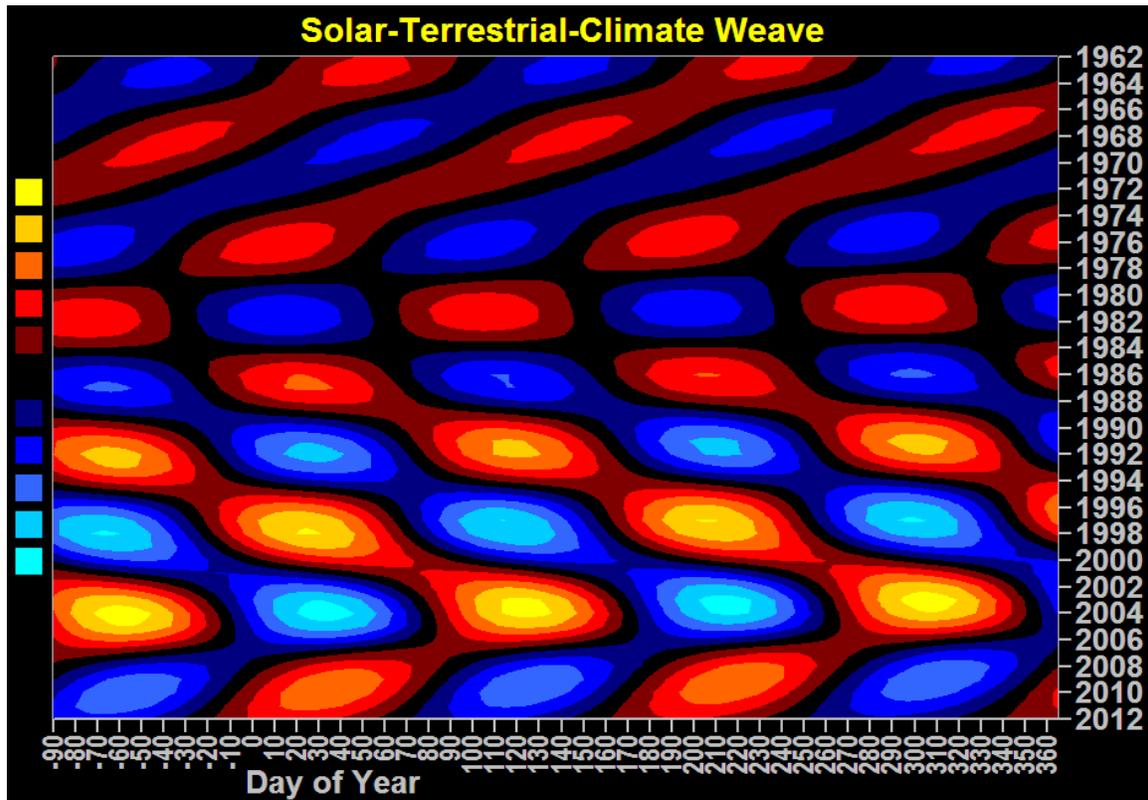
Dickey, J.O.; & Keppenne, C.L. (1997). Interannual length-of-day variations and the ENSO phenomenon: insights via singular spectral analysis.

<http://trs-new.jpl.nasa.gov/dspace/bitstream/2014/22759/1/97-1286.pdf>



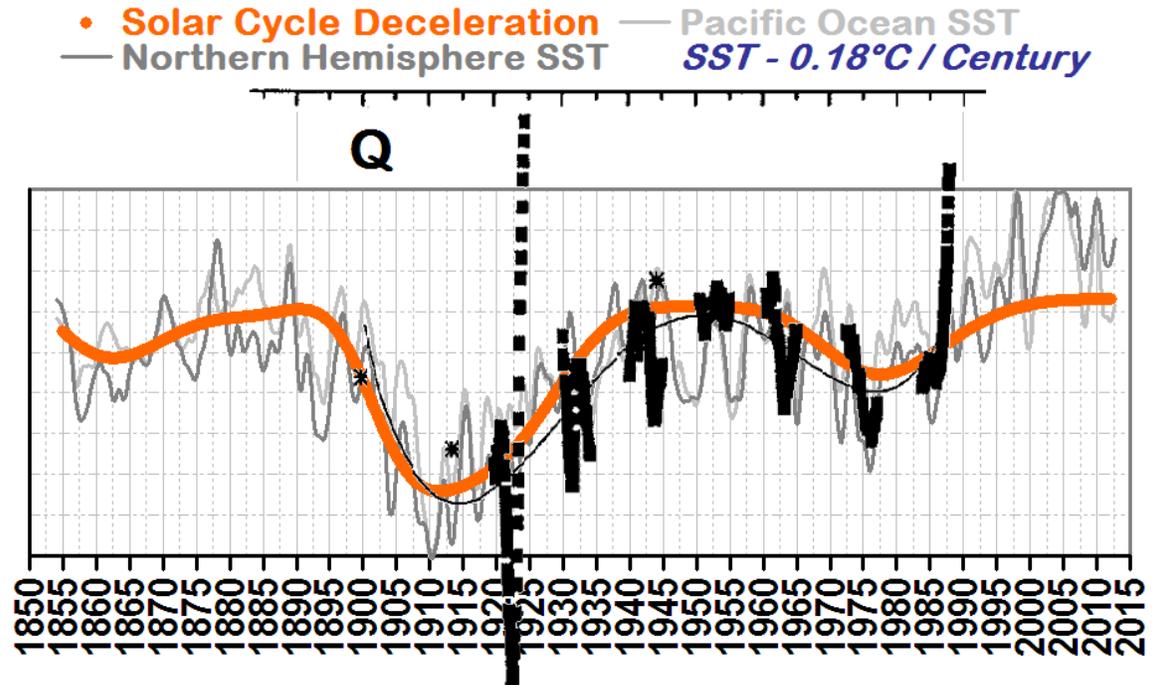
The decadal circulation signal is coherent with the *rate of change* of total column ozone. A widespread misconception is that total column ozone tracks the solar cycle. It does not. The solar cycle drives *changes* in total column ozone, so the solar cycle is a *quarter-cycle ahead* of decadal total column ozone.

