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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Spatial and temporal variability of turbulence dissipation rate in complex terrain" *by* Nicola Bodini et al.

Anonymous Referee #2

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The paper analyses wind and turbulence measurement data obtained from in-situ and remote sensing instrumentation during the WFIP2 campaign in the Columbia River Gorge in the North-West of the USA. It aims at describing the dissipation rate of the turbulence kinetic energy of the flow in orographically complex terrain at various spatial and temporal scales and under different thermal stratification. The authors refer to the need of a better description and parametrisation of turbulence, esp. turbulence dissipation rate, in numerical weather forecast models of different resolutions, and hope that their analysis can provide some insight into the characteristics of turbulence in complex terrain and help the modellers to parameterise it better in their codes.

The paper is well written and good to understand for readers familiar with the subject. For example, when reading the manuscript, several times I had a question which was

soon getting answered later in the text! Very comfortable! Although their qualitative findings (e.g. the patchiness/intermittency of turbulence) are neither new nor surprising, the authors provide a thorough and helpful quantitative analysis. I recommend publication of the paper after the authors have commented on my few points / questions in order make the paper even more comprehensive and complete:

P. 7: the importance of the choice of the sampling size N is correctly emphasised. Could you mention typical (and extreme) example sizes for LN in your data set ? So, what are the dimensions of the turbulence inertial subrange ? The end is given in Fig.2 but where does it typically start ? At f = 0.01 Hz, as Fig.2 possibly suggests?

P.12, Table 3: Why don't you include the neutral flow conditions ? And how frequent do the three stratification classes occur ? In other words, how large is the sampling size for your statistics ?

P.12 bottom and P.13, Fig. 5 and P.14, line 3, and P. 20 lines 7-9 : It did not get clear to me which differences in topography between the "west" and the "east" parts of the "Physics Site" may cause the biased distribution in the mean dissipation rates shown in the figure. Could you provide some more details here ? Or maybe there are other causes for that ? The sample sizes should be large enough to not account for that (then arbitrary) bias, shouldn't it?

P.13, Fig. 5: In my view even more striking than the bias is the difference in the tails of the distribution of the mean dissipation rates displayed in the figure: in about 1% of the cases $<\varepsilon east>$ is between 2.5 and 3.0 times larger than $<\varepsilon west>$; whereas $<\varepsilon west>$ is at least 10 times larger than $<\varepsilon east>$ in 5% of the cases (or at least 5 times larger in 8.5% of the cases). So the tails are in line with the bias: there are more frequent and stronger turbulence "outbreaks" in the western domain compared to the eastern domain. Why ? What causes this strong difference in intermittency ? Is there a topographic feature which could create some coherency (structure) in the turbulence in the western domain which is absent in the eastern part for the prevailing westerly winds ?

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