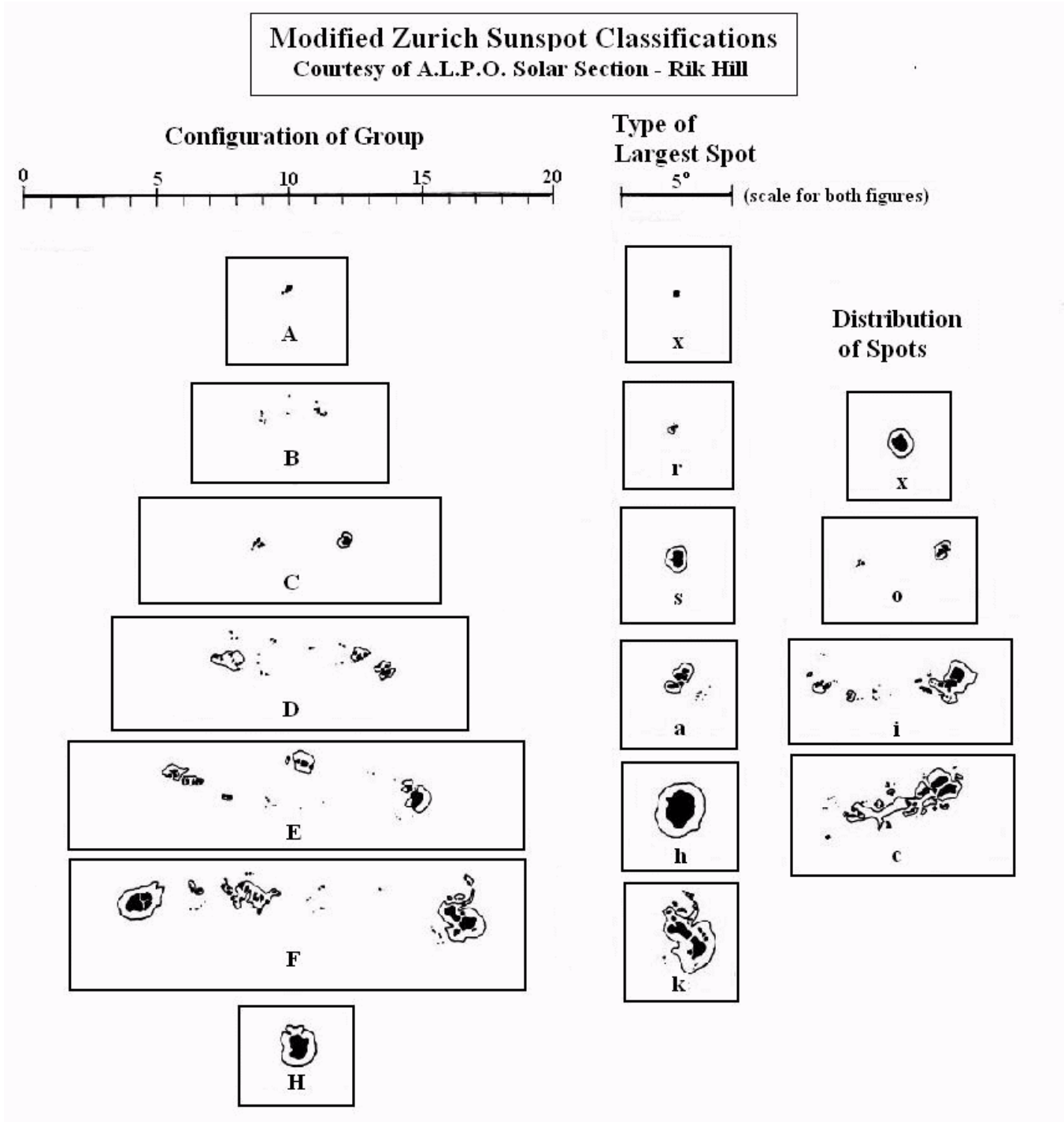
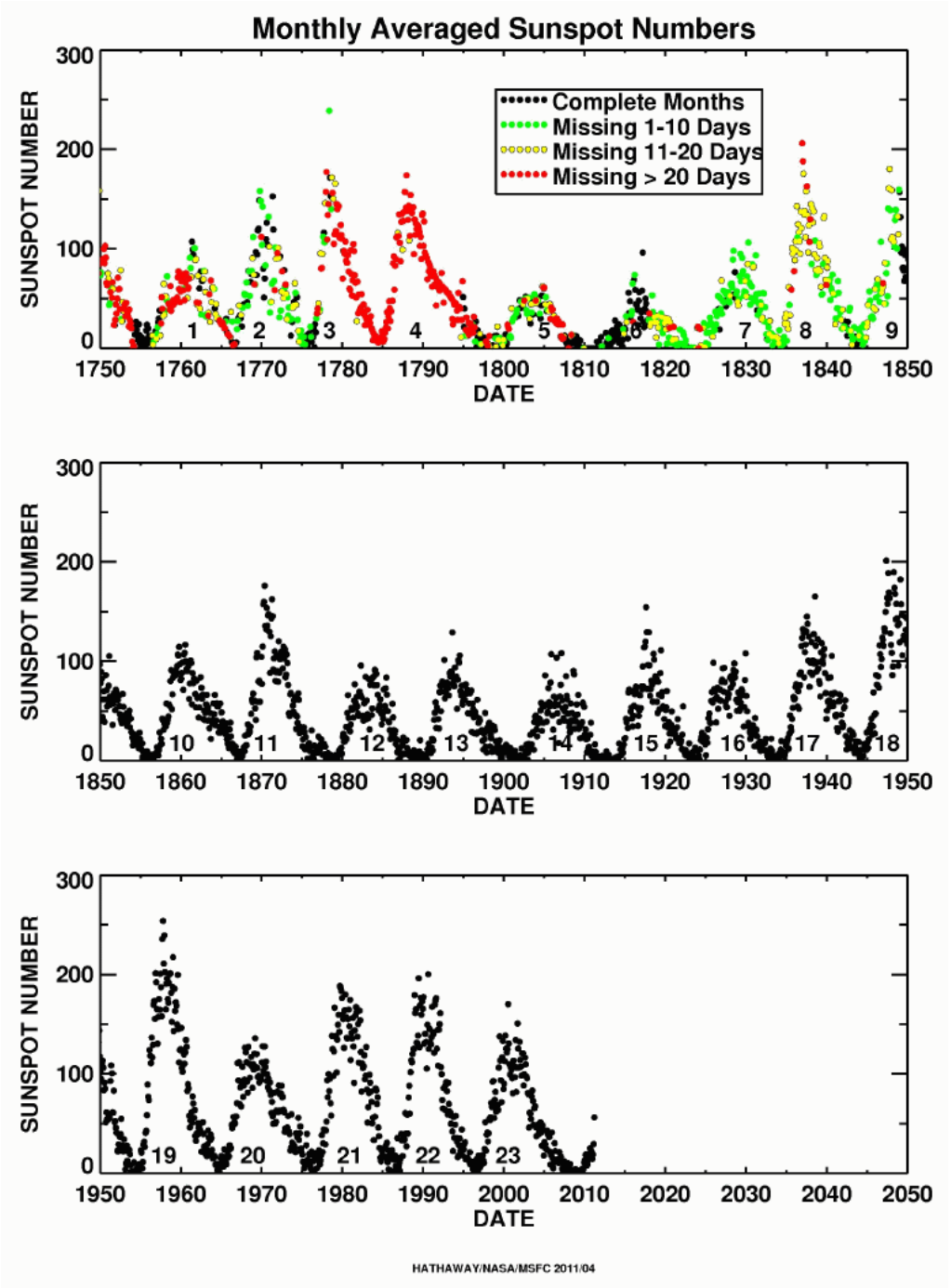
A. Kilcik, V. B. Yurchyshyn, A. Ozguc, and J. P. Rozelot

