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A tidally driven fjord-like strait close to an amphidromic region

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Supplementary figures

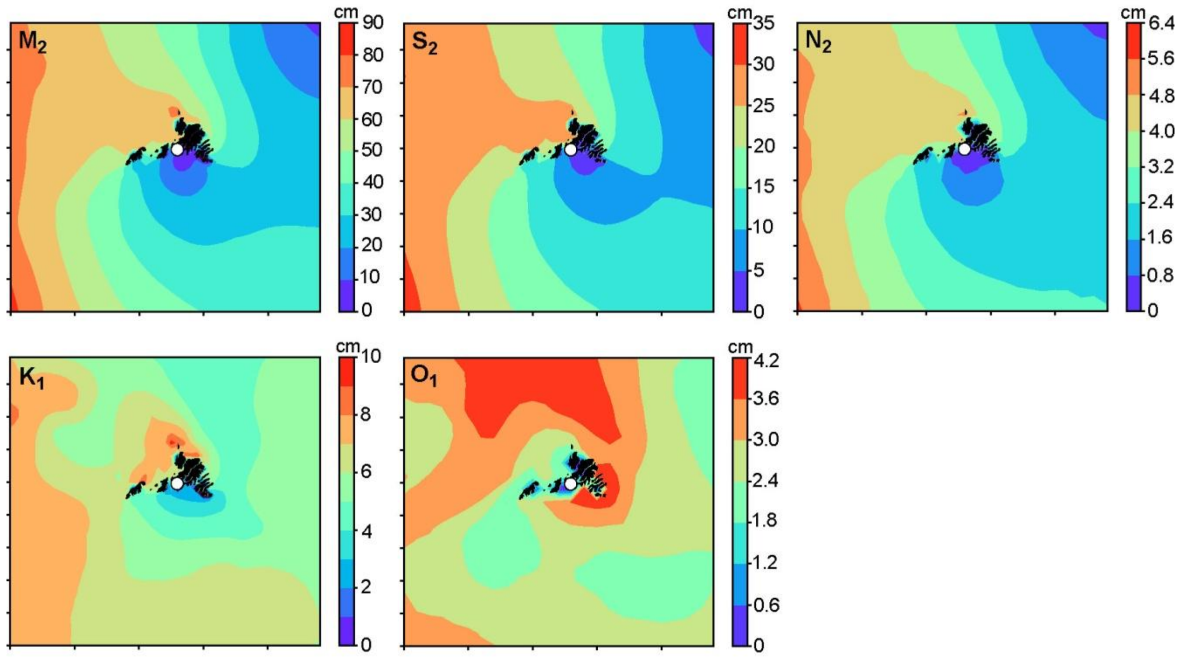

Figure S1. Amplitudes (in cm) of the three dominant semidiurnal and two dominant diurnal tidal constituents of sea level around the Faroes based on the 800 m parent model. The white circle indicates the area close to Tórshavn.

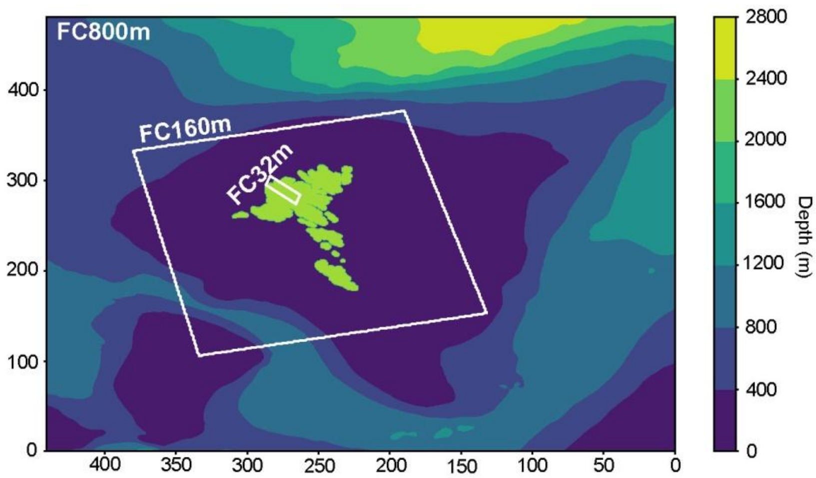

Figure S2. The model used in this study, FC32m, is nested within the FC160m model, which is nested within the FC800m model. The FC800m model is forced along its four open boundaries by the SVIM hindcast archive (4x4 km horizontal resolution, Lien et al., 2013).

