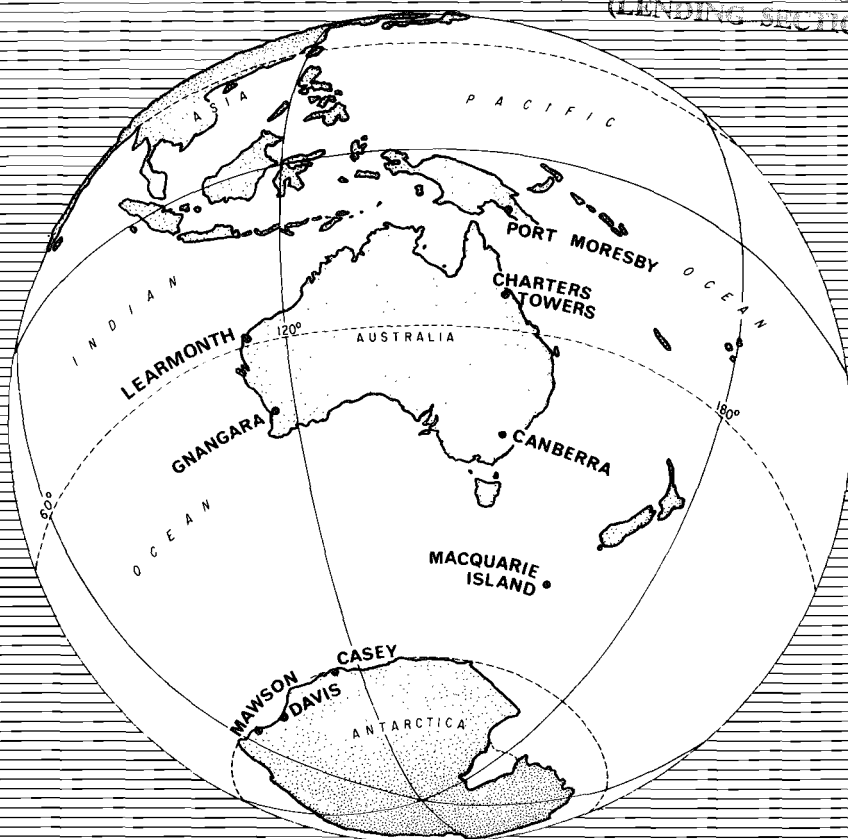




GEOPHYSICAL OBSERVATORY REPORT

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(LENDING SECTION)



MAGNETIC OBSERVATORIES

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BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

DEPARTMENT OF PRIMARY INDUSTRIES AND ENERGY

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Senator the Hon. Peter Cook

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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

| <u>OBSERVATORY</u> | <u>CODE</u> | <u>MAKE (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 - FEBRUARY 1989**

Range for lower limit of K=9 is 300nT

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

Mean of K-Sum is 18.9

**Frequency of K-Indices**

|     |   |    |    |    |    |   |   |   |   |   |   |
|-----|---|----|----|----|----|---|---|---|---|---|---|
| K : | 0 | 1  | 2  | 3  | 4  | 5 | 6 | 7 | 8 | 9 | - |
| f : | 0 | 43 | 79 | 81 | 20 | 1 | 0 | 0 | 0 | 0 | 0 |

