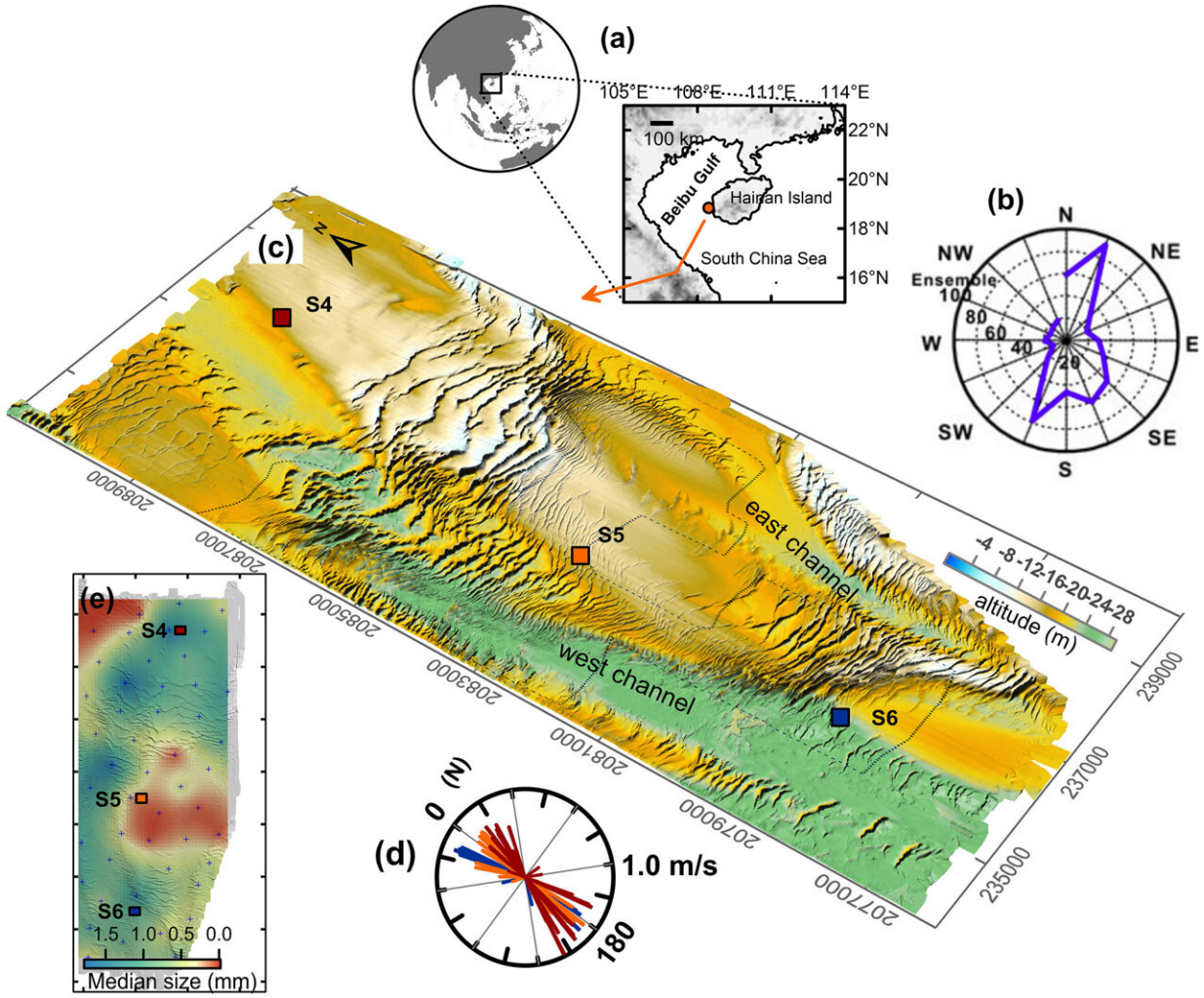
Tracking head-to-head encounters of mobile dune fields on seafloor

March 24 2022, by Li Yuan



(a) Location of the study area. (b) The direction frequency of bottom currents offshore the coast (Ma et al., 2018). (c) 3D map of the dune fields based on the 2-m resolution bathymetry of 2014, where the repetitive survey area of 2016 is outlined by the dashed line. Red, orange, and blue squares denote the sites for

current measurement and synchronous water collection. (d) The magnitude and direction of tidal currents in the three sites. (e) The distribution of sediment characters (left) and the mosaic of sonar images (right). Credit: *Geomorphology* (2022). DOI: 10.1016/j.geomorph.2022.108210

The self-organized and rhythmical shapes of sand waves/dunes and related physical mechanisms are always attractive to scientists. Massive studies have been deployed on the formation, dynamics, evolution of individual dunes on the seafloor.

However, the behaviors of a dune field and the interactions between different dune fields are still elusive.

Recently, a research team led by Prof. Yan Jun from the Institute of Oceanology of the Chinese Academy of Sciences (IOCAS) provided new clues for these questions.

The study was published in *Geomorphology* on March 18.

The researchers analyzed comprehensive field data collected in 2014 and 2016 in the Beibu Gulf, northwestern South China Sea and used simulation to present a vivid case of head-to-head encounter of mobile dune fields in a typical bidirectional flow system for the first time.

They found that the dune fields on the seafloor encountered with each other, end-by-end or side-by-side, and exhibited different patterns. The morphology and mobility of dunes across the encountering fields showed great variabilities, which were determined by regional net sand transport regime.

"The interactions between the encountering dune fields over the field

boundaries look like the battle fronts between troops, and the shifts of field boundaries are like advances and retreats of battle fronts. Our study, for the first time, clearly and visually described these boundaries and the behaviors between dune fields," said Dr. Ma Xiaochuan, the first and corresponding author of the study.

The researchers also found that the field boundary was shifting from 2014 to 2016. The field boundary shifts reflected location inconsistency between the long-term accumulative transport balance (symmetrical shape) and the recent transport balance (non-migration) on dunes near field boundary, which was ascribed to the modulation of residual sand transports associated with the systematic changes in the regional flow conditions.

These results suggested that the behavior of dunes near the field boundary could sensitively reflect the field-field interplay and reveal the relevant minor environmental changes.

"This is quite important for understanding the past evolutions of shelf tidal environment. Usually, to extract the effects of tiny changes in the regional tide condition from geological or sediment records is extremely difficult. Now this result indicates that dune field interaction may give us a hand," said Dr. Ma.

This study provides new insights into the surface processes under a bidirectional flow system on a planet, either in eolian or subaqueous environments.

More information: Xiaochuan Ma et al, The encountering dune fields in a bidirectional flow system in the northwestern South China Sea: Pattern, morphology, and recent dynamics, *Geomorphology* (2022). DOI: 10.1016/j.geomorph.2022.108210

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