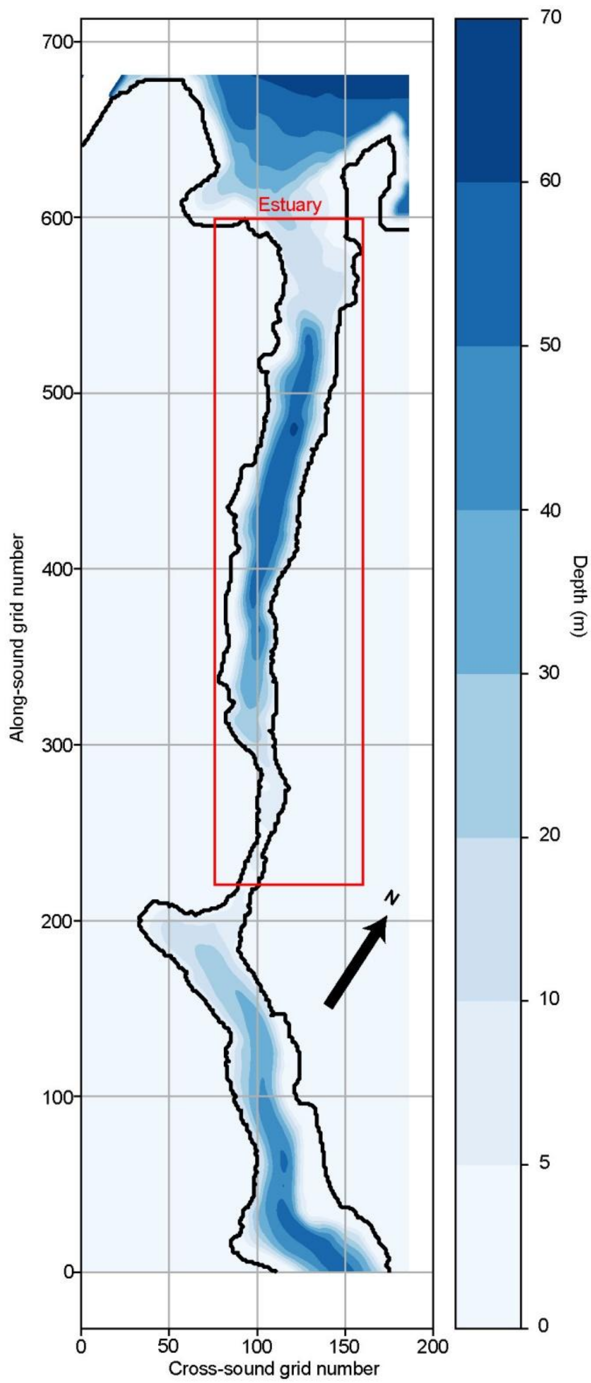

Figure S3. Model domain and bottom topography. The red rectangle labeled "Strait" defines the part of the model domain that is discussed in this study.

