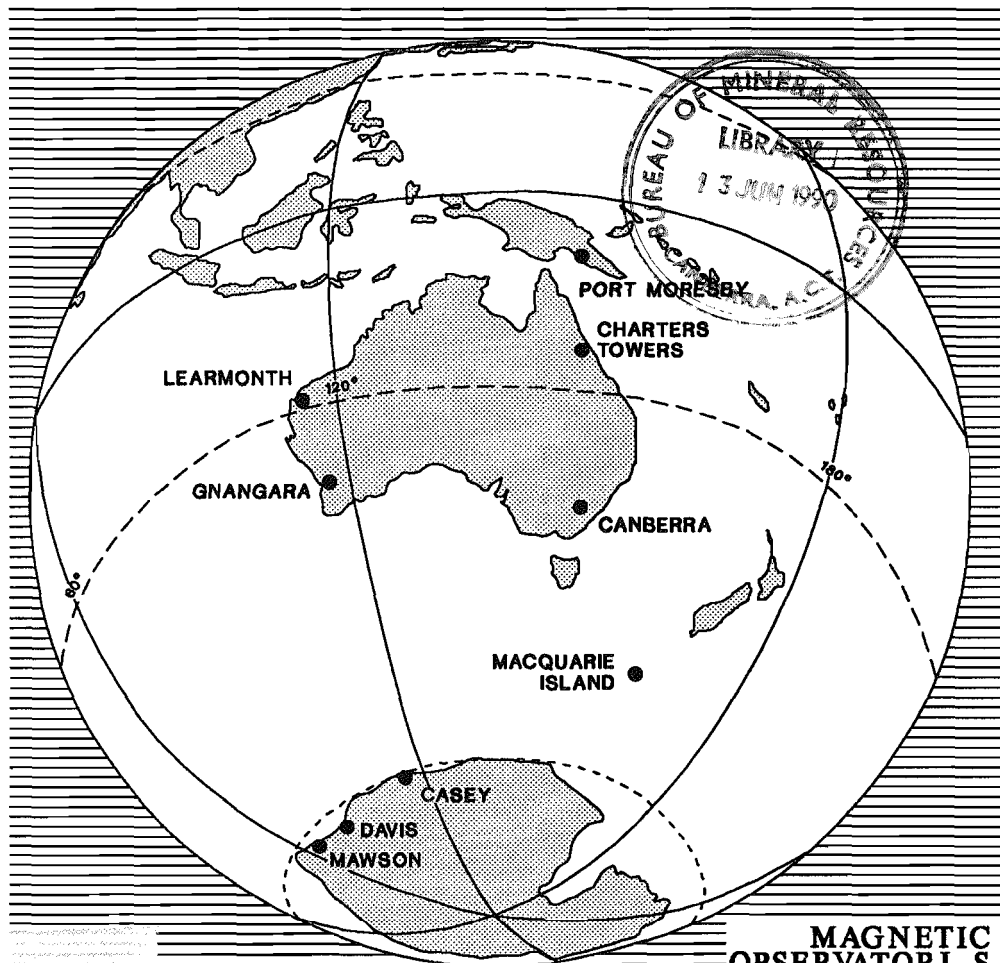


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GEOPHYSICAL OBSERVATORY REPORT



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**MAGNETIC
OBSERVATORIALS**
VOLUME 37 No.10
OCTOBER 1989

COPY 20 OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

Minister for Resources:

Senator the Hon. Peter Cook

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

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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.   | M.J.Underwood         | 54° 30'S   | 158° 57'E | -60.4°      | 244.7° |
| MAWSON          | P.Crosthwaite         | 67° 36'S   | 62° 53'E  | -73.2°      | 106.3° |
| DAVIS           | R.McLoughlin          | 68° 35'S   | 77° 58'E  | -76.8°      | 124.0° |
| CASEY           | O. Holmwood           | 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

| OBSERVATORY     | CODE | MODEL (TYPE/RES.) | ELEMENT/SCALE-VALUE |     |     |  |
|-----------------|------|-------------------|---------------------|-----|-----|--|
| 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 - OCTOBER 1989**

