Earth Surface Dynamics Discussions

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Comment on esurf-2021-11

Helen Beeson (Referee)

Referee comment on "The rate and extent of windgap migration regulated by tributary confluences and avulsions" by Eitan Shelef and Liran Goren, Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2021-11-RC1, 2021

This paper investigates the dynamics of windgap migration using 1-D numerical modeling. In particular, it explores how tributaries and avulsions of those tributaries influence windgap migration rate and stability. The authors present a series of simulations that show that the topology of the network plays a critical role in windgap migration dynamics, influencing the stable location of the windgap, as well as mean windgap migration velocity and how that velocity changes through time (ranging from punctuated to gradual). They show that random processes (avulsion is used here) can trigger a divide that is stable but in a non-optimal location to begin migrating towards a more energetically optimal location. This paper is well written, with a clear hypothesis and experimental design, and it is timely in that it addresses a unique case of divide migration, a subject of much recent interest in the Earth surface process community. I recommend that it be accepted with minor revisions as I have only a few simple questions and a handful of language comments.

1) Is it a given that windgaps migrate or are these channel-head on channel-head windgaps unique?

I have seen many of the type of windgaps you show (there are many in the Apennines) and I agree that they clearly migrate, but I'm not sure windgaps formed by lateral capture of headwaters always do. Maybe following capture, a tributary would form and then push the windgap down the main valley of the losing basin (as in your Parlung-Siang-Lohit example), but the basin could also continue to lose area via continued lateral captures. It is clearly out of the scope of this paper to determine in what scenarios windgap migration occurs following capture, but I think it would be good to recognize this question in some way, either in the discussion or in the introduction. Similarly, in the last paragraph on page 2 I think an introduction to the idea that windgaps *can* migrate along valleys could be added and that when they do, side tributaries are preserved.

2) Are there processes other than avulsions that might have a similar effect and make this model/idea applicable to regions without alluvial fan-forming

tributaries?

Could ground water seeping have a similar effect but on a longer time scale? Eventually the area-gaining basin seeps enough ground water to be able to capture another tributary and advance to a more energetically optimal geometry. Another idea is capture of losing basin tributary by gaining basin tributary. I suggest adding a few sentences to the discussion on other potential mechanisms that make this concept more widely applicable (which I think it is).

Figure comments

Make fig 7 be fig 6 (reorder) – Fig 7 is mentioned before Fig 6.

Fig 6C It would be nice to see the profiles for current windgap location on here also.

Fig 7 (a) Should y-axis label be Ld/Lc? Legend triangle is tilted compared to those in plot. Maybe state in caption that every marker represents the results of a single simulation?

7b caption needs V and Vr inserted after their explanation (I don't think what they represent is stated elsewhere).

All the figure captions are quite long. They could be shortened by removing some of what is already described by legends in the figure. Also, some of them have lengthy interpretations in them that seem like they should go in the main text.

Line comments (mostly typo callouts and language suggestions)

4 maybe "in some tectonically active regions…"

4-6 very biased by the study region

6 describe the geometry as channel-head on channel-head windgap?

Or maybe "Channel-head on channel-head windgap geometry indicates windgap migration with distinct dynamics and potentially quantifiable rates" or something

30 maybe "rapidly eroding to the slowly eroding"

33 change "fast" to "rapidly"

37 "**on** the victim basin that **loses** drainage area"

39 lengthens

42 change "whereby" to "in which"

61 change “set” to “seek”

83 prominant should be prominent

115 Clarify that all nodes (both between and with tributaries) are given a local drainage area (if I understand correctly).

125 “these dynamics”

130 I suggest saying here at the end that you ran all three versions of the simulation (avulsions, no avulsions m=0.45, no avulsions m=0.55) for ten different values of tributary area/ segment area. It took me a little while to understand that every point on fig 7a was a different simulation.

136 “were” instead of “where”

171 “its” instead of “it’s”

189 windgap misspelled

206 windgap misspelled

220 same

274 same

Thank you for the opportunity to review this excellent manuscript!

Helen W. Beeson