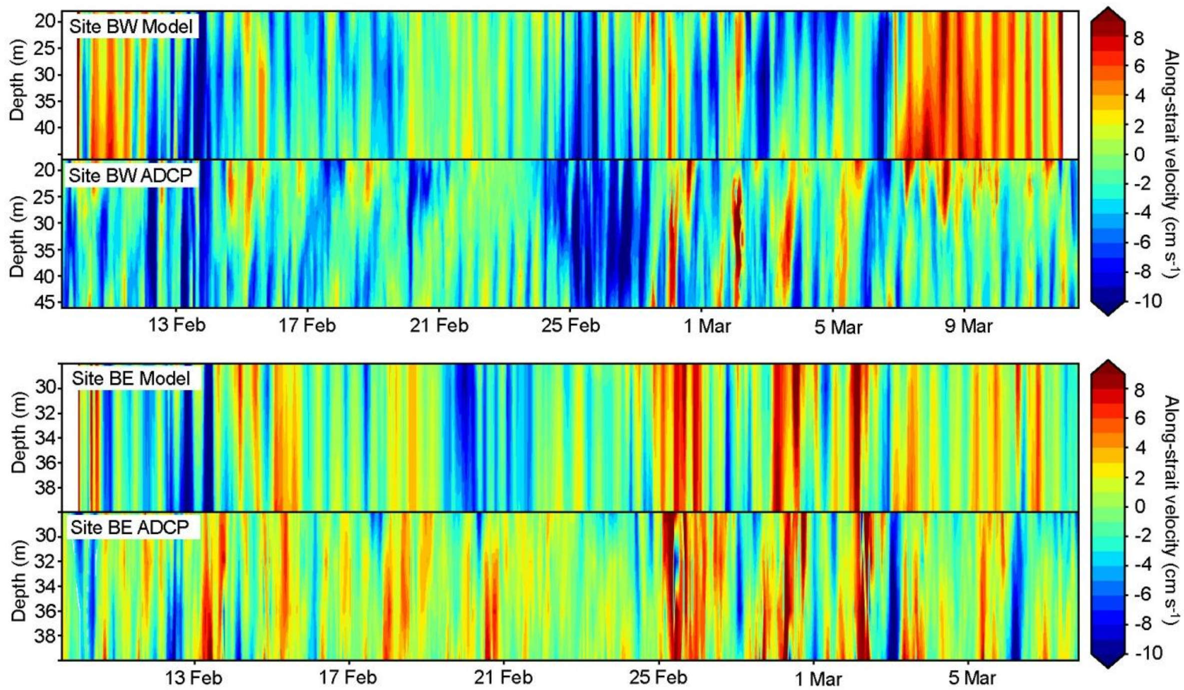

Figure S4. Hovmøller diagrams of along-strait velocities at the two ADCP mooring sites comparing observed (ADCP) and simulated (Model) velocity profiles for the depth intervals with acceptable ADCP data.

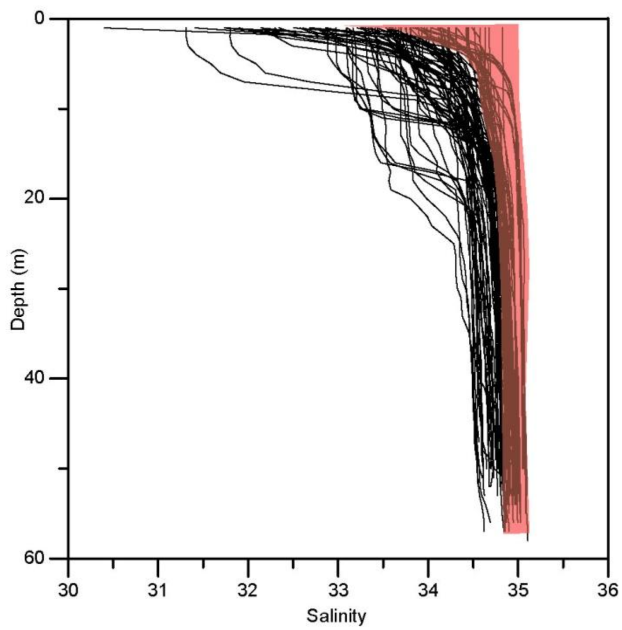

Figure S5. Comparison of salinity profiles from observations and model. The black lines show observed salinity profiles from 92 individual CTD casts at stations with bottom depth at least 50 m in winter (November – April). The semi-transparent red area in front is the simulated salinity range (minimum to maximum at each depth) of daily averaged salinity profiles for all grid cells in the model with a bottom depth of at least 50 m.

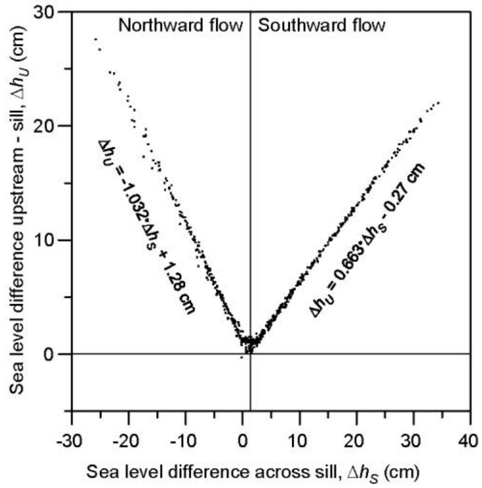

Figure S6. The sea level difference between the sill and the region upstream of it, Δh_U, plotted against the sea level difference, Δh_S, across the whole sill (Fig. 4a in main manuscript). Each point represents one hour and the regression equations are derived for each flow direction separately.

