CFACT

NCAR/EOL ISS Surface Meteorology, PurpleAir and Webcam Products Data Report

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Web References

CFACT Homepage: https://www.eol.ucar.edu/field_projects/cfact
CFACT Field Catalog: https://catalog.eol.ucar.edu/cfact
ISS Operations during CFACT: https://www.eol.ucar.edu/content/iss-operations-cfact
ISS Homepage: https://www.eol.ucar.edu/observing_facilities/iss
Calculation of long-wave radiation:
https://www.eol.ucar.edu/content/calculation-long-wave-radiation

Citations

If these data are used for research resulting in publications or presentations, please acknowledge EOL and NSF by including the following citations, as appropriate:

The ISS Platform

UCAR/NCAR - Earth Observing Laboratory. (1997). NCAR Integrated Sounding System (ISS). UCAR/NCAR - Earth Observing Laboratory. https://doi.org/10.5065/D6348HF9

ISS Surface Meteorology Products

NCAR/EOL ISS Team. 2022. CFACT: NCAR/EOL ISS Surface Meteorology Products. Version 1.0. UCAR/NCAR - Earth Observing Laboratory. https://doi.org/10.26023/VS3C-B9HA-SM00.

ISS Webcam Imagery

NCAR/EOL ISS Team. 2022. CFACT: NCAR/EOL ISS Webcam Imagery. Version 1.0. UCAR/NCAR - Earth Observing Laboratory. https://doi.org/10.26023/5CMC-FPW6-ZC0M.

ISS PurpleAir Aerosol Products

NCAR/EOL ISS Team. 2022. CFACT: ISS PurpleAir Aerosol Products. Version 1.0. UCAR/NCAR - Earth Observing Laboratory. https://doi.org/10.26023/6Z1M-DHD8-40P.

Overview

NCAR/EOL operated the Integrated Sounding Systems (ISS) in the Heber Valley in Utah for the Cold Fog Amongst Complex Terrain (CFACT) winter time fog study. ISS operated individual surface sensors that measured various meteorological parameters. All surface meteorology parameters are merged into 1-minute averaged daily netCDF files. Surface instruments and webcams were mounted on the ISS trailers at the North Pivot and Deer Creek Sounding site. ISS operated three PurpleAir PA-II-SD air quality sensors mounted on ISS trailers at the Provo River Supersite, Railroad Service Pad, and North Pivot site.

Project time period: **06 Jan - 24 Feb 2022**

Site Description

	Latitude	Longitude	Elevation	Sensor
North Pivot	40.48813°N	111.43302°W	1700 m	sfc met., webcam, purpleair
Deer Creek Sounding	40.48917°N	111.46994°W	1660 m	sfc met.
Provo River	40.52811°N	111.445836°W	1700.8 m	purpleair
Railway Service Pad	40.48646°N	111.4726°W	1660 m 4m AGL	Purpleair, webcam

Table 1. General location and elevation of the sensors by site.

