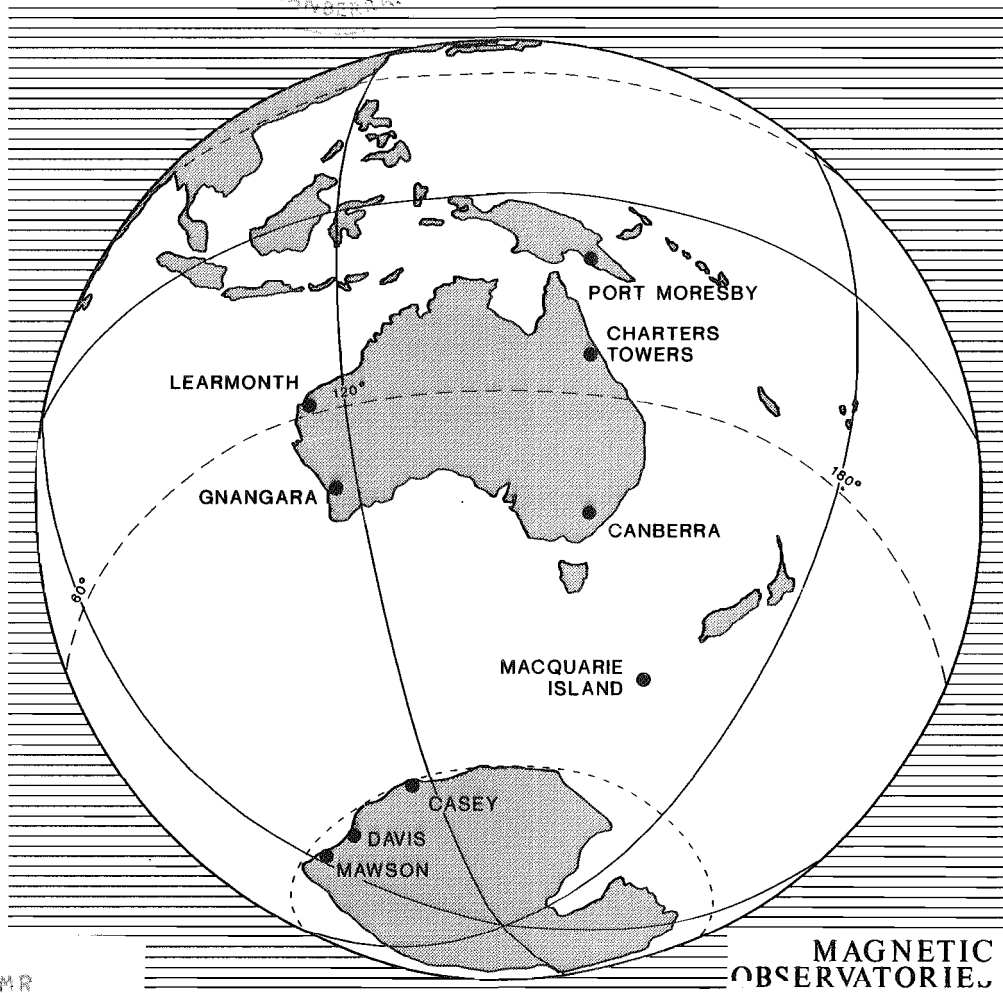




AUSTRALIAN GEOMAGNETISM REPORT



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MAGNETIC
OBSERVATORIES

VOLUME 38 No.12
DECEMBER 1990

OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

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The observers at Casey, Davis and Macquarie Island are officers of the Antarctic Division, The Department of the Arts, Sport, the Environment, Tourism and Territories. Their contributions are gratefully acknowledged. These observers and the Bureau of Mineral Resources' (BMR) geophysicist at Mawson are members of the Australian National Antarctic Research Expeditions (ANARE).

Data from the Port Moresby Geophysical Observatory are contributed by the Geological Survey of Papua New Guinea.

The terminology used in this report is that accepted by the International Association of Geomagnetism and Aeronomy (IAGA). The unit of field intensity is the nanoTesla (nT). All times are in Universal Time (UT).

### CONTRIBUTING OBSERVATORIES

| OBSERVATORY     | OBSERVER<br>IN CHARGE | GEOGRAPHIC |            | GEOMAGNETIC |        |
|-----------------|-----------------------|------------|------------|-------------|--------|
|                 |                       | LAT.       | LONG.      | LAT.        | LONG.  |
| PORT MORESBY    | I.D.Ripper            | 9° 25' S   | 147° 09' E | -18.1°      | 219.8° |
| CHARTERS TOWERS | J.M.Millican          | 20° 05' S  | 146° 15' E | -28.7°      | 220.3° |
| LEARMONTH       | M.W.McMullan          | 22° 13' S  | 114° 06' E | -33.2°      | 185.5° |
| GNANGARA        | P.J.Gregson           | 31° 47' S  | 115° 57' E | -42.7°      | 188.0° |
| CANBERRA        | P.A.Hopgood           | 35° 19' S  | 149° 22' E | -43.3°      | 226.6° |
| MACQUARIE IS.   | S.D.Dennis            | 54° 30' S  | 158° 57' E | -60.4°      | 244.7° |
| MAWSON          | M.A.DeDeuge           | 67° 36' S  | 62° 53' E  | -73.2°      | 106.3° |
| DAVIS           | M.Hesse               | 68° 35' S  | 77° 58' E  | -76.8°      | 124.0° |
| CASEY           | P.Roberts             | 66° 17' S  | 110° 32' E | -77.3°      | 182.7° |

