Earth Surf. Dynam. Discuss.,
doi:10.5194/esurf-2016-59-AC1, 2017

Earth Surface Dynamics
Discussions

Interactive comment on "A probabilistic framework for the cover effect in bedrock erosion" *by* Jens M. Turowski and Rebecca Hodge

Jens M. Turowski and Rebecca Hodge

turowski@gfz-potsdam.de

Received and published: 17 January 2017

We thank the reviewer for the valuable comments, and in revisions, we will strive to clarify the rationale of the paper and the writing as best as possible. We will also be even more careful to avoid typos in the equations and in the symbols used.

Here, we want to briefly comment on eq. 13 that the reviewer found hard to understand. This is a mass balance that is probably more easily understood when viewed in a discrete framework. Consider a mass balance for a control volume in the river (Fig. 1). The rate of change of mobile mass per time, $\Delta Mm/\Delta t$ is then the sum of four terms: the mass influx per time from upstream Δin, the mass outflux per time downstream Δout, the entrained mass per time E and the deposited mass per time D. Both outflux Δout and deposition D reduce mass in the control volume and are therefore negative.

Thus:

$\Delta Mm/\Delta t = \Delta in - \Delta out + E - D$

(eq. 1)

Our equation 13 is essentially a version of this equation where the long-stream variable and the time are treated as continuous corresponding to the limit of infinitesimal length of the control volume and infinitesimal time steps. In this limit the term $\Delta in - \Delta out$ becomes dq_s/dx and the term $\Delta Mm/\Delta t$ becomes dM/dt.

Note that this is essentially equivalent to the standard Exner equation, which is written in terms of bed height rather than mass, and thus wraps both our reservoirs (mobile and stationary) into a single equation. Since we are explicitly interested in the mass on the bed, and since bed height necessarily varies across a partially covered bed, we opted for using mass as a main variable.

Fig. 1: Cartoon illustration of a control volume in the river. The mass balance for the mobile mass Mm leads to eq. 1.

Interactive comment on Earth Surf. Dynam. Discuss., doi:10.5194/esurf-2016-59, 2016.

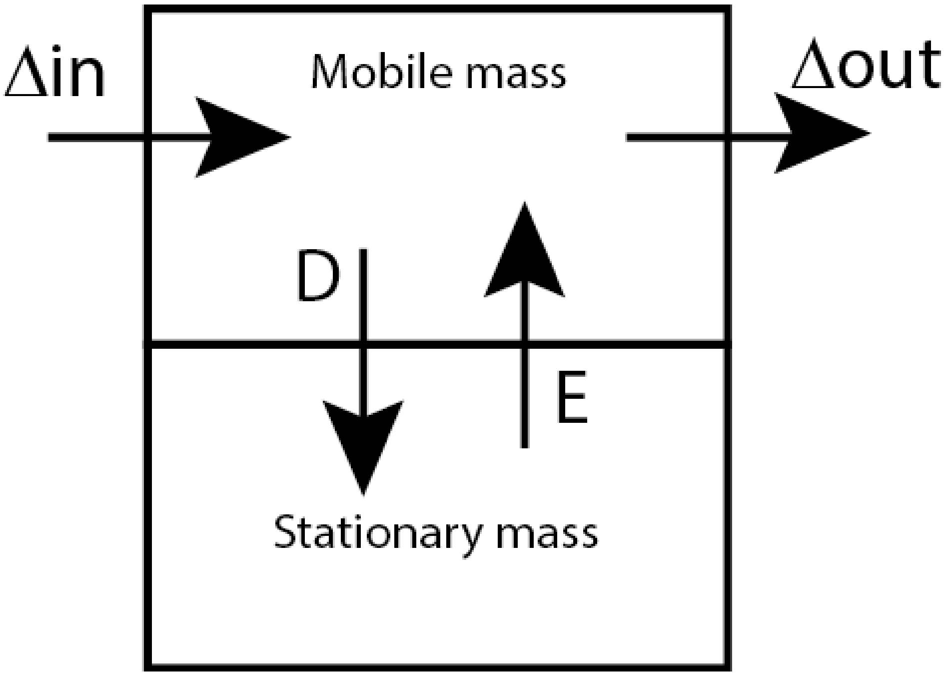

Fig. 1. Cartoon illustration of a control volume in the river. The mass balance for the mobile mass Mm leads to eq. 1.