

Multidecadal climate variability dominated past trends in the water balance of the Baltic Sea catchment area

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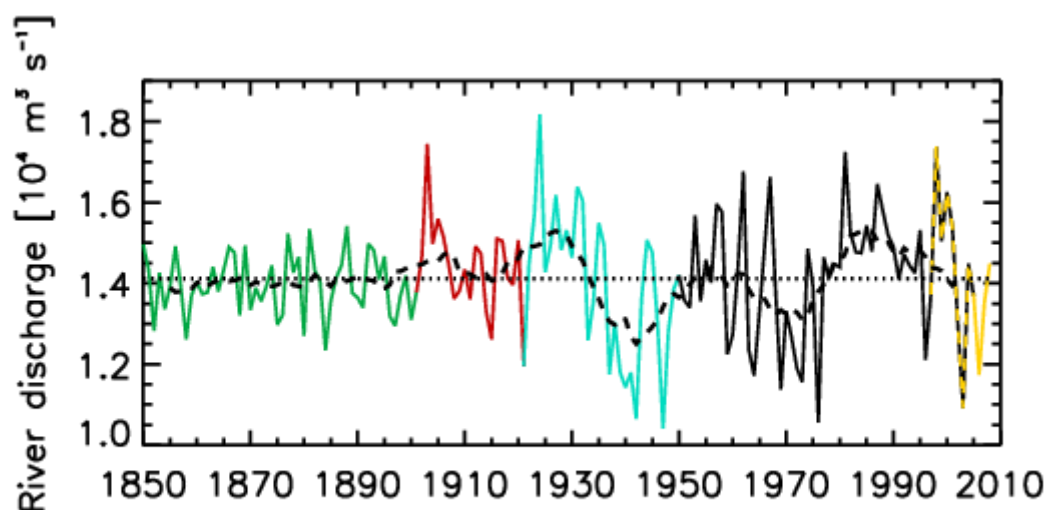
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Supplementary Information

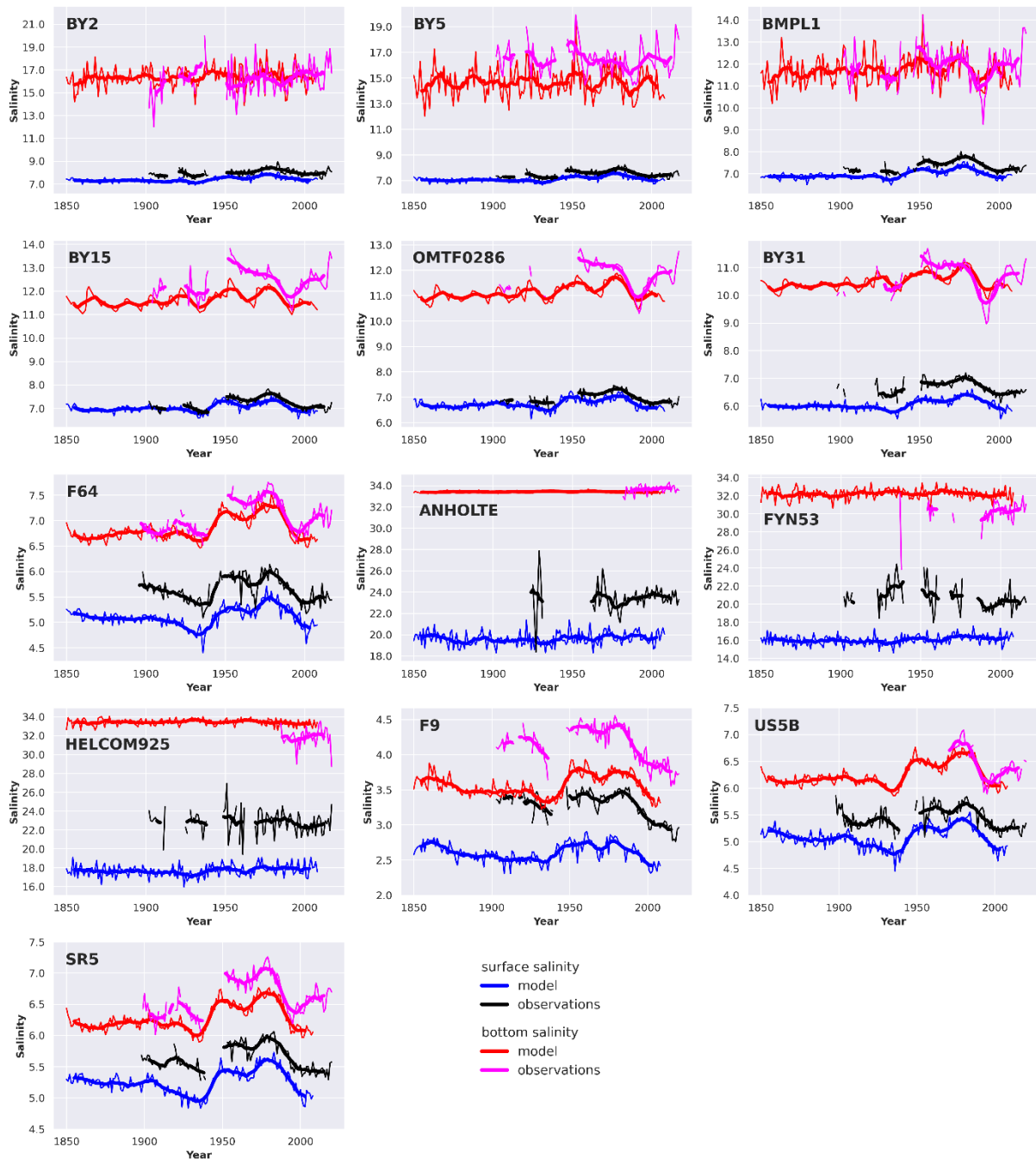
This Supplementary Information consists of Supplementary Figures 1–8.

