**GROUP SUNSPOT NUMBERS: FILE DESCRIPTIONS**

1. OVERVIEW (*This write-up is based on original text provided by D.V. Hoyt*)

This file documents on all the files associated with the construction of the Group Sunspot Numbers (*Rg*) as provided by D.V. Hoyt. *Rg* values were derived to provide a homogeneous record of solar activity from 1610 to 1995. Care was taken that the long-term changes are more self-consistent than are the changes using the Wolf Sunspot Numbers. Procedures used to develop this dataset are described in Hoyt and Schatten [*1998*]. The files can be grouped to five categories as listed below. More descriptive filenames are currently used although references to the original filenames are parenthetically included in the current filenames. The file contents and formats are unchanged. (WFD, 21Aug13)

1.a. Daily input data:

“*group-sunspot-numbers\_raw-daily-input-data(alldata)*”

Raw daily input data for 463 observers.

“*group-sunspot-numbers\_fill-daily-input data(filldata)*”

Raw daily data with some missing days filled by linear interpolation.

1.b. Daily value and means:

“*group-sunspot-numbers\_daily-values(dailyrg)*”

Daily values of the Group Sunspot Numbers (*Rg*)for 1610 to 1995.

“*group-sunspot-numbers\_monthly-means(monthrg)*”

Monthly means of *Rg* with the number of days used to form the means and the standard deviation of the means.

“*group-sunspot-numbers\_yearly-means(yearrg)*”

Yearly means of *Rg* with the number of days used to form the means and the standard deviation of the means.

1.c. Standard deviations:

“*group-sunspot-numbers\_standard-deviation\_daily-values(dailysd)*”

Daily standard deviations of *Rg* for 1610 to 1995. These numbers represent the random errors in the daily means.

“*group-sunspot-numbers\_standard-deviation\_monthly-means(monthsd)*”

Monthly means of daily standard deviations as listed in dailysd.

“*group-sunspot-numbers\_standard-deviation\_yearly-means(yearsd)*”

Yearly means of monthly standard deviations as listed in monthsd.

1.d. Number of observations:

“*group-sunspot-numbers\_number-of-observers\_daily-values(dailynum)*”

Daily average number of observations per day used in forming the daily means.

“*group-sunspot-numbers\_number-of-observers\_monthly-means(monthnum)*”

Monthly average number of observations per day used in forming the daily means.

“*group-sunspot-numbers\_number\_of-observers\_yearly-means(yearnum)*”

Yearly average number of observations per day used in forming the daily means.

1.e. Documentation files:

“*group-sunspot-numbers\_inventory-of-observers(invent)*”

An inventory file listing the observer number, his observation year, and number of days of observations.

“*group-sunspot-numbers\_listing-of-observers(list1)*”

A summary of the 463 observers used to reconstruct solar activity.

“*group-sunspot-numbers\_bibliography(bibliogr)*”

A bibliography listing the literature source of each observer used along with appropriate comments. Also listed are some observers identified but not used for one reason or another.

“*group-sunspot-numbers\_observer-correction-factors(alllevel)*”

A list of the calculated observer correction factors used to place the observer on the Royal Greenwich Observatory (RGO) scale. These factors make all the observers as self-consistent as possible.

The next few sections give more information on the files, such as their formats.

2. INPUT FILES – File Contents and Formats

2a. alldata – Tables of raw daily number of groups by each observer.

Sample: The data are grouped in the form of observer years and a sample table for 1830 is shown below:

