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# FLOW STRUCTURE IN SUBMARINE MEANDERING CHANNELS CREATED BY TURBIDITY CURRENTS

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**Abstract**. The understanding of the flow structure in deep-sea turbidity currents is important for the formation of submarine meandering channels. Similarly to the case of subaerial channels, several types of secondary flows include turbulence-, curvature- and bed morphodynamic-driven flow structures that modulate sediment transport and channel bed morphodynamics. This study focuses on the description of the secondary flow associated with a subaqueous bottom current in a high-curvature meandering channel. For simplicity, a saline bottom current is used as a surrogate for a turbidity current driven by a dilute suspension of fine-grained sediment that does not easily settle out. In the case of subaerial channels, the classical Rozovskiian paradigm is often invoked which indicates that the near-bottom secondary flow in a bend is directed inward. It has recently been suggested based on experimental and theoretical considerations, however, that this pattern is reversed (near-bottom secondary flow is directed outward) in the case of submarine meandering channels. Experimental results presented here, on the other hand, indicate near-bottom secondary flows that have the same direction as observed in a river (normal secondary flow). The implication is an apparent contradiction between experimental results. This study combines theory, experiments and reconstructions of field flows to resolve this apparent contradiction based on the flow densimetric Froude number. Three ranges of densimetric Froude number are found, such that a) in an upper regime, secondary flow is reversed, b) in a middle regime, it is normal and c) in a lower regime, it is reversed. These results are applied to field scale channel-forming turbidity currents in the Amazon submarine canyon-fan system (Amazon Channel) and the Monterey canyon and a saline underflow in the Black Sea flowing from the Bosphorus. Our analysis indicates that secondary flow should be normal throughout most of the Amazon submarine fan reach, lower-regime reversed in the case of the Black Sea underflow, and upper-regime reversed in the case of the Monterey canyon. The analysis predicts both normal and reversed regimes in the Amazon submarine canyon reach. This research presents insights on the importance of flow structure not only to describe subaqueous bed morphodynamics, but also to understand evolution of submarine meandering channels.