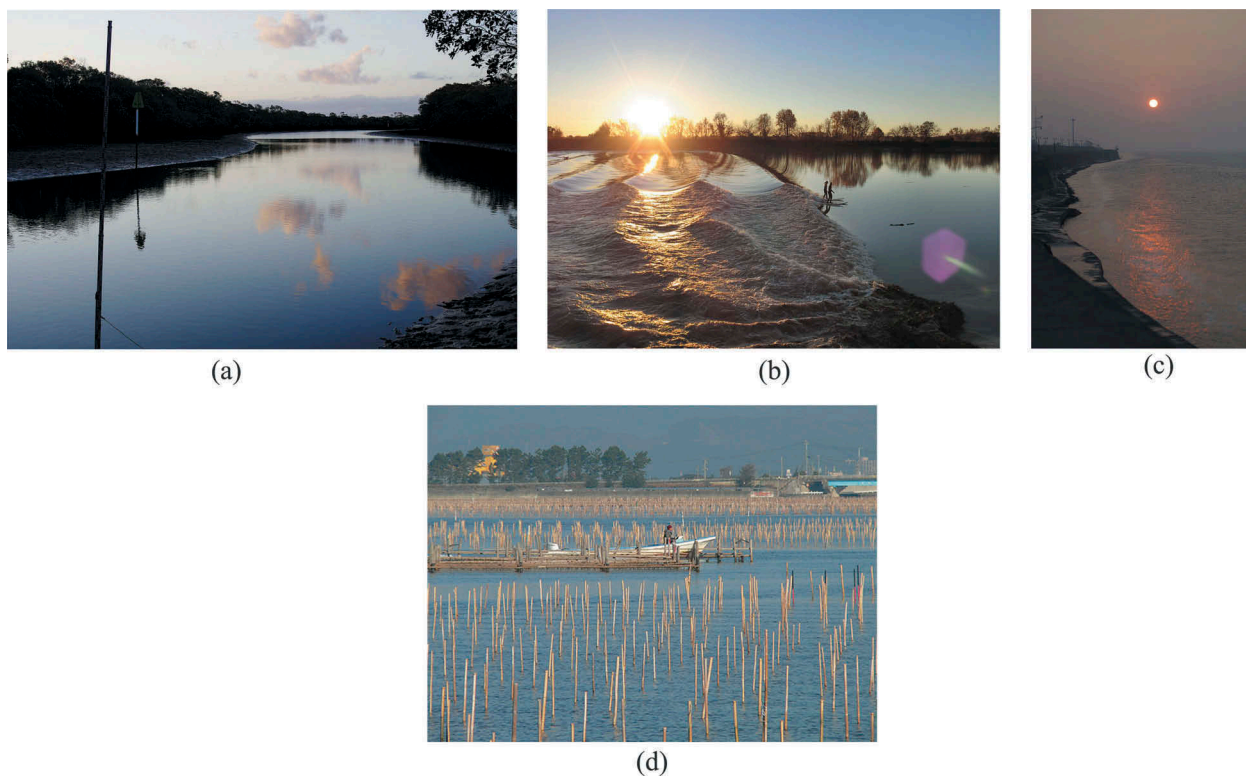


## Estuarine hydrodynamics and morphodynamics: a perspective

An estuary is a water system in which the tide meets a freshwater system with some mixing between freshwater and seawater. Estuaries may be classified as a function of their geomorphology, salinity distribution, and density stratification (Ippen 1966; Fischer et al. 1979; Dyer 1997; Savenije 2005). A salt wedge may develop when the freshwater flows into the sea with low tidal range. The fresher river waters flow at the surface over a dense bottom layer, i.e. the salt wedge. The strong density gradient at the wedge interface inhibits vertical mixing between surface freshwater and bottom saltwater. Shear stresses acting on the interface induced, however, some saltwater entrainment into the freshwater flow. With a moderate tidal range, some vertical mixing is induced by the tidal flow and the estuarine system becomes partially mixed. For larger tidal ranges, the estuary becomes well-mixed vertically. There is very little vertical variation in salinity and the residual flow is seaward at all elevations. Such a classification does not express the unique feature of each estuary, any seasonal

change nor for differences between neap and spring tides (Figure 1). Figure 1 presents examples of estuarine zones across our Planet, illustrating the diversity between systems. Recent advancement of field measurement techniques, as well as progress in numerical simulation and physical modeling methods, have enabled to make more detailed and comprehensive investigations on estuarine hydrodynamics and morphodynamics from various viewpoints, with a range of practical applications including flood control, navigation channel maintenance and environmental issues.

In this special issue on estuarine hydrodynamics and morphodynamics, 11 papers have been accepted from various countries including Australia, Canada, China, France, Japan, and Vietnam, with research topics ranging from basic hydrodynamics and water quality issues. Among these are seven papers dealing with estuarine and adjacent coastal sedimentation and resulting morphology changes based on field observation using an advanced monitoring system, or based on numerical



**Figure 1.** Photographs of estuaries. (a) Sunset over a micro-tidal estuary in south-east Queensland, Australia at low tide on September 12 2014. (b) Sunrise over the tidal bore of the Dorodogne River, France on October 21 2015, nearly 140 km upstream of the river mouth. (c) Sunrise over the Qiantang River estuary at Yanguan, China on September 25 2016, looking downstream with the northern seawall on the left. (d) Hamana Lake, a brackish lagoon off the Enshu Coast, Japan on December 3 2008, looking at seaweed and oyster farms.

analysis. Hydrodynamics and associated sedimentation induced by tidal bore and tsunami ascending a river have been investigated in four papers, with two dedicated numerical studies, and two field and laboratory observations. In addition, numerical study on bay water quality affected by loads of organic matter from highly urbanized river basin has also been reported.

The present special issue thus brings together a diverse group of leading researchers from the entire world and contains scientific papers accepted after a rigorous peer-review process. We would like to thank Prof. Watanabe, Editor-in-Chief, for supporting the idea of this Special Issue, and for allowing us to act as its Guest Editors. We also thank the many reviewers who significantly contributed to improve all the articles, without whom the peer-review process and research quality control would have been impossible, as well as all the authors for their efforts to complete this issue in a timely manner.

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