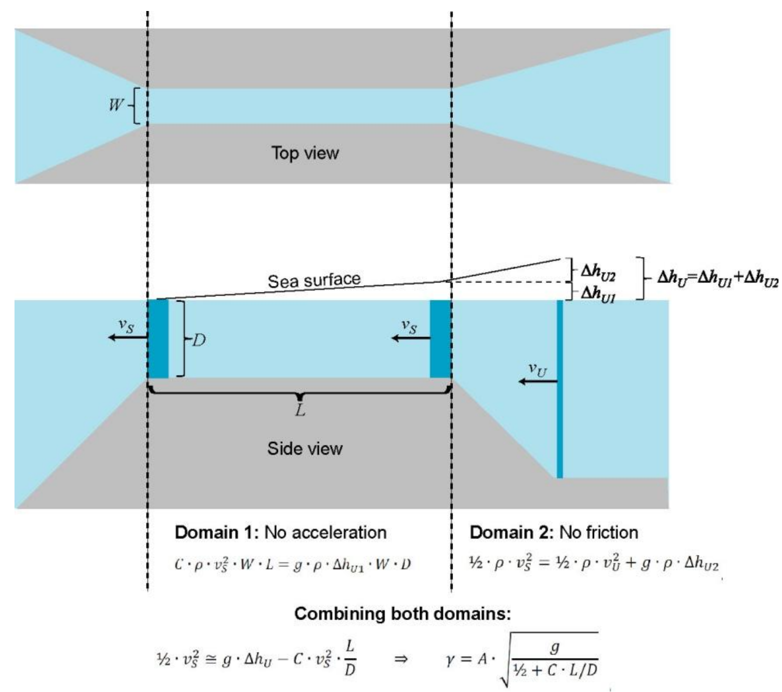

Figure S7. An idealized conceptual model of the southern sill with surroundings, where the central part of the sill (Domain 1) is assumed to be a channel of fixed width (*W*), fixed depth (*D*), and length *L*. The figure is intended to illustrate a situation with south-going flow, forced by a sloping sea surface (slope exaggerated). The dark blue rectangles illustrate three stages of a water parcel as it flows across the sill. The velocities are assumed to be barotropic and to be homogeneous in Domain 1. In this domain, the water is not accelerated and the current speed (v_S) will be determined from the balance between the pressure gradient and the frictional force, which is assumed to be quadratic in speed with the drag coefficient *C*. In Domain 2, the flow is accelerated on its way southwards. The friction will be weaker and is ignored, which leads to the Bernoulli equation. Combining both domains and utilizing that $v_U << v_S$, gives the lowermost equation and an expression for the parameter γ in Fig. 6 in the main manuscript. With the same drag coefficient C = $3 \cdot 10^{-3}$ as in ROMS, the desired value, γ = 1936 $m^3 s^{-1} m^{-½}$, is obtained with a ratio *L/D* = 225. As an example, this may be attained by D = 5 m and L = 1125 m, which seems quite realistic. It is assumed that $\Delta h_{U1} << D$.

