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Viscoelastic-Gravitational Half-Space Model for Postseismic Displacements Revisited

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We consider the problem of surface deformation arising from a fault in a semi-infinite, elastic-gravitational, and/or viscoelastic-gravitational, plane-layered medium, subject to an externally imposed gravitational acceleration g. Rundle [1981, 1982] presented a calculation in which self-gravitation, represented by terms proportional to G are neglected, and the externally imposed acceleration due to gravity, g, is considered constant in the medium. Because of the recent strong interest in computations of this type, we examine the assumptions involved in these computations. To do so, we follow the methodology introduced by Fernández and Rundle [2004]. We show that a generally decreasing g with increasing depth z is a necessary prerequisite for regularity of the solution manifold as z ő(in the half space approximation to the real earth. We show that these assumptions are not likely to have serious consequences in the relatively near-field viscoelastic displacements, where the earth's curvature is neglected. We also show that the approximation described by Rundle [1981, 1982], which was technically not regular as z ő(, can easily be regularized using a new approach without appreciable change in the resulting displacement field. We perform a detailed comparison between the original model [Rundle, 1982; Fernández et al., 1996a,b]. We also update the results shown by Rundle [1982] considering that (1) After a period of 20 years, there is widespread interest in these types of computations with a higher accuracy as a result of the prevalence of more precise measurements; (2) The computing machinery, compilers, mathematical subroutines, and other factors are both substantially different and faster now than 20 years ago; and (3) Given these factors, we would like to make sure that the results are up-to-date and applicable to

the work of the widespread scientific community.We focus in the thrust fault case as an example, but many of the conclusions are of general application for the family of viscoelastic-gravitational half space models for postseismic displacement.