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Nonlinear Processes in Geophysics
Discussions

Interactive comment on "Explosive instability due to flow over a rippled bottom" *by* Raunak Raj and Anirban Guha

Anonymous Referee #1

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The manuscript at hand presents a theory about resonant triadic interactions for water waves propagating on top of a sinusoidal bottom, in the presence of a linearly sheared current. In the absence of current, this interaction is well known, and the only possible interaction involves a propagating wave, a reflected one, and the bottom undulations. In this work, the authors investigate the effect of a linearly sheared current and investigate the possible existence of an explosive instability (i.e. unboundedly growing with time). Indeed, since the dispersion equation admits new possible solutions, various triadic interactions are now made possible. At the end of the manuscript, a short discussion is introduced about this explosive instability in the presence of a two-layered flow, explaining this instability is more likely to occur in such configurations. My overall impression of the manuscript is not very good. It is unclear, and for this reason, the

point made by the authors is rather unconvincing.

The first reason concerns the way the dispersion equation is addressed. The authors present the roots of the dispersion equation as the intersection of the two branches named SG^+ and SG^-, but I could not find any definition of these two curves. As far as I understand, for each value of k, the authors find the two roots of equation 2.2, and then add kU to each of these roots, obtaining the curves SG^+ and SG^-. Unfortunately, in that process, two other branches are neglected (the branches $\omega_{in} - kU$). Indeed, it is well known that even on a linearly sheared current, the dispersion equation admits four distinct solutions. This procedure has a strong impact on the following discussion, since the reader never realizes which wave is considered (as far as I understand, the counter propagating wave is always excluded, since the intrinsic frequency $\omega_{in} = \omega + kU$ is not even considered here). And this is not a minor remark. It is important, I believe, to understand which waves are considered and discussed here, by comparison with the classical four solutions of the dispersion equation (see e.g. the review paper by Peregrine). Anyway, a classical way to proceed with this difficulty is to consider both $k < 0$ and $k > 0$, and seek for positive values of ω. I assume this modification would possibly impact the results presented here (possibly, equations 2.6 and 2.7 might be affected, and the overall discussion impacted.

The second point which remained dark concerns the obtention of equations 2.9. These equations are just dropped into the paper, without any reference, neither theoretical background. We only know that a time dependence is assumed for both a1 and a2, but this sounds very surprising. What exactly is the physical problem at hand? How is it possible that both these amplitudes suffer a time evolution simultaneously? Aren't we considering forcing by an incident wave (which would certainly have a constant amplitude)? This remark is also important. It is almost impossible for the reader to reach a clear idea of the problem considered, including its boundary conditions, or its spatial extension.

These two points seem of major importance to me, and the impression of unclarity remains valid all along the manuscript. Therefore, I cannot recommend this manuscript for publication in its present form.

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