

Hydrothermal circulation at mid-ocean ridges – insights from the joint interpretation of models and data

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Hydrothermal discharge at so-called black smokers along the global mid-ocean ridge system continues to amaze and fascinate the interdisciplinary marine sciences community. Seawater penetrates into the newly formed seafloor along cracks and fractures to reach and react at high temperatures with partially molten rock to form a metal-rich hydrothermal fluid that rises buoyantly towards a vent site at the seafloor. These systems efficiently mine heat from the young ocean crust, sustain unique ecosystems in the otherwise bleak environment of the deep seafloor, and modulate global biogeochemical cycles. Much has been learned about these systems and their role in the Earth System from marine surveys of mid-ocean ridge segments and direct observations of vent sites at the seafloor. Yet, the deep chemical and physical processes that control hydrothermalism remain inaccessible to direct sampling and observations. Here numerical models can help as they can be used to relate seafloor observations to processes and to elucidate the physical connections between interdisciplinary data sets. In this talk I will review the current state of hydrothermal flow modeling and show examples of how a joint interpretation of models and data can lead to a more fundamental understanding of hydrothermal activity on the ocean floor.