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The impact of natural bathymetry changes on tidal dynamics in the German Bight (North Sea) between 1996 and 2016

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The impact of natural bathymetry changes on tidal dynamics in the German Bight (North Sea) between 1996 and 2016

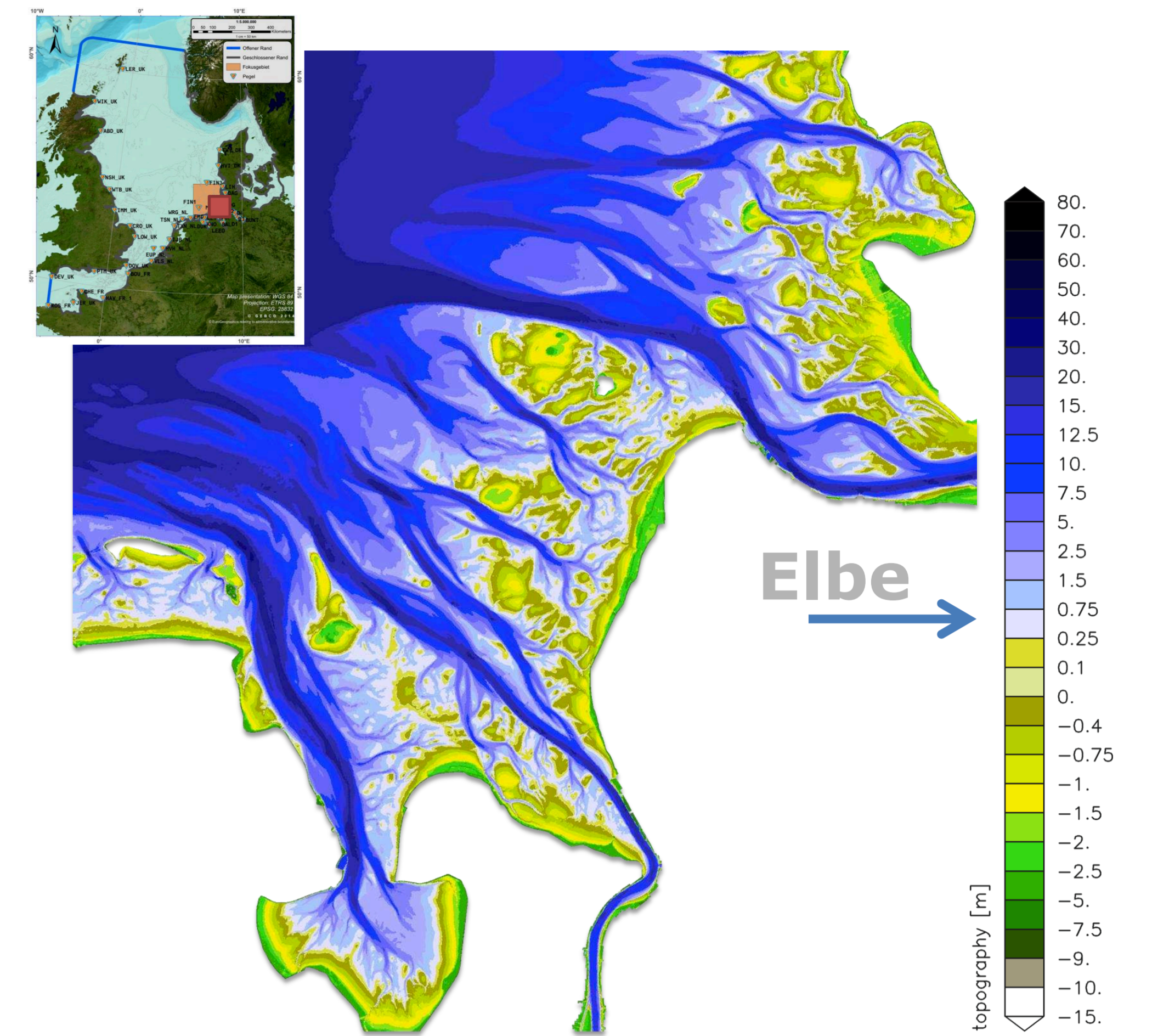
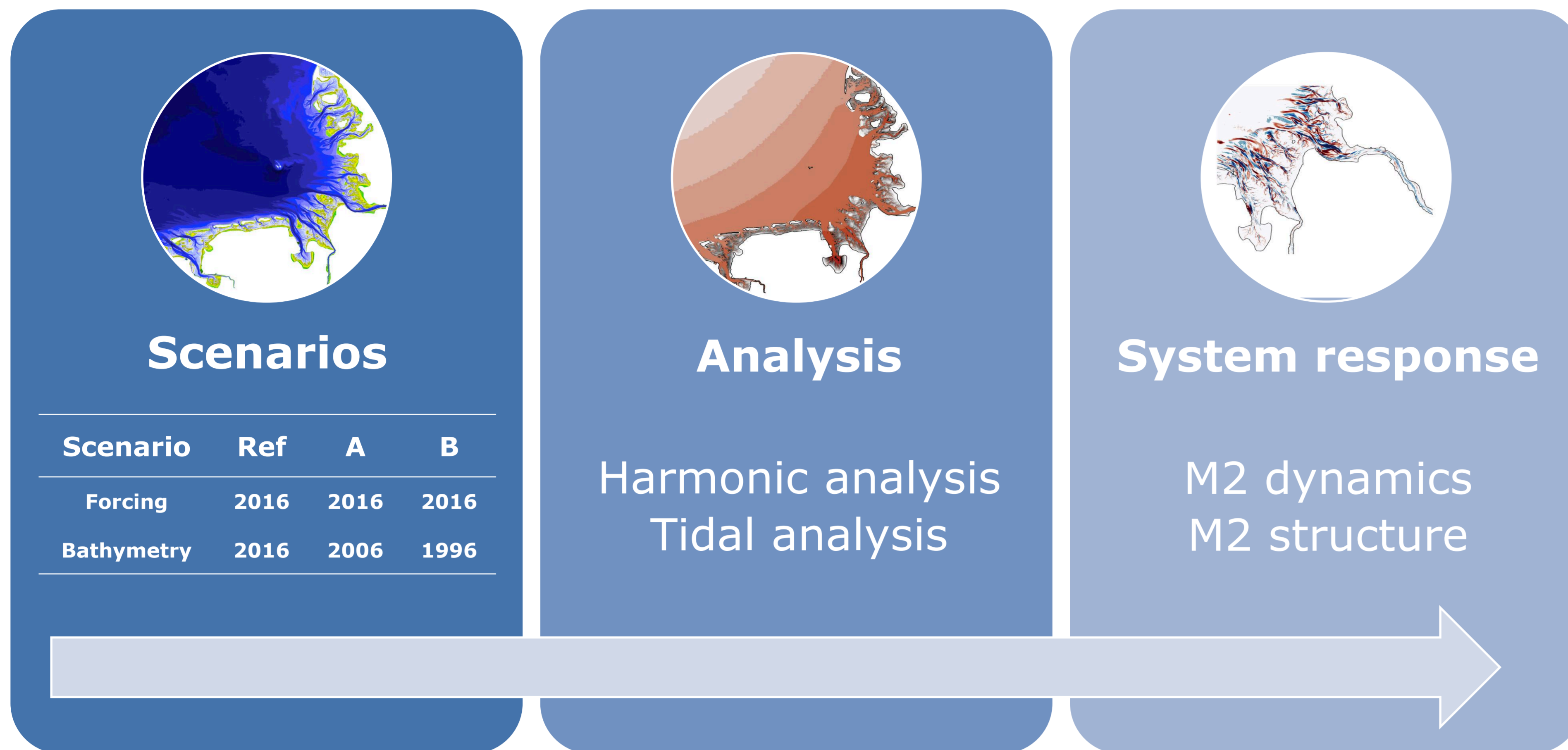


