Source Parameters and Radiation Efficiency in the nucleation volume of the Mw 6.1 L'Aquila Earthquake

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We analyze Brune stress drop and apparent stress of 25 earthquakes, mainshock, foreshocks and aftershocks, occurring in a 2.5 x 2.5 x 2.5 km^3 volume adjacent to the hypocenter of the destructive Mw 6.1 L'Aquila earthquake. In a previous paper, we used a part of these earthquakes to detect a transient anomaly of shear wave velocity in the fault zone one week before the main shock. The purpose of this study is to enlarge the previous dataset with further close earthquakes ($2.2 \leq Mw \leq 4.1$) to investigate if the same area concomitantly shows temporal and/or spatial variations in the stress parameters. Brune stress drops were computed in a conventional EGF-deconvolution approach using local seismological stations, the resulting values vary in the range $0.2 < \Delta\sigma < 8.4$ MPa. Apparent stress was derived from the waveform energy corrected for propagation and site effects, it varies in the range $0.03 < \tau_a < 1.10$ MPa. The ratio $\eta_{sw} = \tau_a / \Delta\sigma$, which provides the radiation efficiency, for the largest part of the investigated earthquakes yields values close to 0.12, which is a value lower than expected for self-similar ruptures. An exception was the immediately following foreshocks and aftershocks (since a four hours before up to a four hours after the main shock, respectively) that result in values of η_{sw} as smaller as 0.06, consistent with ruptures in seismogenic zones with high dynamic strength. The largest $\Delta\sigma$ of these events indicates that the temporal variation is associated to a spatial variation due to the main shock asperity rupture, and a satisfactory consistency is found between the smallest and largest $\Delta\sigma$ with the largest and smallest b-values, respectively, imaged by other authors in the nucleation volume.