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Quantifying the effects of an active blind fault on a shallow aquifer properties and drainage, case study of the Chihshang Aquifer in the eastern Taiwan

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The Chihshang Fault aquifer is nested in the Longitudinal Valley active Fault (LVF) situated along a plate suture between the Philippine Sea plate and the Eurasian plate in eastern Taiwan. The LVF is undergoing rapid creep and co-seismic rupturing. Surface creeping on the fault were simultaneously measured utilizing creepmeters in surface as creeping rate of 2 cm/yr. Combining surface fracture investigation and geodetic results, we show that three branches of the Chihshang Fault developed at shallow depth with average dip angles of 35°. In order to better understand the effects of variations of pore-fluid pressure in the aquifer significantly influence the near-surface behavior of the fault by this blind fault system, 9 observation wells were drilled at depths of 30 to 100 m through the zone of the aquifer affected by fault deformations. Pore pressure variations in hydraulic observation wells induced by artificial single well disturbance (slug test) and pumping/injection experiments were monitored, together with the surface electrical resistivity measurement. It is possible to identify an aquifer zone of specific hydraulic properties that corresponds to the zone deformed by the active fault. Repeated hydraulic tests revealed that the two different phenomenon: the permeability of the footwall had the same trend with the variations of annual groundwater level; the permeability of the fault zone increased following the fault creep movement in 2008.