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Assessing the controls on global modern contourite coverage using an eddy-resolving ocean model

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Contourite drifts are areas of sediment focusing that result from reworking and redistribution by vigorous bottom currents. However, a direct link between bottom current activity and global contourite coverage has been difficult to establish due to the lack of a unified contourite database. We compiled a database of 267 georeferenced contourites to examine the relationship between contourite coverage and the occurrence of high-speed bottom currents, which were simulated using an eddy-resolving ocean model (Modular Ocean Model v.5). Results suggest considerable overlap between contourite drifts and the world's most powerful bottom currents, where drifts align with western boundary currents, major overturning circulation pathways and powerful surface currents. Mean bottom current speeds over contourite-covered areas are slightly higher (2.2 cm/s) than those simulated for the rest of the global ocean (1.1 cm/s), falling far below proposed thresholds deemed necessary to re-suspend and redistribute sediments. However, currents fluctuate more frequently and intensely over areas with contourites, highlighting the potential role of episodic, high-energy bottom current events in sediment erosion, transport, and subsequent drift accumulation. Our work supports previous hypotheses which suggest that contourite deposition predominantly occurs under repeated acute events as opposed to average-intensity flow conditions. Fluctuations in simulated bottom current intensity can be caused by instabilities caused by fluid-obstacle interactions, the meandering behaviour of currents, and the activity of transient eddies. Our work carries implications for how deep-sea sediment record should be interpreted. Contourites may be more indicative of the frequency and magnitude of high-energy bottom current events rather than background flow conditions.