

Reply to Editor

Wenlong Wang on behalf of all co-authors

Editor Decision: Publish subject to minor revisions (review by editor) (21 Jul 2021) by Thom Bogaard

Comments to the Author:

Dear authors,

I happy to inform you I have accepted your manuscript with minor revisions for publication in Hess. I think the revised version is well improved. I have a few technical remarks that I would like you to incorporate when submitting the final version which relate to summary / conclusion section and the figures

Response: Thank you for your letter and for the decision (Publish subject to minor revisions) concerning our manuscript (ID: hess-2020-412). The following comments are valuable and very helpful for improving our work. At the same time, we thank you for giving us the opportunity to revise the manuscript. We have studied and analyzed comments carefully and have made many corrections which we hope meet with approval.

Q1. Can you rephrase the summary in terms of conclusions. It is not so useful to repeat the percentages. Please write the last section in terms of scientific conclusions (answering your research objectives).

Response: Thank you for your valuable comment. We have revised the Summary section. We deleted some percentages and revised some sentences. The spatial change in energy consumption and soil loss during headcut erosion is the core objectives of this study, and thus some percentages are still retained in Summary. The specific revision could be check in the revised manuscript.

Q2. Second, please check English in part Data Availability. I would like to urge you to make the data available as much as possible.

Response: Thank you for you suggestion. We are pleasure to share our data for other colleagues. However, after reconfirmation, the original data of this study is not accessible according to the requirement of the funded program. We will share the all data related to all figures in this study, which can fully satisfy the requirement of other colleagues. The data that support the findings of this study are available from the first author (guomingming@iga.ac.cn) and corresponding author upon request (nwafu_wwl@163.com).

Third: Figures.

Q3. Fig 2: photo panel description should be in figure caption (Figure 3. Panel a) ..., b) ... etc.

Q4. It is OK to indicate things in the photo but the figure description should be below. Please only use black and white for letters, lines and symbols as 'colors and especially red is not visible to everybody. Also try to align the text. Use black or white also for panel indication without grey background

Response: We revised the Figure 2 according to your suggestion. The revised figure 2 as following. Besides, the figure 1 was also revised.



Figure 2. Plot construction (a), runoff width measurement of loess-tableland and runoff and sediment sampling of outlet (b), runoff velocity measurement of loess-tableland (c), jet velocity measurement of gully head (d), runoff velocity and width measurement of gully bed (e), and experimental process recoding (f)

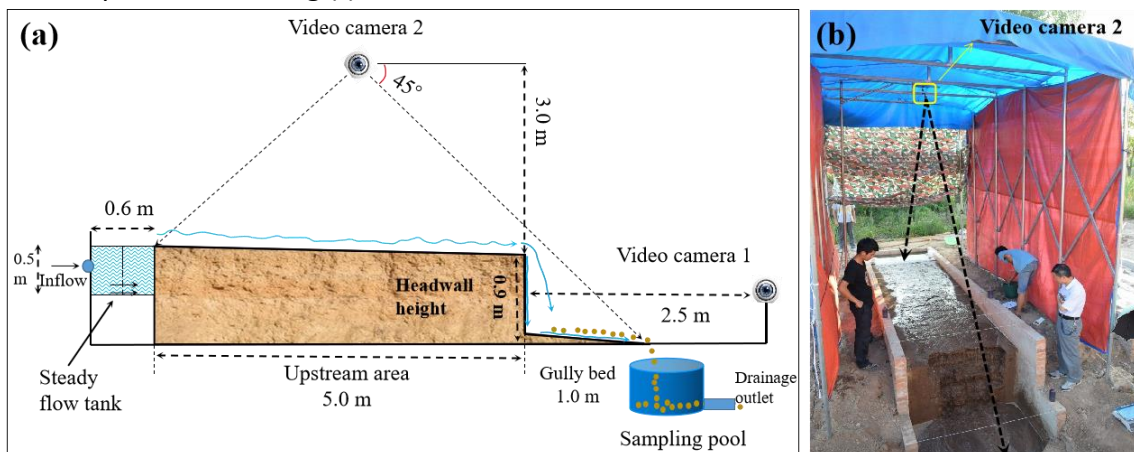


Figure 1. Sketch (a) and photo (b) of experimental plot

Q1. Fig 3: same

Response: The figure 3 was revised as following:

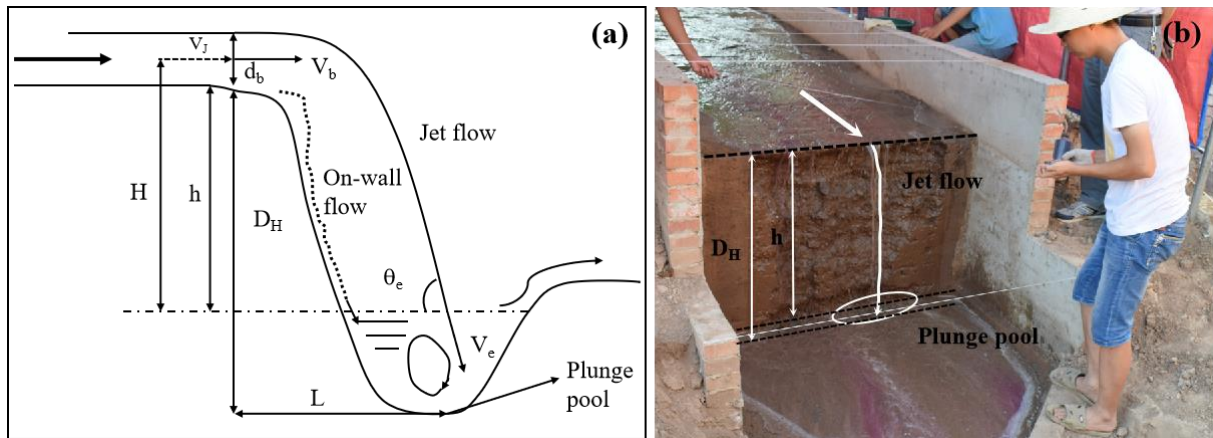


Figure 3. Sketch of jet flow at gully headcut (a) and plunge pool at gully bed (b)

