In this document, the reviewer's comments are in black, the authors' responses are in red.

The authors thank the reviewer for their comments.

The paper under review by Bodini et al., reports turbulent kinetic energy (TKE) dissipation rate measurement in the Columbia river gorge using sonic anemometers, scanning Doppler lidars and profiling Doppler lidars.

Page 7. Line 1-5: It is not clear how TKE dissipation rate could be estimated from "line-of-sight" velocity. Please provide detailed clarification.
We have added the specification that the variance of the line-of-sight velocity measured by the lidars is "averaged across the different beams". Since the method used is not new and it is not the main focus of the present study, we think the interested reader can find a complete and detailed explanation of the method in O'Connor et al. 2010 and Bodini et al. 2018, as stated in the paragraph.

Most important point: All the methods used in the paper use some sort of coarse graining or filtering over the actual fluctuating velocity signal. Given that TKE dissipation rate is after all a small scale quantity, the authors could have tried to directly estimate TKE dissipation rate = 2 \nu * <sij sij> where sij is the fluctuating strain rate tensor. Or with a constant temperature anemometer they could have measured the surrogate TKE dissipation rate 2 \nu * < (du/dt)^2 >.
We appreciate your suggestion. However, for the sonic anemometer data, TKE dissipation rate has been derived using either structure functions or energy spectra in a long tradition of studies (Champagne et al. 1977, Oncley et al. 1996, Piper et al. 2004, Muñoz-Esparza et al. 2018, among others), and good agreement has been found with super high-frequency measurements from hot-wire anemometers (Piper et al. 2004).

Moreover, for the lidars, calculating the strain rate tensor has at least two inherent problems (see reference list below):

1) the range-gate averaged measurement should be within the inertial sub-range of turbulence;
2) the u, v, w measurements must be instantaneous in space and time.

For short-pulsed lidars like the WINDCUBE used in this study, the range-gate is small enough to show that it usually lies within the inertial sub-range (Kumer et al. 2016). However, getting the instantaneous 3D components is extremely difficult in a complex flow field, unless one uses synchronized Doppler Lidars, which was not the case for our experiment.

For our current lidar dataset, we therefore decided to use the methods we explained in the respective sections (structure-function and velocity variance method), which have previously been shown to compare well with in-situ TKE dissipation rate estimates. The assumption of locally isotropic flow is assumed to not have a high impact on the average dissipation rate estimates over significant temporal averages (10 minutes).

References:

- Liu S, Meneveau C, Katz J (1994) On the properties of similarity subgrid-scale models as deduced from measurements in a turbulent jet. J Fluid Mech 275: 83–119
- Meneveau C, Katz J (2000) Scale invariance and turbulence models for large-eddy simulation. Annu Rev Fluid Mech 32: 1–32

- Sheng J, Meng H, Fox RO (2000) A large eddy PIV method for turbulence dissipation rate estimation. Chem Eng Sci 55: 4423–4434
- Sharp KV, Adrian RJ (2001) PIV study of small-scale flow structure around a Rushton turbine. AIChE J 47(4): 766–778
- Krishnamurthy, R., Calhoun, R., & Fernando, H. (2010). Large-Eddy simulation-based retrieval of dissipation from coherent Doppler Lidar data. Boundary-layer meteorology, 136(1), 45-57

Finally, intermittent behavior of TKE dissipation rate is well known. Despite the large database this work creates the paper here is rather observational and does not report causality of the observations, or connect the scale dependence of TKE dissipation rate to reasonably well established turbulence theories on TKE dissipation rate (see Turbulence by U. Frisch). This is a weakness of the paper and needs to be addressed.

We agree that our study has an observational nature, as we state in the Introduction of the paper. To expand our discussion of causality, as the reviewer requests, we have described in more detail why we think that topography has an impact on the variability of dissipation at the microscale, in terms of different slopes of the terrain, and also provided a detailed description (as well as an additional map in the Supplement) of the topography at Gordon Ridge, which we think is responsible for the large values of dissipation measured at that site. We believe that the explanation of the causality of what we see in our observations has now been improved.

We have also added a reference to Turbulence by Frisch and A First Course in Turbulence by Tennekes and Lumley in Sections 2.2 and 3.2 to provide additional theoretical references to our methods and results. We have also made an explicit reference to the intermittency of turbulence and the theories to describe it in Section 3.1, in the description of the variability of ε in the time series at the Physics Site: "This variability can be connected to the intermittent nature of turbulence dissipation rate, for which a multifractal theory has been developed (Frish 1995)."