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Crustal velocity and anisotropy temporal variations at Etna volcano

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It has been already pointed out in many different works how seismic characteristics change with the approaching of a critical event, such as a major earthquake or an eruption. Since all seismic waves bear information about source, medium, site and receiver, the first difficult task is the interpretation of their signatures, and how they can be linked to crustal or source characteristics. One way to retrieve information about the surrounding crust from all those carried on seismic traces, is to take into account doublet events, i.e. earthquakes that show highly similar waveforms and almost the same hypocenter locations, conditions that can be interpreted as the two events are sharing the same source mechanism. Hence all differences in the waveforms can be ascribed solely to time changes along the ray path, i.e. modification of the surrounding crust due to the stress field changes. We studied doublet records of the 2002 Mt. Etna eruption, through the application of Coda Wave Interferometry (CWI) and Shear Wave Splitting (SWS) analysis. The first technique enables measurements of percentage velocity variations, whilst the second one leads to anisotropy change estimations. Our results showed that both methodologies were able to detect even the small stress changes occurred during the eruption, despite the high level of seismic tremor and noise. Therefore their application may noticeably broaden the monitoring of the stress field acting on volcanic areas. Furthermore the combination of velocity and anisotropy time evolution can add more details in modeling the crust.