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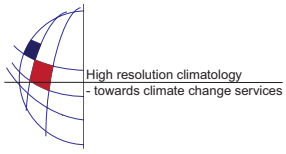

The effect of scale on the applicability of Taylor's hypothesis

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Taylor's frozen flow hypothesis is the central assumption invoked in most experiments designed to investigate atmospheric flow physics. In this work we seek to quantify the effectiveness of Taylor's hypothesis using water vapor as a passive tracer. A horizontal Raman Lidar is used to capture the humidity field in space and time above a small lake in Switzerland. High resolution wind speed and direction measurements are conducted simultaneously allowing for a direct test of Taylor's hypothesis on a field experiment 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. Further, we identify a 'persistency scale' which can be used to quantify the effectiveness of Taylor's hypothesis, and present the accuracy of the hypothesis as a function of this non-dimensional length scale