Supporting Information for "Monitoring Deep Sea Currents with Seafloor Distributed Acoustic Sensing"

D. Mata Flores[1], A. Sladen[1], J.-P. Ampuero[1], E. D. Mercerat[2], D. Rivet[1]

[1]Université Côte d'Azur, CNRS, Observatoire de la Côte d'Azur, IRD, Géoazur, Sophia Antipolis, *250* rue Albert Einstein, *06560*, Valbonne, France

[2]CEREMA, Méditerranée, *500* Rte des Lucioles, *06560*, Valbonne, France

Contents of this file

1. Figures S1 to S2

Introduction

This supplementary contains additional figures.

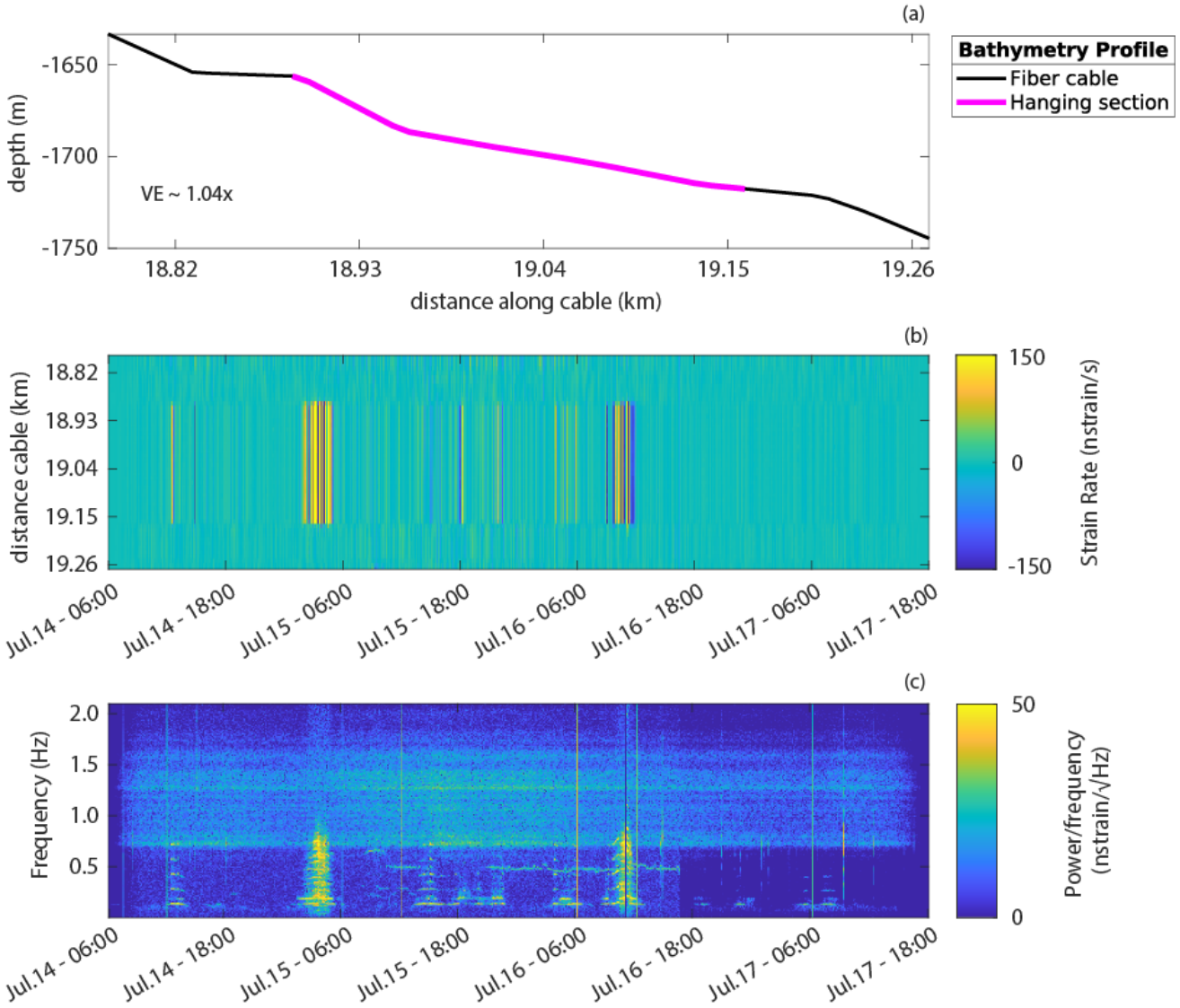

Figure S1. Vortex-Induced Vibrations (VIV) recorded by seafloor DAS in segment 1 of MEUST cable. (a) Bathymetry profile along the MEUST cable path (VE stands for Vertical Exaggeration) and (b) 84 hours-long recording of low-pass filtered strain rate, along a cable portion of Segment 1. A cutoff frequency of 2 Hz is used to filter the strain rate. Uniform quasi-harmonic oscillations of fiber strain occur around a seafloor valley. (c) Spectrogram of strain rate at the center of the vibrating section featuring a time-dependent characteristic frequency, varying from 0.13 to 0.16 Hz. Higher harmonic frequencies of VIV are excited during different periods, accompanied by large strain amplitudes.

