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Tidal and subtidal water level variation in the Rhine-Meuse tidal river network: changes and links to human interference

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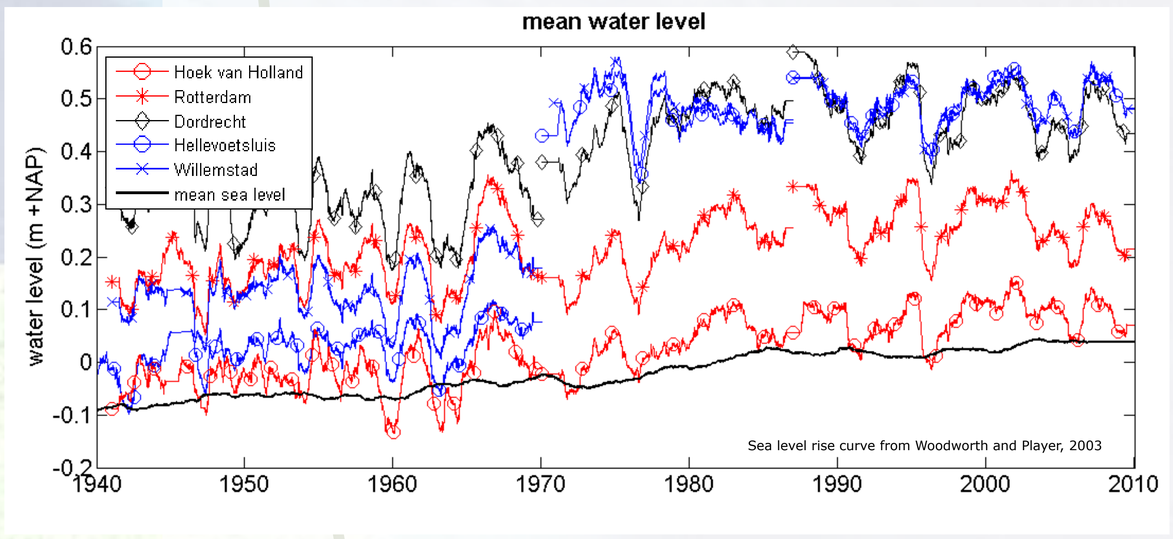
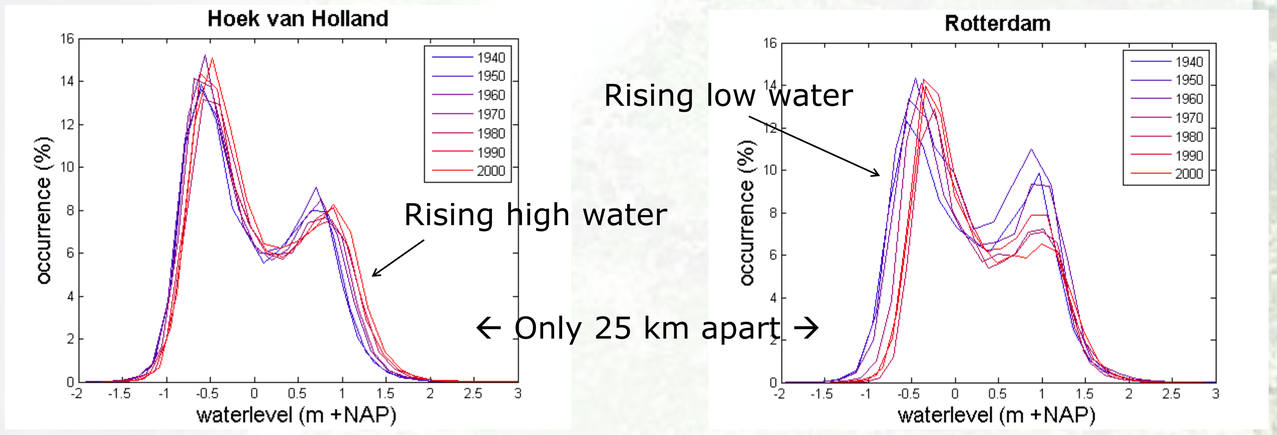
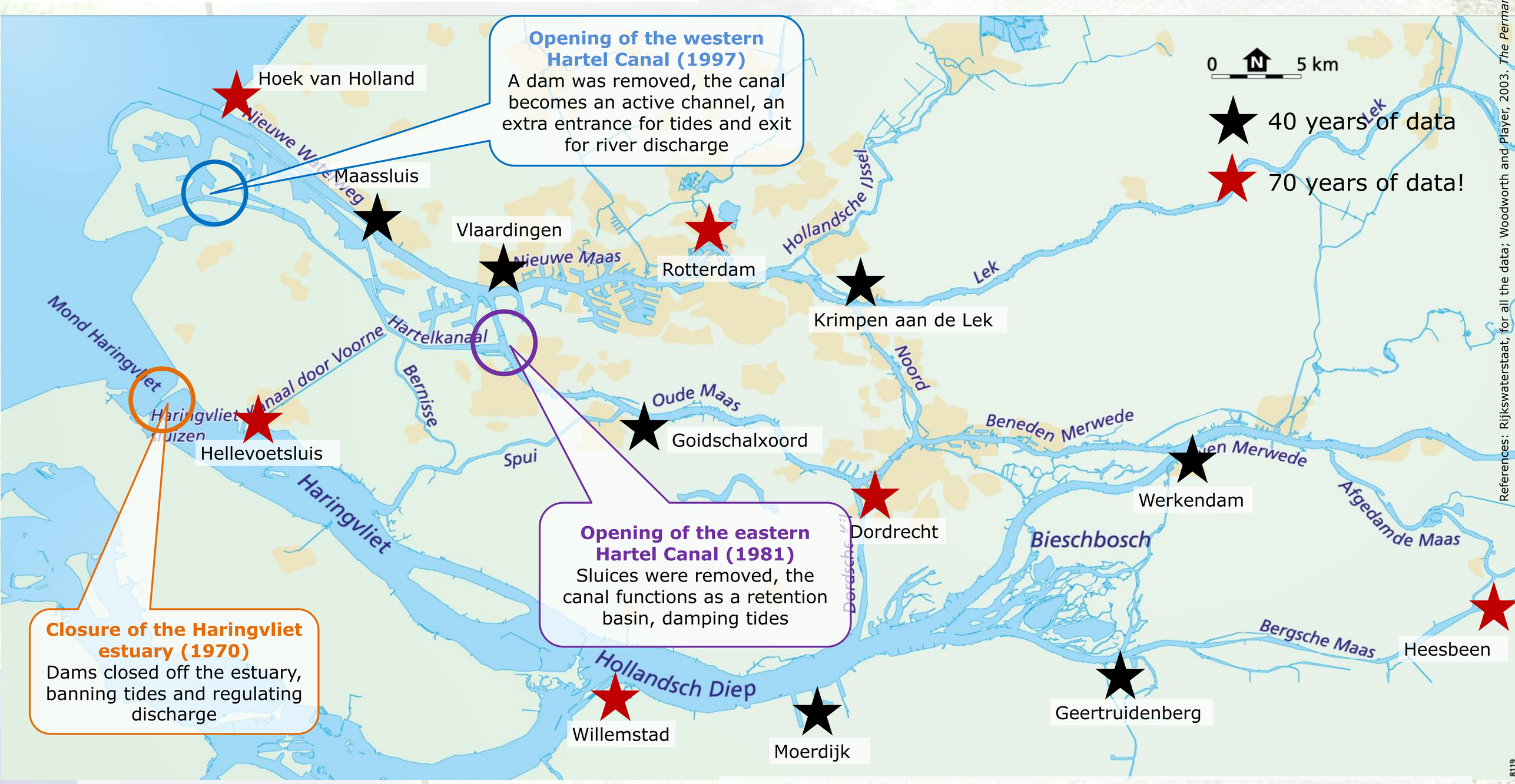
Only the mean water level shows a uniform rise...