CFACT ISS Sites

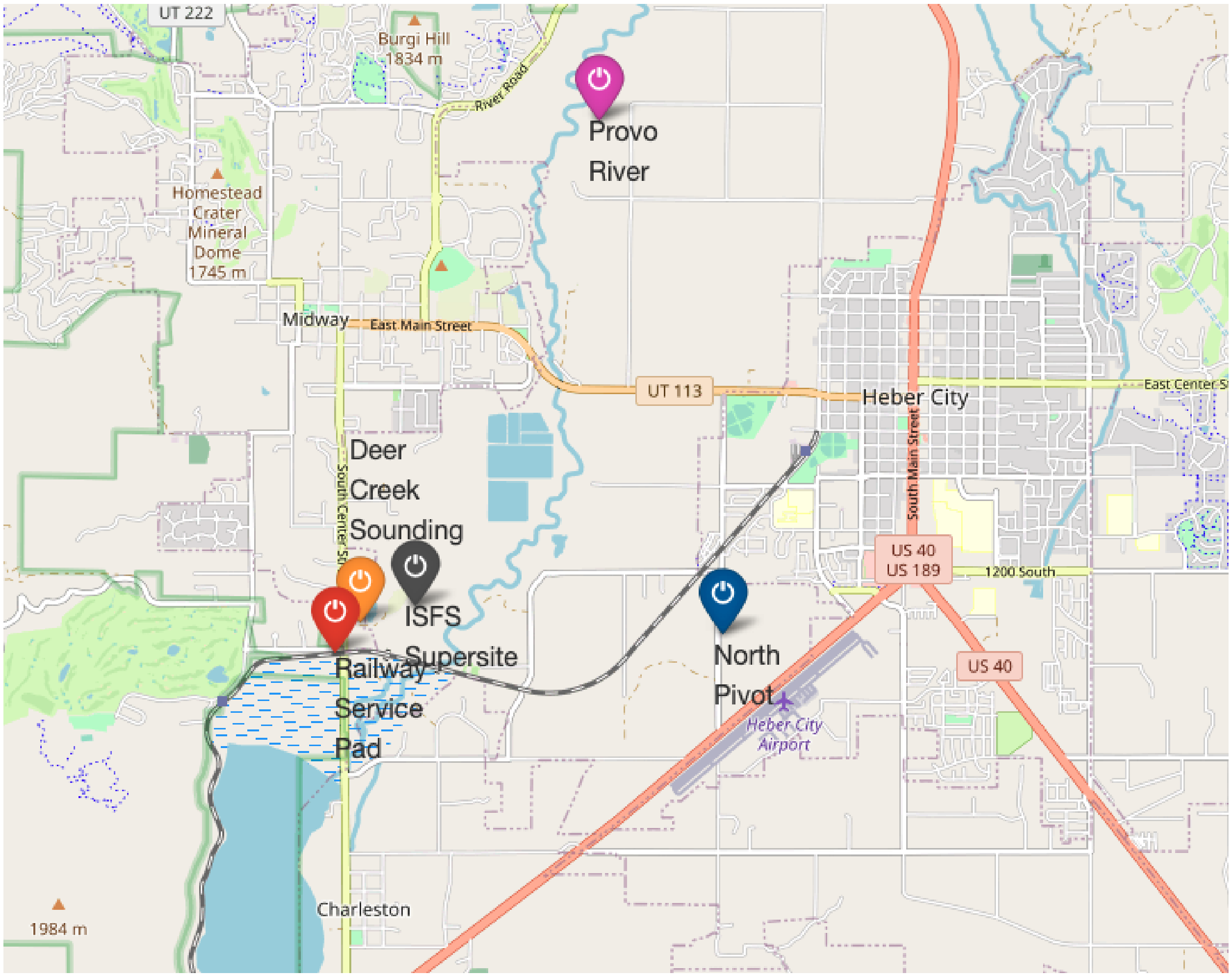


Figure 1. Map of the ISS sites relative to Heber City, UT. For reference the ISFS Deer Creek Supersite(gray) is included.

Instrument Set-up

Railroad Service pad site

The PurpleAir sensor (photo below, white dome instrument with QR code) was mounted next to the wind lidar on top of the lidar trailer at the Railway Service pad site. The sensors were approximately 4 meters above the ground.

North Pivot site

The ISS Surface Met sensors at the North Pivot site included a Lufft WS800 weather sensor (temperature, RH, pressure winds and precip), an Ott Parsivel, two webcams and a PurpleAir aerosol sensor. The Lufft WS800 and PurpleAir sensor were mounted on the 3 meter tower (photo below, tower to the right of the 449 MHz profiler clutter fence), and the Ott was at ground level (to the right of the tower in the photo). The webcams were mounted on the ISS trailer directed towards Daniel Canyon and towards the Deer Creek Reservoir.

Deer Creek Sounding Site

A Lufft WS800 and a Vaisala PTB220 were deployed at the sounding site on a 3 meter tower. Note the low trees approximately 10 meters to the east of the tower which may have affected flow from the east at this site and funneled flow along the valley. There were more trees on the south side of the field, approximately 70 meters south of the met tower.

Provo River Supersite

The PurpleAir aerosol sensor (photo below, white dome instrument with QR code) was mounted on a post next to the University of Utah Halo lidar and web camera.

Instrument Description

Surface Meteorology Instruments

Sensor	Parameters	Site
Lufft WS800 at 3m	P, T, Td, Tchill, RH, wind speed, wind direction, radiation	North Pivot
Hukseflux NR01 at 2m	Incoming/outgoing shortwave radiation and thermopile (see calculation of longwave radiation)	North Pivot
Ott Parsivel 2 disdrometer at 1m	Precipitation type, intensity, and accumulation (mm)	North Pivot
Lufft WS800 at 3m	P, T, Td, Tchill, RH, wind speed, wind direction, radiation	Deer Creek Sounding
PTB220 at 2m	Pressure	Deer Creek Sounding

Webcam Instruments

Manufacturer	**Model**	**Site**	**Format**	**File Freq.**
Sony ELP HD USB	USBFHD06H / IMX322	North Pivot (directed to Daniels Canyon)	jpeg	5 min
MicroSeven	M7B 5MP - SWSAA	North Pivot (directed to Deer Creek Reservoir)	jpeg	1 min
Sony ELP HD USB	USBFHD06H / IMX322	Railway Service Pad (directed to Deer Creek Reservoir)	jpeg	5 min

North Pivot Sony ELP Webcam was mounted on the roof of the ISS trailer pointing southeast towards the Daniels Canyon ISFS flux station.

North Pivot Microseven Webcam was mounted in front of ISS trailer, pointed southwest towards the Deer Creek reservoir.

Railway Service Pad Sony ELP Webcam was mounted on the roof of the lidar trailer pointing south towards the Deer Creek Reservoir.

PurpleAir Instrument

Manufacturer	Model	Sites	Variables	Resolution
PurpleAir	PA-II-SD	North Pivot, Railroad Service Pad, Provo River Supersite	PMX.X* T P RH	2 min

*There are a range of PM sizes reported. Refer to the CSV file header description section below.

