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Hydrology and Earth System Sciences
Discussions

Interactive comment on "Revisiting Kelvin Helmholtz Instabilities and von Kármán Vortices in Canopy Turbulence" *by* Tirtha Banerjee et al.

Anonymous Referee #1

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General comments: The paper presents results from LES of canopy patches with 2 different configurations of spacing between canopy patches. The canopy patches are modelled with a drag formulation in the LES. The stated goal is to investigate if von Karman streets within the canopy, and Kelvin-Helmholtz instabilities above the canopy, are obtained in the LES despite the drag formulation. Several rather innovative analysis methods (POD, Shannon entropy and mutual information criteria, synchronization analysis) are used as a mean to investigate the presence of von Karman streets within the canopy and Kelvin-Helmholtz instabilities above the canopy. The conclusions remain however very hypothetical and too quickly stated. Overall, the paper lacks rigour in its presentation (description of the simulations as well as the methods) and in the interpretation of results. The analysis methods are (at least for some) not standard in

the community and could be introduced more clearly.

Specific comments: - LES description: The setting description of the canopy patches is confusing and no information is given on the spacing between patches for the two different settings, nor on non-dimensional distances of virtual towers to the vegetation patches. Yet the effect of spacing between patches is stated as a major question to be addressed by the analysis. This question should be addressed rigorously with non-dimensional results with a range of spacing and normalized distance to a patch. The equation set could be written fully. The simulations include scalars (temperature and water vapour) but no mention is made on stability conditions, which will have a strong effect on structures. As described, the simulations would not be reproducible.

- The alternative, so-called 'weak' definition of the VK and KH motions is not introduced properly and should be presented with rigorous hypotheses.

- Method descriptions: The Lorentz curve method is not explained. A parenthesis tries to summarize the idea in a rushed way that is not helpful nor reader friendly. The synchronization analysis is poorly justified in the sense that using a model based on two oscillators to identify the presence of KH or VK phenomena in the simulation outputs is not supported by appropriate hypothesis. Do the authors assume linear wave theory to model the KH or VK phenomena using two oscillators? What is the protophase?

- Interpretation of results: overall, the interpretation of results lacks rigour. The values of the different indicators (Shannon entropy, <u'w'>, local maxima of Iw) are not sufficiently linked to physical processes and are concluded to be signs of KH and VK activity. This is not convincing and comes out as overstatements.

- POD analysis: Patch 2 scenario is suddenly abandoned in the POD results section without justification. That the POD results are conclusive for the presence of von Karman street is not so clear from the figures.

- MIC: large and small scales are poorly defined.

- Virtual towers of 20Hz frequency are used to compare with field results, although field results are never discussed. Is there a reason why the authors decided to use a 30 minute period rather than stationary, less noisy results?

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