

Interactive comment on “Shallow subsurface geology and seismic microzonation in a deep continental basin. The Avezzano Town, Fucino basin (central Italy)” by Paolo Boncio et al.

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Author reply to referee 1 comments on “Shallow subsurface geology and seismic microzonation in a deep continental basin. The Avezzano town, Fucino basin (central Italy)” by Paolo Boncio et al.

REFeree: The paper presents the level 1 Seismic Microzonation of the Avezzano town considered as a case study of shallow subsurface and site effects in a deep continental basin environment, focusing on geologic constraints and discussing some methodological procedures.

GENERAL COMMENTS: Despite the topic is interesting and suitable for NHESS (sub-

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surface geology and associated local seismic hazard in anthropized continental basin), the goals of the manuscript are not clearly presented; the authors seem to hesitate in identifying the most important and innovative results of their own work, describing data, methods and results (achieved or open questions) without emphasis (e.g. the proposed new structure of Geological-Technical Map for SM is wound up in few sentences without highlighting the strengths and differences with existing guidelines). This is evident from the very beginning: i) the title refers to seismic microzonation in a deep continental basin but data, methods, maps, and results refer almost exclusively to the shallow part of the basin (the Avezzano town and surroundings); ii) the Introduction is too general and vague (e.g. the “additional methodological procedures” proposed as implementation of guidelines for Seismic Microzonation should be stressed and better described due to their relevant applicative implications); iii) in the further paragraphs new data and implementation of new methods are far from being clearly separated from literature or previous data and methods. The paper can be improved by clearly defining the main goals and going through the rewriting of some paragraphs, first of all the Introduction, in order to clarify the perspective. My recommendation is that the manuscript can be accepted after revisions according to general and specific comments.

RESPONSE: We would like to thank the reviewer for the useful suggestions and we are going to comply all the general comments in the revised version of the manuscript. The queries about the specific comments have been answered separately in the following section.

SPECIFIC COMMENTS

REFeree:

TITLE: The title should be modified to better fit with the content of the manuscript. The use of “deep” referred to the (Fucino) continental basin as a whole is misleading and in contrast with “The Avezzano Town”, indeed the paper deals with the seismic microzonation of the Avezzano town, that is not the deeper part of the basin. More

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in general, considering the map of fig. 1b, the Fucino basin can't be considered as a deep continental basin due to the very limited extension of its deeper part (Quaternary infill up to 1,000 meters). I suggest to modify the title deleting the catchword "deep" and putting in evidence the case study of the Avezzano town. Please don't use the capital letter for Town.

RESPONSE: We will change the title deleting the word "deep". The new title of the paper is: "Shallow subsurface geology and seismic microzonation of the Avezzano town (Fucino continental basin, central Italy)"

REFEREE:

1. INTRODUCTION: The section must be rephrased, especially in the first part, where the many clauses don't make a meaningful sentence. The Authors state that "a geological model is achieved by the interplay of different data, but surface geology obtained by basic detailed geological survey (e.g. 1:5,000 scale), integrated with borehole stratigraphies, still remains the fundamental source of information"; however, considering the morphology of the Fucino basin (flat area) and that the paper focus on the Avezzano town (urbanized area). I suggest the Authors to better explain what they mean and how they have used surface data as fundamental source of information. Also in the paper the subsurface data seem to be the most important ones.

RESPONSE: We accept the comments and we will modify the Introduction. In particular, we will better explain the used geological dataset. It is constituted by the integration of field and subsurface (borehole-derived) data on which the entire microzonation process is based. Moreover, we would like to clear up that an original field geological survey has been performed (1:5000 scale). In spite of the urbanization and relatively flat morphology of the area (please note that the area is flat only where the Lac3 unit crops out), the performed survey helped significantly in constraining the geology of the Avezzano area (e.g., boundaries between cover units and bedrock; boundaries between different units within the continental successions, etc.).

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REFEREE:

2. GEOLOGICAL SETTING: In the text (p. 2 line 25 and p.3 line 5) it is not clear if the Authors consider the Fucino basin as a graben or half-graben; they use (Fig. 1) the geological section from Cavinato et al., 2002 with a half-graben interpretation but the map where the trace of the cross section is indicated reported an articulated graben framework for the Fucino basin not corresponding with the cross section. Please better explain your personal interpretation, based on your own new data, and draw your own geological cross section.

RESPONSE: We agree with this comment. We will draw an original geological transect that takes into account the geometry of the active faults reported in Figure 1b. It is based on our original data for that regarding the western sector, and on the data published by Cavinato et al. (2002) for the central and eastern sectors.

REFEREE:

The Authors use the term Late Pliocene (p.3 line 1): it would be useful to indicate the chronostratigraphic chart used or to modify the term with Gelasian in order to give a clear and unambiguous chronostratigraphic reference.

