Essd-2025-692

Response to reviewers

We sincerely thank both reviewers for their careful reading of our manuscript and for their constructive and insightful comments. Their suggestions have helped us improve the clarity, structure, and overall quality of the paper. All comments have been carefully addressed, and the manuscript has been revised accordingly.

Globally, we would like to emphasize that this manuscript was submitted to Earth System Science Data (ESSD) as a Data Description article. In accordance with the journal's guidelines, the primary objective of this manuscript is to ensure transparency, quality assurance, and accessibility of the dataset, rather than to provide an extensive analysis or interpretation of the results. For this reason, some of the suggested in-depth analyses fall outside the intended scope of this article. Our aim here is to highlight the originality, robustness, and potential scientific value of this unique multi-year dataset.

Furthermore, more detailed analyses regarding marine heatwaves (MHWs) inside Reao atoll, including their characterization, drivers, and ecological impacts, are currently presented in a complementary manuscript under revision (Van Wynsberge et al., in PRESS). Where relevant, we have clarified this point in the revised version and provided additional contextual information while remaining consistent with the ESSD article format.

All changes made in response to the reviewers' comments are detailed below.

Answer to Reviewer #1 - Alejandra Sanchez-Rios

Comment #1 of Reviewer #1: "*Consider briefly including in the first paragraphs the overall temporal coverage (start and end dates) of the full dataset;*"

The overall temporal coverage (December 2016–May 2025) has been added to the Introduction section (line 62), as suggested.

Comment #2 of Reviewer #1: "*Consider briefly including in the first paragraphs an explicit reference to Figure 3, which shows the spatial distribution of the instrumentation. Presenting Figure 3 earlier in Section 3 (or within the instrumentation subsection) would significantly improve the reader's ability to visualize the sampling strategy while reading the text*"

References to Figure 3 have been added in lines 62–63 and 111, as suggested, to improve the clarity of the presentation.

Comment #3 of Reviewer #1: *Consider briefly including in the first paragraphs a short definition of the station and fieldwork nomenclature (e.g., what constitutes a "leg"). Figure A1 in the Appendix is very clear and useful, but it should be explicitly describe in the main text. A brief* *summary explaining what a "leg" represents, how many legs were conducted, and how they relate to the overall sampling plan would help guide the reader"*

The definition of a "leg" (the observation period between the deployment and recovery of instruments), as well as the station nomenclature, has been clarified in the revised manuscript (lines 108–113). We also followed the recommendation of Reviewer #1 by adding Figure A1 in the main text (merged with Figure 3).

Comment #4 of Reviewer #1: *"Lines 106–165 : One suggestion is to replace the long-form URL with a shortened or embedded link for readability. The repeated "last accessed: 7 November 2025" note was slightly confusing, as it was unclear whether this referred to the data itself or the webpage."*

As stated in the ESSD author guidelines, URLs must be spelled out in full rather than embedded as hyperlinks in text. The mention "last accessed: 7 November 2025" referred to the website page, we clarified this in the new version.

Comment #5 of Reviewer #1: "*Line 160-163 A brief description of how the CTD profiles were collected would be helpful. Specifically, clarifying whether the CTD was hand-lowered, the approximate lowering speed, and whether any stabilization or stopping protocol was used would provide useful context for data quality and interpretation.*"

The CTD was hand-lowered from the boat. It was programmed to begin recording 10 seconds after activation, allowing sufficient time for submersion. Once submerged, the instrument was held at a depth of approximately 2 m for about 1 minute, briefly returned to the near-surface, and then lowered directly to the lagoon bottom at a constant descent rate of approximately 10 m min^{-1}. Once the bottom was reached, the CTD was immediately brought back to the surface, up to the vessel, at a faster speed (20 - 40 m min^{-1}). Only profiles acquired during the descent were retained in the NetCDF dataset made available. These clarifications about the CTD cast procedure have been added to the manuscript lines 172-175.

Comment #6 of Reviewer #1: *"Lines 254–258 It would be helpful to briefly state whether salinity spiking was observed in this dataset and, if so, how it was identified and handled during processing."*

We thank the reviewer for this comment. Based on the acquisition protocol, the applied data processing workflow (including conversion to .cnv, low-pass filtering, sensor alignment, derivation of secondary parameters, and vertical bin averaging at 0.5 m), and the high quality of the SBE19Plus V2 CTD, no salinity spikes were observed in the CTD casts. We clarified this in the new version (lines 271-272).

Comment #7 of Reviewer #1: *"Figure 5 and Associated Text (Lines 293–302): There appears to be a possible mismatch between the color scheme described in the text and the currents shown in Figure 5. The text suggests that surface currents are directed northwestward (red) and bottom currents southeastward, consistent with expected pressure gradients. However, this pattern is not immediately clear in the top or middle panel, and the current intensification during wind reversal appears to be oriented northeastward rather than in the opposite direction described as a "current reversal." (might be reading this wrong). This may be a misunderstanding of the reference frame or color scheme, but adding directional arrows or a small schematic indicating flow orientation* *along the primary axis would greatly reduce ambiguity and help readers interpret the figure correctly.”*

Answer to comment #7 of Reviewer #1:

We thank the reviewer for this comment. Section 6.2 has been thoroughly revised to clarify the points raised and improve the interpretation of Figure 5. In addition, the caption of Figure 5 has been updated to better explain the projection framework and associated sign conventions. We hope that the revised version provides a clearer description.