Range for lower limit of K=9 is 300nT

| DAY | K-INDICES |   |   |   |   |   |   |   | K-SUM |
|-----|-----------|---|---|---|---|---|---|---|-------|
| 01  | 3         | 2 | 2 | 2 | 3 | 4 | 2 | 3 | 21    |
| 02  | 3         | 5 | 4 | 3 | 3 | 3 | 1 | 1 | 23    |
| 03  | 2         | 1 | 3 | 3 | 3 | 3 | 3 | 2 | 20    |
| 04  | 2         | 3 | 2 | 1 | 1 | 1 | 1 | 1 | 12    |
| 05  | 2         | 1 | 1 | 1 | 1 | 1 | 1 | 2 | 10    |
| 06  | 2         | 2 | 2 | 3 | 2 | 2 | 2 | 2 | 17    |
| 07  | 3         | 3 | 3 | 1 | 2 | 2 | 2 | 3 | 19    |
| 08  | 3         | 3 | 3 | 2 | 1 | 2 | 1 | 2 | 17    |
| 09  | 3         | 3 | 3 | 2 | 2 | 2 | 2 | 2 | 19    |
| 10  | 2         | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 16    |
| 11  | 3         | 2 | 3 | 2 | 2 | 2 | 1 | 1 | 16    |
| 12  | 2         | 2 | 3 | 2 | 2 | 2 | 2 | 2 | 17    |
| 13  | 2         | 1 | 1 | 0 | 1 | 0 | 0 | 0 | 05    |
| 14  | 0         | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 02    |
| 15  | 1         | 1 | 1 | 1 | 1 | 1 | 2 | 1 | 09    |
| 16  | 2         | 2 | 2 | 3 | 3 | 4 | 3 | 2 | 21    |
| 17  | 3         | 3 | 2 | 2 | 3 | 1 | 2 | 2 | 18    |
| 18  | 4         | 2 | 2 | 4 | 3 | 2 | 2 | 3 | 22    |
| 19  | 4         | 3 | 5 | 3 | 1 | 1 | 2 | 2 | 21    |
| 20  | 1         | 3 | 3 | 6 | 6 | 7 | 7 | 5 | 38    |
| 21  | 5         | 5 | 5 | 9 | 7 | 5 | 6 | 5 | 47    |
| 22  | 3         | 3 | 5 | 4 | 4 | 3 | 3 | 2 | 27    |
| 23  | 2         | 3 | 4 | 2 | 1 | 1 | 1 | 2 | 16    |
| 24  | 4         | 3 | 4 | 4 | 2 | 3 | 3 | 3 | 26    |
| 25  | 3         | 3 | 3 | 5 | 1 | 2 | 1 | 1 | 19    |
| 26  | 1         | 3 | 3 | 3 | 4 | 3 | 3 | 3 | 23    |
| 27  | 2         | 1 | 3 | 3 | 3 | 2 | 2 | 2 | 18    |
| 28  | 1         | 2 | 2 | 3 | 2 | 4 | 2 | 2 | 18    |
| 29  | 2         | 3 | 3 | 1 | 3 | 2 | 3 | 3 | 20    |
| 30  | 3         | 3 | 4 | 3 | 2 | 2 | 3 | 3 | 23    |
| 31  | 3         | 2 | 2 | 2 | 4 | 4 | 1 | 1 | 19    |

Mean of K-Sum is 19.3

**Frequency of K-Indices**

|     |    |    |    |    |    |    |   |   |   |   |   |
|-----|----|----|----|----|----|----|---|---|---|---|---|
| K : | 0  | 1  | 2  | 3  | 4  | 5  | 6 | 7 | 8 | 9 | - |
| f : | 10 | 48 | 83 | 73 | 17 | 10 | 3 | 3 | 0 | 1 | 0 |

