Preface to Version 3

Fred F. Pollitz

December 6, 2006

VISCO1D.v3 includes updated programs and examples to compute post-earthquake deformation. The changes with respect to Version 2 include:

- Capability of computing post-earthquake relaxation of a spherically-stratified viscoelastic structure with a combination of elastic, Maxwellian viscoelastic, standard-linear-solid viscoelastic, and Burgers-body viscoelastic layers.

- New program **vsphm**, which determines the spheroidal motion response functions for the modes identified by **decay4m**. Both **decay4m** and **vsphm** use the method of second order minors (section 2 of *Manual*)) to accurately determine the poles of the Laplace-transformed displacements (**decay4m**) and determine the corresponding eigenfunctions using a combination of upward integration of the second order minors and downward integration of the displacement-stress vector (**vsphm**). Bulirsh-Stoer numerical integration (described in *Numerical Recipes*) is used to perform these integrations. **decay4m** and **vsphm** include gravitational effects; thus, together they compute the response functions for spheroidal-motion gravitational-viscoelastic relaxation (Pollitz, 1997). To perform non-gravitational calculations of the spheroidal-motion deformation field, one may use the existing programs **decay4** and **vsphdep**. Note that **decay4** runs much faster than **decay4m**, and if neglect of gravitation is not an issue then the combination of **decay4** and **vsphdep** is recommended because of their speed.

- New program **strainA**, which accomplishes the combined jobs of the former **strainx** and **strainw**. These programs compute postseismic deformation for specific faulting sources using decay times previously computed and stored in decay.out (toroidal motion) and decay4.out (spheroidal motion), and using response functions previously computed and stored in vtor.out (toroidal motion) and vsph.out (spheroidal motion). **strainA** computes the post-earthquake deformation very efficiently. The efficiency arises because the algorithm performs two key steps. First, it evaluates a large number of response functions for all needed source depths and a number of angular distances at discrete intervals; second, when integrating point sources to simulate a finite source, it uses spline interpolation of the previously calculated response functions to evalaute the post-earthquake deformation at a given set of observation points. The first step accomplishes all of the needed sums over spherical harmonic degree, so then the second step is done is extremely rapidly. Even for faults that require a huge number of point sources to represent them, i.e., the rupture surface of the Sumatra-Andaman earthquake, **strainA** computes all post-earthquake deformation very rapidily, typically 50 times faster than the former **strainx** and **strainw**.

- To summarize the above, the old spheroidal-motion programs for the gravitational case – **decay4g**, **vsphg** – are now obsolete; they are replaced with the single program **vsphm**. Similarly, the old deformation programs **strainx** and **strainw** are now obsolete; they are replaced with the single program **strainA**.