Data Set Description

Data set Name: **CFACT: ISS Surface Meteorology Products**
Location: North Pivot, Deer Creek Sounding site
Data format: netCDF3; isfs_yyyymmdd.nc
Data file frequency: Daily files
Data version: v1.0
Data status: final
Data access: public
Data resolution: 1 minute

Data set Name: **CFACT: ISS Webcam Imagery**
Location: North Pivot, Railway Service Pad sites
Data format: jpeg
Data file frequency: 5 min and 1 min
Data version: v1.0
Data status: final
Data access: public

Microseven file format at North Pivot: PYYMMDDHHmmSS00.jpg
- These are 1 minute files

Sony ELP file format at North Pivot: usbcam-YYYYMMDD-HHmmSS.jpg
- These are 5 minute files

Sony ELP file format at Railway Service Pad: DCRes-YYYYMMDD-HHmmSS.jpg
- These are 5 minute files

Data set Name:	**CFACT: ISS PurpleAir Aerosol Products**
Location:	North Pivot, Railroad Service Pad, Provo River
Data format:	CSV
Data file frequency:	Daily files
Data version:	v1.0
Data status:	final
Data access:	public

Data Collection and Processing

Surface Meteorology Data Products

All sensors were sampled independently with a Linux-based Data System Module or DSM. Data was stored directly onto USB sticks provided for every DSM. All DSMs were connected by local network, so raw data could also be archived in real-time on a Linux computer at the ISS base trailers. Data was also transmitted from the base trailers to servers at EOL for local storage and added back-up. Data processing was performed by the in-house created data acquisition system called NIDAS.

NIDAS (NCAR In-situ Data Acquisition System) handles the data processing for all ISS surface meteorology measurement systems. This is a linux based software produced by Gordon Maclean, formerly at NCAR/EOL.

Each sensor is sampled independently in an asynchronous manner. A time tag of microsecond resolution is assigned to each sample at the moment it is received, based on a system clock, which is continually conditioned from a directly connected GPS with a pulse-per-second (PPS) signal - this allows us to compare and combine data from multiple towers. Minimal data interpretation is performed to differentiate individual messages from a sensor, assembling the data exactly as it was received into a sample, with the associated time-tag and an identifier of the sensor and data system. The concatenated stream of samples from all sensors is then passed on for averaging and saved as netCDf daily files.

NIDAS reads a series of configuration and calibration files that contain pertinent sensor metadata and, more importantly, any input variables that are to be applied to the data either during operations or in the post-processing.

Webcam Images

The images are collected as is. No processing was applied.   The data set includes the raw images taken every 1 - 5 minutes. Hourly images are on the web at:

- Click here to view all North Pivot Site hourly images
- Click here to view all Deer Creek Sounding Site hourly images

PurpleAir Data Products

The PurpleAir is a low-cost aerosol sensor based on PMS5003 and PMS1003 laser particulate counters with on-board SD card logger and linked to a PurpleAir's archiving and analysis web service. ISS deployed three PurpleAir PA-II-SD sensors to CFACT (at the North Pivot site, the Railway Service Pad site, and at the Provo River supersite). The data reported includes estimates of particle counts for the following sizes: 0.3, 0.5, 1.0, 2.5, 5.0, and 10um. Refer to the PurpleAir website https://www2.purpleair.com/ for instrument overview, specifications and processing. Data is provided as is according to PurpleAir processing.

Ardon-Dryer et. al. 2020 provides a useful discussion of PurpleAir measurements as compared to EPA research quality sensors.

Ardon-Dryer, K., Dryer, Y., Williams, J. N., and Moghimi, N., 2020: Measurements of PM2.5 with PurpleAir under atmospheric conditions, Atmos. Meas. Tech., 13, 5441–5458, doi:10.5194/amt-13-5441-2020.

Please note that the PurpleAir measurements at the Railway Service pad site were occasionally contaminated by vehicles parked at the site and by nearby road and rail traffic.

The SD card for the Railway Service Pad site was not operating so the dataset that is uploaded to the archive has been downloaded from purpleair.com as a single csv file.

Surface Meteorology Data Remarks

All surface sensors functioned as expected with notable exceptions mentioned below. No large gaps, spikes, anomalous data were observed or reported.