# GNANGARA

## MAGNETIC K-INDICES - OCTOBER 1989

Range for lower limit of K=9 is 450nT

| DAY | K-INDICES |   |   |   |   |   |   |   | K-SUM |
|-----|-----------|---|---|---|---|---|---|---|-------|
| 01  | 4         | 1 | 2 | 2 | 3 | 3 | 1 | 3 | 19    |
| 02  | 2         | 3 | 3 | 2 | 2 | 1 | 1 | 1 | 15    |
| 03  | 1         | 1 | 3 | 2 | 3 | 3 | 3 | 2 | 18    |
| 04  | 2         | 1 | 1 | 0 | 1 | 2 | 2 | 1 | 10    |
| 05  | 2         | 1 | 0 | 0 | 1 | 1 | 1 | 1 | 07    |
| 06  | 2         | 0 | 2 | 2 | 1 | 3 | 2 | 2 | 14    |
| 07  | 4         | 3 | 1 | 1 | 1 | 1 | 2 | 3 | 16    |
| 08  | 3         | 2 | 1 | 1 | 2 | 1 | 1 | 3 | 14    |
| 09  | 3         | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 14    |
| 10  | 3         | 2 | 3 | 1 | 2 | 3 | 1 | 3 | 18    |
| 11  | 3         | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 16    |
| 12  | 1         | 2 | 2 | 1 | 1 | 1 | 3 | 1 | 12    |
| 13  | 1         | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 02    |
| 14  | 0         | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 00    |
| 15  | 1         | 1 | 0 | 0 | 1 | 0 | 1 | 0 | 04    |
| 16  | 2         | 1 | 1 | 3 | 3 | 3 | 3 | 2 | 18    |
| 17  | 3         | 2 | 1 | 3 | 2 | 1 | 3 | 2 | 17    |
| 18  | 4         | 2 | 1 | 3 | 3 | 2 | 2 | 4 | 21    |
| 19  | 5         | 4 | 4 | 3 | 1 | 2 | 3 | 1 | 23    |
| 20  | 2         | 3 | 3 | 5 | 7 | 6 | 6 | 5 | 37    |
| 21  | 5         | 5 | 6 | 7 | 7 | 6 | 7 | 5 | 48    |
| 22  | 5         | 4 | 4 | 4 | 4 | 4 | 5 | 5 | 35    |
| 23  | 3         | 3 | 3 | 2 | 2 | 2 | 2 | 3 | 20    |
| 24  | 3         | 3 | 4 | 3 | 2 | 2 | 4 | 4 | 25    |
| 25  | 4         | 2 | 2 | 3 | 2 | 2 | 0 | 2 | 17    |
| 26  | 0         | 2 | 2 | 3 | 4 | 5 | 4 | 3 | 23    |
| 27  | 3         | 2 | 2 | 3 | 3 | 2 | 4 | 3 | 22    |
| 28  | 1         | 0 | 2 | 2 | 3 | 5 | 3 | 2 | 18    |
| 29  | 2         | 2 | 2 | 1 | 3 | 1 | 4 | 3 | 18    |
| 30  | 3         | 3 | 3 | 3 | 3 | 2 | 4 | 3 | 24    |
| 31  | 4         | 3 | 2 | 2 | 4 | 4 | 3 | 2 | 24    |

Mean of K-Sum is 18.4

### Frequency of K-Indices

|     |    |    |    |    |    |    |   |   |   |   |   |
|-----|----|----|----|----|----|----|---|---|---|---|---|
| K : | 0  | 1  | 2  | 3  | 4  | 5  | 6 | 7 | 8 | 9 | - |
| f : | 25 | 56 | 61 | 64 | 23 | 11 | 4 | 4 | 0 | 0 | 0 |

**CANBERRA**

**MAGNETIC K-INDICES - OCTOBER 1989**

Range for lower limit of K=9 is 450nT

| DAY | K-INDICES |   |   |   |   |   |   |   | K-SUM |
|-----|-----------|---|---|---|---|---|---|---|-------|
| 01  | 2         | 2 | 2 | 2 | 3 | 3 | 1 | 2 | 17    |
| 02  | 2         | 5 | 3 | 2 | 2 | 2 | 0 | 0 | 16    |
| 03  | 1         | 2 | 2 | 3 | 3 | 3 | 3 | 2 | 19    |
| 04  | 1         | 2 | 1 | 0 | 2 | 2 | 1 | 1 | 10    |
| 05  | 2         | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 06    |
| 06  | 1         | 0 | 2 | 2 | 1 | 3 | 2 | 3 | 14    |
| 07  | 2         | 3 | 2 | 1 | 1 | 2 | 2 | 3 | 16    |
| 08  | 2         | 2 | 2 | 2 | 2 | 2 | 1 | 3 | 16    |
| 09  | 3         | 3 | 1 | 2 | 1 | 1 | 2 | 3 | 16    |
| 10  | 1         | 3 | 2 | 1 | 1 | 2 | 1 | 2 | 13    |
| 11  | 2         | 3 | 3 | 1 | 1 | 1 | 0 | 1 | 12    |
| 12  | 3         | 2 | 3 | 2 | 1 | 2 | 2 | 3 | 18    |
| 13  | 2         | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 02    |
| 14  | 0         | 1 | 0 | 0 | 1 | 0 | 0 | 0 | 02    |
| 15  | 0         | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 04    |
| 16  | 1         | 1 | 2 | 3 | 3 | 3 | 3 | 2 | 18    |
| 17  | 1         | 2 | 3 | 3 | 2 | 2 | 2 | 1 | 16    |
| 18  | 3         | 3 | 1 | 3 | 4 | 1 | 3 | 3 | 21    |
| 19  | 4         | 4 | 4 | 3 | 1 | 0 | 1 | 0 | 17    |
| 20  | 1         | 3 | 4 | 6 | 7 | 6 | 6 | 5 | 38    |
| 21  | 5         | 5 | 6 | 7 | 7 | 5 | 6 | 4 | 45    |
| 22  | 3         | 3 | 5 | 4 | 4 | 4 | 4 | 4 | 31    |
| 23  | 2         | 5 | 4 | 1 | 1 | 1 | 1 | 3 | 18    |
| 24  | 4         | 3 | 4 | 3 | 2 | 2 | 3 | 3 | 24    |
| 25  | 3         | 2 | 3 | 4 | 2 | 2 | 0 | 1 | 17    |
| 26  | 0         | 3 | 3 | 3 | 4 | 4 | 3 | 3 | 23    |
| 27  | 2         | 2 | 3 | 4 | 3 | 2 | 2 | 2 | 20    |
| 28  | 1         | 1 | 2 | 2 | 2 | 4 | 3 | 2 | 17    |
| 29  | 1         | 3 | 3 | 0 | 2 | 2 | 3 | 3 | 17    |
| 30  | 3         | 3 | 3 | 4 | 3 | 2 | 3 | 3 | 24    |
| 31  | 2         | 3 | 2 | 2 | 4 | 4 | 1 | 0 | 18    |