NUMBER OF SUNSPOT GROUPS FOR THE YEAR: 1830

AS OBSERVED BY: SCHWABE, H., DESSAU

Day Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

---------------------------------------------------------------

1 -99 -99 5 -99 7 2 5 -99 -99 5 -99 -99

2 -99 3 7 4 -99 2 4 -99 -99 -99 -99 -99

3 -99 4 8 7 5 2 4 -99 4 5 5 -99

4 -99 -99 7 7 3 2 4 -99 4 6 5 -99

5 -99 -99 5 7 3 5 5 -99 -99 6 6 -99

6 -99 -99 -99 6 -99 5 4 -99 -99 -99 5 -99

7 -99 -99 4 8 4 5 -99 -99 5 6 6 -99

8 -99 -99 4 7 4 5 -99 -99 -99 3 -99 -99

9 2 -99 6 -99 -99 5 -99 -99 3 4 -99 4

10 2 8 8 7 -99 6 -99 -99 -99 3 -99 4

11 -99 -99 -99 8 5 4 -99 -99 4 5 5 7

12 -99 7 -99 -99 6 3 -99 -99 -99 6 5 -99

13 3 7 8 6 6 3 -99 -99 -99 7 8 4

14 -99 7 -99 -99 -99 4 -99 -99 4 8 8 -99

15 -99 -99 7 7 7 5 -99 -99 4 -99 5 -99

16 -99 -99 7 -99 -99 5 -99 -99 5 -99 4 -99

17 -99 5 -99 6 -99 -99 -99 -99 5 5 -99 -99

18 -99 -99 -99 7 3 4 -99 -99 6 7 6 -99

19 -99 4 -99 5 6 -99 -99 -99 4 10 -99 6

20 4 4 -99 5 5 4 -99 2 5 5 -99 6

21 2 5 -99 7 4 4 -99 2 5 7 5 6

22 -99 3 4 -99 4 5 -99 3 3 8 6 4

23 3 -99 4 -99 4 5 -99 3 3 -99 5 6

24 0 4 -99 12 4 6 -99 3 4 -99 5 6

25 2 -99 -99 11 4 5 -99 3 4 4 5 -99

26 3 4 -99 9 4 4 -99 4 4 -99 -99 -99

27 2 5 3 -99 4 5 -99 4 3 4 -99 4

28 -99 5 -99 8 6 5 -99 5 2 -99 -99 6

29 -99 -99 6 9 3 5 -99 5 -99 5 -99 -99

30 2 -99 7 8 2 5 -99 6 -99 5 -99 -99

31 3 -99 -99 -99 1 -99 -99 6 -99 5 -99 6

means: 2.3 5.0 5.9 7.3 4.3 4.3 4.3 3.8 4.1 5.6 5.5 5.3

*Format:* The first line is blank. At the end of the second line, the year is specified. The third line gives the observer name and his location. The fourth line is blank. The fifth line gives the names of the months and the sixth line is a divider. The next 31 lines give the day of the month followed by the number of reported sunspot groups. The table is followed by a blank line and then the monthly means.

If a day was not observed, the fill value of -99 is used. If the monthly mean cannot be formed, a fill value of -9. is used. There are 3010 consecutive tables in *alldata*. A sample portion of the Fortran code to read them is:

do 2000 kk = 1,3010

read(5,99,end=999) dummy

read(5,100) iyear

99 format(a79)

100 format(47x,i4)

read(5,101) name

101 format(23x,a30)

read(5,99) dummy

read(5,99) dummy

read(5,99) dummy

do 2 i = 1, 31

read(5,102) iday(i),(array(i,j),j=1,12)

102 format(i6,12i5)

2 continue

read(5,99) dummy

read(5,103) (mnmeans(j), j=1,12)

103 format(6x,12f5.1)

2000 continue

999 continue

*Comments:* This format was chosen to make the data easy to read by people, even though it is not a compact format.

2b. filldata – The raw daily data with some missing days filled by linear interpolation.

Sample: The raw observation table is shown below as it appears after filling some missing days:

NUMBER OF SUNSPOT GROUPS FOR THE YEAR: 1830

AS OBSERVED BY: SCHWABE, H., DESSAU

Day Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

---------------------------------------------------------------

1 -99 3 5 5 7 2 5 -99 5 5 5 -99

2 -99 3 7 4 6 2 4 -99 4 5 5 -99

3 -99 4 8 7 5 2 4 -99 4 5 5 -99

4 -99 -99 7 7 3 2 4 -99 4 6 5 -99

5 -99 -99 5 7 3 5 5 -99 4 6 6 -99

6 -99 -99 4 6 3 5 4 -99 4 6 5 -99

7 -99 -99 4 8 4 5 -99 -99 5 6 6 -99

8 -99 -99 4 7 4 5 -99 -99 4 3 5 -99

9 2 -99 6 7 4 5 -99 -99 3 4 5 4

10 2 8 8 7 4 6 -99 -99 3 3 5 4

11 2 7 8 8 5 4 -99 -99 4 5 5 7

12 2 7 8 7 6 3 -99 -99 4 6 5 5

13 3 7 8 6 6 3 -99 -99 4 7 8 4

14 -99 7 7 6 6 4 -99 -99 4 8 8 4

15 -99 6 7 7 7 5 -99 -99 4 7 5 4

16 -99 5 7 6 5 5 -99 -99 5 6 4 5

17 -99 5 6 6 4 4 -99 -99 5 5 5 5

18 -99 4 6 7 3 4 -99 -99 6 7 6 5

19 -99 4 5 5 6 4 -99 -99 4 10 5 6

20 4 4 5 5 5 4 -99 2 5 5 5 6

21 2 5 4 7 4 4 -99 2 5 7 5 6

22 2 3 4 8 4 5 -99 3 3 8 6 4

23 3 3 4 10 4 5 -99 3 3 6 5 6

24 0 4 3 12 4 6 -99 3 4 5 5 6

25 2 4 3 11 4 5 -99 3 4 4 5 5

26 3 4 3 9 4 4 -99 4 4 4 -99 4

27 2 5 3 8 4 5 -99 4 3 4 -99 4

28 2 5 4 8 6 5 -99 5 2 4 -99 6

29 2 -99 6 9 3 5 -99 5 3 5 -99 6

30 2 -99 7 8 2 5 -99 6 4 5 -99 6

31 3 -99 6 -99 1 -99 -99 6 -99 5 -99 6

means: 2.3 5.0 5.9 7.3 4.3 4.3 4.3 3.8 4.1 5.6 5.5 5.3

*Format:* The format is identical to that of *alldata*.

*Comments:* The numbers listed above are the number of groups the observer (here Schwabe) reported each day. The format was chosen to make the data easy to read by people, even though it is not a compact format.

3. VALUES and MEANS – File Contents and Formats

3a. dailyrg – Daily values of the Group Sunspot Numbers, *Rg*, for 1610 to 1995.

Sample: A sample output table is listed below:

GROUP SUNSPOT NUMBERS FOR THE YEAR: 1830

AS OBSERVED BY: 10 OBSERVERS

Day Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

---------------------------------------------------------------

1 53 38 81 74 99 26 68 20 95 76 66 -99

2 46 44 95 79 84 26 63 20 92 73 66 -99

3 40 47 117 108 62 19 63 16 62 75 71 -99

4 33 71 92 106 40 37 58 39 62 75 72 -99

5 26 75 61 117 52 69 66 40 62 84 84 49

6 26 75 52 90 63 55 51 40 91 76 84 49

7 26 75 62 97 59 55 30 55 112 71 95 49

8 34 89 62 99 63 63 30 69 89 62 94 49

9 31 89 83 89 64 72 37 61 46 61 94 62

10 33 89 113 94 64 55 58 55 49 62 77 77

11 45 99 113 113 69 45 65 49 53 79 69 71

12 42 99 119 128 81 39 46 52 59 85 85 71

13 43 99 125 98 86 52 44 28 59 104 107 64

14 49 96 117 86 81 65 44 26 59 114 40 64

15 55 87 108 92 88 70 27 4 53 108 40 58

16 61 69 104 42 69 70 50 24 55 83 56 72

17 76 67 98 36 67 59 32 20 72 85 72 72

18 49 58 90 57 55 58 20 28 55 100 63 77

19 32 55 71 72 56 56 14 28 67 81 77 86

20 54 54 70 72 75 53 14 31 54 80 77 80

21 28 58 50 110 52 52 15 26 42 89 77 63

22 7 40 55 114 52 32 15 39 46 116 85 62

23 0 39 46 136 52 57 34 40 49 119 77 76

24 0 53 44 145 59 65 42 46 49 84 72 85

25 15 49 43 144 59 73 33 40 39 83 77 85

26 16 48 47 143 59 69 33 53 20 76 98 47

27 28 72 49 139 53 83 47 59 40 83 115 47

28 25 76 66 129 34 76 26 77 34 77 115 85

29 25 -99 87 130 20 75 20 72 47 72 -99 84

30 25 -99 90 105 8 76 20 83 62 77 -99 85

31 35 -99 90 -99 19 -99 14 86 -99 66 -99 98

means: 34. 68. 81. 101. 59. 57. 38. 43. 59. 83. 79. 69.

