Earth Surface Dynamics Discussions

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Reply on RC1

Hemanti Sharma et al.

Author comment on "Effect of rock uplift and Milankovitch timescale variations in precipitation and vegetation cover on catchment erosion rates" by Hemanti Sharma et al., Earth Surf. Dynam. Discuss., https://doi.org/10.5194/esurf-2021-20-AC1, 2021

I thank you on behalf of all co-authors for your detailed review of our paper. We would like to work on the valuable suggestions you provided, for our revised manuscript. We would like to address briefly the issues raised in your comment in the following points:

- In coupled simulations (coupled vegetation and precipitation oscillations), MAP follows an asymmetrical sinusoidal function for both catchments. This is done to isolate the impact of changing precipitation and vegetation cover on erosion and sedimentation. This asymmetry is more visible in wetter simulations because of the higher amplitude of change in MAP.
- Fig. 5. Yes, using 10% V would make more sense, this will be updated during revision.
- Bedrock erosion here includes weathering too (i.e., bedrock converted to sediment using soil_production component in Landlab). As we use the total change in bedrock elevation to calculate bedrock erosion rate, the loss in bedrock due to weathering is also accounted for.
- Fig. 6. These results are obtained after the spin-up for ~10 cycles of 23 kyr on a steady-state topography. Although the relief and slopes were relatively lower for sparsely vegetated landscape (10% V), we got high erosion rates as the precipitation was kept constant at 30 mm/yr, while the vegetation cover was reduced to 0%. This can be attributed to (bedrock/sediment) stream power thresholds, which are model input parameters. The low erosion thresholds might lead to high erosion for bare soil. We would also like to pardon for typos in figure captions and section e (Fig. 6), that is 0.25 mm/yr and not 2.5 mm/yr.
- In weathering function, the weathering parameter (soil production rate) is different for both catchments, such that densely vegetated landscape would produce more sediment.
- Bedrock erosion happens partially in areas with no or low deposition. In our model, exposed bedrock is subjected to erosion.
- Limitations: We have forced the vegetation oscillations in our model. So, here vegetation cover is an input parameter, which is not affected by flow and entrainment in the model. Thanks for the new point to add to our model limitations.

We hope that we were able to resolve some of the issues mentioned in your comment. We would be happy to elaborate on these points in detail.