Q2. Fig 4: in panel b-d-f, please align formula info (put all three in same location in their panel)

Response: The figure 4 was revised as following:

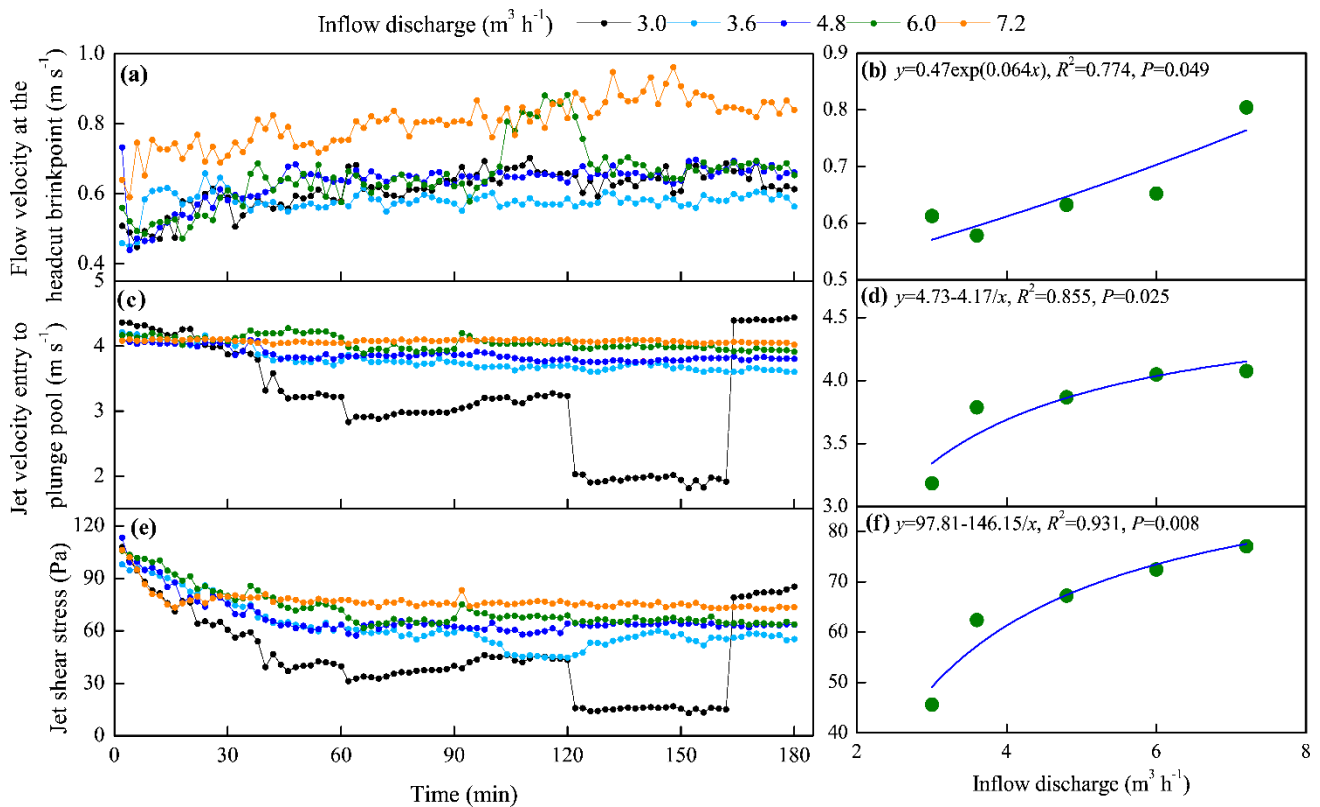


Figure 4. Temporal changes in jet properties of headcut and their relationships with inflow discharge

Q3. Table 1: please add some space between constants and symbols to improve readability. All formulas are at 0.01 significant so it seems to me the double asterix can go out

Response: The table 1 was revised as following:

Table 1. The relationships between jet properties of gully headcut and time

Inflow discharge (m ³ h ⁻¹)	$V_b \sim t$	$V_e \sim t$	$\tau_j \sim t$
3.0	$V_b = 0.42 t^{0.09}, R^2 = 0.691$	$V_e = 5.28 - 0.49 \lg(t), R^2 = 0.290$	$\tau_j = 110.86 - 15.44 \lg(t), R^2 = 0.344$
3.6	$V_b = 0.53 t^{0.02}, R^2 = 0.139$	$V_e = 4.52 - 0.17 \lg(t), R^2 = 0.859$	$\tau_j = 117.93 - 13.14 \lg(t), R^2 = 0.823$
4.8	$V_b = 0.46 t^{0.08}, R^2 = 0.544$	$V_e = 4.25 - 0.09 \lg(t), R^2 = 0.718$	$\tau_j = 109.22 - 9.93 \lg(t), R^2 = 0.770$
6.0	$V_b = 0.52 t^{0.10}, R^2 = 0.509$	$V_e = 4.17 - 1.33 \times 10^{-3} t, R^2 = 0.478$	$\tau_j = 118.73 - 10.96 \lg(t), R^2 = 0.876$
7.2	$V_b = 0.57 t^{0.08}, R^2 = 0.704$	$V_e = 4.09 - 1.38 \times 10^{-4} t, R^2 = 0.111$	$\tau_j = 95.68 - 4.42 \lg(t), R^2 = 0.619$