Ice-build-up

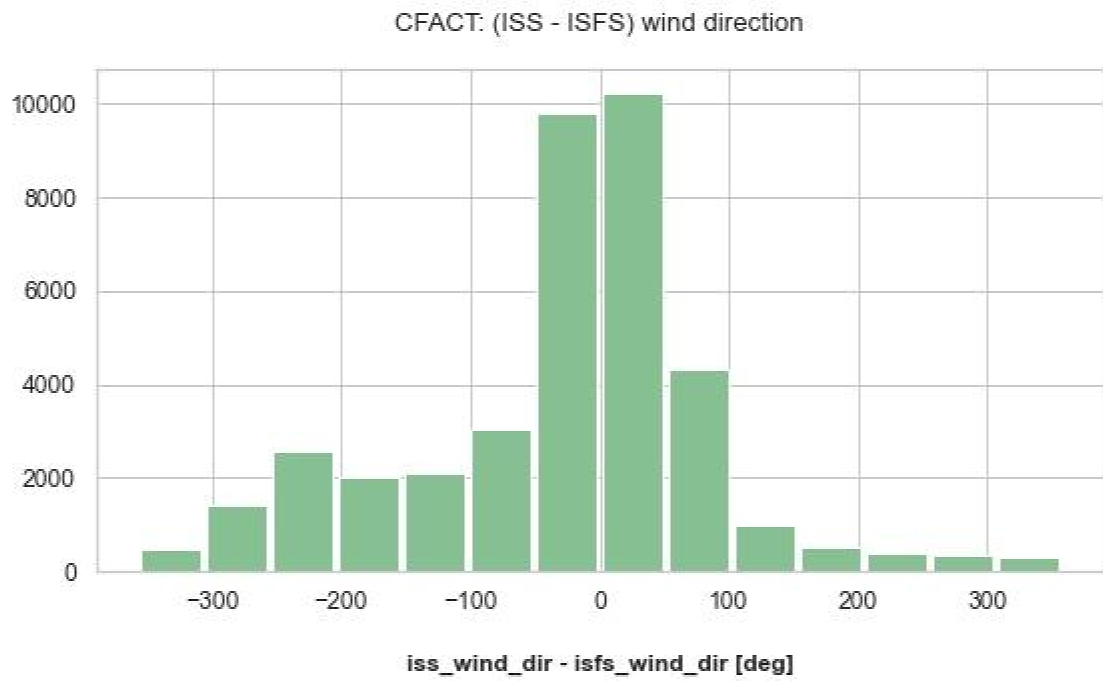
Riming on the Lufft sensors was observed (see photo on page 1) during the first half of January 2022. The heating elements did not function and ice was allowed to build up.

Similarly, there is potential for ice to accumulate on the Hukseflux NR01 4 component radiometers. One can compare with the wetness sensor data mounted on the ISFS South Pivot radiometers.

Lufft WS800 at Deer Creek Sounding Site (comparison with ISFS supersite winds)

As noted above, there was a hedge row approximately 10 meters east of the met tower and trees approximately 70 meters to the south of the Deer Creek sounding site. Below are comparisons between the Lufft sensor mounted at 3m and the nearest ISFS tower (Deer Creek Supersite). Most ISS wind direction measurements are within 100 degree, in either direction, of the ISFS Deer Creek site (**Figure 2A**). Wind speeds are comparable (**Figure 2B**). The Deer Creek sounding site had a hedge row on the east side of the field resulting in potential funneling of the winds. This will act as a buffer likely affecting easterlies measurements. Refer to the site photos in the Instrument set-up.

(A)



(B)

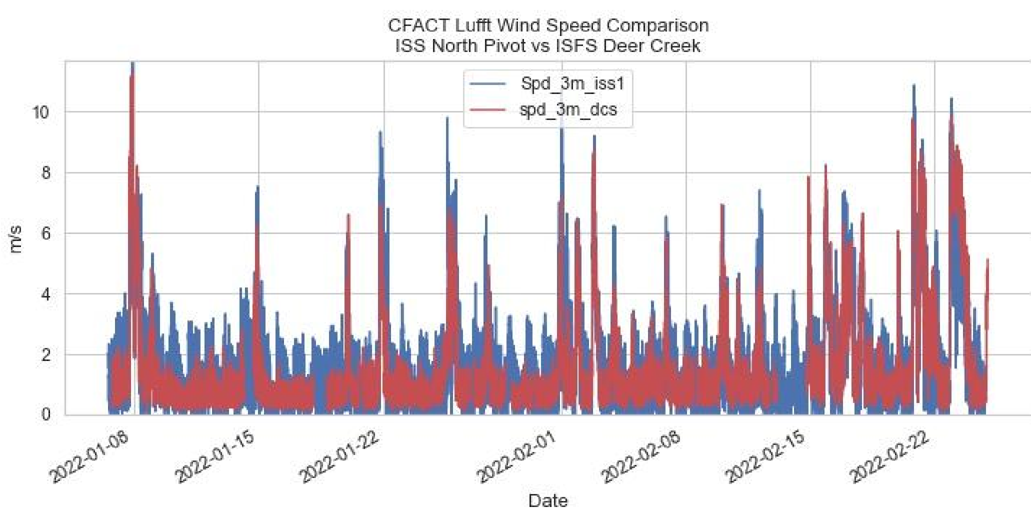


Figure 2. (A) Histogram of the difference in wind direction between ISS and the nearest ISFS site. Data is matched to within 2 minutes using the nearest-neighbor method and filtered for winds less than 1 m/s. (B) Time series of wind speed at the same sites, respectively. Red plots ISFS and blue plots ISS.

OTT Parsivel2 Visibility Data

The ISS surface met included an OTT Parsivel2 precipitation sensor at the North Pivot site. The OTT is sensitive to precipitation droplets larger than about 0.2 mm and larger, and it should be noted that it is not designed to detect fog droplets which are typically 10 - 20 microns. The output of the Ott includes a visibility parameter (Vis_1m_iss1), however this parameter is tuned to precipitation visibility and is not a good indicator of visibility due to fog.

