

Drastic export of organic carbon to hadal trench driven by megathrust earthquake

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Despite a growing understanding of pivotal role of the carbon cycle in governing the Earth system, the nature and quantification of carbon supply to hadal environments remains poorly constrained. The giant 2011 Tohoku-oki earthquake has been inferred to remobilise fine-grained, young surface sediment enriched in organic matter from the slope into the >7 km deep Japan Trench. Yet, this hypothesis and assessment of its significance for the carbon cycle has been hindered by limited data density and resolution in the hadal zone. Here we combine new high-resolution bathymetry data with subbottom profiler images and sediment cores taken during 2012–2016, in order to map for the first time the spatial extent of the earthquake-triggered event deposit along the hadal Japan Trench. We quantify a sediment volume of $\sim 0.2 \text{ km}^3$ deposited from spatially-widespread remobilisation of young surficial seafloor slope sediments triggered by the 2011 earthquake and its aftershock sequence. The mapped volume and organic carbon content in sediment cores encompassing the 2011 event reveals that this single tectonic event delivered >1 Tg of organic carbon to the hadal trench. This carbon is comparable to high carbon fluxes described for other Earth system processes, shedding new light on the impact of large earthquakes on long-term carbon cycling in the deep sea.

Keywords: Hadal zone, Japan Trench, Organic carbon, Carbon cycle, Sediment remobilization, The 2011 Tohoku-oki Earthquake