Evidence of acceleration in sea-level rise for the North Sea

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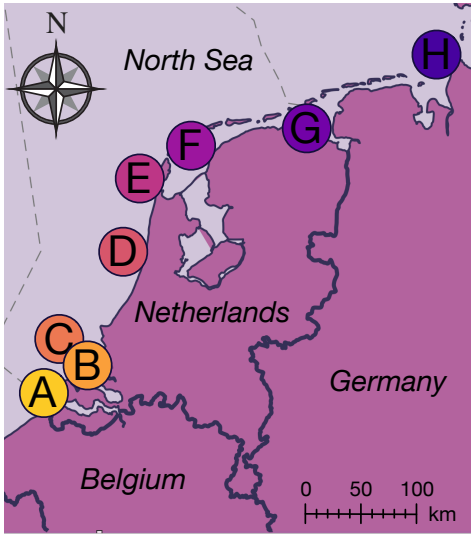
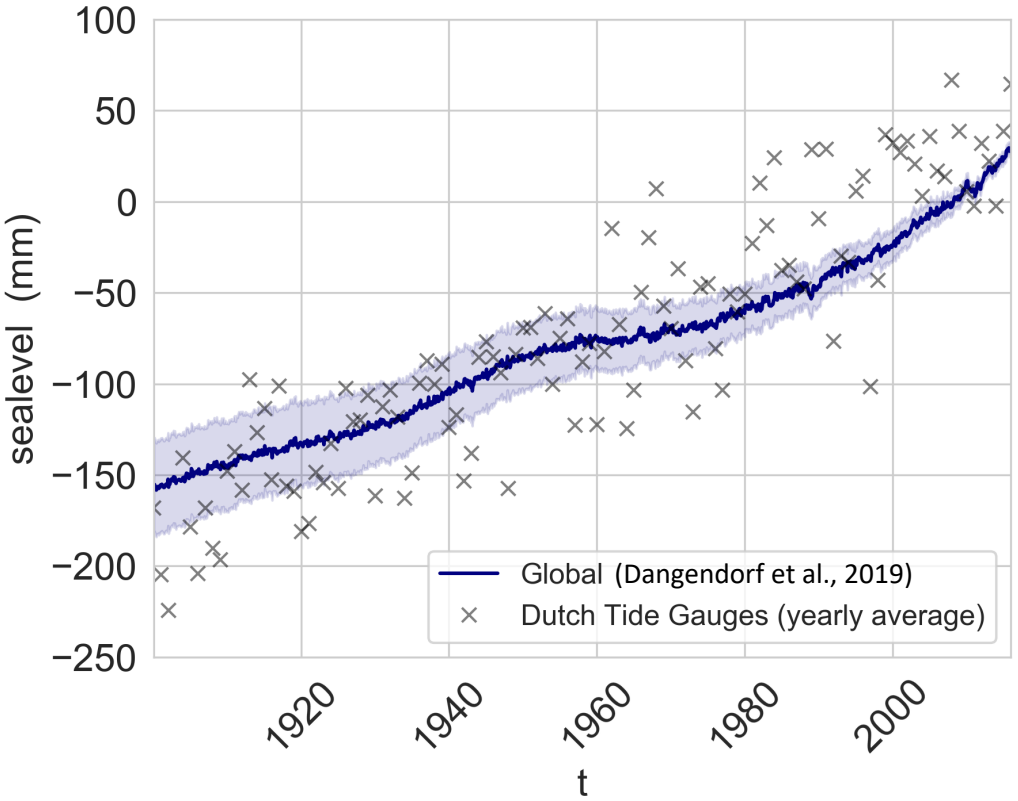
Global vs. Regional Sea-Level Rise



(A) Vlissingen
(B) Maassluis
(C) Hoek v. Holland
(D) IJmuiden
(E) Den Helder
(F) Harlingen
(G) Delfzijl
(H) Cuxhaven



