

# Georgi Dobrovolski Solar Observatory

NEW ZEALAND

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## SUNSPOT RESULTS FOR **DECEMBER 2002**

All observations carried out by HOWARD BARNES.

Telescope : 76 mm refractor ( f.l. 910 mm ) k considered as 1.

Observed by PROJECTION . Full disc diameter = 145 mm approx .

WN = Wolf Number ; SN = Pettisindex ; BX = Beckindex ; CV = Classification Value ;

QC = Quality Count ; QC<sup>2</sup> = Squared Quality Count .

Q = Quietness [ ie. steadiness ] refer to Kiepenheuer scale .

S = Sharpness [ ie. clarity ] refer to Kiepenheuer scale .

T = Transparency where 1 = excellent , 5 = worthless .

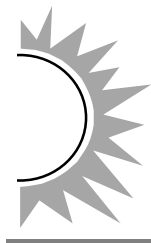
| DATE | UT*  | g    | f     | WN    | p    | s    | SN    | BX     | CV    | QC    | QC <sup>2</sup> | Q    | S    | T    | Ref. |
|------|------|------|-------|-------|------|------|-------|--------|-------|-------|-----------------|------|------|------|------|
| 01   | 2000 | 6    | 36    | 96    | 12   | 17   | 137   | 730    | 101   | 18    | 66              | 2.0  | 2.5  | 2.5  | 4194 |
| 02   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 03   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 04   | 2125 | 7    | 40    | 110   | 11   | 20   | 130   | 789    | 129   | 24    | 96              | 2.0  | 2.5  | 2.5  | 4195 |
| 05   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 06   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 07   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 08   | 2115 | 12   | 25    | 145   | 13   | 10   | 140   | 427    | 143   | 29    | 81              | 1.5  | 2.0  | 2.0  | 4196 |
| 09   | 2055 | 10   | 43    | 143   | 14   | 15   | 155   | 742    | 144   | 29    | 91              | 2.0  | 2.5  | 2.0  | 4197 |
| 10   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 11   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 12   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 13   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 14   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 15   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 16   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 17   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 18   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 19   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 20   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 21   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 22   | 2140 | 6    | 41    | 101   | 15   | 16   | 166   | 992    | 165   | 25    | 113             | 2.0  | 2.5  | 2.5  | 4198 |
| 23   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 24   | 1910 | 5    | 11    | 61    | 6    | 4    | 64    | 153    | 64    | 13    | 39              | 2.0  | 2.5  | 2.5  | 4199 |
| 25   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 26   | 1940 | 3    | 4     | 34    | 4    | 0    | 40    | 110    | 45    | 8     | 24              | 2.0  | 2.5  | 2.5  | 4200 |
| 27   |      |      |       |       |      |      |       |        |       |       |                 |      |      |      |      |
| 28   | 1935 | 4    | 5     | 45    | 2    | 3    | 23    | 61     | 23    | 7     | 15              | 1.5  | 2.5  | 2.0  | 4201 |
| 29   | 2000 | 4    | 14    | 54    | 5    | 8    | 58    | 188    | 55    | 11    | 35              | 1.5  | 2.0  | 2.0  | 4202 |
| 30   | 2015 | 2    | 7     | 27    | 3    | 3    | 33    | 145    | 32    | 6     | 20              | 1.5  | 2.5  | 2.5  | 4203 |
| 31   | 1920 | 2    | 10    | 30    | 2    | 7    | 27    | 80     | 21    | 6     | 18              | 1.0  | 2.0  | 2.0  | 4204 |
| Σ    | —    | 61   | 236   | 846   | 87   | 103  | 973   | 4417   | 922   | 176   | 598             | 19.0 | 26.0 | 25.0 | —    |
| NOBS | —    | 11   | 11    | 11    | 11   | 11   | 11    | 11     | 11    | 11    | 11              | 11   | 11   | 11   | —    |
| MNS  | —    | 5.55 | 21.45 | 76.91 | 7.91 | 9.36 | 88.45 | 401.55 | 83.82 | 16.00 | 54.36           | 1.73 | 2.36 | 2.27 | —    |

MEAN WEIGHT = 0.4779

MEAN CONDITION = 2.1212

TRUNCATED WOLF NUMBER = 65.64

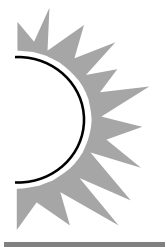
\* Stated times approximate Co-ordinated Universal Time / Temps Universel Coordonné (UTC).



