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Short note
A new estimate of the adopted gravity value at Rothera Station, Antarctic Peninsula

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Introduction

Because of the lack of a definitive air link to an international gravity base station, the Antarctic Peninsula gravity network was originally, and still is, tied to the Potsdam gravity system via long ship links to South America (Renner 1981, Kennett 1965). An indirect link from the British Antarctic Survey (BAS) scientific station at Rothera to an International Gravity Standardisation Net 1971 (IGSN 71) base station in the UK had previously been made via a link to the BAS gravity station on the Falkland Islands in Port Stanley (McGibbon 1988). Whilst the apparent gravity difference between Port Stanley and the base station in the UK had been calculated via a two-way air tie using a LaCoste and Romberg meter (McGibbon 1988) and later strengthened with three two-way air ties using four LaCoste and Romberg meters (Bassett 1987), the link between Port Stanley and Rothera was based on a one-way tie that included a lengthy ship borne passage (McGibbon 1988). The weakness of this link insured that the adopted gravity value at Rothera continued to be based on the ship ties made by Griffiths *et al.* (1964) and Kennett (1965). This note describes the strengthening of the gravity link between Rothera and Port Stanley and the subsequent reassignment of the adopted gravity value at Rothera Station.

Previous estimates of gravity values at stations on the Antarctic Peninsula

The first ties between primary gravity stations on the Antarctic Peninsula and South American base stations were made via long ship links and initially used a Worden (Griffiths *et al.* 1964) and later a LaCoste and Romberg meter (Kennett 1965). An indirect link from a Rothera base station to an international base station in New Zealand, using a two-way aircraft link to McMurdo Station was completed by Renner (1981), but weaknesses in the link prevented the adopted gravity value at Rothera being reassigned. An alternative link to IGSN 71, was made using a link to the BAS gravity station in Port Stanley, (McGibbon 1988). This station was linked to the National Gravity Reference Net 1973 (NGRN 73) at Wallingford FBM (Masson-Smith *et al.* 1974). The gravity values at NGRN 73 stations can be expressed in terms of the IGSN 71 net (Morelli *et al.* 1974).

Recalculation of the adopted gravity value at Rothera Scientific Station

A total of two, two-way links and four, one-way links between Rothera and Port Stanley were completed via an aircraft, using a LaCoste and Romberg land meter G-784. A description of the location of the Rothera base station used in this link (Rothera USGS) is given, along with its coordinates, in Renner (1982), whilst a description and map of the Port Stanley base station is given in McGibbon (1988). All one-way links were completed within 10 hours and all two-way links within 36 hours. All the gravity tie data were processed using weighted adjustment programmes kindly given to BAS by Dr Roger Hipkin of the University of Edinburgh. The basis of these programmes is described in Hipkin (1978). All the data have been corrected for instrumental drift, which on average was 0.001 gu hr^{-1}. Earth tides were corrected for using the expansion of Cartwright & Tayler (1971) and Cartwright & Edden (1973). Details of how these corrections are applied are given in Hipkin (1978).

Table I summarizes the adopted gravity values at Rothera scientific station and Port Stanley. McGibbon (1988) gave the IGSN 71 adopted gravity value at a different Rothera base station as 9.8246600 m s^{-2}. The base station used by McGibbon (1988) is within 100 m and at the same altitude as the base station used in this text (Renner 1981, 1982). The fact that the value shown in Table I differs by only 0.8 gu from the value given by McGibbon (1988) provides added confidence in the calculations described here.

In conclusion, the measurements described here are of sufficient number and quality that a Rothera gravity base station can now be assumed to be accurately linked to the IGSN 71. This value of gravity at Rothera will now be used to relevel the BAS Antarctic Peninsula gravity network (Renner *et al.* 1985).

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Table I. Summary of adopted IGSN 71 gravity values at the primary gravity base stations at Rothera and Port Stanley.

Base	Latitude (°S)	Longitude (°W)	Height (a.s.l.) (m)	Adopted gravity value (gu)	Standard Error in adopted gravity value (gu)
Port Stanley[1]	51°41'32"	57°51'08"	4.2	9812267.5[2]	0.2
Rothera USGS[3]	67°34'06"	68°07'30"	12.1	9824659.2[4]	0.3[5]

[1]Description and map of the location of the base station given in McGibbon (1988)
[2]Bassett (1987)
[3]Description of the location of the base station given in Renner (1982)
[4]This text
[5]Standard error in the calculation of the gravity difference between Port Stanley and Rothera USGS is 0.1 gu
Details of the calculation are given in the text.

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