A tuned wavelet rake easily detects *cyclic volatility* of equally spaced times. Powerful constraints from the laws of large numbers & conservation of angular momentum facilitate clear vision right through ENSO interference to a crystallized semi-annual terrestrial midlatitude westerly wind solar attractor. In cross-ENSO aggregate, semi-annual midlatitude westerly winds oscillate with the solar cycle about a baseline coherent with the integral of global atmospheric angular momentum.



It should be plainly evident that one *cannot* sensibly generalize across the year.

Multidecadal climate waves **perfectly** match multidecadal heliosphere waves.



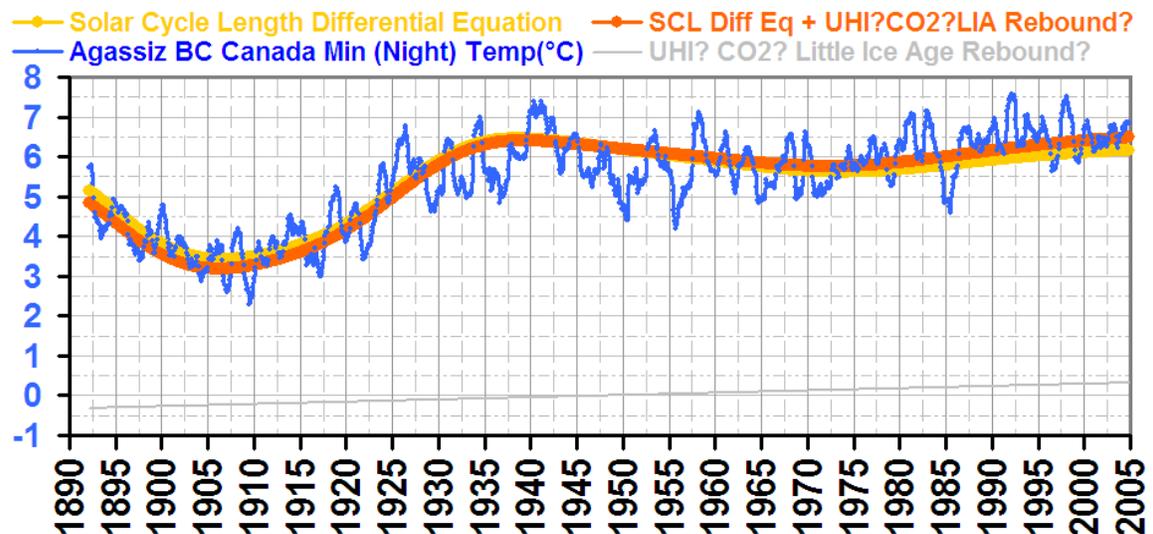
superposed: **figure 5** (p.198) – from **section 8** (pp.196-198)

Obridko, V.N.; & Shelting, B.D. (1999). Structure of the heliospheric current sheet derived for the interval 1915-1996. Solar Physics 184, 187-200.

<http://helios.izmiran.troitsk.ru/hellab/Obridko/189.pdf>

"H α observations of solar large-scale fields were used to reconstruct the heliosphere structure for the time interval of 1915–1996. [...] **The q parameter, characterizing the divergence of the polar plumes in the epochs of the solar minimum** [...] ratio of the meridional and the cylindrical radial components, respectively. Calculations should naturally be performed far from the maximum (where both components pass simultaneously through zero) and as close as possible to the minimum of the solar cycle. Bugoslavskaya (1958) showed a similarity of the q values, calculated from the magnetic data and measured from the polar streamers. However the data, available at that time, did not allow the study of long-term variation of q. [...] 3 extra points are added from (Bugoslavskaya, 1958). [...] quasi-periodic oscillations [...] **The convergence region of the field lines moves up and down with the same period. [...] results in secular variations of the entire structure of the heliosphere.**"

Local Example



The interannual variations predominantly track negative interannual North Pacific Index, leaving almost nothing (3%) unexplained. Similar fits can be done for other locations...