Modified Zurich Sunspot Classifications

Courtesy of A.L.P.O. Solar Section - Rik Hill




Monthly Averaged Sunspot Numbers
SUNSPOT NUMBER
DATE
Complete Months
Missing 1-10 Days
Missing 11-20 Days
Missing > 20 Days
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
HATHAWAY/NASA/MSFC 2011/04

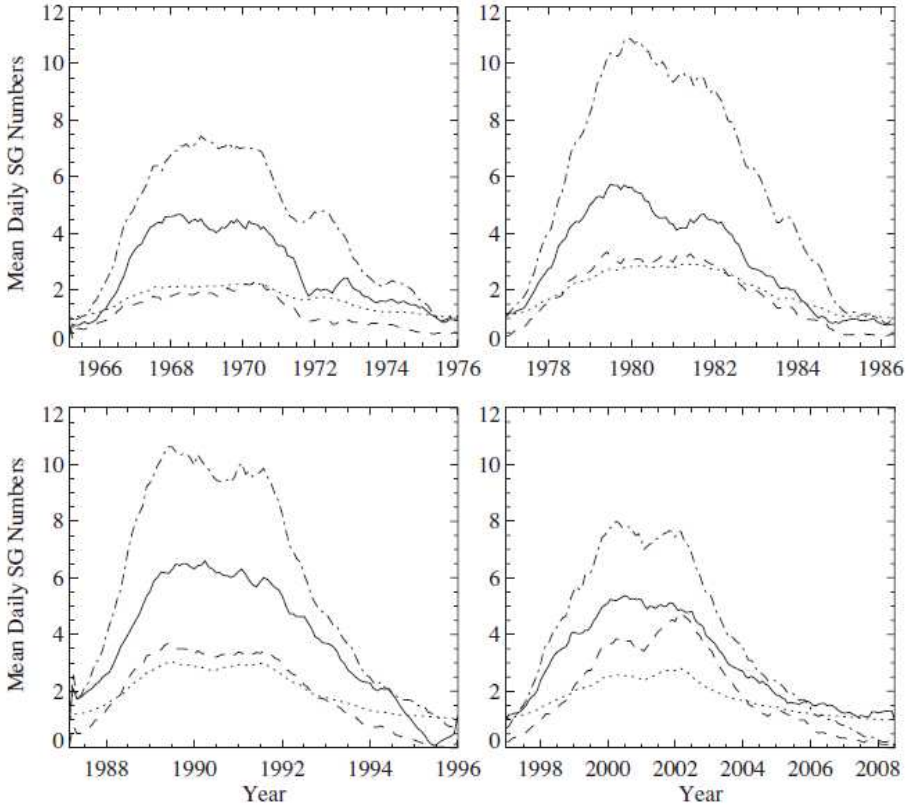


Figure 3. Solar cycle variations of selected parameters smoothed with a 12 step running average filter. For display purposes, the ISSN and 10.7 cm solar radio data were re-scaled: the ISSN was divided by 15, while the F10.7 cm radio flux is divided by 700. The solid (dashed) line represents small (large) SG numbers, the dashed-dotted line the ISSN, and the dotted line represents the F10.7 radio flux.

