

## O35.2

### Tidal bedforms dynamics, Weser Estuary, Germany

Alice Lefebvre<sup>1</sup>, Gerald Herrling<sup>2</sup>, Anna Zorndt<sup>3</sup>, Knut Krämer<sup>2</sup>, Marius Becker<sup>2</sup>, Christian Winter<sup>2</sup>

<sup>1</sup>MARUM - University of Bremen, Germany. <sup>2</sup>University of Kiel CAU, Germany. <sup>3</sup>Federal Waterways Engineering and Research Institute (BAW), Germany

#### Abstract

The distribution, morphology and dynamics of tidal bedforms in the Weser Estuary, Germany, between the tidal limit (river-km 0 at the tidal weir in Bremen) and the open North Sea (river-km 111 in the Outer Weser) was analysed for a three-year period based on monthly bathymetric surveys carried out along the main waterway. Bedforms were detected from gridded bathymetry data and their geometric properties described. In particular, the presence and position of a slip face, defined as the portion of the lee side steeper than 15°, was recorded as a simplified indicator of bedform roughness.

Bedforms were present along most of the estuary channel, apart from a section between river-km 55 and 75. There, muddy cohesive sediment hindered the formation of bedforms. Along the channel and throughout the years, bedform lengths varied between 20 and 60 m and heights between 0.3 and 1.6 m.

During times of high fluvial discharge, in winter and spring, bedforms were generally small, long and ebb-oriented (i.e. the ebb lee side was shorter than the flood lee side). Many bedforms featured an ebb slip face but no flood slip face. This suggests that bedforms were active roughness elements during the ebb phase only.

In summer and autumn, when the discharge was low, bedforms in the upper reach (ca. river-km 15 to 30) gradually became flood-oriented and many bedforms there developed a flood slip face, implying that the bedforms were active roughness elements during the flood. Between km 30 and 55, bedforms were predominantly ebb-oriented, and many bedforms had an ebb slip face but only few had a flood slip face, so bedforms were only active during the ebb phase.

The annual variations of bedform dimensions and shapes reveal an intricate feedback between river and tidal flows, channel morphology, sediment dynamics and bedforms.

#### Keywords

Bedforms, Estuary, Sediment dynamics