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Integration of multi-disciplinary research in deciphering hadal processes

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The extreme depth and pressure of the hadal zone (>6000 m) have hindered the exploration of this vastly unknown environment. Recent advances in deep sea technology are providing a great momentum for hadal research. This project aims to coordinate efforts among multi-disciplines including geomorphology, sedimentology, physical oceanography, chemistry and microbiology to examine the dynamic and complex processes in the Mariana Trench. So far, we have deployed sediment traps, current meters, bottom turbidity monitors, as well as an array of ocean bottom seismometers down to depth greater than 8000 m. An acoustically controlled large-volume water collection system (288 liters) equipped with CTD capabilities was successfully used to collect up to 1000 liters of seawater down to 8212 meters using multiple deployments. Preliminary results demonstrated unique abyssal circulation patterns, heterogeneous distribution of particulate organic matter, and trench-specific microbial populations, which may be intrinsically linked to slope dynamics and transport of nutrients and energy sources (organic and inorganic) to the hadal waters. A conceptual model has been proposed to describe the dynamic interactions between biological pump, the microbial carbon pump and physical processes of the Mariana Trench environment, which would enhance our understanding of the role the hadal zone plays in global carbon cycle.