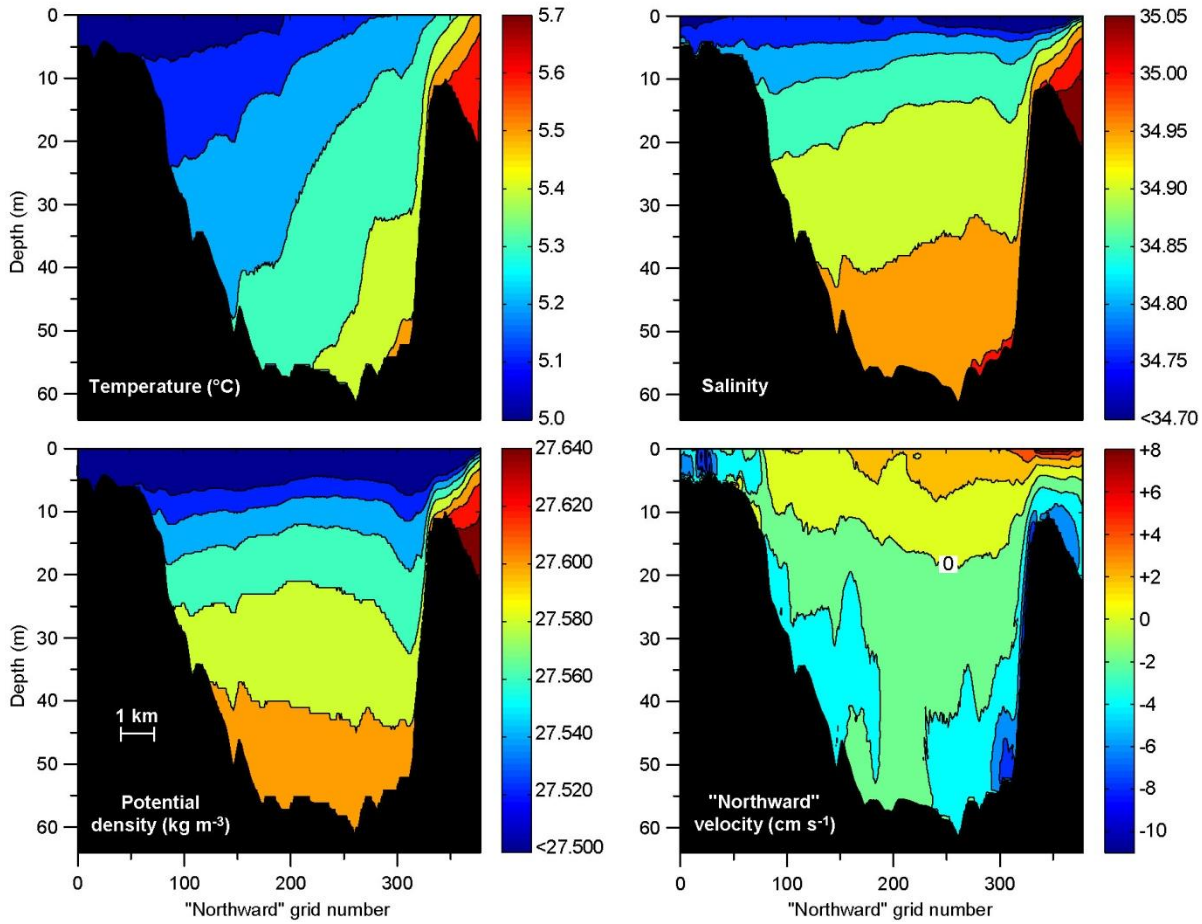

Figure S8. Cross-strait averaged temperature, salinity, potential density, and northward velocity plotted against northward grid number averaged over the whole simulation period. For salinity and potential density, the lowest values are grouped together. The bottom depth indicated by the black areas is the maximum depth along each section crossing the strait.

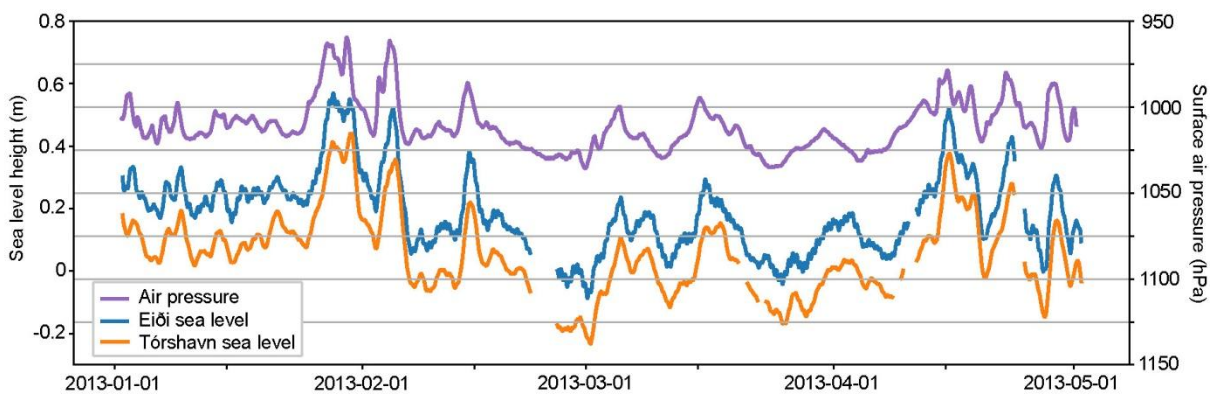

Figure S9. Variation of 25-hour averaged sea level height from Landsverk data from the stations Tórshavn (orange line) and Eiði (blue line) plotted with the Tórshavn surface air pressure provided by the Danish Meteorological Institute (DMI) (purple line) with an inverted y-axis.