\* Geomagnetic co-ordinates based on the 1980 DGRF Geomagnetic North pole position of 78.8°N, 70.9°W

### MAGNETOGRAPHS

| <u>OBSERVATORY</u> | <u>CODE</u> | <u>MODEL (TYPE/RES.)</u> | <u>ELEMENT/SCALE-VALUE</u> |     |     |  |
|--------------------|-------------|--------------------------|----------------------------|-----|-----|--|
| PORT MORESBY       | PMG         | La Cour (A)              | H/3                        | D/5 | Z/4 |  |
| CHARTERS TOWERS    | CTA         | EDA/Elsec (D/1)          | X                          | Y   | Z   |  |
| LEARMONTH          | LRM         | EDA/Elsec (D/1)          | X                          | Y   | Z   |  |
| GNANGARA           | GNA         | Eschenhagen(A)           | H/3                        | D/7 | Z/6 |  |
| CANBERRA           | CNB         | Elsec (D/.1)             | D                          | I   | F   |  |
| MACQUARIE IS.      | MCQ         | PEM (D/.1)               | X                          | Y   | Z   |  |
| MAWSON             | MAW         | PEM (D/.1)               | X                          | Y   | Z   |  |

A = analogue, 20mm/hr, scale values in nT/mm  
D/1 = digital, 1 minute readings, 1 nT resolution  
D/.1 = digital, 1 minute readings, 0.1 nT resolution  
PEM = BMR Photo-electronic magnetograph

### MAGNETOMETERS

Absolute data are based on observations made with QHM's, BMZ's, fluxgate-theodolites, declinometers, proton vector magnetometers and proton precession magnetometers.

Errors in preliminary values obtained from magnetograms are not likely to exceed 5 nT or 0.5 minutes of arc.

PORT MORESBY

MAGNETIC K-INDICES - DECEMBER 1990

Range for lower limit of K=9 is 300nT

| DAY | K-INDICES |   |   |   |   |   |   |   | K-SUM |
|-----|-----------|---|---|---|---|---|---|---|-------|
| 01  | 1         | 1 | 1 | 0 | 1 | 1 | 1 | 2 | 08    |
| 02  | 0         | 0 | 1 | 1 | 2 | 2 | 3 | 1 | 10    |
| 03  | 1         | 1 | 1 | 1 | 2 | 3 | 2 | 3 | 14    |
| 04  | 3         | 3 | 2 | 3 | 2 | 3 | 2 | 3 | 21    |
| 05  | 2         | 2 | 2 | 4 | 3 | 3 | 3 | 2 | 21    |
| 06  | 1         | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 15    |
| 07  | 1         | - | - | - | - | - | - | - | --    |
| 08  | -         | - | - | - | - | - | - | - | --    |
| 09  | 3         | 2 | 1 | 1 | 3 | 3 | 2 | 1 | 16    |
| 10  | 0         | 0 | 1 | 2 | 0 | 0 | 1 | 1 | 05    |
| 11  | 2         | 2 | 1 | 1 | 0 | 1 | 0 | 0 | 07    |
| 12  | 1         | 1 | 1 | 1 | 3 | 3 | 3 | 4 | 17    |
| 13  | 3         | 3 | 3 | 3 | 2 | 1 | 2 | 2 | 19    |
| 14  | 2         | 2 | 2 | 2 | 2 | 2 | 2 | 2 | 16    |
| 15  | 2         | 1 | 2 | 1 | 0 | 1 | 2 | 2 | 11    |
| 16  | 1         | 1 | 1 | 2 | 2 | 3 | 2 | 2 | 14    |
| 17  | 2         | 3 | 2 | 2 | 1 | 2 | - | - | --    |
| 18  | 3         | 1 | 2 | 3 | 2 | 1 | 1 | 1 | 14    |
| 19  | 0         | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 08    |
| 20  | 0         | 1 | 1 | 2 | 2 | 3 | 3 | 1 | 13    |
| 21  | 1         | 1 | 1 | 0 | 1 | 2 | 2 | 2 | 10    |
| 22  | 1         | 1 | 1 | 1 | 1 | 0 | 2 | 3 | 10    |
| 23  | 2         | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 17    |
| 24  | 1         | 3 | 2 | 3 | 4 | 3 | 3 | 3 | 22    |
| 25  | 3         | 3 | 1 | 2 | 2 | 3 | 2 | 1 | 17    |
| 26  | 1         | 2 | 2 | 1 | 1 | 1 | 1 | 1 | 10    |
| 27  | 2         | 1 | 2 | 2 | 2 | 2 | 1 | 1 | 13    |
| 28  | 2         | 2 | 2 | 2 | 1 | 1 | 1 | 1 | 12    |
| 29  | 1         | 1 | 1 | 1 | 2 | 1 | 1 | 1 | 09    |
| 30  | 3         | 4 | 4 | 4 | 3 | 2 | 4 | 3 | 27    |
| 31  | 1         | 2 | 2 | 3 | 3 | 3 | 2 | 3 | 19    |

