

# Clustering of compound flood hazard in deltas and estuaries

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## Introduction

Estuarine and delta environments act as a transition from the river to the sea. They can be affected by **multiple flood drivers** from oceanographic, hydrological, and meteorological processes. For example, low pressure systems combined with strong winds can significantly elevate water levels at the coast (storm surge) and lead to high river discharge. The region where both fluvial and coastal flood drivers contribute to the extreme water level is known as the **transition zone** (Figure 1), an area particularly vulnerable to **compound flooding (CF)**.

Global flood models currently simulate fluvial and coastal floods separately, thereby neglecting CF. **In this work, we will provide an overview of the extent of the transition zone by developing a CF metrics for estuaries and deltas along the continental US coastline:**

- ✓ By creating clusters of CF linked to geophysical and upstream watershed characteristics, we aim to better characterize and understand CF behavior.
- ✓ We also identify locations where more advanced hydrodynamic modelling is needed to capture CF.

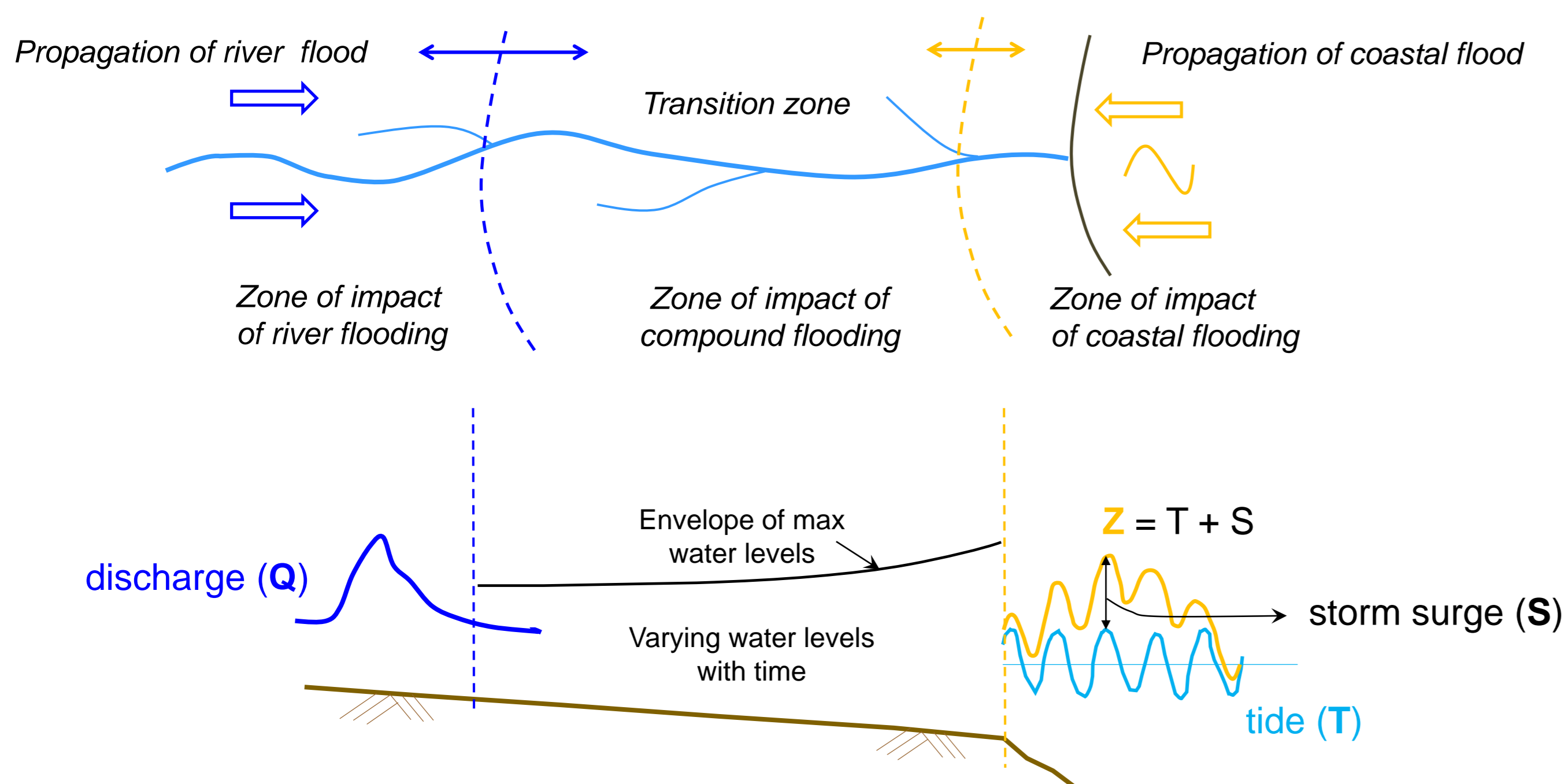


Figure 1: A conceptual explanation of an estuarine system exposed to river, coastal and compound flooding. Plan view (top) and longitudinal cross-section (bottom).

