Dear Dr Orencio D Vinent, Associate Editor

After perusing the MS of "ESurf-2021-71-v1", I would like to submit my comments (**A** and **B** below) and recommendation (**C**) to assist you in reaching a decision on this MS.

Kind regards
Referee 1 (November 1, 2021)

Referee 1 comments on ESurf-2021-71-v1

A. General Comments

A1). This referee has perused "ESurf-2021-71-v1".

A2). This referee is familiar with the parabolic bay shape model that the authors adopted to derive analytical equations for estimating the location of the downdrift control point and the maximum indentation point within an eroded crenulate shoreline planform resulting from beach flanking at a natural groin. In the MS, the authors also validate their analytical solution with that from one-line numerical model and shoreline video monitoring data.

A3). Like no others (e.g., Balaji et al., 2017; etc.) that apply merely the end results of R/R_o (i.e., relative radius distance from the updrift control point to a point on the static planform) from the parabolic model, these authors have extended the applicability of the parabolic model by deriving new mathematical equations to analyze the spatial and temporal changes of the eroded bay shape. These equations are unique and useful for practical engineers to examining beach flanking shape — a phenomenon that has rarely been taught in the classrooms nor well documented in the literature, despite the erosion at downdrift end of seawalls and groins are common in field condition.

(A4). Application of their mathematical equation is straight forward, upon the input of long-term wave data (e.g., breaking wave height and angle, plus longshore sediment transport rate calculated from the input wave condition). This analytical approach will also benefit the readers of Earth Surface Dynamics and other coastal engineering journals on studying beach erosion at the downdrift end of a land-based coastal structure (e.g., seawall or groin).

A5). However, considering many research papers on beach erosion/change (e.g., using theoretical, analytical, experimental and numerical) have been published in learned journals and conference proceedings, the authors must state (in 1. Introduction) why they adopt an analytical approach based on the parabolic model for headland-bay beaches, rather by applying some of the existing methods available.

A6). The quality of this paper has to be improved first, before the method described in the MS could become available to the readers, by overcoming the shortcomings in the current version of the MS. These include redundant words/phrases, readability and grammar in English, title of the paper, overall re-organization/revision of the contents, sections and sub-sections, as well as limitation of the proposed approach.

B. Specific Comments

B1). The current title only partially reflects the contents of the paper, and analysis, results and comparison are loosely spread in various sections and sub-sections. Integration should be considered.

For example, please consider revising the title and sections headings, from

Original title: "The sagging shape of shoreline formed on downdrift side of the structures due to seasonal oblique wave incidence"

1. Introduction
2. Analysis of seasonal incident waves
   2.1 Analysis of NOAA data
   2.2 Analysis of seasonal longshore sediment transport
3. Parabolic bay shape equation
4. Analysis of shoreline change caused by oblique waves
5. Results of comparison with numerical model
   5.1 Shoreline change model
   5.2 Comparison between theoretical and numerical results
6. Results of comparison with Jeongdongjin monitoring data
7. Discussions: engineering countermeasures for mitigating seasonal erosion
8. Conclusions

To become:

Revised title: "Analytical approach for beach flanking downdrift of natural groin induced by winter high waves: Case study of Jeongdongj in Korea"

1. Introduction
2. Analytical approach
   2.1 Parabolic bay shape model
   2.2 Downdrift control point
   2.3 Maximum indentation point
3. NOAA's wave data for Jeongdongjin Beach
   3.1 NOAA's wave data (1979 – 2018)
   3.2 Seasonal longshore sediment transport
4. Results and comparison
   4.1 Analytical results versus numerical results
   4.2 Analytical results versus shoreline monitoring results
5. Discussions
6. Concluding Remarks

B2). Abstract [L9–21]: Note: "L" for Line number in the original MS.

Text written loosely. Please rewrite. Please also provide keywords.

B3). 1. Introduction [L23–78]

Pleas define "beach flanking" at the beginning of the Introduction and describe the effect of groin on sediment transport.

