User's Guide to Dust Devil Detection Dataset from Berg et. al (2024)

1. Overview

This dataset contains dust devil detection pressure values and additional metadata recorded from 2012 to 2019 in Nevada. Dust devils, a type of small-scale convective vortex, manifest as significant short-duration anomalies in meteorological time-series data, such as pressure and temperature. These vortices are identified by characteristic dips in pressure time-series, which are typically less than 1% of the background value and roughly symmetric in time. The dataset provides essential information for understanding the behavior and properties of dust devils over an extended period and demonstrates a new wavelet based dust devil detection technique.

2. Deployment and Instrument Description

The dataset was collected using Hyperion infrasound microbarometers deployed in the valley bottom of the Nevada National Security Site. These instruments detect low-frequency sound waves (infrasound) generated by convective vortices, including dust devils. With a sample rate of 500 Hz across 16 stations, the instruments were configured to log data continuously to ensure comprehensive coverage of dust devil events.

3. Data Description

Streams Folder

The 'Streams' folder contains the raw pressure/time series data. Each detection event is represented by a .csv file that contains pressure values in Pascals and an .xml file with timing information and field descriptions.

Example of a 'Streams' .csv:

106.8627887

107.3852533

108.0161491

108.7540754

109.2265282

…

Metadata Folder

The 'Metadata' folder contains .csv and .xml files that provide detailed metadata for each detection event. These metadata .csv files include:

- **Event ID**: Unique identifier for each event.
- **Year, Month, Day**: Date of the detection.
- **Event Number**: Sequential number for events detected on the same day.
- **Latitude/Longitude**: Coordinates of the detection location.
- **Timestamps**: Start and end times of the detection event.
- **Pressure Statistics**: Various statistical measures related to the pressure data (e.g., mean pressure, standard deviation).
- **Environmental Conditions**: Information on local weather conditions at the time of detection.
- **Additional Metadata**: Other relevant details such as detection duration, time of day (e.g., night or day), and specific event identifiers.

Example of a 'Metadata' .csv:

'IS12', 2012, 7, 24, 1, -116.0611143, 37.22337515, Timestamp('2012-07-24 04:54:58.014000'), 93.36685336, 29.25695117, 0.90938717, 0.584455581, 0.544786051, 2.38626279, 4.75358238, 'IS12-2012-7-24-1', 4.81656132, Timestamp('2012-07-24 04:51:34'), Timestamp('2012-07-24 04:58:03.400000'), 10, '12:42:51Z', '02:58:20Z', 'night', 21, -99, -99, 84710, 61, Timestamp('2012-07-23 21:54:48.624901-0700', tz='US/Pacific')

4. Data Format and Access

Streams Folder

The .csv files in the 'Streams' folder contain only the pressure values for each detection event. The .xml files contain start and end times for each event, and a description of each field in the streams .csv files.

Metadata Folder

The .csv files in the 'Metadata' folder provide comprehensive metadata for each detection event. These files include timestamps, pressure statistics, environmental conditions, and other relevant details. The .xml files contain start and end times for each event, and a description of each field in the metadata .csv files.

5. Analyzing the Data

Users can analyze the pressure/time series data to identify and study the characteristics of dust devil events. By combining the data from the .xml and .csv files in the 'Streams' and 'Metadata' folders, users can gain insights into the environmental conditions and properties of each event.

6. References

- Berg, E.M., Urtecho, L.J., Krishnamoorthy, S., Silber, E.A., Sparks, A., & Bowman, D.C. (2024). *An Accurate and Automated Convective Vortex Detection Method for Long-Duration Infrasound Microbarometer Data*. Journal of Atmospheric and Ocean Technology 341-354.