For the manuscript, "Determinants of modelling choices for 1-D free-surface and erosion issues in hydrology: a review", this study attempts to present a normative classification through a comprehensive literature review. I applaud their efforts in incorporating a wide range of studies with various scales, typology, and dimensionless numbers. I feel in overall the manuscript has been well written, so I contend this deserves to be published in HESS if a couple of reservations will be addressed.

- **Literature**: I appreciate with such a comprehensive review, but my first reservation is whether this could sufficiently reflect the current developments of knowledge in our community. The reason I thought is the total number of cited references except for those used in the appendix is about 370, but only 16 references (less than 5%) are recently published within 5 years (since 2011). Readers can wonder all recently reported state-of-the-art studies are well addressed and reflected in this review. I would appreciate if authors can update some parts with new published contents if any. Some examples, although not limited to, are

(1) friction coefficients in overland flow (not river flow) can be explained by using many dimensionless variables but show mixed trends in controlled conditions (Kim et al., 2012, WRR, "*Hydraulic resistance to overland flow on surfaces with partially submerged vegetation*"). Since overland flow move on surfaces with partially submerged roughness elements and very shallow depths of flow, we could not directly employ empirical relationships developed for river flow. As authors also mentioned, the inundation ratio (Lawrence, 1997) is often a key indicator to differentiate overland and river flows, but most of studies (in Fig. 10) did not focus on very small order of magnitude (<<1) on the ratio (e.g., overland flow on vegetated area). In the above literature, a couple of experimental data was represented for cases with the small ratio numbers. It would be great if authors can discuss and incorporate (in L132, L612, L645, L816, or somewhere) how the friction is addressed in overland flow with larger elements.

(2) Please add/introduce erosion controls (e.g., in L335-337) of, for example, scale effect (Kim et al., 2016. *Environmental stochasticity controls soil erosion variability* Sci. Rep. 6, 22065), shielding effect, nonuniqueness (Kim and Ivanov, 2014. *On the nonuniqueness of sediment yield at the catchment scale: The effects of soil antecedent conditions and surface shield*. WRR, 50, 1025-1045; Nearing et al., *Sediment yields from unit-source semiarid watersheds at Walnut Gulch*. WRR, 43, W06426, 2007), and micro-scale variability (Risse et al., *Assessment of error in the universal soil loss equation*. Soil Sci. Soc. Am. J. 57, 825–833, 1993; Kinnell, *Why the universal soil loss equation and the revised version of it do not predict event erosion well*. Hydrol. Processes, 19, 851–854, 2005), and in L822-834, present an additional importance of shields number that explains the time scale of non-uniqueness (WRR, 50, 1025-1045).

- **Erosion equations**: The second suggestion is, as mentioned by other reviewers, about erosion equations. Unlike flow equation, erosion part is still difficult to grasp because the description of manuscript is more or less written in a narrative way or a list type with many citations only (do not have details). I would suggest to explain flow/erosion phenomena with **physical and empirical components**. For example, in rivers, advection and diffusion are of primary physics while suspended and bed load are main sources which are not directly resolved by physics but addressed by empirical, experimental relationships. In hillslopes, advection is the only driver while splash, rainfall/flow detachments and rainfall/flow entrainments are sources which are only computed by empirical equations. Similarly, what are the main physics and sources in NS-coupled-erosion models? What can or cannot be resolved by physical conservation laws or what can be lumped in each typology case (step-pools, pool-riffles, etc.)?

- **Hydrologic viewpoints**: Although authors frequently employed the term, hydrology, the hydrologic viewpoints are not well revealed. For example, According to the schematic view in Fig. 4, flow depth is always larger than the height of obstacles (rocks, boulders, vegetation, etc.). In hydrology viewpoint, the flow depth is mostly much smaller than that of larger elements. Overland flow often has a slope larger than 10 % up to 100 % (45 degree) in Fig. 5. The median slope 6 % in overland flow seems to be very mild. In shields diagram, most data comes from the experiments in hydraulic conditions while data obtained from hillslope erosion studies seems not to be incorporated. Although most of theories in hillslope erosion was indeed borrowed from the results of river erosion studies, it would be better if authors mention about how those are different since many watershed-based, hydrology-viewpoint erosion studies have been done.

