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## Competition and interaction between two bedform scales in a lowland river

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In fluvial systems worldwide, multiple scales of bedforms coexist. Where most research has focused on the larger, primary dunes, recent studies have indicated the importance of the small, secondary bedforms that are superimposed on the primary ones (Galeazzi et al., 2018, Zomer et al., 2021). The secondary bedforms migrate fast and the bedload sediment transport associated with secondary bedform migration equals that associated with the much larger primary dunes. Depending on the primary lee side slope, secondary bedforms disintegrate or persist at the primary dune lee. Secondary bedforms might have large implications for hydraulic roughness, for local flow dynamics and may interact with the development of primary dunes. Current work focusses on understanding the competition and interaction between primary and secondary bedforms in a lowland river, based on a large, multiyear dataset of bed elevation scans as well as a dedicated field campaign that maps the dynamics of both primary and secondary dunes.

A first objective of the study is to understand the competition between primary and secondary bedforms. Previous work has indicated inverse correlations between secondary bedform height and primary dune lee slope or height. The bed elevation scans indicate a spatial variability in secondary and primary bedform properties and locations where either secondary or primary dunes are dominant. This work aims to map and explain the mechanisms that affect the development and (semi-)equilibrium dune size and shape of both scales as well as the dependence on the discharge and bed grain size distribution.

A second objective is to shed light on the interaction between migrating secondary and primary dunes. Where secondary bedforms disintegrate at the primary lee, the secondary bedform migration contributes to primary dune migration. Secondary bedforms are also observed to persist over the primary dune lee however. Both scales are then actively migrating. Preliminary results suggest that sediment transport associated with secondary dune migration varies depending on the position of the small dunes on the primary dune. Sediment transported by secondary dunes seems to increase over the primary stoss and decrease on the primary lee. The variability in sediment transport indicates net erosion of the primary dune stoss and net deposition on the primary dune lee, resulting in a downstream migration of the primary dune.

References:

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