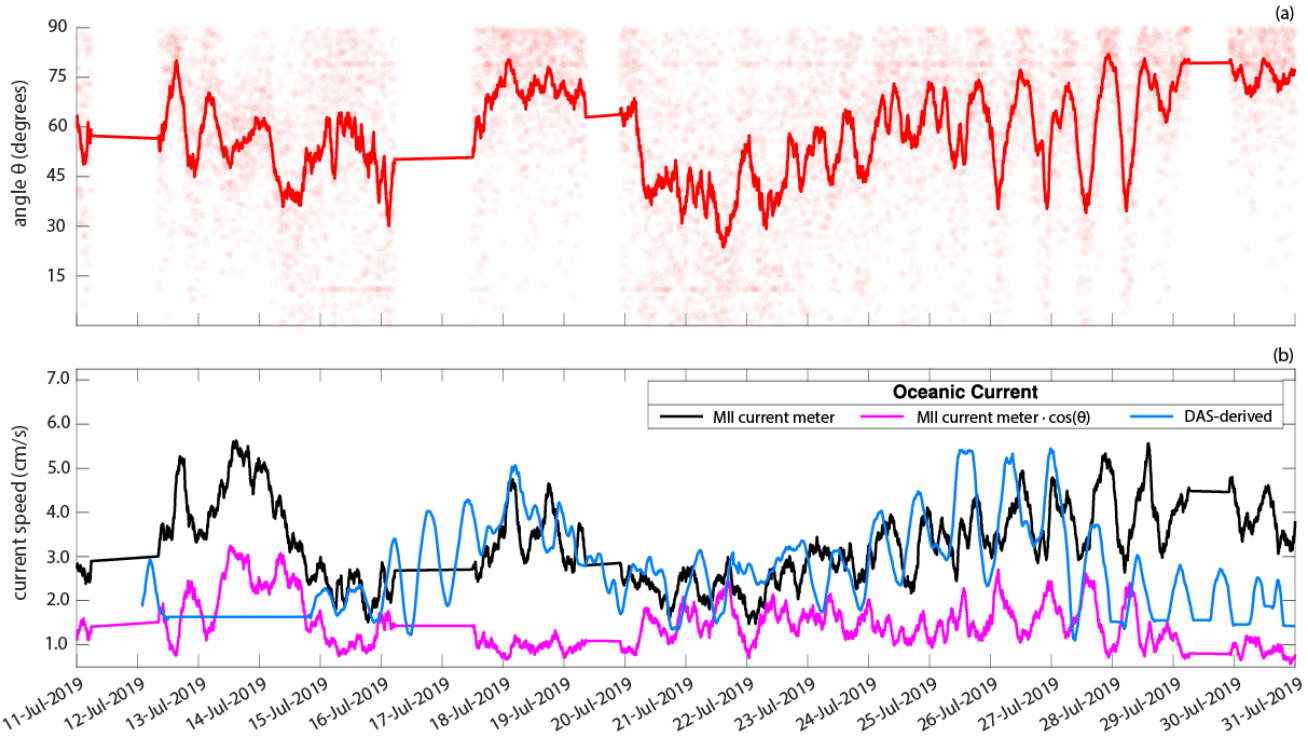

Figure S2. Validity of the Independence Principle (IP) for oblique Vortex-Induced Vibrations registered by underwater DAS. (a) Time variation of the angle *"θ"* between the ocean currents registered by MII current meter and the plane perpendicular to the cable axis (red circles), from 11-July-2019 00:00:00 UTC to 31-July-2019 00:00:00 UTC. The red line indicates the median angle averaged over a 2-hours sliding window. (b) Median of ocean currents registered by MII current meter averaged over 2-hours-long sliding windows (black), its vertical component respect to the plane perpendicular to the cable axis (magenta) and DAS-derived ocean currents (blue), during the same time in (a). The angle *"θ"* fluctuates between 24 and 82 degrees during the campaign. The vertical component of the MII current meter and DAS-derived ocean current time series do not match, which invalidates the IP. We believe that the high variability of *"θ"* may lead the IP to fail predicting the component of the oceanic current speed contributing to the VIV.