

OS12A-04 - Can seafloor voltage cables be used to study large scale transport? An investigation in the Pacific Ocean.



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Abstract

Marine electromagnetic (EM) signals largely depend on three factors: oceanic transport (i.e., depth-integrated flow), the local main magnetic field, and the local seawater conductivity (which depends on the local temperature and salinity). Thus, there is interest in using seafloor telecommunication cables to isolate marine EM signals and study ocean processes because these cables measure voltage differences between their two ends. Data from such cables can provide information on the depth-integrated transport occurring in the water column above the cable. However, these time-varying data are a superposition of all EM fields present at the observatory, no matter what source or process created the field. The main challenge in using such submarine voltage cables to study ocean circulation is properly isolating its signal.

Our study utilizes voltage data from retired seafloor telecommunication cables in the Pacific Ocean to examine whether such cables could be used to monitor transport on large-oceanic scales. We process the cable data to isolate the seasonal and monthly variations, and evaluate the correlation between the processed data and numerical predictions of the electric field induced by ocean circulation. We find that the correlation between cable voltage data and numerical predictions strongly depends on both the strength and coherence of the transport across the cable. The cable within the Kuroshio Current had the highest correlation between data and predictions, whereas two of the cables in the Eastern Pacific gyre (a region with both low transport values and interfering transport signals across the cable) did not have any clear correlation between data and predictions. Meanwhile, a third cable also located in the Eastern Pacific gyre did have correlation between data and predictions, because although the transport values were low, it was located in a region of coherent transport flow across the cable. While much improvement is needed before utilizing seafloor voltage cables to study and monitor oceanic transport across wide oceanic areas, we believe that the answer to our title's questions is yes: seafloor voltage cables can eventually be used to study large-scale transport.

Authors

[Neesha R Schnepf](#)

University of Colorado at Boulder

[Manoj C Nair](#)

University of Colorado

[Jakub Velimsky](#)

Charles University in Prague

[Natalie Paige Thomas](#)