Change in mean water level equals sea level rise:



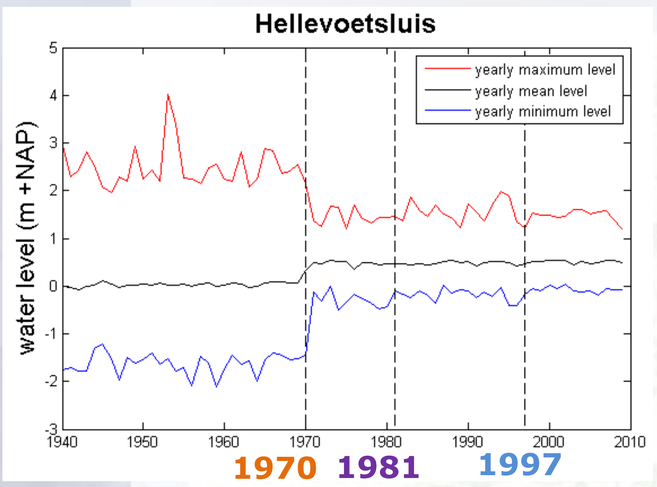
But high- and low water levels show no uniform rise and the water level distribution is spatially variable. For example:





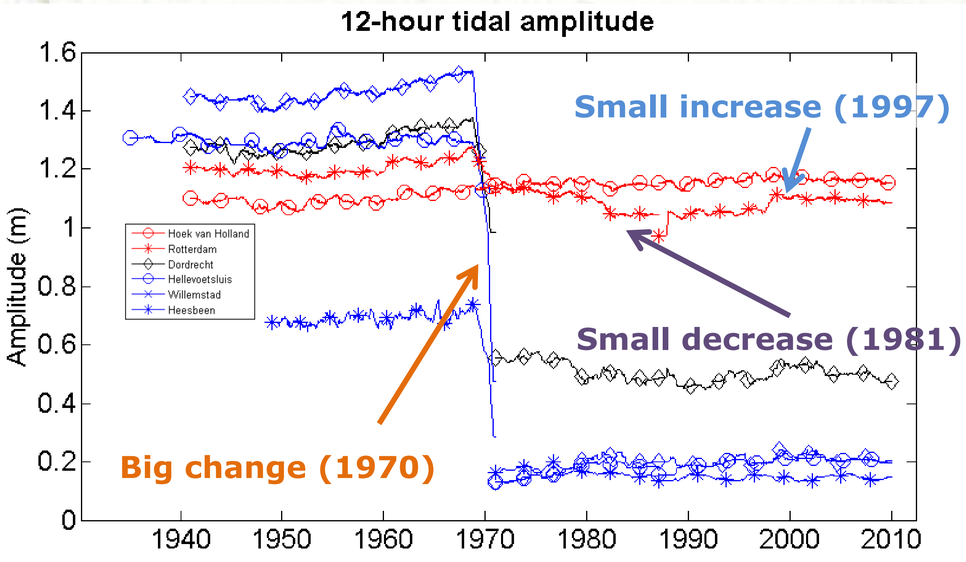
References: Rijkswaterstaat, for all the data; Woodworth and Player, 2003, *The Permanent Service for Mean Sea Level: an update to the 21st century*

Change-point analysis: three changes



Change-point analysis was carried out for yearly maximum, minimum and mean water level. Three significant change-points were found: 1970, 1981 and 1997.

Wavelet analysis: changing tidal amplitudes



Tidal amplitudes derived from wavelet analysis show all changes in amplitudes, large and small. Three moments of sudden change stand out: 1970, 1981 and 1997.

Conclusion: human influences overwhelm sea level rise

Human engineering has a profound effect on water levels. These effects are known for large engineering measures, but not for smaller ones. However, several small measures have a bigger effect than sea level rise and should not be overlooked.