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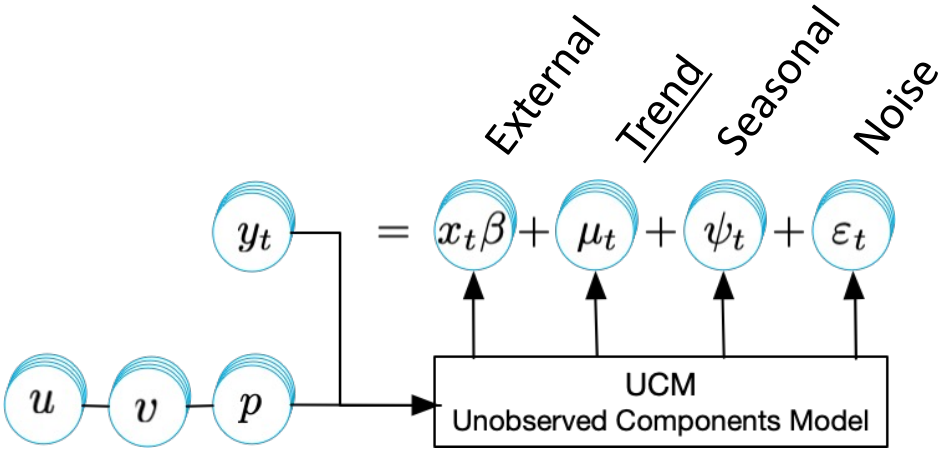
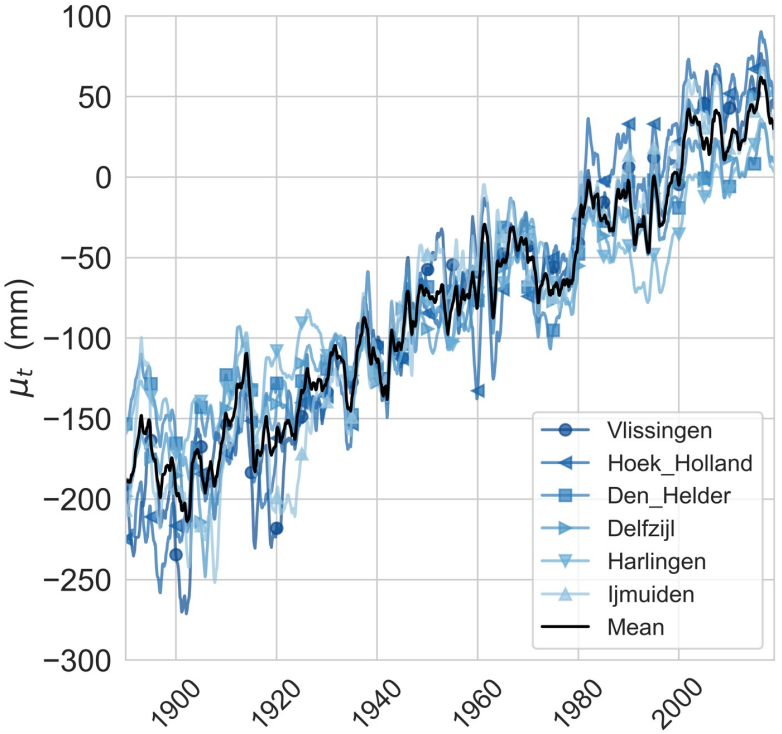
Unobserved Components Model (UCM)