Comment #8 of Reviewer #1: *“Lines 314–315 A brief definition of what constitutes Category I and Category II events is needed here. Even a short descriptive phrase would help readers unfamiliar with the classification fully appreciate the results.”*

We agree with Reviewer #1 that providing the definition of MHW categories would help readers unfamiliar with the classification. MHW categories are derived from the event intensity, following the standard methodology proposed by Hobday et al. (2016). Briefly, intensity categories are based on the difference between the SST 90th percentile and the SST climatology for a given day of the year. If, on a given day, the SST reaches the value of SST climatology plus the previous difference, it is a MHW of category I. If the SST reaches the SST climatology plus two times the difference, it is a MHW of category II. And so on. We added these details in the new version of the datapaper lines 337-340 and the following reference has been added to the References section.

Hobday AJ, Alexander LV, Perkins SE, Smale DA, Staub SC, Oliver ECJ, Benthuysen JA, Burrows MT, Donat MG, Feng M, Holbrook NJ, Moore PJ, Scannell HA, Sen Gupta A, Wernberg T (2016). A hierarchical approach to defining marine heatwaves. Prog Oceanogr 141, 227-238. https://doi.org/10.1016/j.pocean.2015.12.014

Comment #9 of Reviewer #1: *“Lines 338–340 The observed difference in stratification is intriguing. If there is any speculation of what created this difference. A short comment would add valuable context and highlight the significance of this result.”*

We acknowledge that this point requires further explanation. CTD profiles network captured on 17 October 2023 shows quite marked vertical stratification, due to low wind before and during the period of measurement. In the shallow Northwest basin, a thermocline and a halocline were well formed, with surface water (~0-5 m depth) warmer and less saline than deeper water. Although similar patterns were observed at some stations in the intermediate basin, stations located closer to the hoa exhibited an inverted temperature profile, with lower temperatures in the surface layer, associated with a pronounced salinity stratification (nearly 0.6 PSU less in surface water than bottom values). These differences are explained by the inflow of fresher and less saline water than the lagoon through the hoa, which primarily affects the surface layer at these stations.During the 2024 MHW event (29 March 2024), water columns displayed limited vertical stratification in terms of both temperature and salinity, probably because of higher wind speed at the time of measurements. Spatial differences nevertheless persisted between basins (highest temperature and salinity in the northwestern basin), and lowest temperatures were found at immediate proximity of hoa (e.g M40, M15, 341 Fig. 3.B) in the intermediate basin. We added these details in the new version of the datapaper lines 364-374

<u>Answer to Reviewer #2 - Camille Grimaldi</u>

<u>Comment #1 of Reviewer #2:</u> "*Abstract : The abstract would benefit from being reframed around clear research gap or objectives. As currently written, it emphasizes the comprehensive documentation of an MHW event in a semi-enclosed lagoon, but this aspect is only briefly addressed in the manuscript (L316–325). The abstract should more clearly highlight the key results and their significance; at present, it is difficult to identify the main findings of the study.*"

The paper has been submitted to ESSD as a "Data description article". As described on the ESSD website (https://www.earth-system-science-data.net/about/manuscript_types.html), "the focus of this manuscript type is quality assurance and trust-building through assessment of the presented data". It is also clearly mentioned that "Extensive analysis and interpretation of data is considered out of scope". The whole manuscript has been written in the spirit of a "Data description article", and follows the guidelines provided by ESSD for this type of manuscript. The abstract, which should reflect the content of the manuscript, therefore also follows this guideline.

<u>Comment #2 of Reviewer #2 :</u> "*Introduction : The introduction states that the manuscript aims to "characterize the spatial and temporal variability in local temperature regimes and understand their drivers" (L57–58). As it stands, it is unclear whether this objective has been fully achieved.*"

The introduction (L57-58) states that "characterizing the spatial and temporal variability of local temperature regimes, and understanding their drivers is essential, notably with intensifying climate extremes". It does not state that this is the aim of the manuscript itself. Although the acquisition of data was performed in this ultimate objective, the aim of this "Data description article" is to present the data, not the results (extensive analysis and interpretation of data is out of scope for this ESSD manuscript type). In fact, the introduction states (L60-61) that "This study presents a rare and comprehensive dataset of multi-year monitoring of temperature and sea level inside the semi-closed lagoon of Reao", which has been fully achieved and is congruent with the scope of a Data description article.

