Review of "*Dissipation rate of turbulent kinetic energy in stably stratified sheared flows*" by Zilitinkevich et al. (MS# ACP-2018-978)

General Comments:

The manuscript explores scaling relations for the mean turbulent kinetic energy dissipation rate in a stationary and planar homogeneous stably stratified atmospheric flow. The motivation for the work is that uncertainty in the mean turbulent kinetic energy dissipation rate causes non-trivial uncertainties in closure modeling of stratified atmospheric flow properties, especially relaxation time scales needed in numerous closure schemes and numerical simulations. The analysis is elegant and easy to follow, and the results are insightful. The outcome of the scaling analysis is supported by both field measurements and direct numerical simulations (DNS) of a stratified Couette flow. All in all, the work certainly warrants publication with minor revisions in Atmospheric Chemistry and Physics.

Minor Comments:

- p.1, Line 14: "Over years the problem" should be "Over the years, the problem of …"
- p.1, Line 15: " the process of dissipation which takes place" should be "….that takes place"
- p.2, line 1: drop 'topical'
- p.2, line 11 g is the gravitational acceleration, reads better.
- p.2, line 22 – there are font inconsistencies in the stability parameter usage. For example L, the Obukhov length, is capital whereas z/l is used throughout – it should be z/L. Same issue on p.3, line 2.

-The coefficient C_u in equation (8).
According to the Kansas experiment, the stability correction function applied to the mean velocity gradient for **unstable** conditions is $\phi_m = \left(1 - 16\frac{z}{L}\right)^{1/4}$.
If the stability correction function for **stable** conditions is expressed as equation 8, $\phi_m = 1 + C_u\frac{z}{L}$, then continuity of ϕ_m is guaranteed as the flow transitions from unstable to stable and vis-a-versa around $\frac{z}{L} = 0$. However, the Kansas experiment did suggest that ϕ_m is not only **continuous** but also **smooth** around $\frac{z}{L} = 0$. That is, for small $|\frac{z}{L}|$, the unstable ($\frac{z}{L} < 0$) side leads to $\phi_m = \left(1 - 16\frac{z}{L}\right)^{1/4} \approx 1 - 4\frac{z}{L}$. On the stable side, $1 + C_u\frac{z}{L}$ remains valid for small $|\frac{z}{L}|$. Hence, the Kansas data as well as the continuity condition on ϕ_m leads to a $C_u = 4$ not 2. Please comment.

-The value of R_∞: It was shown elsewhere (e.g. Katul et al., 2014) that

$$R_\infty = \frac{1}{1 + \frac{1}{A_\pi}\frac{C_T}{C_o}},$$

where $A_\pi = 1 - 3/5$ is a constant linked to the isotropization of the production term (fast part) correcting the original Rotta model (slow part) and is derived from Rapid Distortion Theory (RDT) in homogeneous turbulence, $C_T = 0.8$ is the Kolmogorov-Obukhov-Corrsin constant associated with the temperature spectrum in the inertial subrange, and $C_o = 0.65$ is the Kolmogorov constant associated with the vertical velocity energy spectrum within the inertial subrange. Inserting those accepted constants yields $R_\infty = 0.25$, slightly higher than 0.2 (but still within reasonable range). So, the comment here is a suggestion: It is worth noting that R_∞ can be derived from well-established phenomenological constants of turbulence in the inertial subrange.

Page 4, lines 27-28: It is worth showing a 1:1 comparison of the mean turbulent kinetic energy dissipation rate estimates from the spectrum and from the residual of the TKE budget. This additional figure is valuable because it allows an independent 'diagnostic' of how well the assumptions of stationary and planar homogeneous flow in the absence of subsidence and other flux transport terms manifest themselves as errors in the TKE budget assumptions used here.

Page 6, Equation (20) is really the main result as it shows how the turbulent potential energy and the turbulent kinetic energy play a role in shaping the mean turbulent kinetic energy dissipation rate with stability. May be worth expanding this connection in the conclusion.

Figure 3 – worth adding the best-fit line from the Kansas data as well. After all, the TKE budget used here leads to:

$$\varepsilon = \frac{u_*^3}{k_v z}\left[\phi_m\left(\frac{z}{L}\right) - \frac{z}{L}\right] \Rightarrow \frac{\varepsilon\, z}{u_*^3} = \frac{1}{k_v}\left[1 + (C_u + 1)\frac{z}{-L}\right];$$

where $C_u = 4$.