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# An innovative approach for very large landslide dynamic and hydrogeological triggering study by inverse modeling (Grand Ilet landslide, Reunion Island)

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Landslide control mechanisms study and displacements modeling interest the scientific community since several decades, with a common objective: landslides prediction for humans and infrastructures protection. However many data acquisition, like pore water pressure or mechanical properties, are necessary for determinist model construction. It could be extremely complex for very large landslides in extreme climatic conditions. An innovative modeling method is proposed for very large landslide functioning characterization using the primary data rainfall and displacement.

Here we study two very large landslides ($\approx$ 450 Mm3) in a humid tropical climate (Salazie cirque, Reunion Island). We use an inverse modeling tool basing on a global approach, with Gaussian-exponential transfer functions. Transfer functions between the rainfall input signal and the velocity output signal (permanent GPS daily data)are determinated. Because of the gap displacement data, the hydrologic cycles 2010 and 2011 is selected for the calibration of transfer functions. Afterwards, we model the landslide velocity from rainfall signal since 2004 to 2011. In the case of Grand Ilet landslide, we study relations between transfer functions characteristics and the coupling between the displacements and the hydrogeological functioning.

For cumulated displacements, final difference between simulations and observations for 7 years modeling is smaller than 5 %. Seasonal landslides velocity variations are accurately modeled during a period of 7 years. Bimodal transfer functions, with dissociation between rapid and slow impulse responses, are particularly effective for reproducing the recorded displacements. In particular, rapid response permits to model velocity increases after cyclonic events. In case of Grand Ilet landslide, transfer functions characteristics are strongly correlated with the landslide aquifer functioning. Indeed, influence times of rapid and slow responses are reliable with a double porosity effect. Rapid response is correlated with preferential flows in fractures network, whereas slow response is correlated with slow piezometric recharge of the porous medium. These results show that global approach is significant for very large landslide study, in Reunion Island context. Present method could then become a promising process for other very large landslide studies.