RESPONSE: We used the chronostratigraphic chart with the base of the Quaternary placed at 2.588 Ma, thus the term "Late Pliocene" is properly used and updates the definition used in the original paper (Galadini and Messina, 1994). We will specify this point in the revised text.

REFEREE:

3. METHODOLOGY : The phase 2 "geologic and geomorphologic field survey" is indicated as the "most important during Level 1 SM" and the Authors state "A detailed geological survey has been carried out". However data and results of this activity are not well presented in the paper. As reported in the text, most of the surface geology characteristics are derived or referred to the 1:50,000-scale Italian Geological Map of

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the CARG Project (see p. 4 line 33, and pp.6-7). Please try to better explain which are your own new data.

RESPONSE: In the revised text we will clear up that the continental deposits were mapped following an original field geological survey. For that regarding the bedrock units: 1) the field geological survey were performed by the authors in the Tre Monti area, 2) the pre-existing CARG map has been used as reference base map, but it was revised, modified where necessary and adapted to the 1:5,000 scale map for the entire studied area.

REFEREE:

â€” I suggest to define with short titles the 4 phases and to use the same titles in sections 4-6.

RESPONSE: There is not a perfect correlation between the 4 phases and the sections 4-6. For this reason, we decided to avoid this change. However, in order to improve the text comprehension, we will add within the description of the 4 phases (section 3) short references to the sections where the results from each phase are described: ex. "Phase 1 (see sections 4 and 5)".

REFEREE:

- At the web page linked at page 4 line 33 the geological sheet Avezzano is reported as published in 2005. Please add the correct reference to the map in the text (pp. 4, 6-7) and in the references list, together with the web link.

RESPONSE: We will correct.

REFEREE:

â€” p. 4 line 22: Fig. 4 is cited before fig. 2 and 3. You can delete this reference, it is not necessary here.

RESPONSE: We will correct.

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REFEREE:

â€” p. 5 line 12 : cover units are distinguished into three classes (as in fig. 2a) and not in two as indicated in the text.

RESPONSE: We will correct.

REFEREE:

4 AND FOLLOWING SECTIONS: â€” I suggest to use the same titles adopted for the 4 phases described at page 4.

RESPONSE: Please, see the reply to the second comment of the "Methodology" section.

REFEREE:

â€” Section 5.1 - p. 6 line 28: what do you mean with stratigraphic "domain"?

RESPONSE: Ok, we change "stratigraphic domain" in "stratigraphic succession".

REFEREE:

â€” Section 5.2. - p. 8 line 28-29, 31: use here the same style for the "name" of the three typologies of shallow subsurface, as in the text at p. 9 lines 16 and 27, and in the figures. i.e.: "A-type.....; B-type.....; C-type.....".

RESPONSE: We will modify.

REFEREE:

â€” p. 9 line 11-14: the time-depth conversion used appears too simple for a basin characterized by high stratigraphic complexity and high lateral variability of the units. Do you have tested different values or more complex velocity models to have a more consistent prediction of the bedrock depth in the whole area?

RESPONSE: We are going to better explain our choices. We would like to point out

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that the reconstruction of a more complex velocity model for the area, finalized to a time-depth conversion, unfortunately is not feasible on the base of the available data.

REFEREE:

â€” Section 6.3 p. 12 line 9: "contained in the MOPS" replace with "summarized in the MOPS".

RESPONSE: We will modify.

FIGURES:

REFEREE:

â€” Fig. 1 - The isochrones from Cavinato et al., 2002 appear to be modified also outside the rectangle of Fig.4. Please check and/or modify the caption.

RESPONSE: We will modify.

REFEREE:

- The geological cross section should be replaced with your own cross section or the trace moved in fig. 1a. As a matter of fact the trace on the map of fig. 1b creates misunderstanding in the reader due to the differences between faults in the map and in the geological cross section.

RESPONSE: Ok. Please, see also the reply to comment 1 of "Geological setting" section.

REFEREE:

â€” Fig. 3: not clear/unreadable

RESPONSE: Ok, we will improve the quality of figure 3. However, it is worth to note that the aim of this figure is to show the distribution, types and the amount of pre-existing data.

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REFEREE:

â€” Fig. S1: please indicate that some of the units included in the legend are not represented in the map, or modify the legend.

RESPONSE: We will modify.

REFEREE:

â€” Fig. S2: please indicate that some of the zones included in the legend are not represented in the map, or modify the legend.

RESPONSE: We will modify.

REFEREE:

REFERENCES â€” Add reference to the geological sheet Avezzano â€” Check the correct form of the publication MS Working Group, 2008. In the text is always cited as Working Group SM, 2008. Unify. â€” SESAME 2004: it is not cited in the text.

RESPONSE: We will correct.

REFEREE:

TECHNICAL CORRECTIONS: â€” there are several words not separated by blank - p. 13 â€” line 31: "undergoe" change in "undergo"

RESPONSE: We will correct.

Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., doi:10.5194/nhess-2016-313, 2016.

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