Answers to anonymous review

The referee is thanked for the review. Answers and actions to all points are given below (blue text).

General comments

- It is important to highlight the issues and aspects of the "quick" load calculation method that have been adressed here and have not been considered before.

- Which information is missing? The model is presented in the introduction and the following sections.

- Does the overturning moment include both the fore-aft and side-side bending moments.

- No, only fore-aft. This will be added in beginning of section 2.2 "The structural model" where the shape function of the model is presented. Reason for fore-aft only is to have a simple and fast model.

- please elaborate on how the aerodynamic damping has been precalculated.

- Which information is missing in the presentation of the methods to calculate the aerodynamic damping?

- please consider the use of a list of symbols, since symbols used in the figures are not self explanatory.

- A list of symbols will be added.

- some information about the wind turbine would be useful since some parameters are mentioned many time such as, rated wind speed, rotational speed at rated etc.

- Agree, this will be added, when the wind turbine is introduced on p.12, l.27.

- the damping behavior may change with the turbulence intensity, especially when the wind turbine is operating above rated wind speed, would the computed damping from the different methods change with turbulence intensity.

- Considering the decay tests, it is not expected that the turbulent intensity would change the results much. As can be seen from figure 8, the damping ratio is very similar irrespectively of whether the wind speed is constant or turbulent, which is due to the fact, that the, pitch and rotor speed is kept constant. Considering the standard deviation method, the damping will change if the displacement changes, which is the case if the turbulent intensity is changed.

- the most critical state is usually around rated wind speed. In this case the wind speed fluctuate between below rated (where the pitch is not active) to above rated where the pitch is activated. How would this constant switching behavior affect the calculation of the damping ratio?

- The damping is calculated for an average wind speed of 10 m/s and 12 m/s. For 12 m/s the pitch and rotor speed is kept constant. If the average wind speed of 10 m/s contained wind speeds above rated, it was not found to cause any problems in decay tests. Perhaps the wind speed did not exceed rated in the 50 s the decay test ran for. But yes, the discussion is missing in the text. This will be added.

- please be more specific on the loads that have been calculated with this method, bending moment in both directions ?

- No only fore-aft direction is considered. This will be added when the figures are presented.

directions ?

- for the design of monopile/bucket, pile rotation could be important

- Do you suggest that we should add a mode more? Rotations are included at 'lid' – refer to the spring in figure 2.

Comments inside the paper

All language and layout-issues will be corrected in the paper.

P5:

- No z is here in the horizontal direction, but I agree that this is confusing and will be change.
- The point force is function of \eta_z, and increases therefore as the wave becomes steeper. It is only significant for very large waves, and therefore it can be seen as a slamming force.

P7

1. No only fore-aft
2. Smaller will be replaced with lower.
3. Yes, gravity of both the RNA and the tower. This will be added in the text.

P8

2. Velocity produces damping through the GD term in eq (8). The pile displacement is just used for calibrating the linear damping coefficient. One could also have used standard deviation of tower top velocity. However, we do not expect difference to be large, at least not if the main motion occur at the natural frequency.
3. "Seen" will be changed to "visible".
4. Please see figure 6 and 7. For each decay test a run with and without an initial velocity is performed and afterwards subtracted.

P9

1. Text will be updated

2-3. Text will be updated. Blade rotational speed and rotor speed is the same.

4. The choice of a simple damping estimation is part of the models philosophy. We compare the model results to the full aero-elastic model FLEX5 in the paper to quantify how well the approximate steps applied work. This is done in figure 12-17.

P10

5. One explanation can be that the standard deviation puts more weight to the low-amplitude motion. In the decay tests, the damping seems to become smaller for low amplitude motion, see figure 7, lower plot, for t>30s. We will look into that during the revision and add a discussion to the paper.

P11

1. A situation with wake could also be considered, as this will change the turbulence intensity, and the aerodynamic forcing. The input to the model is therefore just changed.
2. Yes, soil damping is important to include. The soil damping is part of the viscous damping which represent structural damping, soil damping and hydrodynamic radiation, cf. page 6.

P13

The table text of table 2 will be updated.

As explained in the text on page 12 the "+" and "-" indicates, whether the peak frequency or multiples of the peak frequency are close to the natural frequency.

P17

It is an ultimate limit state, which is considered. This will be corrected in the text.