Data Capture

The North Pivot site was running almost uninterrupted for the entire project (6 January - 23 February 2022) and final data capture is 98.7%.

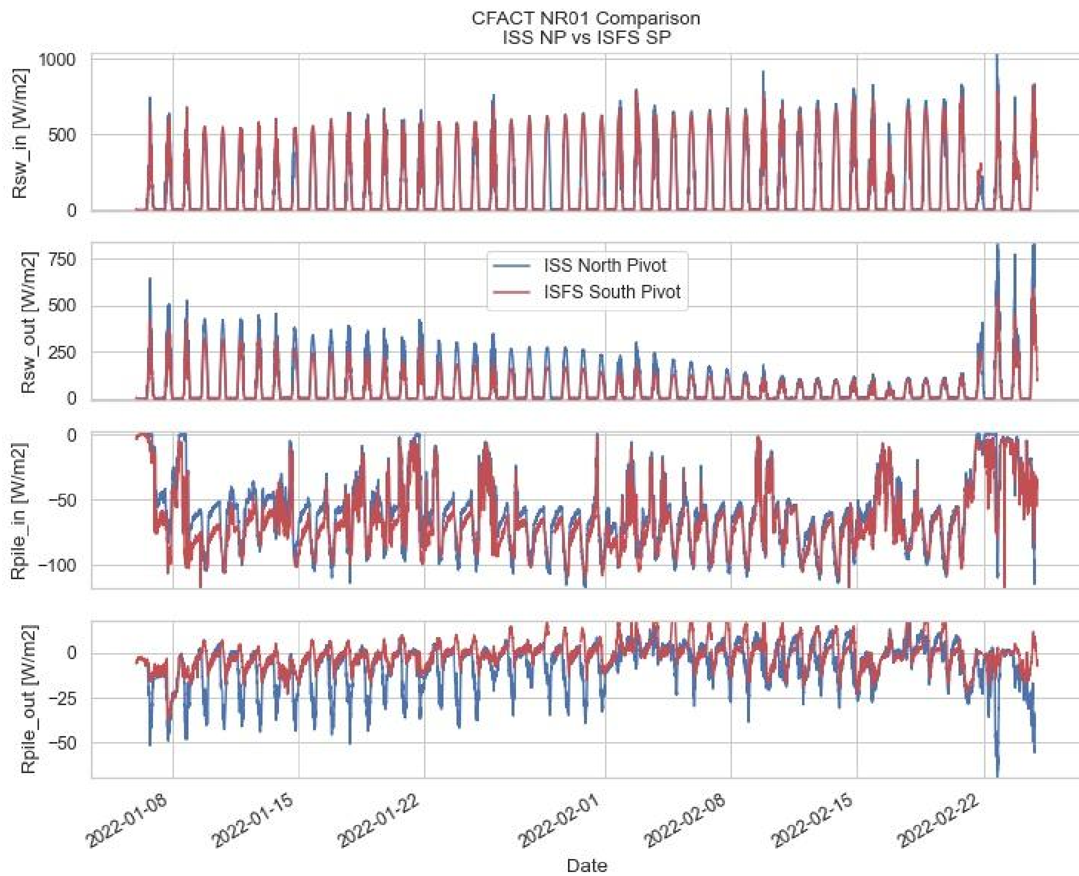
The Deer Creek Sounding site started collecting data later on 12 January 2022 with a final overall data capture of 88%.

