Earthquake and Volcano Deformation: Errata

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1. Chapter 1. Page 9, Equation (1.24) last term. The final term in $\epsilon_{\theta\phi}$ should be $\cot(\theta)u_\phi/r$, not $\cot(\phi)u_\phi/r$

2. Chapter 2. Page 50. Problem 3. The slip distribution $s(\xi) = s_0(1-\xi/D)$ holds for $0 \leq \xi \leq D$. $s(\xi) = 0, \xi > D$.

3. Chapter 3. Page 53. Line 3-4, should read:

   We represent the point force of unit magnitude as a *Dirac delta function* (Figure 3.5) at $\mathbf{x}$ acting in the k-direction as $\delta_{ik}\delta(\xi - \mathbf{x})$.

4. Chapter 3. Page 60. The integral in (3.31) should equal -1, as the shear stress induced by a positive force is negative. The displacement in the positive x_3 direction decreases as r increases. Multiply equations (3.32) through (3.35) by -1.

5. Chapter 3. Page 60. Equation (3.33), the derivative is with respect to ξ_2, that is it should start

$$\tilde{\sigma}_{23}^3 = \mu \frac{\partial \tilde{g}_3^3}{\partial \xi_2} = \ldots$$

6. Chapter 3. Page 63. Third line past equation (3.50) should read:

   "..., substituting equation (3.49) into (3.48)..."

7. Chapter 3. Page 65. The last line of text before equation (3.61) should be changed to read

   " From Figure 3.9, $R^2 = x^2 + d^2 = p^2 + q^2$. The fault parallel coordinate p is found by

$$p^2 = R^2 - q^2 = R^2 - (x \sin\delta + d\cos\delta)^2.$$

   In Figure 3.9 re-label r to R. The figure caption should read: "Coordinate system in which the vector from the top of the fault to the observation point R is decomposed into perpendicular component q and parallel component p."

   (N.B.: The variable r should have been reserved for the distance from *any point* on the fault to the observation point, whereas R is the distance from the dislocation line, or top of the faut.)

8. Chapter 3. Section 3.5. The sign convention on s_1 is reversed from the previous sections. To maintain the same sign convention as in section 3.3, replace s_1 with $-s_1$ in equations: (3.74), (3.77), (3.78), (3.79).

9. Chapter 3. page 74. equation (3.78). The first term in braces has an extraneous "d". It should be omitted.

10. Chapter 3. page 76. equation (3.84). Second term on RHS add F to numerataor. (Subsequent to that we set $F = 1$; it was only there to make the units clearer).

11. Chapter 3. page 77. equation (3.89). Remove μ in the denominator.

12. Chapter 3. page 88. Problem 2.

    "...uniform slip s in the 1-direction at depth d. "

13. Chapter 3. Page 88. Problem 3. The equations are correct as stated, however, if one takes the solutions from (3.51), (3.52), and the previous problem, the observation coordinates are ξ. That is $u_1(\xi_1, \xi_2 = 0) = ...$ To be consistent the non-dimensionalization should read

$$\frac{\xi_1 - x_s}{d}$$

    where x_s is the x_1 coordinate of the updip end of the dislocation. (In computing the displacements in problem 2 above, we integrate over x_1, so it is less ambiguous to label it x_s.)

14. Chapter 3. page 88. Problem 4. Both equations here differ by a sign from equations (3.73). That is positive slip is thrust faulting in the equations here.

15. Chapter 4. Page 93. Figure 4.2, part B. The traction on the fault is: $\tau_0 - \tau^\infty \equiv -\Delta\tau$.

16. Chapter 4. Equation (4.15), should read:

$$B(z) = \frac{-2}{\mu}\frac{a}{\sqrt{a^2 - z^2}}\sum_{n=1}^{\infty} c_n T_n(z/a).$$

17. Chapter 4. Page 116. Problem 4. Problem statement should be: Show that the constant C in equation (4.7) is given by (4.8). Assume that the stress drop can be expanded in Chebyshev polynomials of the second kind as in equation (4.14). Hint: Use the orthogonality relationship for the T_n.

18. Chapter 5. Page 162. Problem 5.3. Replace the problem statement with: Equation (5.26) gives the displacements within the shallow layer (region I) due to an infinitely long strike-slip fault within a half-space beneath a layer with differing shear modulus.

    (a) Show that the displacements within the half space (region II) are given by:

$$\begin{aligned} u^{(2)}(x_1, x_2 < 0) &= \frac{s}{2\pi}\left\{\tan^{-1}\left(\frac{x_1}{x_2 + d}\right) + \kappa\tan^{-1}\left(\frac{x_1}{x_2 - d}\right)\right. \\ &\quad \left. - (1 - \kappa^2)\sum_{n=1}^{\infty}\kappa^{n-1}\tan^{-1}\left[\frac{x_1}{x_2 - (d + 2nH)}\right]\right\} \end{aligned}$$

    (b) Show that the displacements are are continuous across the material boundary.

19. Chapter 6. Page 166, 3rd paragraph: 'Hokaido' should be replaced by 'Hokkaido'.

20. Chapter 6. Page 174. Figure 6.8. The labels on the relaxation functions (bottom) are reversed. The upper diagrams show the stress (or force) while the lower diagrams show the imposed deformation (or strain).