Mean of K-Sum is 14.1

Frequency of K-Indices

|     |    |    |    |    |   |   |   |   |   |   |    |
|-----|----|----|----|----|---|---|---|---|---|---|----|
| K : | 0  | 1  | 2  | 3  | 4 | 5 | 6 | 7 | 8 | 9 | -  |
| f : | 15 | 82 | 83 | 44 | 7 | 0 | 0 | 0 | 0 | 0 | 17 |

GNANGARA

MAGNETIC K-INDICES - DECEMBER 1990

Range for lower limit of K=9 is 450nT

| DAY | K-INDICES |   |   |   |   |   |   |   | K-SUM |
|-----|-----------|---|---|---|---|---|---|---|-------|
| 01  | 2         | 2 | 2 | 1 | 1 | 2 | 2 | 2 | 14    |
| 02  | 3         | 1 | 2 | 1 | 1 | 2 | 2 | 2 | 14    |
| 03  | 2         | 2 | 2 | 1 | 1 | 3 | 2 | 3 | 16    |
| 04  | 3         | 4 | 2 | 3 | 4 | 3 | 1 | 4 | 24    |
| 05  | -         | - | - | 3 | 3 | 4 | 3 | 2 | --    |
| 06  | 2         | 2 | 2 | 2 | 2 | 1 | 2 | 2 | 15    |
| 07  | 3         | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 09    |
| 08  | 1         | 1 | 2 | 2 | 3 | 2 | 3 | 4 | 18    |
| 09  | 2         | 2 | 1 | 1 | 2 | 2 | 1 | 2 | 13    |
| 10  | 0         | 0 | 0 | 1 | 1 | 0 | 2 | 2 | 06    |
| 11  | 3         | 2 | 1 | 1 | 0 | 1 | 2 | 2 | 12    |
| 12  | 2         | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 18    |
| 13  | 5         | 3 | 4 | 2 | 2 | 1 | 2 | 2 | 21    |
| 14  | 3         | 2 | 2 | 2 | 2 | 3 | 2 | 1 | 17    |
| 15  | 2         | 2 | 2 | 2 | 1 | 2 | 2 | 1 | 14    |
| 16  | 3         | 2 | 2 | 2 | 3 | 3 | 2 | 3 | 20    |
| 17  | 3         | 3 | 2 | 2 | 1 | 2 | 2 | 2 | 17    |
| 18  | 2         | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 08    |
| 19  | 0         | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 08    |
| 20  | 0         | 0 | 1 | 2 | 3 | 3 | 3 | 1 | 13    |
| 21  | 1         | 1 | 0 | 0 | 0 | 1 | 2 | 2 | 07    |
| 22  | 1         | 2 | 2 | 1 | 0 | 0 | 1 | 3 | 10    |
| 23  | 1         | 1 | 4 | 3 | 1 | 2 | 1 | 3 | 16    |
| 24  | 2         | 3 | 2 | 3 | 3 | 3 | 3 | 4 | 23    |
| 25  | 3         | 2 | 2 | 2 | 2 | 3 | 3 | 1 | 18    |
| 26  | 1         | 0 | 2 | 1 | 1 | 1 | 1 | 1 | 08    |
| 27  | 2         | 2 | 1 | 1 | 2 | 1 | 0 | 1 | 10    |
| 28  | 1         | 1 | 0 | 1 | 1 | 0 | 1 | 2 | 07    |
| 29  | 1         | 1 | 0 | 1 | 1 | 2 | 1 | 0 | 07    |
| 30  | 2         | 3 | 4 | 3 | 3 | - | - | - | --    |
| 31  | 1         | 1 | 2 | 3 | 3 | 3 | 3 | 2 | 18    |

Mean of K-Sum is 13.8

Frequency of K-Indices

|     |    |    |    |    |    |   |   |   |   |   |   |
|-----|----|----|----|----|----|---|---|---|---|---|---|
| K : | 0  | 1  | 2  | 3  | 4  | 5 | 6 | 7 | 8 | 9 | - |
| f : | 21 | 79 | 86 | 45 | 10 | 1 | 0 | 0 | 0 | 0 | 6 |

