

## Title: Micro Rain Radar Dataset Documentation

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### Dataset Overview:

This dataset includes vertical profiles from two Micro Rain Radars (MRRs) belonging to the University of Utah [UUTAH1 (serial #0506043976) and UUTAH2 (serial #0506023878)] and two MRRs belonging to SUNY Albany [JRM (serial # 0506013866)] and RBS (serial #200305010)] that were deployed for the OWLeS project in a transect beginning on the shore of Lake Ontario and extending to the upper reaches of the Tug Hill Plateau. The sites were Sandy Island Beach State Park (43.630N, 76.196W , 83 m MSL), Sandy Creek Central School (43.647N, 76.076W, 162 m MSL), a private residence (43.626N, 75.880W, 385 m MSL) north of the village of Redfield (hereafter North Redfield), and a private residence (43.733N, 75.717W, 543m MSL) near Sears Pond on the upper plateau (hereafter Upper Plateau). All site elevations represent the elevation of the ground at that location. The height of the dish above ground at each site was approximately 2m, 10m, 6m, and 3m, respectively.

UUTAH1 was initially deployed at the Upper Plateau site, UUTAH2 at North Redfield, RBS at Sandy Creek Central School, and JRM at Sandy Island Beach State Park. The radars were collocated for intercomparison in late January near the end of the OWLeS field campaign, with some shuffling of locations thereafter, as summarized in Table 1.

MRR	Model	Serial Number	Location	Dates
UUTAH2	Metek-MRR-2	506023878	North Redfield	10/18/2013 - 01/28/2014
UUTAH1	Metek-MRR-2	506043976	Upper Plateau	10/19/2013 - 01/19/2014
JRM	Metek-MRR-2	506013866	Sandy Island Beach	10/17/2013 - 01/21/2014
RBS	Metek-MRR-2	200305010	Sandy Creek Central School	11/06/2013 - 01/20/2014
JRM	Metek-MRR-2	506013866	North Redfield	01/24/2014 - 01/28/2014
UUTAH1	Metek-MRR-2	506043976	Sandy Island Beach	01/27/2014 - 01/29/2014
RBS	Metek-MRR-2	200305010	North Redfield	01/24/2014 - 02/23/2014
JRM	Metek-MRR-2	506013866	Sandy Island Beach	01/29/2014 - 03/19/2014

The MRR deployment at the Upper Plateau site was on a tripod staked into the ground and electrically grounded. The dish heater was set to turn on at or below 5°C, but with adequate wind and high snowfall rates, accumulation on the dish could have occurred at times.

Looking West at Upper Plateau Site



Looking East at Upper Plateau Site



Looking South at Upper Plateau Site



Looking North at Upper Plateau Site





The MRR deployment in North Redfield was on the deck of a house. Cables were run inside to the basement where the electronic equipment and logging computer were housed. The heating unit ran at temperatures at and below 5°C.

Looking East at North Redfield site



Looking South at North Redfield site



Looking North at North Redfield site



Looking West at North Redfield site



The MRR deployment at Sandy Creek Central School was on a tripod anchored to the roof of the school and electrically grounded. The cables ran into the school, where the control computer was located. The heating unit ran at temperatures at and below 5°C.

Looking Southwest at Sandy Creek Central School Site





The MRR deployment at Sandy Island Beach was on an electrically grounded tripod next to an outbuilding. The cables ran into the outbuilding, where the control computer was located. The heating unit ran at temperatures at and below 5°C.

Looking Southwest at Sandy Island Beach Site



Looking Southeast at Sandy Island Beach Site



## Looking Northeast at Sandy Island Beach Site



### **Instrument Description:**

The UUTAH1, UUTAH2, and JRM radars are the Metek 'MRR-2' model. The MRR-2 operates at a frequency of 24.230 GHz, with modulation of 0.5 to 15GHz according to the height resolution. The RBS radar is the Metek 'MRR-1' model.

The instruments sample 31 range gates and allow the user set the distance between the range gates from 10–1000 m. For the OWLeS project, all 4 MRRs had 200 m range gates, yielding observations from 0 to 6200 m AGL, although the lowest range gate is unusable.

### **Data Collection and Processing:**

For output, the MRR averages the raw spectra over 10 seconds and outputs them into the 'RawSpectra' file (suffix .raw) corresponding to the day of operation. Only one file is created per day (dates and times in files and file names are UTC), so it is constantly appended with each new output. The other outputs are the 'AveData' (averaged data, suffix .ave) and 'ProcessedData' (suffix .pro) files, once again with only one file corresponding to an entire day of data. The 'ProcessedData' consists of a suite of variables derived by processing the raw spectra. 'AveData' has the same



processing algorithms applied, but the data has been averaged over a longer, user defined interval. 'ProcessedData' is not included in this dataset. In the case of this dataset, the variables in the 'AveData' files have been averaged over 1 minute. For more information on the data processing and formatting, see the Metek User Manual and Physical Basics Manual provided in this directory.

**Intercomparison:**

An intercomparison between the RBS, JRM, and UUTAH2 radars was conducted from 2014-01-25 0000 UTC to 2014-01-28 1500 UTC with all 3 radars placed at the North Redfield site (spread out within 100 m of 43.626N, 75.880W). For a summary of radar locations throughout the study period, see Table 1. For a detailed a summary of the setup and findings of the intercomparison, see the "MRR-Intercomparison" PDF included in this directory.

**Data Format:**

All the output files (.ave, .pro, and .raw) are delimited text files and contain headers for each variable.

A separate set of files using the post-processing algorithm from Maahn and Kollias (2012) is present in NetCDF format in the 'PostProcessed' folder for each radar. Note that this algorithm makes the lowest 2 range gates unusable (instead of just the lowest range gate), but noise in the data is significantly reduced.

**Data Remarks:**

- There were data outages from UUTAH2 from 31 December 2013 to 3 January 2014 and from 21 January to 25 January 2014. There was an outage in only the 'AveData' files from RBS from 25 January to 27 January, and also from 13 February through 23 February. There is no 'PostProcessed' data available from RBS for 20 January. There were no data outages from JRM or UUTAH1.
- For several reasons including a leveling issue, comparisons in the velocity data between radars should not be made. The positioning of a radar off of perfect vertical orientation will theoretically cause a portion of the horizontal velocity to be interpreted as vertical velocity. Also, for this reason, quantitative comparisons in the reflectivity data should be made with caution.

References

Maahan, M and P. Kollias, 2012: Improved micro rain radar snow measurements using Doppler spectra post processing. *Atmos. Meas. Tech.* 5, 2661-2673, doi:10.5194/amt-5-2661-2012