

The Disdrometer Verification Network (DiVeN): A low-cost installation of 13 laser precipitation sensors in the UK.

Ben Pickering, Dr. Ryan R. Neely III, Dawn Harrison, Prof. Alan Blyth
 Institute for Climate and Atmospheric Science, School of Earth and Environment, University of Leeds
 Contact: ben.pickering@ncas.ac.uk | [@wx_radar](https://twitter.com/wx_radar) | see.leeds.ac.uk/people/b.pickering



UNIVERSITY OF LEEDS

Summary

- New network of precipitation sensors capable of observing individual droplets / snowflakes.
- Live data on a public, open access website.
- Used to verify new dual-pol radar network algorithms for precipitation type.

Introduction

In February 2017 a network of 13 Thies laser disdrometers were installed in the United Kingdom at a total absolute cost of under £5,000. The disdrometers measure the fall speed and diameter of every particle passing through its' beam. Hydrometeor type can be derived from this information and is therefore to be used as validation data against the new Met Office dual-polarisation radar network.

This poster describes the network and discusses initial results of consistency tests at Chilbolton Observatory.

Site Locations

Several factors were considered when choosing site locations for the instruments:

- Distance from radar; terrain; altitude.
- Feasibility to install; power, internet, site accessibility and ground conditions.

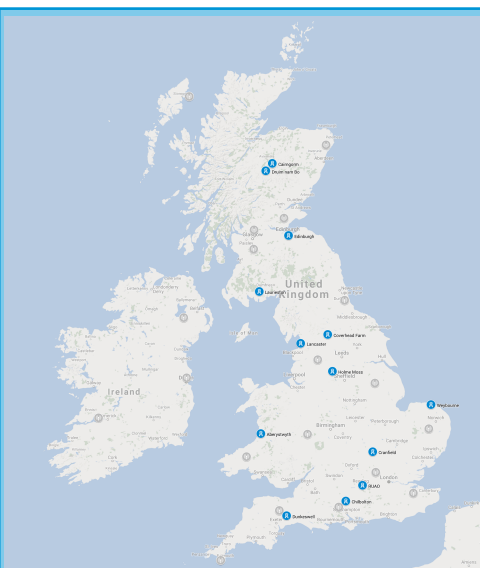


Figure 1: Disdrometer locations that make up DiVeN. The Yorkshire Dales (Coverhead Farm) location is scheduled to be installed by November 2017. Grey icons are operational Met Office radars and the research radar at Warden Hill.

Instrument Details

The disdrometer is able to bin hydrometeors into 20 diameter bins from 0.125 mm to > 8 mm, and 22 speed bins from < 0.2 m/s to > 20 m/s. Using Gunn-Kinzer and other empirical relationships, 11 hydrometeor classes are output from the instrument with an associated observation quality percentage.



Figure 2: Disdrometer installed at Reading University Atmospheric Observatory (RUAO) in February 2017.

Live Website

The data from the Thies disdrometers is being relayed every 5 minutes over Ethernet, WiFi or 3G cellular networks and plotted in near-real-time on a website hosted by the National Centre for Atmospheric Science (NCAS) with a maximum delay of 7 minutes, which is comparable to the UK Met Office radar network relay times. The website is open access and available to all, as is the data (upon request) for other scientific endeavours. Several institutions are using the data from DiVeN, including for Masters projects at the University of Leeds, the Rangers at Cairngorm Mountain, Met Office forecasters, and the Scottish Environment Protection Agency.



Figure 3: DiVeN Website

Open access live data website:
sci.ncas.ac.uk/diven

Initial Results

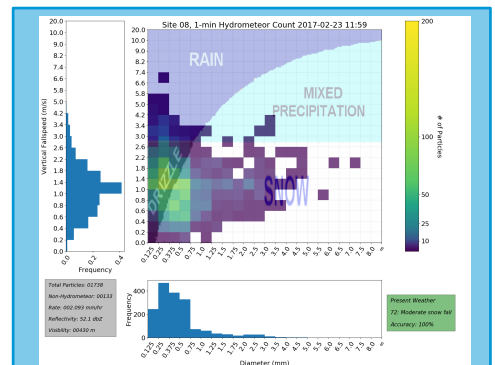


Figure 4: Website disdrometer plot from a snow event during named winter storm Doris, 23rd February 2017. The instrument correctly identifies present weather to be snow.

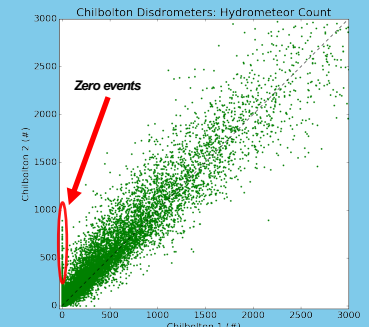


Figure 5: Scatter plot of particle count over 3 months for two disdrometers at Chilbolton. Instrument 2 over reads by 10%, 2% from the zero events labelled, and 8% from general bias. This does not affect present weather codes.

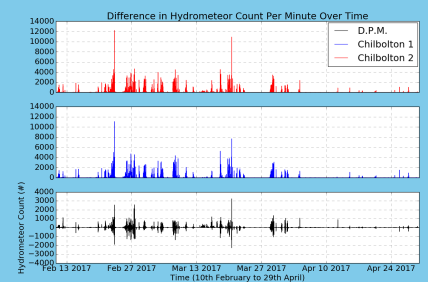


Figure 6: Hydrometeor counts over 3 months for two instruments at Chilbolton and difference. Semi-symmetrical anomaly suggests that time synchronisation is poor. 5 min binned averages greatly reduces anomaly.

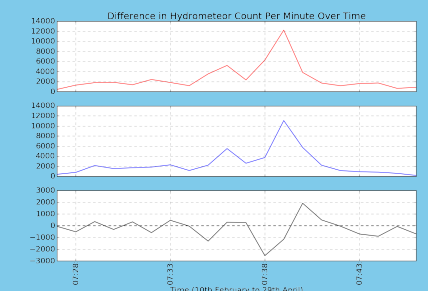


Figure 7: Hydrometeor counts and associated difference for a heavy rain event during storm Doris. 200 particles per second occur in one minute which may be caused by splintering graupel. Both disdrometers and a JOSS impact disdrometer nearby also observe >10,000 counts.