Dear Editor,

I have completed my review of the manuscript entitled "Coexistence of two dune scales in a lowland river" and I am pleased to recommend its publication with revisions. The paper represents a significant contribution to the field of bedform morphodynamics and carries implications for various related disciplines, including geomorphology, sediment transport, hydrology, river modeling, and sedimentology.

The major contribution of this paper lies in its quantification of the spatial and temporal range of secondary and primary bedform coexistence in a natural river. Despite the inherent complexities of the River Waal, which arise from navigational requirements, shipping impacts, and variations in grain size within the channel, the study provides valuable insights into the probable bedform dynamics observed in natural systems. The ability to compare two distinct cases, characterized by different sediment types, under similar conditions is a novel and significant contribution.

I particularly appreciated the meticulous analysis of bedform morphology, coverage, and the comparisons made with river discharge and estimated sediment transport and morphology. The paper offers a substantial advancement in our understanding of the interactions and coexistence of two bedform scales in rivers. It calls attention to the secondary scale, which is often overlooked, despite its prevalence in rivers, as convincingly demonstrated by the authors.

While the manuscript is commendable, I have a few comments in two areas. Firstly, I would like to seek further clarification on the method used to calculate coverage. Although the paper mentions the calculation of coverage for both primary and secondary scales, I feel that certain essential details are missing, preventing me from fully comprehending the procedure. It would be beneficial if the authors could explain how they derived the value representing secondary dune coverage over primary dunes, as this information is crucial for proper interpretation of the results.

Secondly, I noticed a few instances in the manuscript where the discussion lacked consideration of response times for dune morphodynamics, specifically the time lag between flow changes and resulting sediment transport and morphological changes. Addressing this aspect could enhance the discussion, particularly when comparing the morphology of secondary and primary dunes during peak flow to the dune morphology presented in other papers and to the equilibrium predicted values. While I understand that delving into a detailed discussion of response times for dune morphodynamics may be beyond the scope of this paper, I believe that incorporating these ideas into the discussion (particularly lines 270-273 and 310-311) would be valuable. Even more, in section 4.1 of the discussion, the authors suggest that secondary dunes develop in the boundary layer of primary dunes rather than forming during the falling stage. In this context, I would like to inquire about the timescale at which the superimposed dunes reach a point of response (particularly decay) before another flow fluctuation occurs that forces the growth of secondary bedforms. Is there a period within this timescale where the superimposed

dunes migrate multiple wavelengths without significant flow fluctuations that would stimulate their growth or decay, and thus indicates their development dependence within the boundary layer?

In conclusion, I recommend accepting the paper for publication with revisions. The manuscript makes a significant contribution to our understanding of bedform morphodynamics in natural river systems and has been well-written, featuring clear takeaways and beautiful figures. I commend the authors for tackling such a complex dataset and presenting their findings in an exemplary manner. It was a pleasure to read their work.

Please find my line-by-line comments below.

Sincerely,

Julia Cisneros

Jackson School of Geosciences, UT Austin

Line by line comments:

40 in stead -> “instead”

83-84 It is unclear how many profiles were analyzed. Can you be more specific here? Were they taken at a particular spacing?

106 I may be mistaken but I have checked throughout the manuscript and do not see what $\bar{u}$ is defined as. Since you define every other variable, it will be helpful to have this defined as well.

120 See the above comment for $\theta$

146-147 Why is the moving average 4 times the estimated primary length? Is there a reason or is this just a choice?

151 I’m confused why the window length for primary and secondary dunes is different. Does this affect the resultant value for leeside angle of the primary and secondary? It seems to me that the primary dunes leeside angle would be lowered by having a larger smoothing window?

153-154 Do all of the conditions have to be met in order to not be filtered (e.g. 0.25 > HP > 4.0 AND 25 > LP > 350 AND 0.003 > HS > 0.2 AND αP < 0.03 m m−1) or not?

155 I'm not sure I understand this: "the crest elevation of a secondary dunes is in the original signal less than 0.01 m higher than the up- or downstream trough". Can you re-write this to be more clear?

159-166 This paragraph is hard for me to understand. Was the fraction computed for both the primary and secondary dunes? You say "based on the cover fraction, it was determined whether a primary dune has superimposed secondary bedforms." How was this done? Then the description of a 2D moving average is presented, so this is a secondary smoothing and then it looks like a third (?) kind of averaging (removing areas less than 500 cell) to get to the final grid presented. I think, if presented more clearly this is a clever way to get towards superimposed dune coverage! So, I think it is important here to make sure this method is very clear so the reader can make sense of the data presented.

188-189 I wonder, do the groynes along the river banks play a role in influencing the barchan shapes of the primary crests? I remember in this river, the groynes are oriented similarly to the primary dunes crests and have large, flame structured erosional areas that extend from downstream the groyne and into the channel fairway.

191-192 You say the secondary dunes "grow towards the next primary dune." Do you have any ideas as to how the superimposed bedforms grow along the stoss? Do they grow or decay in size as they move along the stoss of the primary dune?

Figure 2 Can you add a line on the maps to show where the profile is taken from? I know you include the "n" location, but I think adding a line may help to visually connect the subplots.

Figure 4 Can you put the variable name beside the variable symbol here (e.g. Primary dune height, $H_p$)?

Figure 5 It is unclear what the different colors mean here as there is no label and no description of these colors in the figure caption. I also believe the subplot labels are wrongly referred to in the figure caption (e.g. (c) Median grain size should be (a) Median grainsize). There is also no mention of subplots (b) and (c) in the caption.

Figure 6 There are no figure subplot labels on the figures but they are mentioned in the figure caption. Please be sure to check that subplot labels and reference to them exist and are correct in all figures.

245-247 See comment above in my general thoughts about possibly discussing the response time of superimposed dunes to the fluctuations in flow and sediment transport to be sure of this statement.

301-305 This is an interesting line of thought. Do you have any ideas about the influence of the ships traveling heavier and thus lower in the water column on the south side (lower

under keel clearance). Wouldn't this possibly increase shear stress in the southern side as the boats are passing? Just a thought!

351-353 I think this is very spot on! Very compelling and this really reinforces the "cat and mouse" problem between the competing processes at play here!