## **UIUC Doppler Lidar Dataset Readme**

## 1. Dataset Title

SAVANT Case Raw/Preliminary Doppler Lidar Data Samples

## 2. Dataset Author

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## 3. Time of Interest

SN	Date	Start Time	End Time
1	09/23/2018	21:39:40	00:00:09 <sup>+1</sup>
2	09/29/2018	20:33:48	00:37:22 <sup>+1</sup>
3	10/11/2018	23:40:59	06:05:26 <sup>+1</sup>
4	10/15/2018	21:42:56	05:49:56 <sup>+1</sup>
5	10/17/2018	22:25:54	06:43:56 <sup>+1</sup>
6	10/23/2018	21:23:22	07:07:43 <sup>+1</sup>
7	10/27/2018	18:51:08	22:22:46 <sup>+1</sup>
8	10/29/2018	17:08:20	23:50:38 <sup>+1</sup>
9	11/02/2018	17:25:38	05:45:27 <sup>+1</sup>
10	11/07/2018	20:47:50	22:52:42
11	11/10/2018	16:38:05	19:21:39
12	11/11/2018	18:23:19	00:10:12 <sup>+1</sup>
13	11/14/2018	00:32:14	05:56:29

Notice that +1 refers to the date of the time stamp is on the next day of the date listed under the same row of Date .

## 4. Area of Interest

SAVANT project experiments were conducted at the test field located at Crowley Rd, Mahomet Township, Illinois 61853.



The UIUC Halo Doppler Lidar was located at :

Longitude	Latitude
40°12'34.31" N	88°24'03.55" W

as marked in the map above. The platform of the Doppler Lidar was elevated up by 1.0 meter.

## 5. Data Frequency

Time Zone	Sampling Frequency	Туре
Central Time	10,000 Hz averaged to appproximately 7 samples/second	Continuous

## 6. Data Spatial Type

Dimension	Туре
2-D	Vector

## 7. General Dataset Description

The Doppler Lidar being deployed during SAVANT experiments is the StreamLine XR from Halo Photonics.

The datasets are NOT quality-controlled.

Datasets are being archived in **.tar** based on the experiment date period as listed in **Session 3**. And it follows the naming convention as:

[SN].<YYYY-MM-DD>.tar

For example, the datasets for experiment 3 listed under Session 3 can be found under:

03.2018-10-11.tar

The datasets were recorded in **ASCII** format with file extension name of **.hpl**. Datasets are categorized based on their scan/sample type following by the naming convention of:

Scan Type	Description
User1/PPI	Configuration based scan
Stare	Aimed vertically
Wind Profile	Background wind profiling scan
RHI	Cross section or vertical slide scan
Background	Recorded to remove non-white features present in the noise floor

### 7.1.1 User1/PPI Scan

# **Lidar Scanning Schematics**

## **Plan Position Indicator Mode**



The lidar sweeps in a full circle, or over a selected range of azimuth angles, sequentially at selected elevation angles. For SAVANT, a common range of azimuth angles was 240° to 360° and elevation angles from 0.0° to 10.0° at increments of 0.5°. It produces data with these characteristics:

Time	Azimuth Angle	Elevation Angle
1	240.000°	2° (2 degrees above the horizontal plane)
2	241.050°	2°
•		
	360.000°	2°
•	360.000°	2.5° (Increamental of 0.5° at each turn)
	359.000°	2.5°
•	358.000°	2.5°
•		
	240.000°	2.5°
	240.000°	3°
•	241.000°	3°

### 7.1.2 Stare Scan

## **Vertical Stare Mode**



The lidar takes data by staring in one direction. In SAVANT stares were conducted with the lidar looking directly upward. Azimuth (set by default to 90° for vertical stares) and the elevation angles are constant – just time changes. It produces data with these characteristics:

Time	Azimuth Angle	Elevation Angle
1	90.000°	90° (Straight up, the azimuth angle is arbitrary)
2	90.000°	90°
•		
	90.000°	90°

### 7.1.3 RHI Scan



The lidar scans does a cross section or vertical slice through the atmosphere. For this, the azimuth angle is kept constant, but the elevation angle varies. It produces data with these characteristics:

Time	Azimuth Angle	Elevation Angle
1	270.000°	0° (Looking due west, horizontally)
2	270.000°	1°
•		
•		
•	270.000°	180° (Looking due east, horizontally)

### 7.1.4 Wind Profile

The wind profile scan uses the same measurement configuration as some RADAR wind profilers, scanning 3 beams, one vertically pointing, one at a set elevation angle to the North, and another towards the East.

### 7.1.5 Background

The Background file is used to remove any (non white) features present in the noise floor. A new file is taken every hour, (unless a scan file is running at the hourly change), at which time the scanner will move to the parked position to ensure that no atmospheric return is present.

