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Incorporating seismic phase correlations into a probabilistic model of global-scale seismology

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We present a probabilistic model of seismic phases whereby the attributes of the body-wave phases are correlated to those of the first arriving P phase. This model has been incorporated into NET-VISA (Network processing Vertically Integrated Seismic Analysis) a probabilistic generative model of seismic events, their transmission, and detection on a global seismic network. In the earlier version of NET-VISA, seismic phase were assumed to be independent of each other. Although this didn't affect the quality of the inferred seismic bulletin, for the most part, it did result in a few instances of anomalous phase association. For example, an S phase with a smaller slowness than the corresponding P phase.

We demonstrate that the phase attributes are indeed highly correlated, for example the uncertainty in the S phase travel time is significantly reduced given the P phase travel time. Our new model exploits these correlations to produce better calibrated probabilities for the events, as well as fewer anomalous associations.