

PREVIEW

EGU General Assembly 2023

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Investigating the effect of a heavy rainfall episode on the Mw4.9 earthquake of 11 November 2019 at Le Teil (France)

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On 11 November 2019, the Le Teil Mw4.9 earthquake occurred in southeast France, in the vicinity of a surface quarry. We focus this work on the effect of hydraulic recharge linked to the infiltration of meteoric water in the fault zones in the period preceding the earthquake. In the reference simulation, we used the *in situ* soil moisture at 30 cm depth (Berzème station) as surface boundary conditions.

We describe first the local 3D fault system from an updated geological model and the boundary conditions that are used to calculate the pressure variations at depth using a double permeability model.

The movement of moisture in partially-saturated media is then simulated by the Compass code (1) during the period 2015-2019. A maximum overpressure takes place near the junction of the three-fault system at around 1,200 m depth. Moreover, the calculated increase in pore fluid pressure is maximum during 2015-2019 just before the earthquake of 11 November 2019. Additionally, the surface soil moisture (SSM) data acquired by the SMOS satellite (2) are used to extend the study period between 2010 and 2015.

A sensitivity study carried out on the main hydraulic parameters allows us to estimate that the overpressure linked to the hydraulic recharge of the fault system is between 0.7 and 1 MPa at about 1200 m depth before the seismic event.

Finally, we compare this result with the maximum Coulomb stress change linked to the mass withdrawal from the surface quarry over the two past centuries (3). The conclusion is that the hydraulic effect is about two and a half times larger than the cumulative effect of the mechanical stress release due to the mass removal from the surface quarry.

(1) <https://github.com/BRGM/ComPASS>

(2) Li, X., Wigneron, J.-P., et al.: The first global soil moisture and vegetation optical depth product retrieved from fused SMOS and SMAP L-band observations, *Remote Sensing of Environment* 282, 113272, 2022. <https://doi.org/10.1016/j.rse.2022.113272>

(3) Maury, J., Guillon, T., Aochi, H., Bazargan, B., and Burnol, A.: Assessing the effect of mass

withdrawal from a surface quarry on the Mw4.9 Le Teil (France) earthquake triggering, EGU General Assembly 2022, Vienna, Austria, 23–27 May 2022, EGU22-2742, <https://doi.org/10.5194/egusphere-egu22-2742>, 2022.