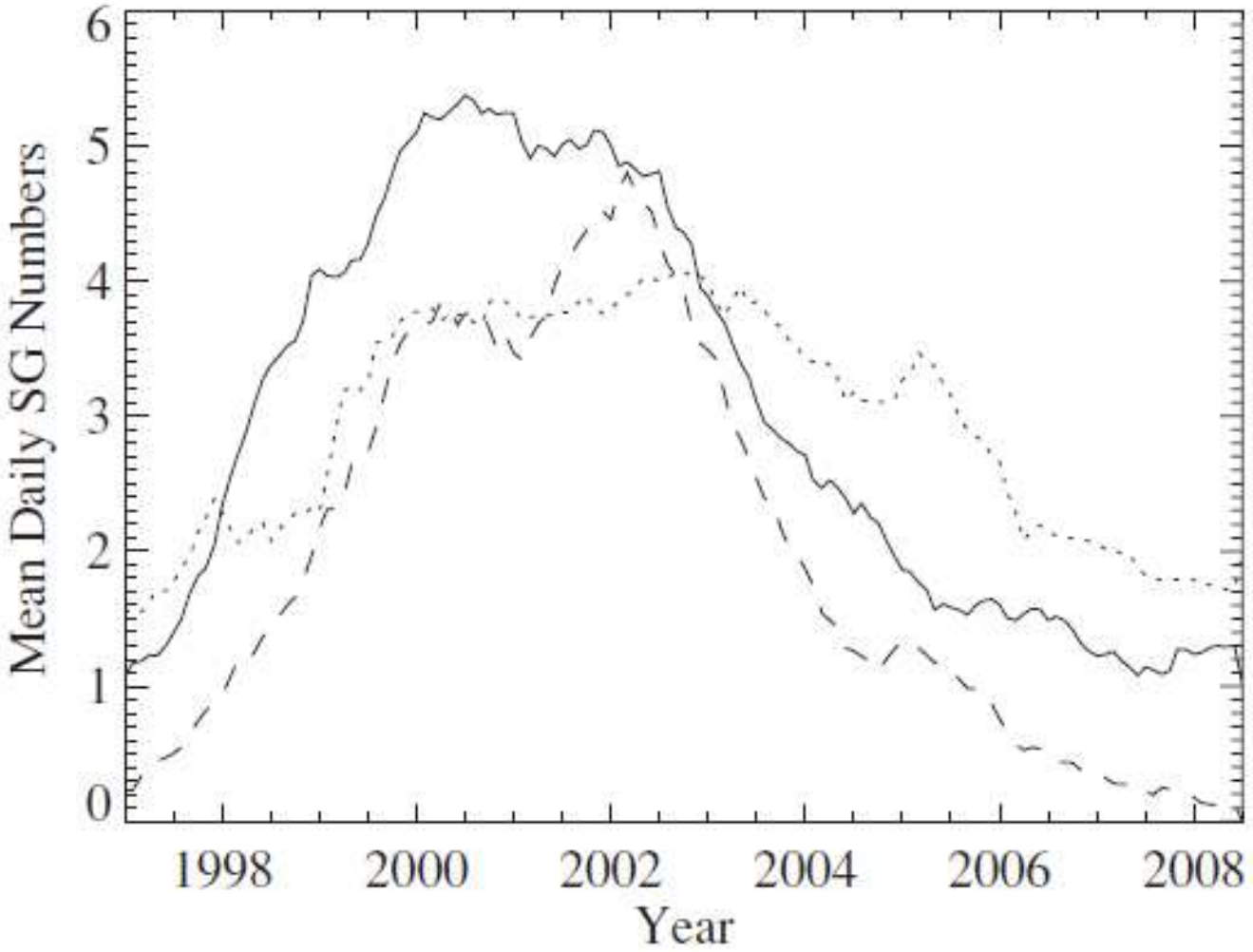


Figure 5. Solar cycle variations of the monthly maximum CME speed (dotted line), large (dashed line) and small (solid) SG numbers. All data were smoothed with a 12 step running average filter. For display purposes CME speed data are re-scaled by dividing by 200.

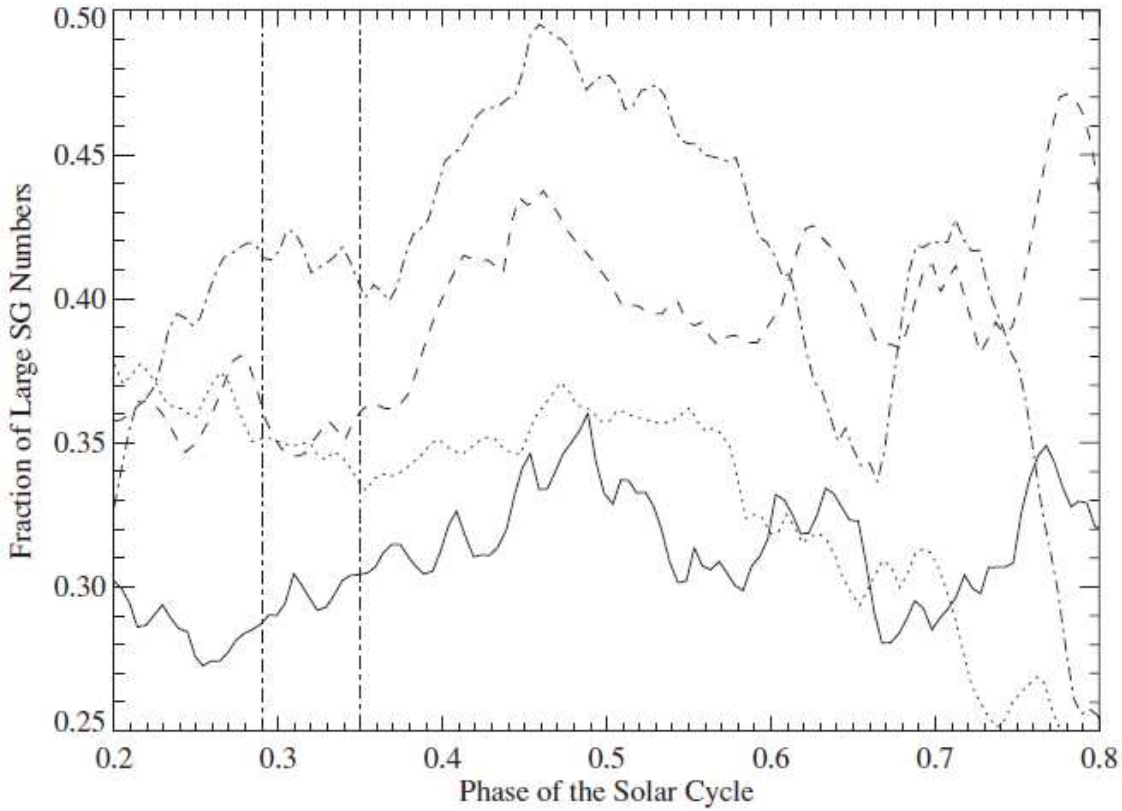


Figure 8. Ratio of the large SG number to the total number of all active regions (i.e., sum of small and large SG numbers) plotted vs. the solar cycle phase. The solid line is cycle 20, the dashed line is cycle 21, the dotted line is cycle 22, and the dashed dotted line is cycle 23. Vertical lines indicate the range of the maximum phase of the ISSN determined for the four studied solar cycles.

