

Peer Review Report

Review Report on SPATIO-TEMPORAL DYNAMICS OF SEDIMENT TRANSPORT PATHWAYS: SAND APRON BARS AND ISLANDS OF TOKELAU AND KIRIBATI, CENTRAL PACIFIC

Original Research, Earth Sci. Syst. Soc.

Reviewer: Stephanie Duce

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EVALUATION

Q 1 Please summarize the main findings of the study.

This paper provides a detailed description of the geomorphic changes in many islands and other sedimentary reef top features (e.g., sand aprons and bars) over monthly to decadal timescales at the atolls of Nukunonu and Atafu in Tokelau and Abemama, Aranuka and Abaiang in Kiribati. It also provides a valuable summary of the wind and wave regimes in the area based on broadscale hydrodynamic models. Based on the geomorphic changes described and displayed in the many visually appealing figures, the authors discuss the conditions required to form sedimentary bars and the influence of physical controls (waves and currents) on their dynamics. They also discuss their influence on sediment transport processes and their relationship to islands. They describe the likely oceanic drivers of the geomorphic changes teasing apart factors that operate across different temporal and spatial scales. The key finding is that atoll islands and sedimentary features are complex and dynamic across multiple temporal and spatial scales and detailed, wholistic, site specific studies are required to fully understand them.

Q 2 Please highlight the limitations and strengths.

This paper's strength is that it is based on meticulous shoreline analysis at many sites over a broad range of timescales. An unavoidable limitation is that it relies on available satellite imagery (with all the limitations that presents) and coarse resolution wave models to provide details about the hydrodynamic conditions.

Q 3 Please comment on the methods, results and data interpretation. If there are any objective errors, or if the conclusions are not supported, you should detail your concerns.

The paper provides a good justification of the remote sensing approach used (which is a well-established technique) and a comprehensive acknowledgement of the limitations. I do not have any concerns. It would be great to see the author's attempt to use their detailed and site specific findings across their many sites to draw out more general implications that could be used to help inform likely trajectories of island dynamics broadly. This would be extremely valuable to the planning and management of atoll islands.

Q 4 Check List

Is the English language of sufficient quality?

Yes.

Is the quality of the figures and tables satisfactory?

Yes.

Does the reference list cover the relevant literature adequately and in an unbiased manner?

Yes.

Are the statistical methods valid and correctly applied? (e.g. sample size, choice of test)

Yes.

If relevant, are the methods sufficiently documented to allow replication studies?

Yes.

Are the data underlying the study available in either the article, supplement, or deposited in a repository? (Sequence/expression data, protein/molecule characterizations, annotations, and taxonomy data are required to be deposited in public repositories prior to publication)

Yes.

Does the study adhere to ethical standards including ethics committee approval and consent procedure?

Not Applicable.

If relevant, have standard biosecurity and institutional safety procedures been adhered to?

Not Applicable.

Q 5 Please provide your detailed review report to the editor and authors (including any comments on the Q4 Check List):

Line 23 - Does the term "granular materials" refer to the sediments composing the bars and islands or the bars and islands themselves?

Lines 16 and 50 - "(or, conversely, the resilience)" I don't know if resilience is the correct word in this context. Here it is being juxtaposed against "morphologic change" so perhaps stability would be a better word. Something can be resilient but change a lot, indeed in the case of reef islands the ability to change maybe what makes them resilient.

Line 97 - I think this should refer to Figure 1D (noting that it is very hard to assess the figures as they have come to me out of order at the end of the manuscript and with no captions, beyond the authors' control)

Figure 1 - Beautiful figure! Perhaps zoom out slightly further so PNG and the east coast of QLD can be seen for context. Maybe it is just because I haven't received the captions but I think it would be good to add the atoll name to insets D-H for ease of interpretation.

Line 124 - I suggest the word experience rather than include

Figure 2C - Are the blue arrows referring to the years on the x-axis of panel B above? Do the years to the left represent the earliest images available? It is not possible to determine which year imagery was from although this figure shows generally the temporal frequency of recapture which may be enough.

Line 210 - typo: our focus is on

Line 238 - ... in a time-series of successive images...