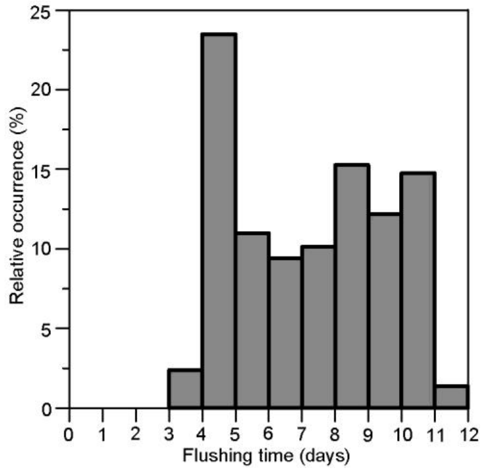

Figure S10. Relative occurrence of flushing times estimated as the number of hours with positive northward volume transport across the northern sill needed to flush out the total volume of the strait. The histogram was generated by starting every hour of the simulation and from that point adding up the outflow for every hour with positive volume transport until the total outflow equaled the volume of the strait.

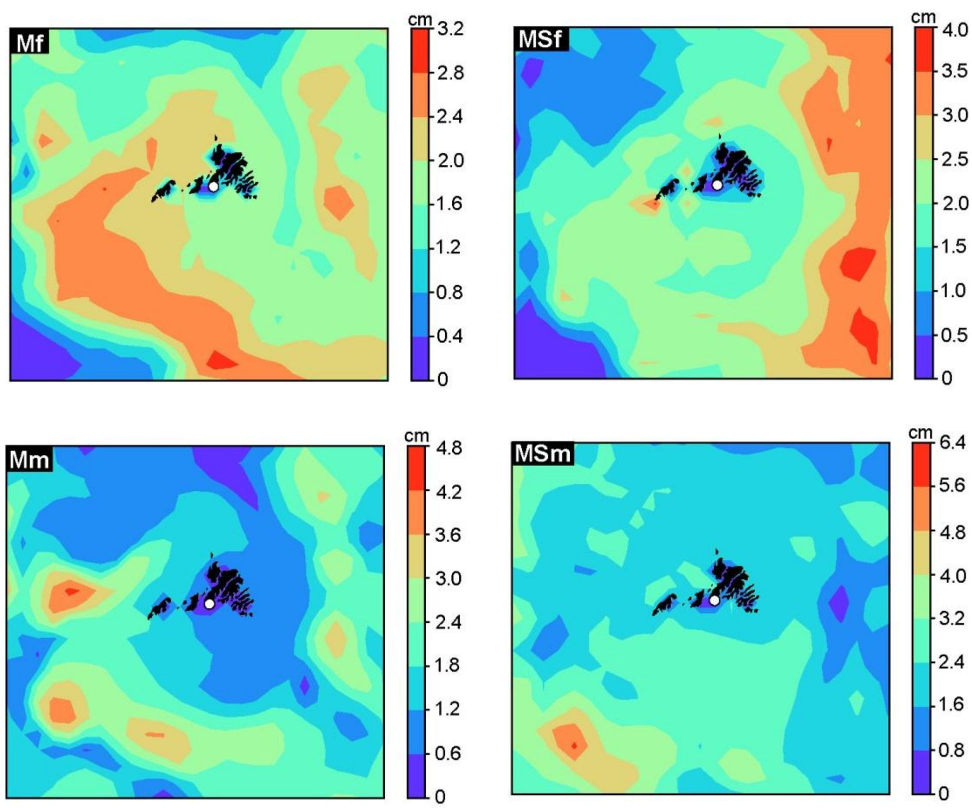

Figure S11. Amplitudes (in cm) of the four dominant long-period tidal constituents of sea level around the Faroes based on the 800 m parent model. The white circle indicates the area close to Tórshavn.