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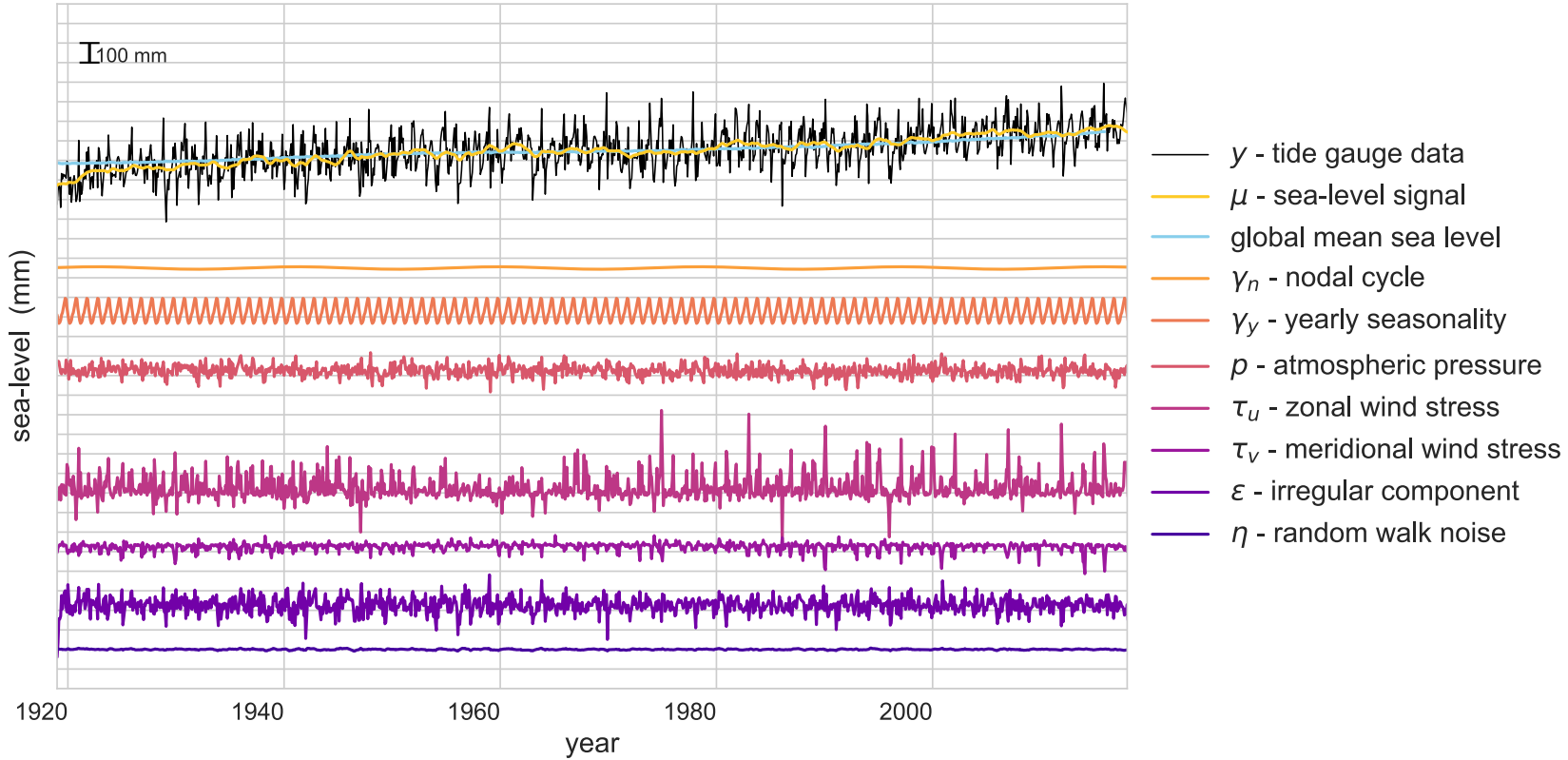
UCM results for Vlissingen



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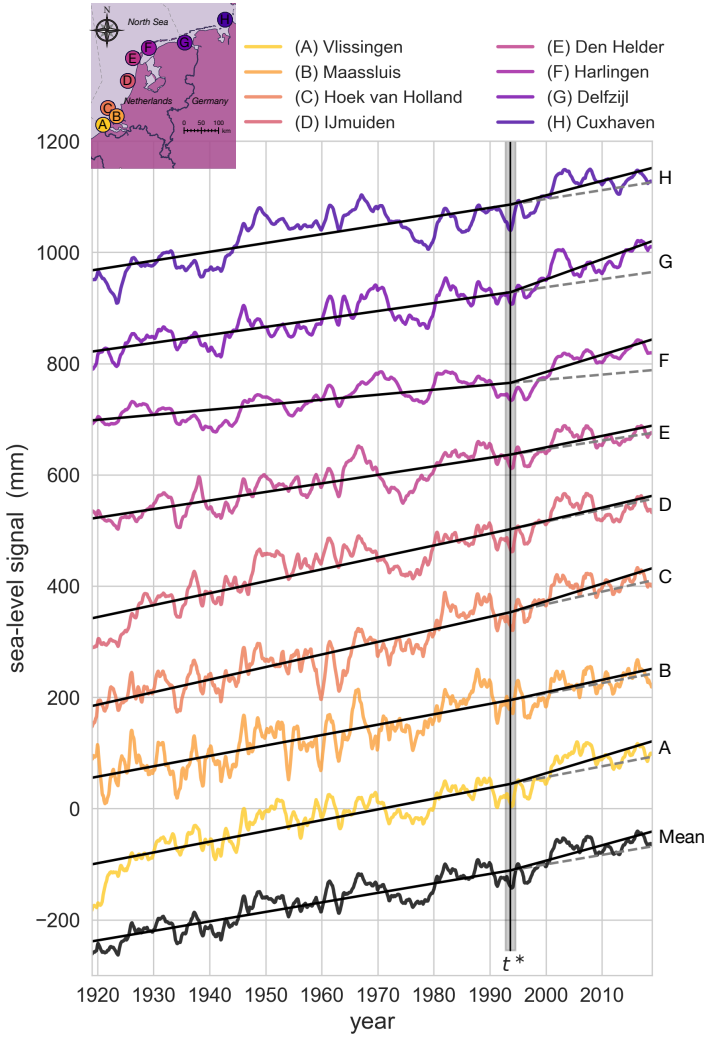
Ensemble breakpoint detected in August 1993 (± 11 months*)