Please describe methods and/or models (numerical etc.) for analyzing beach erosion, and show references.

Please replace "sagging" by an appropriate word throughout.

[L23] "… the eastern coast of …" → "… the east coast of …"?

[L31] "… a group of natural (pillar) rocks…" → "…a cluster of natural pillar rocks…"

[L36] "Many studies….". Please provide references.

[L42] "the LST becomes static to maintain the shoreline planform…". Is "becomes static" correct?

[L44] "…for project planning." → "…for project planning (USACE, 2002)"

[L47] "To reproduce the shapes of shorelines in the laboratory," → please revise.

[L54] "…sagging shape…" →"…crenulate shape…"

[L56] "High resolution numerical models…". High resolution?

[L58–59] "These laboratory experiments … contributed to solving scientific equations about erosion by providing a similar sagging shape." What do you want to say? Please revise.

[L60] "… still lack reliable factor analysis." What is 'factor analysis'? Is this a proper technical term?

[L61] "This study developed a theoretical approach, …". Past tense? 'develop'?

[L61–64] Please use verbs in present tense.

[L64–65] "…formed frequently…"?, "…a group of…"?

[L61–78] "theoretical approach", "theoretical analysis" and "theoretical solutions" etc. → Use "analytical approach", "analysis" and "analytical solutions"?

Please avoid repeating the use of some expressions, such as "Section 2…." at the beginning of a sentence or "…in Section X." at the end of a sentence.

[L77] "… through a theoretical formula that facilitates factor analysis."?? Please revise/clarify.

B4). 2. Analysis of seasonal incidence waves [L79] → please change section heading.

2.1 Analysis of NOAA data [80–99] >>> Relocate this section to new Sect. 3.1?

[L86; L97; L99] "eastern coast" → "east coast"?

[L88] "…cause by the energy of the oblique high waves."? Please revise.

[L95–96] "…Average over 10 year-intervals..." → "…Averaged over every 10-year period…"?

[L97–98] "…local shoreline orientation in Gangwon-do was approximately N43°E." → "…local shoreline orientation at Jeongdongjin is in WN to SE direction, or N133°E."?

B5). 2.2 Analysis of seasonal longshore sediment transport [L100–160] >>> Relocate entire section to new Sect. 3.2?

[L101–146] All "Q_y", "P_y", "I_y" → "Q_l", "P_l", "I_l"? because subscript "y" is not defined, while subscript "*l*" is the most used term in textbook.

All the "sin" and "cos" should not be italicized.

[L118] "…the isobath of the seabed…" → "… seabed contours…"?

[L121] How to derive Eq. (5), reference?

[L133–138] Paragraph and the original Fig. 5 may be deleted?

[L151–152] "…high waves in winter… arrives from…N38°E-2.5° to N38°E +7.5°" >> but α_b = 10° is used in Figs. 16 and 20, Why?

B6). 3. Parabolic bay shape equation [L164–180] >>> Renumbered as new Sect. 2.1?

[L165] "… is provided by…" → "…defines the location of a point P (R, θ) on an embayed beach in static equilibrium by…"

[L166–180] All the "sin" and "cos" should not be italicized.

[L169] "…between the wave crest line (wave crest base line) and the line that passes through the …parallel to the shore base line" → "… between the wave crest base line (at the focus) and the tangential line at …on the shore base line;"

[L173] "…= 0 is satisfied to endure…" → "…= 1.0 (unity) to ensure…"

[L180] Eq. (9). Please show key interim steps that lead to this equation.

B7). 4. Analysis of shoreline change caused by oblique waves [L184–242] >>> Please re-number the section and change the heading as new Sect. 2.1 and Sect. 2.2

[L199] Pease show interim steps leading to Eq. (10).

[L199–237] All the "sin", "cos" and "cot" should not be italicized.

[L200–201] Unit "m3" and "m2" → superscript "m^3" and "m^2"

[L204] "Additionally, the time to reach static equilibrium, $t_{1/2}$, when x_c = L/2, is provided by" → "When static equilibrium is reached for x_c = L/2, the time".

