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Time-series observations of hydrothermal discharge using an acoustic imaging sonar: a NEPTUNE observatory case study

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One intriguing feature of a mid-ocean ridge hydrothermal system is the intimate interconnections among hydrothermal, geological, oceanic, and biological processes. The advent of the NEPTUNE observatory operated by Ocean Networks Canada at the Endeavour Segment, Juan de Fuca Ridge enables scientists to study these interconnections through multidisciplinary, continuous, real-time observations. In this study, we present the time-series observations of a seafloor hydrothermal vent made using the Cabled Observatory Vent Imaging Sonar (COVIS). COVIS is currently connected to the NEPTUNE observatory to monitor the hydrothermal discharge from the Grotto mound on the Endeavour Segment. Since its deployment in 2010, COVIS has recorded a 3-year long dataset of the shape and outflow fluxes of the buoyant plumes above Grotto along with the areal coverage of its diffuse flow discharge. The interpretation of these data in light of contemporaneous observations of ocean currents, venting temperature, and seismicity made using other NEPTUNE observatory instruments reveals significant impacts of ocean currents and geological events on hydrothermal venting. In this study, we summarize these findings in the hope of forming a more complete understanding of the intricate interconnections among oceanic, geological, and hydrothermal processes.