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Time domain finite difference modeling of seafloor compliance

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"Seafloor compliance" refers to the vertical deformation of the seafloor under pressure forcing from ocean surface gravity waves. Because the ocean waves generally travel much more slowly than seismic elastic waves (<=0.2 km/s for water depths <=4 km, for example, compared to >2km/sec), it is convenient in the derivation and analysis to assume decoupling of the two systems. The "compliance effect" is however imbedded in the elastic wave equation. As an example, we obtain the compliance effect using our two-dimensional time-domain finite-difference (TDFD) code which solves the elastic and anelastic wave equations. Ultimately we would like to apply a three-dimensional TDFD code to this problem. Some advantages of this approach would include: 1) The traditional derivation of the compliance relation assumes layered media. With a TDFD approach we can study the applicability and resolution of the method to full three dimensional structures such as axial magma chambers. 2) There are situations in which we would expect propagating elastic waves to couple energy with surface gravity waves. A methodology for treating both simultaneously would be extremely useful. 3) By combining elastic wave propagation and compliance in the same formulation we can better address the relative strengths and weaknesses of compliance and seismic refraction techniques. 4) The concept of anelasticity (attenuation or Q) is based on the notion of "energy loss per cycle". It is really not clear how anelasticity translates to a quasi-static compliance situation. 5) Tsunamis are, of course, impulsive, coherent and directional infra-gravity waves with energy in the same band as the compliance effect. Questions to be addressed would include: a) What is the predicted seafloor deformation under a tsunami? b) What role do evanescent effects (such as compliance) play in the excitation of tsunamis? c) Are identifiable seismic waves generated when tsunamis impact coastlines?