**Response to Reviewer 2**

**Reviewer comments in** plain text
**Author comments are in BOLD**
**ESurfD Manuscript text is in** *italics*
**Added Text is in** ***Bold Italics***

**We thank Referee #2 for taking the time to read and review our manuscript. We address each specific comment below:**

The authors build upon their previously developed numerical ecomorphodynamic models, to demonstrate some of the factors controlling the hummockiness of a foredune, at the absence of external forcing. This is a good paper, and it would be very interesting to see the model compared to field and remote sensing observations of foredunes, so as to provide some validation to the model.

**We agree — as we stated in the last paragraph of the Discussion (which has been removed from to address comments from R1), we have ongoing monitoring work aimed at testing this model with spatially continuous vegetation and topography data, taken at regular intervals (i.e., not post-storm surveys). Although direct testing of the model is beyond the scope of the current paper, we have added a new last sentence that highlights useful next steps aimed at testing the model, and current observational research that is applicable to our modeling work:**

**Page 8; line 31-35:**

"***Although beyond the scope of this effort, observational work aimed at assessing the relationships among storm frequency/magnitude, species composition of dune-building vegetation and dune development (e.g., van Puijenbroek et al., 2017a; 2017b) will be useful in addressing the future implications of model results presented here as climate change is anticipated to alter each of these factors.*** "

Following are some more detailed comments:
The term "annealing" may be mistakenly interpreted as if a foredune is annealed and washed by waves, whereas the authors mean that the hummockiness is annealed, not the foredune. I suggest that the authors use a different term throughout the paper.

**We have replaced all uses of the term 'anneal' (referring to closing of the gap between dunes), and its variants, with 'coalesce' (referring to merging of the dunes themselves, and therefore closing of the gap).**

**We have also changed the title of the manuscript:**

***Lateral vegetation growth rates exert control on coastal foredune "hummockiness" and coalescing time***

Add a table showing all variables, abbreviations and their meaning, to make it easier for the readers to follow the equations which are developed.

**We now include a table with all variable abbreviations and names as an Appendix**

p. 2. l. 21: Continuous dune ridges may also become less continuous and hummocky with time, see: Levin, N., Tsoar, H., Herrmann, H. J., Maia, L. P., & Claudino-Sales, V. (2009). Modelling the formation of residual dune ridges behind barchan dunes in Northeast Brazil. Sedimentology, 56(6), 1623-1641.

**Thank you for pointing us to this paper. We have added text to the discussion about this:**

**Page 8 line 6-16:**

*"In addition to storms, other factors such as a high water table, low sediment supply, grain size variability, development of shell lag, and climatic conditions may also result in suppression of the coalescing of coastal foredunes (Mountney and Russell, 2006; 2009; Wolner et al., 2012; Hoonhout and de Vries, 2016;* ***Ruz and Hesp, 2014; Ruz et al., 2017a****). Feedbacks between the wind, dune vegetation and sediment transport that are specific to hummocky dunes may also alter the rates of coalescing (Barrineau and Ellis, 2013; Gilles et al., 2014),* ***such as the development of high wind velocity regions located adjacent to hummocky dune forms (Hesp and Smyth, 2017). Work here does not address observations of older foredune ridges that lose their continuous morphology as a result of plant succession, erosion via rain and flow in rivulets, or trampling (Levin et al 2009; 2017). Additionally the potential for lag between 'fast' cross-shore beach recovery time vs. slower cross-shore vegetation recovery time (e.g., Castelle et al 2016; Keijsers et al., 2016; Ruz et al., 2017b) could introduce novel dynamics that are not explored in this work."***

p.4 l. 12-13: Is it a reasonable assumption, that plants establish "only by lateral propagation"?

**This is an interesting issue. Though seeds are known to be a source of new *U. paniculata* plants, it is unclear to us (from our own field work and from the literature) what percentage of plants are from seed vs. lateral propagation. However lateral propagation in this model is somewhat generic, so could be inclusive of local seed dispersal and plant initiation. This is an assumption of the model. To address this question we have added to the sentence in question so that it now reads:**

**Page 4 line 24-27:**

***"In the absence of observational data that reveals the degree to which dune-building vegetation establishes via seed versus lateral propagation,*** *beyond the initial 'seeding' we allow plants to establish in unvegetated cells only by lateral propagation,* ***which can be thought of as encompassing establishment via both mechanisms."***

Figures 4, 5: State in the figure captions what does Hv represent.

**This has been done**

Discussion: While hummocky foredunes may indeed anneal to form continuous foredunes at their early life stages, later on, foredunes often "lose" their continuous form, as large shrubs and trees start to develop, and additional process of erosion take place. See Figure 8 in Levin, N., Jablon, P. E., Phinn, S., & Collins, K. (2017). Coastal dune activity and foredune formation on Moreton Island, Australia, 1944–2015. Aeolian Research, 25, 107-121. I also refer the authors to Castellte et al. (2017), who show that following a storm, foredune vegetation recovery time may be much longer than sand volume recovery time: Castelle, B., Bujan, S., Ferreira, S., & Dodet, G. (2017). Fore- dune morphological changes and beach recovery from the extreme 2013/2014 winter at a high-energy sandy coast. Marine Geology, 385, 41-55.

**Thank you for pointing us to these papers as well. We have added text to the discussion about the applicability to our model for only growing ridges, and the potential for novel behavior in the cross-shore direction because of the lagged timescales of beach and vegetation recovery (Keijsers et al 2016 also demonstrates this behavior in a model) :**

**Page 8 line 6-16:**

*"In addition to storms, other factors such as a high water table, low sediment supply, grain size variability, development of shell lag, and climatic conditions may also result in suppression of the coalescing of coastal foredunes (Mountney and Russell, 2006; 2009; Wolner et al., 2012; Hoonhout and de Vries, 2016;* ***Ruz and Hesp, 2014; Ruz et al., 2017a****). Feedbacks between the wind, dune vegetation and sediment transport that are specific to hummocky dunes may also alter the rates of coalescing (Barrineau and Ellis, 2013; Gilles et al., 2014),* ***such as the development of high wind velocity regions located adjacent to hummocky dune forms (Hesp and Smyth, 2017). Work here does not address observations of older foredune ridges that lose their continuous morphology as a result of plant succession, erosion via rain and flow in rivulets, or trampling (Levin et al 2009; 2017). Additionally the potential for lag between 'fast' cross-shore beach recovery time vs. slower cross-shore vegetation recovery time (e.g., Castelle et al 2016; Keijsers et al., 2016; Ruz et al., 2017b) could introduce novel dynamics that are not explored in this work."***