Review of "S- and P-wave velocity model estimation from seismic surface-waves" by Anjom et al.

This paper compares three different surface wave measurement and dispersion methods and applies them to real data. The methods include: (1) a data transformation method based on the wavelength-depth (W/D) relationship that was developed and presented by the first author in another paper; (2) a laterally constrained inversion; (3) a traditional dispersion curve analysis based on interstation measurements. I am only familiar with the third method. The advantages of the first one is that it is a lot faster than the other two and it enables to constrain V_P.

Overall, the paper needs some reorganization. Too many sections and subsections that are too short. Some will need to be expanded (there is very little motivational background about the region where the methods are applied, description of the models, or geological implications). Considering the new method was already presented in a separate paper, this paper should not be yet another technique paper and needs to be more than that. It is fine to compare with other methods (though perhaps it should have been done in the previous paper), but there needs to be more than that here. It would be good to reframe the paper and focus on the geological problem that is tackled and fold the method comparison into it.

- Section 2 I a little short. It would be useful to give some more background about the location. What previous studies have been conducted? What have they found? What are the remaining issues you can solve with your technique?
- Figs. 1 and 2: Please, add latitude and longitude markers on the figures
- Section 4.2:
 - Please, specify if the Monte Carlo inversion is linear or non-linear. If it is linearized, please comment on how this can affect the solution.
 - Density is considered a priori. How? Please describe what kind of constraint is imposed. A fixed value? A fixed ratio? Something else? Justify the choice.
 - Line 145: "wide model space" is a vague statement. Please quantify by giving the bounds of your model space.
 - Have you tried to modify the bounds of the model space and see how it affects the solution?
 - \circ What criteria did you apply to select the models with the Fisher test?
 - "The experimental W/D relationship is significantly sensitive to Poisson's ratio." Please, demonstrate or provide a reference to justify this statement.
 - It would be very useful to see a plot of sensitivity curves at the measured periods
 - In Figs. 6 and 7, VSZ was not defined
 - Fig. 8 is based on one model only. It would be useful to plot and discuss the uncertainties in each Vs and Vp model and how they propagate into Poisson's ratio uncertainties. Without good error estimates, differences between clusters are not meaningful
 - Section 4.3 is very short and may need to be expanded or folded into another section.
- Section 5.2
 - $\circ~~V_{P}$ and density are fixed a priori: how? Details are needed
 - Line 221: What does "contemporarily" mean in this context? I suspect it is incorrect English usage.
 - What are the lateral constraints applied?
 - Section 5.3: Please expand and describe your models
- Section 6.3: The results need to be described. A paper section should have more than one sentence.

- Section7:
 - Again, model comparison would be better with error bars on the individual models
 - Fig. 18: the caption should explain the difference between blue and red symbols
 - A discussion of the geological implications of the results is needed. The short paragraph at the end of the section needs to be expanded.
- Section 8: I think saying a method is "a great breakthrough" may be an overstatement. It would be better to use the word "advantageous" or something like that instead.

Minor comments

- Overall, a lot of indices, exponents, and subscripts need to be fixed (e.g. VS, VP, density units, etc).
- There are too many subsections that are very short and probably should be combined into bigger sections or be expanded significantly.
- Line 38: reference to Sotto et al. (2017) needs reformatting
- I am not familiar with the type of study this is applied to. Why do you calculate a time-average velocity? This needs a bit of context. Do you mean Vs measured at different times? Why would Vs depend on time?
- Line 39: Rephrase "showed with synthetic and real tests" to "showed with synthetic tests and tests on real data"
- Line 50: mantel should be mantle
- Line 53: application of SWT for the near-surface characterization \rightarrow application of SWT for near-surface characterization
- Line 54: In literature \rightarrow In the literature
- Line 60:
 - \circ ~ VS should have been defined much earlier in the text
 - o "the" S-wave velocity model
 - Remove *"the recordings of"*. It is the receivers that are aligned with the event. Also, please specify that the alignment is approximately along the great-circle path and thus implies ray theory I applied.
- Line 66: "on two-station ones." \rightarrow "on two-station methods."
- Line 71: Incorrect English wording for "that is in advantage of SWT."
- Line 8: "the" south of France
- Fig. 7b: vertical axis label needs to be moved
- Line 288: analyse \rightarrow analyze