Review of “**Evaluation of turbulent dissipation rate retrievals from Doppler cloud radar” by Shupe, Brooks, and Canut.**

The authors use a method for estimating dissipation rates in mixed-phase clouds in the Arctic using Doppler velocities from an upward facing K_a band radar. These estimates of dissipation rates are then compared with dissipation rates obtained from sonic anemometers carried on a tethered balloon and mounted on a fixed tower. An additional set of estimates based on aircraft turbulence observations made some distance from the radar are also included. The details of the basic radar retrieval method and the estimates made from the other sensors are mostly missing, although key references are provided. Further key variables and parameters used in the retrievals are neither provided nor their source explicitly identified. Consequently, it is very difficult to evaluate the reliability of the estimates and to understand the uncertainties in those estimates. If would be virtually impossible for anyone to reproduce the results presented in this manuscript even if they had access to the raw data. A number of the uncertainties in the radar retrieval estimates are discussed in the conclusions, but many of these points cannot be appreciated without appropriate discussion in the main text on these points. Major efforts will be needed to put this manuscript in a form that adequately addresses several major issues and can be published.

Since the work focuses on the evaluation of the radar retrieval method, it is important that some effort be made to establish what the sources of the uncertainties are in the retrieval and those from the in situ sensors to give some sense of the magnitude of these uncertainties. Some of these points are discussed in the conclusions, but a context for these uncertainties is missing in the main part of the text. The retrieval method relies on two major assumptions that are not fully justified. Further, there are two major sources of uncertainty in the dissipation rate estimates that are not fully discussed.

The two basic assumptions in the retrieval are that 1) the vertical velocity variance estimates are unaffected by the variation in the terminal velocities of the hydrometers—most notably the differences between the terminal velocities of ice and water droplets and 2) that the averaging intervals used for the determination of the dissipation rates remain within the inertial subrange . The authors indicate that “These assumptions have been shown to hold for ice clouds and drizzling stratocumulus (Bouniol et al., 2003; O’Connor et al., 2005; hereafter OC), both of which have some properties that are similar to mixed-phase stratocumulus”. This statement is not adequate, since the turbulence conditions in those previous studies may not be the same as in the case analyzed. Both assumptions could be easily addressed by showing and discussing the spectra calculated from radar Doppler vertical velocities. These could be made for 30-60 minutes of radar observations at a fixed level. If a -5/3 slope indicating the presence of an inertial subrange can be identified in these spectra, then the validity of the first assumption can be established and the validity of sub-averaging intervals that can be used in the retrieval can be obtained. Although ideally these spectral analyses should be done for the entire observing period, for the purposes of this work sample spectra from different turbulence regimes may be sufficient. Based on the results show in Fig.

1, one possibility would be to show spectra for the 2-4 UTC period and for the 6-8 UTC period at heights of 0.3 and 0.7 km where substantial differences in the turbulence intensity are evident.

The uncertainties in the dissipation rate estimates are not fully discussed. Fortunately, OC gives a very careful evaluation of the possible sources of errors in the dissipation rate estimates made from the same technique applied to lidar observations and it provides a useful framework for estimating the uncertainties in the current study. Two major sources are identified. One is the uncertainty in the estimates of the mean Doppler velocity variance σ_{vm}^2 in Eq. 3 and the other is in the uncertainty in the length scale L_l. The uncertainty in the σ_{vm}^2 depends on the number of samples N used in the estimate (see Eq. 12 of OC) that is 15 in this study compared with 45 for one of the instruments used in OC. This difference in N corresponds to about a 50% increase in the error associated with this term in the current studied compared to OC and a 150% increase in the dissipation rate error. Although the noise contributions to the error in this term cannot be compared directly, it should be noted that σ_{vm}^2 here is based on samples made every 4 seconds but based on a 1 s dwell. OC uses values every 4 sec, but these are based on a 4 s dwell.

The other source of error in the dissipation rate estimated is associated with errors in L_l. More problematic for the manuscript under review is that the authors give no indication of how this quantity is estimated, since there is no discussion of horizontal wind speed U that is needed to calculate L_l. It is unclear how U varies with time and height in this study. This is a major shortcoming that needs to be addressed.

OC note that for stable non-convective conditions that the uncertainties can easily exceed 300% as the turbulence weakens and only estimates that have an error less than 300% are considered. Application of such a threshold to the current study may well eliminate some of the very low dissipation rates estimates presented in this manuscript, particularly in the lower cloud layer after 6 UTC. The physical interpretation of the very small dissipation rates is problematic. What is the physical significance and importance of dissipation rates made in areas that are non-turbulent? The very low dissipation rates observed in the area of may be very close to zero and may not represent anything physical. There may also be major uncertainties in the dissipation rates from the in situ probes under these conditions. Further consideration of this possibility is needed.

In the comparisons of the dissipation rates from the different platforms, the investigators indicate that they are within an order of magnitude. But this level of agreement is not a very satisfying result unless something can be said about the variability expected and the estimates in the uncertainty of the estimates—both those from the radar retrieval and those from the other platforms. In Fig 1 the log of the dissipation rates obtained from the two techniques are compared and a linear fit is made to the log-log representation of the dissipation rates. But even this fit only gives an r^2 of about 0.5. How does the degree of uncertainty in the estimates fit into the evaluation? From the plot it looks like if the low dissipation rates ($<10^{-4}$ m^2s^{-3}) were removed that the correlation would be even weaker.