<u>Comment #3 of Reviewer #2 :</u> "*The introduction would benefit from a clearer description of the specific MHW being studied, including its intensity, duration, and how it compares to previous heatwave events affecting Reao Atoll. If this was the most prolonged or intense event on record, additional context is needed regarding earlier events, their drivers, and their impacts. This background is essential for framing the novelty and relevance of the 2023–2024 MHW and for justifying the focus on potential drivers.*"

We agree with Reviewer 2 that some details about past MHW that affected Reao's lagoon could be provided in introduction. Note that the characterization of MHW (number, intensity, and duration of events) that affected Reao's lagoon and their impact on giant clam (bleaching and mortality) is under publication in Coral Reefs (Van Wynsberge et al., in revision). This modelling work highlighted that Reao's lagoon experienced more than 20 MHW over the past decade, with strongest events that occurred in March-April 2016 (duration: 40 days; maximum intensity: 1.8°C above the climatology), in January-February 2017 (38 days; 1.8°C), and in February-March 2024 (41 days; 2.4°C). Using the model established in Van Wynsberge et al. (in revision) to hindcast MHW over a longer period of time (from 1993 to 2024) also highlighted that the 2024 MHW was the strongest in intensity and duration over this time frame. In terms of impact on giant clams, the 2024 heatwave induced lower bleaching than in 2016 despite an exposure to higher accumulated temperature stress levels, which might possibly be explained by the fact that giant clams' bleaching thermal threshold had increased after 2016 (Van Wynsberge et al., in revision). Note that lagoon hydrodynamics could not be characterised by in situ data before or during the 2016 nor during the 2017 events, which make the dataset acquired during the 2024 event very valuable. We now provide these details in the introduction section (lines 62-65).

Comment #4 of Reviewer #2: "*Methods : The Methods section is very long, yet several key pieces of information are missing. Much of the detailed instrument description (currently spanning several pages) could be condensed into a summary table, with standard deployment details moved to the Supplementary Material. I recommend substantially condensing this section, potentially to a single page of essential information, while adding clarity where needed.*"

See our answer to comment #1 of Reviewer #2. Because quality assurance and trust-building, not extensive analysis and interpretation of data, should be the focus of "Data description articles" in ESSD, we believe it is strongly justified to present these methodological aspects as comprehensively as we did in the previous version of the manuscript. We are also confident in the fact that these aspects should be presented in the main text, and not as Supplementary Material.

Comment #5 of Reviewer #2: "*Consider adding/merging Figure A1 and Figure 3, summarizing instrument deployments and timing, including the CTD casts.*"

Answer to comment #5 of Reviewer #2: We thank the reviewer for pointing this out. Figure A1 has been updated to summarize instrument deployments and timing now including the CTD casts. And, to provide an overall view of the sampling strategy, Figure 3 and A1 have been combined into a single figure.

Comment #6 of Reviewer #2: "*Describe the bathymetry dataset used in Figure 1.*"

Answer to comment #6 of Reviewer #2: Although not strictly necessary, the bathymetry was displayed here in the Figure as a background map because we think it helps the reader in visualising the three lagoon basins and make the hydrodynamic data and figures presented after easier to understand (e.g. bathymetry explains the differences of maximum depth in CTD profiles in Fig. 7). However, generating the satellite derived bathymetry map required a modelling step, whose description is out of the scope of a Data description article. In this Data description article, we aim to describe the hydrodynamic data (temperature, salinity, currents, water level) of the lagoon acquired before and during the MHW of 2024, not to describe the model development which enabled the bathymetric map to be generated. More information about this bathymetric map is nevertheless available at the data access link (https://doi.org/10.17882/108293) and the associated reference link (https://archimer.ifremer.fr/doc/00971/108285/), which is now provided in the new version of the manuscript in the legend of Figure 1 and reference list.

Comment #7 of Reviewer #2: "*Specify the sources of wind, wave, SST and tidal (FES) datasets, including where they were extracted from.*"

Winds, waves and SST are extracted from ERA5 reanalysis (https://cds.climate.copernicus.eu/datasets/reanalysis-era5-single-levels?tab=overview ; Hersbachet al., 2020). Tidal harmonics were extracted from the Finite Element Solution oceanographic model, version 2012 (Stammer et al., 2014), and tidal recomposition was performed using the first 8 harmonics. Winds and SST data were extracted at the grid point closest to the center of the atoll (18.5°S, 136.5°W), while incident waves and tidal harmonics were extracted at an oceanic grid point at the vicinity of the southern rim of Reao (18.75°S, 136.6°W).

Note that the wind, waves, SST and tidal solution data sources were already cited in the captions of Figures 4, 5 and 6. We also included the location of the extraction point. However, we acknowledge that the references associated were lacking and agree with Reviewer #2 that this information is worth mentioning in the main text. We now provide this information and references in the main text of the revised version, in the "6- Overview of observation" section. We also remind that this external sources of wind, wave, sea surface temperature (SST) and tide data have been used in this datapaper and confronted with our temperature, water level and current data in order to enhance trust-building in our dataset, not to provide an extensive analysis and interpretation of data.

Hersbach, H., Bell, B., Berrisford, P., Hirahara, S., Horányi, A., Muñoz-Sabater, J., ... & Thépaut, J. N. (2020). The ERA5 global reanalysis. *Quarterly journal of the royal meteorological society*, *146*(730), 1999-2049.