Supplementary Figures

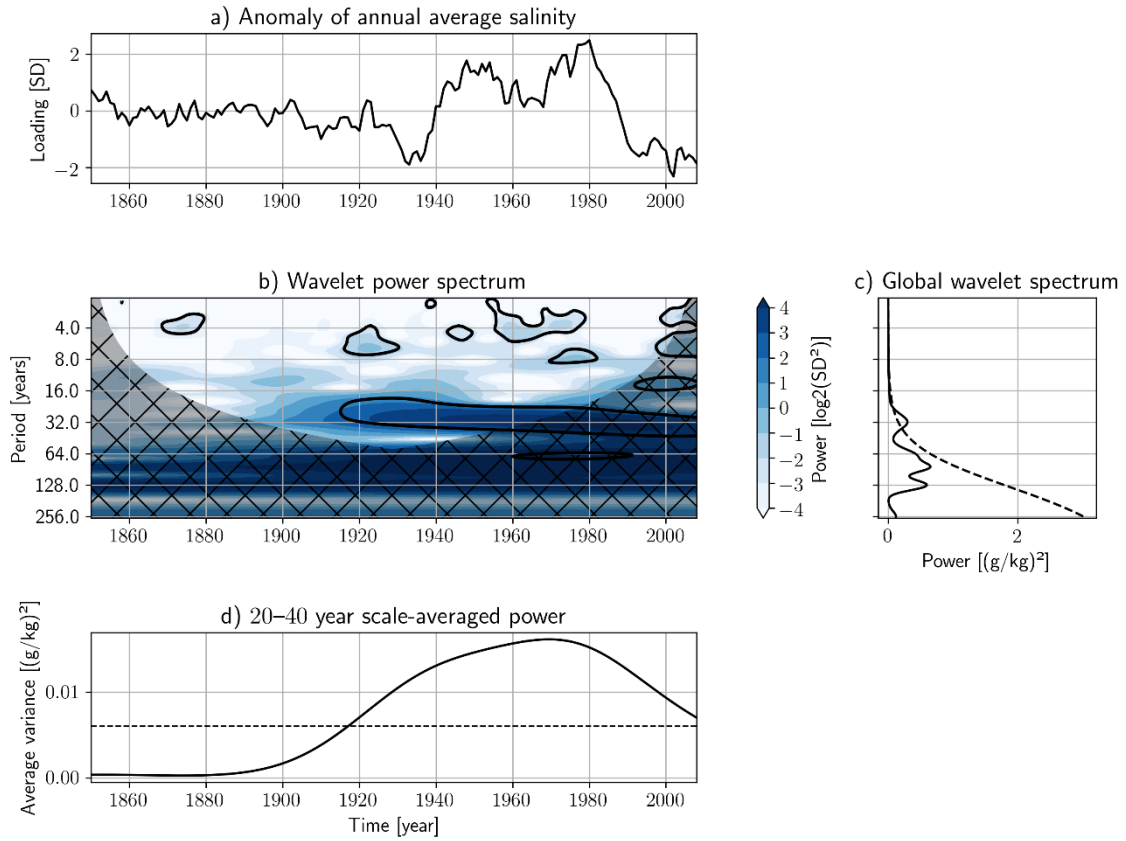


Supplementary Fig. 1 Reconstructed total river discharge to the Baltic Sea 1850-2008.

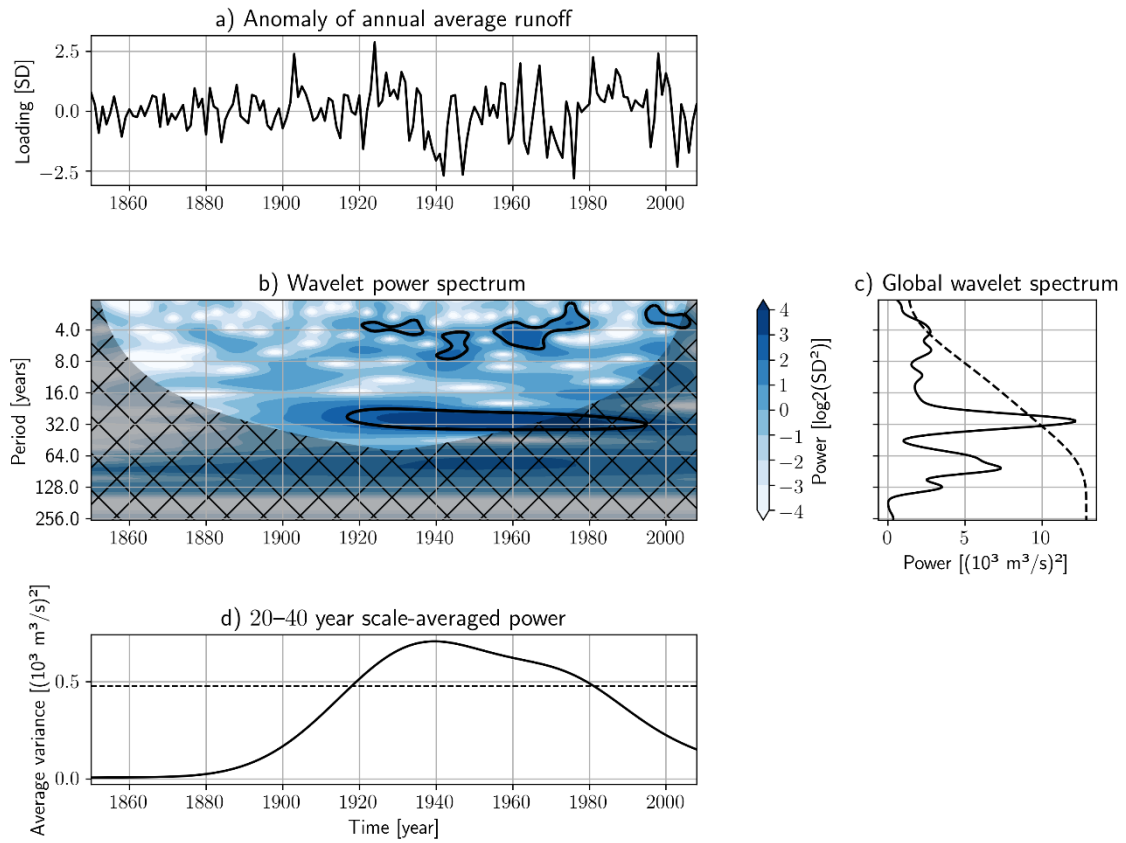
Annual (solid line) and low-pass filtered (dashed line) river discharge reconstructed from various datasets (indicated by different colors) with a cut-off period of 12 years by Meier et al. (2019). The long-term mean (1850-2008) river runoff to the Baltic Sea (dotted line) amounts to $14,100 \text{ m}^3 \text{ s}^{-1}$. (Source: Meier et al., 2019; their Fig. 3 published open access under the terms of the Creative Commons Attribution 4.0 International licence)



Supplementary Fig. 2 Simulated and observed sea surface and bottom salinities at various monitoring stations. Salinities in g kg⁻¹. Following Radtke et al. (2020), measurements are post-processed to fill gaps. Thin lines: annual averages. Thick lines: 11-year running mean. In Fig. 1, the locations of the long-term monitoring stations are shown.



