Netherlands Enterprise Agency

Q&A Webinar Morphodynamics and Scour Mitigation HKN

May 23, 2019

Questions: from the audience
Answers given by: Tim Raaijmakers (Deltares), Tom Roetert (Deltares), Ben de Sonneville (BLIX Consultancy) and Cynthia Mors (Netherlands Enterprise Agency)

Question: There is no distinction between the northern and southern areas in concerns of sand waves migration rates (net sediment transport increase from south to north)?
Answer: It is correct that the differences in migration rates in HKN between south and north are less pronounced than for instance in HKZ, where we saw a clear increase in migration rates from south to north. Also please note that the variation in sand wave shapes, heights and lengths is larger in HKN (compared to HKZ, where we saw a more regular sand wave pattern), resulting in a larger range in migration rates. Furthermore the underlying bathymetry in HKN shows a larger variation compared to HKZ. Therefore, no direct comparison between the magnitude of the normalized net sediment transport and the migration rates of sand waves could be made.

Question: There is no distinction between short (caused by waves and storms) and long term (caused by tidal current) migration rates. In addition, oscillation of sand waves might be possible at short term, this could be important for construction.
Answer: In the morphodynamics study for HKZ we have analyzed the effect of a storm on the sand wave shapes. It was hypothesized that severe storms might cause a flattening of the sand waves (lowering the crests and filling up the troughs). In HKZ along the same multibeam line two surveys were performed, perpendicular to a number of sand wave crests and troughs: one pre-storm and one post-storm. We did see a change in the megaripples (i.e. smaller seabed features), but the sand waves themselves were unaffected by the storm. This is most likely related to the large dimensions of sand waves (and hence large volumes of sand involved) and large water depths in HKZ, resulting in relatively small changes in storm-induced bed shear stresses between crest and trough. At shallower water depths the correlation between sand wave shape and storm intensity is expected to be more pronounced.

Question: The BEL are calculated by moving the sand waves with the migration rates in one direction. This doesn't consider potential movement in other directions due to storms.
Answer: The Best-Estimate-Levels (BEL's) are based on the best-estimate migration directions and best-estimated migration rates, so indeed not based on incidental (or event-driven) changes in hydrodynamics, but on the best-estimate hydrodynamic conditions, which are based on tidal motion. The variation in directions and rates is covered by the LSBL and HSBL. By the way, we do not expect a strong variation in migration direction during storms, but storms may (when sufficiently strong in relation to the water depth, see also the response to question 2) flatten out the sand waves a bit. Sand waves in HKN are migrating due to subtle tidal-driven migration cells (averaged over multiple tides); such conditions do not exist in storms. And migration rates are only in the order of a few m/year, resulting in very limited migration during the duration of a storm. Note that this may be very different for areas that are shallower and/or closer to the shoreline.

Question: Is movement and settlement of UXO considered in the definition of LOL and HOL?
Answer: For calculation of the UXO levels, only settlement of UXO's is taken into account. For this analysis we assume that once objects were dropped (during the second World War) they lowered with the seabed but did no longer follow the seabed once this rose, e.g when a sand wave migrates over the object. Horizontal movement of the UXO's is not considered as this study focusses on seabed dynamics rather than movement of various types (and weights) of UXO's. In that sense the LOL and HOL will be most reliable for UXO's that will partly self-bury due to self-weight and scouring around the object, typically allowing the object to sink ~50% of its height into the seabed. Lighter type of UXO's that do not (partly) sink into the seabed can be picked up from the seabed by severe wave action and could be transported in horizontal direction, theoretically ending up at levels higher than the HOL.