Understanding Plume Bending at Grotto Vent on the Endeavour Segment, Juan de Fuca Ridge

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COVIS acoustic imaging

Processes Influencing Bending

In a fluctuating plume, the instantaneous centerline is not steady

Estimating Bending

Predicting plume bending

Comparison with Tidal Currents

Given that this image is averaged only over 2 samples, the curve may be due to fluctuations

Interaction with cross-flow (varying regimes)

W >> U  W ~ U  W << U

Doppler data shows evidence of forced entrainment!

When plumes merge, vertical velocity increases reducing response to currents.

But entrainment into larger plume can cause smaller to bend more.

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Both along-axis currents and plume bending show a strong semi-diurnal (12.5 hr) periodicity. The plume bending may also show a longer (~3-5 day) periodicity most evident in the cross-axis currents.

Their spectra suggest tidal currents are dominate forcing of bending

Direction and magnitude of bending vary a lot.

Top of North Tower (main plume)

Small plume site

(COVIS's viewpoint with ping)

(COVIS acoustic imaging)

(COVIS's viewpoint with ping)

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