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Detection of Diffuse Sea Floor Venting Using Structured Light Imaging

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Structured Light Overview

Identifying and localizing active diffuse low temperature sea floor venting at hydrothermal sites is difficult and inefficient. Typically, such sites are identified by a temperature induced optical shimmering visible during direct visual inspections by a remotely operated vehicle (ROV) working within meters of the sea floor. Such an approach prevents efficient surveys over broad areas and complicates establishing spatial relations between areas of float activity.

Our recent work with a structured light laser system indicates that venting can be detected in survey images in an automated and systematic fashion. During the summers of 2010 and 2011 the E/V Nautilus and ROV Hercules surveyed several active vent sites which provide examples of vent detection.

Kolumbo Vent Field, 2010

During the 2010 E/V Nautilus expedition active vents were surveyed within the Kolumbo crater, located about 7km from the coast of Santorini, Greece. As a depth of 500m there are numerous chimney vents with temperatures up to 230°C surrounded by larger areas of lower temperature diffuse venting (30°C-60°C). The background water temperature in the crater is 16°C. A laser survey was completed over large sections of the vent field, which created dramatic diffraction (Fig 3b). Bathymetry and the second moment of the laser line were then computed and plotted for comparison.

Kolumbo Vent Field, Poet’s Candle 2011

Within the Kolumbo crater, the around the Poet’s Candle vent, there is a region of diffuse venting and associated coverage by a white bacteria mat (Fig. 7). A 2011 laser survey over the area was able to capture lower temperature venting, measured 25°C-45°C above ambient.

Palinuro Seamount, Tyrrhenian Sea, 2011

Small active vents discharging shimmering water were discovered on the eastern flank of the large Palinuro seamount in the Tyrrhenian Sea at depths of 600m. Maximum fluid temperatures were 68°C in two rocky areas where tubeworm colonies were growing (Fig 12).

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Further Work: Additional work will seek to relate the laser image statistic to the vent intensity in a more quantitative way.