CANBERRA

MAGNETIC K-INDICES - DECEMBER 1990

Range for lower limit of K=9 is 450nT

| DAY | K-INDICES |   |   |   |   |   |   |   | K-SUM |
|-----|-----------|---|---|---|---|---|---|---|-------|
| 01  | 2         | 2 | 0 | 0 | 0 | 2 | 1 | 1 | 08    |
| 02  | 0         | 1 | 1 | 1 | 2 | 0 | 2 | 0 | 07    |
| 03  | 0         | 1 | 1 | 1 | 1 | 3 | 1 | 3 | 11    |
| 04  | 3         | 3 | 2 | 3 | 3 | 3 | 2 | 3 | 22    |
| 05  | 2         | 2 | 2 | 3 | 2 | 3 | 3 | 2 | 19    |
| 06  | 1         | 2 | 2 | 2 | 1 | 1 | 2 | 3 | 14    |
| 07  | 2         | 1 | 2 | 1 | 0 | 1 | 1 | 0 | 08    |
| 08  | 0         | 2 | 2 | 0 | 3 | 2 | 3 | 3 | 15    |
| 09  | 2         | 1 | 1 | 1 | 3 | 2 | 2 | 1 | 13    |
| 10  | 0         | 0 | 0 | 1 | 0 | 0 | 0 | 1 | 02    |
| 11  | 1         | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 04    |
| 12  | 0         | 1 | 0 | 1 | 2 | 3 | 3 | 4 | 14    |
| 13  | 3         | 4 | 4 | 2 | 2 | 1 | 1 | 1 | 18    |
| 14  | 3         | 2 | 2 | 1 | 2 | 3 | 1 | 0 | 14    |
| 15  | 0         | 2 | 2 | 1 | 0 | 1 | 2 | 1 | 09    |
| 16  | 1         | 1 | 2 | 3 | 3 | 3 | 2 | 2 | 17    |
| 17  | 2         | 3 | 2 | 1 | 1 | 2 | 2 | 1 | 14    |
| 18  | 2         | 1 | 0 | 2 | 2 | 1 | 1 | 1 | 10    |
| 19  | 0         | 1 | 1 | 0 | 1 | 1 | 1 | 1 | 06    |
| 20  | 1         | 1 | 2 | 2 | 3 | 3 | 2 | 1 | 15    |
| 21  | 0         | 2 | 1 | 0 | 0 | 1 | 2 | 1 | 07    |
| 22  | 0         | 1 | 2 | 2 | 1 | 0 | 1 | 3 | 10    |
| 23  | 1         | 1 | 5 | 3 | 1 | 2 | 2 | 3 | 18    |
| 24  | 2         | 3 | 3 | 3 | 3 | 3 | 4 | 3 | 24    |
| 25  | 2         | 2 | 1 | 2 | 2 | 3 | 3 | 1 | 16    |
| 26  | 1         | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 08    |
| 27  | 1         | 2 | 2 | 1 | 2 | 2 | 1 | 1 | 12    |
| 28  | 0         | 2 | 1 | 1 | 1 | 0 | 1 | 2 | 08    |
| 29  | 0         | 1 | 0 | 1 | 1 | 1 | 1 | 0 | 05    |
| 30  | 2         | 5 | 5 | 4 | 3 | 2 | 3 | 4 | 28    |
| 31  | 1         | 1 | 3 | 3 | 3 | 3 | 3 | 1 | 18    |

Mean of K-Sum is 12.7

Frequency of K-Indices

|     |    |    |    |    |   |   |   |   |   |   |   |
|-----|----|----|----|----|---|---|---|---|---|---|---|
| K : | 0  | 1  | 2  | 3  | 4 | 5 | 6 | 7 | 8 | 9 | - |
| f : | 39 | 90 | 65 | 45 | 6 | 3 | 0 | 0 | 0 | 0 | 0 |

**MAWSON**

**MAGNETIC K-INDICES - DECEMBER 1990**

Range for lower limit of K=9 is 1500nT

| DAY | K-INDICES |   |   |   |   |   |   |   | K-SUM |
|-----|-----------|---|---|---|---|---|---|---|-------|
| 01  | 5         | 6 | 3 | 1 | 3 | 3 | 3 | 1 | 25    |
| 02  | 2         | 2 | 2 | 3 | 4 | 3 | 4 | 4 | 24    |
| 03  | 4         | 4 | 3 | 1 | 3 | 3 | 3 | 5 | 26    |
| 04  | 5         | 5 | 3 | 4 | 3 | 3 | 4 | 4 | 31    |
| 05  | 5         | 3 | 4 | 5 | 4 | 5 | 5 | 4 | 35    |
| 06  | 4         | 4 | 3 | 4 | 3 | 3 | 3 | 3 | 27    |
| 07  | 4         | 5 | 3 | 3 | 3 | 3 | 2 | 2 | 25    |
| 08  | 3         | 4 | 4 | 3 | 4 | 4 | 3 | 3 | 28    |
| 09  | 4         | 4 | 3 | 4 | 4 | 4 | 2 | 3 | 28    |
| 10  | 3         | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 18    |
| 11  | 4         | 3 | 2 | 1 | 2 | 3 | 2 | 2 | 19    |
| 12  | 4         | 4 | 2 | 2 | 2 | 4 | 4 | 4 | 26    |
| 13  | 5         | 7 | 5 | 5 | 2 | 2 | 2 | 4 | 32    |
| 14  | 4         | 4 | 3 | 2 | 3 | 3 | 3 | 2 | 24    |
| 15  | 4         | 4 | 4 | 3 | 1 | 3 | 3 | 4 | 26    |
| 16  | 4         | 4 | 3 | 4 | 4 | 4 | 4 | 4 | 31    |
| 17  | 3         | 5 | 3 | 2 | 2 | 3 | 3 | 3 | 24    |
| 18  | 4         | 4 | 2 | 3 | 4 | 3 | 2 | 2 | 24    |
| 19  | 3         | 3 | 3 | 2 | 2 | 2 | 1 | 2 | 18    |
| 20  | 3         | 5 | 3 | 4 | 4 | 6 | 6 | 4 | 35    |
| 21  | 4         | 5 | 5 | 2 | 1 | 2 | 2 | 3 | 24    |
| 22  | 3         | 4 | 4 | 2 | 2 | 1 | 1 | 2 | 19    |
| 23  | 3         | 2 | 5 | 3 | 2 | 2 | 2 | 5 | 24    |
| 24  | 3         | 5 | 5 | 3 | 5 | 4 | 5 | 4 | 34    |
| 25  | 3         | 5 | 4 | 3 | 3 | 3 | 3 | 4 | 28    |
| 26  | 4         | 3 | 3 | 2 | 4 | 2 | 2 | 2 | 22    |
| 27  | 3         | 5 | 3 | 3 | 4 | 3 | 2 | 2 | 25    |
| 28  | 4         | 4 | 3 | 2 | 2 | 1 | 3 | 3 | 22    |
| 29  | 4         | 4 | 3 | 2 | 3 | 3 | 2 | 2 | 23    |
| 30  | 4         | 4 | 5 | 3 | 3 | 3 | 2 | 2 | 26    |
| 31  | 3         | 3 | 3 | 4 | 4 | 5 | 5 | 4 | 31    |

