

Mental models of fluids in solid body rotation: students' reasoning about fluid processes modeled during oceanography and atmospheric science instruction

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Abstract

A pedagogical tool in undergraduate oceanography and atmospheric science education is a water filled, rotating, tank used to model geophysical fluid flow on Earth. We used a typical classroom rotating tank to investigate students' mental models of fluids in rotation. In two experiments, we conducted semi-structured interviews with participants (N=59) who predicted the behavior of water in rotation, explained their predictions, and attempted to make sense of observed demonstrations. We found participants had accessible mental models of fluid behavior based on analogies, however these mental models were wrong. Our results suggest that the behavior of rotating fluids is highly unintuitive and that without tangible opportunities for mental model formation, the mind adopts mental models representative of experiences with fluids to fill this gap. We discuss implications for education and suggest a better understanding of how humans reason about fluids can inform cognitive science while improving oceanography and atmospheric science instruction.