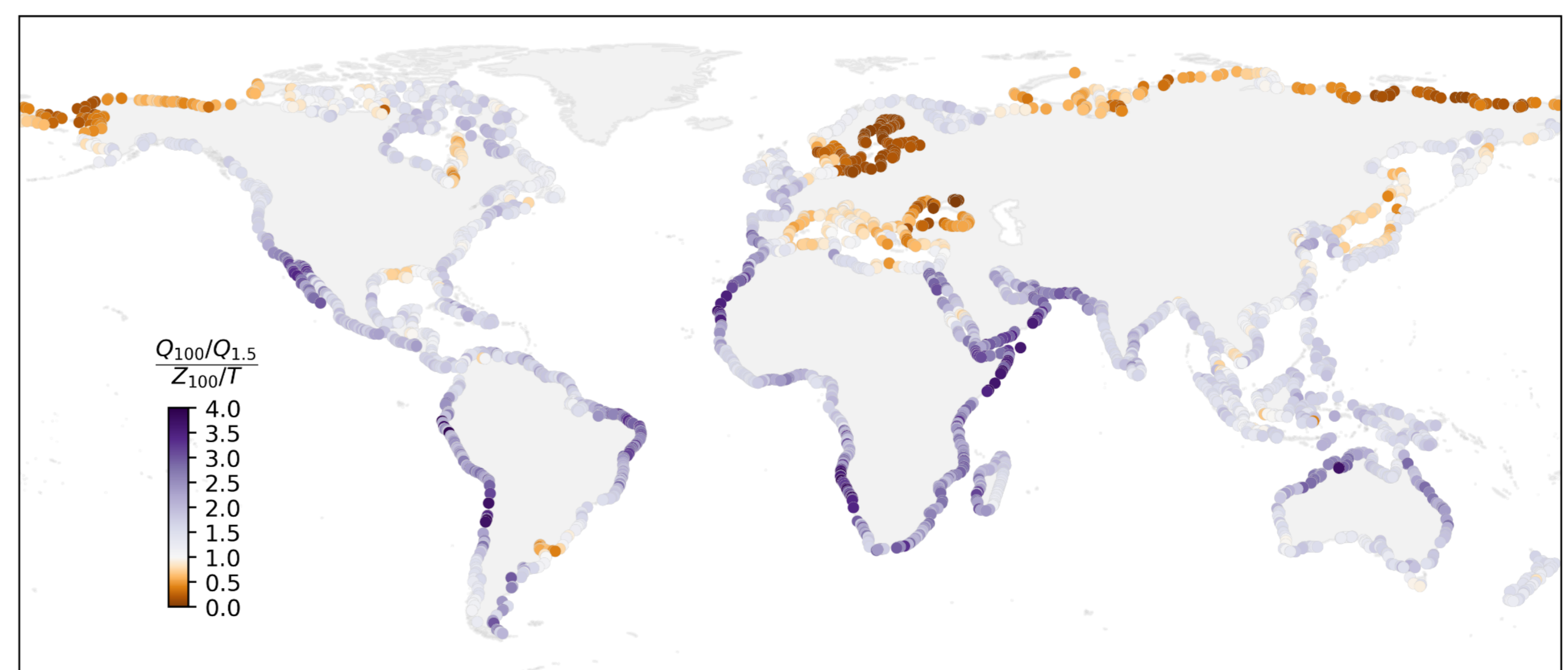
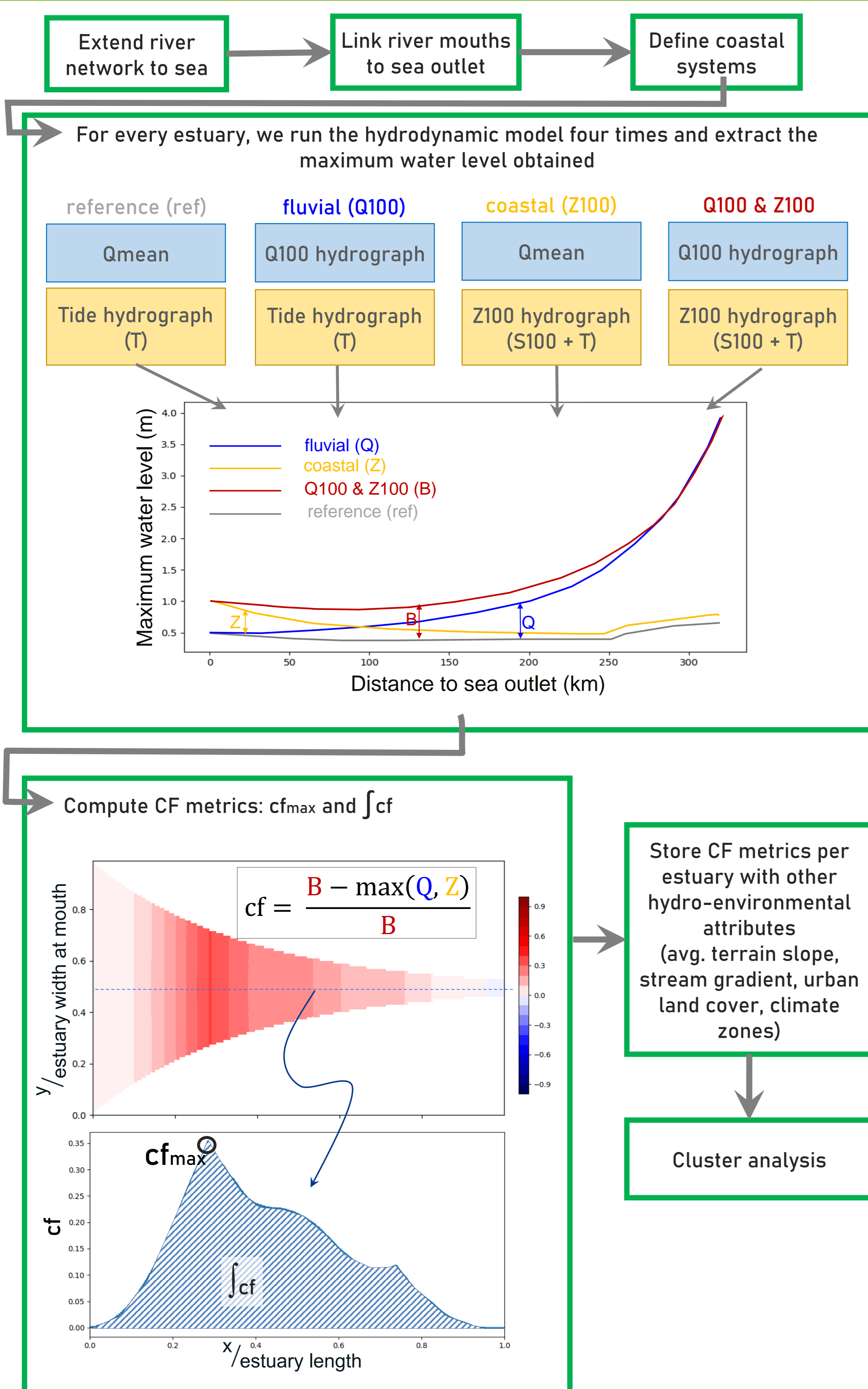


Figure 2: Ratio calculated from the time series available from Eilander (2019). Return periods are obtained by fitting a Gumbel distribution. A value higher than 1 indicates a heavier tail (spread) in extreme discharge than in extreme surge.

## Methods



## Datasets & Models

Variables	Dataset	Source
Discharge	JULES model + CaMa-Flood	Eilander (2019)
Tide	CoDEC	Muis et al. (2020)
Storm surge	CoDEC	Muis et al. (2020)
Bathymetry	CUDEM	CIRES (2014)
Topography	CUDEM + MERIT Hydro	Yamazaki et al. (2019)
Hydro-environmental attributes	RiverATLAS	Linke et al. (2019)

To link river mouths with sea outlets, we use the **RivGraph** package (Schewen and Hariharan, 2021). We will use the **SFINCS** hydrodynamic model (Leijnse et al., 2020) to obtain maximum water levels. Setting up of the models is done using the **hydromt\_sfincs** plugin (Deltares, 2021). The cluster analysis will be done with the **scikit-learn** package.

## Preliminary results based on ideal estuaries

