Reviewer 1

The paper is addressed to study the dynamic response and the failure of trees subject to a landslide-induced air blast. The study is developed into a framework that includes the eigenfrequency prediction method, tree motion equations and breakage conditions.

The tree is modeled as a flexible variable cross-section beam hinged at ground using elastic support. The air blast loading is calculated considering the large tree deformations.

Two failure modes (bending and overturning) and the associated failure criteria are defined.

The paper address relevant scientific questions within the scope of NHESS, that is the potential forest destruction of the air blasts.

The paper applies known methods on a specific framework.

The scientific methods and assumptions are outlined clearly and the results are sufficient to support the conclusions. The conclusions present the definition and the evaluation of the dynamic magnification effect of an air blast travelling at 20 m/s and the influence of anchorage properties on the tree eigenfrequency.

Some calculations need to be better explained to allow their reproduction by fellow scientists. For example:

(1) in eqs. 4 and 5, what is “B” ? please define it;

Response: We apologize for the mistake. Same to A_1-A_4 (Line 116), B_1-B_4 are also coefficients that need to be determined based on the boundary and continuity conditions.

(2) in eq 7, what is “F”? please define it and explicit its determinant;

Response: According to Eqs. 5 and 6, $u_1(z)$ and $u_2(z)$ can be written as:

$$u_2(z)=\frac{1}{z}\left[B_1J_2\left(2\sqrt{\lambda_2 z}\right)+B_2Y_2\left(2\sqrt{\lambda_2 z}\right)+B_3J_2\left(2i\sqrt{\lambda_2 z}\right)+B_4Y_2\left(2i\sqrt{\lambda_2 z}\right)\right] \quad l\leqslant z\leqslant h \tag{5}$$

$$u_1(z)=\frac{1}{z}\left[A_1J_2\left(2\sqrt{\lambda_1 z}\right)+A_3J_2\left(2i\sqrt{\lambda_1 z}\right)\right] \quad 0\leq z<l \tag{6}$$

Constrained by the continuity conditions of two segments at the splitting point and the boundary condition at the tree base, Eqs. 5 and 6 must satisfy $u_1(l)=u_2(l)$, $u_1'(l)=u_2'(l)$, $u_1''(l)=u_2''(l)$, $u_1'''(l)=u_2'''(l)$, $u_2(h)=0$, and $Ku_2'(h)+EI(h)u_2''(h)=0$ (Lines 126-128). Therefore, a total of 6 equations are determined here. These 6 equations can be written as a matrix format:

$$[\mathbf{F}(\lambda_1,\lambda_2)]_{6\times6}\,[A_1 \quad A_3 \quad B_1 \quad B_2 \quad B_3 \quad B_4]^T=0 \tag{7}$$

where $[\mathbf{F}(\lambda_1,\lambda_2)]_{6\times6}$ is a matrix that is composed of λ_1 and λ_2 . The eigenfrequency and the corresponding vibration mode can be obtained by solving the equation: the determinant of matric $|F(\lambda_1,\lambda_2)|=0$. Notably, the derivatives of $u_1(z)$ and $u_2(z)$ have very complicated expressions but could be easily calculated using Matlab. Therefore we did not provide the complete expression here.

(3) maybe there is some mistakes in the equations of boundary condition in line 128 (the first one);

Response: Dear reviewer, the first boundary condition “$u_1(l)= u_2(l)$” is correct here. As shown in Fig. 2 and described in Line 104, for the Eigenfrequency calculation, the original point (z=0) is set at the treetop and the maximum value of z is at the tree base. Therefore, $z=l$ corresponds to the crown base, which is the splitting point of two segments (Fig. 2b). Continuity conditions must be satisfied at the point: $u_1(l)= u_2(l)$, $u_1'(l)= u_2'(l)$, $u_1''(l)= u_2''(l)$ and $u_1'''(l)= u_2'''(l)$.

(4) line 158 presents the “w” symbol that is not defined (or is it a typo?);

Response: “w” is the first eigenfrequency and we have provided the definition in Line 158.

(5) please make the velocity and displacement symbols explicit.

Response: We apologize for the chaotic use of symbols. To make readers have a better understand, we will use symbol “v” to represent the velocity and symbol “u” to represent the displacement.

About the title, I suggest deleting the sentence after the colon.