### 7.2.1 Scanning Dataset Structure

Filename:	RHI_100_20181102_220439.hpl
System ID:	100
Number of gates:	556
Range gate lengt	h (m): 18.0
Gate length (pts	): 6
Pulses/ray:	500
No. of rays in f	ile: 181
Scan type:	RHI
Focus range:	65535
Start time:	20181102 22:04:45.62
Resolution (m/s)	: 0.0382
Altitude of meas	urement (center of gate) = (range gate + 0.5) * Gate length
Data line 1: Dec	imal time (hours) Azimuth (degrees) Elevation (degrees) Pitch (degrees) Roll (degrees)
f9.6,1x,f6.2 <mark>.1x</mark> .	th./
Data line 2: Ran	ge Gate Doppler (m/s) Intensity (SNR + 1) Beta (m-1 sr-1)
i3,1x,f6.4,1x,to	.5,1X,e12.5 - repeat for no. gates
****	
22.079303 292.00	
	-0.00 -0.01
0 -0.3668 1.01	-0.00 -0.00 -0.01 2517 7.047540E-7
0 -0.3668 1.01 1 -2.5836 0.90	-0.00 -0.00 -0.01 2517 7.047540E-7 8499 -5.155412E-6
0 -0.3668 1.01 1 -2.5836 0.90 2 -1 6663 28 5	-0.00 -0.00 -0.01 2517 7.047540E-7 8499 -5.155412E-6 52919 1 554410E-3
0 -0.3668 1.01 1 -2.5836 0.90 2 -1 6663 28 5 3 -0.0610 40.3	-0.00 -0.00 -0.01 2517 7.047540E-7 8499 -5.155412E-6 62919 1 554410E-3 44720 2.221474E-3
0 -0.3668 1.01 1 -2.5836 0.90 2 -1 6663 28 5 3 -0.0610 40.3 4 -0.0228 39.5	-0.00 -0.00 -0.01 2517 7.047540E-7 8499 -5.155412E-6 62919 1 554410E-3 44720 2.221474E-3 23520 2.178243E-3

As for **RHI**, **Stare**, and **User1/PPI** scan types, the samples are categorized into 4 major variables as shown in the figure above. Data line structure is given in the header. As time increases within a particular scan, observations are appended starting with Data Line 1 and then Data Lines 2 for each gate. For each beam, the gate ranges from 0 to 565. Then, the data log will start with a new cluster with one Data Line 1, and 566 Data Line 2.

Please see the figure above for references.

#### 7.2.2 Wind Profile Dataset Structure

Processed files are in the format shown below, with the total number of heights first, then successive data points giving height (AGL), bearing and horizontal wind speed.

556		
0	39.14	0.54
18	40.84	1.51
36	39.48	5.99
54	181.41	0.80
72	156.76	0.56
90	139.15	0.39
108	154.31	0.64
126	137.71	0.47
144	180.29	0.55
162	137.20	0.58
180	134.81	0.58
198	177.74	0.78
216	120.08	0.31
234	188.49	0.83
252	168.57	0.92
270	166.95	0.32
288	125.90	0.83
306	173.20	0.49
324	241.24	0.98
342	202.19	0.64
360	258.73	0.59

### 7.2.3 Background Dataset Structure

The background reference values are saved in the format shown below.

```
49855.400000
45244.500000
84048.500000
818650.100000
851116.100000
847975.900000
848186.700000
848646.000000
853385.800000
```

### 8. File Names

The datasets follow the following name convention:

```
[Scan/Data Type]_[Sampling Frequency in kHz]_[YYYYMMDD]_[HHMMSS].hpl
```

and

Background\_[DDMMYY]-[HHMMSS].txt

For example, the dataset being recorded on November 03, 2018 at 02:10:32 (CT) for PPI scan type at 10 kHz is named as:

PPI\_100\_100\_20181103\_021032.hpl

and the background dataset recorded on October 17, 2018 at 22:25:48 (CT) is named as:

Background\_171018-222548.txt

### 9. Data Restrictions

**SAVANT** Doppler Lidar data are freely available.

### 10. Digital Object Identifier (DOI)

Please visit the following link for DOI information:

```
https://doi.org/10.26023/H2RW-JG1C-NS0C
```

### 11. GCMD Keywords

Category: EARTH SCIENCE Topic: ATMOSPHERE Term: AEROSOLS Variable\_Level\_1: AEROSOL BACKSCATTER UUID: f795b88f-1aba-4548-97f6-7b587e8ba451 Category: EARTH SCIENCE **Topic:** ATMOSPHERE Term: ATMOSPHERIC WINDS Variable\_Level\_1: BOUNDARY LAYER WINDS UUID: 8bb1dca3-9793-4120-b0ea-f27a5b81f259 Category: EARTH SCIENCE Topic: SPECTRAL/ENGINEERING Term: LIDAR UUID: 6182be8b-d006-4327-994d-6f27c7e4d9a9 Category: EARTH SCIENCE Topic: SPECTRAL/ENGINEERING Term: LIDAR Variable\_Level\_1: LIDAR BACKSCATTER

UUID: ca776e14-fc3d-4044-9d1a-fd7c07569399

Category: EARTH SCIENCE Topic: ATMOSPHERE Term: ATMOSPHERIC PRESSURE Variable\_Level\_1: PLANETARY BOUNDARY LAYER HEIGHT UUID: f51a3caf-c5ec-496a-8dd3-854d9bb994e7