Stammer, D., Ray, R. D., Andersen, O. B., Arbic, B. K., Bosch, W., Carrere, L., ... & Yi, Y. (2014). Accuracy assessment of global barotropic ocean tide models. *Reviews of geophysics*, *52*(3), 243-282.

Comment #8 of Reviewer #2: "*Explain how inflow and outflow are calculated. Were current velocities rotated to align with reef pass orientations?*"

For each instrumented hoa, scatter plots of current speed (y-axis) as function of current directions (x-axis) were plotted using each observational time step (every 1 min for Lowell inclinometers and every 20 min for Aquadopp currentmeters). These scatter plots were similar to two gaussians, centered on the direction of inflow and outflow, respectively. The direction for which the current speed reached its maximum was considered as the main direction of the hoa. We then defined inflow currents as currents entering the hoa with the main direction ± 90°. Other currents were characterised as outflows. We now precise these details in the new version of the manuscript (lines 289-294).

Comment #9 of Reviewer #2: "*Explain the MHW analysis presented in Figure 6 was done?*"

The MHW detection presented in Figure 6 followed Hobday et al. 2016 method and was applied to SST time series at T2 re-constructed over the period 1993-2024 thanks to a statistical model. The method used to re-construct such time series is described in a publication in Coral Reefs (Van Wynsberge et al., in revision), and is not in the scope of the datapaper. Yet, we can mention that the MHW detection was applied to these re-constructed time series following Hobday et al. 2016 method over 1993-2024, without any detrending of time series and using the period 1993-2022 as climatology (30 years). The results of this detection are illustrated in Figure 6, for the MHWs detected during the instrumented period. The shaded areas thus correspond to MHWs detected with re-constructed SST time series (which are not shown here), with in situ data illustrated in Figure 6. We added this information in the new version in Figure 6's caption.

Comment #10 of Reviewer #2: "*Results. Important background context is missing. The hydrodynamics of the atoll are described primarily using a 5-day subset of data, despite the availability of a much longer and more comprehensive dataset. The rationale for this choice needs to be more clearly justified.*"

The purpose of this ESSD data paper is not to provide a comprehensive analysis of the atoll hydrodynamics, but to describe the dataset, its acquisition, processing, quality control, and potential applications. The 5-day subset (for exchanges on the atoll rim) and 7-day subset (for the circulation inside the lagoon) were selected to provide representative periods illustrating some hydrodynamic features of the atoll. The full dataset spans a much longer period and is made entirely available for future in-depth analyses, which are beyond the scope of this data paper. The complete time series is available in the public repository and can be used for detailed hydrodynamic or process-based studies.

Comment #11 of Reviewer #2: "*Results. Subsection titles could be improved to better guide the reader. For example, Section 6.1 appears to characterize either non-MHW conditions or maximum flushing conditions, but this is not made explicit.*"

We thank the reviewer for this comment. Once again, the sections presented (including Section 6.1) are intended as illustrative examples of processes captured by the dataset (e.g., flushing conditions, circulation patterns), and not as a comprehensive characterization of either non-MHW or maximum flushing conditions. We therefore believe that the section titles can remain as they are, as illustrative examples of:

1. exchanges across the reef rim and lagoon water-level variability;
2. current profiles measured during an episode of variable winds;
3. a multi-year overview of temperature variability, including a focus on the major 2024 event.

Comment #12 of Reviewer #2: "*Results.Given the title of the manuscript, a more thorough description of temperature dynamics before and during the MHW is expected. Currently, the analysis relies largely on a single average temperature difference between SST and one lagoon site.*"

Here again, as explained in our previous responses, although the title of the article refers to marine heatwaves, the objective of a data paper is not to provide an in-depth analysis of the observed dynamics or to interpret them, but rather to illustrate the potential of this dataset for future use in dedicated scientific studies.

Comment #13 of Reviewer #2: "*The conclusions drawn at the end of Section 6.3 appear to be over-interpreted given the data presented (see detailed comments below).*"

We are not entirely sure what Reviewer #2 is referring to. We assume this comment refers to these 2 sentences: "Overall, during this unprecedented event, the lagoon alternated between high-level and ranoa phases, and winds were blowing mostly from E/SE. Unexpectedly, oceanic (exacerbated ocean-lagoon exchanges during certain periods such as the end of February 2024) and wind forcings seemed to have only "marginally" affected the high temperature trends suggesting that exceptionally strong solar fluxes, likely associated with anomalously warm air temperatures, were the primary contributing factors." Some further analyses will be conducted on our datasetet in a research paper to analyze in-depth the processes involved in this exceptional event. Text has been modified accordingly.

Comment #14 of Reviewer #2: "*Overall, the dataset provides an excellent opportunity to place the MHW in the context of background hydrodynamic and thermal variability at the atoll scale, but this potential is not yet fully realized.*"

Answer to comment #14 of Reviewer #2: We appreciate that Reviewer #2 recognize the excellent opportunity of our dataset to place the MHW in the context of background hydrodynamic and thermal variability at the atoll scale. Highlighting the potential of this dataset to be used for such purposes is precisely the objective of this Data description article. Please note, however, that extensive analysis and interpretation of data is considered out of scope by ESSD for this manuscript type. See also our answer to Comment #1 of Reviewer #2.

