2nd Sunspot Number Workshop

ROB, 21 – 25 May 2012

Summary

Frédéric Clette

SIDC – WDS Sunspot Index

Royal Observatory of Belgium

A workshop series: primary goals

- **Focus: the sunspot number series**
  - Longest direct record of solar activity.
  - Primary reference for long-term studies (solar cycle, dynamo, space climate, irradiance)
- **Goals:**
  - **Identification of long-term scaling biases and trends in the SSN**
  - Improved **understanding of parallel indirect solar activity indices**:
    - Geomagnetic indices (aa)
    - Cosmogenic Isotopes
    - More recent solar indices: $F_{10.7}$, sunspot area, CaII-K plage, R_A
  - **Diagnostic of recent anomalies in solar indices** > key to past problems
- **Attendance:**
  - Limited to 30 – 40 participants (on invitation): key specialists

    ⇒ Maximal interaction: ample time for discussions
  - **"Observers":** solar physicists from other domains:
    - P. Judge, H.S.Hudson, N.Crosby, L. van Driel-Gesztelyi. G. de Toma, R.Brajsa

SSN workshop: chronology

- Initiated by Ed Cliver (NSO), Frédéric Clette (ROB) and Leif Svalgaard (Standford)
- Informal organization:
  - no association with a project > no specific funding
  - Support by hosting institute
  - Large flexibility and freedom in meeting planning and content
- **1st SSN workshop**: NSO – Sunspot, Sacramento Peak, NM, September 2011
- **2 or 3 future workshops**:
  - NSO, Tucson, January 2013
  - Specola Solare Ticinese, Locarno, September 2013
- Cycle completion:
  - All results published as a coherent **set of papers in a special journal issue** (Solar Physics?)
  - **Publication of a new sunspot number time series** with corrected trends and biases (next to the original series as produced by Zürich).

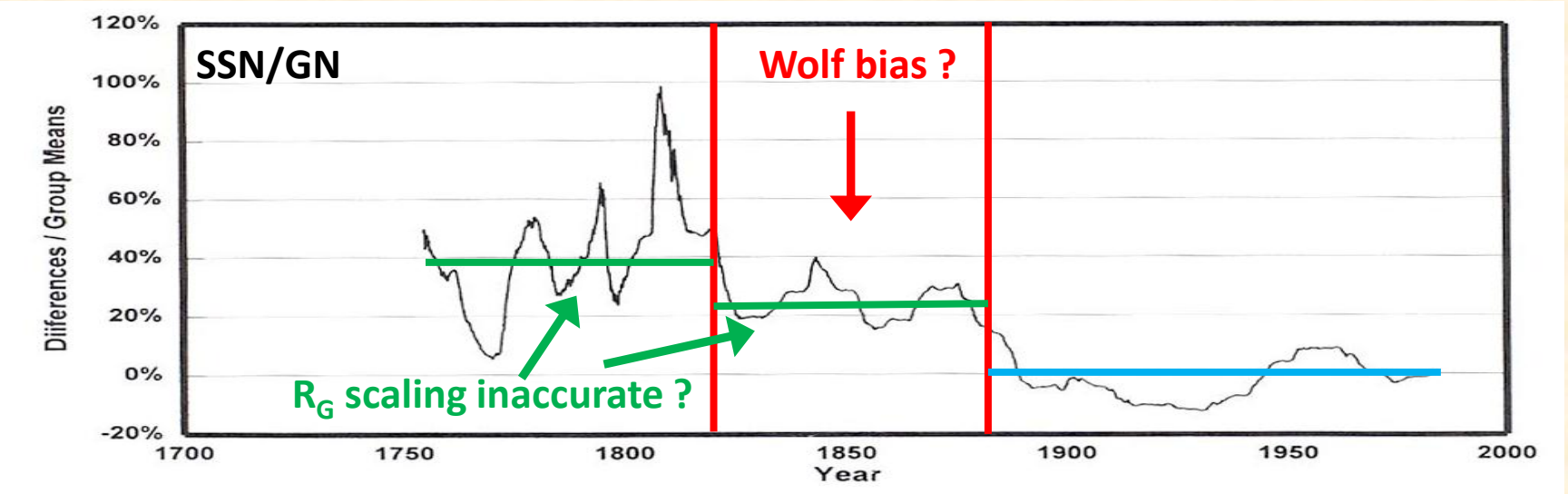
SSN Workshop 1: Sac Peak

Credit line: *Dave Dooling, NSO/AURA/NSF*

SSN Workshop 2: ROB, Brussels

Key issues and themes

- **Reconciling the SSN and the Group number** *(Hoyt & Schatten, 1998)*: the 1882 transition, a 25% discrepancy
  - Trends in the early part of the **RGO photographic data** *(Hathaway, Willis)*
  - **Bias in the K personal coefficients** established for the Group number before 1870 *(Schatten, Svalgaard)*
  - **Wolf corrections** to the Zürich SSN **based on the magnetic needle** (geomagnetism)
  - **Trends in the Earth geomagnetic field** *(Cnossen, Rouillard, Svalgaard, Mursula*) **and cosmogenic isotope proxies** (*Usoskin)*

