Impact of Mean Sea Level Rise in the Rias Baixas Hydrodynamics (NW Iberian Peninsula)

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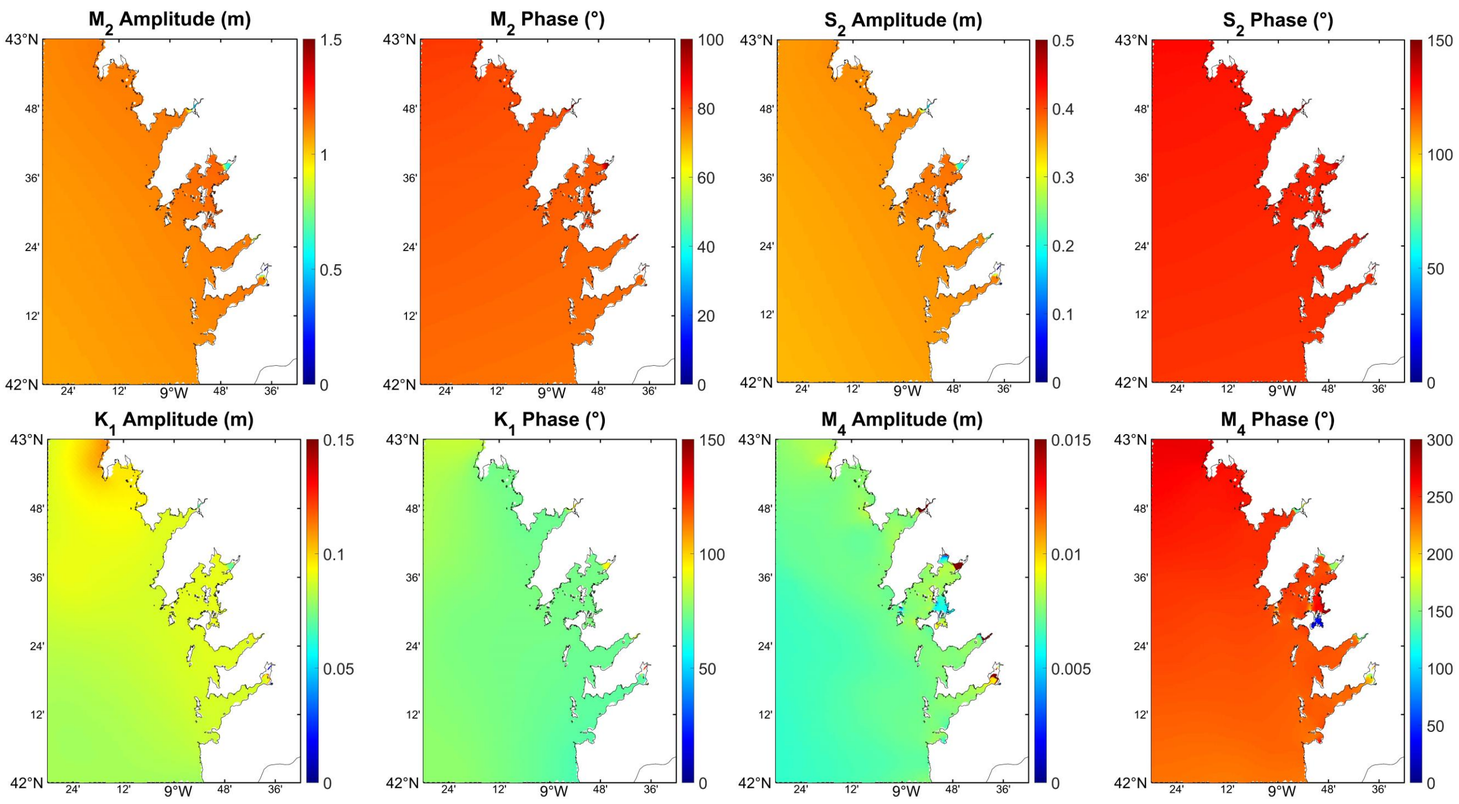
This study aims to validate a hydrodynamic model of the Rias Baixas and to analyse the effect of mean sea level rise in the local hydrodynamics.

Methodology

- The methodology followed comprises the application of a three-dimensional numerical model (Delft3D), with realistic bathymetry and coastline of the NW Iberian Peninsula including the Rias Baixas. The model considers the main physical processes, circulation features, and ambient shelf conditions, including FES2014 tidal solution.
- Firstly, the model validation was done through qualitative and quantitative analysis.
- After the model validation, the main semidiurnal and diurnal constituents and tidal asymmetry were determined for Ria Baixas for three mean sea level scenarios: present mean sea level and two future scenarios from CMIP6, a more optimistic one (SSP1 - 2.6) and a more pessimistic one (SSP5 - 8.5).
- Both future scenarios are for the long term period (2081-2100), with a change in sea level rise of 0.4 m in SSP1 – 2.6 and 0.7 m in SSP5 - 8.5.

