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Modelling regional seismic wave propagation across a passive margin: a coupled local-mode approach

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In view of preparing for making a European reference model, it is important to evaluate the effect of various geodynamical settings, upon wave propagation phenomena. We try here to evaluate the influence of a continental margin on the propagation of surface waves. Drastic changes of structure and of elastic properties through a passive margin modify very strongly the depth dependence of the modes eigenfunctions and may prevent using the asymptotic ray theory in intermediate and long-period synthetic seismograms calculations. Instead of propagating independently of each other, modes couple at strong and rapid lateral variations. We model their propagation by using an extension of the coupled local mode approach (e.g., Maupin 1988). We consider seismic propagation across a 2-dimensional waveguide; the local wavefield is expanded on the basis of local surface-wave modes, supplemented, for completeness, by the so-called improper eigenfunctions. The latter are the modes associated with body waves radiated in the half-space underlying the waveguide. All these modes (improper or not) strongly depend on the local elastic structure, and the lateral evolution of the waveguide structure controls the evolution of the amplitude of each of the modes. Broadband seismograms are then synthetised; specific attention is paid to the mode coupling for frequencies at which one of the normal modes of the structure goes to cut-off. We analyse to which extend the total phase of the surface wavetrain can be considered as a linear function of the phase slowness across the margin, an assumption which is commonly used in tomographic studies.