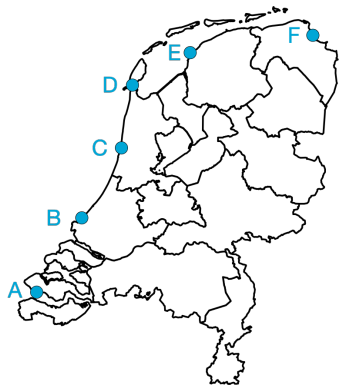




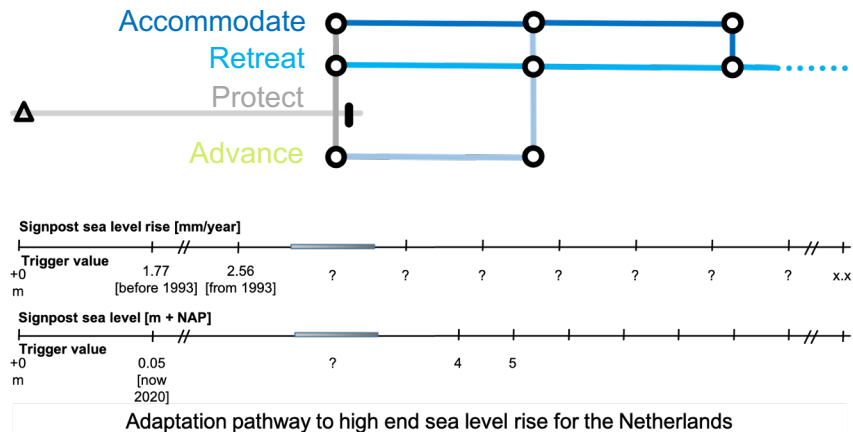
# Detecting non-linear sea-level variations in tide gauge records: A study case along the Dutch coast

D.B. Steffelbauer, R.E.M. Riva, J.S. Timmermans, J. Arens, J. Kwakkel, & M. Bakker  
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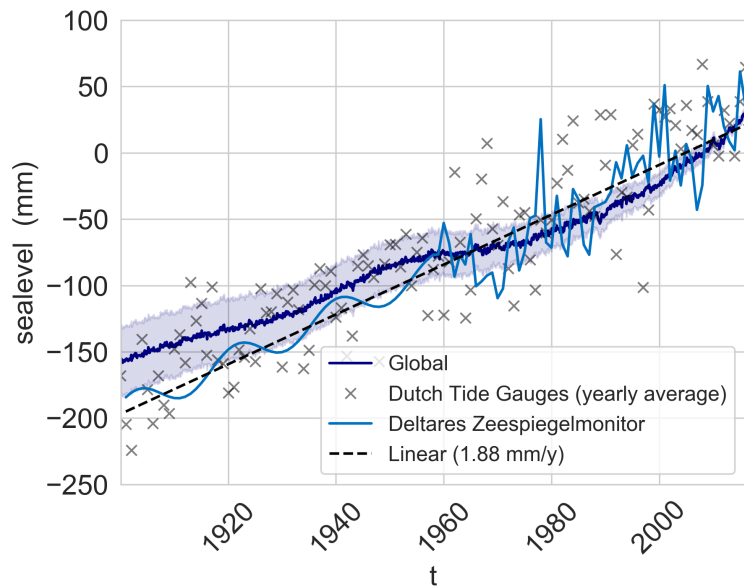


## Rationale

Early detection of non-linear sea-level variations at decadal scales is crucial for long-term infrastructure planning.

