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Long-period GPS waveforms. What can GPS bring to Earth seismic velocity models?

Krisztina Kelevitz (1), Nicolas Houlié (1), Lapo Boschi (2), Tarje Nissen-Meyer (3), and Domenico Giardini (1)

(1) Institute of Geophysics, ETH Zürich, Switzerland (krisztina.kelevitz@geod.baug.ethz.ch), (2) Institute of Earth Sciences, Sorbonne University, Paris, France, (3) Department of Earth Sciences, University of Oxford, United Kingdom

It is now commonly admitted that high rate GPS observations can provide reliable surface displacement waveforms (Cervelli, et al., 2001; Langbein, et al., 2006; Houlié, et al., 2006; Houlié et al., 2011). For long-period (T>5s) transients, it was shown that GPS and seismometer (STS-1) displacements are in agreement at least for vertical component (Houlié, et al., Sci. Rep. 2011). We propose here to supplement existing long-period seismic networks with high rate (>= 1Hz) GPS data in order to improve the resolution of global seismic velocity models. GPS measurements are providing a wide range of frequencies, going beyond the range of STS-1 in the low frequency end.
Nowadays, almost 10.000 GPS receivers would be able to record data at 1 Hz with 3000+ stations already streaming data in Real-Time (RT). The reasons for this quick expansion are the price of receivers, their low maintenance, and the wide range of activities they can be used for (transport, science, public apps, navigation, etc.).

We are presenting work completed on the 1Hz GPS records of the Hokkaido earthquake (25th of September, 2003, Mw=8.3). 3D Waveforms have been computed with an improved, stabilised inversion algorithm in order to constrain the ground motion history. Through the better resolution of inversion of the GPS phase observations, we determine displacement waveforms of frequencies ranging from 0.77 mHz to 330 mHz for a selection of sites. We compare inverted GPS waveforms with STS-1 waveforms and synthetic waveforms computed using 3D global wave propagation with SPECFEM. At co-located sites (STS-1 and GPS located within 10km) the agreement is good for the vertical component between seismic (both real and synthetic) and GPS waveforms.