Consiglio Nazionale delle Ricerche (CNR)
Istituto di Geologia Ambientale e Geoingegneria (IGAG)

Title: "Ground motion prediction maps using seismic microzonation data and machine learning" by Federico Mori et al., Nat. Hazards Earth Syst. Sci. Discuss.,

Dear Referee,

we thank you for your thorough assessment of our paper. We have carefully addressed the comments and made corresponding changes to the manuscript. We have modified and added some figures. We have carefully revised the ambiguous statement in the article.

Referee comment RC1 https://doi.org/10.5194/nhess-2021-282-RC1

The manuscript utilizes machine learning in ground motion prediction and compares ML based techniques with GMM and ShakeMap. The former has been shown to have better performance than the latter two. I am not surprised by the results, as has been demonstrated by many that ML techniques are advantages over parametric GMMs. ShakeMap is basically also based on GMMs which reply on an input grid-based V_{S30} map.

General comments:

- What is the logic behind the selection of site proxies? For instance, why do you utilize elevation? Is there any physical reasoning? Is it necessary to use elevation, slope (hx and hy) and curvature (hxx and hyy) simultaneously? Could you provide a plot or some discussions on the performance of each site proxy in the best performing model (GPR)? I recommend the authors expend a bit on the performance of these site proxies?

Reply:

Zhou et al. (2020) suggests that the parameters of the topographic elevation, the first gradient of the elevation and the second-order gradient in two orthogonal directions are enough to provide the acceptable topographic effect model.

So, the philosophy was to add these five proxies (topographic effect proxies) respect to the four standard proxies (magnitude, epicentral distance, hypocentral depth, V_{s30}) already used in the Ground Motion Models GMMs.

In the case of PGA, for example, these are the differences in terms of performance (14% reduction in terms or Root mean squared error, RMSE, and 17% reduction in terms of Mean Absolute Error, MAE). In terms of residuals, there is a 46% reduction of standard deviation.

Selected proxies	Root Mean Squared Error (RMSE)	Mean Absolute Error (MAE)	R-squared	mean of residuals	standard deviation of residuals
GMMs standard 4 proxies	0.37	0.29	0.85	-0.001	0.3
This study 9 proxies	0.31	0.24	0.89	-0.000033	0.161

Specific comments:

- Line 74-95: these paragraphs have many details. I suggest they better be moved to other sections, rather than in the introduction. The introduction shall serve to intrigue the readers to read the paper, but these paragraphs are too detailed and may be counterproductive.

Reply:

The lines 74-95 were rephrased and moved at the beginning of the section 3.2 “Testing phase”.