Geophysical Research Abstracts
Vol. 20, EGU2018-10688, 2018
EGU General Assembly 2018

Wind tunnel evaluation of a distributed wind speed measurement technique

Justus G.V. van Ramshorst (1,2), John S. Selker (2), Chad W. Higgins (2), Miriam Coenders-Gerrits (1), Bart Schilperoort (1), Hubert H.G. Savenije (1), and Bas J.H. van de Wiel (1)

(1) Delft University of Technology, Netherlands (j.g.v.vanramshorst@student.tudelft.nl), (2) Oregon State University, USA

Distributed Temperature Sensing (DTS) with fibre optics is an emerging technique, which has been used for many environmental applications (lakes, glaciers, seasonal snow, streams, and soil) over the past decade. Recently DTS has been adapted to atmospheric studies to provide high temporal and spatial resolution observations: current technology allows for 1 Hz temporal resolution, and spatial to 30 cm with maximum range over 5 km. Temperature measurements can be leveraged to quantify other variables. Here wind speed is measured by including an actively heated fibre in addition to a non-heated (reference) fibre. In this 'hot wire' configuration, the temperature difference between the heated and reference cables can be related to the wind speed by way of an energy balance (Sayde et al., 2015). The technique has the potential to increase the data density of measurement in the atmosphere by one or two orders of magnitude, but has not yet ben rigorously tested in controlled conditions.

Wind tunnel wind speed was measured with the DTS and a sonic anemometer. The measurements were performed with four angles of attack and with speeds from 1 to 17 m/s. The signal-to-noise ratio was computed across a range of heat settings (W/m). These results provide a design framework for the use of atmospheric DTS measurements, and establish a quantitative methodology with significant improvements in spatial and temporal resolution which we expect will give new insights into atmospheric processes.