*Format:* The format is very close to that used by *alldata* and *filldata* except the number of observers used for the year replaces the individual observer's name and the monthly mean.

File format: (i6,12f5.0)

Missing daily or monthly means have a fill value of -99. The code to read *alldata* may be used with these small changes made.

*Comments:* Here is a copy of the abstract of Hoyt and Schatten [*1998*] which summarizes the dataset: "Abstract. In this paper, we construct a time series known as the Group Sunspot Number. The Group Sunspot Number is more internally self-consistent and less noisy then the Wolf Sunspot Number. It uses the number of sunspot groups observed, rather than groups and individual sunspots. Daily, monthly, and yearly means are derived from 1610 to the present. The Group Sunspot Numbers use 65,941 observations from 117 observers active before 1874 that were not used by Wolf in constructing his time series. Hence, we have calculated daily values of solar activity on 111,358 days for 1610-1995, compared to 66,168 days for the Wolf Sunspot Numbers. The Group Sunspot Numbers have estimates of their random and systematic errors tabulated. The generation and preliminary analysis of the Group Sunspot Numbers allow us to make several conclusions: 1) Solar activity before 1882 is lower than generally assumed and consequently solar activity in the last few decades is higher than it has been for several centuries, 2) There was a solar activity peak in 1801 and not 1805 so there is no long anomalous cycle of 17 years as reported in the Wolf Sunspot Numbers. The longest cycle now lasts no more than 15 years. 3) The Wolf Sunspot Numbers have many inhomogeneities arising from observer noise which affects the daily, monthly and yearly means. The Group Sunspot Numbers also have observer noise, but it is considerably less than the noise in the Wolf Sunspot Numbers."

Users are cautioned that the observations before 1653 are not very reliable and should be used with caution.

There are 386 tables from 1610 to 1995 in *dailyrg*.

3b. monthrg – Monthly means of *Rg* with the number of days used to form the means and the standard deviation of the means.

Sample: Here is a sample portion of the file:

1830 1 31 34.1 17.2

1830 2 28 68.2 19.9

1830 3 31 80.6 26.1

1830 4 30 101.5 29.1

1830 5 31 59.5 20.3

1830 6 30 56.7 16.5

1830 7 31 38.0 17.6

1830 8 31 42.8 20.7

1830 9 30 59.1 19.9

1830 10 31 83.1 15.4

1830 11 28 78.8 18.3

1830 12 27 69.1 14.6

File format: (i5,2i3,2f8.1)

The file gives the year, the number of the month from 1 to 12, the monthly mean, and the standard deviation of the monthly mean. The standard deviation represents the variability in the Group Sunspot Numbers and not their uncertainty.

*Comments:* The file has 4632 lines.

3c. yearrg – Yearly means of *Rg* *with the number of days used to form the means and the standard deviation of the means [TBD?].*

Sample: Here is a sample portion of the file:

1825 14.4

1826 28.6

1827 44.4

1828 57.0

1829 59.2

1830 64.3

1831 39.2

1832 22.7

1833 6.5

1834 9.8

Data format:(i6,f7.1)

The first column gives the year and the second column gives the yearly mean Group Sunspot Number formed by averaging the monthly means.

*Comments:* The file contains 386 lines.

4. STANDARD DEVIATIONS – File Contents and Formats

4a. *dailysd* – Contains daily standard deviations of the Group Sunspot Numbers for 1610 to 1995. These numbers represent the random errors in the daily means.