**Mean of K-Sum is 25.9**

**Frequency of K-Indices**

|            |   |    |    |    |    |    |   |   |   |   |   |
|------------|---|----|----|----|----|----|---|---|---|---|---|
| <b>K :</b> | 0 | 1  | 2  | 3  | 4  | 5  | 6 | 7 | 8 | 9 | - |
| <b>f :</b> | 0 | 11 | 54 | 83 | 69 | 27 | 3 | 1 | 0 | 0 | 0 |

**PRINCIPAL MAGNETIC STORMS - DECEMBER 1990**

| OBSERVATORY  | Commencement |        | SSC-amplitude |      |       | Max. 3hr K-index |                  | Ranges |      |       | UT End |        |
|--------------|--------------|--------|---------------|------|-------|------------------|------------------|--------|------|-------|--------|--------|
|              | Day          | Hr Min | Type          | D(') | H(nT) | Z(nT)            | Day (3hr-period) | K      | D(') | H(nT) | Z(nT)  | Day Hr |
| Port Moresby |              | Nil    |               |      |       | Principal        |                  |        |      |       | Storms |        |
| Gnangara     |              | Nil    |               |      |       | Principal        |                  |        |      |       | Storms |        |
| Canberra     | 30           | 03 ..  | ...           | ..   | ..    | ..               | 30(1,2)          | 5      | 17.9 | 92    | 14     | 30 22  |

DECEMBER 1990

PRELIMINARY MONTHLY MEAN VALUES

| OBSERVATORY     | H     | D   |         | Z      | F     |
|-----------------|-------|-----|---------|--------|-------|
|                 | nT    | deg | min     | nT     | nT    |
| PORT MORESBY    | 35933 | 06° | 35.8´ E | -23709 | 43050 |
| CHARTERS TOWERS | 31759 | 07° | 46.7´ E | -38254 | 49719 |
| LEARMONTH       | 29537 | 00° | 27.6´ W | -44431 | 53354 |
| GNANGARA        | 23216 | 03° | 04.7´ W | -53790 | 58586 |
| CANBERRA        | 23668 | 12° | 30.5´ E | -53647 | 58636 |
| MACQUARIE IS.   | 12589 | 29° | 44.9´ E | -63501 | 64737 |
| MAWSON          | 18511 | 64° | 23.0´ W | -45968 | 49555 |
| DAVIS           | 16679 | 77° | 24.5´ W | -51944 | 54556 |
| CASEY           | 9643  | 91° | 53.2´ W | -63901 | 64625 |

The values are derived from magnetograms over the Quietest 5 International Days, except at Mawson, Davis and Casey, where the locally quietest days are used.

INTERNATIONAL QUIET AND DISTURBED DAYS

Quietest days (1- 5):   10   19   11   26   22  
Quietest days (6-10):   29   21   28   07   02  
Most Disturbed days :   04   24   13   05   30

# **SUDDEN STORM COMMENCEMENTS (ssc): DECEMBER 1990**

| Observatory  | Day | Type<br>and<br>Quality | U.T.     | Sense and Amplitude<br>of Chief Movement |       |       |
|--------------|-----|------------------------|----------|------------------------------------------|-------|-------|
|              |     |                        |          | H(nT)                                    | D(nT) | Z(nT) |
| PORT MORESBY | Nil | ssc's                  | reported |                                          |       |       |
| GNANGARA     | 22  | ssc*C                  | 2240     | +3                                       | -28*  | -16*  |
| CANBERRA     | 08  | ssc C                  | 1426     | +15                                      | +5    | 0     |

# **SOLAR FLARE EFFECTS (sfe): DECEMBER 1990**

| Observatory  | ----- U.T. of sfe ----- |       |          |       | Con-<br>fir-<br>med. | Sense & Amplitude |       |       |
|--------------|-------------------------|-------|----------|-------|----------------------|-------------------|-------|-------|
|              | Day                     | Began | Max.     | Ended |                      | H(nT)             | D(nT) | Z(nT) |
| PORT MORESBY | Nil                     | sfe's | reported |       |                      |                   |       |       |
| GNANGARA     | 16                      | 0444  | 0445     | 0450  |                      | +1.5              | -2    | -3    |
| CANBERRA     | 22                      | 2240  | 2248     | 2310  | *                    | +5                | -18   | +8    |

**Note on Learmonth & Casey mean values:** The summary of monthly mean values for Learmonth 1990 given on page 12 reflects differences to values previously reported due to the application of more up to date baseline data. The values reported for Casey on page 14 are different to previously reported values due to the application of a 423 nT pier difference to total-field observations.

