Confidence in operational forecasting

Fedor Baart

April 18, 2011

Introduction

Fedor Baart

PhD thesis: Operational forecasts of morphological effects of storms

Links

http://citg.tudelft.nl http://www.deltares.nl
http://www.openearth.nl http://www.micore.eu

Operational modelling

Forecasts

Improvements to several aspects of the operational coastal morphological model.

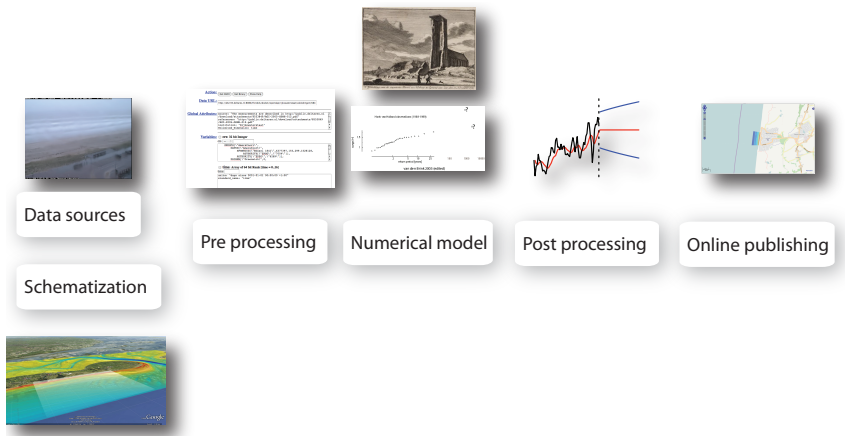

Figure: Improvements to several aspects of the operational coastal morphological model.

How safe should it be?

Norm

Dutch safety standard of $1/10000$ (exceedance probability for the Holland Coast per year) is based on economic evaluation of the hinterland.

Erosion -

Tide +=

Surge =

Waves =

Sea level +

Subsidence -

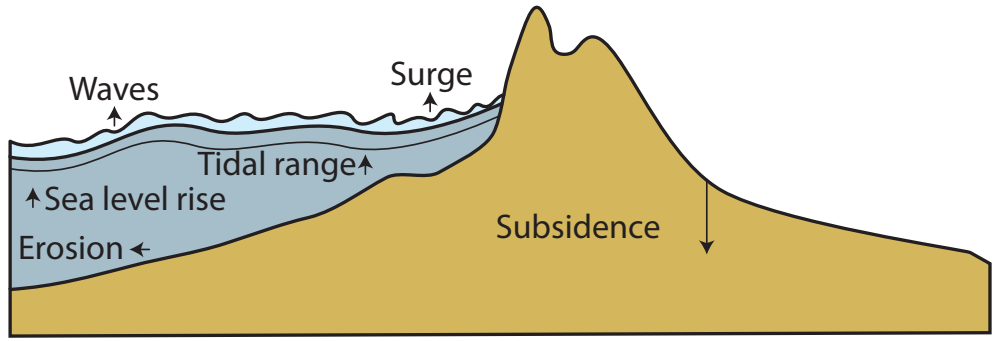

Figure: Possible changes affecting coastal safety

Sea level rise

Relative sea level rise

Constant trend of 19cm/century

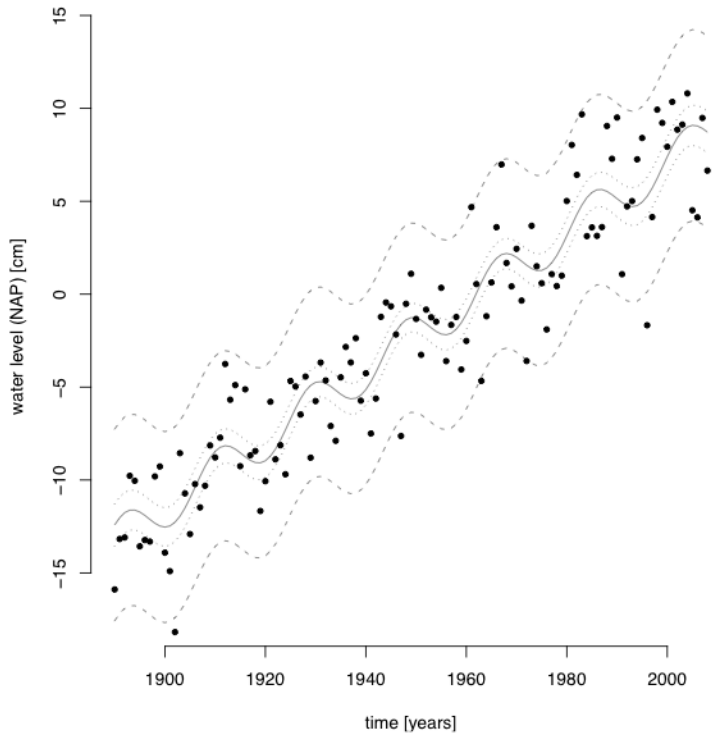

Figure: Sea level rise since 1890

Paintings

Sea level trends in Venice.

