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## First deployment of a 6-km long fiber-optic strain cable and a seafloor geodetic network, across an active submarine fault (offshore Catania, Sicily): The FOCUS experiment

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For the first time, a 6-km long fiber-optic strain cable was deployed across an active fault on the seafloor with the aim to monitor possible tectonic movement using laser reflectometry, 25 km offshore Catania Sicily (an urban area of 1 million people). Brillouin Optical Time Domain Reflectometry (BOTDR) is commonly used for structural health monitoring (bridges, dams, etc.) and under ideal conditions, can measure small strains ( $10^{-6}$ ) along a fiber-optic cable, across very large distances (10 - 200 km), with a spatial resolution of 10 - 50 m. The FocusX1 expedition, (6-21 October 2020) onboard the R/V Pourquoi Pas? was the first experiment of the European funded FOCUS project (ERC Advanced Grant). We first performed micro-bathymetric mapping and a video camera survey using the ROV Victor6000 to select the best path for the cable track and for deployment sites for eight seafloor geodetic stations. Next we connected a custom designed 6-km long fiber-optic cable (manufactured by Nexans Norway) to the TSS (Test Site South) seafloor observatory in 2100 m water depth operated by INFN-LNS (Italian National Physics Institute) via a new Y-junction frame and cable-end module. Cable deployment was performed by means of a deep-water cable-laying system with an integrated plow (updated Deep Sea Net design Ifremer, Toulon) to bury the cable 20 cm in the soft sediments in order to increase coupling between the cable and the seafloor. The cable track crosses the North Alfeo Fault at four locations. Laser reflectometry measurements began on 18 October 2020 and are being calibrated by a 3 - 4 year deployment of eight seafloor geodetic instruments (Canopus acoustic beacons manufactured by iXblue) deployed on 15 October 2020. During a future marine expedition, tentatively scheduled for early 2022 (FocusX2) a passive seismological experiment is planned to record regional seismicity. This will involve deployment of a temporary network of Ocean Bottom Seismometers (OBS) 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 slipping event types along the North Alfeo Fault (e.g. - creep, slow-slip, rupture). A long-term goal of the project is the development of dual-use telecom cables with industry partners.