Sample:

DAILY STANDARD DEVIATIONS FOR THE YEAR: 1830

AS OBSERVED BY: 10 OBSERVERS

Day Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

---------------------------------------------------------------

1 26 5 15 9 2 3 3 3 16 5 6 -99

2 0 3 9 19 2 3 3 3 8 1 6 -99

3 0 8 17 20 16 8 3 0 5 6 1 -99

4 4 1 18 13 5 6 2 4 5 12 0 -99

5 2 3 11 14 11 4 6 7 5 2 0 0

6 2 9 5 7 3 7 6 7 9 9 0 0

7 2 9 5 19 1 7 3 5 4 10 6 0

8 2 7 5 2 3 3 3 3 10 6 21 0

9 3 7 1 9 8 0 6 11 4 5 21 5

10 5 10 5 8 6 7 3 5 6 6 6 10

11 4 3 5 5 4 17 6 0 6 6 3 1

12 13 2 3 23 7 5 13 5 1 3 12 1

13 0 3 11 15 1 17 28 6 1 7 8 5

14 9 16 21 1 6 10 28 2 1 14 11 5

15 0 15 9 13 7 4 15 8 6 9 11 0

16 0 3 7 9 3 4 34 0 7 1 5 0

17 0 7 8 17 7 1 16 3 0 12 0 0

18 0 2 7 12 7 2 3 4 7 15 3 4

19 0 4 1 0 12 5 2 4 13 22 6 1

20 5 5 13 0 6 6 2 2 25 6 6 10

21 0 19 8 6 5 5 1 3 9 10 6 3

22 9 5 12 2 5 4 0 5 4 4 3 5

23 0 3 10 13 5 12 2 5 0 18 6 15

24 0 5 3 27 1 4 9 4 0 12 0 3

25 1 0 5 17 1 2 3 5 4 1 4 18

26 3 9 3 11 1 8 3 6 5 8 0 15

27 0 10 6 12 6 9 2 1 5 1 0 15

28 5 5 6 17 2 4 2 6 2 6 0 3

29 5 -99 6 20 5 4 3 0 3 0 -99 2

30 5 -99 16 9 14 13 3 1 5 6 -99 3

31 11 -99 18 -99 6 -99 2 1 -99 6 -99 10

means: 3.5 6.9 9.1 12.2 6.0 6.7 7.4 4.3 6.3 7.9 5.8 5.4

*Format:* The format is identical to that of *dailyrg*.

*Comments:* The file contains 386 tables from 1610 to 1995. The daily standard deviations provide a measure of how well the daily means are formed. Typically the ratio of the standard deviation to the mean is about 12% which gives a measure of the uncertainty in the daily values.

4b. monthsd – Monthly means of the daily standard deviations in *dailysd*.

Sample:

1830 1 25 3.5 3.7

1830 2 28 6.9 4.6

1830 3 31 9.1 5.3

1830 4 30 12.2 7.0

1830 5 31 6.0 3.7

1830 6 30 6.7 4.3

1830 7 31 7.4 8.5

1830 8 31 4.3 2.7

1830 9 30 6.3 5.3

1830 10 31 7.9 5.2

1830 11 28 5.8 5.7

1830 12 27 5.4 5.6

File format: (i5,2i3,2f8.1)

The file gives the year, the number of the month from 1 to 12, the monthly mean standard deviation and the standard deviation of the monthly mean standard deviation. The monthly mean standard deviations (column 4) provide a measure of the variability of solar activity for that month.

*Comments:* The file has 4632 lines.

4c. yearsd – Yearly means of monthly standard deviations in *monthsd*.

Sample:

1825 2.9

1826 5.1

1827 6.4

1828 8.4

1829 6.5

1830 6.8

1831 5.7

1832 3.8

1833 1.0

1834 1.2

File format:(i6,f7.1)

The first column gives the year and the second column gives the average yearly Group Sunspot Number standard deviations (from monthsd.dat) formed by averaging the monthly means. The numbers provide a rough measure of the day-to-day variability of the sun each year.

*Comments:* The file contains 386 lines.

5. NUMBER OF OBSERVATIONS

5a. dailynum

Contents: The daily average number of observations per day used in forming the daily means.