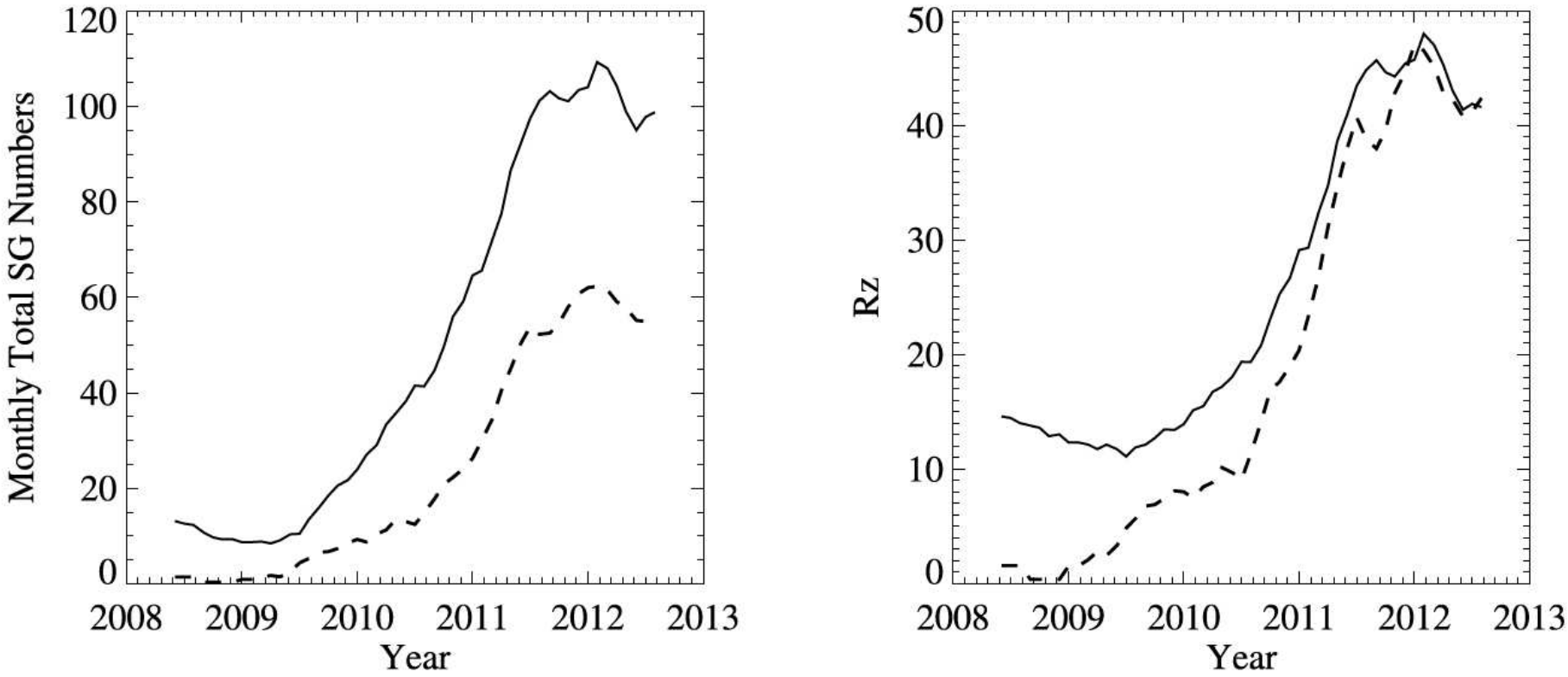
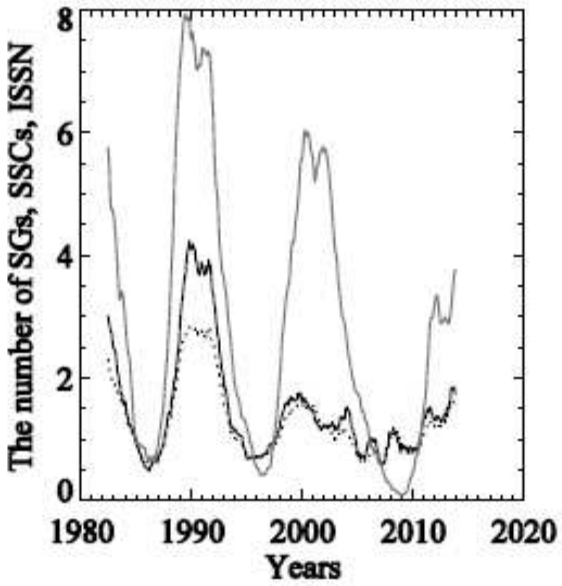
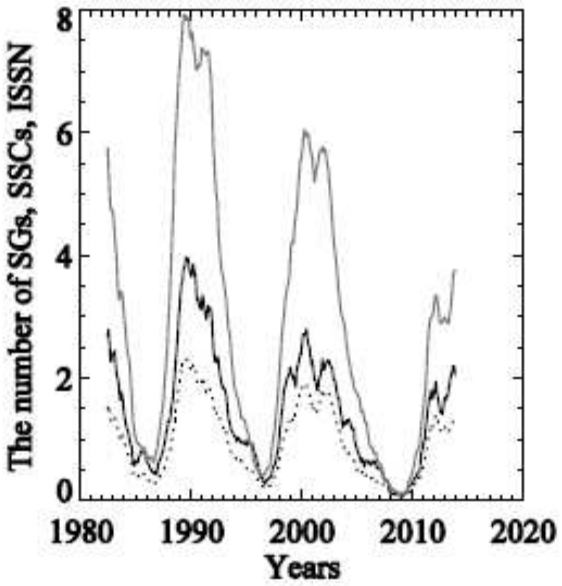