**SUNSPOT DISTRIBUTION & INTER-SOL INDICES FOR  
DECEMBER 2002**

All observations carried out by HOWARD BARNES .  
 Telescope : 76 mm refractor ( f.l. 910 mm ) .  
 Observed by PROJECTION . Full disc diameter = 145 mm approx .  
 IS = Inter-Sol Index .  
 gr = number of multi-spot groups .  
 grfp = number of umbræ within penumbrae within the groups (gr) .  
 grf = number of non-penumbra spots within the groups (gr) .  
 efp = number of single penumbral spots .  
 ef = number of single non-penumbra spots .  
 Q = Quietness [ ie. steadiness ] refer to Kiepenheuer scale .  
 S = Sharpness [ ie. clarity ] refer to Kiepenheuer scale .  
 T = Transparency where 1 = excellent , 5 = worthless .

| DATE | UT   | IS    | gr   | grfp  | grf  | efp  | ef   | Q    | S    | T    | Ref. |
|------|------|-------|------|-------|------|------|------|------|------|------|------|
| 01   | 2000 | 40    | 4    | 18    | 16   | 1    | 1    | 2.0  | 2.5  | 2.5  | 4194 |
| 02   |      |       |      |       |      |      |      |      |      |      |      |
| 03   |      |       |      |       |      |      |      |      |      |      |      |
| 04   | 2125 | 46    | 6    | 20    | 19   | 0    | 1    | 2.0  | 2.5  | 2.5  | 4195 |
| 05   |      |       |      |       |      |      |      |      |      |      |      |
| 06   |      |       |      |       |      |      |      |      |      |      |      |
| 07   |      |       |      |       |      |      |      |      |      |      |      |
| 08   | 2115 | 30    | 5    | 10    | 8    | 5    | 2    | 1.5  | 2.0  | 2.0  | 4196 |
| 09   | 2055 | 51    | 8    | 26    | 15   | 2    | 0    | 2.0  | 2.5  | 2.0  | 4197 |
| 10   |      |       |      |       |      |      |      |      |      |      |      |
| 11   |      |       |      |       |      |      |      |      |      |      |      |
| 12   |      |       |      |       |      |      |      |      |      |      |      |
| 13   |      |       |      |       |      |      |      |      |      |      |      |
| 14   |      |       |      |       |      |      |      |      |      |      |      |
| 15   |      |       |      |       |      |      |      |      |      |      |      |
| 16   |      |       |      |       |      |      |      |      |      |      |      |
| 17   |      |       |      |       |      |      |      |      |      |      |      |
| 18   |      |       |      |       |      |      |      |      |      |      |      |
| 19   |      |       |      |       |      |      |      |      |      |      |      |
| 20   |      |       |      |       |      |      |      |      |      |      |      |
| 21   |      |       |      |       |      |      |      |      |      |      |      |
| 22   | 2140 | 46    | 5    | 24    | 16   | 1    | 0    | 2.0  | 2.5  | 2.5  | 4198 |
| 23   |      |       |      |       |      |      |      |      |      |      |      |
| 24   | 1910 | 14    | 3    | 6     | 3    | 1    | 1    | 2.0  | 2.5  | 2.5  | 4199 |
| 25   |      |       |      |       |      |      |      |      |      |      |      |
| 26   | 1940 | 5     | 1    | 2     | 0    | 2    | 0    | 2.0  | 2.5  | 2.5  | 4200 |
| 27   |      |       |      |       |      |      |      |      |      |      |      |
| 28   | 1935 | 6     | 1    | 1     | 1    | 1    | 2    | 1.5  | 2.5  | 2.0  | 4201 |
| 29   | 2000 | 17    | 3    | 6     | 7    | 0    | 1    | 1.5  | 2.0  | 2.0  | 4202 |
| 30   | 2015 | 8     | 1    | 3     | 3    | 1    | 0    | 1.5  | 2.5  | 2.5  | 4203 |
| 31   | 1920 | 12    | 2    | 3     | 7    | 0    | 0    | 1.0  | 2.0  | 2.0  | 4204 |
| Σ    | —    | 275   | 39   | 119   | 95   | 14   | 8    | 19   | 26   | 25   | —    |
| NOBS | —    | 11    | 11   | 11    | 11   | 11   | 11   | 11   | 11   | 11   | —    |
| MNS  | —    | 25.00 | 3.55 | 10.82 | 8.64 | 1.27 | 0.73 | 1.73 | 2.36 | 2.27 | —    |



**SUNSPOT CENSUS BY CLASSIFICATION FOR  
DECEMBER 2002**

All observations carried out by HOWARD BARNES.  
Telescope : 76 mm refractor ( f . l . 910 mm ).  
Observed by PROJECTION . Full disc diameter = 145 mm approx .  
IF 2 OR MORE REGIONS ARE OF THE SAME CLASSIFICATION , THEN SUNSPOT COUNTS  
ARE SEPARATED BY SOLIDI ( / ) .