Time-series plots

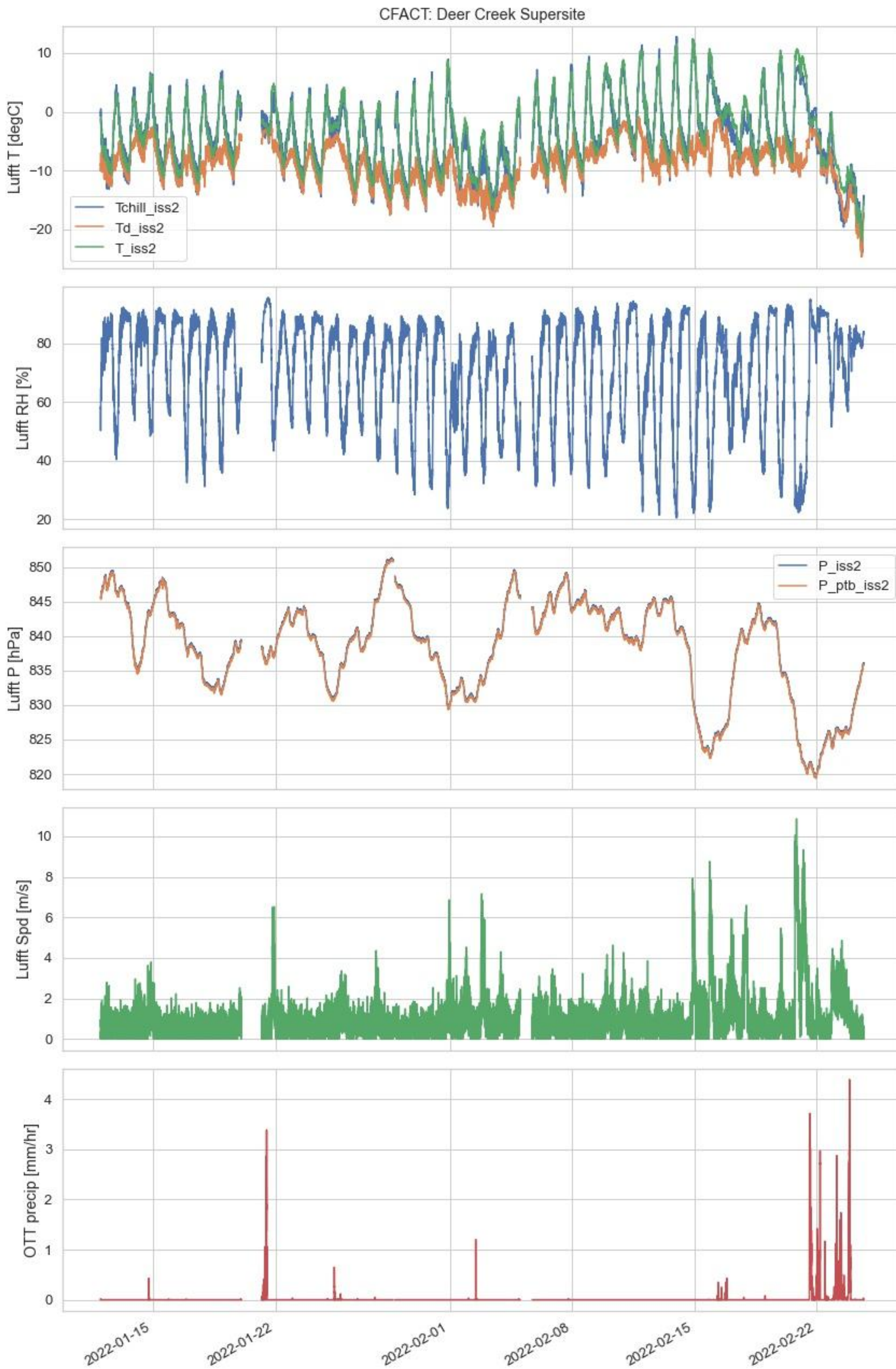
Below are time-series plots of key parameters that are double checked for quality assurance.