# Preliminary Monthly Mean Values for 1990

| PORT MORESBY<br>1990 | H<br>(nT) | D<br>deg min | Z<br>(nT) | F<br>(nT) | I<br>deg min |
|----------------------|-----------|--------------|-----------|-----------|--------------|
| January              | 35934     | 06 36.1      | -23714    | 43054     | -33 25.3     |
| February             | 35917     | 06 36.2      | -23707    | 43035     | -33 25.6     |
| March                | 35926     | 06 36.2      | -23707    | 43043     | -33 25.2     |
| April                | 35907     | 06 36.2      | -23714    | 43031     | -33 26.5     |
| May                  | 35914     | 06 36.2      | -23712    | 43036     | -33 26.1     |
| June                 | 35921     | 06 36.3      | -23714    | 43043     | -33 25.9     |
| July                 | 35930     | 06 36.1      | -23709    | 43047     | -33 25.2     |
| August               | 35915     | 06 36.1      | -23708    | 43034     | -33 25.8     |
| September            | 35916     | 06 36.1      | -23708    | 43035     | -33 25.7     |
| October              | 35924     | 06 36.1      | -23708    | 43042     | -33 25.4     |
| November             | 35935     | 06 35.9      | -23709    | 43052     | -33 24.9     |
| December             | 35933     | 06 35.8      | -23709    | 43050     | -33 25.0     |
| Annual Means         | 35923     | 06 36.1      | -23710    | 43042     | -33 25.6     |

| CHARTERS TOWERS<br>1990 | H<br>(nT) | D<br>deg min | Z<br>(nT) | F<br>(nT) | I<br>deg min |
|-------------------------|-----------|--------------|-----------|-----------|--------------|
| January                 | 31759     | 07 46.6      | -38261    | 49725     | -50 18.3     |
| February                | 31743     | 07 46.7      | -38260    | 49713     | -50 19.1     |
| March                   | 31737     | 07 47.1      | -38263    | 49712     | -50 19.6     |
| April                   | 31737     | 07 47.3      | -38265    | 49714     | -50 19.6     |
| May                     | 31747     | 07 47.1      | -38260    | 49717     | -50 18.9     |
| June                    | 31734     | 07 47.1      | -38265    | 49712     | -50 19.8     |
| July                    | 31751     | 07 47.3      | -38255    | 49715     | -50 18.5     |
| August                  | 31739     | 07 47.1      | -38257    | 49709     | -50 19.2     |
| September               | 31743     | 07 47.3      | -38259    | 49713     | -50 19.0     |
| October                 | 31750     | 07 47.1      | -38255    | 49714     | -50 18.5     |
| November                | 31760     | 07 47.1      | -38253    | 49719     | -50 17.9     |
| December                | 31759     | 07 46.7      | -38254    | 49719     | -50 18.0     |
| Annual Means            | 31747     | 07 47.0      | -38259    | 49715     | -50 18.9     |

| LEARMONTH<br>1990 | H<br>(nT) | D<br>deg min | Z<br>(nT) | F<br>(nT) | I<br>deg min |
|-------------------|-----------|--------------|-----------|-----------|--------------|
| January           | 29521     | -00 29.9     | -44443    | 53354     | -56 24.4     |
| February          | 29510     | -00 30.1     | -44447    | 53351     | -56 25.1     |
| March             | 29504     | -00 29.4     | -44448    | 53349     | -56 25.5     |
| April             | 29500     | -00 29.5     | -44448    | 53346     | -56 25.7     |
| May               | 29515     | -00 29.0     | -44442    | 53350     | -56 24.7     |
| June              | 29503     | -00 28.6     | -44441    | 53343     | -56 25.2     |
| July              | 29516     | -00 28.3     | -44432    | 53342     | -56 24.3     |
| August            | 29507     | -00 28.0     | -44433    | 53338     | -56 24.8     |
| September         | 29515     | -00 28.2     | -44435    | 53344     | -56 24.4     |
| October           | 29527     | -00 28.1     | -44434    | 53349     | -56 23.7     |
| November          | 29537     | -00 27.8     | -44428    | 53351     | -56 23.0     |
| December          | 29537     | -00 27.6     | -44431    | 53354     | -56 23.1     |
| Annual Means      | 29516     | -00 28.7     | -44439    | 53348     | -56 24.5     |

**Preliminary Monthly Mean Values for 1990**

| <b>GNANGARA<br/>1990</b> | <b>H<br/>(nT)</b> | <b>D<br/>deg min</b> | <b>Z<br/>(nT)</b> | <b>F<br/>(nT)</b> | <b>I<br/>deg min</b> |
|--------------------------|-------------------|----------------------|-------------------|-------------------|----------------------|
| January                  | 23204             | -03 07.7             | -53808            | 58598             | -66 40.4             |
| February                 | 23198             | -03 06.6             | -53806            | 58594             | -66 40.6             |
| March                    | 23185             | -03 06.6             | -53806            | 58589             | -66 41.3             |
| April                    | 23173             | -03 06.9             | -53813            | 58590             | -66 42.1             |
| May                      | 23187             | -03 06.1             | -53807            | 58590             | -66 41.2             |
| June                     | 23195             | -03 05.8             | -53806            | 58593             | -66 40.8             |
| July                     | 23199             | -03 05.7             | -53796            | 58585             | -66 40.3             |
| August                   | 23177             | -03 05.8             | -53802            | 58582             | -66 41.7             |
| September                | 23192             | -03 05.6             | -53797            | 58583             | -66 40.7             |
| October                  | 23200             | -03 06.1             | -53794            | 58584             | -66 40.2             |
| November                 | 23212             | -03 05.0             | -53793            | 58587             | -66 39.6             |
| December                 | 23216             | -03 04.7             | -53790            | 58586             | -66 39.3             |
| <b>Annual Means</b>      | <b>23195</b>      | <b>-03 06.1</b>      | <b>-53802</b>     | <b>58588</b>      | <b>-66 40.7</b>      |