| DATE   | UT   | A |     | B |   | C  |       | D  |        | E |      | F |   | G |   | H |   | J  |               |
|--------|------|---|-----|---|---|----|-------|----|--------|---|------|---|---|---|---|---|---|----|---------------|
|        |      | g | f   | g | f | g  | f     | g  | f      | g | f    | g | f | g | f | g | f | g  | f             |
| 01     | 2000 | 1 | 1   | 1 | 2 | 0  | 0     | 2  | 7/10   | 1 | 15   | 0 | 0 | 0 | 0 | 0 | 0 | 1  | 1             |
| 02     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 03     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 04     | 2125 | 1 | 1   | 1 | 2 | 1  | 5     | 2  | 3/6    | 2 | 7/16 | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0             |
| 05     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 06     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 07     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 08     | 2115 | 2 | 1/1 | 0 | 0 | 3  | 2/3/4 | 2  | 3/6    | 0 | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 5  | 1/1/1/<br>1/1 |
| 09     | 2055 | 0 | 0   | 1 | 2 | 3  | 2/2/4 | 3  | 8/9/12 | 0 | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 3  | 1/1/2         |
| 10     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 11     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 12     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 13     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 14     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 15     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 16     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 17     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 18     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 19     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 20     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 21     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 22     | 2140 | 0 | 0   | 0 | 0 | 0  | 0     | 3  | 3/5/11 | 1 | 13   | 1 | 8 | 0 | 0 | 0 | 0 | 1  | 1             |
| 23     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 24     | 1910 | 1 | 1   | 0 | 0 | 2  | 2/3   | 1  | 4      | 0 | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 1  | 1             |
| 25     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 26     | 1940 | 0 | 0   | 0 | 0 | 0  | 0     | 1  | 2      | 0 | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 2  | 1/1           |
| 27     |      |   |     |   |   |    |       |    |        |   |      |   |   |   |   |   |   |    |               |
| 28     | 1935 | 2 | 1/1 | 0 | 0 | 1  | 2     | 0  | 0      | 0 | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 1  | 1             |
| 29     | 2000 | 1 | 1   | 0 | 0 | 2  | 2/3   | 1  | 8      | 0 | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0             |
| 30     | 2015 | 0 | 0   | 0 | 0 | 0  | 0     | 1  | 6      | 0 | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 1  | 1             |
| 31     | 1920 | 0 | 0   | 0 | 0 | 2  | 3/7   | 0  | 0      | 0 | 0    | 0 | 0 | 0 | 0 | 0 | 0 | 0  | 0             |
| TOTALS | —    | 8 | 8   | 3 | 6 | 14 | 44    | 16 | 103    | 4 | 51   | 1 | 8 | 0 | 0 | 0 | 0 | 15 | 16            |

REGIONAL PERCENTAGES

| A    | B   | C    | D    | E   | F   | G   | H   | J    | Σg |
|------|-----|------|------|-----|-----|-----|-----|------|----|
| 13.1 | 4.9 | 23.0 | 26.2 | 6.6 | 1.6 | 0.0 | 0.0 | 24.6 | 61 |

NOBS = 11

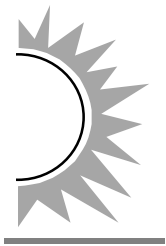
$\overline{p/g}$  mean = 1.3944

$\overline{f/g}$  mean = 3.7922

$\overline{p/g}$  mean = 1.4262

$\overline{f/g}$  mean = 3.8689

GROUP COMPLEXITY INDEX (GCI) = 5.2951



**SMOOTHED RESULTS OF OBSERVED VALUES FOR THE  
LAST 12 MONTHS (OBTAINABLE)  
USING THE WALDMEIER & BARNES-13 METHODS.**

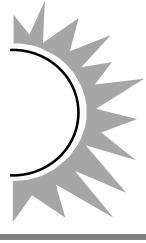
DATA BELOW ARE PRELIMINARY. FINAL VALUES WILL BE PUBLISHED IN THE GDSO ANNUAL REPORTS.

