Review of the paper "Beneath the Tide: Sediment-Controlled Groundwater and Salinity Stratification Across an Estuarine Wetland Transect" by Owers et al.

The authors use ERT, hydrological monitoring, and sediment analysis to show that fine-grained sediments in a low-energy Australian barrier estuary create a vertically stratified groundwater system, with shallow saline water overlying fresher deeper groundwater, controlling vegetation zonation across the wetland transect. Overall, the paper requires substantial revision. In my view, the main issues are: 1) insufficient engagement with the existing literature on this topic, several important contributions are missing; 2) some discrepancies between results obtained using different methods; 3) the central message of the paper is not well focused , I suggest the authors better highlight the strength of their data collection effort across the transect, which is genuinely valuable; 4) the Results section should expand the hydrological analysis and reduce the space dedicated to site setup and sediment characterization , part of this material would be better placed in the Methods, and I would recommend a dedicated section linking hydrology/hydraulics to sedimentation; 5) evapotranspiration is entirely absent from the Results; 6) the Methods section is occasionally too detailed and risks losing the reader's focus and I recommend trimming it. The paper sometimes reads more as a technical report than a research article, and I would encourage a full reorganization. However, I believe the dataset, even from a single transect, is sufficient to tell a compelling story on a topic that is highly relevant and increasingly discussed in the scientific community. I recommend major revisions.

Abstract. The abstract is well written. I would also recommend including quantitative values where possible, as numbers help catch the reader's attention. For example: *"Results reveal a pronounced lateral and vertical salinity structure characterized by a shallow saline wedge extending inland **[how far?]** within fine-grained intertidal sediments, while deeper groundwater remains comparatively fresh."* The last sentence feels disconnected from the rest of the abstract.

Introduction. The writing is clear, but the reference list needs revision since several key contributions to this field are missing and should be acknowledged. Some examples: Pennings & Bertness (2001); Cahoon et al. (2021); Mariotti & Carr (2014); Fagherazzi et al. (2012). At line 42, I recommend engaging with the work of Matthew Kirwan's group, whose research focuses on the links between organic matter, sedimentation, elevation, and sea-level rise. At line 50, I recommend engaging with the work of Alicia Wilson's group, which is very active on groundwater dynamics in salt marshes. At line 57, I suggest also citing Guimond et al. (2024), Adams et al. (2024), and Pratt et al. (2025). At line 71, Tackley et al. (2025) published an important study on the role of marine sediment in regulating saltwater intrusion during flooding events…I recommend reading and citing it. At line 71, I agree that surface–groundwater dynamics in coastal critical zones and their ecological consequences remain understudied, but interest in this topic is growing rapidly. Examples include LTER coastal sites in the United States and the Coastal Critical Zone Network. This is a timely and increasingly central topic in the scientific community, and the authors should frame their contribution accordingly.

Pennings, S. C., & Bertness, M. D. (2001). Salt marsh communities. *Marine community ecology*, *11*, 289-316.

Cahoon, D. R., McKee, K. L., & Morris, J. T. (2021). How plants influence resilience of salt marsh and mangrove wetlands to sea-level rise. *Estuaries and Coasts*, *44*(4), 883-898.

Mariotti, G., & Carr, J. (2014). Dual role of salt marsh retreat: Long-term loss and short-term resilience. *Water Resources Research*, *50*(4), 2963-2974.

Fagherazzi, S., Kirwan, M. L., Mudd, S. M., Guntenspergen, G. R., Temmerman, S., D'Alpaos, A., ... & Clough, J. (2012). Numerical models of salt marsh evolution: Ecological, geomorphic, and climatic factors. *Reviews of Geophysics*, *50*(1).

Pratt, D., Guimond, J. A., Bacmeister, E. S., Fagherazzi, S., & Michael, H. A. (2025). Terrestrial groundwater drives coastal ecosystem shifts. *Geophysical Research Letters*, *52*(14), e2025GL116251.

Guimond, J. A., Grande, E., Michael, H. A., Pratt, D., Herndon, E., Noyce, G. L., ... & Arora, B. (2025). The hidden influence of terrestrial groundwater on salt marsh function and resilience. *Nature Water*, *3*(2), 157-166.

Adams, K. H., Reager, J. T., Buzzanga, B. A., David, C. H., Sawyer, A. H., & Hamlington, B. D. (2024). Climate-induced saltwater intrusion in 2100: Recharge-driven severity, sea level-driven prevalence. *Geophysical Research Letters*, *51*(22), e2024GL110359.

