Vehicle in the Vent Plume

Submitted by Dwight Owens Wed, 2014-06-04 17:11

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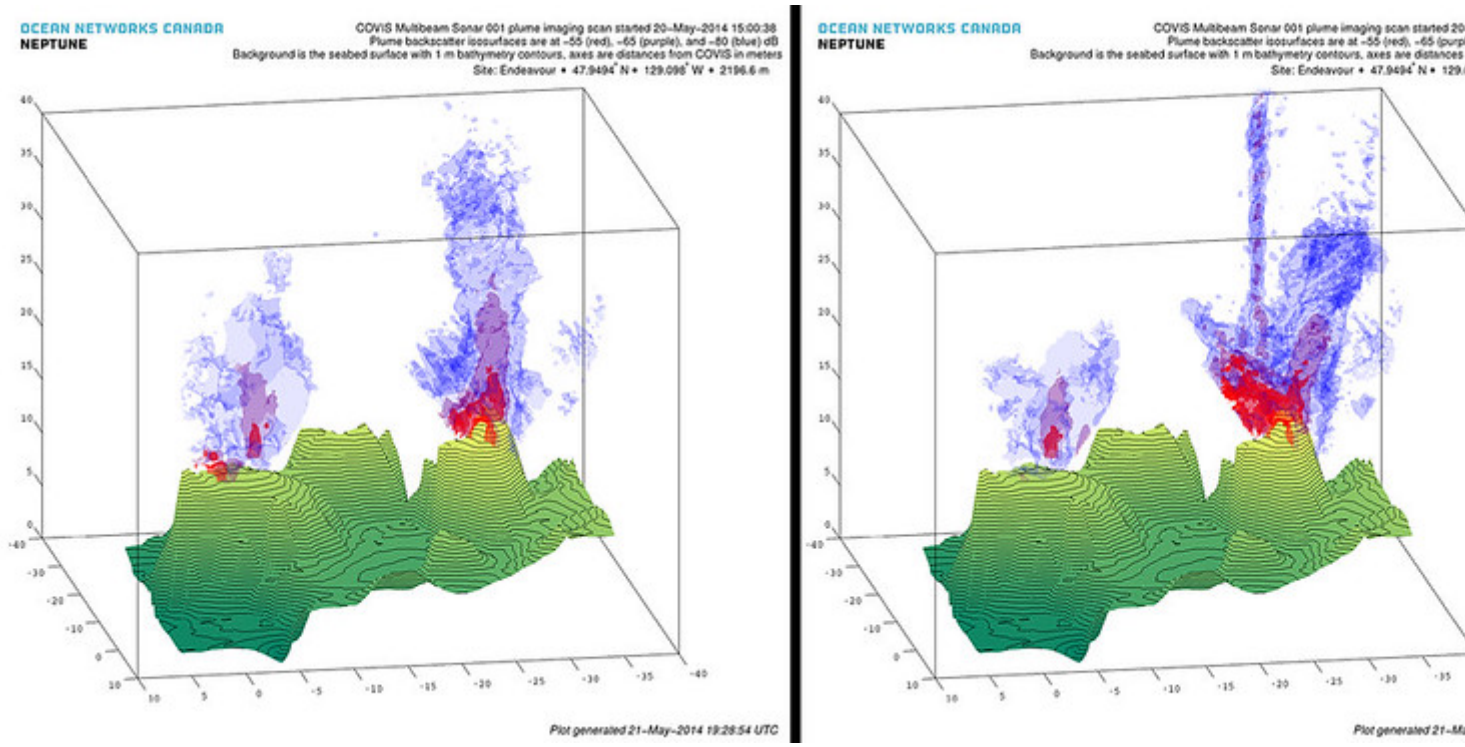
An unusual SONAR data plot was generated from COVIS (Cabled Observatory Vent Imaging Sonar) data on 20 May 2014, as the remotely operated vehicle ROPOS flew above Grotto hydrothermal vent in Main Endeavour Field (depth: 2195 m).

