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Head-to-head encountering dune-fields under reversing flows in the Beibu Gulf, South China Sea

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Dunes and dune-fields, being indicators and recorders of environmental conditions, have attracted extensive attentions and are massively studied on the individual behaviors and dune-dune interactions. However, the processes of field-field interaction are still elusive. Here, using the latest bathymetric datasets, we presented the new-found dune fields developing under reversing tidal currents on a shallow shelf, northwest South China Sea. The dune fields separately had dunes with opposite inclination and were head-to head colliding with a coarse-coarse pattern and a coarse-fine pattern in term of the sediment character. The dune-field fronts defined by the transition of dune asymmetry were outlined, where convergent bed load transports coexisted with divergent suspended load transports. The dunes had apparent spatial variability in their scale and morphology across the dune fields. Dunes obtained steeper shapes towards the dune-field fronts due to the different responses of height and length when dune-fields met together, which were benefited from the bidirectional sand supply and the comparable reversing current speed. Dune scale also exhibited distinct variations towards the dune-field fronts, suggesting the past dominant southward migration of the north fields and the resistance of the south fields. From 2014 to 2016, dunes inside the dune fields mostly moved to their inclining direction while some dunes in the dune-field fronts migrated to oppositely. The dune-field fronts shifted oppositely in various regions because of the rebalance of sand transports, which are inferred to essentially result from the regional flow changes. The migrating rates of the fronts are also influenced by the magnitude of grain size, water depth, dune height, and current speed. The behaviors of dune-field fronts can possibly record the interactions between dune-field and local environmental changes. More studies are still required on the internal structures of dunes near dune-field fronts and the modelling of local effects of regional environment modification.