**GNANGARA**

**MAGNETIC K-INDICES - FEBRUARY 1989**

Range for lower limit of K=9 is 450nT

| DAY | K-INDICES |   |   |   |   |   |   |   | K-SUM |
|-----|-----------|---|---|---|---|---|---|---|-------|
| 01  | 5         | 4 | 3 | 4 | 5 | 3 | 4 | 5 | 33    |
| 02  | 4         | 3 | 2 | 2 | 2 | 2 | 5 | 4 | 24    |
| 03  | 5         | 4 | 3 | 3 | 5 | 4 | 4 | 5 | 33    |
| 04  | 5         | 3 | 3 | 3 | 4 | 3 | 4 | 4 | 29    |
| 05  | 4         | 3 | 3 | 3 | 3 | 3 | 4 | 4 | 27    |
| 06  | 3         | 3 | 4 | 4 | 3 | 4 | 4 | 3 | 28    |
| 07  | 4         | 3 | 3 | 3 | 4 | 4 | 3 | 4 | 28    |
| 08  | 4         | 2 | 2 | 2 | 2 | 2 | 1 | 2 | 17    |
| 09  | 3         | 3 | 3 | 1 | 1 | 3 | 4 | 3 | 21    |
| 10  | 3         | 1 | 2 | 1 | 4 | 0 | 0 | 0 | 11    |
| 11  | 1         | 1 | 1 | 1 | 3 | 3 | 3 | 2 | 15    |
| 12  | 2         | 2 | 1 | 1 | 1 | 2 | 5 | 3 | 17    |
| 13  | 3         | 4 | 3 | 4 | 4 | 4 | 3 | 1 | 26    |
| 14  | 2         | 2 | 2 | 2 | 2 | 4 | 1 | 1 | 16    |
| 15  | 1         | 2 | 1 | 1 | 0 | 4 | 4 | 5 | 18    |
| 16  | 5         | 4 | 3 | 2 | 2 | 1 | 2 | 4 | 23    |
| 17  | 3         | 2 | 1 | 1 | 0 | 0 | 1 | 3 | 11    |
| 18  | 1         | 1 | 1 | 1 | 3 | 3 | 2 | 1 | 13    |
| 19  | 2         | 2 | 2 | 2 | 1 | 4 | 2 | 3 | 18    |
| 20  | 4         | 3 | 4 | 3 | 4 | 3 | 2 | 2 | 25    |
| 21  | 4         | 2 | 3 | 2 | 1 | 4 | 2 | 2 | 20    |
| 22  | 3         | 1 | 3 | 3 | 2 | 1 | 2 | 2 | 17    |
| 23  | 2         | 1 | 2 | 2 | 0 | 2 | 1 | 2 | 12    |
| 24  | 2         | 1 | 2 | 2 | 3 | 1 | 1 | 2 | 14    |
| 25  | 2         | 1 | 2 | 2 | 1 | 0 | 1 | 2 | 11    |
| 26  | 2         | 1 | 0 | 1 | 2 | 0 | 0 | 2 | 08    |
| 27  | 3         | 0 | 1 | 1 | 2 | 3 | 2 | 3 | 15    |
| 28  | 1         | 1 | 3 | 2 | 2 | 2 | 2 | 3 | 16    |

Mean of K-Sum is 19.5

**Frequency of K-Indices**

|     |    |    |    |    |    |    |   |   |   |   |   |
|-----|----|----|----|----|----|----|---|---|---|---|---|
| K : | 0  | 1  | 2  | 3  | 4  | 5  | 6 | 7 | 8 | 9 | - |
| f : | 12 | 45 | 62 | 54 | 40 | 11 | 0 | 0 | 0 | 0 | 0 |

CANBERRA

**MAGNETIC K-INDICES - FEBRUARY 1989**

Range for lower limit of K=9 is 450nT

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

Mean of K-Sum is 18.0

**Frequency of K-Indices**

|     |    |    |    |    |    |   |   |   |   |   |   |
|-----|----|----|----|----|----|---|---|---|---|---|---|
| K : | 0  | 1  | 2  | 3  | 4  | 5 | 6 | 7 | 8 | 9 | - |
| f : | 15 | 46 | 62 | 72 | 28 | 1 | 0 | 0 | 0 | 0 | 0 |

