Geophysical Research Abstracts
Vol. 18, EGU2016-5262, 2016
EGU General Assembly 2016

Explore Seismic Velocity Change Associated with the 2010 Kaohsiung Earthquake by Ambient Noise Tomography

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A ML 6.4 earthquake occurred on 4 March 2010 in Kaohsiung, the southern part of Taiwan, this shallow earthquake is the largest one of that area in the past few years. Some damages occurred on buildings and bridges after the earthquake, obvious surface deformation up to few cm was observed and the transportation including road and train traffic was also affected near the source area. Some studies about monitoring the velocity change induced by the big earthquake were carried out recently, most of studies used cross-correlation of the ambient noise-based method and indicated velocity drop was observed immediately after the big earthquake. However, this method is not able to constrain the depth of velocity change, and need to assume a homogeneous seismic velocity change during the earthquake. In this study, we selected 25 broadband seismic stations in the southern Taiwan and time period is from 2009/03 to 2011/03. Then we explored the velocity change associated with the 2010 Kaohsiung earthquake by applying ambient noise tomography (ANT) method. ANT is a way of using interferometry to image subsurface seismic velocity variations by using surface wave dispersions extracted from the ambient noise cross-correlation of seismic station-pairs, then the 2-D group velocity map with different periods could be extracted. Compare to ambient noise-based cross-correlation analysis, we estimated sensitivity kernel of dispersion curves and converted 2-D group velocity map from "with the period" to "with the depth" to have more constraints on the depth of velocity change. By subtracting shear velocity between “before” and “after” the earthquake, we could explore velocity change associated with the earthquake. Our result shows velocity reduction about 5-10% around the focal depth after the 2010 Kaohsiung earthquake and the post-seismic velocity recovery was observed with time period increasing, which may suggest a healing process of damaged rocks.