Validation/Reconstruction of the Sunspot Number Record, 1841-2007

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Sunspot Number (SSN) Applications

- Solar Dynamo
- Space Weather/Climate
- Cosmic Ray Modulation
- Climate Change
Two SSN Series

$R_{\text{INT}}$: 1700 - 2007 (SIDC/ROB)

SSN correlated with daily range of geomagnetic elements
$S_R$ Ionospheric Current System (Torta et al., 1997)

$S_R$ at Hobarton (1848)
Wolf (1875) used the SSN-daily range relationship to adjust the SSN for years before 1848

\[ rD = a + b R_z \]
Show that over extended periods of time (decades, centuries) constant, stable relationships exist between rY at stations such as Niemegk and Honolulu that are widely separated in longitude and latitude.
Link together observations of the regular variation observed at long-term stations (normalizing to Niemegk and using Oslo to bridge the gaps for early years) to obtain the variation of $S_R$ since 1840.
Step 3

Relate average $r_Y$ to $R_{RI} \ (\& \ F_{10.7})$

$y = 5.973x - 185.05$

$R^2 = 0.9681$
The daily range $r_Y$ is highly correlated with $R_{\text{INT}}$ & $F_{10.7}$ at all phases of the sunspot cycle.
Use the $R_{\text{INT}}$ vs. $rY$ relationship to obtain a new SSN series back to 1840
Obtain correction factors for each cycle for the International and Group SSN series.
Provisional SSN Series:
Cycles 10 & 11 comparable to 22 & 23
Work in Progress

- Strengthen 1840-present series
- Extend before 1840
- Determine causes of jumps in 1893 & 1945
- Determine effect of Earth’s decreasing dipole (~10% since 1840)