Results

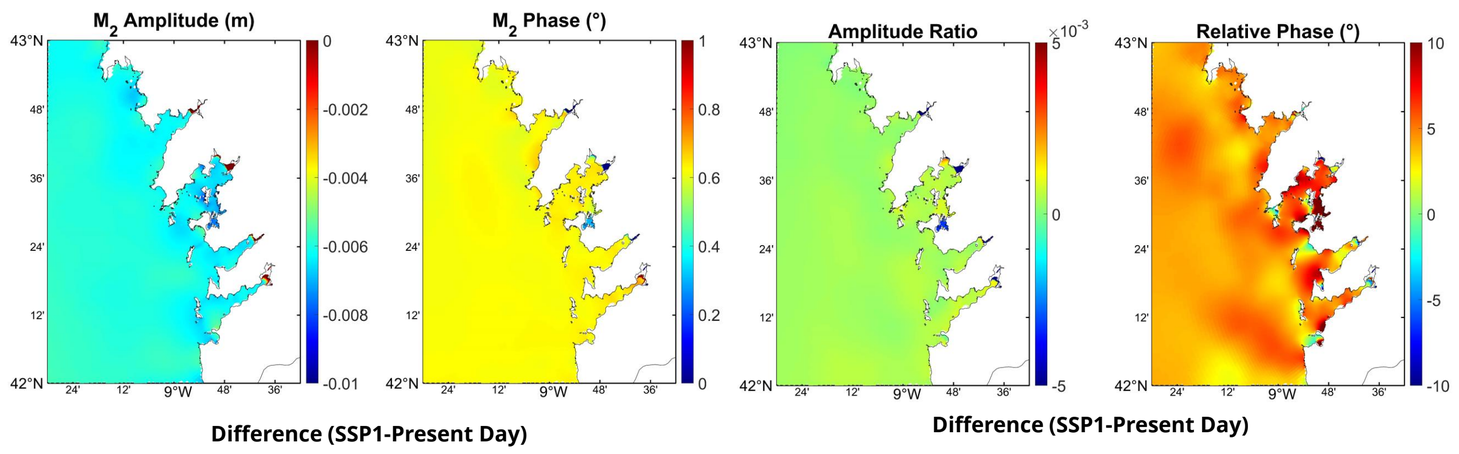
Present Day



For the major constituent, M_2, the **amplitude** is 1.2 m in the **whole region,** while the **phase increases** with latitude ranging from 70° to 80°. For S_2 the **amplitude** is approximately 0.35 m and the **phase** is 130° for the entire region. For the **diurnal** constituent, the **amplitude increases northward**, reaching a value of around 0.1 m, while the **phase** is approximately 80°. For M_4, the **amplitude increases inside** the Rias with values around 0.007. The **phase** increases with latitude, ranging from 220 to 250°.

The **amplitude ratio** shows values around 0.007 and the **relative phase** is between 250 and 300°, showing an **ebb tide dominance**.

SSP1 – 2.6

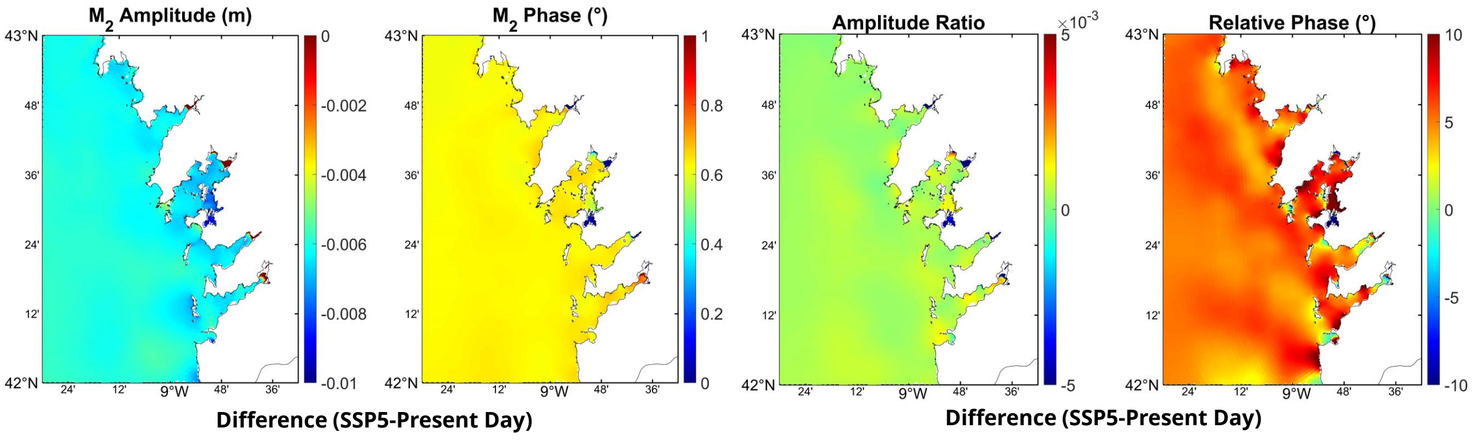


The **amplitudes** of the various tidal components **will change** differently in **different areas**.

M_2 amplitude will decrease uniformly throughout the whole region, while **M_4 will increase** slightly in some areas and remain unchanged in others. The **phase** of M_2 will increase by about 0.02°. M_4 will decrease by -2° to -10° but will slightly increase by 2° in some areas.

The **relative phase will mainly increase**, ranging from 4° to 10°, but will remain unchanged or slightly decrease near the capes of the Rias and **the amplitude ratio will mainly remain the same**, with only a small decrease near the coast.

SSP5 – 8.5



This scenario is **similar** to the previous one, but the **changes** in both **amplitude** and **phase** are **slightly higher**. Generally, the **amplitude ratio remains close to 0** and the relative **phase increases by 2°** compared to the SSP1 scenario.

Main Conclusions

The model results show that the amplitude of the main semidiurnal and diurnal constituents will generally decreases in the future, whereas the respective phase and amplitude ratio increase towards the head of the Rias.

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