Mean of K-Sum is 17.6

**Frequency of K-Indices**

|     |    |    |    |    |    |   |   |   |   |   |   |
|-----|----|----|----|----|----|---|---|---|---|---|---|
| K : | 0  | 1  | 2  | 3  | 4  | 5 | 6 | 7 | 8 | 9 | - |
| f : | 31 | 51 | 67 | 62 | 22 | 7 | 5 | 3 | 0 | 0 | 0 |

**MAWSON**

**MAGNETIC K-INDICES - OCTOBER 1989**

Range for lower limit of K=9 is 1500nT

| DAY | K-INDICES |   |   |   |   |   |   |   | K-SUM |
|-----|-----------|---|---|---|---|---|---|---|-------|
| 01  | 5         | 5 | 6 | 4 | 4 | 3 | 3 | 2 | 32    |
| 02  | 3         | 4 | 4 | 3 | 2 | 2 | 2 | 2 | 22    |
| 03  | 2         | 2 | 3 | 2 | 3 | 5 | 3 | 4 | 24    |
| 04  | 4         | 3 | 2 | 2 | 2 | 2 | 3 | 4 | 22    |
| 05  | 4         | 4 | 2 | 1 | 2 | 1 | 3 | 5 | 22    |
| 06  | 5         | 3 | 3 | 3 | 3 | 5 | 3 | 3 | 28    |
| 07  | 6         | 4 | 5 | 3 | 3 | 2 | 3 | 6 | 32    |
| 08  | 4         | 5 | 5 | 2 | 2 | 3 | 3 | 4 | 28    |
| 09  | 4         | 5 | 5 | 2 | 2 | 1 | 2 | 3 | 24    |
| 10  | 3         | 5 | 4 | 3 | 2 | 3 | 3 | 4 | 27    |
| 11  | 3         | 4 | 4 | 3 | 2 | 2 | 1 | 4 | 23    |
| 12  | 3         | 4 | 3 | 2 | 2 | 2 | 3 | 3 | 22    |
| 13  | 3         | 2 | 1 | 2 | 1 | 0 | 1 | 1 | 11    |
| 14  | 3         | 2 | 1 | 1 | 1 | 0 | 0 | 1 | 09    |
| 15  | 3         | 4 | 2 | 1 | 2 | 2 | 4 | 2 | 20    |
| 16  | 4         | 4 | 2 | 3 | 3 | 3 | 4 | 3 | 26    |
| 17  | 4         | 6 | 6 | 4 | 3 | 3 | 6 | 4 | 36    |
| 18  | 6         | 5 | 4 | 4 | 4 | 3 | 3 | 5 | 34    |
| 19  | 6         | 6 | 7 | 5 | 3 | 2 | 5 | 4 | 38    |
| 20  | 5         | 6 | 7 | 6 | 7 | 7 | 6 | 6 | 50    |
| 21  | 7         | 7 | 7 | 6 | 6 | 6 | 9 | 6 | 54    |
| 22  | 6         | 6 | 6 | 5 | 6 | 7 | 7 | 6 | 49    |
| 23  | 4         | 7 | 7 | 3 | 4 | 4 | 7 | 6 | 42    |
| 24  | 6         | 5 | 6 | 4 | 3 | 4 | 4 | 5 | 37    |
| 25  | 6         | 7 | 7 | 5 | 3 | 3 | 3 | 5 | 39    |
| 26  | 4         | 5 | 5 | 4 | 4 | 5 | 7 | 6 | 40    |
| 27  | 6         | 5 | 5 | 4 | 4 | 3 | 5 | 3 | 35    |
| 28  | 3         | 5 | 3 | 3 | 3 | 4 | 4 | 3 | 28    |
| 29  | 4         | 5 | 3 | 3 | 3 | 2 | 5 | 6 | 31    |
| 30  | 6         | 5 | 5 | 4 | 3 | 3 | 4 | 5 | 35    |
| 31  | 5         | 5 | 3 | 2 | 4 | 5 | 6 | 3 | 33    |