Using paintings as a source for sea level rise estimates.

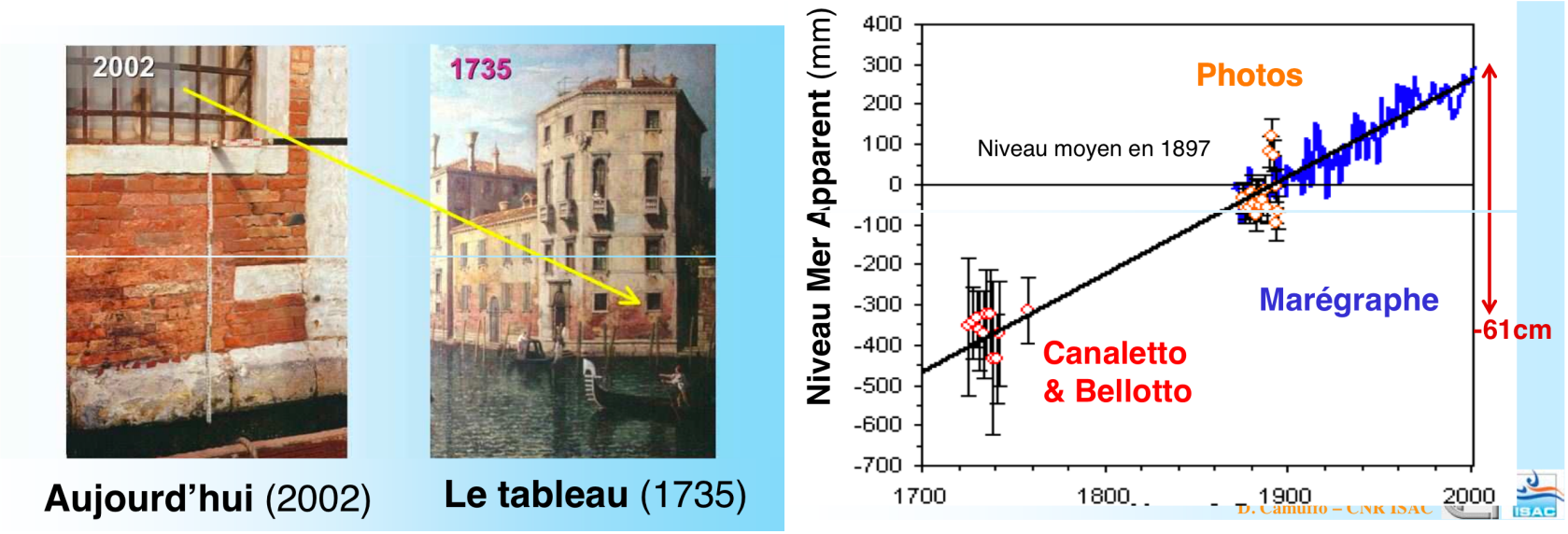

Figure: Sea level rise (source: D. Camuffo 2010)

How big is the $^1/_{10000}$ storm?

The size of the $^1/_{10000}$ storm.

Convidence interval size: over 3m.

