TEXAS TECH UNIVERSITY STICKNET DOCUMENTATION FOR PERiLS 2022

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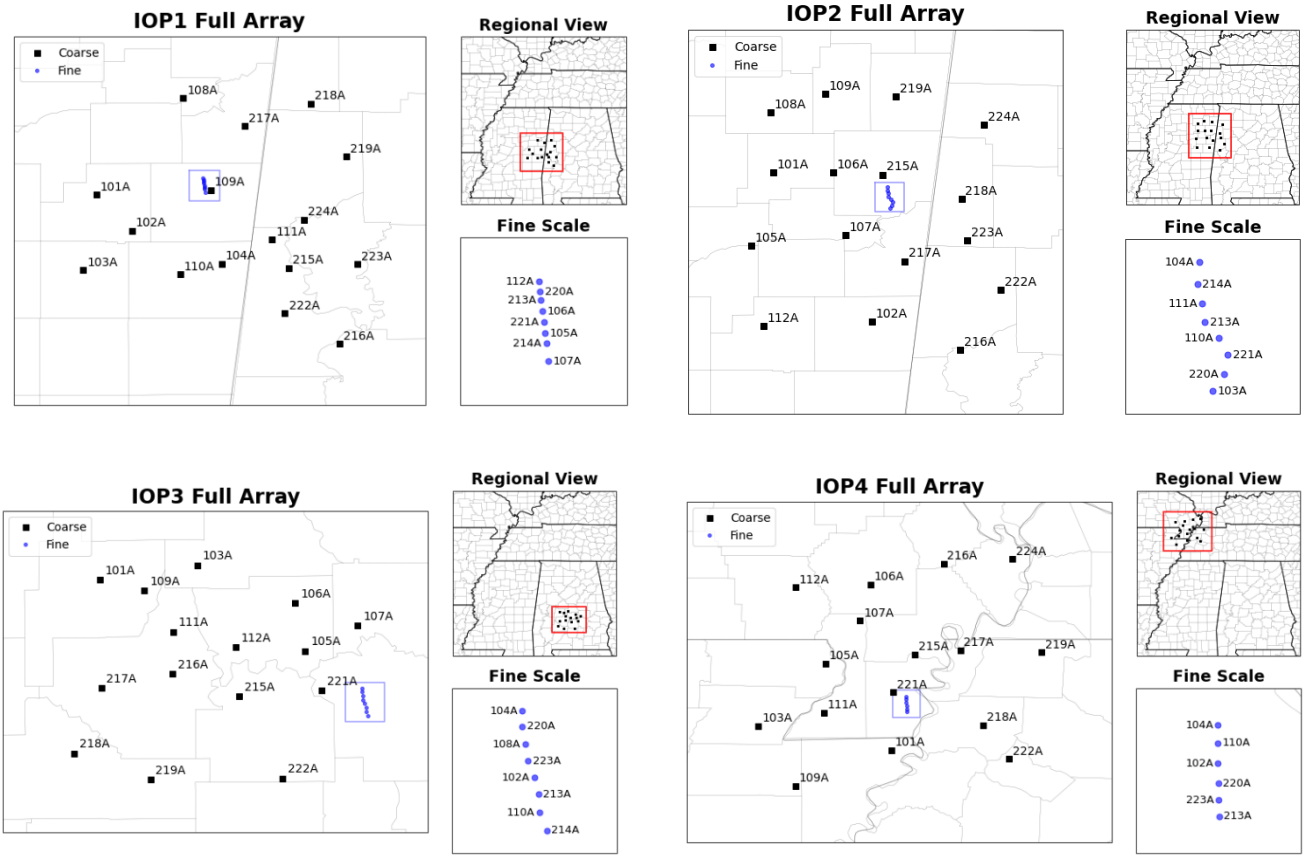
1.0 DATA SET OVERVIEW

This document provides information concerning the Texas Tech University StickNet data from the 2022 PERiLS (*Propagation, Evolution, and Rotation in Linear Storms*) field campaign. There were four IOPs during PERiLS:

IOP	Date	Domain
1	22 March 2022	Brooksville
2	30 March 2022	Amory
3	5 April 2022	Selma
4	13 April 2022	Kennett

During each IOP, 24 StickNets were deployed within the chosen domain. 16 of the StickNets were deployed the day before each event as a coarse array (~20 km spacing), and the remaining 8 (only 6 for IOP4) were deployed during the event in front of ongoing convection (~1 km spacing). The following images display the StickNet locations for each IOP, along with their corresponding ID:



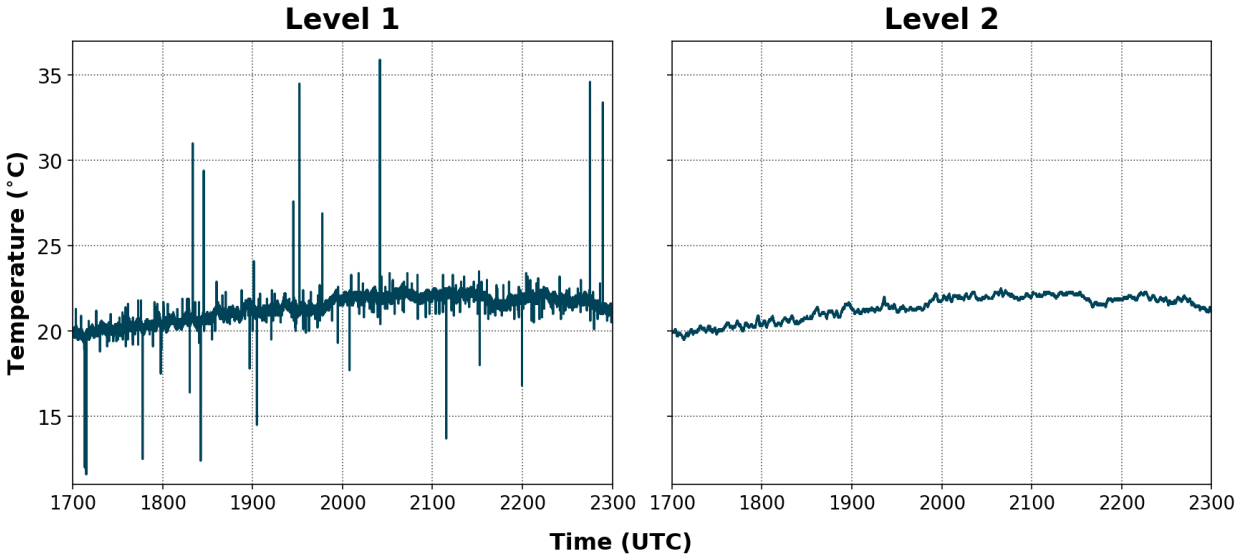
The data are available at 3 different levels:

Level 1: Raw 10-Hz data. The data are run through a QC algorithm (see Section 3.0) to flag potentially erroneous data. No other quality control or processing is done.

Level 2: Processed 1-Hz data. Any data flagged in the QC algorithm are removed. The data are also run through a Fourier transform filter (see Section 3.0) to remove high frequency noise, and the data are averaged to 1 Hz.

Level 3: Level 2 data that has been bias corrected. The biases are determined using mass tests that were done immediately after each IOP deployment (see Section 3.0). ***Recommended for analysis work.***

Below is a 6-hour example time series (101A from IOP1) of Level 1 and Level 2 data. Level 3 is identical to Level 2, but with a scalar offset due to the bias correction.



2.0 INSTRUMENT DESCRIPTION

The StickNet is an approximately 2-m tall observing station that records temperature, relative humidity, pressure, wind direction, and wind speed (Weiss and Schroeder 2008). They have been used in many field campaigns to document thermodynamic data in the presence of convection (e.g., Skinner et al. 2011, Weiss et al. 2015, Klees et al. 2016, McDonald and Weiss 2021).

