Relationship between physical properties assumed pyrolite composition and seismic velocitiy structure in the upper mantle

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Assuming that the upper mantle consists of pyrolite composition, we determined the values of derivatives of bulk modului and shear modului with respect to pressure and temperature and those of Grüneisen-Anderson parameter for composite minerals of pyrolite composition, by comparing depth distributions of seismic velocities calculated from the redetermined values of physical properties using genetic algorithm from high pressure and high temperature experiments with those of IASP91.

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As a result, we found that the values of physical properties for modified spinel were determined so as to decrease seismic velocities. We also found that the values of physical properties for perovskite, magnesiowüstite and majorite except the values of derivative of shear modulus for magnesiowüstite with respect to temperature were determined so as to increase seismic velocities. Depth distributions of seismic velocities calculated from the redetermined values of physical properties show that the depth of velocity jump, corresponding to the 410km seismic discontinuity, occurs at a depth shallower than that for IASP91. The amount of velocity jump at the 660km seismic discontinuity calculated in this study reaches 3 0.000000or P-wave, which is smaller than that (5.8) for IASP91. We also investigated the effect of mantle geotherm on depth distributions of seismic velocities. The results show that the seismic velocities increase as the mantle geotherm becomes low, and the amount of velocity jump at the 660km seismic discontinuity obtained in this study is too small to explain that for IASP91 for any mantle geotherm. Thus, the amount of velocity jump at the depth of 660km remains unchanged, even if the mantle geotherm changes to some extent. If we assume that the upper mantle consists of pyrolite composition, these suggest that the amount of velocity jump at the 660km seismic discontinuity for IASP91 is overestimated.