Unprocessed results of computation fluid dynamics simulation of a pipette run in COMSOL Multiphysics: Capture regions for a CFD simulation of flow into a pipette

Website: https://www.bco-dmo.org/dataset/642924
Data Type: model results
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Project
» A framework to characterize inhalant siphon flows of aquatic benthos (Inhalant flows)

Contributors	Affiliation	Role
Jumars, Peter	University of Maine (U Maine DMC)	Principal Investigator
Crimaldi, John	University of Colorado (CU)	Co-Principal Investigator
Du Clos, Kevin	University of Maine (U Maine DMC)	Student, Contact
Copley, Nancy	Woods Hole Oceanographic Institution (WHOI BCO-DMO)	BCO-DMO Data Manager

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Dataset Description

Results of computation fluid dynamics simulation of a pipette run in COMSOL Multiphysics.

Unprocessed data.

This dataset is available for download: Pipette_Simulation_Data.zip (300 MB)

Figure 2. Reynolds number: Particle positions for capture regions calculated at a range of Reynolds numbers.
Capture regions for a CFD simulation of flow into a pipette.
Re: 0.5, 1, 2, 4, 8, 16, 32, 33, 64, 128, 256, 384, 512, 768, 1024
T: selected to give equal volume for each Re (T* = 20).
Cylinder geometry in pipe inner diameters
Rad: 2
Bot: 16

Figure 3a. Cylinder geometry 1/2: Particle positions for capture regions calculated for different cylinder geometries.
Capture regions for a CFD simulation of flow into a pipette.
Re: 200
T: 2889/290 s (T* = 20)
Cylinder geometry in pipe inner diameters
Rad: 2, 2.25, 2.5, 3, 3.25, 3.5, 3.75, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
Bot: 2, 16

Figure 3b. Cylinder geometry 2/2: Particle positions for capture regions calculated for different cylinder geometries.
Capture regions for a CFD simulation of flow into a pipette.
Re: 200
T: 2889/290 s (T* = 20)

Cylinder geometry in pipe inner diameters
Rad: 2, 2.25, 2.5, 3, 3.25, 3.5, 3.75, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16
Bot: 2, 16

Figure 4. Time: Particle positions for capture regions calculated over time
Capture regions for a CFD simulation of flow into a pipette.
Re: 200
T: 0:1:60 s
Rad: 2, 16
Bot: 2, 16

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Data Files

File
pipette_simulation.csv(Comma Separated Values (.csv), 440 bytes) MD5:c7abd099874d6a57ae2be8524d18098e Primary data file for dataset ID 642924

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Parameters

Parameter	Description	Units
figure	the figure number from paper	unitless
description	brief description of dataset	unitless
comments	further description	unitless

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Project Information

A framework to characterize inhalant siphon flows of aquatic benthos (Inhalant flows)

Coverage: Laboratory data to be generated at the Darling Marine Center and the University of Colorado

Description from NSF award abstract:
Inhalant siphon flows produced by benthic invertebrates such as clams and tunicates through suspension feeding and respiration can directly affect a wide range of physical and chemical processes in benthic marine ecosystems. These flows are energetically costly and influence the feeding and reproductive biology of the individual. Moreover, an understanding of siphon flows at multiple scales can be widely used not only to address questions of flow fields for other aquatic organisms and exchange processes, but that understanding has direct impacts on a variety of engineering problems such as sewer designs. Despite the importance of these flow fields in biology, relatively little research has been conducted on this topic, specifically on inhalant (vs. exhalant) flows. For this study, the PIs have modeled the flow outside the siphon entrance of several important benthic marine animals and have found radically different results from those commonly assumed. Given these findings, the PIs propose to test the results of their numerical simulation on inanimate physical models, and then verify their accuracy using live organisms.

The proposed numerical modeling will examine and predict effects of several parameters including inhalant siphon wall thickness, siphon height, disturbances caused by exhalant flows, and sensitivity to ambient flows. Predictions will be initially tested by using inanimate analog models. To provide a broad ecological framework, the PIs will then focus on five model suspension feeders, each of which has been extensively studied, and include a species of benthic shrimp, a tunicate, a soft shelled clam, the parchment worm, and a tube-dwelling amphipod. This suite of species will provide a broad description of intake flows as the combination of feeding systems spans nearly the full range of Reynolds numbers observed in animals that produce siphon flows. The results of this study will improve current understanding the effects of organismal intake flows on near-bed processes such as vertical fluxes of organic and inorganic nutrients, an important aspect of benthic ecology. Direct deliverables will include verified quantitative models of inhalant flows of marine benthos, connecting form and function and detailing fluid mechanical costs of operation.

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Funding

Funding Source	Award
NSF Division of Ocean Sciences (NSF OCE)	OCE-1260199
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