Supplementary Fig. 3 Spectrum of annual mean salinity averaged over the Baltic Sea 1850-2008. Shown are results of the reference simulation REF+. a) Time series, b) wavelet power, c) power averaged over time and d) wavelet power averaged for the period band between 20 and 40 years as a function of time. The black contour lines in the wavelet power spectrum show the 95% significance level (Grinsted et al., 2004).



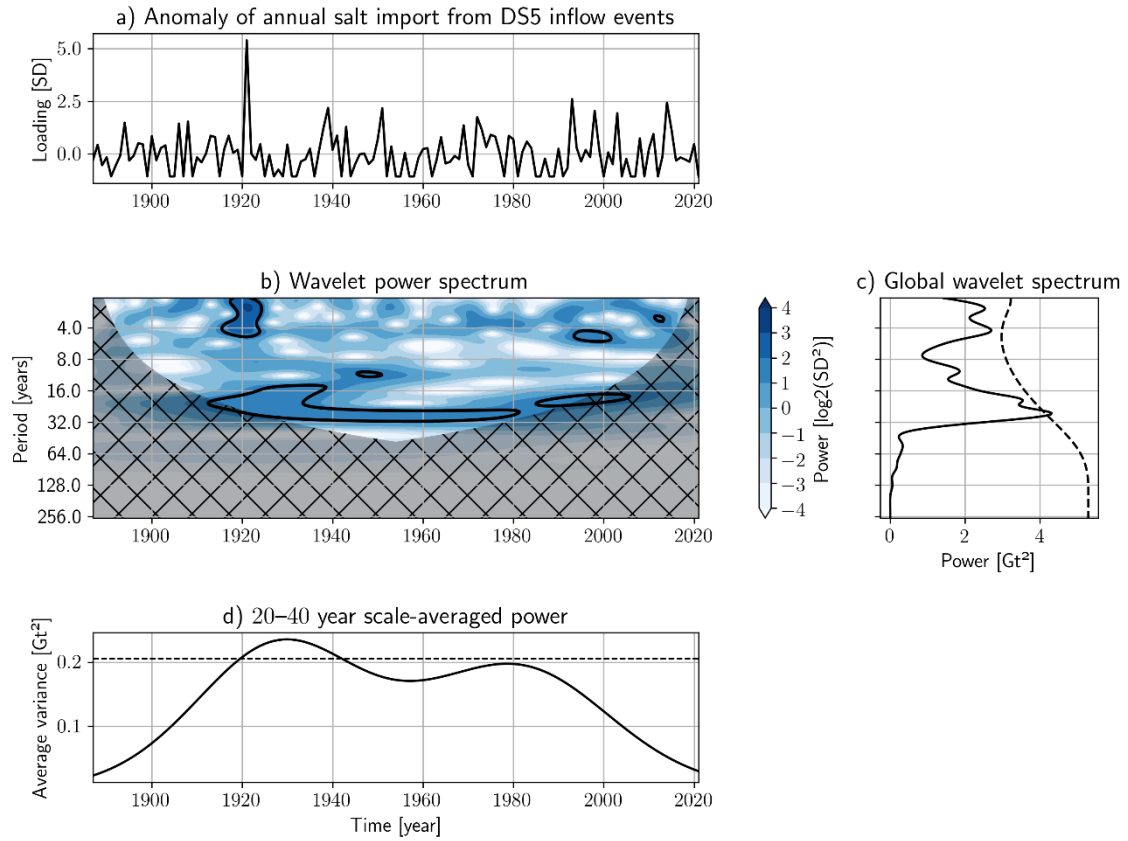
Supplementary Fig. 4 Spectrum of the annual river discharge to the Baltic Sea 1850-