Response: Following your advice, we will delete the sentence after the colon.

The abstract provides a concise, complete and unambiguous summary of the work done and the results obtained. The title and the abstract pertinent, and easy to understand to a wide and diversified audience. About the figures, I do not really like the graphics of the fig.s 4, 5, 6 (the histograms). In Fig. 2.b, I suggest to put into evidence the “z” and “u” with vertical and horizontal axis, respectively.

Response: Many thanks for your comments on our manuscript. For Figs. 4, 5 and 6, we will modify them as line charts to make readers have a better understand. Also, we will put into evidence the “z” and “u” with vertical and horizontal axis in Fig. 2b.

The authors give proper credit to previous work, and they indicate clearly their own contribution. The number and quality of the references are appropriate, although not all references are easily accessible by fellow scientists.

The overall presentation is well structured, clear but not so easy to understand by a wide and general audience. The length of the paper is too long: thank you if you can shorten it by removing the various repeated concepts.

Response: Many thanks for your comments on our manuscript. We will shorten the manuscript by removing the repeated concepts.

The English language is fluent, simple and easy to read and understand by a wide and diversified audience and the technical language is precise and understandable by fellow scientists.

Response: Thank you for your recognition of our English writing.

I would ask the authors to make these concepts more explicit in the text:

(1) Are the authors really sure they can use the large deformation hypothesis in this specific case? If so, why? This hypothesis is usually used to study the deformation of hyper-elastic materials, rubbers, etc. “Large deformations” = Theory of large deformations (I am referring to the non-linear Cauchy model)or Large-displacement or large-rotation theory?

Response: We totally agree with the reviewer’s comment and apologize for the incorrect term. According to the definition by Pivato et al. (2014), our work accounts for the “large deflection” not “large deformation”. The geometric non-linearities related to the tree curvature are accounted for in the expression of the wind load on the tree structure (Eq. 9). Pivato et al. (2014) have tested the ability of using the multi-degree-of-freedom tree swaying model to simulate large deflections and shows good performance. We will make the corresponding modifications (change the term to “large deflection”) in the revised manuscript to make readers have a better understand.

Pivato, D., Dupont, S., and Brunet, Y.: A simple tree swaying model for forest motion in windstorm conditions, Trees, 28, 281-293, 2014.

(2) About the boundary condition at the tree base (continuity conditions, lines 126 - 128), I believe the authors use elastic line theory (i.e. Euler-Bernoulli beam theory), i.e. they refer to a linear model of the beam. If this were true, this passage would go against the hypothesis of large deformations. please explain why you can use these equations.

Response: We apologize for the incorrect term in the manuscript. Our work accounts for the "large deflection" (Pivato et al. 2014) rather than "large deformation" you mentioned. The eigenfrequency is calculated using a Euler-Bernoulli beam theory and a linear modal analysis is used to model the tree motion under air blast load. The geometric nonlinearities related to the tree curvature are accounted for in the expression of the wind load on the tree structure. Therefore, our work does not against the "large deflection". This method could account for the large tree deflection and has been tested by Pivato et al. (2014).

Pivato, D., Dupont, S., and Brunet, Y.: A simple tree swaying model for forest motion in windstorm conditions, Trees, 28, 281-293, 2014.

(3) it is not clear to me why (in lines 271-274) "to investigate the impact of these factors, we conducted a comparative analysis by simplifying the tree motion model of eq.8 WITHOUT involving the impact of large tree deformation". so the starting hypothesis is no longer taken into account? we return to the hypothesis of small deformations? Thank you if you can explain this better.

Response: Many thanks for your valuable comment. As we stated in Lines 269-274, our proposed model accounts for the impacts of large tree deflection (Sorry, not large deformation): eccentric gravity and modeling of air blast force regarding the wind-tree relative motion and geometric nonlinearities. To investigate the impacts of these factors and confirm the necessity of considering large deflection, a comparative analysis is needed to make readers have a better understand. Therefore, we performed a comparative analysis in the absence of the hypothesis of large tree deflection. The comparative analysis in the absence of large tree deflection provides two main contributions here: (1) highlight the impact of large tree deflection to the air blast assessment; (2) validate the proposed model (both analyses show high agreement in the case of a very low air blast loading, as shown in Fig. 6).