

EGU2020-7589

<https://doi.org/10.5194/egusphere-egu2020-7589>

EGU General Assembly 2020

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## Soil gas CO<sub>2</sub> emissions and fault locking along the Anninghe fault and the Zemuhe fault, in China Seismic Experimental Site

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The Anninghe fault (ANHF) and the Zemuhe fault (ZMHF) with high level of seismic hazards in the China Seismic Experimental Site, located in southeastern of Tibet, are some of the most active faults in China. Measurement of the soil gas CO<sub>2</sub> has been conducted in three sites along the ANHF and the ZMHF for the first time. Totally, 394 sampling points along 15 profiles were measured. The fault locking degree of different segments of the ANHF and the ZMHF were inverted by the negative dislocation model using GPS velocity data since 2013 to 2017. The measurements results show that the average and maximum value of CO<sub>2</sub> in the ZMHF is significantly higher than that in the ANHF. Soil gas CO<sub>2</sub> geochemistry yielded different spatial anomalous features, indicating the different properties and permeability of the faults. The inversion results reveal that the level of coupling including the locking depth and intensity along the southern segment of the ANHF was significantly larger than the northern segment of the ZMHF. Combining the CO<sub>2</sub> emission results, we concluded that the intensive locking of the segments reduced their permeability due to the self-sealing process, results in less gas to escape from the deep. Correspondingly, the creeping fault with low level of coupling can maintain high permeability which is more favorable to gas CO<sub>2</sub> migration.