We thank referee #2 for taking the time to read our manuscript and provide useful suggestions and feedback. We have modified the manuscript to address your points. Referee comments are in black, our responses are in green, and changes to the manuscript are colored blue. Our line references refer to the revised manuscript.

Referee #2

General comments.

In this work the authors compare turbulence measurements made on a car instrumented with a sonic anemometer with the same measurements taken on a fixed tripod at the side of the road. The choice of the site, with lateral obstructions but with light traffic, is appropriate to the purposes of the comparison. The growing need of spatially extended data over inhomogeneous terrain makes mobile measurements an important topic in turbulence measurements. The most intriguing part is a wavelet based approach to reduce eddy-covariance measurements when they substantially differ from the ones from the fixed instruments and to remove the effect of intersecting vehicles on the measurements. The paper is clear and well written, sometimes a bit heavy to read for someone not familiar with all the correction methods described throughout. I recommend publication after the authors addressed my minor comments.

Major comments.

1) Section 2.5. As said above, this may be the most interesting part of the paper, since it offers a solid correction method for car measurements. However, while the wavelet analytical formulation is very clear, how the wavelet is applied is far less clear. I struggled a bit in understanding what is the averaging time scale on which the measurements are compared. At line 403 it seems that the maximum track length (in seconds) is around 40–60s while 5 to 8 minutes averaging was used before for wind directions and speeds. Was a different averaging time used for variances and covariances to compare with wavelet analysis or was only T set to 40–60 s as wavelet max–scale to reduce low–frequency contribution?

Response: We have expanded Section 2.8 to address your question and clarify the averaging periods used (see below).

Expanded Section 2.8 between lines 371 to 402:

The averaging period (T_m) on the car is set to the temporal length of the 1000 m track for atmospheric means. For car-measured atmospheric variances and covariances T_m is calculated from Taylor's hypothesis (as $T_m = L/\bar{u}$,) with an L = 1000 m track length. On the instrumented car we have $\bar{u} \cong s$, where s is the near-constant vehicle speed over the 1000 m track, and therefore T_m is equivalent to the time it takes for the car to travel 1000 m (for both eddy-covariance and wavelet analysis). For the car, any measurement pass that follows closely behind a vehicle is excluded from the results. To quantify a wavelet variance or covariance on the car, the maximum wavelet time scale (a^*) must be chosen. In this study a^* is set to match T_m as closely as possible (i.e., the temporal length of the 1000 m track). This approach is used so that the wavelet variance (or covariance) is directly comparable to eddy covariance since both methodologies will include the same time scales (a^* controls the maximum time scale included in the wavelet variance or covariance).

T_m on the tripod is set to 5 min for atmospheric means, but for atmospheric variances and covariances T_m varies depending on the mean 5-min wind speed measured by the tripod ($\bar{u}$) according to Taylor's frozen hypothesis, where L = 1000 m. For the two measurement days investigated here, T_m on the tripod ranges between 5 and 8 min. For consistency, the averaging period used for calculation of the tripod means, variances and covariances is centered on the time that the instrumented car passes the tripod (for both Track #1 and Track #2). The choice of L on the tripod is not trivial, since L should be determined by taking into consideration the vehicle speed in addition to the mean ambient flow. Since the mean ambient flow in this study was relatively weak (~2.5 m s^{-1}) and typically at an angle to the vehicle, we have $\bar{u} \cong s$ on the car, but in strong ambient flow $\bar{u} \neq s$, and Taylor's hypothesis would suggest a different L on the tripod to compare with the 1000 m track driven by the car. For example, if $\bar{u}$ = 30 m s^{-1} on the car with $s = 22$ m s^{-1}, then 1000 m travelled by the car would correspond to a distance of L_s = 1364 m travelled by an air parcel, and this distance should be used to determine T_m on the tripod, that is $T_m = \frac{L_s}{\bar{u}} > \frac{1000}{\bar{u}}$. The averaging periods adopted in this study for each methodology (wavelet analysis or eddy-covariance) and measurement system (car or tripod) are summarized in Table 2.