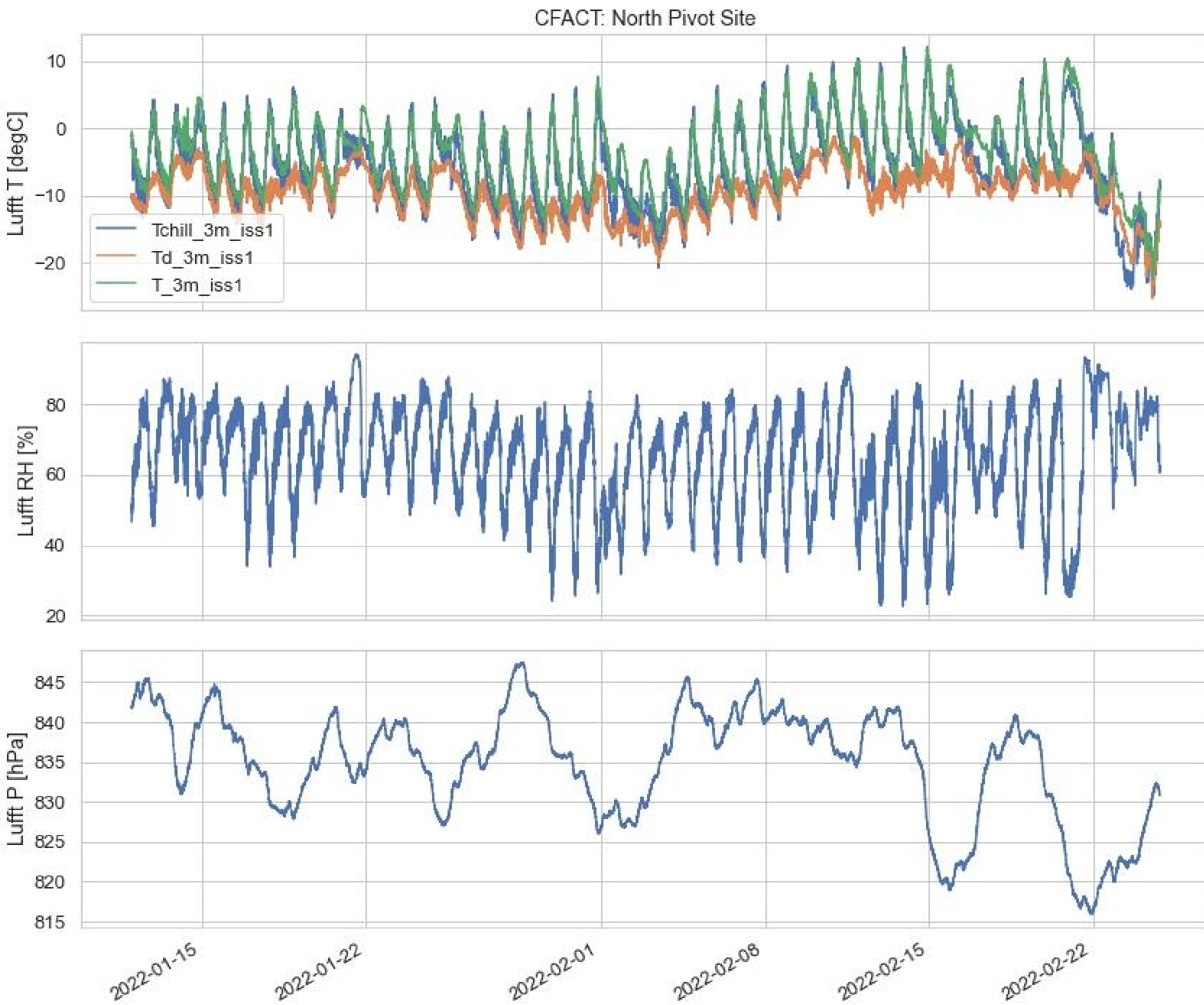
NR01 Comparison

The figure below shows a comparison of the ISS NR01 at the North Pivot site compared to the NR01 at the nearest ISFS site at South Pivot.



Surface Met. Variables




CFACT: North Pivot Site
Lufft T [degC]
Tchill_3m_iss1
Td_3m_iss1
T_3m_iss1
Lufft RH [%]
Lufft P [hPa]
2022-01-15
2022-01-22
2022-02-01
2022-02-08
2022-02-15
2022-02-22

Webcam Data Remarks

Note there are issues with icing and the rising sun that washed out the images during sunrise.

PurpleAir Data Remarks

The Railroad Service Pad site is used by locals as a parking area primarily for fishing along the nearby Provo River. There may be a biased weekday/weekend effect in PM2.5 concentrations due to vehicle exhaust contamination. In addition, during the IOPs students would camp overnight beside the Lidar trailer and the sensor may pick up exhaust from the generators used to heat the student's camper van. Refer to the IOP dates in the next section to validate possible biases in the PM2.5 time series.

Intensive Operating Periods (IOPS)