Tackley, H. A., Lake, C. B., van Proosdij, D., Jamieson, R. C., & Kurylyk, B. L. (2025). Saline sediment deposition in estuarine floodplains exacerbates vertical saltwater intrusion. *Journal of Hydrology*, *657*, 133116.)

Methodology. Additional technical details are needed throughout.

Line 96: Did the authors conduct fieldwork visits to identify and delineate the vegetation zones? If so, when, and in which season? Is the ecological zonation observed along the transect representative of nearby areas? The elevation range for each ecological zone should also be defined explicitly in the text, not only shown in Figure 1.

Line 113: The rationale for site selection only appears at the end of this section, it should be moved to the beginning. Figure 1: Please add panel labels (a, b, c).

Lines 118–119: Were preliminary ecological surveys conducted, or was plot selection based solely on the ERT results?

Lines 127–134: The ERT surveys are well executed. However, it is important to clarify how the authors distinguished between the effects of salinity, water content, and soil properties on the ERT signal, particularly in the unsaturated zone, where this interpretation can be ambiguous.

Line 146: The ecotone is referred to as "MSE" here but as "ET" in Figure 1, please be consistent throughout.

Lines 147–149: Is the PVC pipe fully screened over the 0.5 m interval? If so, please provide screen dimensions and explain whether the screen design was informed by the sediment analysis.

Lines 149–: Please clarify the screen position … is it located at the bottom of the pipe?

Lines 158–160: Elevations referenced here should be reported in a Table or shown on a map.

Line 165–166: Please specify where the barometric sensor was installed …which plot, and at what height above ground?

Line 162: The pressure sensors should be referred to as "CTD sensors" (measuring conductivity, temperature, and pressure). Please also provide the exact model for both the Levelogger and HOBO instruments.

Line 192: Please state explicitly the distance between the study site and both the tide gauge and rain gauge.

Line 219: "Results were presented as grain size distributions" …if these data are not shown here, this sentence should be removed. If they are presented in the Results, please remove this statement from the Methods.

Line 222: Please refer to hydraulic conductivity as "saturated hydraulic conductivity (K)" for precision.

Lines 244–247: This content belongs in the Methods section.

Results

Section 3.1: From my point of view, this material does not constitute Results in the strict sense … it describes the physical setting and data collected to characterize the study area. I would recommend moving it to the Methods, as it serves primarily to contextualize the hydrological analysis rather than present new findings.

Lines 287–292: Please refer to figure panels using letters (a, b, c). Also…is *Casuarina glauca* in the supratidal zone a moderately salt-tolerant species? If so, what is its known salinity tolerance threshold, and is it expected to remain in good condition at 10 mS/cm?

Figure 4: At approximately 180 m from ET, there appears to be an elevated salinity anomaly (~16 mS/cm). Can the authors explain this feature? Is there a topographic depression at this location that might account for it? ERT-2 was acquired shortly after a storm surge event. Yet this anomaly is not evident here since the storm surge signal does not reach this point? Please clarify. In the following section, where hydraulic heads are presented, the authors should address this observation and cross-reference it with the ERT results.

Line 292: This appears to be a well-known pattern in estuarine and coastal forested environments. The shallow saline plume broadens with increasing inundation frequency and is particularly pronounced in silty-clay soils due to reduced flushing efficiency.

Line 304: Rainfall should be expressed as cumulative rainfall , please revise.

Section 3.4: Please refer explicitly to figure panels throughout. The use of "correlation" throughout this section requires clarification…what type of correlation was computed (Pearson? Spearman?)? What significance criterion was applied? This should be described in the Methods.

Figure 6: Please define the dashed line in the caption.

Lines 308–313: This paragraph is unclear. It is not evident which data the authors are referring to, and the relationship between the described values and Figure 6 is difficult to follow. Please revise this section thoroughly.

Lines 314–315: Is there a supplementary figure showing these correlations?

Lines 334–341: Please add figure references. Figure 7 caption is also incomplete: the dashed red line and continuous red line are not defined. Here I would add a comparison with the bulk EC shown in ERT profiles. It is also notable that salinity peaks during compound events (combined flooding and rainfall) appear lower than during flooding-only events …this is worth highlighting.

Figure 7: Compound flooding events also merit closer examination. In these events, rainfall and saltwater intrusion simultaneously fill soil pores, producing more complex hydrological dynamics within the soil.

