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Waveform cross correlation and relocation using the CINCA aftershock dataset from the Antofagasta (Chile) 1995 earthquake

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CINCA (Crustal Investigations On- and Offshore Nazca Plate and Central Andes), a temporary seismic network located in the Antofagasta (northern Chile) region recorded continuously between Aug. 10 and Oct. 11 1995. The dense CINCA network surrounded the rupture region of the large Mw=8.0 July 30 1995 Antofagasta earthquake (Delouis et al., 1997) and collected 3 months of aftershocks from this earthquake.

Similar waveforms are produced when earthquakes have the same rupture mechanism and are colocated (i.e.share the same ray paths between source and receiver). Cross-correlation techniques are commonly used (e.g. Poupinet et al., 1984; Schaff & Waldhauser, 2005) and take advantage of waveform similarity to produce accurate relative arrival times. We use a STA/LTA algorithm to locate the onset of the P-wave and use manually picked P-wave onsets to guide the position of the cross correlation window. We then processed the complete CINCA dataset to measure accurate differential P-wave travel times for correlated earthquakes observed at common stations using a 2.5 sec time window.

We calculated over 10,000 P-wave differential travel times from pairs of waveforms that had cross-correlation coefficients of 0.8 or larger. We find numerous areas with clusters of cross-correlated events. In particular, we find a large group of 40 earthquakes clustered between the NEIC and local network location of the Mw=8.0 Antofagasta earthquake (Delouis et al., 1997). We relocate these events using the double difference earthquake relocation algorithm HypoDD (Waldhauser and Ellsworth, 2000) to study the seismogenic zone in the Antofagasta region. S-wave cross correlation will also be undertaken on the CINCA dataset to increase the differential travel time

dataset and improve earthquake relocations.