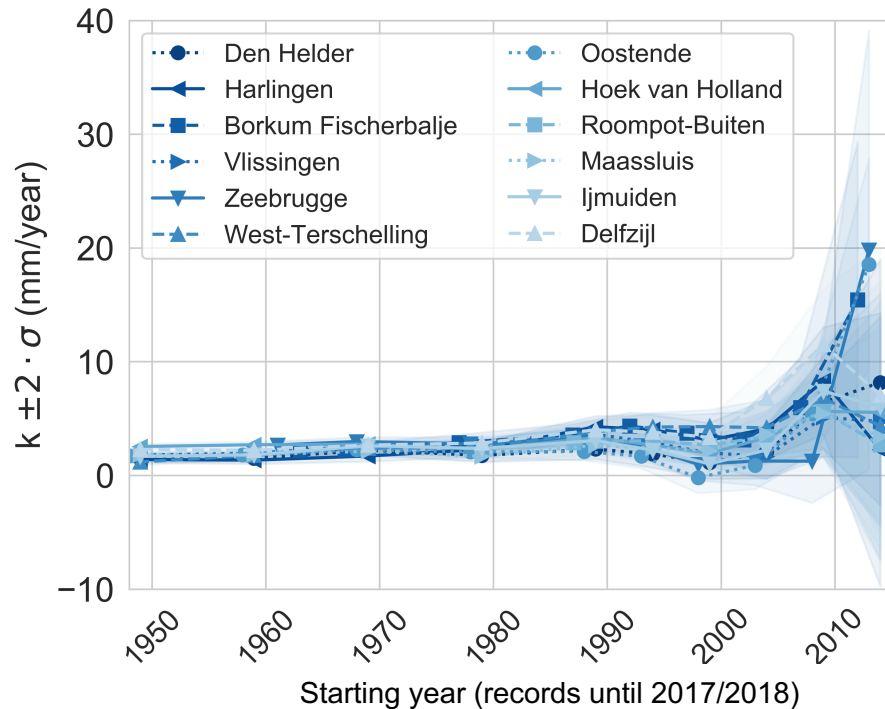


# Global vs. regional, and trend dependence on record length

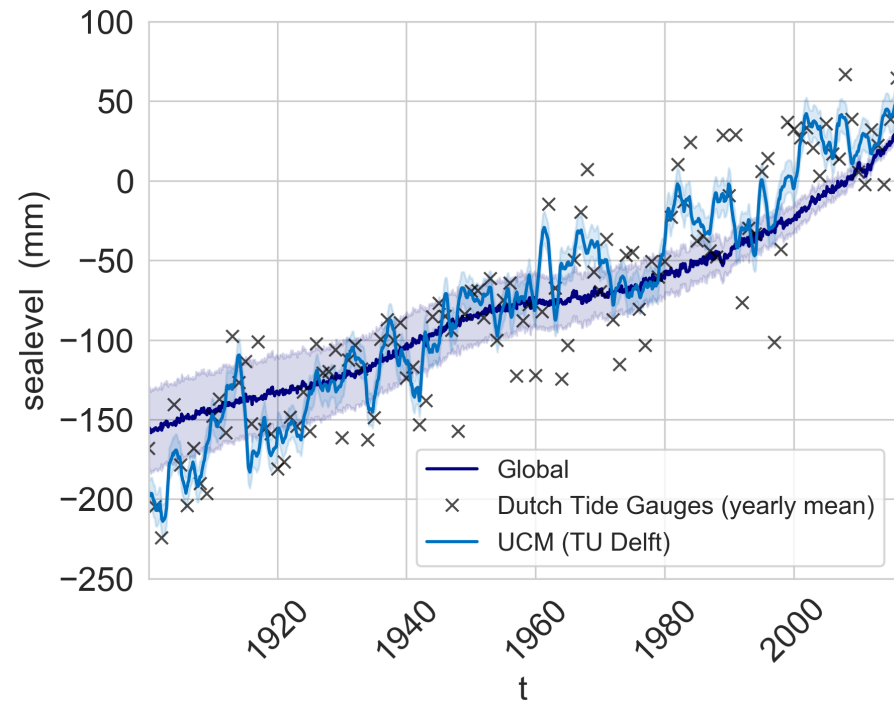
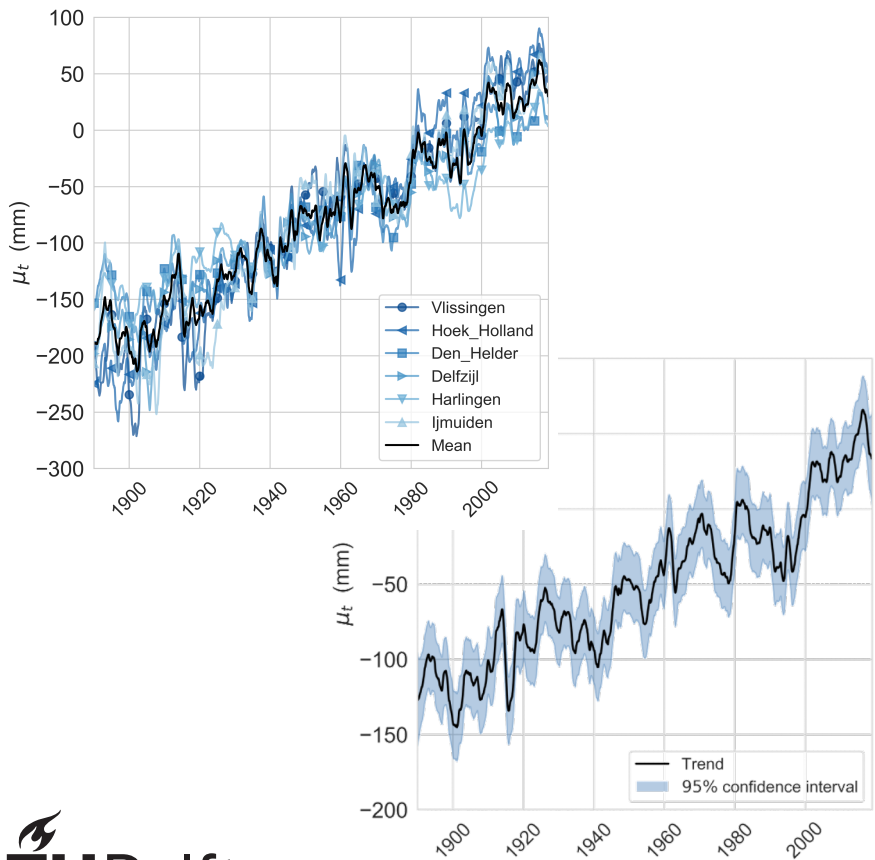
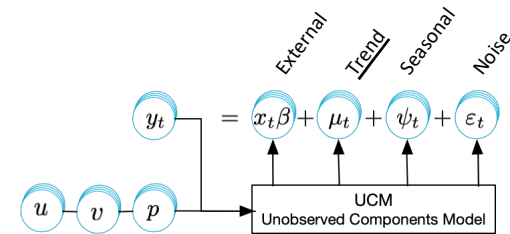


