

Interactive comment on “Velocity and concentration profiles of saline and turbidity currents flowing in a straight channel under quasi-uniform conditions” by M. Stagnaro and M. Bolla Pittaluga

Anonymous Referee #2

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The manuscript presents and discusses the results of 28 laboratory experiments on density and turbidity currents. During the experiments one or more boundary conditions were changed, concentration and velocity profiles were measured in at least one cross section. The experimental data were used to discuss how non-dimensional parameters - densimetric Froude number, Reynolds number and excess density, the presence of suspended sediment and the bed roughness affect the characteristics of the flow. In particular, the authors describe the flow in terms of non-dimensional vertical profiles of velocity and excess density. This is certainly a topic of interest for the

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community working on density and turbidity currents. However, the motivation of the experimental work is not clear. In other words, the authors do not discuss limitations of previous research efforts, and do not illustrate how their experiments are designed to partially fill the present knowledge gap. My specific comments and questions are listed below.

1) The manuscript should refer to similar and related work, for example the work suggested by the other reviewer and/or

Parker, G., Fukushima, Y., and Pantin, H.M., 1986, Self-accelerating turbidity currents, *Journal of Fluid Mechanics*, 171, 145-181.

Sequeiros, O.E., Naruse, H., Endo, N., Garcia, M.H., and Parker, G., 2009, Experimental study on self-accelerating turbidity currents, *Journal of Geophysical Research*, vol. 114, C05025, doi:10.1029/2008JC005149.

Cantero, M.I., Balachander, S., Cantelli, A., Pirmez, C., and Parker, G., 2009, Turbidity currents with a roof: Direct numerical simulation of self-stratified turbulent channel flow driven by suspended sediment, *Journal of Geophysical Research*, vol. 114, C03008, doi:10.1029/2008JC004978.

Cantero, M.I., Balachander, S., and Parker, G., 2009, Direct numerical simulation of stratification effects in a sediment-laden turbulent channel flow, *Journal of Turbulence*, vol. 10 (27), 1-28.

Yeh, T., Cantero, M., Cantelli, A., Pirmez, C., and Parker, G., 2013, Turbidity currents with a roof: Success and failure of RANS modeling for turbidity currents under strongly stratified conditions, *Journal of Geophysical Research: Earth Surface*, vol. 118, 1975-1998, doi: 10.1002/jgrf.20126.

2) The manuscript should describe how the authors designed the laboratory experiments, and how they bracketed the ranges of flow rates and excess density used in the runs. Furthermore, the experimental conditions reported in Table 1 should be thor-

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oughly presented to the reader.

3) Page 820, lines 1-5: I wonder if a 50 cm deep flume is deep enough to run turbidity currents experiments with layer averaged depths up to 17 cm. What was the water depth in the laboratory flume?

4) Page 821, lines 1-5: The authors should tell the reader how they measured the excess density. Did they use a hydrometer? How large were the samples? (see comment 20 below).

5) Page 821, lines 25-29: I would delete figure 2 to reduce the number of figures in the manuscript.

6) Page 822, line 8: the authors should explain why they chose the upper limit of integration where $u = 0.3U$.

7) Page 822, lines 14-24: This seems a partial repetition of the text in the experimental apparatus section. The authors should reorganize the two sections.

8) Page 823, lines 1-4: it is not clear if and how the authors kept the water surface elevation at the downstream end of the flume constant during their experimental runs.

9) Page 823, figure 3: to reduce the number of figures in the manuscript, the authors can probably delete figure 3. It does not seem to add any particular information to the paper.

10) Page 823, lines 20-21: the velocity profiles were averaged over a 10s time interval. Why? Is this temporal interval long enough to have reliable average velocities?

11) Page 823, lines 22-26: figure 4, the authors should explain how they determined the elevation of the flow interface and what it represents. To reduce the number of figures in the manuscript, I would delete figure 4 and just keep figure 5.

12) Page 824, lines 7-8: Throughout the manuscript the authors refer to quasi-steady and quasi-uniform flow conditions downstream of the hydraulic jump. It would certainly

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be beneficial to the reader if the authors clarify a) what they mean with quasi-uniform and quasi-steady, b) how their definitions fits within the literature, and c) in which context they use quasi-steady or quasi-uniform.

13) Page 824, lines 12-15: the authors write "The cross section C1 closest to the inlet was already located downstream of the hydraulic jump". Doesn't this mean that all their velocity profiles refer to subcritical flows?

14) Page 825, line 3: a detailed explanation of how the densimetric Froude number was computed is needed. Is this an inlet Froude number or a Froude number downstream of the hydraulic jump?

15) Page 825, lines 8-12: figure 6b other researchers already showed the collapse of the non-dimensional velocity profiles. It would be nice to acknowledge this in the text.

16) Page 825, figure 8: figure 8 is difficult to read. I would remove it.

17) Page 826 section 3.3 "Head velocity": I wonder if this section is relevant to the analysis of the layer averaged velocity profiles in the current body.

18) Page 827, lines 6-10: this period should be reworded. It reads that it took about 10 minutes to collect one suspended sediment sample, while the number of siphons in cross section C5 was larger than one, and on page 823, line 12 the authors say that the duration of each run varied between 10 and 30 minutes.

19) Page 827, lines 20-24: the measured density distribution remembers the density distribution for subcritical flows of Sequeiros et al. (2010).

20) figure 11b: the authors should explain how they computed the depth averaged excess density. The non-dimensional profile S-18, as well as the vertical profiles of figure 12, shows constant values of the density excess measured at two or three sampling points. How do the authors explain the vertical segments of their profiles? Is this related to the density measurements?

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21) sections 4.1, 4.2, 4.3, 4.4 and 4.5: the authors should discuss how their results compare with the results of previous experimental work.

22) Finally I note that some of the symbols used in the figures are not defined in the main text, e.g. Re^* in figure 15.

Interactive comment on Earth Surf. Dynam. Discuss., 1, 817, 2013.