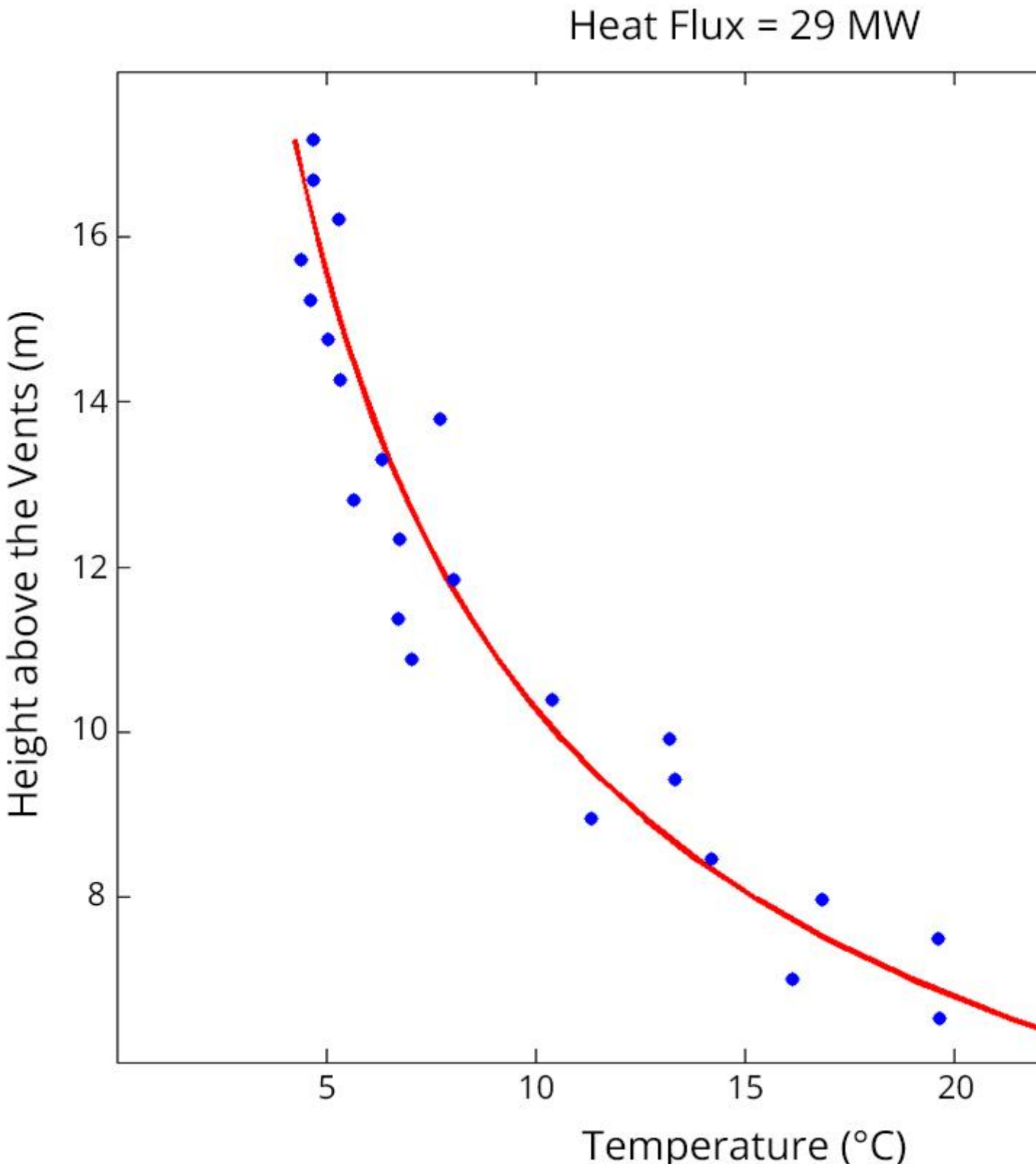


Side-by-side plots generated from COVIS sonar data at Grotto hydrothermal vent, 20 May 2014. The plot on the left shows the undisturbed plumes. The plot on the right shows the remotely operated vehicle ROPOS operating within the plume effluent of North Tower.

The above sonar images, showing hydrothermal plumes issuing from Grotto, were obtained by processing the acoustic backscatter data recorded by COVIS. This specialized vent imaging sonar was invented and developed by the University of Washington Applied Physics Laboratory and Rutgers University Institute of Marine and Coastal Science. The acoustic

dataset used to produce the righthand image was recorded while ROPOS was surveying the black smoker distributions atop Grotto?s western edifice named North Tower. The umbilical cable above ROPOS generates strong acoustic backscatter and is clearly evident in the righthand image as the straight line embedded vertically into the plume. ROPOS itself is obscured within the plume directly above North Tower.

Shortly before the unusual data plot was generated, ROPOS had spent an hour rising up and down within the plume measuring temperatures and taking water samples using Niskin bottles. The temperature profile (figure below) shows the cooling of the plume as it rises above the vents. In addition, by fitting a theoretical curve (calculated as a function of the heat flux driving the plume) to the measured temperature profile, one can estimate the heat flux from the vents that drives the plume.



Observed temperatures (blue) and theoretical temperatures (red, corresponding to a plume heat flux estimate of 29 MW) above North Tower of Grotto hydrothermal vent, based on measurements taken by the conductivity-temperature-depth sensor aboard remotely operated vehicle ROPOS, 20 May 2014.

Water samples were captured using Niskin bottles, which were triggered by ROPOS while it was hovering in the thickest, blackest part of the plume. These samples will be analyzed to determine the *concentration* and *grain size* of the suspended particles within the plume above North Tower. These 2 properties will be used to estimate the theoretical acoustic backscatter from the plume particles.

Triggering the Niskin

Image not found
https://farm4.staticflickr.com/3878/14345227531_546994cb22_c.jpg

The remotely operated vehicle prepares to pull the trigger to collect a Nisken water sample from the plume of effluent from Grotto hydrothermal vent, 20 May 2014.

Guangyu Xu, the scientist who directed this sampling operation, is attempting to identify the dominant acoustic backscatter mechanism, be it suspended particles or temperature fluctuations, within a hydrothermal plume. The answer to this fundamental question (what mechanism causes the vent backscatter patterns observed by COVIS) is a critical piece of information needed for the interpretation of the huge volume of data gathered by COVIS.

COVIS Head and Feet

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The scanning sonar head (left) and base of the Cabled Observatory Vent Imaging Sonar (COVIS) appeard to be in good condition during visual inspections at Main Endeavour Field, 20 May 2014.

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