	k_1 (mm/year)	k_2 (mm/year)
(A) Vlissingen	1.96 ± 0.06	2.9 ± 0.2
(B) Maassluis	1.85 ± 0.06	2.2 ± 0.2
(C) Hoek van Holland	2.26 ± 0.06	3.1 ± 0.2
(D) IJmuiden	2.17 ± 0.05	2.2 ± 0.1
(E) Den Helder	1.55 ± 0.06	1.9 ± 0.2
(F) Harlingen	0.92 ± 0.06	3.0 ± 0.2
(G) Delfzijl	1.47 ± 0.06	3.5 ± 0.2
(H) Cuxhaven	1.59 ± 0.06	2.6 ± 0.2
Mean	1.7 ± 0.3	2.7 ± 0.4

(* all uncertainties represent 95% confidence)



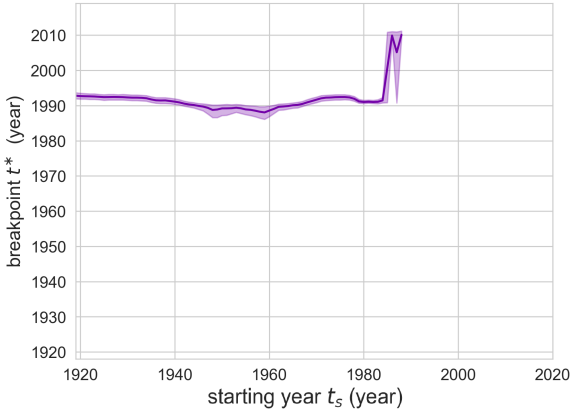
Robustness analysis

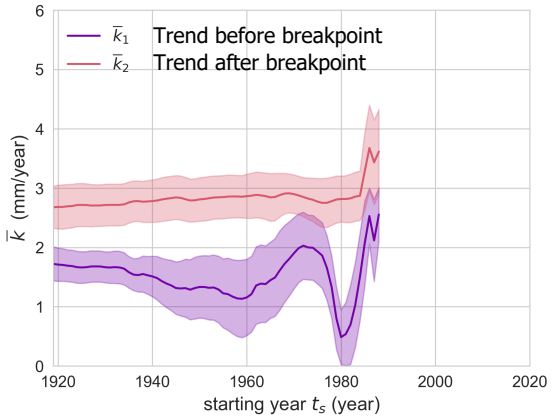
Left column: end in 2018, start progressively shorter.

Right column: start in 1919, end progressively longer.

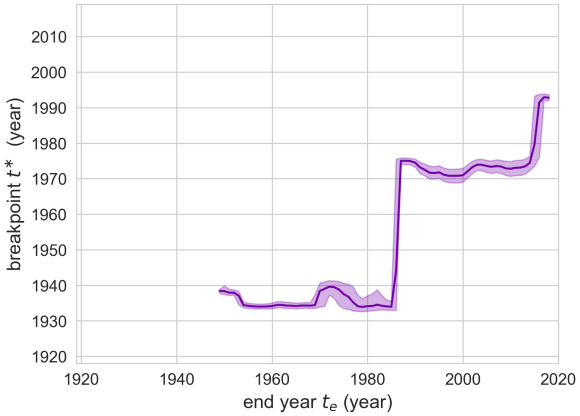
Bottom panels: breakpoint considered meaningful when error bands do not overlap.

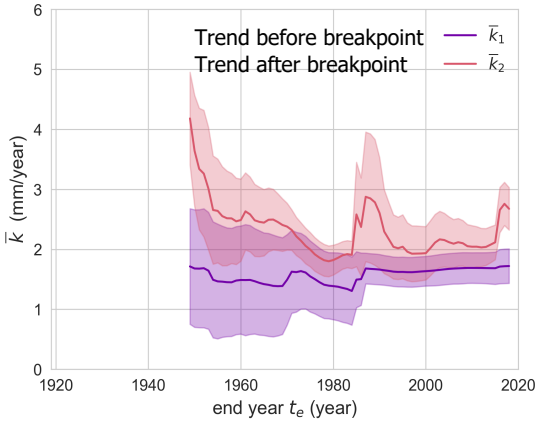
Varying start year (1919-1989)





Varying end year (1948-2018)





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Conclusions

- Robust indication of a recent acceleration with advanced time series analysis and breakpoint detection.
- Statistically significant change most likely in 1993 (1 mm/yr trend change).
- It requires records starting before 1970 and ending after 2012 (not fully shown here).

=> Keep an eye on the paper comig soon in ERL (Steffelbauer, Riva et al.).