Comment #15 of Reviewer #2: "*The results and discussion sections are combined, but the discussion does not sufficiently place the findings in a broader scientific context. Instead, it relies heavily on self-citation, while several relevant references appear to be missing. The discussion would benefit from a more balanced engagement with the wider literature.*" Reviewer #2 provides additional references on atoll thermodynamics.

Answer to comment #15 of Reviewer #2: Because this manuscript is submitted as a datapaper, the structure of the manuscript is not intended to follow the standard structures of the original research paper (methods/results/discussion). References provided in the last version were provided to support trust-building. The chosen references were provided because they focus on Reao or neighbouring atolls that are similar in terms of geomorphology. The four references suggested by Reviewer #2 focus on reefs whose geomorphology is very different from Reao, with atoll rims composed of wide areas of submerged reefs allowing ocean-lagoon exchanges. In contrast, ocean-lagoon exchanges are restricted to several hoa in Reao. These references should therefore be used with caution to support trust-building in our dataset. However, all references provided by Reviewer #2 report variability in temperature within the lagoon, which is a pattern also found in Reao. We now cite these references to support this point in the revised version.

Rogers, J. S., Monismith, S. G., Koweek, D. A., Torres, W. I., & Dunbar, R. B. (2016). Thermodynamics and hydrodynamics in an atoll reef system and their influence on coral cover. *Limnology and oceanography*, *61*(6), 2191-2206.

Green, R. H., Lowe, R. J., Buckley, M. L., Foster, T., & Gilmour, J. P. (2019). Physical mechanisms influencing localized patterns of temperature variability and coral bleaching within a system of reef atolls. *Coral Reefs*, *38*(4), 759-771.

Grimaldi, C. M., Lowe, R. J., Benthuysen, J. A., Cuttler, M. V. W., Green, R. H., & Gilmour, J. P. (2023). Hydrodynamic and atmospheric drivers create distinct thermal environments within a coral reef atoll. *Coral Reefs*, *42*(3), 693-706.

Reid, E. C., Lentz, S. J., DeCarlo, T. M., Cohen, A. L., & Davis, K. A. (2020). Physical processes determine spatial structure in water temperature and residence time on a wide reef flat. *Journal of Geophysical Research: Oceans*, *125*(12), e2020JC016543.

Comment #16 of Reviewer #2: "*the manuscript would be strengthened by addressing potential ecological implications of the observed MHW, if any are known or can be inferred.*"

Answer to comment #16 of Reviewer #2: The ecological implications of MHW in Reao and Tuamotu archipelago were already mentioned in the introduction section. The detailed report of *T. maxima* bleaching rates are out of the scope of this datapaper, but they made the object of a specific scientific article (Van Wynsberge et al. in press). In the introduction, the reader is referred to this publication for further information on ecological implications of MHW in Reao, and we now mention in section 6.3 "*observed thermal patterns with a focus on the 2024 MHW event*" that the Category III MHW in 2024 resulted in mass bleaching of giant clams.

Comment #17 of Reviewer #2: "*please check carefully for typographical and formatting errors throughout the manuscript (e.g., L316, L340).*"

Typographical and formatting errors have been carefully checked and corrected throughout the manuscript.

Comment #18 of Reviewer #2: "*L33: Please define what is meant by "shallow."*"

A clarification has been added to better define the term "shallow" for the case of hoa, approximately 1-2m deep.

Comment #19 of Reviewer #2: "*L39: Do you mean "regional" instead of "external"?*"

Following reviewer #2 suggestion, we replaced external by regional which seems more adapted.

Comment #20 of Reviewer #2: "*L78: Consider indicating "permanent" for readers unfamiliar with such systems. Please also indicate average island elevation above sea level. Could large swell events combined with spring tides overtop the reef? This is important context.*"

We thank Reviewer #2 for this important contextual point. For the northern rim, we have added "fully & permanently" emerged. We unfortunately do not have access to data that would allow us to provide the average elevation of the land on this atoll, but it is estimated to be at a maximum of a few meters (~ 2-5m). Although a significant part of the northern rim can be submerged during extreme floods, water can never cross this northern rim. For the southern rim which is alternatively composed of land (motu) and shallow shanels (hoa), large swell events combined with spring tides can overtop the reef and fill hoa with water. Lagoon aperture (defined as the ratio of the sum of the widths of all functional channels to the atoll perimeter) ranges from 1% to 13% depending on water level (Andréfouët et al., 2022). We now precise this more clearly in the *study site* section.

Comment #21 of Reviewer #2: "*L89: Ensure correct formatting of m s^{-1} (or use m/s), add °N, and correct subscripts for Hs and Tp.*"

Correct formatting (*m s^{-1})* has been applied throughout the manuscript.

