Marquette, Michigan Snowfall Instrument Site: Micro Rain Radar Dataset README

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Description

Radar observations supply detailed information about the structure and evolution of precipitation. These observations allow one to evaluate the macro- and/or micro-physical properties of precipitation at high spatial and temporal resolution. This dataset provides a nearly continuous collection of radar observations from a Metek Micro Rain Radar 2 (MRR) in Marquette, Michigan, USA (MQT). The MRR is a relatively low-cost, low-power K-band (24 GHz) profiling radar that scans the atmosphere at a fixed 90° zenith angle (i.e., directly overhead). The MRR in MQT is configured such that observations are provided every minute at a vertical resolution of 100m up to 3000m AGL (note: due to ground clutter, the effective operating range is 400m–3000m AGL). The MRR data are processed using IMProToo (*Maahn and Kollias, 2012*; https://doi.org/10.5194/amt-5-2661-2012) to increase the sensitivity of the radar to -10 dBZ and are "de-noised" using a principal component analysis method on the MRR raw power spectra to remove interference from a nearby broadcasting tower (*Pettersen et al., 2020*; https://doi.org/10.1175/JAMC-D-19-0099.1). Within this dataset, users will find observations such as the equivalent reflectivity factor, Doppler velocity, and reflectivity power spectra.

Data Format

The MRR dataset is provided in commonly used NetCDF-4 format, enabling easy access, use, and sharing of the data within the scientific community.

Location and Data Coverage

The MQT site is located on the Upper Peninsula (UP) of Michigan near the shore of Lake Superior (46.53°N, 87.55°W, 426 m above sea level). The figure below depicts the MQT site at the NWS Office along with a topographic map of the UP and images of two instruments deployed there (including the MRR). The MRR data within this dataset currently covers the period 9 January 2014 – 6 March 2023. Uptime of the MRR during this period is approximately 97%, highlighting the consistency and robustness of the MRR.
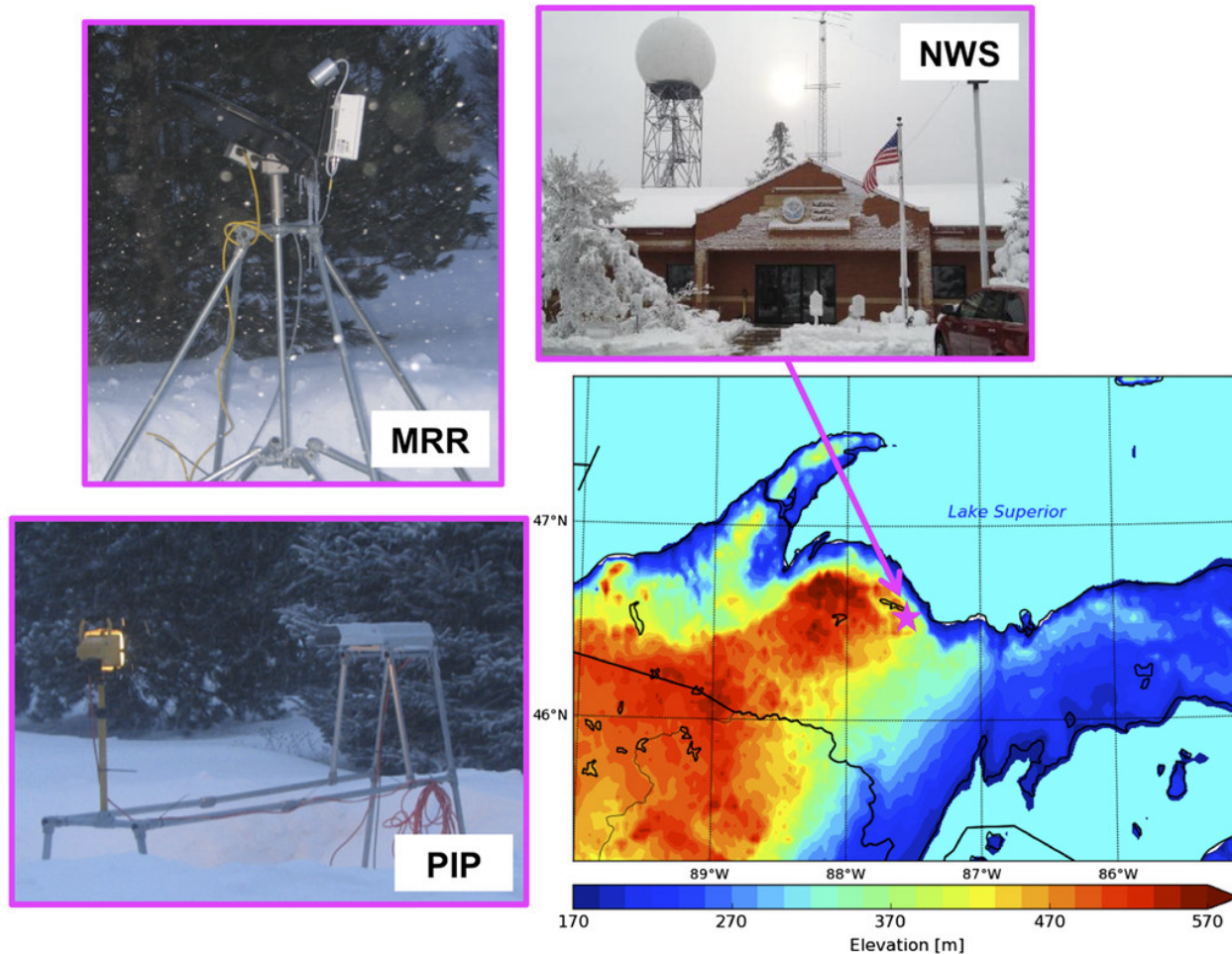
mqt_site_instruments.png: the MQT instrument site location in the Upper Peninsula of Michigan (lower right), the site is hosted at the National Weather Service (NWS) Office in MQT (upper right), the deployed MRR (upper left), and an additional deployed instrument called the Precipitation Imaging Package (PIP; see *Supplementary Dataset Information*)