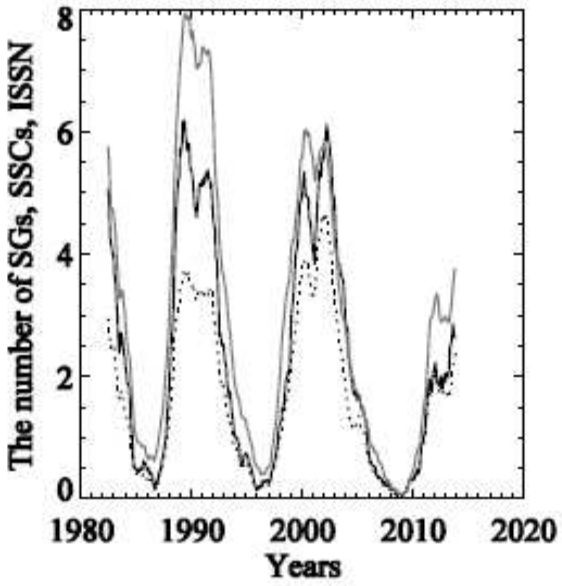
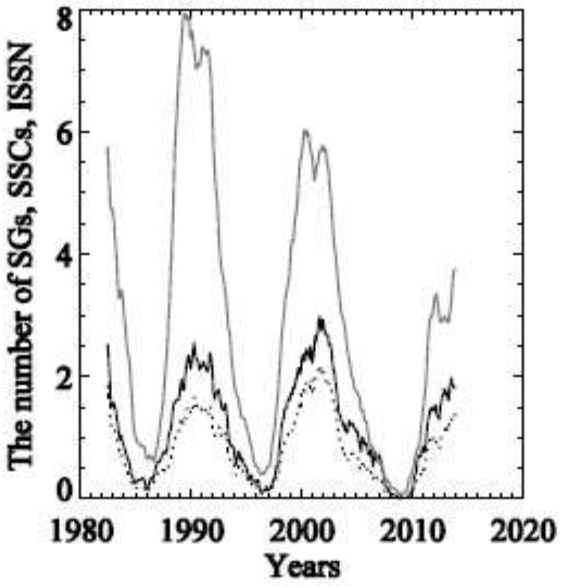


