

Quantification of tidal asymmetry and its non-stationary variationsLeicheng Guo^{a,*}, Zheng Bing Wang^{a,b,c}, Ian Townend^{a,d}, Qing He^a^a State Key Lab of Estuarine and Coastal Research, East China Normal University, Shanghai 200062, China^b Department of Hydraulic Engineering, Faculty of Civil Engineering and Geosciences, Delft University of Technology, Delft 2600GA, the Netherlands^c Marine and Coastal Systems Department, Deltares, Delft 2629 HV, the Netherlands^d Ocean and Earth Sciences, University of Southampton, Southampton, UK**Contents of this file**

Figures S1 to S6

Introduction

This file include supporting figures of the main texts.



Figure S1. Tidal gauges along the US coasts. One-year data (one hour interval) in 2016 are collected at 80 gauges from NOAA (<https://co-ops.nos.noaa.gov>).

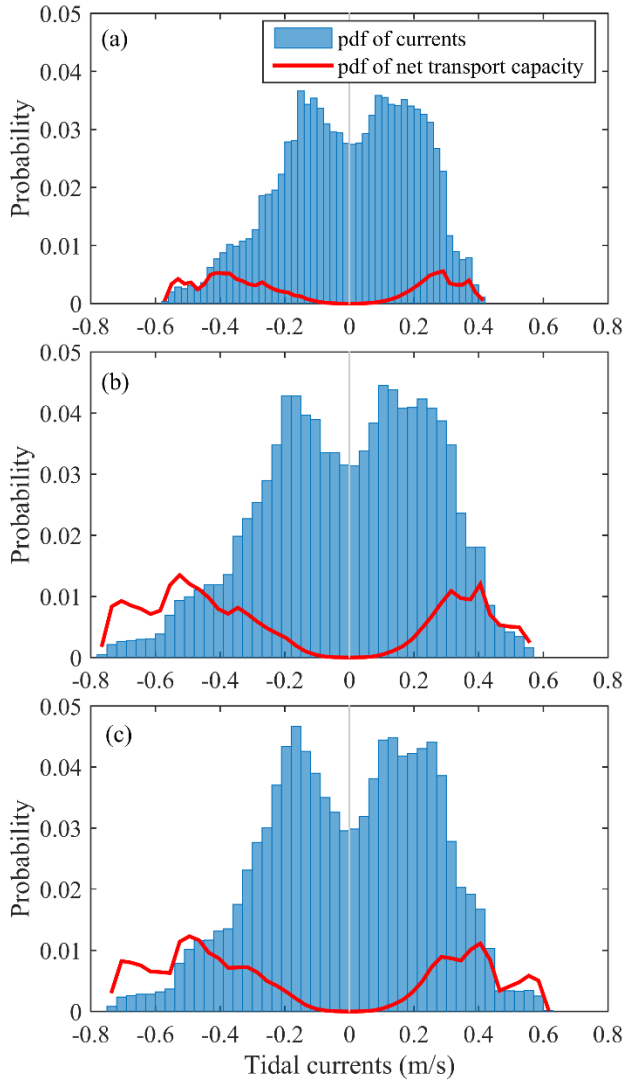


Figure S2. The PDFs of tidal currents and associated indicators of net sediment transport capacity at (a) estuary mouth, (b) middle estuary (PCH), and (c) upper estuary (Big Canyon) in Newport Bay in southern California (see Guo et al. (2018) for site locations). Ebb currents are negative and flood currents are positive. The net transport capacity is the product of the probability of tidal currents and the cubic currents for each bin.

