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A multilayer approach for turbidity currents

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When a river that carries sediment in suspension enters into a lake or the ocean it can form a plume that can be classified as hyperpycnal or hypopycnal. Hypopycnal plumes occurs if the combined density of the sediment and interstitial fluid is lower than that of the ambient. Hyperpycnal plumes are a class of sediment-laden gravity current commonly referred to as turbidity currents [7,9].

Some layer-averaged models have been previously developed (see [3, 4, 8] among others). Although this layer-averaged approach gives a fast and valuable information, it has the disadvantage that the vertical distribution of the sediment in suspension is lost.

A recent technique based on a multilayer approach [1, 2, 6] has shown to be specially useful to generalize shallow water type models in order to keep track of the vertical components of the averaged variables in the classical shallow water equations. In [5] multilayer model is obtained using a vertical discontinuous Galerkin approach for which the vertical velocity is supposed to be piecewise linear and the horizontal velocity is supposed to be piecewise constant.

In this work the technique introduced in [5] is generalized to derive a model for turbidity currents. This model allows to simulate hyperpycnal as well as hypopycnal plumes. Several numerical tests will be presented.

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