Sunspot Number Workshop 3: Comments and Suggestions

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It's ugly in there!

But needed as a pure solar activity index back 400 years to tie in with longer-lived but less direct proxies. *Use-inspired basic research.*



Lord Kelvin's Dictum

" To measure is to know."

"I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science, whatever the matter may be."

Comments - 1

- Inertia to change is part of the scientific method reduces big mistakes. (More about this later.)
- Need to have a pure solar activity index.
- There are clear problems with the existing SSN.
 - Brunner-Waldmeier jump correction looks convincing.
 - Wolf-Wolfer jump origin needs to gain consensus.
 - Need to fix the Locarno drift problem.
 - Need to pay very close attention to small drifts.
- New (mostly negative) 'Waldmeier effects'.
- Keep raw data; clearly document adjustments.

Comments - 2

- Can seeing quality be incorporated in *k* values?
- Distributions should be examined for non-Gaussian behavior before averaging.
- Can something more stable than a pilot station be devised to reduce k drift?
- Use different *k* values for spots and groups?
- Good to avoid feedback bias, but how to train?
- Consider doing sensitivity analyses (remove various data points and see what happens to a result).

Comments - 3

- Backbone method is nice but need to plot individual observers in overlap periods to test for drifts.
- Make distinctions between drifts on various time scales.
- It's depressing that various discrepancies seem to be getting worse with time.
- The Debrecen data base and its web presentation is wonderful!
- Need to bring more spirit and passion to group discussions!

Some Respectful Suggestions - 1

- The new daily SSN series should:
 - Include only white light sunspot data (SDO, MDI caution).
 - Include error estimates (or at least weights).
 - Include traceability to original data and corrections done.
 - Be authoritative (e.g. SILSO home, IAU approval, etc.).
 - Be unique and recognizable in research papers (e.g. R_{2013}).
 - Be widely publicized (e.g. articles in *EOS*, etc.).
 - Be capable of incorporating new data (e.g. R_{2014}).
 - Include a list of caveats.
 - List data sets examined but not used and why.
 - Be independently reproducible.

Some Respectful Suggestions - 2

- Include temporal coverage fraction in monthly and longer averages.
- Use MWO drawings and other high quality data.
- Possible profitable research areas:
 - Rigorous assessment of sensitivity of SSN to small spots, size thresholds, foreshortening effects, etc.
 - Continue observations of sunspot magnetic field strength and temperature. Correction for sample selection. Analysis of archives of SOLIS spectra and (with great caution) MWO, USSR, etc. visual field strength measures.
 - Develop other indices more independent of observation quality (e.g. Pettis index?).

Some Respectful Suggestions - 3

- Encourage volunteer/amateur efforts!
 - A network of good CCD-equipped amateurs to collect highquality data?
 - A web-based effort to look at vast amounts of data or to get large number of estimates of subjective data?
- Preserve and curate raw data! (*c.f.* Waldmeier missing data; Naval Obs. plates)
- Collaborate with highly qualified statistician(s) to utilize most modern and powerful techniques.

Selected Quotes

- "We don't agree again! That does not surprise me."
- "It's only a factor of two --- close enough."
- "What is the difference between cycles 23 and 24? Fewer spots!"
- "Sunspot positions: Very boring work."
- "I have a high opinion of data."
- "No dataset is perfect."
- "It may look linear but really isn't."
- "You're verging on a technical assault."
- "The definition of pore has generated more heat than light."