# Summary of the manuscript titled "The impact of suspended sediments on exchange flow in a macrotidal, hyperturbid estuary."

This manuscript rigorously investigates how **suspended sediment concentration (SSC)** influences **water density**, **stratification**, and ultimately the **total exchange flow (TEF)** within a **macrotidal, hyperturbid estuary** resembling the Gironde. The authors run two numerical models:

- **Active model**, where density = salinity + SSC

- **Passive model**, where density = salinity only

Using a **10-month, semi-realistic 3D Telemac–GAIA setup**, they explore how SSC-induced density affects:

- vertical density gradients

- longitudinal density gradients

- suppression of mixing (Ri > 0.25)

- TEF inflow during neap vs spring tides

- impacts upstream, at, and downstream of the ETM (estuarine turbidity maximum)

Key findings include:

- SSC strongly modifies stratification **upstream** and **at the ETM**, especially during **spring tides**.

- TEF inflows differ by **≤4%** over 5 months, but locally during spring tides differences reach **22% at the ETM** and **70% upstream**.

- SSC-induced stratification decreases the baroclinic pressure gradient and reduces TEF inflow by up to **2000 m$^3$ s$^{-1}$**.

- The interaction of salinity- and SSC-induced stratification produces dominant periodicities analogous to compound tides.

The study concludes that neglecting SSC in density leads to **systematic overestimation of estuarine exchange flows**, especially in hyperturbid systems.

# Minor revision

## Section-by-section comments

The **Introduction** is clearly written, well-referenced, and covers all key concepts required to understand the work, including SSC processes, ETM behaviour, and sediment–stratification interactions.

The **Study Region** section is also well presented, and the justification for selecting the Gironde estuary is sound. It would be helpful, however, to include information on suspended sediment and seabed sediment distributions within the Gironde.

Overall, **the Methods** are clearly explained, and the authors consistently apply robust analytical approaches such as wavelet analysis.

The Methods section provides a clear description of the numerical model configuration. I was wondering whether the source code is available on GitHub and could be cited in the paper? Only one sediment grain size is included in the model, which seems limited for an estuarine environment (page 5, line 120: "In the present study, however, only one class of fine sediment is considered"). Could you also specify the mean grain size of this class? Have different grain size distributions been tested?

Regarding the vertical resolution, it would be useful to state whether a constant vertical spacing was used, or whether the grid was adapted based on averaged density gradients. A brief discussion of sensitivity to vertical discretisation would strengthen the methodology.

In addition, could you clarify whether alternative sediment densities were tested? A value of 2650 kg m$^{-3}$ may be high if flocculation processes reduce effective particle density.

The **Results** section is supported by well-chosen and relevant figures.

The **Conclusion** provides a clear and effective synthesis of the main findings.

## Typo

A few typos have been spotted:

- Page 2, Line 42: "strength the estuarine exchange flow" → "strength**en**".

- Page 8, line 202: "For this, we considered the cross-sectional average density the mouth and the head of the estuary". **At missing after density?**

- Page 8, Line 208: "it span ∼ 70 km with" → "it span**s** ∼70 km with".

- Page 8, line 207-208: " it well reproduced by the model": verb is missing. →" it **is** well reproduced…"

- Page 8, line 211 and 212: "reaching up to 3 gL−1 , and". You need an insecable space between the value (3) and unit (g/L)

**Page 9**

- Line 223: "differences increases with the tidal range" → "differences increase".

- caption figure 2: The horizontal red line. Maybe make this line solid, or long dash-dot (chain) line so that we do not think at first sight that it is similar to the dashed red lines of panel d?

**Page 20**

- Line 430: "Is the first time a study analyze the effects…" → "This is the first time a study analyze**s** the effects…".

Could I please see a revised version of the manuscript once the minor revisions listed above have been incorporated?