Note: V_b , V_e and τ_j are runoff velocity at the headcut brinkpoint, runoff velocity entry to plunge pool and the jet shear stress, respectively. The sample number is 90 for the fitted equations, and all fitted equations are at 0.01 significant level.

Q4. Table 2: the same, maybe indicate which expression have not 0.01 significance level

Response: The table 2 was revised as following:

Table 2. Relationships between runoff hydraulic parameters and time

Variable	Landform unit	Inflow discharge (m ³ h ⁻¹)				
		3.0	3.6	4.8	6.0	7.2
Reynold number	UA	$Re = 618.69 \lg(t) + 286.69, R^2 = 0.761$	$Re = 705.93 \lg(t) + 1006, R^2 = 0.815$	$Re = 1433 \lg(t) - 1159, R^2 = 0.849$	$Re = 946.64 t^{0.38}, R^2 = 0.794$	$Re = 2760 t^{0.14}, R^2 = 0.486$
	GB	$Re = 514.36 t^{0.15}, R^2 = 0.504$	—	$Re = 4.31 t + 1760, R^2 = 0.334$	$Re = 1.12 \times 10^3 t^{0.16}, R^2 = 0.566$	$Re = 744.99 t^{0.28}, R^2 = 0.872$
Froude number	UA	$Fr = 2.89 - 0.33 \lg(t), R^2 = 0.651$	$Fr = 2.46 - 0.19 \lg(t), R^2 = 0.651$	$Fr = 3.27 - 0.35 \lg(t), R^2 = 0.656$	$Fr = 2.76 - 0.20 \lg(t), R^2 = 0.515$	—
	GB	$Fr = 0.72 - 0.05 \lg(t), R^2 = 0.326$	—	$Fr = 1.0 - 0.09 \lg(t), R^2 = 0.359$	—	$Fr = 1.21 - 0.10 \lg(t), R^2 = 0.634$
Shear stress	UA	$\tau = 0.66 \lg(t) + 0.55, R^2 = 0.737$	$\tau = 1.18 \lg(t) + 0.78, R^2 = 0.813$	$\tau = 1.32 \lg(t) - 0.62, R^2 = 0.817$	$\tau = 1.50 \lg(t) - 0.63, R^2 = 0.663$	$\tau = 1.11 \lg(t) + 0.99, R^2 = 0.819$
	GB	$\tau = 2.44 t^{0.08}, R^2 = 0.205$	$\tau = 3.88 t^{0.05}, R^2 = 0.106$	$\tau = 2.27 t^{0.19}, R^2 = 0.664$	$\tau = 3.64 t^{0.12}, R^2 = 0.212$	$\tau = 1.99 t^{0.27}, R^2 = 0.686$
Stream power	UA	$\omega = 0.34 \lg(t) + 0.16, R^2 = 0.761$	$\omega = 0.38 \lg(t) + 0.55, R^2 = 0.815$	$\omega = 0.78 \lg(t) - 0.63, R^2 = 0.849$	$\omega = 0.69 \lg(t) - 0.23, R^2 = 0.737$	$\omega = 0.27 \lg(t) + 1.56, R^2 = 0.436$
	GB	$\omega = 0.28 t^{0.15}, R^2 = 0.504$	$\omega = 0.69 t^{0.09}, R^2 = 0.123$	$\omega = 0.50 t^{0.19}, R^2 = 0.540$	$\omega = 0.83 t^{0.09}, R^2 = 0.338$	$\omega = 0.51 t^{0.23}, R^2 = 0.806$

Note: UA and GB refer to upstream area and gully bed. Re , Fr , τ and ω are Reynold number, Froude number, shear stress, stream power, respectively. The sample number is 90 for the fitted equations, and the fitted equations are at 0.01 significant level.

Q5. Fig 5: please do not use red text in figure. Try to place legend outside the box (fitting formula is OK, but legend and extra text (like you do in fig 8)

Response: The figure 5 was revised as following:

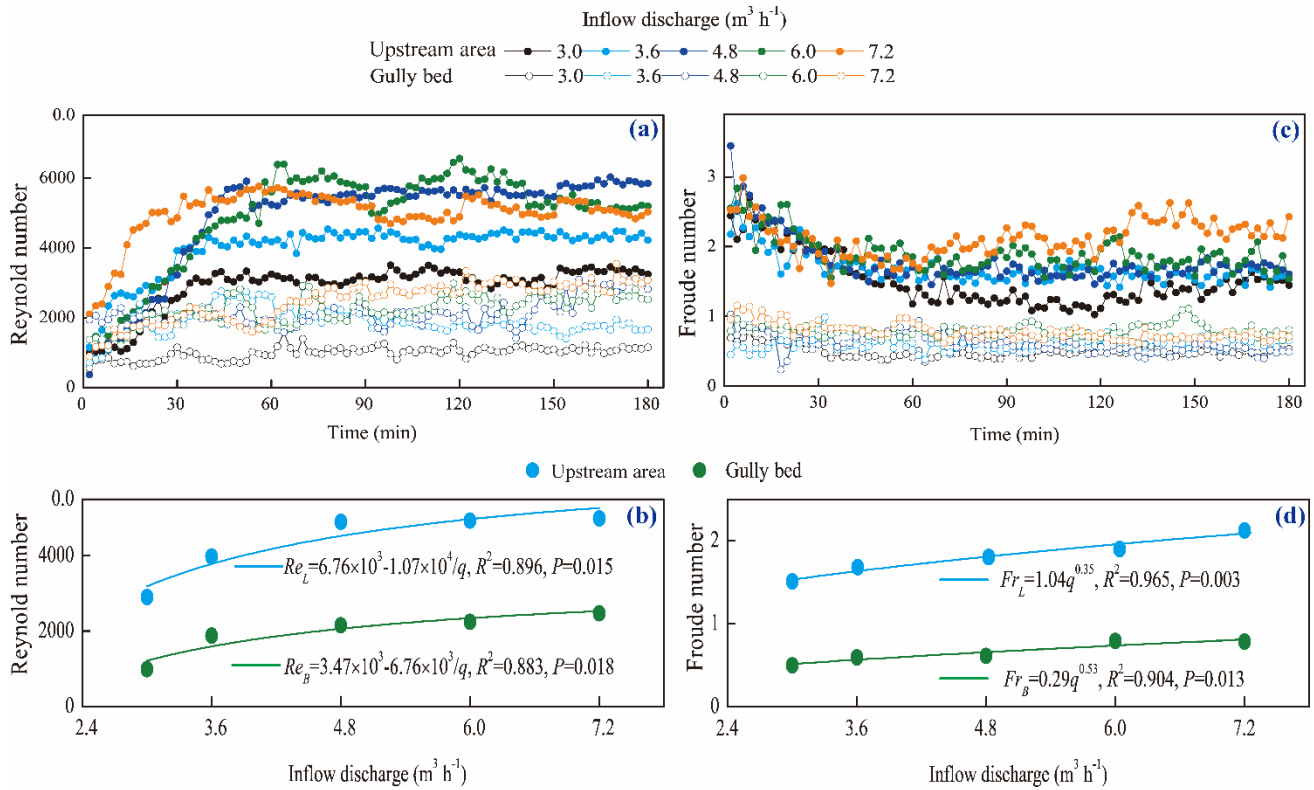


Figure 5. Temporal changes in runoff regime of upstream area and gully bed and their relationships with inflow discharge

Q6. Fig. 7: same as fig 5

Response: The figure 7 was revised as following:

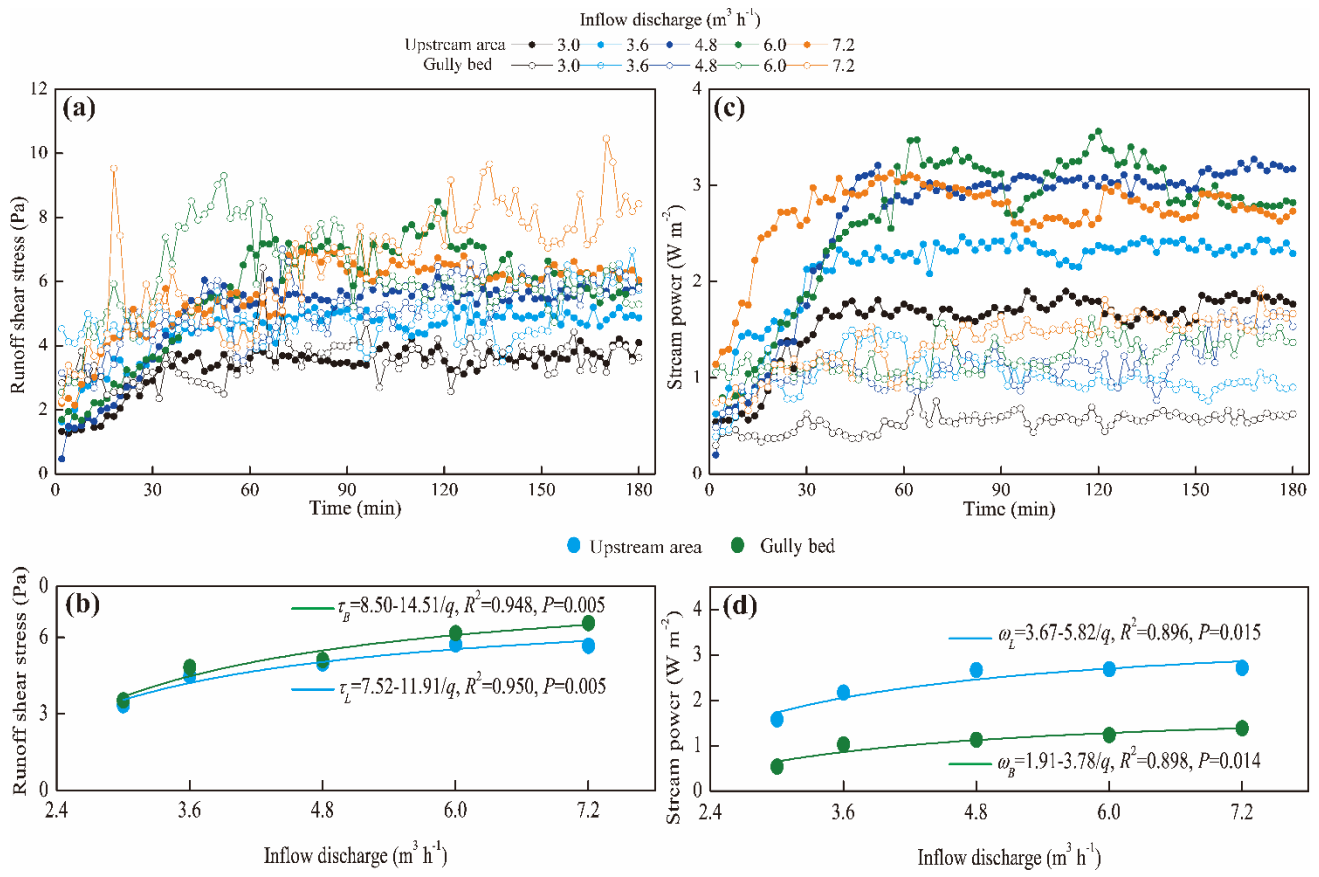


Figure 7. Temporal changes in runoff shear stress and stream power of upstream area and gully bed and their relationships with inflow discharge

Q7. Fig 9: use black for panel indication. Describe panel in figure caption

Response: The figure 9 was revised as following:

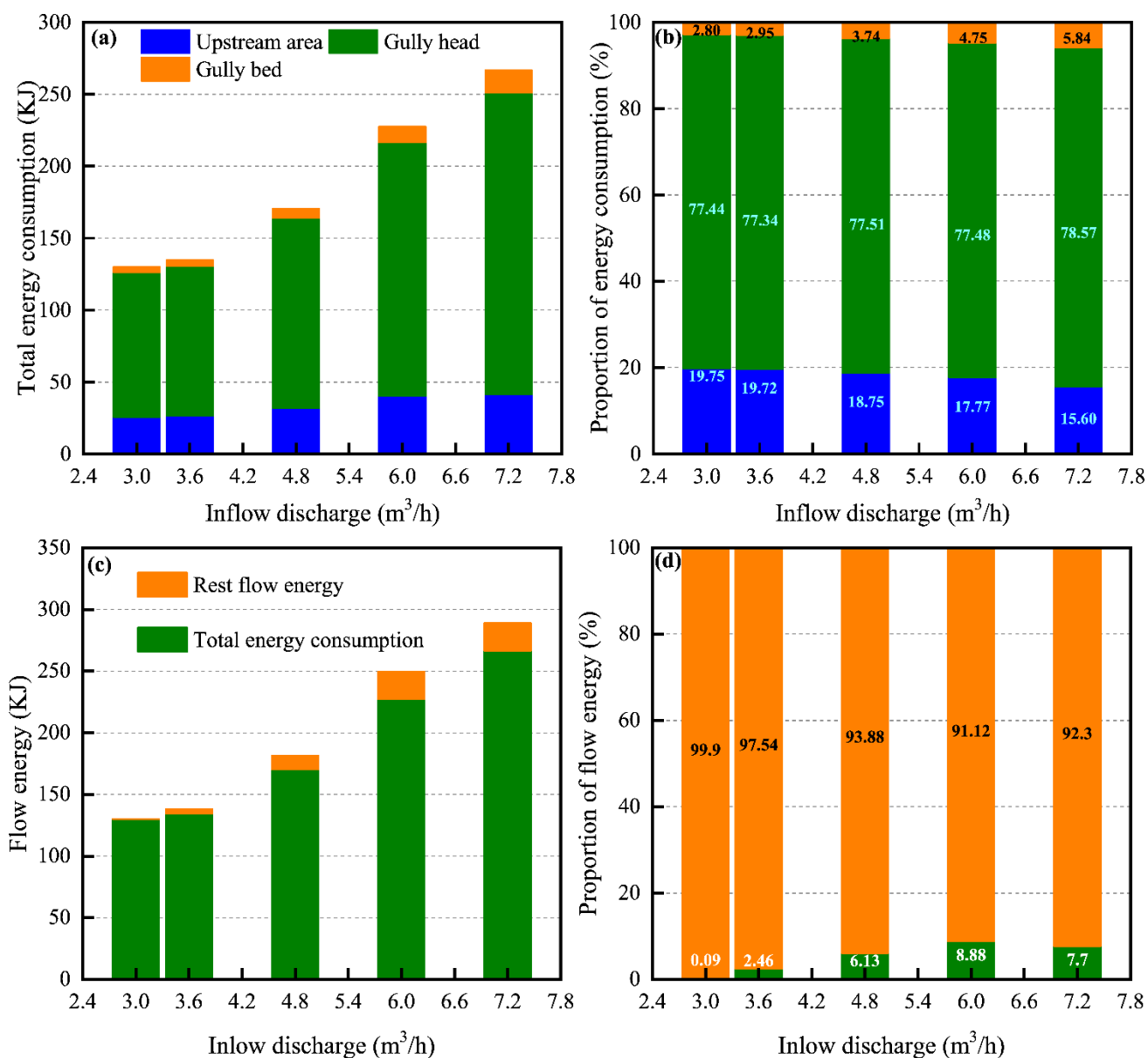


Figure 9. Total energy consumption (a) and their proportions (b) of upstream area, gully head and gully bed, and the total energy consumption and rest flow energy (c) and their proportions (d) with under different inflow discharge conditions

Q8. Fig 10: use black for panel indication and text in figure

Response: The figure 10 was revised as following:

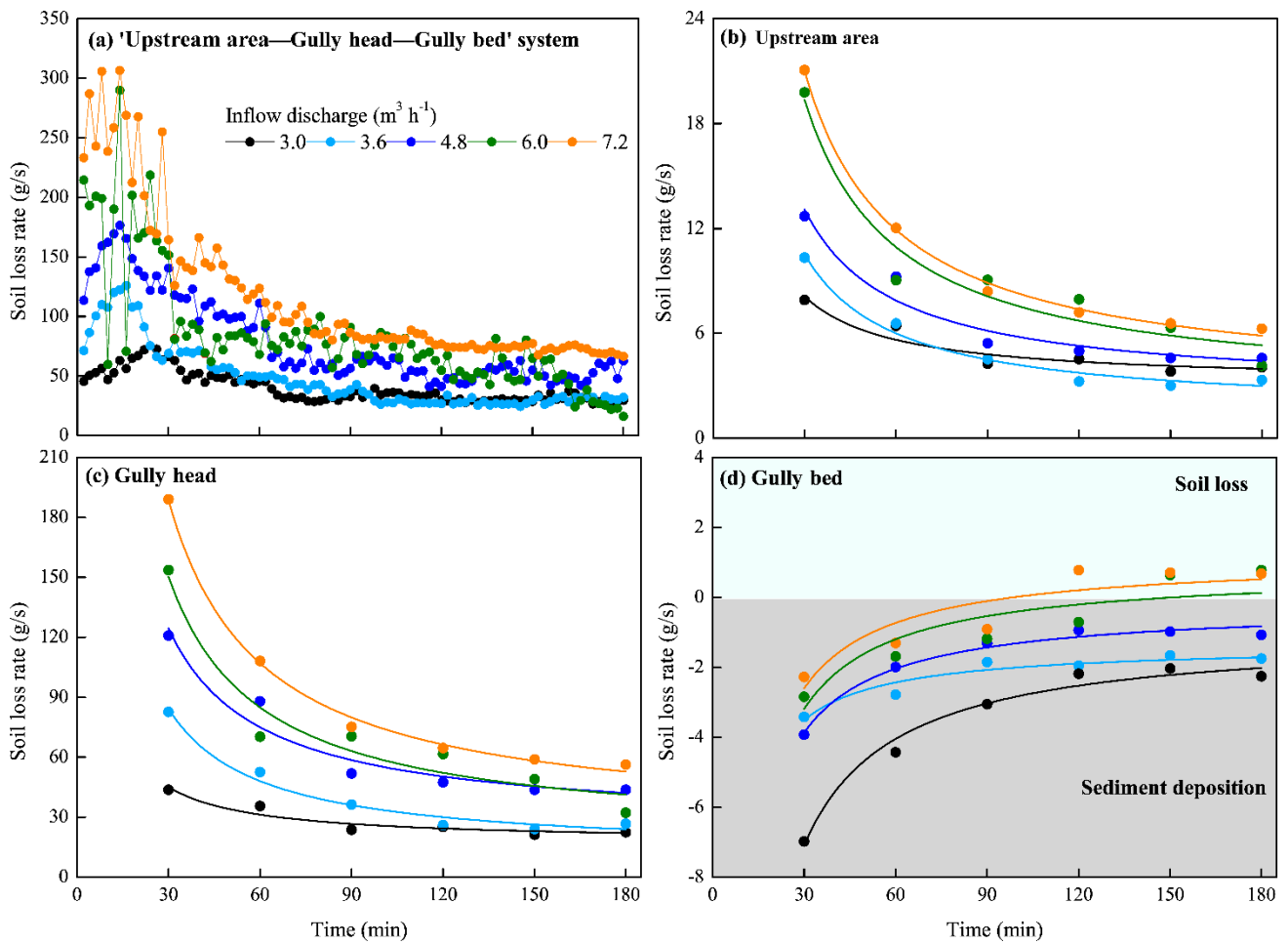


Figure 10. Temporal variation in soil loss rate of the "upstream area—gully head—gully bed" system (a), upstream area (b), gully head (c) and gully bed (d)

Q9. Fig 12: try to align formula text in panels to be at same height and distance from side

Response: The figure 12 was revised as following:

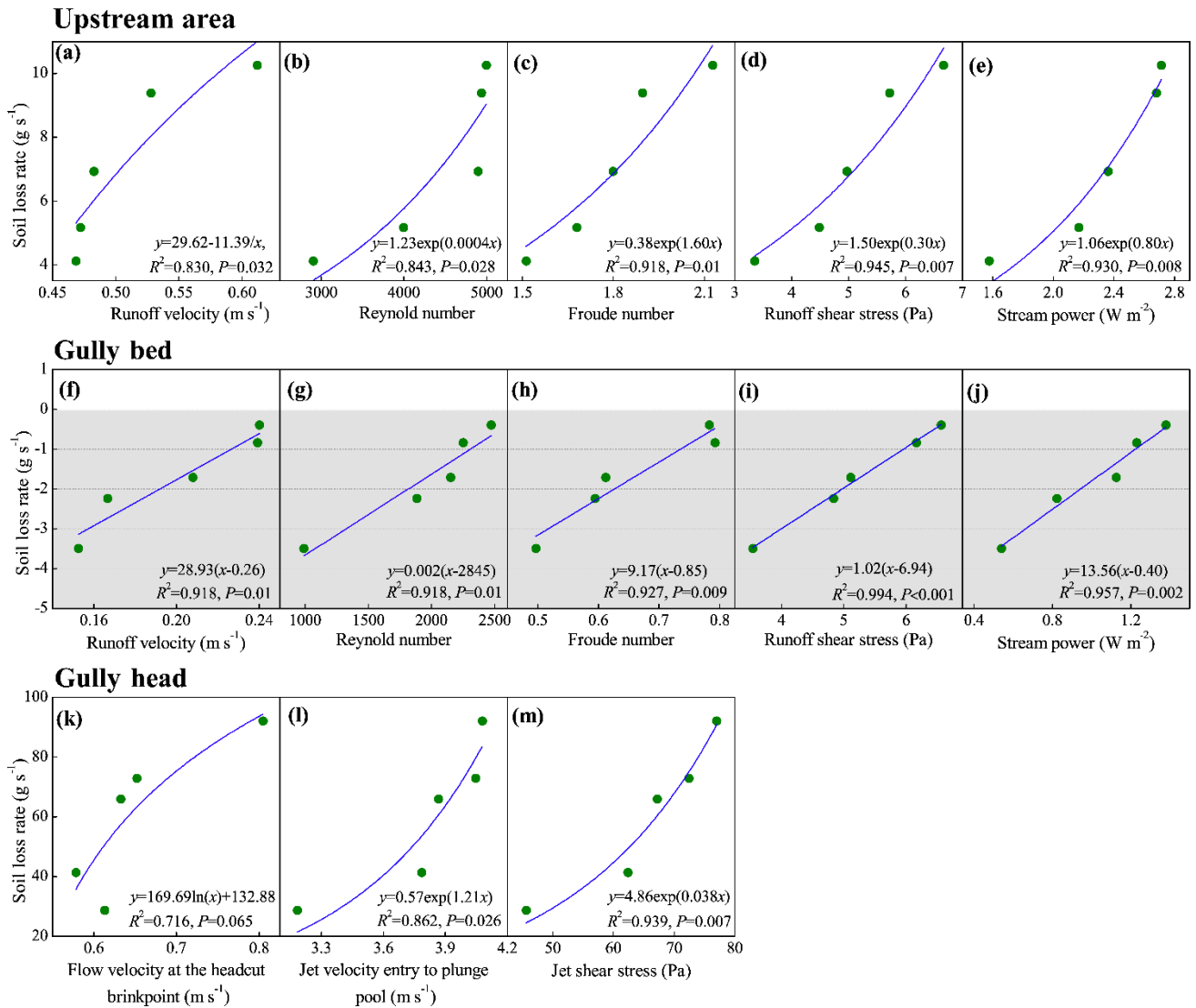


Figure 12. Relationships between soil loss rate of upstream area, gully bed and gully head and runoff hydraulic and jet properties

Q10. Fig 13: use two grades of grey to indicate parts, use black panel indications

Response: The figure 13 was revised as following:

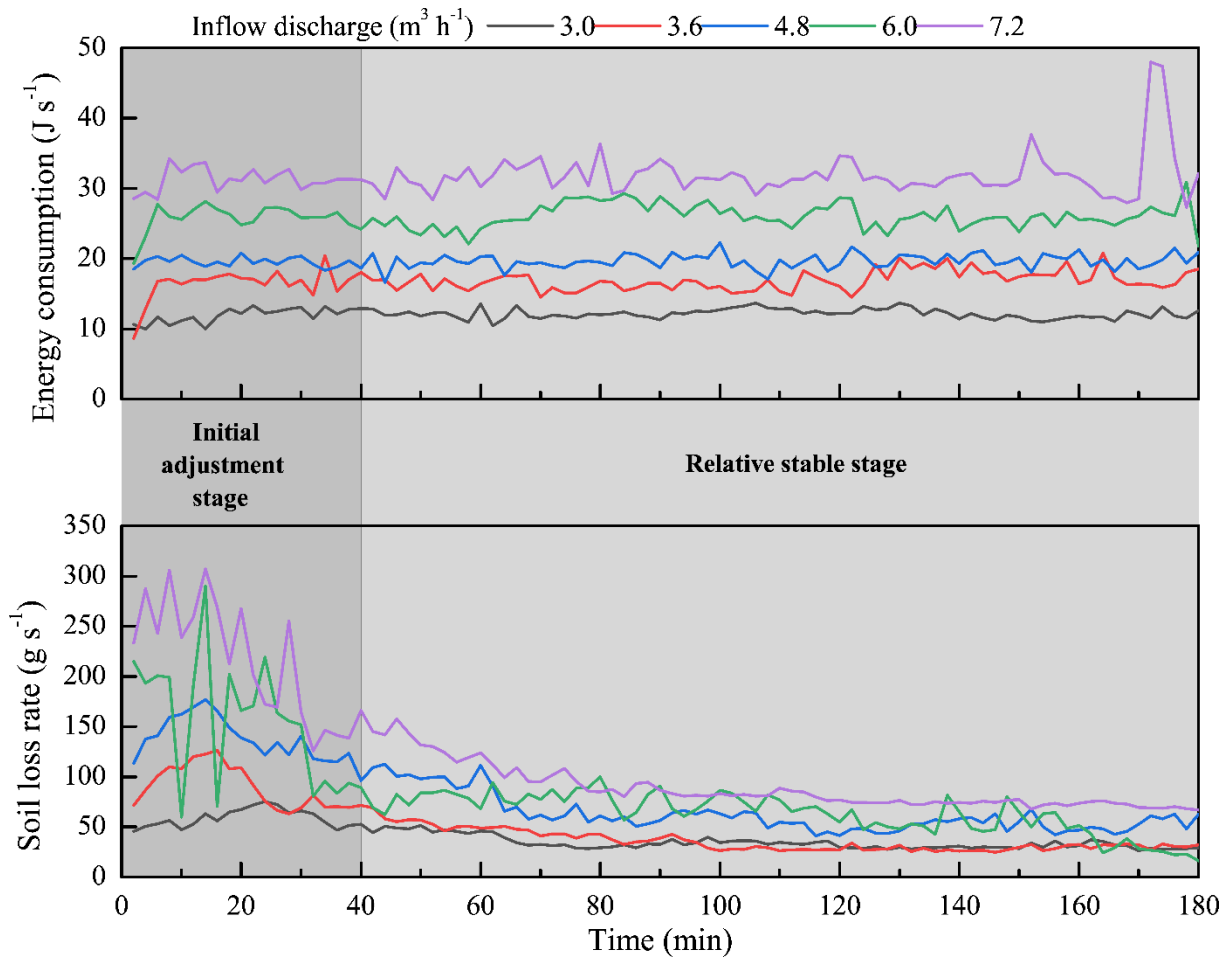


Figure 13. Synchronous change of soil loss rate of “upstream area-gully head-gully bed” system and total energy dissipation during headcut erosion

Q11. Fig 14: black text. Formula does not need bold letter font

Response: The figure 14 was revised as following:

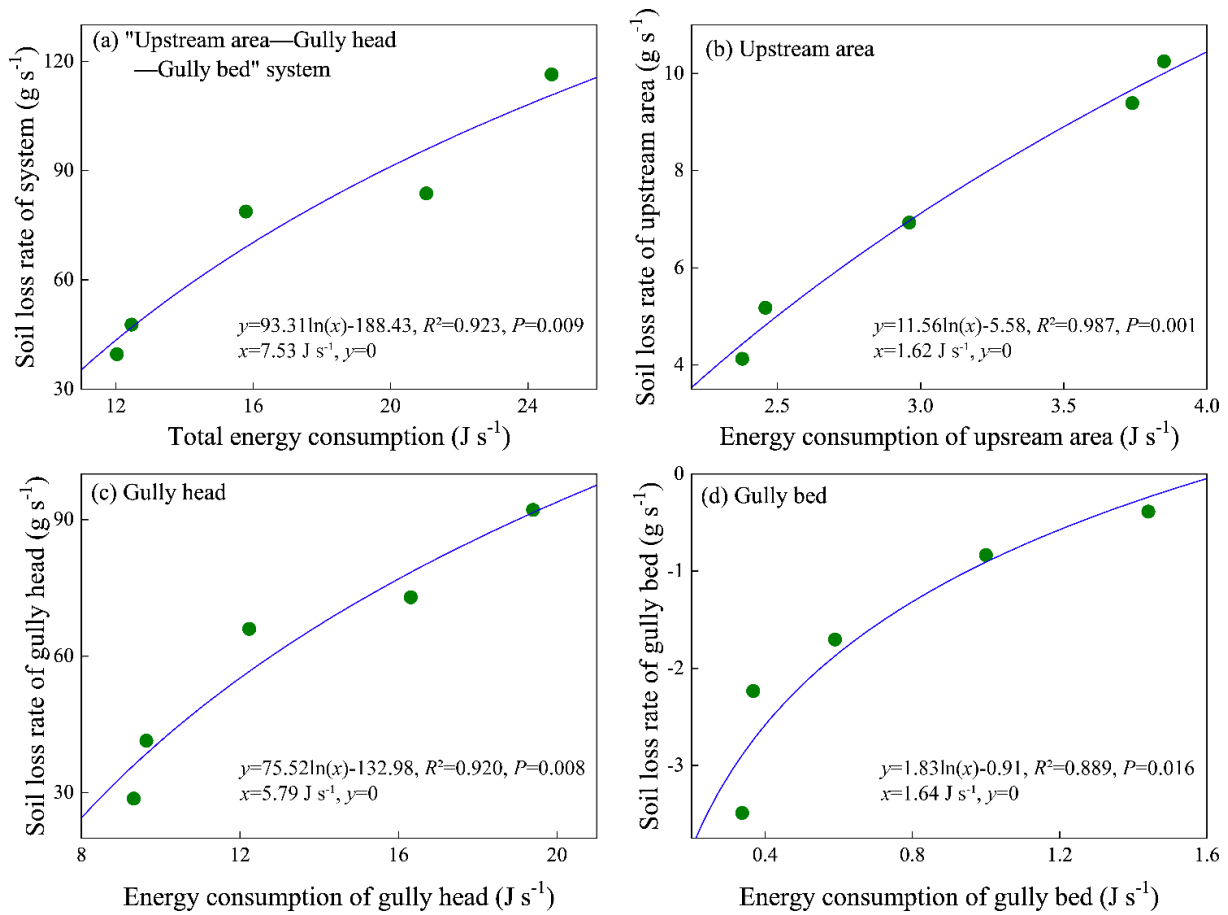


Figure 14. Relationships between soil loss rate of “upstream area-gully head-gully bed” system (a), upstream area (b), gully head (c) and gully bed(d) and energy consumption

Q12. Other figures and revisions

Response: We thank you for your valuable suggestion. We also revised the Figures 1, 6,8,11.

We also check the full MS carefully and revised some inappropriate description.