[L206] "… wave power decreases…"??

[L210] Please show key interim steps leading to Eq. (13).

[L223–224] Please show key interim steps leading to Eqs. (14a) and (14b).

[L241–242] Please consider to replot Fig. 14 using "α_b" values of 0°, 2.5°, 5°, 7.5°, 10°, 15° and 20°, for better viewing and manual application.

B8). 5. Results of comparison with numerical model [L243–272] >>> Re-number section as new Sect. 4 and also change section heading as: Results and comparison

5.1 Shoreline change model [L244–256] >>> First part in new Sect. 4.1: Analytical results with numerical results

[L245–247] "…for the shoreline change model…sediment transport. It determines the shoreline change due to the difference in the LST along the coast within the active zone between the…" → "… for shoreline change…within a control volume due to the difference in LST across the active beach zone from berm…"

[L248 Eq. 20; L250; L253 Eq. 21; L255] → Replace all four "Q_y" by "Q_l", to be consistent with the LST in the existing Sect. 2.2 (or new Sect. 3.2)?

[L255–256] "…, we calculated or assigned the quantity of the LST at each grid. For example, we used Q_y= 0 for the eroding shoreline along the boundary of the groyne." → "…, the quantity of LST at each grid is calculated or assigned. For example, Q_l= 0 is assigned along the updrift groin where shoreline is receding."

B9). 5.2 Comparison between theoretical and numerical results [L257–272] >>> Second part in new Sect. 4.1: Analytical results with numerical results

[L269] "…gives x_c = -32.5 m, …" → "… gives y_E = - 32.5 m, …"?

[L270–272, Fig. 16] → Replace the "Offshore (m)" on the ordinate by "Cross-shore (m)"

B10). 6. Results of comparison with Jeongdongjin monitoring data [L 273–317] >>> Renumber Sect. and heading as in new Sect. 4.2: Analytical results versus shoreline monitoring results

[L274–276] "As shown in Fig. 17, where … to September 27th, 2013 to November 21st, 2016." >>> to be relocated after the new Fig. 10 at the end of new Sect. 3.1, and the two original sentences are revised as "Nearshore wave data were collected by an AWAC wave meter at a depth of 32.4 m to the south of Jeongdongjin Beach. From the data recorded over three years (27 September 2013 to 21 November 2016), the distribution of the annual mean wave direction is plotted (Fig. 11). As shown in Fig. 11, the prevailing wave direction was within -15° and +10° from the normal to the shoreline."

[L276–281] "As the distribution of the annual …obtaining fairly similar results." >> Suggestion: Please delete this part, as it may be irrelevant.

[L282–283] Original Fig. 17 to be re-numbered as new Fig. 9 and relocated under new Sect. 3.1.

[L283–284] Original Fig. 18: The shoreline with gama-groin and legend may be

deleted and just retain the little plot (called new Fig. 11) that shows the 'Distribution of the annual mean wave direction'.

[L285–286] Figure caption for the original Fig. 18 may be revised as:

"Fig. 11: Distribution of annual mean wave direction obtained from AWAC meter during 2013 – 2016."

[L287–290] "Shoreline monitoring in Korea…Project~~. The survey as also conducted~~ to promote…based on ~~scientific~~ data accumulation and analysis; at Jeongdongjin, a video monitoring program that used four cameras…, covering 3,280 m (97.3%) of the total shoreline within a total of 3,370 m (Fig. 19)" → "Shoreline monitoring in Korea…Project, aiming to promote…, based on data collection and analysis. At Jeongdongjin, a video monitoring program employing four cameras…, which covers 3,280 m (97.3%) of a total of shoreline about 3,370 m (Fig. 18)."

Question: Are the values of "3,280 m" and "3,370 m" correct??

Please double check the correctness of the length of shoreline cited in the original MS [L290], because the length of Jeongdongjin Beach is only about 800 m (see [L330] in the original MS).

