

Ground Motion Analysis for the Einstein Telescope: ShakeMap, Seismic Hazard, and Case Studies: Take-Home Message

- Sos Enattos is one of the most seismically stable locations in Europe
 - $PGA < 0.03\text{ g}$ for standard design events (probability of exceedance of 10% in 50 years)
 - Even under extreme scenarios (probability of exceedance for 2% in 50 years), shaking remains far below critical thresholds

—>Even if the operational lifespan of the infrastructure is limited, evaluating very low exceedance probability scenarios (e.g., 10^{-4} annual probability) is essential, as the facility is critical and must be designed to withstand rare but potentially catastrophic seismic events
- Deep geological knowledge and stability
 - Rock conditions at tunnel depth confirmed
 - Attenuation of ground motion from surface to depth validated using borehole-based models
- Rich seismic data heritage
 - Centuries of historical documentation
 - Updated analysis of past events and improved instrumental monitoring
- Robust methodology, international benchmarks
 - PSHA using ESHM20 and MPS19 models
 - Scenario-based ShakeMap simulations using GMMs calibrated to real data
- Why it matters
 - Guarantees low seismic noise for gravitational wave detection
 - Supports long-term resilience and scientific excellence of the Einstein Telescope project