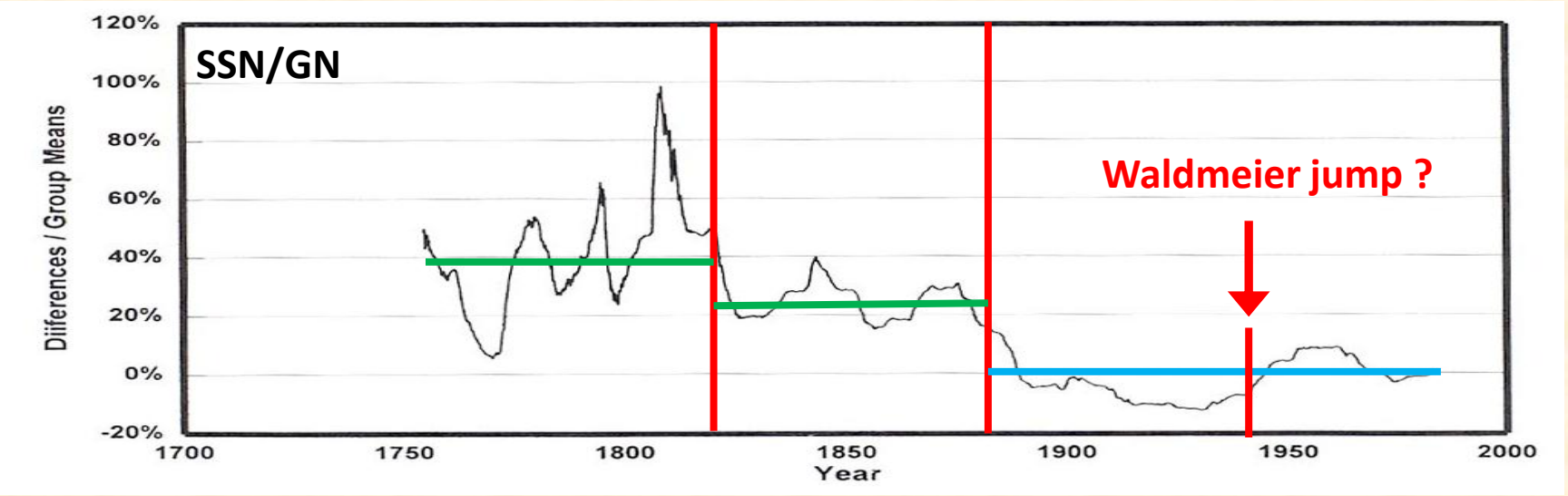


Key issues and themes

- **Contemporary Group number reconstruction**: variable relation Group number and SSN *(Clette & Wauters)*

- **The 1945 "Waldmeier jump"** (15% rise of the SSN):
  - Introduction of a **weighting according to spot size** by Brunner (~1928)

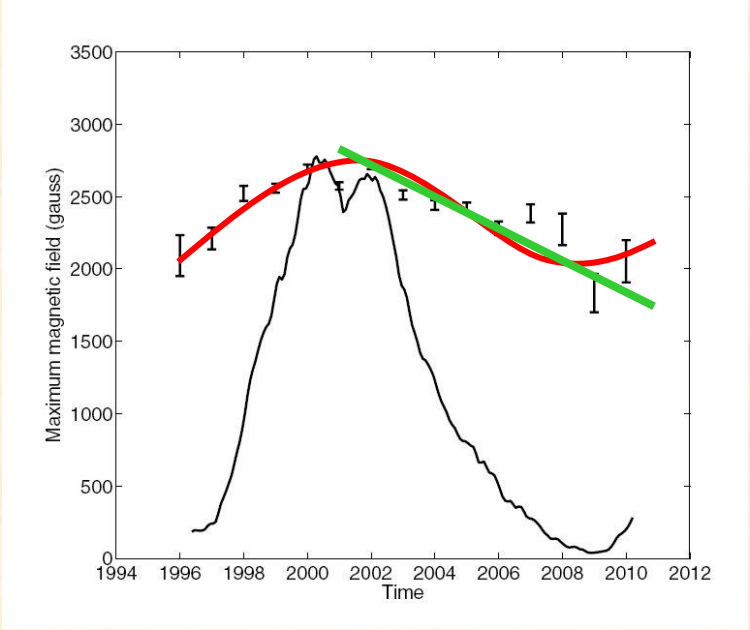
    ➡ Another cause for the 1945 "jump" ?
  - **Study of current practices** *(T. Friedli, M. Cagnotti)*: + 15 to 20% excess