Figure taken from *Pettersen et al., 2020*: https://doi.org/10.1175/JAMC-D-19-0099.1

Internal Structure of the NetCDF Files

Data Dimensions: range, velocity, time (note: not all variables will utilize all three dimensions)
- range: denotes the distance from the radar, height axis (size: 31)
- velocity: denotes the binned Doppler velocity of the data (size: 192)
- time: denotes the time axis of the data (size: 1440)
  - If the MRR experienced downtime during the day, time will have size < 1440

Data Variables: time, height, Ze, eta, etaMask, spectralWidth, skewness, kurtosis, W, SNR

- time (time): Time in seconds since epoch
- height (time, range): Height range to measurement volume
- Ze (time, range): Equivalent reflectivity factor of the most significant peak
- eta (time, range, velocity): Spectral reflectivities (raw reflectivity power spectra)
- etaMask (time, range, velocity): Noise mask of eta, 0: signal, 1: noise
- spectralWidth (time, range): Spectral width of the most significant peak
- skewness (time, range): Skewness of the most significant peak
- kurtosis (time, range): Kurtosis of the most significant peak
- W (time, range): Mean Doppler velocity of the most significant peak
- SNR (time, range): Signal to noise ratio of the most significant peak

Missing data are represented by NaNs. The data follows the Climate and Forecast (CF) conventions (version 1.11) and compressed with level 2 deflation for optimized file size.

Filename Convention

The naming convention for the NetCDF files are: MRR_MQT_YYYYMMDD.nc

Where:
- YYYYMMDD: Date (YearMonthDay)

Directory Structure

- MQT_YYYY/ → e.g., MRR directory for 2018 data would be: MQT_2018
  - MRR_MQT_YYYYMMDD.nc

Supplementary Dataset Information

A dataset containing collocated video disdrometer and surface meteorological observations at the MQT site from 2014–2023 can also be found on Deep Blue Data (*King and Pettersen, 2023*; https://doi.org/10.7302/37yx-9q53)

Contact

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