Comment #22 of Reviewer #2: "*Figure 1: Please clarify what is meant by "most/least open" hoa. Is this related to depth, width, or another metric?*"

We thank Reviewer 2 for requesting this clarification. This part of text corresponded to a previous version of Figure 1 and has now been revised as follows: "C) Zoom on the southern rim and its hoa. Numbers indicate the 5 main hoa that were selected for instrumentation. Hoa n°3 (locally called Tarahaero), located along the central section of the southern rim, is associated with the highest ocean-lagoon exchange efficiency, whereas hoa n°1 (locally called Tahunamua), located along the southern section of the southern rim, is associated with the lowest."

Comment #23 of Reviewer #2: "*L95: This is important context, does the lack of northern reef passes imply higher permeability elsewhere? Please also describe the tidal regime and ranges.*"

In the sense used here, permeability refers to the degree of opening of Reao Atoll toward the ocean. In our view, the absence of a reef passes across the northern rim does not imply greater permeability elsewhere around the atoll rim. However, no data can support this hypothesis (hydrodynamic modeling and simulations would be necessary to test this hypothesis, which is out of the scope of this datapaper), thus we choose not to mention it in the main text.

At Reao Atoll, ocean–lagoon exchanges occur exclusively along the southern rim. In the open ocean, using FES2012 global tide solution, the approximate tidal range is 0,93m (2 * (M2_amplitude + S2_amplitude + K1_amplitude + O1_amplitude) south of Reao. The oceanic tidal regime is semi-diurnal (Form factor = 0.058). Within the lagoon, tidal variability ranges from a complete absence of tidal signal during Ranoa phases (when no exchanges between ocean and lagoon) to only a few centimeters of tidal amplitude (maximum observed 25 cm) when lagoon water levels are particularly high. We agree with Reviewer #2 that offshore tidal regime is an important context and has now been added in the *study site* section. The lagoon tide is not context information, but is direct observation based on the dataset presented in this datapaper. We have therefore added this information in section 6.1 *Ocean-lagoon exchanges and lagoon level*.

Comment #24 of Reviewer #2: "*L114–122: This information is fairly standard and could be moved to the Supplementary Material*"

See our answer to comment #1 and #3 of Reviewer #2. Because quality assurance and trust-building should be the focus of "Data description articles" in ESSD, we believe it is strongly justified to present these methodological aspects as comprehensively as we did in the previous version of the manuscript. We are also confident in the fact that these aspects should be presented in the main text, and not as Supplementary Material.

Comment #25 of Reviewer #2: "*Figure 2: Panel (A) does not appear to show an SBE56. Panel (B) is a Nortek Aquadopp, and panels (D) and (E) appear to be RDI ADCP Sentinels.*"

Panel A shows an SBE56 logger (or a RBR Duet) but inside its PVC protective tube. Legend has been revised accordingly. Panel C displays a photo of a lowell inclinometer, whereas panel D is a RDI ADCP Sentinel mooring. There is actually no panel E.

Comment #26 of Reviewer #2: "*L173: Define or avoid acronyms*"

The acronym SNO (*National Observation Service*) has now been modified in its first occurrence in the manuscript.

Comment #27 of Reviewer #2: "*Sections 3–5: These sections are very long and could be substantially condensed. Consider moving to supplementary.*"

See our answer to comment #1 and #4 and #24 of Reviewer #2.

Comment #28 of Reviewer #2: "*Figure 1: Add "(A)" to the main panel, change "Ouest" to "West" on y-axis labels, and make colorscale discrete.*"

"A" was already apparent to the main panel (see lower-right corner), but following the comment of Reviewer #2, we moved it to the upper-left corner for better visibility. "O" was now changed to "W" in the axis labels. For the continuous versus discrete nature of the colorscale, we appreciate the suggestion of Reviewer #2 but choose to keep a continuous colorscale, since bathymetry is a continuous variable.

Comment #29 of Reviewer #2: "*246: Were currents rotated to indicate inflow/outflow?*"

Currents observed in hoa (from Lowell or Aquadopp sensors) were not rotated into a specific along-pass (hoa) coordinate system during post-processing. As stated in the "Current Meters" paragraph (lines 246-249), all measurements were first expressed in a common reference frame (East-North-Up). Inflow and outflow were then determined using methodology described in response to comment #8 by reviewer #2.