| <b>CANBERRA<br/>1990</b> | <b>H<br/>(nT)</b> | <b>D<br/>deg min</b> | <b>Z<br/>(nT)</b> | <b>F<br/>(nT)</b> | <b>I<br/>deg min</b> |
|--------------------------|-------------------|----------------------|-------------------|-------------------|----------------------|
| January                  | 23665             | 12 29.6              | -53668            | 58654             | -66 12.3             |
| February                 | 23651             | 12 30.0              | -53668            | 58648             | -66 13.0             |
| March                    | 23641             | 12 30.3              | -53673            | 58649             | -66 13.7             |
| April                    | 23642             | 12 30.3              | -53673            | 58649             | -66 13.7             |
| May                      | 23652             | 12 30.7              | -53669            | 58650             | -66 13.0             |
| June                     | 23647             | 12 30.6              | -53668            | 58647             | -66 13.3             |
| July                     | 23656             | 12 30.8              | -53659            | 58642             | -66 12.6             |
| August                   | 23645             | 12 30.7              | -53662            | 58640             | -66 13.2             |
| September                | 23650             | 12 30.9              | -53658            | 58639             | -66 12.9             |
| October                  | 23656             | 12 30.6              | -53654            | 58638             | -66 12.4             |
| November                 | 23662             | 12 30.6              | -53651            | 58637             | -66 12.0             |
| December                 | 23668             | 12 30.5              | -53647            | 58636             | -66 11.6             |
| <b>Annual Means</b>      | <b>23653</b>      | <b>12 30.5</b>       | <b>-53663</b>     | <b>58644</b>      | <b>-66 12.8</b>      |

| <b>MACQUARIE IS.<br/>1990</b> | <b>H<br/>(nT)</b> | <b>D<br/>deg min</b> | <b>Z<br/>(nT)</b> | <b>F<br/>(nT)</b> | <b>I<br/>deg min</b> |
|-------------------------------|-------------------|----------------------|-------------------|-------------------|----------------------|
| January                       | 12591             | 29 39.1              | -63518            | 64754             | -78 47.3             |
| February                      | 12588             | 29 39.5              | -63526            | 64761             | -78 47.5             |
| March                         | 12581             | 29 40.9              | -63531            | 64765             | -78 47.9             |
| April                         | 12571             | 29 42.5              | -63557            | 64789             | -78 48.7             |
| May                           | 12570             | 29 43.3              | -63522            | 64754             | -78 48.4             |
| June                          | 12572             | 29 42.6              | -63528            | 64760             | -78 48.4             |
| July                          | 12570             | 29 43.4              | -63505            | 64738             | -78 48.2             |
| August                        | 12571             | 29 44.1              | -63509            | 64742             | -78 48.2             |
| September                     | 12567             | 29 45.4              | -63516            | 64747             | -78 48.5             |
| October                       | 12577             | 29 44.5              | -63508            | 64741             | -78 47.9             |
| November                      | 12579             | 29 43.6              | -63503            | 64737             | -78 47.7             |
| December                      | 12589             | 29 44.9              | -63501            | 64737             | -78 47.2             |
| <b>Annual Means</b>           | <b>12577</b>      | <b>29 42.8</b>       | <b>-63519</b>     | <b>64752</b>      | <b>-78 48.0</b>      |

**Preliminary Monthly Mean Values for 1990**

| <b>MAWSON<br/>1990</b> | <b>H<br/>(nT)</b> | <b>D<br/>deg min</b> | <b>Z<br/>(nT)</b> | <b>F<br/>(nT)</b> | <b>I<br/>deg min</b> |
|------------------------|-------------------|----------------------|-------------------|-------------------|----------------------|
| January                | 18506             | -64 16.0             | -46046            | 49626             | -68 06.3             |
| February               | 18493             | -64 17.6             | -46044            | 49619             | -68 07.0             |
| March                  | 18486             | -64 19.6             | -46042            | 49615             | -68 07.6             |
| April                  | 18478             | -64 20.1             | -46041            | 49611             | -68 07.9             |
| May                    | 18493             | -64 20.6             | -46025            | 49601             | -68 06.6             |
| June                   | 18490             | -64 21.0             | -46013            | 49589             | -68 06.5             |
| July                   | 18485             | -64 22.0             | -46002            | 49577             | -68 06.5             |
| August                 | 18486             | -64 23.1             | -46005            | 49580             | -68 06.5             |
| September              | 18488             | -64 22.9             | -46001            | 49577             | -68 06.3             |
| October                | 18488             | -64 24.3             | -45999            | 49575             | -68 06.2             |
| November               | 18503             | -64 22.8             | -45989            | 49572             | -68 05.0             |
| December               | 18510             | -64 23.0             | -45968            | 49555             | -68 04.0             |
| <b>Annual Means</b>    | <b>18492</b>      | <b>-64 21.1</b>      | <b>-46015</b>     | <b>49591</b>      | <b>-68 06.4</b>      |