Fig. 1: Bathymetry of the inner German Bight

1. Bathymetry differences

The underlying bathymetries of 1996, 2006 and 2016 have been extrapolated from 90.000 data sets using a time-space interpolation algorithm.

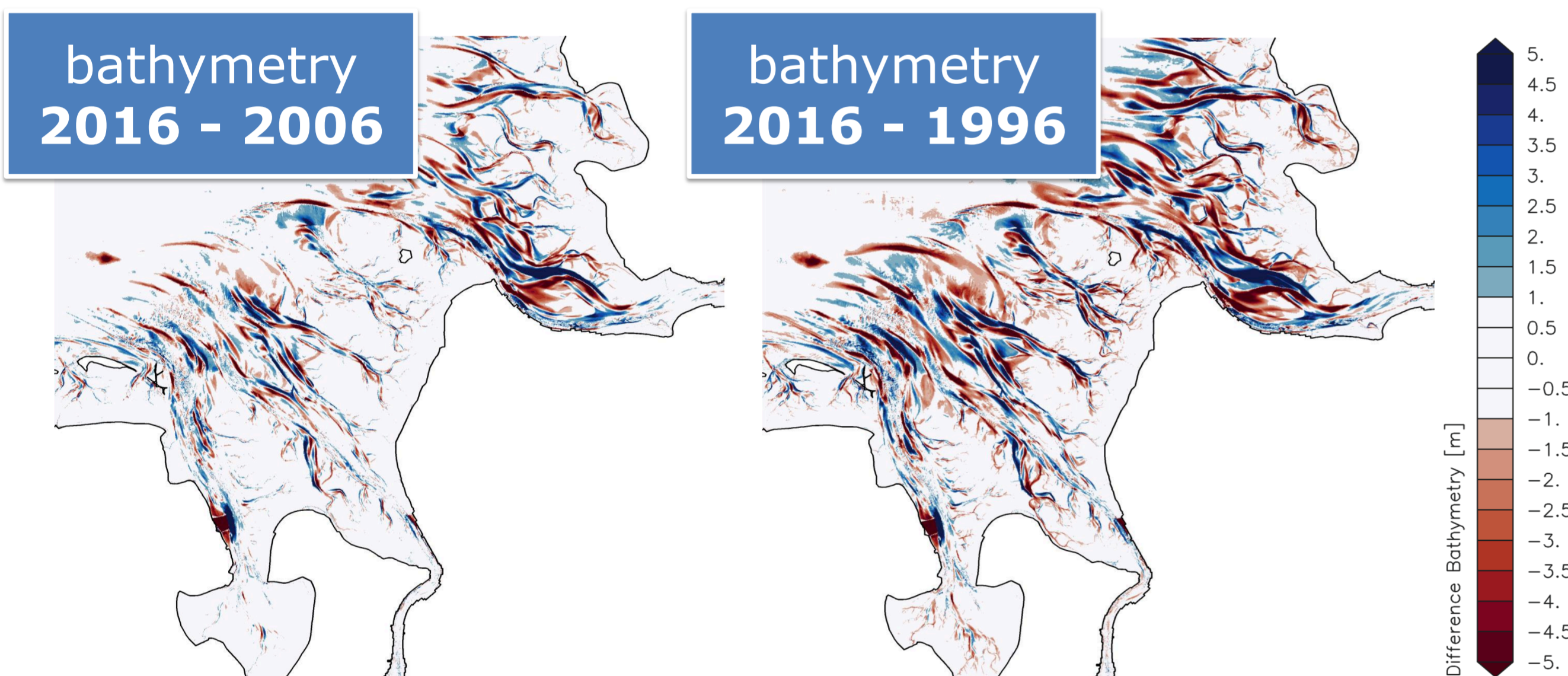


Fig. 2: Bathymetry differences (inner German Bight, 423 km²)

Bathymetry differences demonstrate strong morpho-dynamic activity near the highly complex, dynamic shoal and channel systems in the German Wadden Sea.

2. Volume differences

The water volume in the inner German Bight (Figure 2) has decreased over time while the volume of the Elbe river (estuary volume) has increased.