Table 2: The averaging periods (T_m) used to calculate means, variances and covariances on the instrumented car and stationary roadside tripod. T_m for variances and covariances are calculated from Taylor's hypothesis ($T_m = L/\bar{u}$) with an L = 1000 m track length. On the instrumented car we have $\bar{u} \cong s$, where s is the near-constant vehicle speed over the 1000 m track, but for the tripod $\bar{u}$ is the mean wind speed measured on the tripod and calculated from 5-min averages.

	T_m **on the instrumented car**	T_m **on the tripod**
Means	40 – 60 s	5 min
Variances / covariances (eddy covariance)	40 – 60 s	Varies between 5 and 8 min
Variances / covariances (wavelet analysis)	40 – 60 s, including wavelet scales up to a^*, where $a^* \cong T_m$	N/A

2) The comparison between the turbulent heat flux is very interesting and well discussed. Would not be the case to compare the temperature variances seen by the tripod and the car?

Response: We have added analysis of the sonic temperature variance to the revised manuscript.

New figure for sonic temperature variance (line 552 – 555):

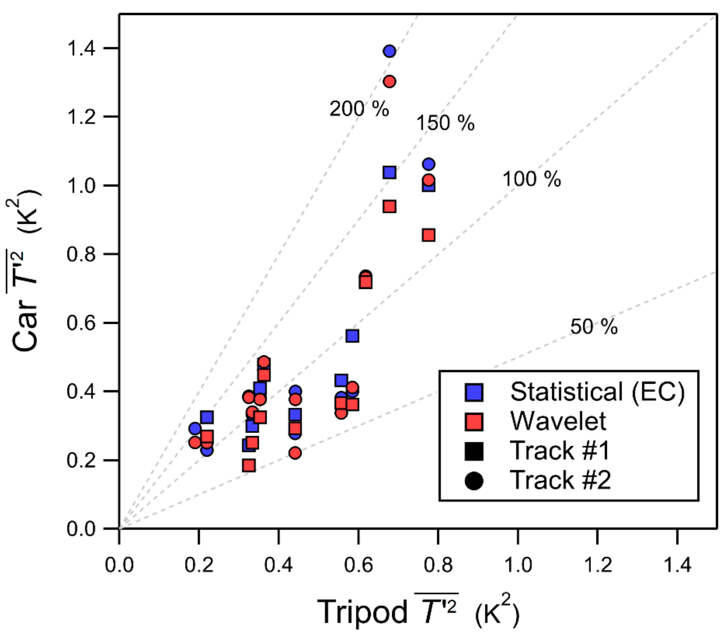

Figure 9: The sonic temperature variance, $\overline{T'^2}$ measured by the tripod (horizontal) and compared to the mobile car (vertical). Covariances calculated using wavelet analysis and eddy covariance are shown as red and blue markers respectively. Dashed grey lines denote constant percentages of the independent variable.

Added new line for temperature variance to Table 3:

Table 3: Statistics calculated over all measurement passes (i.e., on both tracks on 20 and 22 Aug). Subscript EC denotes a statistical variance or a covariance calculated using eddy–covariance. A subscript W denotes a variance or covariance calculated using wavelet analysis.

	MBE_{EC}	MBE_{W}	RMSE_{EC}	RMSE_{W}	Mean_{EC} Car	Mean_{W} Car	Mean_{EC} Tripod
$\overline{u'^2}$ (m² s⁻²)	0.90	0.44	1.44	0.75	2.15	1.69	1.26
$\overline{v'^2}$ (m² s⁻²)	0.20	0.04	0.61	0.44	1.38	1.21	1.19
$\overline{w'^2}$ (m² s⁻²)	–0.11	–0.12	0.12	0.13	0.17	0.16	0.29
$\overline{T'^2}$ (K²)	**0.05**	**0.01**	**0.19**	**0.18**	**0.52**	**0.48**	**0.46**
$\overline{u'w'}$ (m² s⁻²)	0.005	0.02	0.08	0.08	–0.13	–0.11	–0.14
$\overline{w'T'}$ (K m s⁻¹)	–0.05	–0.04	0.06	0.06	0.08	0.08	0.13
$\overline{u}$ (m s⁻¹)	0.04		0.53		2.45		2.42

Added lines 527 – 533: Despite a low bias noted in $\overline{w'T'}$, there is no low bias found in the sonic temperature variance ($\overline{T'^2}$) measured on the instrumented car compared to the tripod (shown in Fig. 9), where the $\mathrm{MBE_{EC}} = 0.05$ K^2. Since the sonic anemometer is placed over the front bumper which holds the vehicle engine, there may potentially be some impact from its heat in our measurements. While the effect of engine heat is probably more important in cold ambient temperatures, there may still be an impact on T measured on the car in this study while driving, which would likely result in $\overline{T'^2}$ being biased high compared to an instrumented car without engine heat effects.

