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Discussion

Reply to comments on "Separation of Qi and Qs from passive data at Mt. Vesuvius: A reappraisal of the seismic attenuation estimates" by Ugalde, A. and Carcolé, E.

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1. Introduction

The paper by Del Pezzo et al. (2006), hereafter named DPBZ, deals with the estimate of the seismic attenuation in the high frequency range for the volcanic area of Mt. Vesuvius. In particular DPBZ use a method based on the fit of the observed local earthquake coda envelopes to the radiative transfer classical equation (see Sato and Fehler, 1998 for a wide and exhaustive review on this argument) in terms of the intrinsic attenuation and the scattering attenuation coefficients.

Ugalde and Carcolé in their comment (hereafter named UC) discuss two points of DPBZ that we summarize here in their essence:

(a) Two approximations of the exact solution of the 3-D radiative transfer model have been calculated, that discussed by Zeng (1991) – hereafter Z91 – expressed by Formula (5) of UC, and that by Paasschens (1997) – hereafter P97 – expressed by Formula (6) of UC. UC show that P97 is more accurate than Z91, which is instead used in DPBZ.

(b) DPBZ obtain the separated estimates of intrinsic- and scattering-attenuation coefficients, respectively ηi and ηs, first stacking the normalized energy envelopes (starting at 2*Ts* lapse time) and then fitting the experimental data with the normalized (in the same way) theoretical curve. UC disagree with this procedure. Their opinion is that DPBZ should have inverted the single energy envelopes and then have averaged the results obtained.

In the following we reply to points (a) and (b) in two separate sections.

2. Reply to point (a)

UC show that P97 is more accurate than Z91. This is true, with no doubts at all. At the time DPBZ was written (2005) the authors were not informed of P97, being P97 published on a General Physics

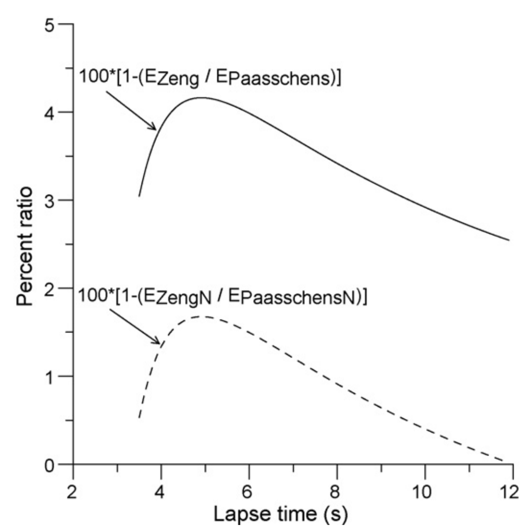

Fig. 1. Percent ratio between Z91 and P97 ($100 \times (1 - (E_{\text{Zeng}})/(E_{\text{Paasschens}}))$, continuous line) and between Z91-normalized and P91-normalized ($100 \times (1 - (E_{\text{ZengN}})/(E_{\text{PaasschensN}}))$, dashed line) as a function of lapse time, in the lapse time interval between 3.6 and 12 s, used by DPBZ.

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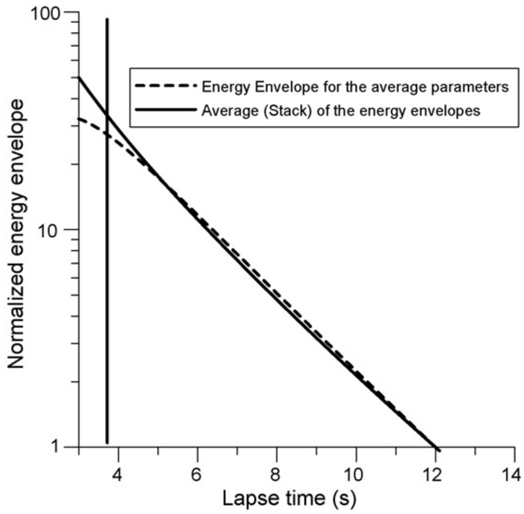

Fig. 2. Normalized energy envelope calculated for the average (dashed) and stack of the energy envelopes (continuous). The vertical bar mark the lapse time at which DPBZ start their analysis.

Journal in a sector different from that of Seismology. The authors of DPBZ are grateful to A. Ugalde and E. Carcolè for having informed that the approximation described in P97 is better than that in Z91; accordingly they already changed the formula in Z91 with that in P97 in their Matlab files for a possible use in their future works. However, due to the assumptions that are at the base of DPBZ as well as to the data scatter produced by the high level of background seismic noise in their study, the separated estimates of intrinsic- and scattering-attenuation coefficients, respectively ηi and ηs, are affected by an uncertainty (see Fig. 7 of DPBZ) that results so high that the use of P97 instead of Z91 is practically ineffective. In addition, but only for the sake of precision (or in other words to be scholastic), in DPBZ the authors use theoretical curves normalized at 12 s lapse time to fit their data. In the plot of Figs. 1 and 2 of UC the percent ratio between the absolute P97 and Z91 instead of the normalized values used in DPBZ is reported. In the present reply we plot in Fig. 1 the percent ratio between the normalized P97 and Z91, estimated for the values of ηi and ηs estimated by DPBZ for Mt. Vesuvius. Due to the normalization, the bias is much lower than that calculated by UC.

3. Reply to point (b)

We generate two vectors of normally distributed values ηi_k and ηs_k in the error range determined in DPBZ for the estimate of ηi and ηs (at 3 Hz, see Fig. 7 of DPBZ) and a vector of uniformly distributed (between 0.5 and 5 km) synthetic values of source station distances, r_k, $k \in [0, 1000]$, roughly corresponding to the real distribution of measured source-BKE distances for the seismicity at Mt. Vesuvius. Then, for each value of k we calculated the theoretical energy envelopes using Formula (6) of UC for ηi_k, ηs_k and r_k. For these synthetical envelopes we eventually calculate the stack in the same way as described in DPBZ. Indicating the average of ηi_k, ηs_k and r_k respectively with $\overline{\eta i}$, $\overline{\eta s}$ and $\bar{r}$ we plot in Fig. 2 the energy envelope calculated using Formula (7) of UC for $\overline{\eta i}$, $\overline{\eta s}$ and $\bar{r}$ and the stacked envelope of the synthetic traces. The two quantity are practically coincident in the range of lapse time used for the analysis done at Mt. Vesuvius by DPBZ.

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