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A Simulation Study to Assess the Potential of Real-Time GPS for Tsunami Early Warning in Chile

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Global Positioning System (GPS) has been proved to be a powerful tool for measuring co-seismic ground displacement with application to earthquake rupture inversion. Due to the fact that most of the tsunamis are triggered by large earthquakes, GPS could contribute to tsunami early warning by helping to resolve for the tsunami source in almost real-time. Recently, this became a core of the concept of a "GPS-Shield for Tsunami Early Warning". In present study we extend this concept to the Chilean Pacific continental margin. Chile is situated at the western margin of the South American plate which experiences constant tectonic forcing due to the actively subducted Nazca oceanic plate. This ongoing subduction makes almost the whole Chilean coast to be vulnerable to earthquake and tsunami threats. New Chilean tsunami early warning system is expected to incorporate the novel real-time GPS-component for fast source inversion. We use numerical simulation technique to evaluate the potential of the coastal real-time GPS arrays for reliable early warning. We provide start-to-end simulations of the related physical processes (earthquake rupture, ground shaking, tsunami generation and propagation) together with their sensor (GPS) imaging and processing. In particular, co-seismic GPS observations are simulated using Bernese 5.2 software. For GPS data processing, both Bernese 5.2 and (real-time) PANDA are adopted for comparison. We demonstrate our 'close-loop' simulation workbench together with main results reflecting the importance of the real-time GPS component for the tsunami early warning in Chile. Special attention is paid to the uncertainty propagation through the early warning chain.