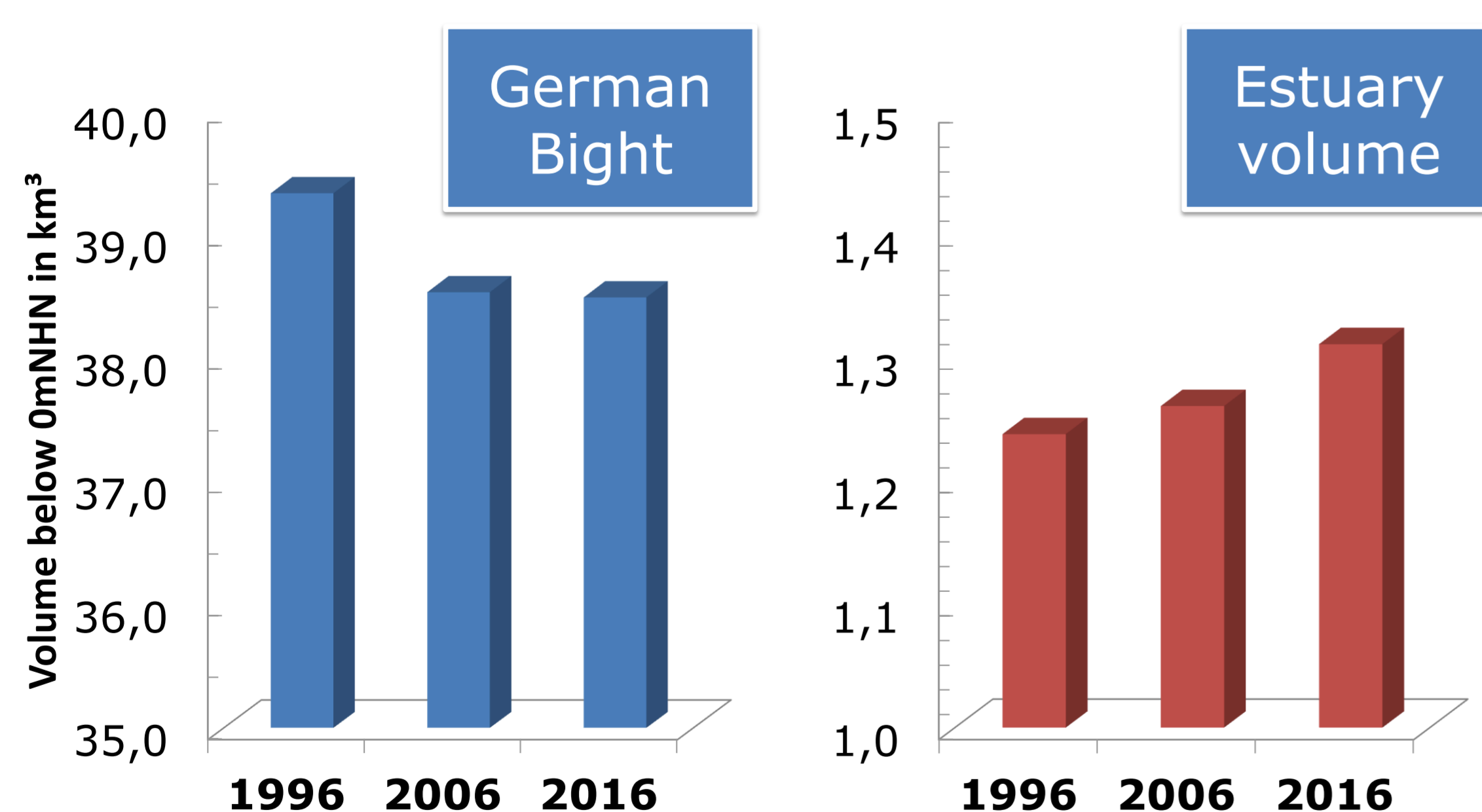


Fig. 3: Water volume below 0mNN for the inner German Bight from Figure 1 and the Elbe River (estuary volume)

Note, that the observed volume differences may also result from uncertainty of bathymetry measurements prior to the availability of laser scan technology.

