

Interactive comment on “The permeability and elastic moduli of tuff from Campi Flegrei, Italy: implications for ground deformation modelling” by M. J. Heap et al.

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The manuscript by Heap et al. presents a systematic laboratory study of the influence of pressure and temperature on the permeability and elastic moduli of the two most widespread tuffs from the Campi Flegrei volcanic district, Italy. Their results show that the water permeability of Neapolitan Yellow Tuff (NYT) and a tuff from the Campanian Ignimbrite (WGI) differ by about two orders of magnitude. In addition, while the NYT properties are systematically affected by temperature, no clear patterns depending on temperatures were revealed for the WGI samples. Moreover, the authors show that the dynamic and static elastic moduli differ significantly.

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The results of this study have implications for surface deformation modelling and interpretation at CF caldera and elsewhere. The manuscript may represent a key contribution for a better understanding the influence of rock physical parameters, as well as for a more conscious use of these parameters in models of deformation processes occurring in active volcanic areas. In some cases, the consideration of homogeneous half-space in mechanical models of deformation processes occurring at volcanic areas might be still acceptable, mainly because of lack of information on the material properties. However, in cases as CF caldera where a large dataset of information is already present, the effect of heterogeneities has to be taken carefully into account. Instead, if homogeneous half space is still preferred in modeling attempts, one has to be aware that this might be an oversimplification deeply influencing the modeling results and thus potentially leading to misinterpretations. The methodology and results are clearly presented and thoroughly discussed in the manuscript. Due to the high quality of the results and their important implications, the paper deserves publication in Solid Earth, though some very minor issues have to be clarified before final acceptance. Please find my specific comments/criticism here below.

- 1) Please provide and eventually discuss/comment expected errors in the estimation of rock properties for the considered methodologies of investigation. This might help the reader to better evaluate the results of your analyses.
- 2) In section 5.3, the authors claim that the NYT and WGI have similar elastic moduli, (thought pressure/depth dependent) supporting the homogeneous half space notion for the CF caldera. However, this statement might be misleading, as these rocks represent only a portion of the caldera infill materials (see e.g. Orsi et al., JVGR 1996).
- 3) Fig. 4 is the only one among figs 4-7 where the effective pressure is on the y-axis. Then figs. 8-9 show the differential stress on y-axis. I suggest to make all figures consistent (e.g. pressure/stress on the x-axis for all figures, or vice-versa) to ease their reading and eventual cross-comparison.

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4) Please check that abbreviations are systematically defined when used for the first time in the text. I could not find the definition for Pp.

Interactive comment on Solid Earth Discuss., 5, 1081, 2013.

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