

Interactive comment on “Electrical Resistivity Tomography surveys for the geoelectric characterization of the Montaguto landslide (southern Italy)” by Jessica Bellanova et al.

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Reviewer #3:

The authors greatly thank the Anonymous reviewer for his comment. Replies to the questions from the reviewer are as follows:

General comments:

The manuscript presents the results of an ERT survey performed on the Montaguto earth-flow, located in the southern Apennines (Campania Region, southern Italy). 11 profiles ERT with a maximal investigation depth of 40 meters were performed with the goal to reconstruct the geometry of the landslide body. The paper is well written, the

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abstract clear and precise, the figures are well documented and clear. On the other side, the treatment of data can be improved, e.g., a 3D modelling could be included, and the robustness of the inversion should be discussed. How sure are the estimations of the interface between the “old flow” and the “actual flow”? How the location of this interface will change depending on iterations and on the inversion method (robust or least-square) ? The discussion of results is too general and rather speculative, the conclusions are too strong. Answer: Thanks for highlighting this subtle but important issue. We carried out once again the inversion of all 2D data set. We used both least-square and robust inversion constrain, preferring the former because, in our case, subsurface resistivity changes in a smooth manner. Furthermore, we checked also the resistivity models for different iteration numbers. In some cases (e.g. ERT1, ERT2, ERT5 and ERT10) we replaced the resistivity model, due to a slightly improvement of the subsurface resistivity patterns. In any case, we note that the interface between the “old flow” and the “actual flow” does not change significantly. Finally, we modified the conclusions of our paper by removing generic sentences and focusing the attention on the information coming only from geophysical results.

Specific comments:

1) The survey consists of 11 parallel profiles showing coherent features. In my opinion, it would be very helpful to try a 3D inversion of this data set. Answer: Thanks for the kind advice. We tried a 3D inversion of the whole resistivity data set, but the 3D model did not produce realistic resistivity patterns of the underground since the distance between the ERT was much more greater than both the distance between the electrodes and the 2D electrical resistivity model cells. Moreover, the complex topography of the area (i.e. very steep towards North-East section) was also an issue. We decided not to show the result in this paper due to its scarce information content and the presence of artifacts in the 3-D inversion model caused in the use of parallel 2-D lines.

2. Figures 2-3: Please give the borehole information in the same terms as ERT profile

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units (FFa1, 2 etc)? Answer: Thanks for the suggestion. We modified and simplified borehole information.

3. The major remark concerns lines 162-164. The authors “used data from literature, geological surveys and exploratory boreholes to calibrate the ERT and to directly correlate electrical resistivity values with the lithostratigraphic characteristics”. It is not enough to give a reference in such a major point, please detail this translation of the ERT features to the lithostratigraphic characteristics which is a most important point in the paper. Are there some laboratory measurements available on the samples or are the resistivity? Or is the calibration done using outcrops or borehole data? How do you find and how sure you are that 6-12 Ohm structure corresponds to the activated earth flow (e.g., L228-230)? Answer: Thanks for the suggestion. To calibrate the ERT and to directly correlate electrical resistivity values with the lithostratigraphic characteristics we used data from literature (e.g. in Giocoli et al., 2008 and Mucciarelli et al., 2009 resistivity measurements on the Faeto Flysch were carried out), geological surveys, exploratory boreholes, direct and indirect surveys (e.g. static cone-penetration tests and shallow-seismic profiles from Guerriero et al., 2014) and direct resistivity measurements on outcrops. The manuscript text has been modified accordingly.

4. L231-234: Observed resistivity values and water content. It lacks a reference here (e.g. Waxman & Smith, 1968). The authors suppose that the higher conductivity of the underlying unit is related to a higher water content and refer to the independent piezometric data coming from boreholes but do not show these data. It would be interesting to show the data on water content and to check your assumption using the formalism given in Waxman & Smith, 1968 (or equations 6-7 in Rinaldi et al, 2010). Answer: Thanks for the suggestion. We tried to apply the formalism given in Waxman & Smith (1968) but, unfortunately, we don't have all the required parameters. We have a measurement of porosity for a single depth (at S6, S7 and S8 boreholes) thus we should assume the same porosity throughout the investigated section. Such an assumption would probably smooth out the spatial variations of the subsoil saturation

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that we would like to highlight instead. Moreover, data on the type of clays and on their cation-exchange capacity for the estimation of the surface conduction are not available. Our assumption is based on the resistivity values and, as also specified in the text, is supported by the water table levels measured and indicated in the S8, S7 and S6 boreholes and by the pore water pressures recorded at the P1 and P2 piezometers (see Fig.9 in Lollino et al., 2014).

Please also note the supplement to this comment:

<http://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2016-28/nhess-2016-28-AC3-supplement.pdf>

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