Comment #30 of Reviewer #2: "*L261: Why focus on a 5-day window? Please define what constitutes an "energetic swell event," including duration, mean Hs, Tp, and direction. How typical are those events?*"

Thanks for this comment. Please see precedent answers about the philosophy of an ESSD Datapaper. This 5-day subset was selected here to illustrate a period of strong exchanges between ocean and lagoon. The choice of 5 days was done for sake of clarity of Figure 4 (to see the infra-daily variability of exchanges in the hoa). We here acknowledge that the use of

"Energetic swell events" in this context is not that clear. The purpose was not really to describe the wave climate around Reao but to give an illustration of a typical period where oceanic waters entered the lagoon as well as lagoon waters were flushed out in the oceanic side. Nevertheless, this 5-day window represents a snapshot of the beginning of a swell event in Reao. This event lasted 9 days (from the 20th of October to the 29th of October), with maximum Hs of 2.75m (reached on the 23th of October) and Tp around 11 s and swell direction around 160° (South East swell). More information about French Polynesia wave climate can be found in other relevant papers such as: https://www.sciencedirect.com/science/article/pii/S0025326X20308699 ; https://www.sciencedirect.com/science/article/pii/S0921818123001674 ; https://www.sciencedirect.com/science/article/pii/S0025326X12002962#f0025

Comment #31 of Reviewer #2: "*L265: The offshore tidal regime has not yet been described. Did this event occur during spring or neap tides? Please indicate tidal ranges.*"

For information about offshore tidal regime, please refer to our answer to comment #23 of reviewer #2. This event occurred during spring tides, with an oceanic tidal range of approximately 1m, as shown in Figure 4. During neap tides, the oceanic tidal range can go down to 0.4m.

Comment #32 of Reviewer #2: "*L271–273: Would different behaviour be expected under these conditions?*"

Not necessarily. Drag-tilt current meters are significantly less expensive than Acoustic Doppler Current Profilers. Overall, we examined the congruence between Lowell and Aquadopp and Lowell data and found that, throughout the sampling period, both types of instruments provided similar measurements.

Comment #33 of Reviewer #2: "*L273–274: Faster and increased compared to what?*"

Overall, we meant that the lagoon fills faster than it drains. For sake of clarity we modified the manuscript as follows : Finally, the lagoon water level rises more rapidly during the filling phase than it falls during the drainage phase, with an increase in lagoon level exceeding 30 cm in less than 24 hours.

Comment #34 of Reviewer #2: "*L275: Currents at A2 appear consistent with increased flushing during large Hs, please clarify how they differ from other sites.*"

Answer to comment #34 of Reviewer #2: Text has been modified to clarify the difference in A2 currents compared to other hoa : intra-phase flow reversal within a single drainage or filling phase.

Comment #35 of Reviewer #2: "*Figure 4: Add units to the left axis. Replace "FES" with "offshore water level" (or equivalent). Modify the legend to "depth-averaged currents." Add a grid. Clarify what "projected Hs" means. Why is water level at T11 so flat?*"

Answer to comment #35 of Reviewer #2:

Figure 4 was modified as suggested. Yet, the legend was kept as 'current speed' and not replaced by 'depth averaged currents' since data from lowel and aquadopp represent currents at the bottom of the hoa, and are not depth averaged.

Hs projected means that the significant wave height Hs from ERA5 was projected along the axis of the atoll for which waves have the strongest impact on the water level. More precisely, Hs_projected=Hs*cos(wave_direction-optimal_wave_direction), with optimal_wave_direction = 210degrees. This 'optimal' direction was found by fitting a gaussian on the scatter plot of variations of water level inside the lagoon (y) in function of wave direction (x).

The water level appears flat on the figure because of the use of a second axis and of multiple panels in the figure. The panel associated to the water level thus appears very stretched, but it only represents a 5 day period. The level consequently appears flat, but it is a matter of representation. This issue couldn't really be improved due to the presence of multiple panels in the figure.

Comment #36 of Reviewer #2: "*L288: Do you mean current speed?*"

Answer to comment #36 of Reviewer #2: We thank the reviewer for pointing this out. Indeed, the term "currents" refers to the current velocities measured. We have modified the text accordingly.

Comment #37 of Reviewer #2: "*L292–295: Define wind slope and sea surface slope; both should be described in the Methods.*"

Answer to comment #37 of Reviewer #2: The text refers to a "wind-induced slope" (not "wind slope"). We clarified in Figure 5 caption the definition of surface slope. Globally, the sea surface slope here refers to the difference in water level between the two stations (ADCP B1 and ADCP B3). It is computed from sea level anomalies at each station (i.e., after removal of the temporal mean), so that it represents the time-varying component of the free-surface slope. Positive values indicate higher water levels at B1 relative to B3.

Comment #38 of Reviewer #2: "*L298: Please clarify what is meant by "overturning circulation." Given the year-long dataset, can the frequency of such events be quantified?*"

Answer to comment #38 of Reviewer #2: Wind-driven overturning circulation in an atoll lagoon is characterized by a "two-layer flow structure", where surface waters are advected downwind while deeper currents return upwind (cf Dumas et al., 2012). It would indeed be possible to quantify the frequency of such events over the ADCP observation period. However, this lies beyond the scope of the present data paper, whose primary objective is to describe the dataset and its potential future uses. Such analyses would be a valuable direction for future work.

Comment #39 of Reviewer #2: "*Figure 5: The "main axis" is referred to as "cross axis" in Figure 3. What does "slope" in panel (b) represent? Consider using contours for clarity.*"

Answer to comment #39 of Reviewer #2: Text in figure 3 has been modified to be consistent with the main axis terminology. Figure 5 caption has been modified (see answer to comment #37).

