Correlating earthquake static stress drop values with fault complexity in the 2016 Amatrice-Norcia earthquake sequence, Central Italy

S21E-0552

References + Supplementary

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What and Why?

- Investigate Static Stress Drop Values
  - Single spectrum + Spectral Ratio Methods
- Scaling and Distribution of Stress Drop
- Spatio- and Temporal Evolution of Stress Drop
  - Relationship to Large Earthquakes and Mapped Faults
- Insights into the Stress Field and its Evolution

Where?

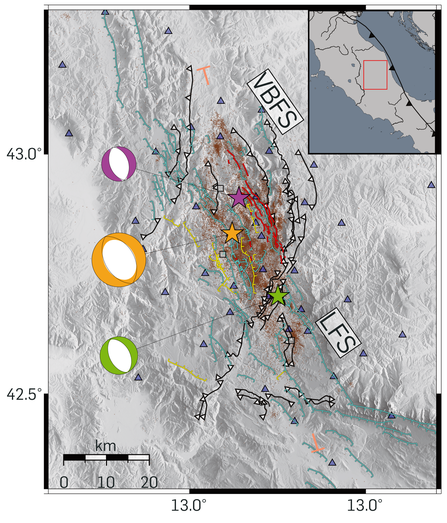


Figure 1: Epicentral area of the Amatrice-Visso-Norcia (AVN) seismic sequence with all earthquakes used in this study. Mapped active normal faults are marked with yellow (E-dipping) and cyan (W-dipping) colored lines. Miocene-Pleistocene thrust fronts are denoted with black barbed lines, and mapped surface ruptures are marked with red lines (modified after Villani et al. 2018). VFBS – Vettore-Bove fault system, LFS – Laga fault system.

- 2016-06-01 – 2016-11-31
- Three "Mainshocks"
  - Amatrice M_W 6.0
    - 2016-08-24
  - Visso M_W 5.9
    - 2016-10-26
  - Norcia M_W 6.5
    - 2016-10-30

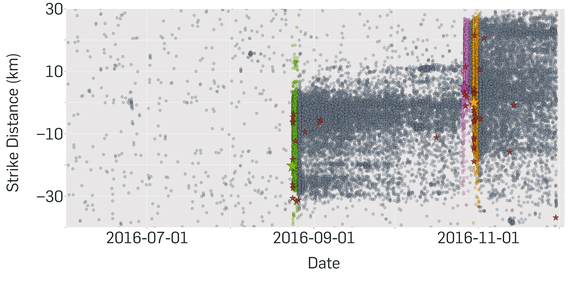
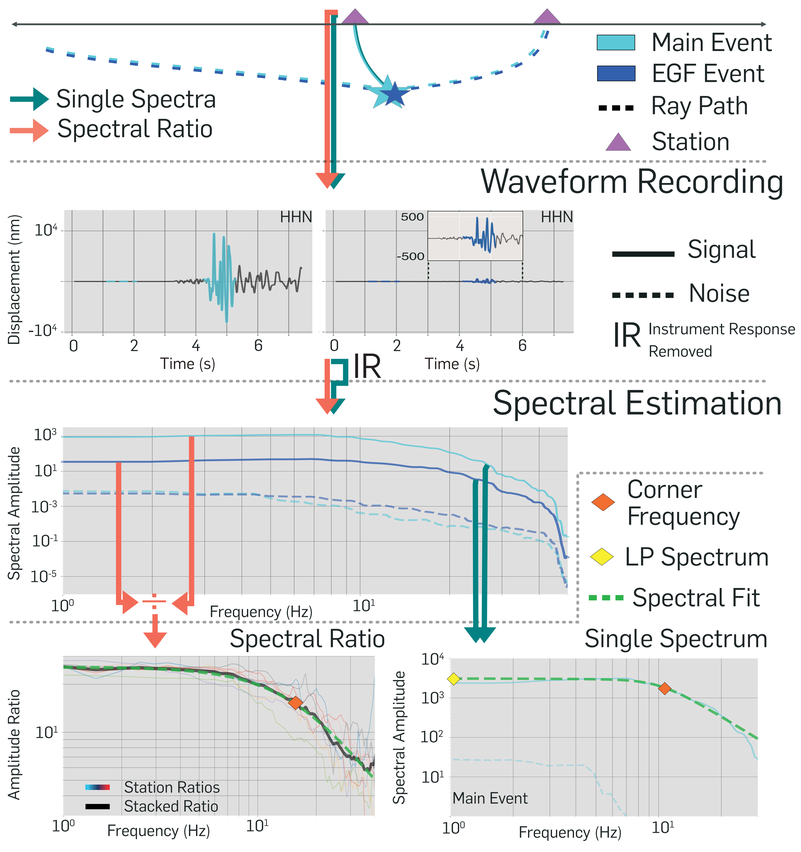


Figure 2: Earthquake occurence along strike (Norcia mainshock at position zero). Brown stars denote earthquakes with M ≥ 4. The standard catalog from INGV is used before the Amatrice mainshock. Afterwards, the catalogs from Chiaraluce (2017) and Improta (2019) are combined. Colored earthquakes denote the early aftershock sequences of each mainshock.