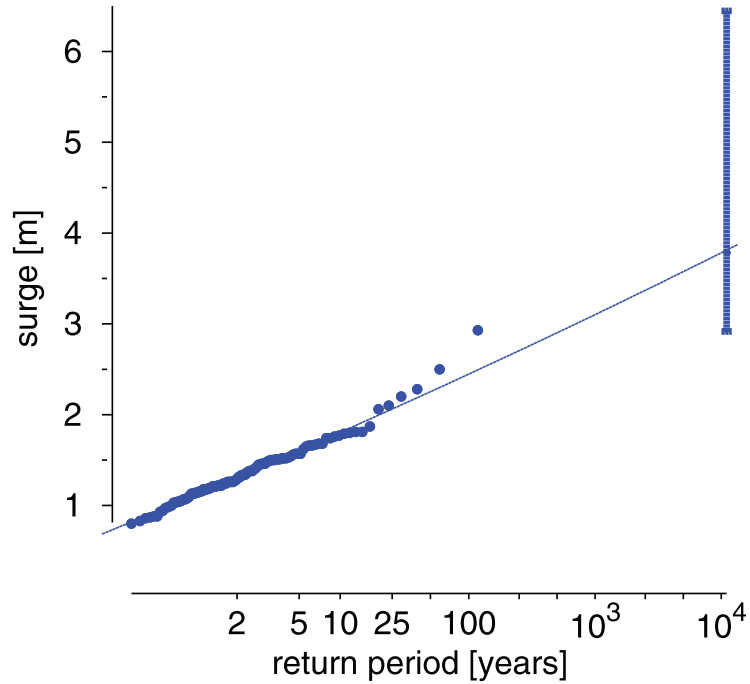

Figure: Confidence interval of storm surge for Hoek van Holland (van den Brink 2004)

How to reduce the size of the confidence interval?

The size of the confidence interval

$$\frac{1}{\sqrt{n}}$$

How to reduce the size of the confidence interval?

The size of the confidence interval

$$\frac{1}{\sqrt{n}}$$

How to get a bigger n?

- Pre-historic storms
- Historic storms
- Measured storms
- Modelled storms

Data for the 1717 storm: paintings

Figure: Paintings from Egmond aan Zee between 1600–1750

- Water levels from Amsterdam
- 1 floodstone
- Letters, poems, reports
- Maps
- Paintings

Pre and post storm profile

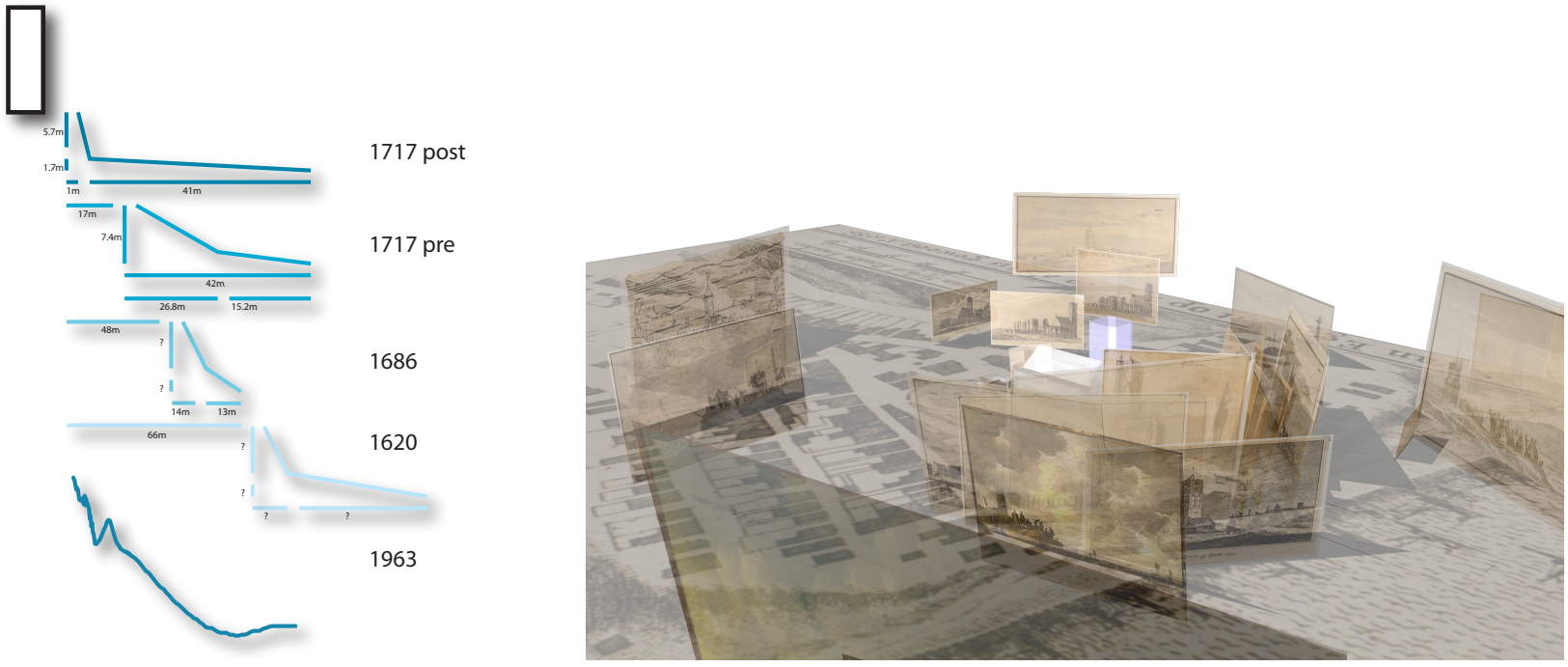

Figure: Estimating the pre and post storm profile. Inverse model the magnitude of the storm.

