Solid Earth Discuss., 7, C1058–C1060, 2015
www.solid-earth-discuss.net/7/C1058/2015/

Solid Earth
Discussions
Open Access

Interactive comment on "Numerical models for ground deformation and gravity changes during volcanic unrest: simulating the hydrothermal system dynamics of an active caldera" *by* A. Coco et al.

Anonymous Referee #2

Received and published: 6 September 2015

As effectively stated in the Abstract, this paper "presents a numerical model to evaluate the thermo-poroelastic response of the hydrothermal system in a caldera setting by simulating pore pressure and thermal expansion associated with deep injection of hot fluids (water and carbon dioxide)."

I found it a good technical methodological paper, worth to be published in SE. However, the applicability of the model to Campi Flegrei is not obvious and should be discussed in more detail by the authors. Although my requests do not involve technical issues, I think that, for final publication, the manuscript should be reconsidered after major

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

revision because in my opinion the results are not discussed in an appropriate and balanced way.

General comments.

1. The Introduction creates the impression that there is a ten-year general consensus about the hydrothermal origin of Campi Flegrei deformation. However, several recent papers attribute Campi Flegrei unrests to magma (e. g., Amoruso et al, EPSL 2008; Woo and Kilburn, JGR 2010; Trasatti et al., EPSL 2011; Amoruso et al. GRL 2014) and the authors should at least mention that the two interpretations (magma and hydrothermal system) are still under debate.

2. Ground deformation: although computed ground deformation looks alike that from a Mogi source during the first years of unrest for Scenario I, still some time evolution of the deformation pattern is clearly visible in Figure 5. The deformation pattern is even more variable over time for Scenarios II and III. The authors should discuss those time evolutions versus the constancy of the deformation pattern at Campi Flegrei claimed e. g. by De Natale et al. (J. Geodyn. 2001), Manconi et al. (JGR 2010), Amoruso et al. (JGR 2014), Amoruso et al. (GRL 2014). Moreover, no abnormal deformation close to the ring faults has been observed e. g. by Trasatti et al. (GRL 2008), Manconi et al. (JGR 2010), Amoruso et al. (JGR 2014), Amoruso et al. (GRL 2014), Trasatti et al. (GRL 2015). I suspect that the time evolution of the computed ground deformation pattern may be more noticeable after the injection ends. In case of multiple injection episodes, ground deformation from the different episodes would combine, originating an even more noticeable time evolution.

Minor comments

1. Somewhat differently from what stated at p. 2059, Amoruso et al. (GRL 2014, and more specifically, JGR 2014) found a single small deformation anomaly, restricted to La Solfatara.

SED
7, C1058–C1060, 2015

2. The authors should compare computed gravity residuals with those measured during the major 1982-84 unrest. To my best knowledge, 1982-84 gravity measurements show the best S/N ratio.

3. Although I am aware that taking into account the feedbacks between ground deformation and rock permeability and porosity is a very difficult task, the authors might discuss the expected effects qualitatively.

5. By convention, fault dip is the angle between the fault and a horizontal plane. I suggest to follow this practice throughout the paper.

6. The coordinate system used in the paper is not clear to me. Maybe the authors use the adjective "Cartesian" instead of "cylindrical".

7. Figs. 5 and 6 - I suggest to use the same depth units (m or km) for initial conditions and changes.

Interactive comment on Solid Earth Discuss., 7, 2055, 2015.