2008. a) Time series, b) wavelet power, c) power averaged over time and d) wavelet power

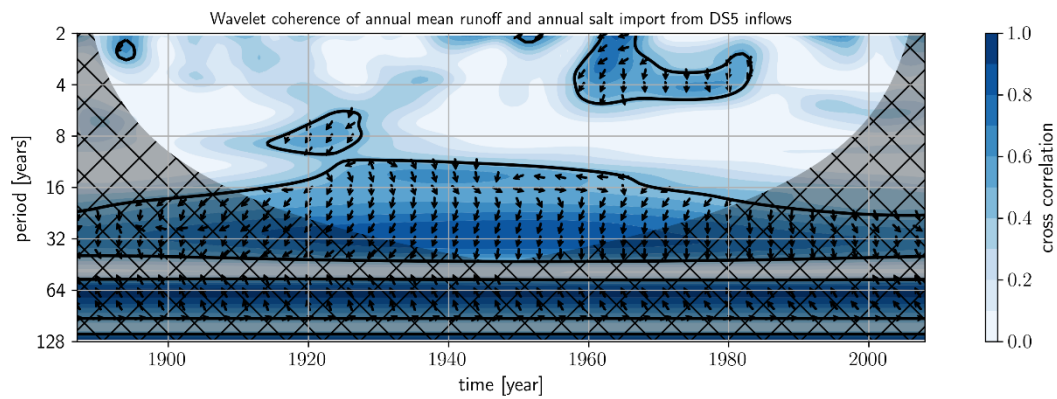
averaged for the period band between 20 and 40 years as a function of time. The black

contour lines in the wavelet power spectrum show the 95% significance level (Grinsted et al.,

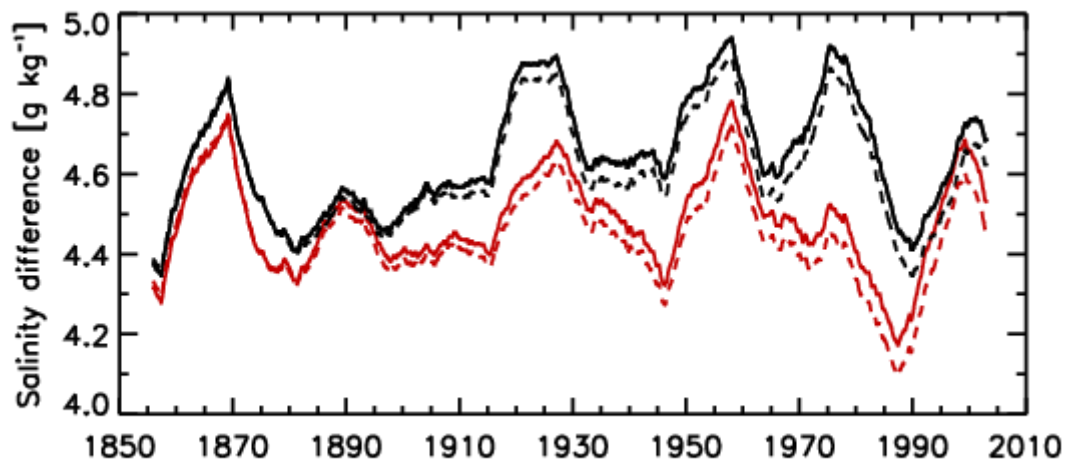
2004). (Data source: Meier et al., 2019)



