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Model Resolution, Model Covariance, and Travel Time Prediction Uncertainty for a Global Tomographic P-Velocity Model

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Global 3D models of the compression wave speed in the Earth can provide superior travel time predictions at both regional and teleseismic distances. However, given the variable data quality and highly uneven data sampling associated with this type of model, the uncertainty of predicted travel times computed through these models will vary significantly with position in the Earth. Seismic event location codes require good estimates of the prediction uncertainty in order to apply appropriate weights to the various observations used to compute the locations and to reliably estimate the uncertainty of the resulting locations. The approach that we are adopting is to calculate prediction uncertainties from the tomographic matrices. Quantities that are computed along the way include the model resolution matrix, the model covariance matrix and, finally, the travel time uncertainties. We have found it necessary to include a previously ignored term in the determination of the model covariance matrix that we call the '*a priory* covariance of the change in slowness', which we will describe in detail. We will also show results of all of these quantities obtained by applying the calculations to our SALSA3D model, a global P-velocity model of the Earth's mantle.

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