Line 327: This is a good observation that merits discussion. The saltmarsh elevation is higher than both the mangrove and ecotone, making elevation a primary control on its inundation frequency. In the mangrove, despite proximity to the coast, efficient tidal drainage limits waterlogging. In the ecotone, however, water is effectively trapped after inundation, promoting persistent waterlogging.

Section 3.4 (general): This section needs to be substantially expanded. The hydrological results are the most important part of the paper and deserve more thorough treatment, including hydraulic gradients, the response to individual rainfall and flooding events, the combined role of tidal forcing and storm surges, and the seasonal patterns in the water level data. In particular, the dry season (roughly September to April in Australia) shows systematically lower water levels — this seasonal signal is important for understanding surface–groundwater dynamics. Additionally, evapotranspiration is entirely absent from the analysis — do the authors have ET data, or at minimum an estimate of potential evapotranspiration?. Moreover, in my view, this section describes the hydrological results in terms of means and ranges rather than exploring the underlying processes. Again, I think an analysis of selected temporal windows would be useful.

Lines 347–350: I recommend reading and citing Boufadel (2022), Geng & Boufadel (2015), and Geng & Boufadel (2017), whose work specifically addresses the role of evapotranspiration in driving salinity increases in supratidal zones following storm surge events.

Boufadel, M. C. (2022). Collaborative Research: Impact of evaporation and waves on groundwater dynamics in tidally influenced beaches. *NSF Award Number 2130595. Directorate for Geosciences*, *21*(2130595), 30595.

Geng, X., & Boufadel, M. C. (2015). Impacts of evaporation on subsurface flow and salt accumulation in a tidally influenced beach. *Water Resources Research*, *51*(7), 5547-5565.

Geng, X., & Boufadel, M. C. (2017). The influence of evaporation and rainfall on supratidal groundwater dynamics and salinity structure in a sandy beach. *Water Resources Research*, *53*(7), 6218-6238.

Line 365: "Which estimates?". Please clarify what is being referred to here.

Lines 363–367: This explanation is too brief for a Discussion section. The flushing dynamics during rainfall events and the dilution signal in the porewater deserve a more thorough treatment, ideally with supporting data shown in the Results.

Lines 369–370 and 406–408: The fine-grained surface layer functions as a "pillow layer" — a concept discussed by Nordio et al. (2024a, b). It is worth noting that this layer also plays a protective role: while fine-grained sediments are difficult to flush of saltwater (leading to longer recovery times), they simultaneously prevent rapid downward contamination of deeper groundwater. This is a counterbalancing effect worth discussing explicitly.

Nordio, G., Pratt, D., Michael, H. A., & Fagherazzi, S. (2024). Initial soil moisture and soil texture control the impact of storm surges in coastal forests. *Science of The Total Environment*, *953*, 175911.

Nordio, G., & Fagherazzi, S. (2024). Evapotranspiration and rainfall effects on post-storm salinization of coastal forests: Soil characteristics as important factor for salt-intolerant tree survival. *Water Resources Research*, *60*(10), e2024WR037907.

Discussion

Section 4.2: The analysis of rainfall impacts on water levels and electrical conductivity needs to be developed further in the Results section before being interpreted here. Evapotranspiration is again entirely absent …what happens during the dry season? What are the consequences if saltwater flooding occurs when antecedent water levels are already low? Lines 398–401 are interesting but need to be better contextualized and explained in a dedicated section.

Lines 420–421: This type of salinity configuration — shallow saline plume overlying fresher deeper groundwater — is well documented in coastal systems. I strongly recommend engaging with the work of (for instance) Julia Guimond, Holly Michael, Anner Paldor, Barrett Kurylyk, Alicia Wilson, whose research directly addresses this topic.

Lines 464–476: Please refer to Nordio et al. (2024), who have already discussed the points raised here regarding vegetation water access and root-zone salinity dynamics.

Lines 445–451: I think the paper's main contribution is not a novel conceptual model but rather a well-designed and carefully executed observational study that corroborates and extends findings reported by others. I would encourage the authors to reframe their contribution accordingly, focusing on the quality and comprehensiveness of the dataset collected along the transect, and on what it confirms and adds to the existing understanding of surface–groundwater–salinity dynamics in low-energy estuarine wetlands. The stratification and hydraulic anisotropy described here are not new findings, as the literature I have suggested demonstrates. The real value of this paper lies in the richness of the data and the ecological context in which they are interpreted.