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Imaging the rupture zone of the 1912 Ganos earthquake using fault zone head waves from a local seismic network

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The Ganos Fault (GF) is the westernmost onshore segment of the North Anatolian Fault Zone (NAFZ) and was last activated in the Mw7.4 Ganos/Mürefte earthquake in 1912. The GF is a first order linear and a right lateral strike-slip fault with a locking depth of 8-17 km. A 40-station seismic array has been deployed between 2017 and 2020 along the GF to study the fault zone characteristics at depth. Fault Zone Head Waves (FZHW) are an important diagnostic signal to detect velocity contrast across fault and thus identify them as interfaces. A fault consisting of a sharp material contrast between different lithologies is expected to generate FZHW. They spend a large portion of their propagation paths refracting along the bimaterial interface. The head waves propagate with the velocity and motion polarity of the faster block, and are radiated from the fault to the slower velocity block where they are characterized by an emergent waveform with opposite motion polarity to that of the direct body waves. The FZHW are the first arriving phases at locations on the slower block with normal distance to the fault less than a critical distance. The high station coverage across the fault will allow us to observe micro-earthquake activity and FZHW close to the seismically active region of the GF throughout the entire seismogenic depth down to approximately 20 km thereby enhancing the resolution of seismological observations in that area. Preliminary results from MONGAN array allow to identify FZHWs at several stations in waveforms originating from events in the western Marmara Sea. We focus on the interpretation of a distinct first phase (FZHW) contained in the waveform coda that is well separated from the direct P wave. FZHWs are visible in many waveforms and have a specific time delay before the direct P wave arrivals at each station. Based on a polarization analysis of records at MONGAN stations, this first phase is interpreted as a FZHW at an interface near the study area. Its particle motion is consistent with FZHW and the direct P wave produced by the bimaterial interface. This is an indication of a bimaterial interface along the GF where the northern block is faster than the southern block.