Sample:

NUMBER OF OBSERVERS EACH DAY FOR THE YEAR: 1830

AS OBSERVED BY: 10 OBSERVERS

Day Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

---------------------------------------------------------------

1 0 3 3 3 3 2 2 2 3 3 2 0

2 0 3 3 3 3 2 2 2 3 3 2 0

3 0 3 4 4 4 3 2 1 2 3 2 0

4 0 2 4 4 2 2 3 2 2 4 2 0

5 2 2 3 4 2 2 3 2 2 3 2 1

6 2 2 3 3 2 2 3 2 2 3 2 1

7 2 2 2 3 2 2 2 2 2 3 3 1

8 2 2 2 3 2 2 2 2 2 3 2 1

9 4 2 2 2 2 2 2 2 2 4 2 2

10 4 2 2 3 3 2 2 2 3 3 2 2

11 2 2 2 2 2 2 2 2 2 3 2 2

12 2 3 2 3 3 3 2 2 2 2 2 2

13 1 2 2 2 2 3 2 2 2 3 2 2

14 0 3 2 2 4 2 2 2 2 3 2 2

15 0 4 2 2 3 3 2 3 2 2 2 1

16 1 3 3 2 3 3 2 1 2 2 3 1

17 1 4 4 2 3 2 2 2 2 3 2 1

18 1 3 3 2 2 3 2 2 2 3 2 2

19 1 4 2 2 3 3 2 2 2 2 2 2

20 3 3 3 2 3 2 2 2 2 3 2 2

21 2 3 3 3 3 3 2 2 2 3 2 2

22 2 2 3 2 3 3 2 3 2 3 2 2

23 3 3 3 2 3 2 2 2 2 3 2 2

24 4 4 3 3 2 3 2 2 2 3 2 2

25 2 2 3 4 2 4 2 2 2 2 2 2

26 2 3 3 5 2 3 2 2 2 2 1 2

27 2 3 3 3 2 3 2 2 2 2 1 2

28 3 3 4 4 2 4 2 2 2 2 1 2

29 3 -99 4 4 2 5 2 2 3 2 0 3

30 3 -99 4 4 3 4 2 2 2 2 0 2

31 2 -99 4 -99 2 -99 2 2 -99 2 -99 2

means: 1.8 2.8 2.9 2.9 2.5 2.7 2.1 2.0 2.1 2.7 1.8 1.5

The file format is identical to that of *dailyrg*.

*Comments:* The file contains 386 tables from 1610 to 1995. The daily number of observations used to form the daily means in *dailyrg* are tabulated. A value of 0 means the daily mean was formed by interpolation.

5b. monthnum – Monthly average number of observations per day used in forming the daily means.

Sample:

1830 1 31 1.8 1.2

1830 2 28 2.8 .7

1830 3 31 2.9 .7

1830 4 30 2.9 .9

1830 5 31 2.5 .6

1830 6 30 2.7 .8

1830 7 31 2.1 .3

1830 8 31 2.0 .4

1830 9 30 2.1 .3

1830 10 31 2.7 .6

1830 11 30 1.8 .6

1830 12 31 1.5 .8

File format: (i5,2i3,2f8.1)

The file gives the year, the number of the month from 1 to 12, the daily mean number of observations for that month, and the standard deviation of the column 4 means. The monthly means provide a measure of how actively the sun was observed each month.

*Comments:* The file has 4632 lines.

5c. yearnum – Yearly average number of observations per day used in forming the daily means.

Sample:

1825 2.7

1826 2.6

1827 2.8

1828 2.9

1829 2.7

1830 2.3

1831 2.3

1832 2.9

1833 2.8

1834 2.5

File format:(i6,f7.1)

The first column gives the year and the second column gives the average yearly number of observations made each day for that year. The numbers provide a measure of how actively the sun was observed each year.

*Comments:* The file contains 386 lines.

6. DOCUMENTATION

6a. invent - An inventory file listing the observer number, his observation year and number of days of observations.

Sample:

1174 1830 209 SCHWABE, H., DESSAU

1175 1830 10 SCHWARZENBRUNNER, KREMS.

1176 1830 44 ARAGO, F.D., PARIS

1177 1830 11 TEVEL, C., MIDDELBURG

1178 1830 5 FLAUGERGUES, H., VIVIERS

1179 1830 206 HUSSEY, T.J., ENGLAND

1180 1830 2 STARK, AUGSBURG, ZERO DAYS

1181 1830 66 STARK, J.M., AUGSBURG

1182 1830 165 PASTORFF, J.W., DROSSEN

1183 1830 171 PASTORFF/WOLF, DROSSEN

File format: (2i5,i6,a30)

The first column is the observer number from 1 to 3010, the second column is the year of observation, the third column is the number of observations made that year, and the last column is the name and location of the observer.