21. Chapter 6. Page 185. Line after equation (6.49) should read "... is simply $-i\Delta u/k$, which is the Fourier transform of a step function with magnitude Δu.
22. Chapter 7. Figure 7.5 caption should be labeled as ρ/d.
23. Chapter 7. Equation 7.18. The expression should be $r = \sqrt{(x_1 - \xi_1)^2 + (x_2 - \xi_2)^2 + (x_3 - \xi_3)^2}$.
24. Chapter 7. Equation 7.78. The expression for u_3 should be multiplied by -1. (N.B. The Green's functions in (7.76) and (7.77) employ a coordinate system with x_3 positive upward, as in Chapter 3. If depth is taken to be a positive quantity, and $d_2 > d_1 > 0$ this requires a sign-change for terms in (7.76) and (7.77) that are odd functions of ξ_3. This changes the sign on the vertical displacement in (7.78), but not the radial displacement).
25. Chapter 7. 4 Lines past equation (7.24) should read: " By the equivalence discussed above, this is a first order approximation to a pressurized spherical cavity in a *half* space. "
26. Chapter 7. Equation 7.52. Both expressions for the integrals I_{12} should both be multiplied by a factor of 3.
27. Chapter 7. Equation 7.113. The last line, $f(t, \ldots)$ for the case $t_S = t_R$, the factor multiplying the exponential in the first term should be t/t_R rather than t.
28. Chapter 7. Page 251. Equation 7.121. The expression for σ_{11} should be multiplied by -1.
29. Chapter 8. Page 256. Equation (8.8). * is missing on the ∂x_3.
30. Chapter 8. Page 257. Equation (8.10). The formal expansion at order (H/L) is such that the left-hand side of the second equation should be $(H/L)\sigma_{j3}^{(1)}$. Solution to the boundary value problem at this order leads to displacements $(H/L)u_i^{(1)}$. In what follows (equations 8.11, 8.12 and 8.15, etc), the factor (H/L) was absorbed into $\sigma_{ij}^{(1)}$ and $u_i^{(1)}$. In other words equation (8.5) becomes $u_i = u_i^{(0)} + u_i^{(1)} + ++$, since the factor (H/L) was absorbed in $u_i^{(1)}$.
31. Chapter 9. Page 269. Equation (9.15). The second term should be written as $-\nabla(\rho_0 \mathbf{u} \cdot \nabla \phi_0)$.
32. Chapter 9. Page 275. Following equation (9.15) should read "where $P(0, H)$ and $P(0, z_s)$ are propagator matrices that ..."
33. Chapter 9, p. 311, Figure 10.6 b) The x axis should range from 0 to 2, rather than 0 to 4.
34. Chapter 10, p. 314, equation (10.77); replace all occurrences of b in both expressions with Δu.
35. Chapter 10. Figure 10.9. Change caption to read "fault has *half*-length, L of 2.0".
36. Chapter 10. p. 321, bottom. Expression should be $u_{poro} = u(\nu) - u(\nu_u)$ since post-seismic displacements are $u(t \to \infty) - u(t = 0)$.
37. Chapter 10. p. 322, 2nd paragraph. Sentence should read "maximum displacements are on the order of 3 or 4 percent of the coseismic slip."
38. Chapter 10. p. 327, equation (10.115). Multiply the right-hand side by $1/\mu$.

39. Chapter 10, p. 330, Problem 6. The problem statement should read "the vertical stress on the plane $z = 0$ take $\sigma_{zz}(z = 0, t) = -FH(t)H(z)$." N.B. The initial condition on the pore-pressure must be accounted for in the Laplace transformation.

40. Chapter 10, p. 330, Problem 10. Replace the problem statement with: "Show that for an infinitely long dip-slip fault (plane strain), *in a homogeneous half-space,* that the free-surface displacements at time $t = 0$ are identical to those in the limit $t \to \infty$.

41. Chapter 11. Page 347. First line should read: Note with reference to (11.22) that $\partial\tau_{ss}/\partial \log v = \sigma(a - b)$, so that it is possible to write the critical stiffness as

$$k_{crit} = -\frac{1}{d_c}\frac{\partial\tau_{ss}}{\partial \log v}.$$

42. Chapter 11. Page 350, last paragraph. The "no healing" limit is $\theta v/d_c \gg 1$.

43. Chapter 11. Page 356, 3 lines from bottom, multiply by -1, such that $s(t) = -d_c \log(1 - t/t_{inst}) = d_c \log[1/(1 - t/t_{inst})]$.

44. Chapter 11. Page 357, equation (11.54), multiply right-hand side by -1.

45. Chapter 11. Page 364, equation (11.69), Should cite the following, who derived it first: *Perfettini, H., and J.P. Avouac. Postseismic relaxation driven by brittle creep: A possible mechanism to reconcile geodetic measurements and the decay rate of aftershocks, application to the Chi?Chi earthquake, Taiwan. JGR* 109.B2 (2004).

46. Chapter 11. Page 369. Problem 2. Replace v with v^∞ in the problem statement.

47. Chapter 11. Page 369. Problem 3. After equation (11.73) it should read: Since $a rcsinh(x) = \ln(x + \sqrt{x^2 + 1})$.

48. Chapter 12. p. 376. The second line after equation (12.2) should read:

$$\frac{v^{plate}}{\pi}\int_{-a}^{z}\frac{d\xi}{\sqrt{a^2 - \xi^2}}$$

49. Chapter 12. p. 413. Problem 1.26. The equation (12.59) should read

$$u_3(k, t) = \frac{-i\Delta u}{k}\left(1 - e^{-at}e^{-H|k|}\right).$$

50. Appendix B p. 420. The correct spelling is Heaviside. This appears also in Chapters 6, 7, 9, and 12.