- **Scale**: Another suggestion is about scale. I am wondering about “Problem/Domain” scale and “Resolving” scale for computations. Please refer to the below classification table, fill in blank if possible with authors’ language, and modify/reflect something useful for this review if any. Some part of description was used in Kim and Ivanov, *A holistic, multi-scale dynamic downscaling framework for climate impact assessments and challenges of addressing finer-scale watershed dynamics*. J. Hydrol. 522, 645–660, 2015. The most often used modelling in hydrology is based on watershed scale in which, as an example, length scale is say 10 km and time scale is event, seasonal, or annual. Authors used the term, hydrology in title and others, but there is no even typical context addressed in Table 1.

		turbulent	hydraulic	hydrologic	geomorphic
Problem scale	Temporal	< hours	Hours to days	days to years	> years
	Spatial	Stream reach	Stream or river	watershed	Continental
Resolving scale	Temporal	~ millisecond	Less than sec	~minute, hour	~day
	Spatial	O(0.001) m	O(0.1 – 100)m	O(10 – 100) m	(>100)m
Flow equations	Physical	NS, DNS, RANS	SV	ASV	ASV(?)
	Empirical	For turbulence	For friction	For friction, channel geometry, etc.	For tectonic, aeolian, biologic processes
Erosion equations	Empirical				
	Physical		Exner, Hairsine-Rose	Land evolution eq.	

- **Title**: I suggest title to use better words for “free-surface flow” and “hydrology”. The impression of the term, free surface flow seems to be related to a topic for tracking and locating the free surface between water and air, but there is no discussions on this (e.g., volume of fluid technique). Also, the reviews of this study are more or less focused on the viewpoints of hydraulics and fluid mechanics, not hydrology. At least to me, I expected hydrology could be used when it is based on watershed scale. I agree watershed-based erosion models are also commented in the manuscript, but their relative importance might be less than 20-30 %. My tentative suggestion on the title is “*Determinants of modelling choices for 1-D surface flow and erosion problems in hydrology and hydraulics: a review*” If authors want to use “hydrology”, I hope they can describe more on hydrology viewpoints.

- Last but not the least, we can usually select a proper model in many hydrologic and hydraulic applications. For example, for watershed modelling, ASV with transport capacity concept; for flooding and river sedimentation, SV coupled with Exner equation; at much finer scale for structures NS-based erosion models has been widely used. I think there exists a certain rule of thumb that everyone can agree to choose a model. Can authors present a couple of examples when people can misuse or select incorrectly numerical models?

All typology authors mentioned exists at the same time within a larger watershed. How do authors present any suggestion or implication on watershed-based hydrology modelers? In this point of view, I contend a certain level of coupling will be necessary to address the details; it is associated that people are currently trying to combine many numerical models in many discipline (see below literature), which will be more facilitated in near future as computing power is increasing. L451-455

Maxwell, R. M., et al. (2014), Surface-subsurface model intercomparison: A first set of benchmark results to diagnose integrated hydrology and feedbacks, WRR, 50, 1531–1549.

Kim et al., 2012. Coupled modeling of hydrologic and hydrodynamic processes including overland and channel flow. Adv. Water Resour. 37, 104–126.

Kim et al., 2013. Modeling erosion and sedimentation coupled with hydrological and overland flow processes at the watershed scale. Water Resour. Res. 49, 5134–5154.

Minor comments:

- L169: Please clarify what “this” refers to.

- In 3.1.1: For domain length (L), it makes sense to use length for river, but how did you compute the length scale for watershed (i.e., square shape)?

- L700-702: Is it correct that Fig. 4e is not mentioned in the description of the line?