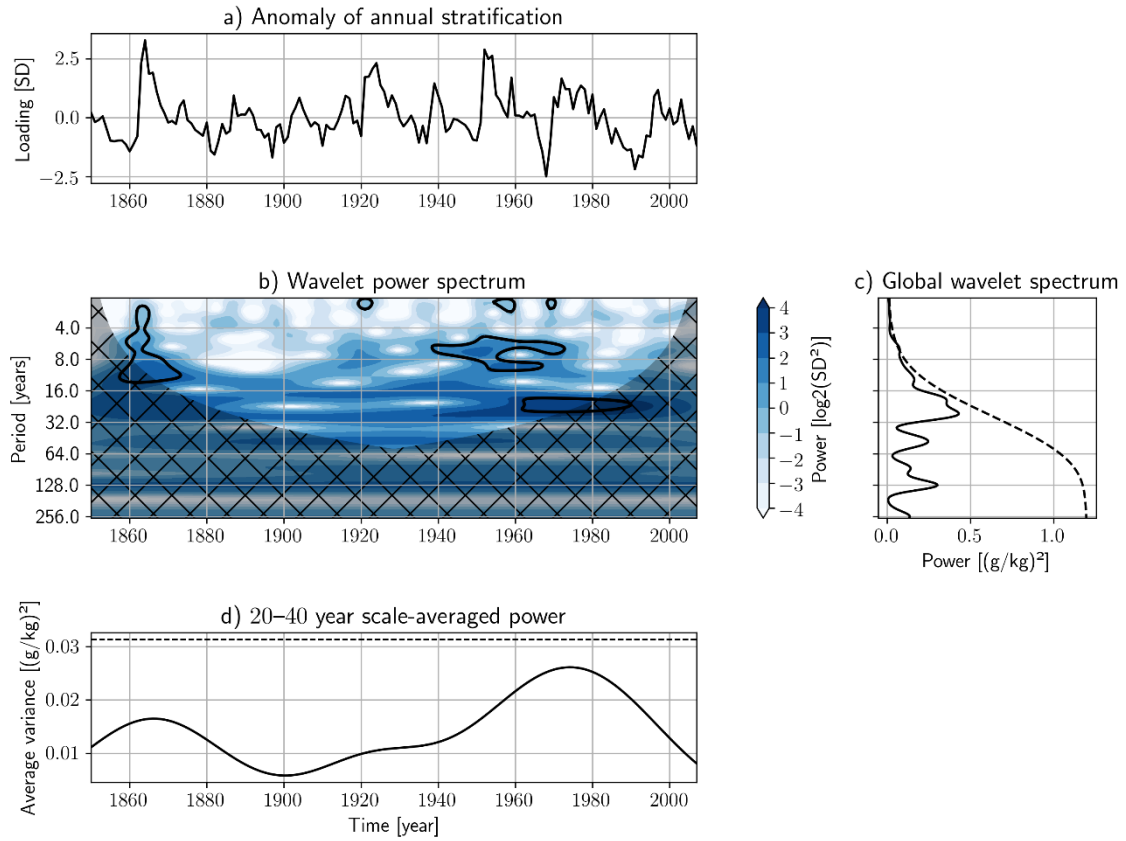
Supplementary Fig. 5 Spectrum of the annual mean salt import from reconstructed Major Baltic Inflows (so-called DS5 events) 1887-2021. a) Time series, b) wavelet power, c) power averaged over time and d) wavelet power averaged for the period band between 20 and 40 years as a function of time. The black contour lines in the wavelet power spectrum show the 95% significance level (Grinsted et al., 2004). (Data source: Mohrholz, 2018)



Supplementary Fig. 6 Wavelet coherence between the annual mean river discharge and the annual mean salt import from DS5 inflow events 1887-2008. The black contour lines show the 95% significance level (Grinsted et al., 2004). The arrows in the significant regions indicate the phase relationship between the signals: pointing right (left) in phase (antiphase), and river discharge leading (lagging) the salt import straight down (up). (Data source: Mohrholz, 2018; Meier et al., 2019)



Supplementary Fig. 7 Stratification in the central Baltic Sea. Low-pass filtered salinity difference (in g kg^{-1}) between sea surface and bottom salinity at Gotland Deep (BY15) with a cut-off period of 12 years. For the location of the monitoring station BY15 see Fig. 1. The curves show the numerical experiments REF+ (black solid line), REF (black dashed line), RUNOFF+ (red solid line) and RUNOFF (red dashed line).



Supplementary Fig. 8 Spectrum of annual mean stratification in the central Baltic Sea 1850-2008. Shown is the salinity difference (in g kg^{-1}) between sea surface and bottom salinity at Gotland Deep (BY15) in the numerical experiment REF+. a) Time series, b) wavelet power, c) power averaged over time and d) wavelet power averaged for the period band between 20 and 40 years as a function of time. The black contour lines in the wavelet power spectrum show the 95% significance level (Grinsted et al., 2004).

References

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