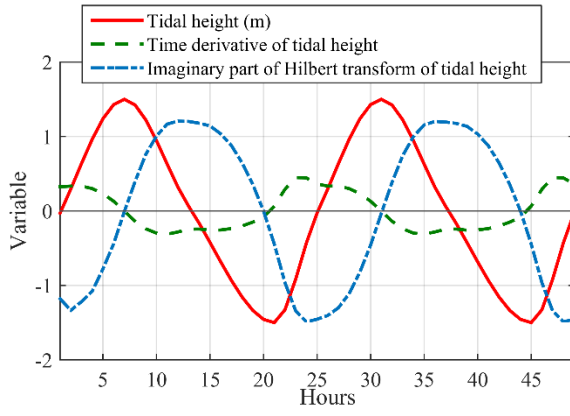


Figure S3. An example of a time series of tidal height signals and its time derivatives and the imaginary part of its Hilbert transform

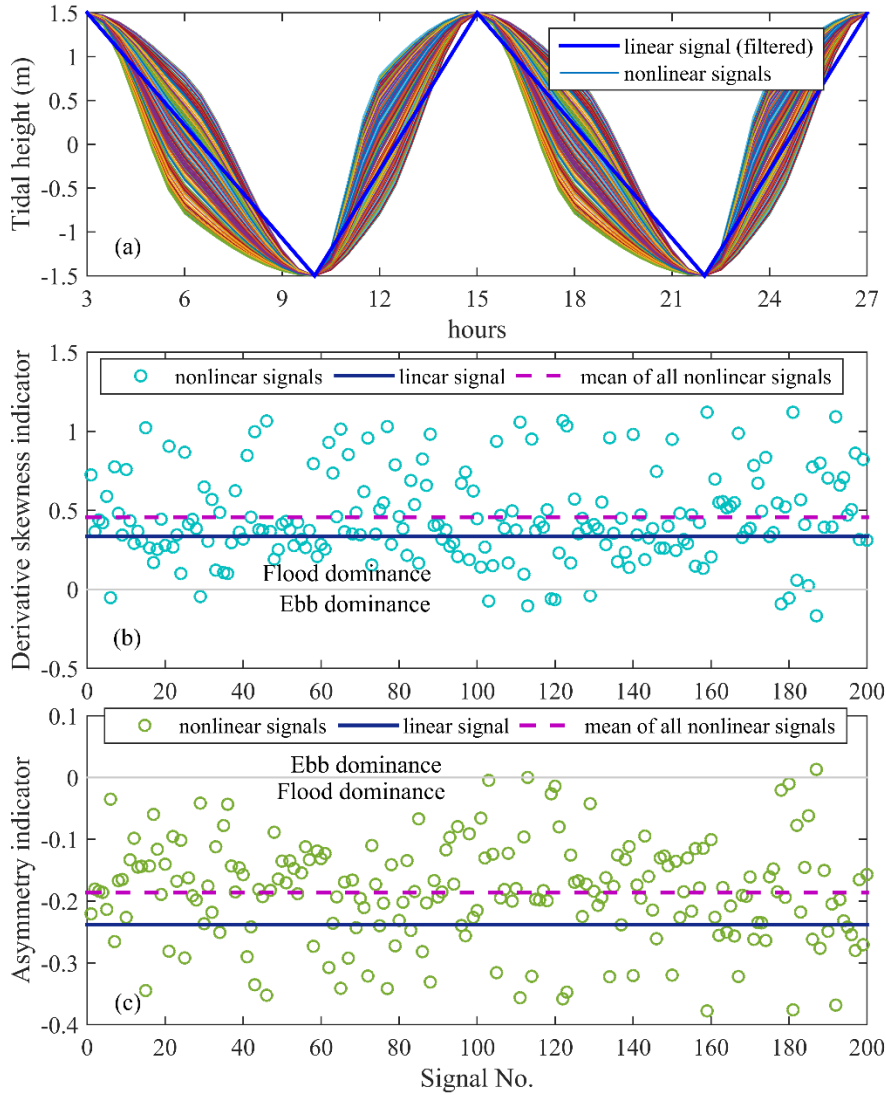


Figure S4. (a) A constructed linear signal and 200 non-linear tidal height signals with falling tidal period 1 hour shorter than rising tide, (b) the derivative skewness and (c) the transformed skewness of the constructed signals. The data in this figure (panel a) are numerically interpolated time series of tidal signals based on fixed high water and low water with predefined amplitudes (1.5 m) and tidal periods (falling and rising tidal periods are 7 and 5 hours, respectively), but different rising and falling limbs.

