# 1 Summary

The manuscript presents an implementation of the actuator-cylinder model in OpenFOAM. The model is used to study the wakes of vertical-axis wind turbines. The implementation is compared with a number of previous studies, both experimental and numerical. While the topic of the study is relevant for the field, the scientific quality of the paper leaves much to be desired. A major revision, with a fair amount of additional work, is therefore necessary IMO before the manuscript is suitable for publication.

# 2 Turbulence

The main issue with the manuscript is the sometimes cavalier approach to turbulence. Below, I outline my main criticism in this regard.

## 2.1 Variation of TI over the computational domain

The authors give the adopted value of TI without further critical discussion. As turbulence is subject to dissipation, plots should be shown of how turbulence varies over the computational domain (e.g. by plotting TI on a line through the AC, from inlet to outlet).

## 2.2 Turbulence intensity is not a free parameter

In sect. 5.3, turbulence is increased from 1 % to 5 %, 'until the results become optimal'. This is wrong, of course. Apart from the fact that the adopted values are low for the ABL, turbulence is a variable describing a physical state, and cannot be treated as a free parameter. Also, turbulence along a line in the wind direction going through different VAWTs, will vary in a nonmonotonic way. The authors should show how their TI varies along this line. And, again, TI should not be treated as a fit parameter.

# 3 Solidity

While it is understandable that the ACM performs less well a high solidity, the discussion of this issue in the paper is not always clear. On p. 3, sect. 1, the issue is first mentioned. Rather than stating that will be discussed 'later', refer to the appropriate sections. The performance of the ACM as a function of solidity should be discussed more carefully. On p. 3, sect. 1, the high solidity of the VAWT in the paper by Araya et al is mentioned but, nevertheless, there is an extensive comparison with that work. Should the reader conclude that $\sigma = 0.3$ is still acceptable? If so, at which solidities do results cease to be acceptable? The effect of solidity is presented in figure 8, but only chord langths are given. The solidity should be given explicitly, and the results should be discussed more carefully, including the ability of the ACM to generate a result at high TSR and high solidity (lower panels of fig. 8).

# 4 Stall

In sect. 5.3, the discussion of stall and the 'heuristic correction' needs to be improved. The statement is made (p. 16) that the AoA exceeds the static stall angle and this is remedied by squeezing the values of $\alpha$ so that they no longer exceed the static stall angle. I am not convinced that this is justified: at low TSR, the blades *will* experience stall. Why does this physical phenomenon need to be removed from the model? Also, what occurs is dynamic stall rather than static stall. Why then is the focus here on static stall?

## 5 Paired VAWTs

Paired counter-rotating VAWT pairs in close proximity are modelled in sect. 5.3. Were modifications to the model required to handle this case?

## 6 Figure 13

Fig. 13 should have ticks and values for the normalised spatial coordinates, to facilitate the interpretation of the subsequent figures.