[L293] "the continuously changing shoreline…" → "the spatial and temporal change in shoreline…"

[L295–303] Delete four "we"s in "we divided…", "we determined…", "we applied…" and 'we analyzed…"

[L294–296] "images, ~~we divided~~ the accumulative sum…every pixel by the number of captured images, from which ~~we determined~~ the coordinates…and changing shoreline." → "images, the cumulative sum…of every pixel is divided by the number of the images captured, to determine the coordinates… and changing shoreline."

[L297] "image, ~~we applied~~ the geometric transformation equation of Lippmann and Holman (1989), which transforms…" → "image, the geometric transformation equation given by Lippmann and Holman (1989) is applied to transform…"

[L299] The two "*tan*"s in Eq. (22a) should not be italicized.

[L303–304] "~~By using this method, we analyzed~~ the images of critical points taken twice a day from December 6 – 30, 2015, at Jeongdongjin Beach, as shown in Fig. 20, and compared them with the theoretical solution." → "Images of the critical points that were taken twice daily on Jeongdongjin Beach during December 6 – 30, 2015 are analyzed and compared with the analytical solution, as marked in Fig. 20."

[L307–308] "…, ~~our~~ results of the video…with those of the theoretical solution for

the…) that used the PBSE approximation,…" → "…, the results of video…with that of the analytical solution for the…) predicted by the analytical approach, …"

[L309–311] "…video monitoring data… in ~~November and~~ December 2015, while we obtained the theoretical results from the analysis of the NOAA wave data within the same period of time." → "…video monitoring data … in December 2015, while the analytical results are calculated applying the NOAA wave data within the same period."

B11). 6. Results of comparison with Jeongdongjin monitoring data [L318–333]

[L318–333] Please relocate this part to new Sect. 5: Discussions (1)

[L318] "Because our results exclude shoreline retreat because of cross-shore sediment transport, the theoretical solution…" → "Due to cross-shore sediment transport is excluded in the present study, the analytical solution…"

[L319–320] "…, both theoretical equations neglect…." → "…, the mathematical equations (i.e., Eqs. (22a) –(22b)) neglect…"

[L323] Eq. (23): "tan" should not be italicized.

[L324–325] "Here, the subscript 1 denotes the limiting value. Table 2 compares the variables x_c and x_c^l, obtained from …, respectively. If x_c obtained for each α_b is greater than x_c^l obtained a given y_G,"

→ "where subscript l denotes the limiting value. Variables x_c and x_c^l, obtained from …, respectively, are compared in Table 2. If x_c for each α_b is greater than x_c^l for a given y_G,"

[L327] "…the theoretical solution that the use of α_b = 10° for…" → "…the analytical solution that uses α_b = 10° for…"

B12). 7. Discussions [L334–350] >>> Renumber this section as new "5. Discussions"
[L334–350] Please relocate this part to new Sect. 5: Discussions (2)

- Please expand the Discussion section by including description on the limitations of the analytical approach presented in this study, as compared with other known theoretical methods and/or numerical models for predicting shoreline changes!

B13). 8. Conclusions [L351–376] >>> Renumber as new "6. Concluding remarks"
[L351–376] Please revise.

B14). References [L387–444]
Please double check the references, and remove redundant list.
>>> Please add the following references:

Bakker, W.T., 19??. The influence of longshore variation of the wave height on the littoral current. Report WWK71-19, Ministry of Public Works, The Netherlands.
Balaji, R., Kumar, S.S., Misra, A., 2017. Understanding the effects of seawall construction using a combination of analytical modelling and remote sensing techniques: Case study of Fansa, Gujarat, India. J. Ocean and Climate Systems 8 (3), 153–160.
Ozasa, H., Brampton, A.H., 1980. Mathematical modeling of beaches backed by seawalls. Coastal Eng. 4 (1), 47 –64.

C. Recommendation

C1). Major revision is required to improve the quality of this manuscript, prior to resubmittal.

***** END of REPORT ****