Lines 278 and 279 - This says that "...infrequent storm events may be difficult to resolve." This is a bit vague. Is it possible to determine if any high energy events were experienced? Is it possible to determine their magnitude and when they occurred and for how long? Please explain in a little further what the limitations of this data source are.

Terminology section - great to have this! Can you include the term islet and how it is different to island?

Line 308 - I wasn't sure what "(see below)" is referring to. Is it possible to add a reference to a section or figure number?

Figure 3 caption - Add what the white arrows represent in 3B

Line 349 - six rather than 6

Line 348 - Change subsection heading to Nukunonu Atoll Geomorphic Change or something similar that is slightly more descriptive.

Line 355 - add reference back to Figure 1E

Lines 365-373 - To be honest I found it difficult to see the patterns you described, or at least difficult to be sure I was looking at the right thing. Is it possible to add arrows or in some way provide a little more indication on the figure which bar/delta you're talking about? Maybe digitizing it over the imagery?

Line 378 - The reference to Figure 2 is incorrect. Also in Line 403.

Figure 5 Caption - Add what the yellow triangles are for (at first I thought they were north arrows!)

Line 404 - Phalanges is a new word for me in this context. What are you referring to? Perhaps add an arrow on the figure to avoid confusion.

Line 415 and 417 - add reference to the relevant panel in Figure 8. Maybe adding some more zoomed in insets would make the bar migration clearer.

Line 419 - remove the word is

Line 420 - maybe re-word for clarity.

Line 425 - four. Ensure numbers less than 10 are written as text.

Line 426 - Add how much area is represented by the islands gained.

Line 427 - Clarify what you mean by "their numbers". Is 59 the total number of islands in 1970?

Line 449 - expand the first sentence, e.g. "... nature of geomorphic changes between 1970 and 2020."

Line 451 - say when it passed through with respect to the imagery.

I would be interested to know what the nature of the vegetation is on the islets. It looks quite well developed but seems to grow quite quickly. Maybe a statement about this could be included in the methods.

Line 480 - I don't think the last sentence is needed as the wind waves were just described.

Line 514 - ... bars tend to migrate lagoonward

Line 1081 - What is meant by a sediment cover? Maybe a missing word?

Line 549 - I can't see any Planet data in Figure 16. This text doesn't seem to match Figure 16. The red dashed lines in Figure 16-A-D are very difficult to see.

Line 615 - "First, the net balance is influenced by lagoonward-directed energy, and any spatial changes." This sentence seems unfinished to me. And any spatial changes in what the energy, the bars?

Lines 623-625 - "Alternatively, in time, with lagoonward expansion of the reef sand apron (Purdy and Gischler 2005), a widened reef sand apron would include less pronounced on-platform transport capacity (Ortiz and Ashton, 2019; Rankey 2020)." I don't think "alternatively" make sense to start this sentence. Accumulation of sed where water depth increases in the lagoon is not an alternative to widening of the sand apron decreasing the transport capacity. I think this sentence requires slightly more explanation.

Line 627 - decrease capacity for what?

Line 666 - remove "are" from the end of the line

Line 706 - 707 - add that bars can also merge with/provide islands with sediment (e.g., in the cases you describe of Bike and Bikentakei)

As you have shown so well with this paper these islands and other reef top features are extremely diverse, complex and influenced by so many factors. Nevertheless, do you think it would be possible to define certain traits of islands that make them more or less dynamic or vulnerable to erosion or complete loss? I wonder if you can tease out of your findings inherent features of the islands that could be used to inform their likely future trajectory? This would be very valuable to those who live and depend on these atoll islands and any insights would be a valuable addition to the (already very interesting) Implications section. E.g. Does the presence of a large lagoonward sand delta behind an island infer greater stability? Does a smaller lagoon and therefore less lagoon wind waves and a less robust bar system mean the islands on that rim are more vulnerable? Do islands on the windward side during the austral summer and associated larger northerly waves tend to be more dynamic?

QUALITY ASSESSMENT

Q 6	Originality	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q 7	Rigor	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Q 8	Significance to the field	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
Q 9	Interest to a general audience	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Q 10	Quality of the writing	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Q 11	Overall quality of the study	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>