The storms of the 18th century

Table: Estimated magnitude of the three largest storms of the 18th century

Year	Water level	Wave height	Wave period
1717	4.2 m	8.4 m	13.3 s
1775	4.6 m	8.8 m	13.9 s
1776 [a]a	4.9 m	9.1 m	14.3 s

[a] Estimated as the water level of 1775 plus 0.29 m based on the floodstones, see Table **??**

The updated confidence interval

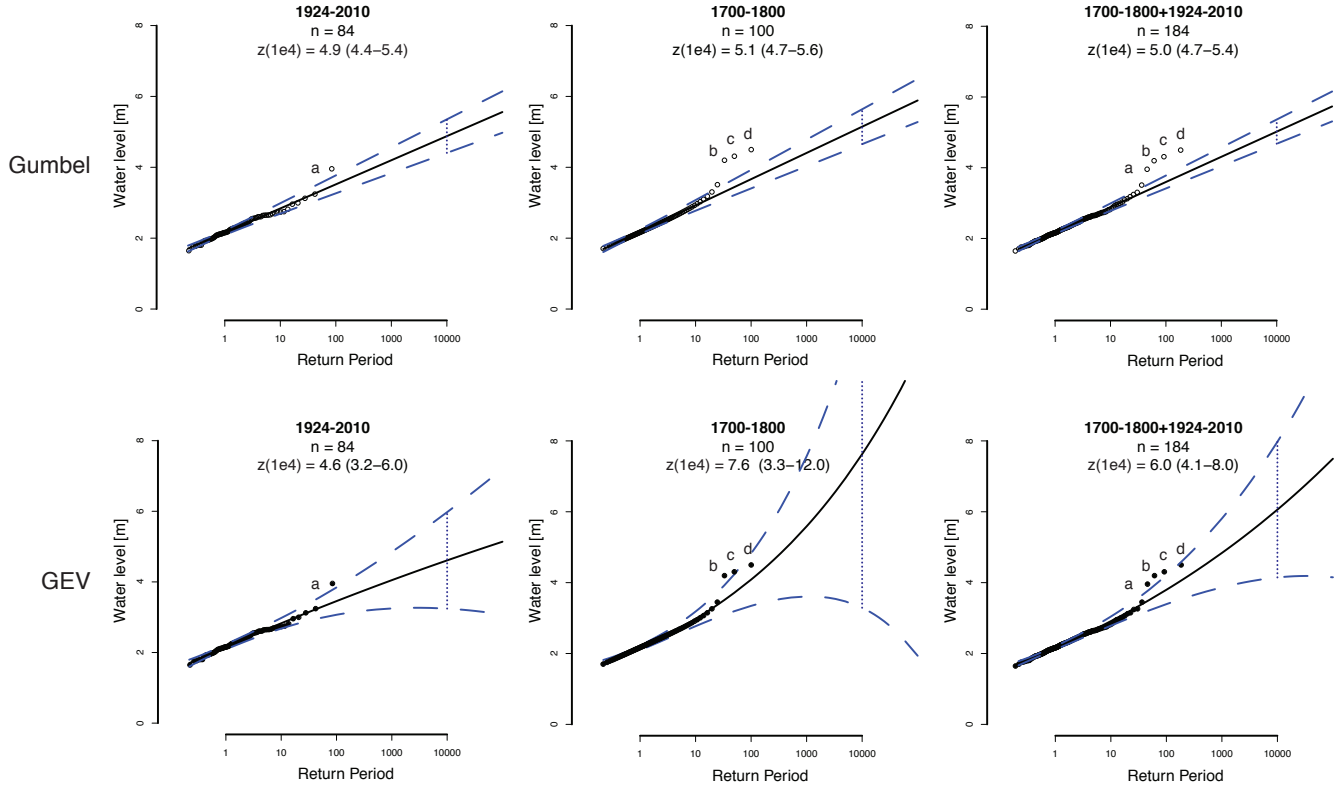

Figure: 30% smaller confidence interval using the Gumbel method. Higher estimate 1.4 with bigger confidence interval using the GEV method.

Response measures

Figure: Twee gebroeders, 1953

Figure: Research: Emergency measures Delfland, Walstra et al 2009

References

P H A J M van Gelder.
Statistical methods for the risk-based design of civil structures.

PhD thesis, Delft University of Technology, January 2000.

J van Malde.
Historische stormvloedstanden.
Technical Report 2003.08.1, Aqua Systems International, August 2003.