The relationship of actively migrating sand bodies to the tidal streams and eddies in the Bay of Fundy – new insights through combined mapping and modeling

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The Bay of Fundy has seen ongoing multibeam mapping for 15 years now. Combined results currently provide a view of surficial sediments and morphology over about 60% of the Bay. As well as obvious relict glacial morphology, there are clear regions in which intense modern active sediment transport is resulting in the development and apparent concentration of mobile sand sheets. Most notably, headland-associated lens-like bodies of sand are found to be common, the most notable one being the Scots Bay sand wave field. It is apparent that for most significant coastal protrusions into the tidal stream, at least one, and often a pair, of these lens-like banks develop. In order to try to understand the association of these headland-associated sand bodies with the tidal stream, a series of nested, high resolution 3D barotropic finite-element hydrodynamic models have been developed, forced using the lower-resolution but spatially more extensive DFO Webtide models.

Many of the headlands develop eddies downstream of the flow. These eddies variously develop over the tidal cycle and advect away from the headland depending on the form factor of the headland. Although the instantaneous eddies clearly are not stationary, they result in a clear tidally-averaged residual inshore flow toward the headland. This is reflected in a ubiquitous development of asymmetric dunes in the inshore side of these lens-like bedform fields. In contrast the offshore side normally exhibit near symmetric bedform characteristics.

By coupling a sediment transport model to the variation in bottom bed shear stress observed over an M2 tidal cycle, residual sediment transport vectors have been calculated. The headland-associated banks are clearly related to, but offset from, local minima in the tidally averaged sediment transport vectors. The relatively simple geometry of the main coastal protrusions is reflected in the paired bedform fields.

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More complex residual sediment transport systems develop in and around the islands immediately to the south of Grand Manan including several lens-like sand bodies. The combination of a hydrodynamic and a sediment transport model help understand the more complex circulation in these areas.