

Table 4.2. Secular Trends in Mean Tidal Range in the German Bight (after Führböter and Jensen, 1985)

Location	Rate of Change of Mean Range (m/100 yr)	
	N = 100	N = 25
Norderney	- <sup>a</sup>	0.431
List	- <sup>a</sup>	0.369
Bremerhaven	0.380	1.293
Cuxhaven	0.065	0.949

<sup>a</sup>Insufficient data

The rate of change of mean tidal range has been calculated in two different ways for each location. The first is the average rate based on the entire 100 year period (no values were computed for Norderney and List due to insufficient data). The second is based on the last 25 year (=N) record, converted to an equivalent 100 year rate. Comparing Norderney and List to Bremerhaven, it is observed that the tidal rise (N=25) has been far more significant (three-fold) within the estuary than on the open coast. The rise at the estuary mouth is intermediate in magnitude. One likely reason is the effect of reduced bottom friction due to sea level rise. This effect is more pronounced in the shallow estuary than in the deeper sea.

It is also interesting to observe from Table 4.2 (for Bremerhaven and Cuxhaven) that the increase in tidal range has been considerably more significant in recent years (N=25) than what is obtained based on a 100 year record (N=100). At Bremerhaven, the mean tidal range 100 years ago was ~ 3.30 m. Thus the range increased there by ~ 9% during the subsequent 75 years. During the next 25 years the range increased again by about the same percentage.

Führböter and Jensen noted a trend of rising tidal range approximately over the past century at all ten locations examined. They concluded that this trend is not due to any long-term changes in meteorological conditions, but is possibly due to the morphology of the North Sea, a very shallow water body in which the global rise of the mean water level effect is amplified via a standing wave effect. This possibly suggests a situation in which the natural