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Building a new type of seafloor observatory on submarine telecom fiber optic cables in Chile

Diane Rivet¹, Sergio Barrientos², Rodrigo Sánchez-Olavarría², Jean-Paul Ampuero¹, Itzhak Lior³, Jose-Antonio Bustamente Prado⁴, and German-Alberto Villarroel Opazo⁴

¹Université Côte d'Azur, Observatoire de la Côte d'Azur, CNRS, IRD, Géoazur, 250 Route d'Albert Einstein, 06220 Valbonne, France

²Centro Sismológico Nacional, Universidad de Chile, Santiago, Chile

³Institute of Earth Sciences, The Hebrew University, Jerusalem, Israel

⁴GTD Grupo S.A., Santiago, Chile

In most subduction zones, a great portion of seismicity is located offshore, away from permanent onland seismic networks. Chile is not the exception; since the upgraded seismic observation system began operating in 2013, 35% of the ~7000 earthquakes with $M \geq 3$ recorded yearly were located offshore. Most importantly, the epicenters of the largest earthquakes ($M > 7.5$) from 2014 to 2016 were located offshore as well.

The Chilean national seismic network is mainly composed of coastal and inland stations, except for two stations located on oceanic islands, Rapa Nui (Easter Island) and Juan Fernandez archipelago. This station configuration makes it difficult to observe in sufficient detail the lower-magnitude seismicity at the nucleation points of large events. Moreover, the lack of seafloor stations limits the efficiency of earthquake early warning systems during offshore events. These challenges could be overcome by permanently instrumenting existing submarine telecom cables with Distributed Acoustic Sensing (DAS).

Thanks to GTD, a private telecommunications company that owns a 3500-km-long network of marine fiber optic cables with twelve landing points in Chile (Prat project), from Arica (~ 18°S) to Puerto Montt (~ 41°S), we conducted the POST (Submarine Earthquake Observation Project in Spanish) DAS experiment on the northern leg of the Concón landing site of the Prat cable. This experiment, one of the first to be conducted on a commercial undersea infrastructure in a very seismically active region, was carried out from October 28 to December 3, 2021. Based on the longitudinal strain-rate data measured along 150 km of cable with a spatial resolution of 4 meters and a temporal sampling of 125 Hz, we present preliminary results of analyses to assess the possibility of building a new type of permanent, real-time and distributed seafloor observatory for continuous monitoring of active faults and earthquake early warning systems.