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Discussions

Interactive comment on "Quantifying lahar damage using numerical modelling" by S. R. Mead et al.

S. R. Mead et al.

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We would like to thank the reviewer for their suggestion and further suggested corrections. We incorrectly (in the manuscript, not in calculations), referred to dynamic pressure as ρv^2 when we actually used $0.5\rho v^2$. As you have mentioned, the dynamic pressure is a scalar quantity and therefore using terminology as 'directional components of dynamic pressure' could be misleading. However, we disagree with the suggestion to adopt momentum flux instead.

Dynamic pressure is used extensively in literature examining the forces applied to buildings by fluids (see e.g. Roos (2003), Zeng et al. (2015), Zuccaro et al. (2008) and Jenkins et al. (2015)) and the theoretical basis for using dynamic pressure is sound, based on Bernoulli's theorem: when a fluid interacts with a fixed solid surface, the

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velocity normal to the surface is zero and the total pressure (i.e. force per unit area) is given as the stagnation pressure (see e.g. Landau and Lifshitz, 1959 pp. 11-21)

$$P_{max} = P_{static} + 0.5\rho v^2$$

Where v is the velocity normal to the wall.

This was not explained in enough detail in the original manuscript, and discussion of 'directional components of pressure' is misleading. To solve this, we intend to (1) add discussion to the section on lahar simulations explaining how dynamic pressure is calculated and (2) modify the flow behaviour section to explain the difference between using the velocity magnitude (scalar, not normal to walls) and normal velocity to determine forces exerted on the walls.

Please also note the supplement to this comment:
http://www.nat-hazards-earth-syst-sci-discuss.net/nhess-2016-282/nhess-2016-282-AC2-supplement.pdf