*Comments:* This file provides an inventory of the observations in *alldata*. There are 3010 lines in this file.

6b. list1 – A summary of the 463 observers used to reconstruct solar activity.

Sample:

274 1822 1837 122 HERSCHEL, J., LONDON

275 1823 1823 9 LORENZ, WITTENBURG

276 1823 1824 16 BIELA, J., PRAGUE

277 1825 1830 364 SCHWARZENBRUNNER, KREMS.

278 1825 1826 183 VON BOTH, G., BRESLAU

279 1826 1867 11945 SCHWABE, H., DESSAU

280 1826 1837 1207 HUSSEY, T.J., ENGLAND

281 1826 1826 1 BEAUFOY, G., BUSHEY HEATH

282 1831 1832 200 LAWSON, H., HEREFORD

283 1832 1832 39 RUPRECHT, H., ZIEGENHAIN

File format:(i8,2i5,i6,a30)

The first column gives the observer number from 1 to 463, the second and third columns give the first and last years of observations by that observer, the fourth column lists the total number of observations by that observer and the last column gives the name and location of the observer.

*Comments:* There are 463 lines in this file and at the end is appended the grand total of the number of observations; i.e., "Grand total of observations = 455242 455242", which were summed two different ways.

6c. bibliogr – A bibliography listing the literature source of each observer along with appropriate comments. Also listed are some observers identified but not used for one reason or another.

Format: This a free form text document meant to be read by a person instead of a computer.

*Comments:* The references are reasonably complete but not fully, particularly for some of the earlier papers. These omissions arise because the bibliography was constructed rather late in the project. The omissions are felt to be minor and should not hinder one in locating the source material.

6d. *allevel* – A list of the calculated observer correction factors used to place the observer on the Royal Greenwich Observatory (RGO) scale. These factors make all the observers as self- consistent as possible.

Sample:

274 1.203 .017 5 HERSCHEL, J., LONDON

275 1.073 .098 4 LORENZ, WITTENBURG

276 1.064 .064 6 BIELA, J., PRAGUE

277 1.280 .089 6 SCHWARZENBRUNNER, KREMS.

278 1.121 .091 6 VON BOTH, G., BRESLAU

279 1.208 .058 9 SCHWABE, H., DESSAU

280 1.365 .042 7 HUSSEY, T.J., ENGLAND

281 1.255 .112 1 BEAUFOY, G., BUSHEY HEATH

282 1.528 .112 3 LAWSON, H., HEREFORD

283 1.027 .139 2 RUPRECHT, H., ZIEGENHAIN

File format: (i5,2f8.3,i5,a30)

The first column gives the observer number, the second column gives the multiplying factor by which observations must be multiplied to put him on the same scale as RGO, the third column provides the one standard deviation of this correction factor, the fourth column provides the number of pathways used to derive the correction factor, and last column gives the observer's name and location.

*Comments:* There are 463 lines in this file.

REFERENCES

Here are list of references to papers written about this project. The first paper provides the best overview of the methods and results.

Hoyt, D.V. and K.H. Schatten (1998), Group Sunspot Numbers: A New Solar Activity Reconstruction, *Solar Physics, 181*, pp. 491-512.

Hoyt, D.V. and K.H. Schatten (1996), How well was the Maunder Minimum observed? *Solar Physics, 165*, 181-192.

Hoyt, D.V. and K.H. Schatten (1995), Overlooked sunspot observations by Hevelius in the early Maunder Minimum – 1653-1684, *Solar Physics, 160*, 371-378.

Hoyt, D.V. and K.H. Schatten (1995), Observations of sunspots by Flamsteed during the Maunder Minimum, *Solar Physics, 160*, 379-385.

Hoyt, D.V. and K.H. Schatten (1995), A new interpretation of Christian Horrebow's sunspot observations from 1761 to 1777, *Solar Physics, 160*, 387-392.

Hoyt, D.V. and K.H. Schatten (1995), A revised listing of the number of sunspot groups made by Pastorff – 1819 to 1833, *Solar Physics, 160*, 393-399.

Hoyt, D.V. and K.H. Schatten (1995), A new reconstruction of solar activity based upon telescopic observations, IUGG Assembly,Boulder, CO.

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