**WALDMEIER METHOD**

| <i>MONTH</i> | $g(S^W)$ | $WN(S^W)$ | $SN(S^W)$ | $BX(S^W)$ | $CV(S^W)$ | $QC(S^W)$ | $IS(S^W)$ |
|--------------|----------|-----------|-----------|-----------|-----------|-----------|-----------|
| 2001 JULY    | 8.80     | 142.89    | 175.64    | 1277.1    | 165.76    | 27.58     | 61.10     |
| AUGUST       | 8.94     | 145.63    | 180.81    | 1319.6    | 169.94    | 28.18     | 62.47     |
| SEPTEMBER    | 9.05     | 146.85    | 183.01    | 1317.4    | 171.83    | 28.54     | 62.71     |
| OCTOBER      | 9.12     | 147.40    | 184.28    | 1298.2    | 172.46    | 28.78     | 62.72     |
| NOVEMBER     | 9.34     | 151.25    | 189.72    | 1335.1    | 177.55    | 29.61     | 64.49     |
| DECEMBER     | 9.39     | 151.90    | 190.62    | 1344.3    | 180.28    | 29.78     | 64.61     |
| 2002 JANUARY | 9.32     | 152.68    | 193.33    | 1406.6    | 182.22    | 29.68     | 66.03     |
| FEBRUARY     | 9.35     | 156.18    | 199.58    | 1508.3    | 186.49    | 30.04     | 69.31     |
| MARCH        | 9.28     | 155.62    | 198.73    | 1505.9    | 185.22    | 29.81     | 69.44     |
| APRIL        | 9.15     | 153.37    | 196.02    | 1476.5    | 181.17    | 29.24     | 68.37     |
| MAY          | 9.03     | 151.55    | 195.32    | 1467.9    | 179.03    | 28.89     | 67.66     |
| JUNE         | 8.78     | 146.77    | 189.58    | 1420.1    | 173.86    | 28.11     | 65.19     |

**BARNES-13 METHOD**

| <i>MONTH</i> | $g(S^{B13})$ | $WN(S^{B13})$ | $SN(S^{B13})$ | $BX(S^{B13})$ | $CV(S^{B13})$ | $QC(S^{B13})$ | $IS(S^{B13})$ |
|--------------|--------------|---------------|---------------|---------------|---------------|---------------|---------------|
| 2001 JULY    | 8.84         | 142.43        | 175.08        | 1247.7        | 165.30        | 27.57         | 60.26         |
| AUGUST       | 9.06         | 147.06        | 182.12        | 1309.5        | 172.55        | 28.43         | 62.82         |
| SEPTEMBER    | 9.25         | 150.77        | 187.66        | 1355.9        | 178.21        | 29.16         | 64.86         |
| OCTOBER      | 9.33         | 152.58        | 190.50        | 1376.9        | 180.94        | 29.57         | 65.89         |
| NOVEMBER     | 9.42         | 154.21        | 193.31        | 1399.4        | 183.08        | 29.96         | 66.78         |
| DECEMBER     | 9.45         | 154.58        | 194.69        | 1404.9        | 183.77        | 30.15         | 66.82         |
| 2002 JANUARY | 9.42         | 154.17        | 195.39        | 1412.4        | 183.21        | 30.13         | 66.66         |
| FEBRUARY     | 9.36         | 153.64        | 195.76        | 1426.3        | 182.20        | 30.00         | 66.73         |
| MARCH        | 9.26         | 152.50        | 194.87        | 1426.0        | 180.44        | 29.69         | 66.49         |
| APRIL        | 9.19         | 152.11        | 195.10        | 1438.7        | 179.61        | 29.42         | 66.73         |
| MAY          | 9.10         | 151.78        | 195.65        | 1462.1        | 179.48        | 29.12         | 67.22         |
| JUNE         | 8.90         | 149.77        | 193.63        | 1473.0        | 177.57        | 28.48         | 67.06         |



**OBSERVED ANNUAL MEANS OF SUNSPOT DATA FOR  
2002**

All observations carried out by HOWARD BARNES .

Telescope : 76 mm refractor ( f.l. 910 mm ) .

Observed by PROJECTION . Full disc diameter = 145 mm approx .

Q = Quietness [ ie. steadiness ] refer to Kiepenheuer scale .

S = Sharpness [ ie. clarity ] refer to Kiepenheuer scale .

T = Transparency where 1 = excellent , 5 = worthless .

|                                     |   |         |
|-------------------------------------|---|---------|
| <i>g</i>                            | = | 8.57    |
| <i>f</i>                            | = | 58.60   |
| <b>Wolf Number</b>                  | = | 144.34  |
| <b>Truncated Wolf Number</b>        | = | 126.97  |
| <i>p</i>                            | = | 16.35   |
| <i>s</i>                            | = | 22.73   |
| <b>Pettisindex</b>                  | = | 186.26  |
| <b>Beckindex</b>                    | = | 1418.69 |
| <b>Classification Value</b>         | = | 170.95  |
| <b>Quality Count</b>                | = | 27.52   |
| <b>Squared Quality Count</b>        | = | 105.09  |
| <b>Inter-Sol Index</b>              | = | 64.62   |
| <b>Mean Weight</b>                  | = | 0.4604  |
| <b>Q</b>                            | = | 1.87    |
| <b>S</b>                            | = | 2.34    |
| <b>T</b>                            | = | 2.45    |
| <b>Mean Condition</b>               | = | 2.2216  |
| <b>Total Number of Observations</b> | = | 176     |