Key issues and themes

- Current knowledge of the **calibration of other long-term solar indices (20th century)**:
  - Variable uncertainty in the **$F_{10.7cm}$ radio flux** *(Tapping, White)*
  - Calibrating the Mount-Wilson **CaII-K plage index** and **sunspot areas** *(Foukal, Bertello, Tlatov, Pevtsov, Hathaway)*
  - The other sunspot indices: **Boulder SSN** *(Biesecker)*, **AAVSO R_A** *(Howe)* + statistical cross-relations: SVD/PCA approaches *(Dudok de Wit, Riggs)*

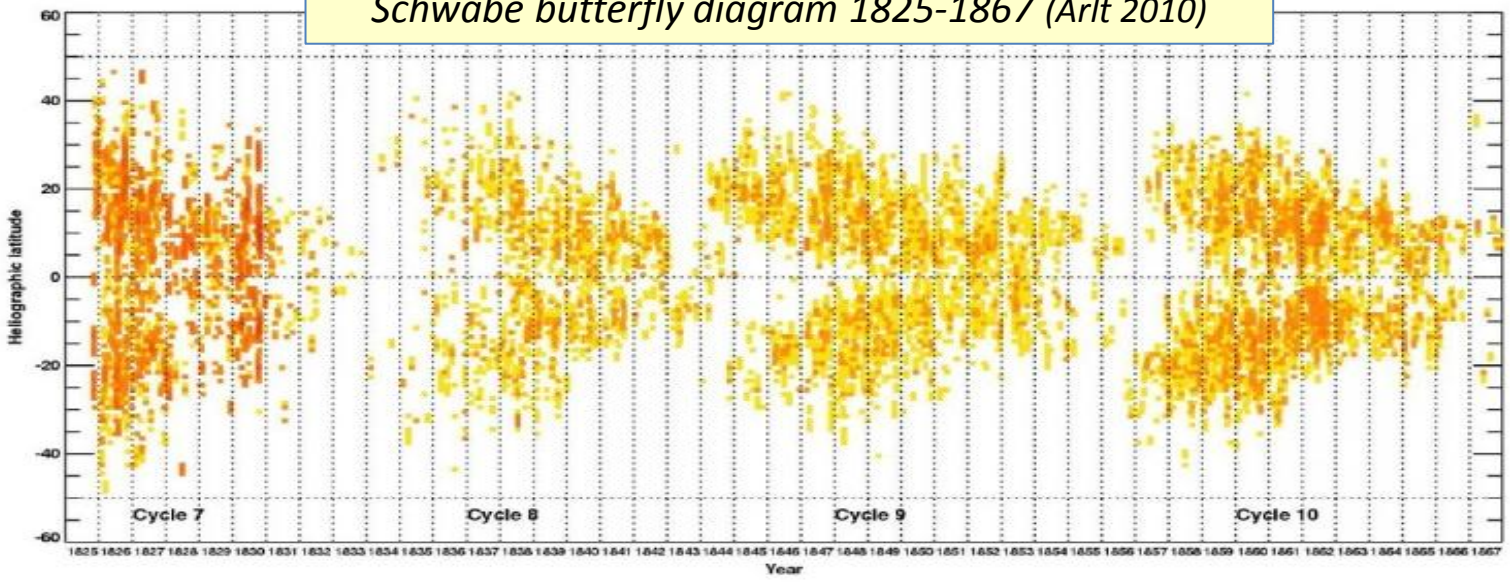
- **Recent solar 23 anomalies: the Penn-Livingston effect** (vanishing sunspot magnetic fields):
  - Contradictory evidence: **continuous trend** *(Penn, Livingston)* **or solar cycle modulation** *(Watson & Fletcher)*
  - **Small-scale sunspot deficit** *(Clette & Lefèvre, Kilcik, de Toma)*