Comment #40 of Reviewer #2: "*L311: What does "cover a range of values" mean? The ERA dataset should be described in the Methods.*"

Answer to comment #40 of Reviewer #2: We agree that the initial wording was unclear. We have revised the text and replaced it with "a greater annual amplitude". To preserve the structure of Section 3 (Instruments, Methods and Deployments) and keep it focused on the observations conducted in Reao, we chose to include a description of ERA5 at the beginning of Section 6.

Comment #41 of Reviewer #2: "*L317: Which site is used for this average? It would be informative to compare across sites to assess spatial variability and controls (e.g., depth, proximity to hoa).*"

Answer to comment #41 of Reviewer #2: We agree with Reviewer #2 and now provide the values for all sensors deployed at 1 m depth during this period. It is indeed worth noting that differences in temperature during this MHW were found according to lagoon location, with higher temperature found at T10 in the shallow northern basin than in the deep wide basin at T4. We now provide this information in the new version.

Comment #42 of Reviewer #2: *"L322: High levels of what?"*

Answer to comment #42 of Reviewer #2: High level of water. We made the change in the new version.

Comment #43 of Reviewer #2: "*L323–325: The term "marginal" is unclear. Without even a simple heat budget, these conclusions are difficult to assess. Figure 6 suggests higher Hs during the MHW than during the earlier event, yet reduced inflow is inferred. Temperature variability is driven by both advection and air–sea heat fluxes, neither of which are sufficiently quantified. Consider estimating flushing rates and/or air–sea heat fluxes.*"

Answer to comment #43 of Reviewer #2: We agree that this assertion remains a hypothesis and that further research and analysis are needed to confirm it. Because quality assurance and trust-building, not extensive analysis and interpretation of data, should be the focus of "Data description articles" in ESSD, we now explicitly mention in the main text that further analyses are required to assess this hypothesis. We also replaced "marginally" by "little".

Comment #44 of Reviewer #2: "*Figure 6: Consider adding SST to the zoomed panel. Why does temperature appear flat during parts of the diurnal cycle?*"

Answer to comment #44 of Reviewer #2: We thank the reviewer for this suggestion. ERA5 SST has been added to the zoomed panel in the revised figure 6.
The apparent flattening of the diurnal signal during the night only applies to B2, which is at 22 m depth, and does not apply to sensors located at shallower depths (1m, 4m, and 7m; Fig. 6). The apparent flattening of the diurnal signal at 22 m depth during the night can be explained by higher wind speeds during the day than at night. Stronger daytime winds enhance vertical mixing, allowing the daily temperature cycle to reach deeper layers, whereas weaker nighttime winds limit this mixing. This hypothesis is supported by the fact that this apparent flattening of diurnal cycle during the night at B2 is not observed from 26th February to 4th March (Fig. 6), which is a period of continuously high wind speed, even during the night. We now precise this in the revised version.

Comment #45 of Reviewer #2: "*Figure 6: Is "depth" water depth or offshore tidal water level?*"

Answer to comment #45 of Reviewer #2: The "Depth" indicated on the y-axis label on the third vertical subplot of Figure 6, corresponds to the lagoon water depth. It represents the water column height (above T11) in the lagoon. The offshore tidal water level is plotted separately on the secondary y-axis for comparison. This clarification ("Water depth" instead of "Depth") has been made in the revised Figure 6.

Comment #46 of Reviewer #2: "*Figure 6: Add "A1" to indicate the measurement location.*"

Answer to comment #46 of Reviewer #2: We thank the reviewer for the suggestion. The measurement location "A1" has now been added to Figure 6 (fourth panel's legend).

Comment #47 of Reviewer #2: "*The legend states that the MHW was calculated from a statistical hindcast model—this requires further explanation in the Methods.*"

Answer to comment #47 of Reviewer #2: The methodology used to reconstruct this climatology is currently being published in an article in Coral Reefs (Van Wynsberge et al. in press). Briefly, we used the in-situ temperature time series to train and validate Generalized Additive Models (gam) that infer the daily minimum temperature and the diurnal temperature range, from oceanic and atmospheric regional data. We now added this in the new version (first paragraph of section 6 - Overview of observation. However, since the detailed description of the temperature model and its validation is outside the scope of a data description article (see ESSD guidelines), we stay brief and concise about this methodology and refer the reader to Van Wynsberge et al. (in press) for further details. See also our answer to comment #9 of Reviewer #2.

Comment #48 of Reviewer #2: "*L334: This section would benefit from a clearer introduction. Are you investigating whether the MHW affected the full water column or only surface waters? Is the CTD snapshot representative of the full 40-day MHW? Were additional profiles collected?*"

Answer to comment #48 of Reviewer #2: We thank the reviewer for this comment. We acknowledge that a clearer introduction could improve this section. However, we would like to clarify that the primary objective of this manuscript is to present and document the dataset, in line with the scope and recommendations of ESSD, rather than to provide an in-depth investigation of the underlying processes. These aspects, including the investigation of water column structure and the representativeness of the CTD snapshot, will be addressed in future dedicated studies based on this dataset.

END OF REPLIES