

Applying laser reflectometry to study active submarine faults: the FOCUS project (FOCUS = Fiber Optic Cable Use for Seafloor studies of earthquake hazard and deformation)

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Laser reflectometry (BOTDR), commonly used for structural health monitoring (bridges, dams, etc.), will for the first time be applied to study movements of an active fault on the seafloor, 25 km offshore Catania Sicily (an urban area of 1 million people). This technique can measure and locate micro-strains (< 1 mm) across very large distances (10 - 200 km). The goal of the European funded FOCUS project (ERC Advanced Grant) is to connect a dedicated 6-km long strain cable to the EMSO (European Multidisciplinary water-column and Seafloor Observatory) seafloor observatory in 2100 m water depth. Here, in May 2017, between the onshore fault system on the SE flank of Mount Etna and the deeper offshore Alfeo fault system, 4 cm of dextral strike-slip movement was documented as a slow slip event by seafloor acoustic ranging. For the planned seafloor operations, a detailed site survey of the seafloor will first be performed to determine the best path for deployment of the new strain cable. The next step will be to connect this 6-km long fiber optic cable to the EMSO station TSS (Test Site South) using a deep-water cable-laying system with an integrated plow to bury the cable 20 cm in the soft sediments in order to increase coupling between the cable and the seafloor. The targeted track for the cable will cross the North Alfeo Fault at three locations. Laser reflectometry measurements will be calibrated by a three-year deployment of seafloor geodetic instruments to quantify relative displacement across the fault. During the implementation of the laser reflectometry, a passive seismological experiment is planned to record regional seismicity. This will involve deployment of a temporary network of OBS (Ocean Bottom Seismometers) on the seafloor and seismic stations on land, supplemented by INGV permanent land stations. The simultaneous use of laser reflectometry, seafloor geodetic stations as well as seismological land and sea stations will provide an integrated system for monitoring a wide range of types of slipping events along the North Alfeo Fault. A long-term goal is the development of dual-use telecom cables with industry partners.