3. Results

The results from the numerical model UnTRIM2 show a strong discrepancy of the M2 amplitudes between the bathymetries of 2016, 2006 and 1996:

- Large area differences between 2016 and 1996
- Local differences between 2016 and 2006

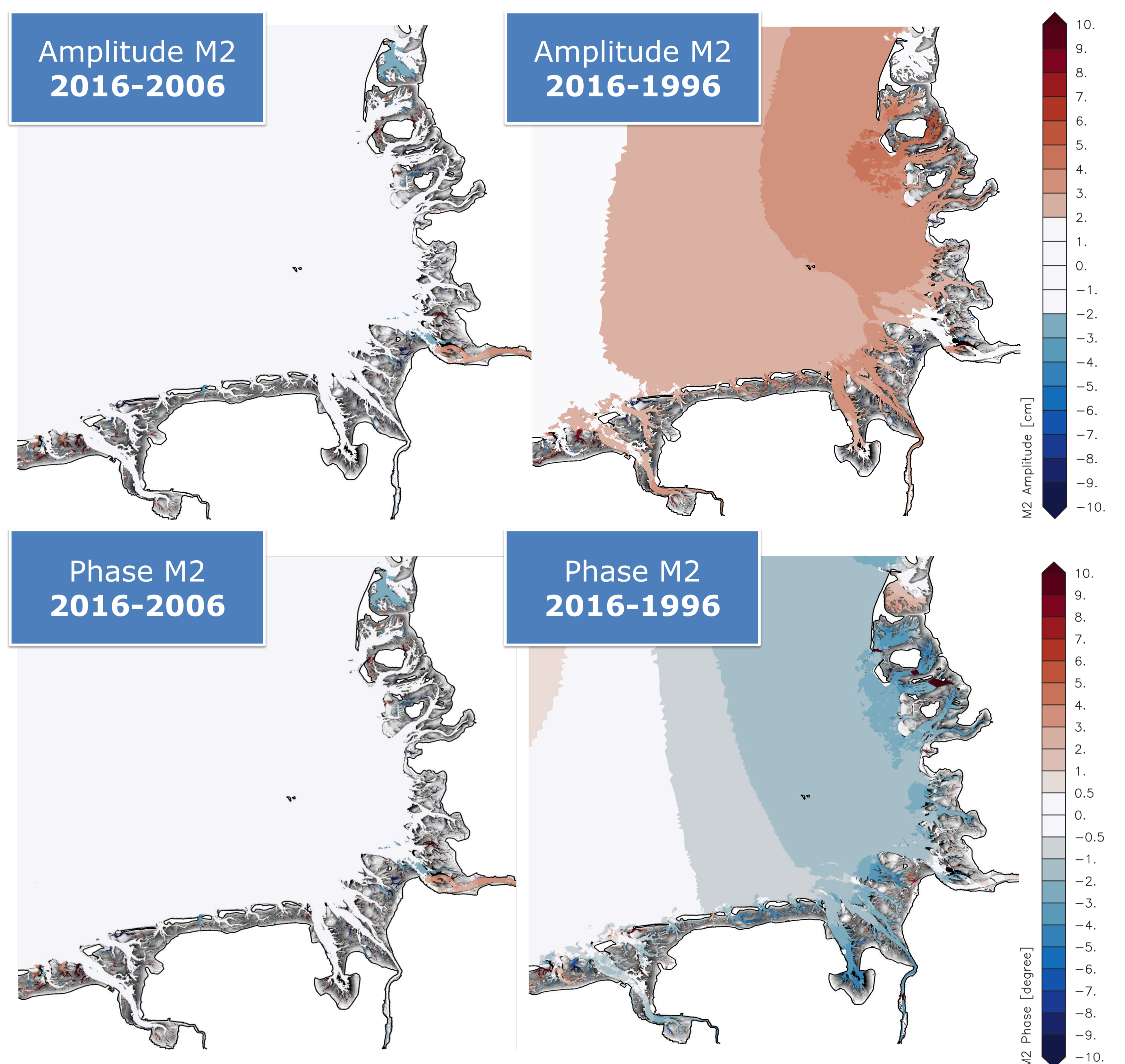


Fig. 4: M2-Amplitude (top) and phase (bottom) differences

4. Take home messages

- Large volume changes result in shifts of the tidal regime (amphidromy)
- Volume changes within the estuary result in local responses
- German Bight: Volume changes of the inner German Bight moved the closely M2- amphidromy 20km northwards.
- German Bight: this shift results in an increased M2 amplitude (~7.5%)