Figure 1 Temporal variation of monthly total large (dashed) and small (solid) SG numbers (left panel) and calculated daily average *Rz* for each class (right panel). The data smoothed by a 12-step running-average smoothing method. Here we did not take into account the correction factor given in Equation (1).


The number of SGs, SSCs, ISSN
0
2
4
6
8
1980
1990
2000
2010
2020
Years


The number of SGs, SSCs, ISSN
0
2
4
6
8
1980
1990
2000
2010
2020
Years


The number of SGs, SSCs, ISSN
0
2
4
6
8
1980
1990
2000
2010
2020
Years


The number of SGs, SSCs, ISSN
0
2
4
6
8
1980
1990
2000
2010
2020
Years

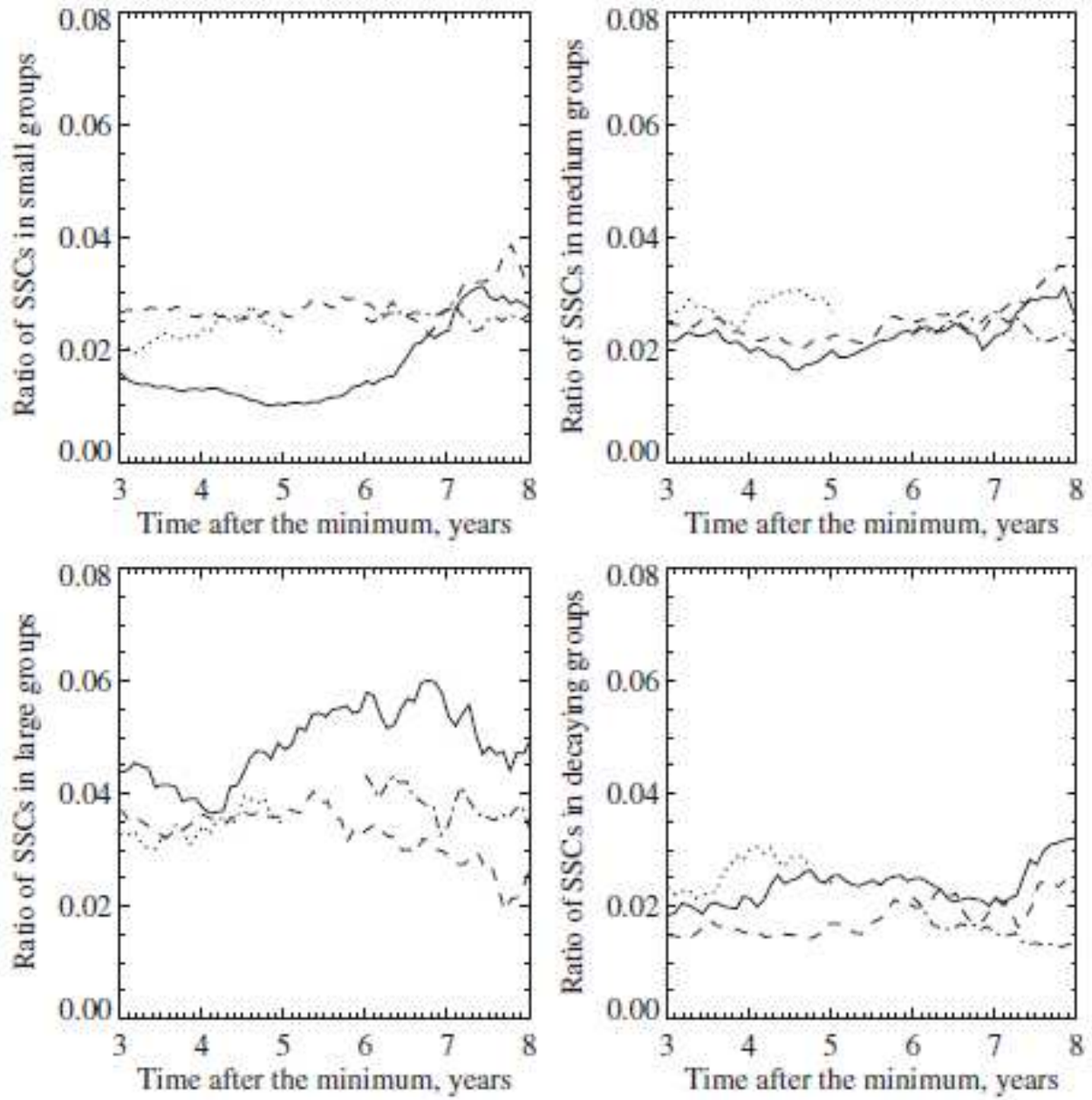


Figure 3. Ratio of the SSCs for each type of sunspot group to the smoothed monthly mean ISSNs plotted for a 5 yr interval starting at year 3 after the solar minimum. Clockwise from the upper left: the ratio for the simple, medium, decaying, and large sunspot group counts. The dashed-dotted/dashed/solid/dotted curves plot the ratio for cycles 21, 22, 23, and 24, correspondingly.

