Earth Surf. Dynam. Discuss.,
https://doi.org/10.5194/esurf-2018-14-AC1, 2018

Interactive comment on "Effect of changing vegetation on denudation (part 1): Predicted vegetation composition and cover over the last 21 thousand years along the Coastal Cordillera of Chile" *by* Christian Werner et al.

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Received and published: 30 June 2018

We thank the anonymous reviewer for the kind words and positive assessment of the submitted manuscript. Below we first reply to the two major points raised and follow with a detailed line-by-line response to the minor comments (responses in blue). We give our reply in the supplement attached to this file for better readability.

Major comment 1: Manuscript section organization and improvement of validation

The organization of result and discussion section could have been clearer (as also

noticed by Reviewer 2). To improve the readability we restructured parts of the result and discussion section. The evaluation of PNV distribution (biome locations) for PD conditions was merged into section 4.2. The comparison of simulated foliar projected cover with MODIS-based vegetation cover estimates was combined in result section 4.3. Furthermore, we introduced a new section that describes the results from our CO2 sensitivity simulation experiment (formerly covered in 5.3). We did however keep the section describing the results from an alternative paleo climate dataset (ECHAM5) in the discussion section, as its not part of the TraCE-21ka-based simulation ensemble of this paper and was merely included to illustrate the importance of climate data for DVM simulation results. Furthermore, we added more quantifications of discrepancies between modelled and observed FPC to the relevant section (mean absolute error, MAE). However, we want to note that the evaluation of both FPC and biome distribution is complicated for multiple reasons (which was also our reason for our simplistic visual characterization of the results). First, mismatches of biome classifications can be the result from multiple causes. The biome map given in Fig. 1a is based on an aggregated version of the floristic units (Luebbert and Pliscoff, 2017) that do not necessarily align with a PFT- and physiological-based classification. Also the large number units and their often very specific mosaic of co-occurring species make a clear separation into major biomes (that are based on very few characteristic PFTs) often impossible. For instance, Matorral and Sclerophyllous Woodland were not easily separable based on these units. A thorough runoff validation is unfortunately not possible in the scope of this study (esp. due to a lack of spatially explicit runoff data). However, as Part II (Schmid et al., 2018) only uses FPC yet, we opted to postpone this issue to the planned future publication of the coupled DVM-LEM model which will include FPC and runoff effects. We thus added a paragraph that acknowledges this limitation and we revised all sections that concern runoff results. We still want to include runoff data is it will be considered in future work (as mentioned). We added a quantitative assessment of simulated FPC against MODIS vegetation cover (Sect. 4.3) and correlation analysis when appropriate.

Major comment 2: Request for more details of landform effect in simulations

The reason to present only a single landform in Fig. 9 was to clearly show the PFT transitions with time. If one reports the average PFT composition of all landforms in a grid cell these trends are masked/ harder to showcase (but all simulations reported in the manuscript are run using the landform approach). Another reason for originally not including the full details of the implemented landform approach was that we assumed this would bring the document to an unfeasible length. However, since both reviewers ask for more details of the approach we now include a new Appendix C that explains the conceptual approach and the modifications of site conditions for the landforms in detail. The landform simulation mode in general improved the simulation especially in semi-arid to Mediterranean locations as a heterogeneous landscape representation (i.e. valley landforms and higher altitude locations with lower temperatures) generally led to higher vegetation cover (access to more soil water, lower temperature with less water-limiting conditions).

We included a new figure to the supplement that highlights the differences in simulated FPC for individual landforms, the area-weighted average FPC from those landforms and the original LPJ-GUESS simulation for the last 2000 years of the transient simulation runs of the four focus sites. As can be observed (Fig. S4a), the implemented landform approach has differing effects for the four focus sites. The area-weighted average FPC at site Sta. Gracia closely resembles the results from the default simulation mode (apart from landform 810 of high altitudes that only covers 1.7% of the grid cell area, Fig. S4b). Average-landform and default results for site La Campana also differ only marginally. However, here a set of landforms of higher altitudes has a substantially lower FPC than the average ($\sim$ - 15%). Variation at the hyper-arid site Pan de Azucar is lower (as is the FPC), but generally higher than the default simulation (which aligns with MODIS observations for the site, where the default model underestimates satellite-observed cover). The higher FPC in the new model setup is likely a result of deeper soil profiles of flat and valley landforms

that allow a longer water storage versus the default uniform 1.5m soil assumption of LPJ-GUESS. The larger variability of FPC at site Nahuelbuta can be attributed to the rel. Large altitudinal variation in this 0.5x0.5 grid cell (coast to mountainous terrain) and is thus likely a temperature effect. From site explorations (see Fig. 1 for impressions from the four locations) it is clear that vegetation is not distributed uniformly in the landscapes. Thus, the higher spatial diversity of simulated FPC in the landform approach can be assumed to more realistically describe true FPC in these areas and should thus also lead to more non-uniform erosion rates when FPC is spatially disaggregated on a high-resolution landscape utilized by an LEM. We added a section (5.1) to the discussion section that points at these results. We acknowledge that a thorough analysis of individual effects on simulated FPC would be interesting, but we deem this outside the scope of this manuscript as it would lead to a substantial extension of the paper which is already very long. However, we added section that discusses the observed differences to default model simulations.

Please also note the supplement to this comment:
https://www.earth-surf-dynam-discuss.net/esurf-2018-14/esurf-2018-14-AC1-supplement.pdf

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