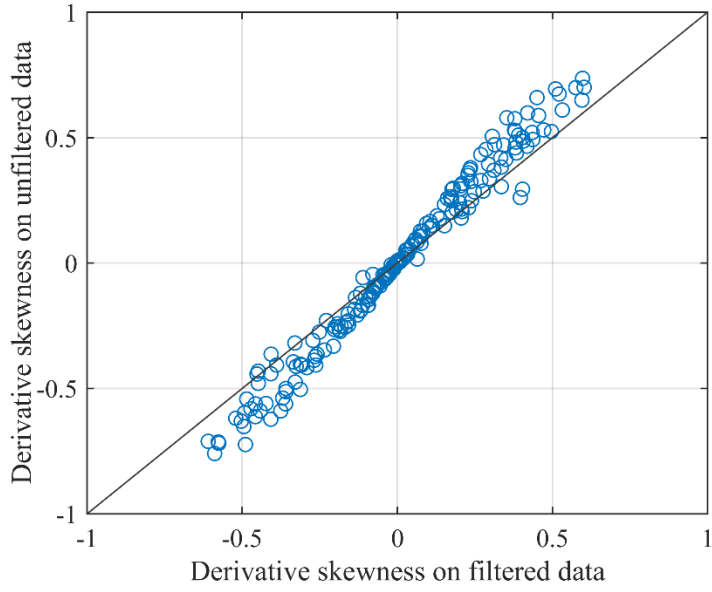


Figure S5. Comparison of the derivative skewness of filtered and unfiltered data based on tidal water level data collected along US coasts (data from NOAA, see Figure S1)

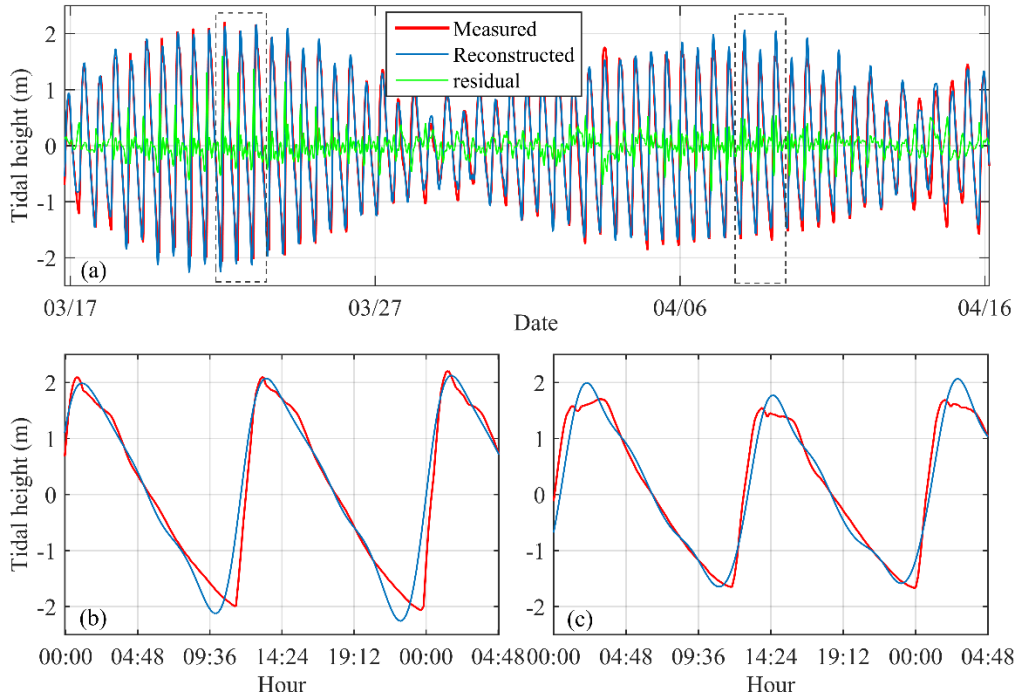


Figure S6. (a) Measured and reconstructed tidal heights and their difference (residual) at QLG, a tidal gauge station in the North Branch of the Changjiang River estuary (see Figure 1). The panel (b) and (c) are zoom-in of two selected periods in panel (a) at spring tide.