

## ***Interactive comment on “Fault sealing and caprock integrity for CO<sub>2</sub> storage: an in-situ injection experiment” by Alba Zappone et al.***

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Answer to general comments

We thank the Referee #2 for careful reading of the manuscript and constructive criticisms. The comments and remarks of Referee #2 are related to the organization and writing of the manuscript, that could be written in a more concise way. We addressed this criticism and reorganized some sections. To give more emphasis on the phase 1 of the experiment, the parts related to the outlook and successive stages have been shortened. Nevertheless, we think that a description of the potential outcomes of the next steps and the implications of the experiment for an upscaling to the full operational scale, is beneficiary to better contextualize the experiment. We have partly rewritten

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the outlook chapter and shortened the speculations projected towards the phases of the experiment following those described in the manuscript. Regarding the geochemical aspects presented in the work, we tried to add as much as possible details where it was suggested by the Referee #2. The mixing of the injection fluid and how its composition is determined is now better described. It is true that our installation has technical limits and we cannot define a priori the content of CO<sub>2</sub> in the injected fluid, but we calculate it through known parameters (pressure, temperature of mixing, and chemical composition of the fluid prior CO<sub>2</sub> saturation). A second point relates to monitoring the CO<sub>2</sub> leak using the miniRuedi mass spectrometer. We added a sentence detailing what is actually measured by the spectrometer and what we mean about CO<sub>2</sub> breakthrough, which is, as the referee correctly pointed out, the dissolved CO<sub>2</sub> from the injected CO<sub>2</sub>-rich water.

#### Answers to specific comments

L. 68 to l.70: The text has been modified as suggested.

l.84 to l.88: We thank the Referee#2 for pointing out this omission of a second field scale experiment in Australia at the CO<sub>2</sub> Otway Research Facility, and for the indication of the relevant literature about it. The text of the manuscript has been completed, including this experiment, and of course we are thrilled to follow the development of this field scale experiment in Otway! The review papers by Bush and Kampman, 2018 and Skurtveit et al., 2018 have been added to the references.

l.219 to 226: the tense used in this section has been reviewed. The phase 2 started in June 2019 and is still ongoing. We think we managed to modify the tense in a more correct way.

l.292 : injection water: the composition of the water has been introduced here and not later l.302 to l.304: l.293 : we briefly explained that we used Kr as tracer because 1. It is non-reactive, 2. It is absent in formation water.

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I.343: the circulation guarantees that the fluid is homogeneous in the sampling interval; the text has been amended.

I.409 to I.411 : ETH and EPFL labs have performed experiments specifically on the rocks of this study. References have been added.

Technical comments

All technical comments have been accepted and amendments have been inserted in text and figures.

We hope that with the modifications we made the text can be accepted for publication.

Alba Zappone on behalf of the Authors

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