Mean of K-Sum is 30.7

**Frequency of K-Indices**

|     |   |    |    |    |    |    |    |    |   |   |   |
|-----|---|----|----|----|----|----|----|----|---|---|---|
| K : | 0 | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8 | 9 | - |
| f : | 3 | 13 | 37 | 63 | 48 | 37 | 31 | 15 | 0 | 1 | 0 |

# PRINCIPAL MAGNETIC STORMS - OCTOBER 1989

| 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 | 18           | 00 50  | ssc*          | -0.1* | +30   | +26              | 19(3)            | 5      | 10   | 150   | 80     | 19  | 13 |
|              | 20           | 01 ..  | ...           | ..    | ..    | ..               | 21(4)            | 9      | 15   | 430   | 180    | 23  | 09 |
| Gnangara     | 20           | 09 15  | ssc           | +2.2  | +28   | +12*             | 21(4,5,7)        | 7      | 58   | 270   | 330    | 22  | 16 |
| Canberra     | 20           | 05 ..  | ..            | ..    | ..    | ..               | 20(5);21(4,5)    | 7      | 39.9 | 340   | 214    | 23  | 08 |

OCTOBER 1989

PRELIMINARY MONTHLY MEAN VALUES

| OBSERVATORY     | H     | D   |         | Z      | F     |
|-----------------|-------|-----|---------|--------|-------|
|                 | nT    | deg | min     | nT     | nT    |
| PORT MORESBY    | 35932 | 06° | 36.4' E | -23712 | 43051 |
| CHARTERS TOWERS | 31760 | 07° | 46.1' E | -38255 | 49721 |
| LEARMONTH       | 29492 | 00° | 33.4' W | -44432 | 53329 |
| GNANGARA        | 23204 | 03° | 08.0' W | -53807 | 58597 |
| CANBERRA        | 23661 | 12° | 29.6' E | -53670 | 58654 |
| MACQUARIE IS.   | 12581 | 29° | 40.9' E | -63525 | 64759 |
| MAWSON          | 18470 | 64° | 14.4' W | -46075 | 49639 |
| DAVIS           | 16679 | 77° | 42.0' W | -52039 | 54647 |
| CASEY           | 9699  | 87° | 50.4' W | -64013 | 64744 |

The values are derived from magnetograms for selected quiet days except at Davis and Casey, where they are derived from semi-weekly absolute measurements.

INTERNATIONAL QUIET AND DISTURBED DAYS

Quietest days (1- 5): 14 13 15 5 4  
Quietest days (6-10): 11 12 8 2 6  
Most Disturbed days : 21 20 22 19 26

OCTOBER 1989

SUDDEN COMMENCEMENTS AND OTHER RAPID VARIATIONS

| OBSERVATORY  | DAY | TYPE AND<br>QUALITY | TIME | SENSE AND AMPLITUDE<br>OF CHIEF MOVEMENT |       |       |
|--------------|-----|---------------------|------|------------------------------------------|-------|-------|
|              |     |                     |      | H(nT)                                    | D(nT) | Z(nT) |
| PORT MORESBY | 18  | ssc*B               | 0050 | +30                                      | +1*   | +26   |
| GNANGARA     | 20  | ssc B               | 0915 | +28                                      | +15   | +12   |
| CANBERRA     | 24  | ssc B               | 0215 | +35                                      | +15   | +3    |
|              | 26  | ssc*B               | 1426 | +27                                      | +16*  | 0     |

CHANGE OF TITLE

To more accurately reflect the nature of the contents of this publication, the title will be changed to the "Australian Geomagnetism Report". This will take effect from the January 1990 issue (Vol. 39, No. 1).

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