Dangendorf, S., Hay, C., Calafat, F.M. *et al.* (2019) Persistent acceleration in global sea-level rise since the 1960s. *Nat. Clim. Chang.* **9**, 705–710.  
 Baart, F., Rongen, G., Hijma, M. *et al.* (2019). Zeespiegelmonitor 2018, Delft, The Netherlands.

Average linear trend: 1948-2018:  $2.0 \pm 0.5$  mm/yr  
 $(y(t) = kt + d)$       2013-2018:  $8.0 \pm 6.0$  mm/yr

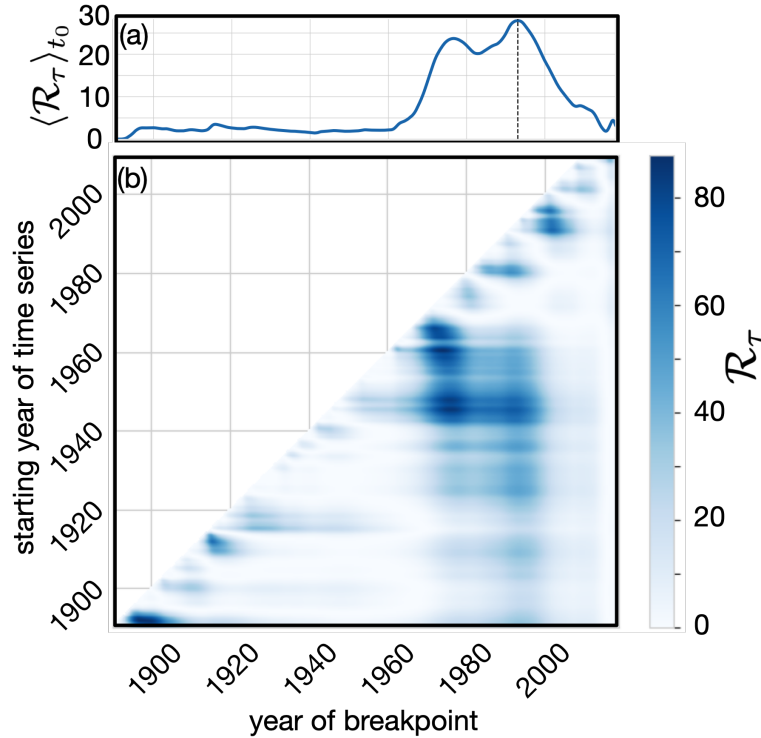


# Unobserved Components Model (UCM)<sup>1</sup>



# Breakpoint detection and piecewise linear function fit

Breakpoint  $\approx 1993$  ( $p=0.013$ )



Linear trend: 1900-1993:  $1.77 \pm 0.01$  mm/yr  
1993-2018:  $2.6 \pm 0.1$  mm/yr

