High-resolution displacement field for the 2019 Ridgecrest earthquake (California) : first considerations in terms of fault zone structure and near-fault deformation processes

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High-resolution imaging of the deformation field associated with surface ruptures has long been a challenging task while it became a critical information for Fault Displacement Hazard Assessment. Classical methods as InSAR and field studies have a hard time grasping the fine-scale deformation pattern near the surface rupture. Optical image correlation appears as good alternative by making possible the dense measurement of ground deformation very close or even inside of the fault zone, thus going beyond the limitations of the previously cited methods. In this work, we combine 0.5 meters resolution images and MicMac sub-pixel correlator to measure surface displacements associated with the Ridgecrest rupture sequence (California , M_w6.5 on the 4th of July 2019, followed by M_w7.1 on the 5th of July 2019). With this technic, we are imaging with an unprecedented precision of 5 centimeters the displacement pattern in the fault zone, with a spatial resolution of 50 centimeters. Our results reveal very heterogeneous displacement patterns at every scales. Far-field pattern is complex as our correlation window frames the two rupture events that occurred within a 32 hours time slot, on two perpendicular faults. Near-field pattern is complex as well, with very discontinuous and non-linear fault traces that sometimes also divide into several branches. Numerous structures as relays, jumps and bends are visible and are used as a catalogue to be compared with what have been observed in our previous work on the Baluchistan earthquake and with other studies. We also generate high-resolution slip profiles that first, provide a more accurate surface slip budget for the earthquake and second, enable an exhaustive description of the distribution of deformation in the fault zone. All these information will be crucial to the understanding of shallow fault physics and surficial material deformation behaviors.

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