We thank the editor for handling and reviewing this manuscript and providing helpful feedback, which has greatly improved the manuscript. We address all issues raised in their comments below and incorporate the revised changes into the manuscript. The editor comments are included below in black, and our responses to their comments are in blue. The line numbers in the responses refer to the marked-up manuscript; modified text is presented in red in the marked-up version and presented below in the responses as *italic text*.

EC1

Dear authors,

I have read your responses to the reviewers' comments and, overall, I support the direction you have taken and the revisions you have made. I encourage you to submit a revised manuscript. However, please consider the following points carefully when preparing your revision.

The quality of the CTD profile data remains a concern (for Thorpe scale analysis). The measurements appear to be based on a 4 Hz sampled SBE SeaCAT instrument, and sufficient detail has not yet been provided to demonstrate that the resulting density profiles are of adequate quality for estimating turbulent mixing rates from overturning analyses. Key information is missing (e.g., profiling speed, the effective vertical resolution, what will be the minimum overturn scale that can be resolved, hence the detection level for dissipation rates?). The statement that “Data were quality-controlled ... CTD data were processed and visualised using ODV” provides little information on the actual processing and quality-control procedures applied. It describes the software used for visualization, but not how the data were processed, filtered, calibrated, or assessed for quality. A much more thorough description of the data processing workflow is needed.

Related to this issue are the extensive regions of negative N2 shown in the profiles. The manuscript interprets these as gravitationally unstable waters and evidence of active mixing. However, I am not yet convinced that sufficient analyses have been presented to demonstrate that these negative values are significantly different from zero and exceed the expected measurement noise and uncertainty. Given the importance of this interpretation for the subsequent turbulence estimates, the authors should provide a more rigorous assessment of data uncertainty and demonstrate that the observed overturns are robust and physically meaningful.

Kind regards,

Ilker Fer

We thank the editor for this important comment. We agree that CTD-derived Thorpe-scale analysis requires a more detailed description of profile quality, effective vertical resolution, density-noise screening, and overturn validation. We have revised the Methods to provide the requested CTD processing and Thorpe-overturn quality-control details. The revised text now reports the SBE 19plus sampling rate, average vertical spacing, inferred profiling speed, downcast-only processing, lack of bottle adjustment, use of 2 m binning for N^2 and Turner angle, and use of original-resolution downcast density profiles for the Thorpe analysis. We also added a Park-style (Park et al., 2014) density-noise and overturn-validation procedure, including RMS noise estimation in well-mixed layers, multiplication by a factor of 4 to 5, intermediate density profiles and the $R_o = 0.25$ values are now treated as candidate density inversions and are used for overturn interpretation only when they pass these QC tests. The resulting L_T and $K_\rho^{(T)}$ values are presented as relative hydrographic overturn proxies, not as direct microstructure turbulence measurements.

Please check lines 93-101 (Sect. 2.1 Data), quoted below:

"*This study uses 51 Conductivity–Temperature–Depth (CTD) profiles collected in the Gulf of Oman, offshore Fujairah, between 9 and 18 July 2025 (Fig. 1). Profiles were obtained using a Sea-Bird SBE 19plus V2 SeaCAT CTD operating at 4 Hz. The average vertical sampling interval during the downcasts was approximately 0.06 m, corresponding to an average profiling speed of approximately 0.24 m/s. Only downcast measurements were used because upcast measurements were affected by winch motion. No bottle sampling was used for adjusting the measurements. The original CTD resolution was used for hydrographic parameters and for the Thorpe-scale analysis, whereas N^2 and Turner angle were calculated from 2 m binned downcast profiles to reduce gradient noise.*"

Please also check lines 144-163 (in the new Methods subsection, "2.2.2 CTD-derived fine-structure and overturn-proxies"), quoted below:

"The Thorpe analysis was performed on the original CTD data resolution and each used density profile was quality-controlled following Park et al. (2014) and Gargett and Garner (2008), retaining only vertically coherent, well-resolved overturns. The original CTD vertical sampling interval was approximately 0.06 m, while the practical overturn-detection threshold was controlled by the density-noise floor, intermediate-profile construction, and overturn-validation criteria. The density variable used for overturn detection was σ0, with in situ density used only

where σ0 was unavailable. Apparent density inversions were first treated as candidate overturns. They were retained only if they were vertically coherent, exceeded the adopted density-noise threshold, and passed the overturn-ratio criterion. The density noise floor was estimated from the root-mean-square density variability in locally well-mixed profile segments and multiplied by a factor of 4 to 5 to define the density-noise threshold. This threshold was used to construct intermediate density profiles from the top and bottom of the selected profile interval, following the intermediate-profile method of Gargett and Garner (2008). The top-down and bottom-up intermediate profiles were then used to identify density changes that exceeded the noise threshold and to suppress density fluctuations that were not significantly different from measurement noise. Candidate overturns were further screened using the overturn ratio Ro, following Park et al. (2014). Only overturns with Ro ≥ 0.25 were retained. This criterion rejects spike-like or one-sided inversions that do not contain a physically balanced distribution of upward and downward Thorpe displacements. Candidate overturns were also rejected if they were not vertically coherent or if they did not exceed the effective vertical detection scale."