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Comparison of tidal asymmetry descriptors – a sensitivity study based on one-year monitoring data of the Ems estuary

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Estuarine management requires fundamental system understanding on drivers and effects of flow and transport dynamics. Among other system descriptors, tidal asymmetry is a fundamental property, used in many ways, e.g. to define the dominant direction of sediment transport in estuaries. There are several different parametrizations of tidal asymmetry, and the number of methods of their derivation has increased in recent years. We present an attempt to discuss comparability of descriptors for tidal asymmetry. We computed descriptors from one-year measured monitoring data of the Ems estuary. Using conformal mapping we scaled each of these for comparison. A sensitivity analysis shows the pronounced influence of freshwater discharge on descriptors derived from velocity data and, on the other hand, the influence of wind on quantities based on duration of tidal phases. The impact of spring neap variability changes over the estuary. Our results show that observations of short periods (e.g. two tides) are not robust compared to the average of a spring neap cycle. Finally, we conclude that the classification of the estuary in terms of flood or ebb dominant sediment transport is critically dependent on location and period of the input data. Further, we discuss how to interpret hydrodynamic parameters derived from point measurements. The actual characterization of an estuary requires more comprehensive data, such as variability over cross sections, data of suspended sediment concentration and a consideration of the entire density-driven circulation.