Key issues and themes

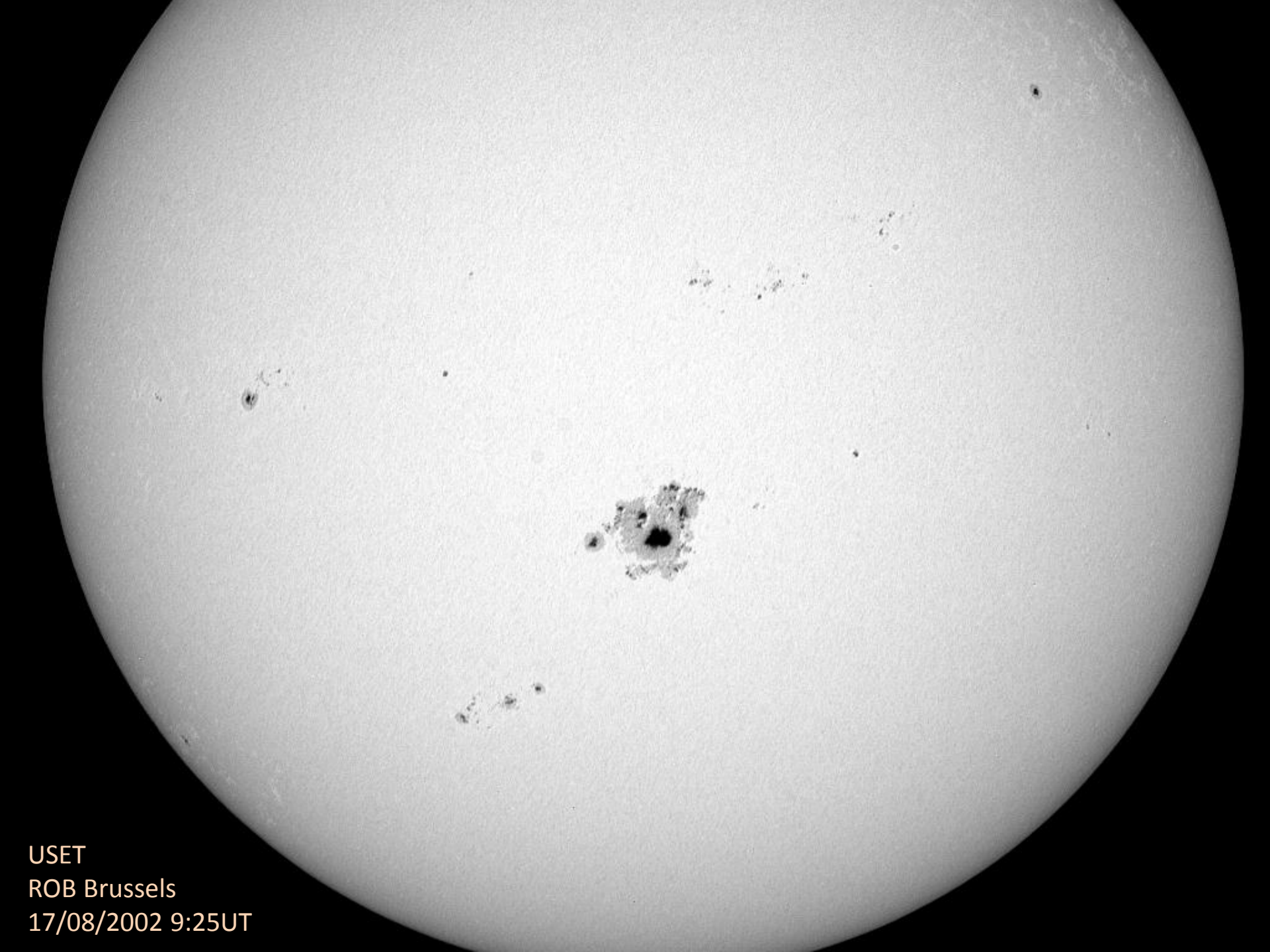
- **Recovery of new historical observations**:
  - Carrington *(Cliver)*
  - Staudacher, Schwabe, Spörer *(Arlt)*
  - Spanish observers and pre-18th century observations *(Vaquero)*
  - "Live" diagnostic of past counting methods

Schwabe butterfly diagram 1825-1867 (Arlt 2010)



Emerging outcomes

- Over just 8 months, **clear progress** in our understanding of the long-term scaling of the SSN.
- **Tighter community links**: new exchanges and common work spawned by the SSN Workshops.
- Need of publishing a **single "state-of-the-art" series of sunspot number**:
  - Agreement on the most reliable calibration by all specialists.
- Need to **recover unexploited information in historical observations**:
  - Zürich drawings and raw reports (microfilm)
  - RGO plates and catalog
  - Digitization and measurements of other sunspot drawing collections
- Reviving the emphasis on solar synoptic observations:
  - A.Pevtsov (NSO): since 2011, new **IAU Working Group on Coordination of synoptic observations of the Sun** *(http://www4.nso.edu/staff/apevtsov/IAU-Com12/main/)*
- **Synergies with current activities**:
  - ISSI workshop *("Long-term Reconstruction of Solar and Solar Wind Parameters", May 2012)*
  - COST-ES1005 TOSCA *("Towards a more complete assessment of the impact of solar variability on the Earth's climate", www.cost-tosca.eu)*
- ***SSN workshops WEB SITE: http://ssnworkshop.wikia.com/wiki/Home***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