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Simple atmospheric turbulence analysis made possible by a high resolution Raman Lidar

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High resolution, 1.25 m in space and 1 s in time, field measurements of atmospheric specific humidity were conducted over a small lake in Switzerland using the EPFL Raman Lidar. These measurements are coupled with more traditional eddy flux and meteorological measurements, and make several simple analyses possible that were previously untenable simply due to requirements that the data be spatially distributed. For example, Taylor's frozen flow hypothesis is the central assumption invoked in most experiments designed to investigate flow physics. Here we present a direct test of Taylor's hypothesis at the field scale. Through a wavelet decomposition of the data we show that scale has a strong influence on the applicability of Taylor's hypothesis. This dependency on scale is explained through the use of Lagrangian structure functions and dimensional analysis. These results are further investigated through the use of large eddy simulations of the same field site.