Final report of Referee 1 on revised ESurf-2021-71

A. General Comments

A1). This referee has perused the Marked Copy, called "esurf-2021-71-ATC1", for the revised MS of ESurf-2021-71, together with authors' response to both referees (RC1 and RC2) as documented in "esurf-2021-71-author_response-version1".

A2). In the authors' response file, it can be found that many similar comments were given by both referees, especially on the issues related to (1) English grammar and readability of the MS, (2) title of the paper, (3) overall organizational structures (sections and sub-sections) of the presentation, (4) confused mix of analyses, results and discussions within the same section, and (5) redundant figures, etc.

A3). From comparing the original MS with the Marked Copy that yields the Clean Copy "esurf-2021-71-manuscript-version3" — the final MS, this referee believes that the authors have satisfactorily revised the MS, based on the comments raised by both referees. The results show: (1) the revised title is adequate to reflect the context of the MS, (2) readability and grammar have improved, (3) overall structures of the presentation (especially sections and sub-sections) well revised and organized, (4) Abstract is rewritten, with revised Introduction and additional references, (5) clear separation is made between analysis and results, and (6) redundant figures are removed and new figures appended.

A4). In the MS, the authors have adopted the term "beach flanking" to replace the original term of "sagging shoreline". This referee agrees with the authors' statement that "… beach flanking, is common, yet rarely being taught in the classrooms nor well documented in the literature."

A5). On the application of the parabolic model to crenulate beaches, like no others that apply only the end results of R/R_o (i.e., relative radius distance from the updrift control point to a point on the static planform) of this model, these authors have extended its applicability by deriving new mathematical equations to analyze the spatial and temporal changes of the eroded bay shape. These equations are not only unique but also useful for practical engineers to examining the flanking beach shape. In addition, the results of this analytical approach, are validated by one-line numerical model and shoreline video monitoring data.

A6). Finally, the methodology presented in this paper will benefit the readers of the Earth Surface Dynamics and related journals published by Copernicus on studying beach flanking — beach erosion at the unprotected downdrift end of a land-based coastal structure (e.g., seawall or groin), which has occurred almost universally in the field but seldom discussed in the classroom.

B. Specific Comments

B1). Now, the revised **title** is adequate to reflect the contents of the paper, which deals with the phenomenon/problem associated with beach flanking, the method used, the analysis, results and comparison, as well its application to a specific site in Korea.

For example, the original title:

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

is revised as:

"Analytical approach for beach flanking downdrift of natural groin: Case study of Jeongdongjin Beach, Korea"

B2). The **overall structures** of this MS is now well re-organized.

For example, the original layout:

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

are now revised as:

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

B3). Definition of "beach flanking" and work on beach erosion downdrift of groins are made.

Definition of "beach flanking" is now given in Abstract [L 10–13] and Introduction [L 23– 31]. Methods for analyzing beach flanking are described [L 13–20; L 60–61], and work on the beach erosion downdrift of groins are cited [L 46–57] with relevant references (see **B8)** below).

B4). Aims of the paper are now clearly stated [L 72–74].

B5). During the revision, several tasks are also involved (cited in author's esurf-2021-71-ACsupplement):

(1) Renumber many equations and figures, resulting from overall reorganization of sections and sub-sections;

(2) Produce a new figure (i.e., new Fig. 1) and deleting four original figures (Figs. 5, 10, 17 and 19) and original Table 1, and

(3) Redraw or modify eight existing figures. For example, original Figs. 4, 7, 9, 14, 15, 18, 20 and 22 are now become new Figs. 11, 13, 4, 8, 15, 10, 17 and 19.

B6). Limitations of the analytical approach presented in this study is stated in the Discussion [L 315– 323].

B7). Concluding Remark is rewritten [L362–376]

B8). New References relevant to groins are appended [L390–481]. For example:

Bakker, W.T. (1968).
Bakker, W.T., Klein Breteler, E.H.J., Roos, A. (1970).
Balaji, R., Kumar, S.S., Misra, A. (2017).
Dean, R.G., Dalrymple, R.A. (2002).
Hanson, H., Kraus, N.C. (1989).
Headland, J., Smith, W.G., Kotulak, P., Alfageme, S. (2000).
Hsu, J.R.C., Uda, T., Silvester, R. (2000).
Kraus, N.C., McDougal, W.G. (1996).
Larson, M., Hanson, H., Kraus, N.C. (1997).
Lehnfelt, A., Svendsen, S.V. (1958).
Longuet-Higgins, M.S. (1970a; 1970b).
Magoon, O.T., Edge, B.L. (1978).
Price, W.A., Tomlinson, K.W. (1970).
Reeve, D., Chadwick, A., Fleming, C. (2012).
USACE (2002).

C. Recommendation

This referee wishes to strongly recommend that the revised MS be accepted as is for publication in the Earth Surface Dynamics.

Reason: This recommendation is made based on the fact that, among the numerous papers applying the parabolic model for crenulate bay beaches since 1999, the present MS is the only one that has derived additional mathematical equations from the original parabolic bay shape equation for the phenomenon of beach flanking discussed in this MS, and the analytical results are well supported by shoreline monitoring data and numerical model using NOAA’s wave data.

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