

Interactive comment on “Fault sealing and caprock integrity for CO₂ storage: an in-situ injection experiment” by Alba Zappone et al.

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We thank the Referee #1 for careful reading of the manuscript and constructive criticisms.

What he/she defines as minor technical issues have been carefully considered. We agree with the referee on the fact that the experiment is designed to provide insight into process understanding related to leakage into fault zone, basically scale independent. In the discussion, we describe the implications of the experiment for an upscaling to the full operational scale, partially making the effort to better contextualize the experiment. Following the referee’s suggestion, we have partly rewritten the outlook section and modifies parts of the conclusions to keep the paper less speculative on the future

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results of the long term injection.

Answer to specific comments

All specific comments have been addressed: 1. Line 669 and ff.: The transfer of monitoring approaches from (our) decameter scale experiment to the full scale of large storage sites is not intended to be a direct translation but it is an investigation on the strength of coupling different monitoring techniques. Furthermore, the sentence was partly wrongly written: what we mean is that when the flow is confined, geophysical measurements may not be able to detect leakage, and thus they must be used in combination with other instruments (like the ones that can monitor geochemical indicators). We agree that the sentence is not clear, and to avoid speculation we removed it from the outlook. 2. Line 700 and ff.: the fault zone is characterized by a fine network of fractures and slip planes (fig. 8a). The presence of fractures to some degree has an influence on the bulk seismic properties of the rock, but it strongly depends whether they are open (then they will decrease seismic velocities) or completely locked, as we rather expect. In the second case, this effect is probably minor. The internal structure of the fault defines a different anisotropy pattern inside the fault juxtaposed to the host rock, thus strongly contributing to the seismic anomaly. The sentence has been reformulated. 3. Seismic Tomography: data processing: The median filter applied is a simple subtraction of the median amplitude (median of the amplitudes along the entire trace lengths) from the signal. Therefore, it has no other effect than removing a constant shift from the signal. The sentence has been modified.

All technical comments have been accepted and all 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