Expanded lines 537 – 544: For three independent 8 min periods, the average $\overline{w'^2}$, $\overline{T'^2}$ and $\overline{w'T'}$ on the upwind side of the highway are measured at 0.15 m^2 s^{-2}, 0.46 K^2 and 0.085 K m s^{-1} respectively. Downwind of the highway $\overline{w'^2}$, $\overline{T'^2}$ and $\overline{w'T'}$ are found to be larger, near 0.33 m^2 s^{-2}, 0.68 K^2 and 0.109 K m s^{-1} on average (from 5 independent samples), which are more consistent with measurements made on the tripod, except for $\overline{T'^2}$. The car-measured $\overline{T'^2}$ on the downwind side of the highway has a large standard deviation (0.41 K^2) and a single outlier that skews the average. Removing this outlier (where $\overline{T'^2}$ = 1.39 K^2) reduces the average car-measured $\overline{T'^2}$ downwind of the highway to 0.50 K^2, which is more consistent with the tripod; the 8 min sample with the anomalously large $\overline{T'^2}$ does not have an anomalously large $\overline{w'^2}$ or $\overline{w'T'}$.

Minor comments.

3) The paper would benefit a table with the number of measurements records analyzed each day.

Response: We have added new details to the revised manuscript to address this point.

Added lines 151 - 161: Track #1 and Track #2 overlap spatially for 380 m, and so a portion of the data contained within both measurement tracks are identical, for each trip past the tripod. Table 1 gives the number of measurement passes performed on each measurement track. The amount of measurement passes that are excluded (from both Track #1 and Track #2) due to traffic ahead of the instrumented car is also given. Two extra measurement passes corresponding only to Track #2 were also analyzed on 22 Aug, where the car was parked at the tripod and then drove away (a constant vehicle speed was achieved before 120 m). Since the car did not travel down the entire length of Track #1 prior to parking at the roadside, there are no corresponding Track #1 for these two measurement passes on Track #2.

Table 1: The number of measurement passes performed on each measurement track on 20 and 22 Aug.

Date	Track 1	Track 2	Excluded (traffic ahead)	No. of trips past the tripod
20 Aug	6	6	1	7
22 Aug	5*	7*	2	9

* Two extra measurement passes are included corresponding only to Track #2, where the car was stationary prior to the pass. There is no corresponding Track #1, since the car did not complete the entire length of Track #1 before parking near the tripod.

4) In Section 2.4 what is the averaging time of the data presented?

Response: We have added new details to the manuscript to address this question.

Added lines 201 – 206: The data shown in Fig. 3 includes all back–and–forth passes completed on 20 and 22 Aug and the binned data are derived from individual measurements made by the 40 Hz sonic anemometer (every 0.025 s). Each bin requires at least 80 independent samples (2 s of data), otherwise it is rejected. Binning using individual measurements is done instead of averaging over all of A and over all of B, since it is difficult to maintain a constant vehicle speed during each part of the measurement pass. However, most measurements of U fall into 2 to 4 speed bins during a particular back-and-forth pass consisting of parts A and B.

Other minor corrections/changes:

1. Changed T to T_m to represent the averaging period in the updated manuscript. In the original manuscript T is also being used for sonic temperature, which may lead to confusion.
2. **Corrected Line 784-785 in conclusion section**: For $\bar{u}$ measured on Track #1 and Track #2, the $\mathrm{NMBE} \approx 2\ \%$ and $\mathrm{NRMSE} \approx 22\ \%$ respectively
3. Other grammar fixes (missing “the”, “or”).