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Interactive comment on "Decoupling of a Douglas fir canopy: a look into the subcanopy with continuous vertical temperature profiles" *by* Bart Schilperoort et al.

Anonymous Referee #3

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General comments:

This manuscript deals with the decoupling in atmospheric boundary layer in a forest canopy, through the identification of static stability, from temperature profile obtained by the DTS technique. Forest canopy studies, which contain higher vertical resolution, are rare and may contribute to understanding the exchanges between under-canopy/canopy/free atmosphere above. Particularly, in very stability, conditions, the decoupling of layers under-canopy induce the accumulation, important in quantifying the exchange of momentum, water and scalars between the forest atmosphere, because contributes this balance. The manuscript add understanding of the flow over

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forests and is well written, succinct and well organized. However, I have some considerations (suggestions): - I mainly suggest use the instruments at 0.8 $\sim$ 1m installed, in some way (sonic anemometer). You can use both for u* analysis, as well include others turbulent parameters, such σw or VTKE, in relationships with temperature gradients via DST technique. (If the measurement period coincides). - A second methodology to determine decoupling thresholds of layers can be interesting, reinforcing your results. Either for all period, or maybe in case study (same periods used in section 3.1). I believe this is feasible, if high frequency measurements are available in anemometer (Gill 3D), in the specific comments I better present this suggestion.

Specific comments:

Lines 15 – 16: "This points towards the understory layer acting as a kind of mechanically 'blocking layer' between the forest floor and overstory", in fact I believe that a dense canopy, the leaves can act as turbulence filter. For that, it would be necessary adjust the time window of averages (in this case you used 15 min. I may be wrong!), to better observe this filtering. Some studies in forests have shown the turbulence in time scales until 100 seconds is restricted within canopy, while movements with larger scales can reach top and pass to above. Please consider adding something related to this.

Lines 39 – 40: "These regimes vary per site and are dependent on both the forest structure and the ambient weather conditions. In particular, the subcanopy tends to be decoupled during the day, when highest temperatures are found at the top of the canopy, and to be coupled in the night when lowest temperature occurs at the canopy top". The layer under canopy decoupled from the atmosphere above forest, generally, at night. You need review, because it's confused, or you be referring only the layers within canopy?

Section 2.4: Using polynomial fit, could you expose example of the profiles/gradients from raw data and after being adjusted. Maybe, can determine differents Richardson numbers, taking advantage the temperature profile. One stability parameter above and another within the forest. Consider using the bulk Richardson number. (MAHRT, et al., 2013).

Lines 189 -190: “This will cause a stable stratification above the canopy and above the forest floor, while the bulk of the canopy (2 - 26 m) is unstably stratified due to the colder air in the overstory.” I don’t think 2-26m is unstable, but rather, near-neutral.However, if the classification was unstable, show the temperature gradient quantification that led this classification, it seems is very subtle.

Section 3.2: About forest floor discussion, is interesting analyzes between temperature gradient and friction speed at 1 m (sonic anemometer). Maybe, extrapolate using turbulence at level for other analyzes.

Section 3.3 - Also with the eddy covariance (48m) and sonic anemometer (0.8 $\sim$ 1m) systems, you can use some other turbulent parameters, perhaps σw or VTKE (VTKE = 0.5 (σuˆ2 + σvˆ2 + σwˆ2) ˆ1/2), in temperature gradients classification. If you choose VTKE, its relation with the average wind (could compare with the wind above and within canopy), can help determining threshold at under-canopy layer starts to be decoupled from levels above (see: SUN et al., 2012, ACEVEDO, et al. 2016).

Technical corrections:

line 95: “mean speed speed” double.

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