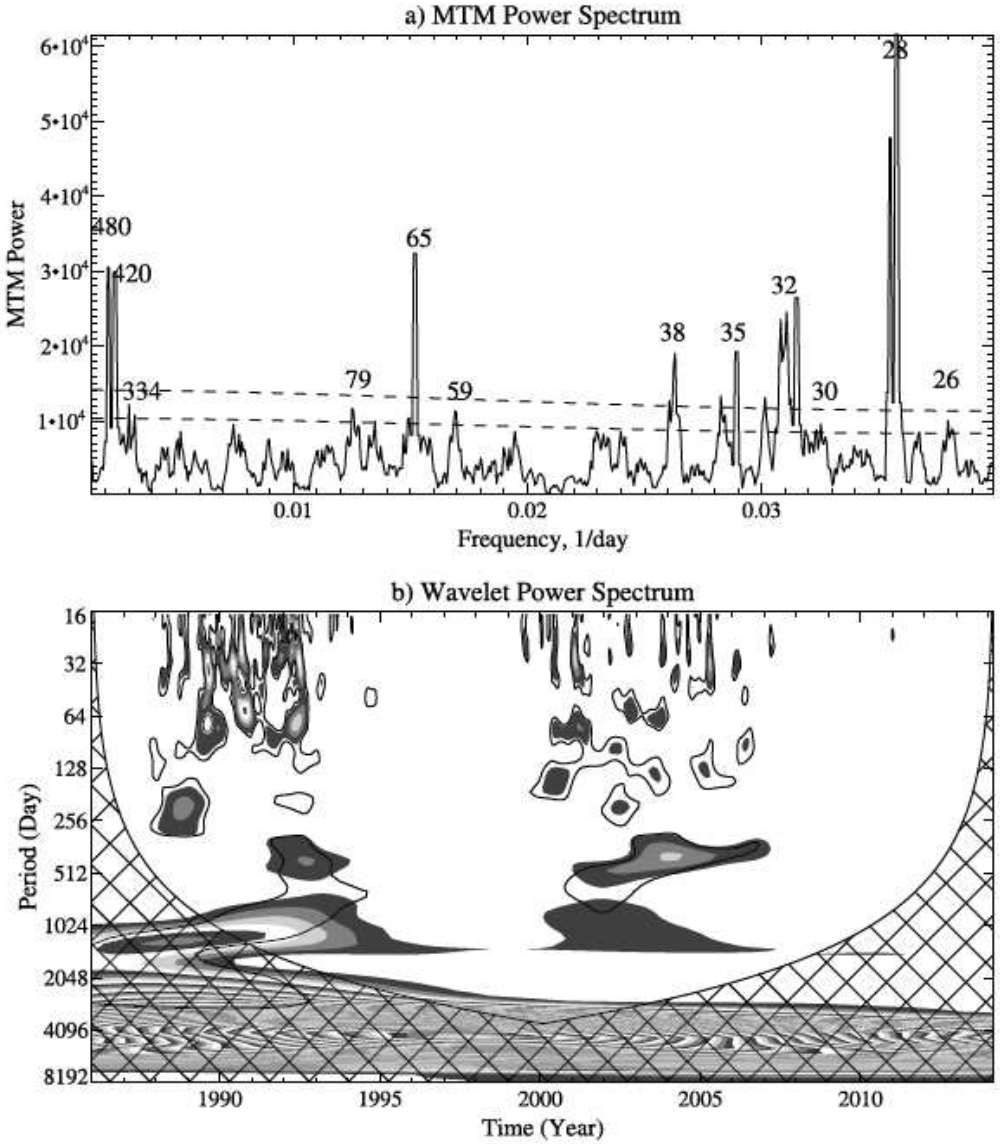


Figure 3 (a) and (b) analysis of cycle periods using the MTM and the Morlet wavelet method, respectively, for the daily sunspot counts in large groups. The data extend from January 1986 to October 2013. The black contours in the wavelet scalogram (b) indicate a 90 % confidence level and the hatched area below the thin black line is the cone of influence (COI). Numbers close to the peaks in (a) show the value of periods in days. The horizontal dashed lines indicate 95 % and 99 % confidence levels of the MTM power spectrum.

Table 1 Periods obtained for different groups using the MTM. The first column corresponds to the obtained periods and the rest of the columns show the presence of these periods in all groups by means of their significance levels. The numbers between parentheses show the closest values in the other groups.

Period (day)	Simple groups	Medium groups	Large groups	Final groups
480	+ > 99	–	+ > 99	+ > 95 (496)
420	+ > 95	–	+ > 99	+ > 99
315 – 348	–	+ > 95 (348)	+ > 95 (334)	+ > 99 (315)
213	–	+ > 95	–	–
168	+ > 99	–	–	+ > 99
129	+ > 95	–	–	–
112	+ > 95 (109)	–	–	+ > 95
100	+ > 95 (97)	+ > 95	–	+ > 95
79 – 74	+ > 99	+ > 95	+ > 95	–
65	+ > 95	+ > 99 (63)	+ > 99	–
51 – 59	+ > 95 (55, 59)	+ > 95 (54, 51)	+ > 95 (59)	+ > 95 (55)
48	–	+ > 99	–	+ > 95
41	–	–	–	+ > 99
25 – 37	+ > 95	+ > 95	+ > 95	+ > 95