| <b>DAVIS<br/>1990</b> | <b>H<br/>(nT)</b> | <b>D<br/>deg min</b> | <b>Z<br/>(nT)</b> | <b>F<br/>(nT)</b> | <b>I<br/>deg min</b> |
|-----------------------|-------------------|----------------------|-------------------|-------------------|----------------------|
| January               | 16782             | -77 00               | -52066            | 54704             | -72 08.1             |
| February              | 16744             | -77 17               | -52082            | 54707             | -72 10.7             |
| March                 | 16752             | -77 17               | -52073            | 54701             | -72 10.0             |
| April                 | 16722             | -77 18               | -52049            | 54669             | -72 11.3             |
| May                   | 16670             | -77 25               | -52030            | 54635             | -72 14.1             |
| June                  | 16650             | -77 25               | -52020            | 54620             | -72 15.1             |
| July                  | 16660             | -77 27               | -51986            | 54590             | -72 13.8             |
| August                | 16675             | -77 27               | -51981            | 54590             | -72 12.9             |
| September             | 16700             | -77 22               | -51968            | 54585             | -72 11.1             |
| October               | 16710             | -77 15               | -51954            | 54575             | -72 10.2             |
| November              | 16670             | -77 18.              | -51930            | 54540             | -72 12.2             |
| December              | 16679             | -77 25               | -51944            | 54556             | -72 11.9             |
| <b>Annual Means</b>   | <b>16701</b>      | <b>-77 20</b>        | <b>-52007</b>     | <b>54623</b>      | <b>-72 11.8</b>      |

| <b>CASEY<br/>1990</b> | <b>H<br/>(nT)</b> | <b>D<br/>deg min</b> | <b>Z<br/>(nT)</b> | <b>F<br/>(nT)</b> | <b>I<br/>deg min</b> |
|-----------------------|-------------------|----------------------|-------------------|-------------------|----------------------|
| January               | 9560              | -91 36               | -63908            | 64619             | -81 29.5             |
| February              | 9457              | -91 38               | -63941            | 64637             | -81 35.2             |
| March                 | 9640              | -91 45               | -63948            | 64671             | -81 25.6             |
| April                 | 9751              | -91 56               | -63928            | 64667             | -81 19.6             |
| May                   | 9620              | -92 15               | -63938            | 64658             | -81 26.6             |
| June                  | 9590              | -92 06               | -63938            | 64653             | -81 28.2             |
| July                  | 9620              | -92 06               | -63933            | 64653             | -81 26.6             |
| August                | 9610              | -92 06               | -63925            | 64643             | -81 27.0             |
| September             | 9580              | -92 00               | -63894            | 64608             | -81 28.4             |
| October               | 9575              | -92 00               | -63905            | 64618             | -81 28.7             |
| November              | 9570              | -91 42               | -63875            | 64588             | -81 28.7             |
| December              | 9643              | -91 53               | -63901            | 64625             | -81 25.1             |
| <b>Annual Means</b>   | <b>9601</b>       | <b>-91 55</b>        | <b>-63920</b>     | <b>64637</b>      | <b>-81 27.4</b>      |

**Preliminary Annual Mean Values of the Magnetic Field Elements - 1990**

| <b>OBSERVATORY</b>      | <b>D<br/>Deg Min</b> | <b>I<br/>Deg Min</b> | <b>H<br/>(nT)</b> | <b>X<br/>(nT)</b> | <b>Y<br/>(nT)</b> | <b>Z<br/>(nT)</b> | <b>F<br/>(nT)</b> |
|-------------------------|----------------------|----------------------|-------------------|-------------------|-------------------|-------------------|-------------------|
| <b>Port Moresby</b>     | 06 36.1 E            | -33 25.6             | 35923             | 35685             | 4130              | -23710            | 43042             |
| <b>Charters Towers</b>  | 07 47.0 E            | -50 18.9             | 31747             | 31454             | 4300              | -38259            | 49715             |
| <b>Learmonth</b>        | 00 28.7 W            | -56 24.5             | 29516             | 29515             | -246              | -44439            | 53348             |
| <b>Gnangara</b>         | 03 06.1 W            | -66 40.7             | 23195             | 23161             | -1255             | -53802            | 58588             |
| <b>Canberra</b>         | 12 30.5 E            | -66 12.8             | 23653             | 23092             | 5123              | -53663            | 58644             |
| <b>Macquarie Island</b> | 29 42.8 E            | -78 48.0             | 12577             | 10923             | 6234              | -63519            | 64752             |
| <b>Mawson</b>           | 64 21.1 W            | -68 06.4             | 18492             | 8004              | -16670            | -46015            | 49591             |
| <b>Davis *</b>          | 77 20 W              | -72 11.8             | 16701             | 3664              | -16294            | -52007            | 54623             |
| <b>Casey *</b>          | 91 55 W              | -81 27.4             | 9601              | -322              | -9596             | -63920            | 64637             |

# Port Moresby results were provided by the PNG Geological Survey

\* The Annual means for Casey and Davis were obtained graphically from the periodic absolute observations.