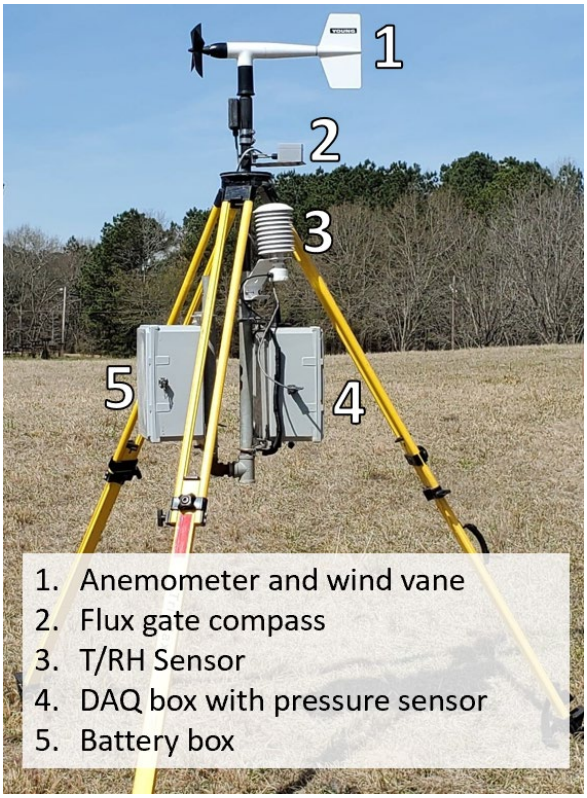
STICKNET INSTRUMENT SPECIFICATIONS

Instrument	Model	Accuracy
Wind	R. M. Young 05103V	WS $\pm$ 1 m s^{-1}, WD $\pm$ 3 deg
T/RH	R. M. Young 41382	T $\pm$ 0.3 C, RH $\pm$ 2%
	R. M. Young 41372*	T $\pm$ 0.3 C, RH $\pm$ 3%*

*104A and 109A only

There were two different T/RH sensors used across the fleet. The R. M. Young 41382 has a time constant of 10 s for both T and RH. The R. M. Young 41372 has a time constant of 15 s for RH and 42 s for T. Use caution when comparing T/RH data between sensors in the presence of strong gradients (e.g., the edge of a cold pool).

STICKNET WITH LABELED COMPONENTS



3.0 DATA COLLECTION AND PROCESSING

LEVEL 1 DATASET:

All data have been run through an objective QC algorithm. Two flags have been appended to the end of each data string (0 = pass, 1 = fail):

- a thermodynamic flag (tflag) for potentially erroneous values of T, RH, and/or P
- a kinematic flag (wflag) for potentially erroneous values of WS and/or WD

Each data file contains StickNet data for one IOP for a single probe. The sampling rate is 10 Hz.

LEVEL 2 DATASET:

Due to random noise in the T/RH R. M. Young 41382 sensor, Level-1 data were run through a finite impulse response low-pass filter. A 28^{th}-order Blackman Harris filter with a cutoff frequency of 0.1 Hz was chosen (after vigorous testing) to minimize both side-lobe effects and errors towards 'truth' value. After the filter was implemented, the 10-Hz data was averaged to 1 Hz.
This filtering was not applied to 104A or 109A as they had different sensors

LEVEL 3 DATASET:

Bias correction was applied for all data (T, RH, P, WD, WS) where appropriate. Biases were determined using mass tests that were performed after each IOP, resulting in slightly different bias corrections for each IOP dataset. The biases applied for each IOP are included in a csv file in this dataset.

Due to instrument, maintenance, and time constraint issues, some of the StickNets could not be calibrated for temperature and/or wind direction during certain IOPs. Below is a table of StickNet data that were not calibrated. Note that these data are not necessarily inaccurate, but we cannot confirm that the data magnitudes are correct.

UNCALIBRATED STICKNET DATA

IOP	T	WD
1	112A, 215A	102A, 107A, 110A, 111A, 221A
2	104A, 112A	102A, 104A, 111A, 221A
3	112A	102A, 104A, 111A, 221A
4	112A	101A, 102A, 104A, 111A, 217A, 221A

4.0 DATA FORMAT

DATA FILES:

Each file name depicts the probe ID, IOP number, and data level (see Sections 1.0 and 3.0).

