Correction to "An Extensive Region of Off-Ridge Normal-Faulting Earthquakes in the Southern Indian Ocean" by Eric A. Bergman, John L. Nabelek, and Sean C. Solomon

In the paper "An Extensive Region of Off-Ridge Normal-Faulting Earthquakes in the Southern Indian Ocean" by E. A. Bergman, J. L. Nabelek, and S. C. Solomon (*Journal of Geophysical Research, 89*(B4), 2425–2443, 1984), a formal inversion of teleseismic long-period *P* and *SH* waveforms was used to estimate source parameters of nine earthquakes. We have recently discovered two minor errors in the computer code used for these inversions. Both errors occurred in the analysis of the *SH* waveforms, one consisting of an overestimate of the delay of the *sS* phase relative to the direct *S* phase, the other resulting from an overestimate of the magnitude of the partial derivative of the waveform with respect to centroid depth. The effects of these errors were confined principally to the estimate of the centroid depth (too shallow) and its standard error (too small). The purpose of this note is to report revised source parameters for these earthquakes, based on waveform inversions performed with the corrected code.

When the previously reported solution (including station weights, number of points of the digitized waveforms used in the inversion, and alignment in time between observed and synthetic waveforms) was used as the initial estimate with the corrected code, the inversion quickly converged to a virtually identical mechanism, generally at a slightly greater centroid depth (by 0.5 km or less). With the corrected code, the formal error in the inferred centroid depth ($2\sigma = 0.5$ to 1.0 km) is 3–4 times larger than before but is still less than our estimate of the true uncertainty, in general about ± 2 km.

We also took this opportunity to conduct a more complete reappraisal of the waveform analysis for these earthquakes, including a wide range of starting points for the inversion. The resulting source parameters are listed in the revised version of Table 4. Some of the revised solutions are actually shallower than before because the typical uncertainty in the centroid depth is greater than the bias introduced by the error in synthesizing the *SH* waves. Although the misfit between observed and synthetic waveforms has been reduced in the reanalysis with the corrected code, the changes in the best fitting synthetic waveforms are for the most part not discernible.

Some of the differences between the original and the revised source parameters are attributable to two changes in the inversion procedure. The source time function is parameterized as a series of overlapping triangular elements rather than the box functions used previously. Tests indicate that this usually leads to a slightly smaller estimate (by a few percent) of the seismic moment. We also adopted a different strategy concerning the specification of a priori parameter variances, which influence the estimates of the formal errors in Table 4. By specifying an infinite a priori parameter variance, we now make no assumptions about the solution. The a posteriori parameter variance changed significantly only for the seismic

TABLE 4. Source Mechanisms Obtained From Body Wave Inversion

No.	Date	Moment*	t_s,† s	Depth,‡ km	Strike	Dip	Slip
1	Dec. 19, 1965	13.0 ± 5.0	4.0 ± 1.0	11.3 ± 0.7	300.2° ± 2.1°	68.3° ± 1.2°	303.6° ± 3.2°
2	Feb. 17, 1966	84.0 ± 6.6	11.2 ± 1.1	11.4 ± 0.7	276.0° ± 1.9°	59.5° ± 0.8°	289.8° ± 2.0°
3	Oct. 8, 1968	22.8 ± 10.4	4.0 ± 0.8	8.9 ± 0.6	5.7° ± 2.0°	53.7° ± 1.1°	268.8° ± 1.8°
4	May 3, 1973	8.0 ± 2.1	3.0 ± 1.0	15.0 ± 0.6	184.7° ± 2.6°	50.1° ± 0.9°	252.8° ± 2.0°
5	Sept. 19, 1975	48.5 ± 10.0	10.5 ± 1.5	17.9 ± 0.9	241.3° ± 2.6°	63.1° ± 0.7°	274.8° ± 2.4°
6	Nov. 2, 1976	76.4 ± 4.4	9.0 ± 1.5	13.9 ± 0.5	230.5° ± 3.4°	36.7° ± 0.8°	282.1° ± 2.0°
7	Nov. 2, 1976	5.6 ± 1.7	3.0 ± 1.0	13.8 ± 0.7	249.0° ± 4.2°	40.8° ± 1.3°	293.2° ± 2.5°
8	May 22, 1979	3.6 ± 1.3	2.0 ± 1.0	16.5 ± 1.0	197.1° ± 2.4°	49.0° ± 0.8°	278.8° ± 1.9°
9	Sept. 24, 1981	4.4 ± 1.0	3.0 ± 1.0	10.9 ± 0.7	142.1° ± 4.5°	36.6° ± 1.1°	247.4° ± 4.4°

Range indicated for each parameter is 2σ (95% confidence level). The range of t_s is one half the width of the elementary time function elements.

*In units of 10^{24} dyn cm (10^{17} N m).

†Total duration of faulting. For events 2 and 6, t_s is the time function appropriate to a direction normal to the rupture vector for the horizontal line source used to model these events.

‡Relative to top of crust.

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TABLE 5. Stress Drops Obtained From Seismic Moment and Source Time Duration

No.	Date	Stress Drop, bars Minimum	Stress Drop, bars Maximum
1	Dec. 19, 1965	1	6
2	Feb. 17, 1966	1	2
3	Oct. 8, 1968	2	11
4	May 3, 1973	1	9
5	Sept. 19, 1975*	1	5
6	Nov. 2, 1976	1	3
7	Nov. 2, 1976	1	6
8	May 22, 1979	2	14
9	Sept. 24, 1981	1	5

Note that 1 bar = 0.1 MPa.

*The time function for this event suggests that the rupture occurred in two distinct pulses, each with a stress drop in the range of 1–5 bars.

moment with this procedure. The revised formal errors (2σ) for seismic moments, ranging from about 5 to 50%, are on average several times larger than before.

The changes in centroid depth, seismic moment, and source time functions resulting from the reanalysis of these earthquakes require revision of the estimates of the minimum and maximum stress drop in Table 5. We also correct here a simple error in the conversion of units which caused all the reported stress drops to be too large by a factor of 10. The revised stress drops are nearly all between 1 and 10 bars.

Our interpretation of the tectonic significance of these unusual earthquakes is unaffected by these revisions to the source parameters.

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