

**Review of “*The impact of the Santa Coloma de Queralt fire on the atmospheric boundary layer: the development of a fire-induced circulation*” by Roelofs et al. 2025**

I would like to thank the authors for their thorough review of the article and the corrections that have been made. The objectives have been made clearer. Thanks as well for checking on the typos of my review (units of kW/m<sup>2</sup>/s for example).

I have nevertheless pointed out some small points, mainly of the discussion, that still need to be addressed.

**Comments of your answer**

A comment regarding your answer: “Although we understand the wish for a measurement error, this is impossible for sounding measurements, as they only provide a single measurement per height and per time step.” All experimental measurements provide a single measurement, then you can calculate the uncertainty of your measurement using tabulated data or propagation techniques. However, it does seem that it is uncommon to provide measurement errors for sounding experiments.

A comment regarding the vertical wind velocity probability distribution. Although it's out of scope of this paper it might be interesting to try to find the probability law distribution of your data (looks like a gamma distribution from -10 to 18 m/s) and try to find how changing the wind or fire intensity modifies the distribution.

**Comments and detailed points of the modified manuscript**

I think it is important to detail that you speak about “dry convective plumes” every time you mention pyro-convection, so the reader understands better the context of the study. For example, the recent paper from Wang et al. (2025), while still a preprint, also explains the fire-induced circulation in moist convective plumes (<https://arxiv.org/pdf/2507.01237>).

Regarding Figure 15, I do realize now the difference, and I agree with this version, it also corresponds better to what is shown in Figure 10. However, I think it could be completed with a YZ plan (across the fire front). Fire is a 3D phenomenon (4D if you include time) and the papers you cite show another fire-induced circulation across the fire front. (Filippi et al. 2018) shows it in Figure 9c. It can be interesting to further develop your Figure 15.

For coherence reasons, the conclusion could benefit from a rewriting. Indeed, at the beginning of the conclusion you say that “the objective of the study was threefold” (L498) while in the introduction (L76) you say that “we pursue a twofold objective”. The first objective mentioned in the conclusion (ie: “replicate the measured in-situ thermodynamic structure of wildfire plumes using LES”) is in fact the *validation* of your LES simulation which all three reviewers agreed was not an adequate term here.

Similarly, in the second paragraph of the conclusion you say that “The simulated plume shape and in-plume  $\theta_v$  matched the observation”. While the plume shape does seem to qualitatively represent the observed one (even if we don’t have actual measurements or distance estimations of the observed plume shown in Figures 5a,b,c) it is more difficult to support that statement for the virtual potential temperature (for different reasons: ERA5, simulated  $\theta_v$  is a median-per-height value, the initial launching location of the radiosonde outside of the flaming zone etc).

L402: Choose « directly » or « indirectly ». You can also explicitly explain how the fire-induced circulation was shown directly in some papers and indirectly in others.

L411: Justify your statement regarding extreme fire behaviour with a reference.

L412: Lareau et al. said that frontal inflow « is a common feature » (page E1310 in (Lareau et al. 2022)). Saying that « frontal inflow is linked to the formation of fire-generated vortices » could induce a relation of causality that might not be true.

L413: Do you have a reference? The ACP journal accepts *informal* literature but only when there is no alternative. In all cases provide your source.

L427: You write that the SCQ fire increases the BL height ahead of the fire and in line 424 you wrote that you observed a 50% decrease in the BL height further ahead of the fire. This could sound contradictory: please rephrase L427 by specifying the distance in which you observe the increase (i.e. first 2 km).

L494: The reference to your future work belongs to the conclusion part, not the discussion.

End of document.