Sample: 0102A_IOP1_level2.csv

Probe: 0102A
IOP: IOP1
Level: Level 2

The data is output in the following order: Time, T, RH, P, WS, and WD. Each file contains a header with this information.

DATA UNITS

Variable	Units
Time:	UTC format: YYYY-MM-DD HH:mm:ss (year-month-day hour:minute:second)
Temperature:	°C
Relative Humidity:	%
Barometric Station Pressure:	hPa
Wind Speed:	m s^{-1}
Wind Direction:	deg

Sample: 2022-03-21 18:13:11, 12.0, 41.8, 984.9, 0.3, 170.4

Time: 3 March 2021, 18:13:11 UTC
T: 12.0 °C
RH: 41.8%
P: 984.9 hPa
WS: 0.3 m s^{-1}
WD: 170.4 deg

Level 1 only:
For Level 1 files, the data string will have two additional columns for the tflag and wflag (in that order). If a data point does not pass the QC algorithm, the corresponding flag is set to 1, otherwise it is set to 0. The time string will also include tenths of seconds in the time string (HH:mm:ss.s; hour:minute:second.tenth of second).

ADDITIONAL FILES:

StickNet Locations:

For each IOP, there is a file with StickNet location information (e.g., IOP3_StickNet_Locations.csv for IOP3).

Each file contains every StickNet's ID, Latitude (deg), Longtiude (deg), Elevation (m), and Array Type, in that order. The Array Type is either "Coarse" or "Fine", depending on if the StickNet was used in the coarse array (set up the day before each event) or used in the fine-scale array deployed the day of the event.

Sample: 213A, 32.231392, -86.29392, 83.9, Fine

ID:	StickNet 0213A
Latitude:	32.231392 deg (N)
Longitude:	86.29392 deg (W)
Elevation:	83.9 m
Array type:	fine scale

Biases:

This file (Bias_Sticknet.csv) contains the biases **subtracted** from the Level 2 data to create the Level 3 data. The data is output in the following order: IOP number, StickNet ID, T bias, RH, bias, P bias, WS bias, and WD bias. The units are the same as in the data files.

Sample: IOP1, 102, 0.7, 0.2, 0.2, 0.0, 0.0

IOP:	IOP 1 (22 March 2022)
ID:	StickNet 0102A
T bias:	0.7 °C
RH bias:	0.2 %
P bias:	0.2 hPa
WS bias:	0.0 m s^{-1}
WD bias:	0.0 deg

This file is only needed for bias correcting Level 1 or 2 data.

5.0 REFERENCES

Klees, A.M., Y.P. Richardson, P.M. Markowski, C. Weiss, J.M. Wurman, and K.K. Kosiba, 2016: Comparison of the Tornadic and Nontornadic Supercells Intercepted by VORTEX2 on 10 June 2010. Mon. Wea. Rev., 144, 3201–3231, https://doi.org/10.1175/MWR-D-15-0345.1

McDonald, J. M., & Weiss, C. C. (2021). Cold Pool Characteristics of Tornadic Quasi-Linear Convective Systems and Other Convective Modes Observed during VORTEX-SE, Monthly Weather Review, 149(3), 821-840, https://doi.org/10.1175/MWR-D-20-0226.1

Skinner, P. S., C. C. Weiss, J. L. Schroeder, L. J. Wicker, and M. I. Biggerstaff, 2011: Observations of the surface boundary structure within the 23 May 2007 Perryton, Texas, supercell. Mon. Wea. Rev., 139, 3730–3749, doi:10.1175/MWR-D-10-05078.1.

Weiss, C. C., D. C. Dowell, J. L. Schroeder, P. S. Skinner, A. E. Reinhart, P. M. Markowski, and Y. P. Richardson, 2015: A comparison of near-surface buoyancy and baroclinity across three VORTEX2 supercell intercepts. Mon. Wea. Rev., 143, 2736–2753,

Weiss, C. C., and J. L. Schroeder, 2008: StickNet - A new, portable, rapidly-deployable, surface observing system. Preprints, 88th Annual Meeting of the American Meteorological Society, New Orleans, LA, 4A.1