How? – Spectral Workflow



Results

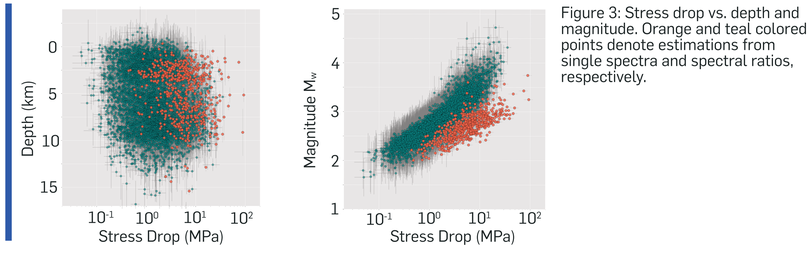


Figure 3: Stress drop vs. depth and magnitude. Orange and teal colored points denote estimations from single spectra and spectral ratios, respectively.

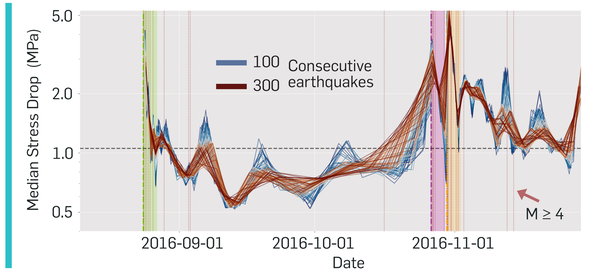


Figure 4: Moving median of the stress drop estimates with time.The heavy vertical dash-dotted lines denote the occurrence of the three largest earthquakes.

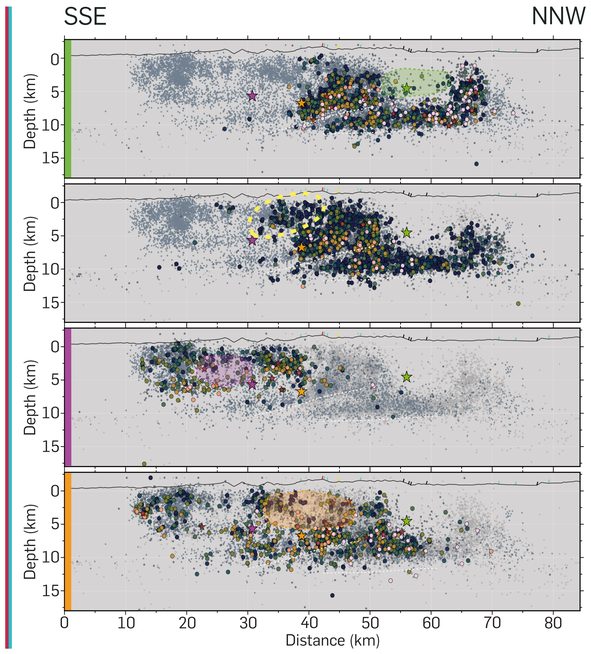


Figure 5: Earthquakes colored by stress drop estimation from S wave single spectra projected (10 km width) onto a section parallel to the VBFS and LFS (shown in Figure 1).The areas of maximum slip are roughly outlined for each main-shock with the dashed oval patches (after Lavecchia et al. 2016; Pizzi et al. 2017; Scognamiglio et al. 2018; Walters et al. 2018). Earthquakes potentially related to fluid-diffusion are broadly circled with the yellow dashed ellipse (Walters et al. 2018).The hash marks on the topographic profile show the location of mapped faults in Figure 1.

Conclusions

- **Higher** stress drops …
  - › for early aftershocks
  - › around areas with max slip
  - › in fault intersection zones
  - › for higher magnitudes (?)
- **Lower** stress drops …
  - › for late aftershocks
  - › during fluid diffusion
  - › during post-seismic afterslip (?)
  - › preceding large events
- Lower stress drop events may exhibit migratory patterns between large slip events.