Plume Heat Flux Estimates
Guust Nolet, Raffaella Montelli • Princeton University
Shun Karato • Yale University

The global coverage with broad-band seismic stations is now such that our resolving power in selected locations is good enough to make quantitative estimates of plume flux. This figure shows an example of a resolution test for a cross-section through the Reunion plume at a depth of 1100 km. The left image shows the temperature anomaly (degrees K), the center column the rise velocity in cm/yr computed for a viscosity at background temperature of $1.6 \times 10^{23}$ Pa·s and an iron enrichment $\Delta X_{Fe}$ of 0.3%. On the right we show the associated heat flux in W/m². These quantities were computed for three different models, from top to bottom: the model that was input to generate data for the resolution test, the model resulting from the tomographic inversion of these synthetic data, and the model resulting from the tomographic inversion of the actual data. In this case the heat flux (0.12 TW) calculated from the tomographic image of the synthetic model was slightly higher than the input heat flux of 0.10 TW. The 'observed' heat flux calculated for the same values of viscosity and iron enrichment is 0.29 TW (biased) or 0.24 TW (corrected for bias). These estimates become lower when the effect of anelasticity is taken into account. The units are K (left), cm/yr (center) and W/m² (right).