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Numerical simulation of the dispersion of a sediment plume induced by seabed dredging in the northeastern tropical Pacific Ocean

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Prediction of the dispersion of sediment plumes induced by potential mining activities is still very limited due to operational limitations on *in-situ* observations required for a thorough validation and calibration of numerical models. Here we report on a plume dispersion experiment carried out in the German License Area for the exploration of polymetallic nodules in the northeastern tropical Pacific Ocean. The dispersion of a sediment plume induced by a dredging experiment in April 2019 was investigated by employing a hydrodynamic high-resolution regional ocean model coupled to a sediment transport module.

Various aspects including sediment characteristics and ocean hydrodynamics are examined to obtain the best statistical agreement between observation and model results. Results show that the model is capable to reproduce suspended sediment concentration and re-deposition patterns observed in the dredging experiment. Due to a strong southward current during the experiment, the model predicts no sediment deposition and plume dispersion north of the dredging tracks. The sediment re-deposition thickness reaches up to 9 mm at the dredging tracks and 0.01 mm at far-field at a distance of about 500 m from the dredging tracks.

The model results suggest that seabed topography and variable sediment release heights above the seafloor cause significant changes especially for the low sedimentation pattern in the far-field region due to different current regimes. The termination of seawater stratification can rise sediment plume above the seafloor and spread it in a larger vertical distances up to 10 m from the seafloor.