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TIDAL VARIATIONS IN FLUID DISCHARGE VELOCITIES AT MID-OCEAN RIDGE HYDROTHERMAL SYSTEMS: A CRITICAL MEASUREMENT

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Mid-ocean ridge hydrothermal systems provide a challenging environment in which to work and most studies of venting are still based on point measurements and sampling. In recent years, there has been considerable effort to develop instruments to obtain time series measurements. In terms of the quantity of data, this work has been most successful for temperature and it suggests that the properties of hydrothermal outflow may co-vary with tides in some systems. A challenge now facing modelers is to develop tools to interpret existing data in terms of subsurface processes thereby guiding future observational work. We have developed a two-dimensional open-top poroelastic convection algorithm to examine the response of mid-ocean ridge hydrothermal systems to tidal loading. This model suggests that temperature-dependent fluid properties and spatial variations in permeability and elastic properties will lead to very small tidally-induced variations in venting temperature that might be compatible with observed fluctuations of up to a few degrees Celsius at most. However the model also suggests that large fluctuations in fluid exit velocities may occur at both high- and low-temperature sites with flow reversals at lower temperatures. Reliable measurements of tidally induced changes in seafloor discharge fluxes may prove critical to better understanding subseafloor hydrological processes. We are developing two techniques to make time series measurements of outflow. For diffuse flows, we are testing an electrochemical flow meter which uses an array of sensing electrodes to detect the motion of a chlorine perturbation that is generated electrochemically. For high-temperature focused flows, we are working with the Jet Propulsion Laboratory to develop an in-

situ imaging system that uses image correlation velocimetry to measure fluid velocity based on the motion of turbulent features in black smoker plumes.