MAWSON

**MAGNETIC K-INDICES - FEBRUARY 1989**

Range for lower limit of K=9 is 1500nT

| DAY | K-INDICES |   |   |   |   |   |   |   | K-SUM |
|-----|-----------|---|---|---|---|---|---|---|-------|
| 01  | 4         | 7 | 6 | 4 | 5 | 3 | 6 | 6 | 41    |
| 02  | 5         | 5 | 5 | 2 | 3 | 2 | 6 | 5 | 33    |
| 03  | 7         | 6 | 6 | 5 | 5 | 7 | 6 | 5 | 47    |
| 04  | 5         | 5 | 6 | 4 | 5 | 3 | 7 | 6 | 41    |
| 05  | 5         | 5 | 5 | 4 | 3 | 4 | 6 | 6 | 38    |
| 06  | 6         | 5 | 6 | 4 | 4 | 3 | 6 | 5 | 39    |
| 07  | 5         | 6 | 6 | 5 | 5 | 6 | 7 | 6 | 46    |
| 08  | 5         | 6 | 5 | 4 | 4 | 3 | 4 | 4 | 35    |
| 09  | 5         | 7 | 6 | 3 | 4 | 3 | 6 | 5 | 39    |
| 10  | 5         | 5 | 5 | 3 | 4 | 1 | 1 | 1 | 25    |
| 11  | 3         | 3 | 4 | 4 | 5 | 3 | 7 | 4 | 33    |
| 12  | 4         | 4 | 4 | 3 | 4 | 4 | 7 | 5 | 35    |
| 13  | 5         | 6 | 5 | 6 | 5 | 5 | 4 | 5 | 41    |
| 14  | 4         | 4 | 5 | 4 | 4 | 5 | 4 | 3 | 33    |
| 15  | 2         | 5 | 5 | 2 | 2 | 5 | 7 | 5 | 33    |
| 16  | 5         | 6 | 5 | 3 | 3 | 2 | 3 | 3 | 30    |
| 17  | 5         | 5 | 2 | 3 | 1 | 0 | 1 | 3 | 20    |
| 18  | 3         | 6 | 3 | 2 | 3 | 4 | 3 | 2 | 26    |
| 19  | 2         | 4 | 4 | 3 | 2 | 4 | 2 | 5 | 26    |
| 20  | 3         | 5 | 5 | 4 | 4 | 6 | 6 | 4 | 37    |
| 21  | 3         | 4 | 4 | 4 | 2 | 3 | 1 | 1 | 22    |
| 22  | 3         | 4 | 4 | 4 | 3 | 2 | 3 | 4 | 27    |
| 23  | 3         | 3 | 3 | 2 | 1 | 2 | 2 | 5 | 21    |
| 24  | 5         | 4 | 3 | 3 | 3 | 1 | 1 | 2 | 22    |
| 25  | 3         | 4 | 5 | 3 | 2 | 0 | 1 | 1 | 19    |
| 26  | 2         | 2 | 2 | 2 | 2 | 0 | 1 | 2 | 13    |
| 27  | 4         | 3 | 2 | 2 | 3 | 2 | 3 | 4 | 23    |
| 28  | 2         | 5 | 3 | 3 | 3 | 5 | 4 | 5 | 30    |

Mean of K-Sum is 31.2

**Frequency of K-Indices**

|     |   |    |    |    |    |    |    |   |   |   |   |
|-----|---|----|----|----|----|----|----|---|---|---|---|
| K : | 0 | 1  | 2  | 3  | 4  | 5  | 6  | 7 | 8 | 9 | - |
| f : | 3 | 13 | 29 | 45 | 46 | 52 | 27 | 9 | 0 | 0 | 0 |

# PRINCIPAL MAGNETIC STORMS - FEBRUARY 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    | NIL          |      |               |       |       |                  |   |        |       |       |        |    |
| Charters Towers | NIL          |      |               |       |       |                  |   |        |       |       |        |    |
| Gnangara        | 31 17 ..     | ...  | ..            | ..    | ..    | 1 (8)            | 6 | 29     | 100   | 100   | 02     | 07 |
|                 | 02 18 ..     | ...  | ..            | ..    | ..    | 2 (7); 3 (1,8);  | 5 | 21     | 100   | 90    | 08     | 03 |
|                 |              |      |               |       |       | 4 (1)            |   |        |       |       |        |    |
| Canberra        | NIL          |      |               |       |       |                  |   |        |       |       |        |    |

**FEBRUARY 1989**

**PRELIMINARY MONTHLY MEAN VALUES**

| OBSERVATORY     | H     | D           | Z      | F     |
|-----------------|-------|-------------|--------|-------|
|                 | nT    | deg min     | nT     | nT    |
| PORT MORESBY    | 35931 | 06° 36.5' E | -23717 | 43053 |
| CHARTERS TOWERS | 31755 | 07° 46.3' E | -38255 | 49717 |
| LEARMONTH       | 29485 | 00° 34.9' W | -44423 | 53317 |
| GNANGARA        | 23203 | 03° 10.0' W | -53809 | 58599 |
| CANBERRA        | 23662 | 12° 28.7' E | -53682 | 58666 |
| MACQUARIE IS.   | 12586 | 29° 24.0' E | -63568 | 64802 |
| MAWSON          | 18459 | 64° 09.7' W | -46120 | 49677 |
| DAVIS           | 16633 | 77° 06.8' W | -51983 | 54579 |
| CASEY           | 9732  | 91° 13.1' W | -63979 | 64715 |

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

**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    |     |                     | NIL  |                                          |       |       |
| CHARTERS TOWERS |     |                     | NIL  |                                          |       |       |
| GNANGARA        |     |                     | NIL  |                                          |       |       |
| CANBERRA        | 10  | sfe                 | 0422 | +12                                      | +15   | -2    |