IOP1 - Ephemeral fog - Tues/Wed Jan 11-12 2022

IOP2 - Ephemeral fog - Sun/Mon Jan 16-17 2022

IOP3 - Ephemeral fog - Wed/Thurs Jan 19-20 2022

IOP4 - Ice-crystal - Thurs/Fri Feb 3-4 2022

IOP5 - Moisture surge - Wed/Thurs Feb 9-10 2022

IOP6 - Quiescent - Sat/Sun Feb 12-13 2022

IOP7 - Thurs/Fri Feb 17-18 2022

IOP8 - Fri/Sat Feb 18-19 2022

IOP9 - Wed/Thurs Feb 23-24 2022

NetCDF metadata contents

North Pivot

```
{
dimensions:
	time = UNLIMITED ; // (1440 currently)
variables:
	int base_time ;
		base_time:units = "seconds since 1970-01-01 00:00:00 00:00" ;
	double time(time) ;
		time:units = "seconds since 2022-01-20 00:00:00 00:00" ;
		time:interval\(sec\) = 60. ;
	float T_3m_iss1(time) ;
		T_3m_iss1:_FillValue = 1.e+37f ;
		T_3m_iss1:long_name = "Air Temperature" ;
		T_3m_iss1:short_name = "T.3m.iss1" ;
		T_3m_iss1:units = "degC" ;
	float Td_3m_iss1(time) ;
		Td_3m_iss1:_FillValue = 1.e+37f ;
		Td_3m_iss1:long_name = "Dewpoint Temperature" ;
		Td_3m_iss1:short_name = "Td.3m.iss1" ;
		Td_3m_iss1:units = "degC" ;
	float Tchill_3m_iss1(time) ;
		Tchill_3m_iss1:_FillValue = 1.e+37f ;
```

```
		Tchill_3m_iss1:long_name = "Wind Chill Temperature" ;
		Tchill_3m_iss1:short_name = "Tchill.3m.iss1" ;
		Tchill_3m_iss1:units = "degC" ;
	float RH_3m_iss1(time) ;
		RH_3m_iss1:_FillValue = 1.e+37f ;
		RH_3m_iss1:long_name = "Relative Humidity" ;
		RH_3m_iss1:short_name = "RH.3m.iss1" ;
		RH_3m_iss1:units = "%" ;
	float P_3m_iss1(time) ;
		P_3m_iss1:_FillValue = 1.e+37f ;
		P_3m_iss1:long_name = "Relative Air Pressure" ;
		P_3m_iss1:short_name = "P.3m.iss1" ;
		P_3m_iss1:units = "mb" ;
	float Spd_3m_iss1(time) ;
		Spd_3m_iss1:_FillValue = 1.e+37f ;
		Spd_3m_iss1:long_name = "Wind Speed" ;
		Spd_3m_iss1:short_name = "Spd.3m.iss1" ;
		Spd_3m_iss1:units = "m/s" ;
	float raina_3m_iss1(time) ;
		raina_3m_iss1:_FillValue = 1.e+37f ;
		raina_3m_iss1:long_name = "Precipitation quantity" ;
		raina_3m_iss1:short_name = "raina.3m.iss1" ;
		raina_3m_iss1:units = "mm" ;
	float preciptype_3m_iss1(time) ;
		preciptype_3m_iss1:_FillValue = 1.e+37f ;
		preciptype_3m_iss1:long_name = "Precipitation type" ;
		preciptype_3m_iss1:short_name = "preciptype.3m.iss1" ;
		preciptype_3m_iss1:units = "1" ;
	float rainr_3m_iss1(time) ;
		rainr_3m_iss1:_FillValue = 1.e+37f ;
		rainr_3m_iss1:long_name = "Precipitation intensity" ;
		rainr_3m_iss1:short_name = "rainr.3m.iss1" ;
		rainr_3m_iss1:units = "mm/hr" ;
	float Sn_3m_iss1(time) ;
		Sn_3m_iss1:_FillValue = 1.e+37f ;
		Sn_3m_iss1:long_name = "Min. wind speed" ;
		Sn_3m_iss1:short_name = "Sn.3m.iss1" ;
		Sn_3m_iss1:units = "m/s" ;
	float Sx_3m_iss1(time) ;
		Sx_3m_iss1:_FillValue = 1.e+37f ;
		Sx_3m_iss1:long_name = "Max. wind speed" ;
		Sx_3m_iss1:short_name = "Sx.3m.iss1" ;
		Sx_3m_iss1:units = "m/s" ;
	float Sg_3m_iss1(time) ;
		Sg_3m_iss1:_FillValue = 1.e+37f ;
		Sg_3m_iss1:long_name = "Avg. wind speed" ;
```

```
        Sg_3m_iss1:short_name = "Sg.3m.iss1" ;
        Sg_3m_iss1:units = "m/s" ;
float Sv_3m_iss1(time) ;
        Sv_3m_iss1:_FillValue = 1.e+37f ;
        Sv_3m_iss1:long_name = "Vct. wind speed" ;
        Sv_3m_iss1:short_name = "Sv.3m.iss1" ;
        Sv_3m_iss1:units = "m/s" ;
float Da_3m_iss1(time) ;
        Da_3m_iss1:_FillValue = 1.e+37f ;
        Da_3m_iss1:long_name = "Act. wind direction" ;
        Da_3m_iss1:short_name = "Da.3m.iss1" ;
        Da_3m_iss1:units = "deg" ;
float Dn_3m_iss1(time) ;
        Dn_3m_iss1:_FillValue = 1.e+37f ;
        Dn_3m_iss1:long_name = "Min. wind direction" ;
        Dn_3m_iss1:short_name = "Dn.3m.iss1" ;
        Dn_3m_iss1:units = "deg" ;
float Dx_3m_iss1(time) ;
        Dx_3m_iss1:_FillValue = 1.e+37f ;
        Dx_3m_iss1:long_name = "Max. wind direction" ;
        Dx_3m_iss1:short_name = "Dx.3m.iss1" ;
        Dx_3m_iss1:units = "deg" ;
float Dv_3m_iss1(time) ;
        Dv_3m_iss1:_FillValue = 1.e+37f ;
        Dv_3m_iss1:long_name = "Vct. wind direction" ;
        Dv_3m_iss1:short_name = "Dv.3m.iss1" ;
        Dv_3m_iss1:units = "deg" ;
float Ca_3m_iss1(time) ;
        Ca_3m_iss1:_FillValue = 1.e+37f ;
        Ca_3m_iss1:long_name = "Act. compass heading" ;
        Ca_3m_iss1:short_name = "Ca.3m.iss1" ;
        Ca_3m_iss1:units = "deg" ;
float Ga_3m_iss1(time) ;
        Ga_3m_iss1:_FillValue = 1.e+37f ;
        Ga_3m_iss1:long_name = "Act. global radiation" ;
        Ga_3m_iss1:short_name = "Ga.3m.iss1" ;
        Ga_3m_iss1:units = "W/m" ;
float Gn_3m_iss1(time) ;
        Gn_3m_iss1:_FillValue = 1.e+37f ;
        Gn_3m_iss1:long_name = "Min. global radiation" ;
        Gn_3m_iss1:short_name = "Gn.3m.iss1" ;
        Gn_3m_iss1:units = "W/m" ;
float Gx_3m_iss1(time) ;
        Gx_3m_iss1:_FillValue = 1.e+37f ;
        Gx_3m_iss1:long_name = "Max. global radiation" ;
        Gx_3m_iss1:short_name = "Gx.3m.iss1" ;
```

```
		Gx_3m_iss1:units = "W/m" ;
	float Gg_3m_iss1(time) ;
		Gg_3m_iss1:_FillValue = 1.e+37f ;
		Gg_3m_iss1:long_name = "Avg. global radiation" ;
		Gg_3m_iss1:short_name = "Gg.3m.iss1" ;
		Gg_3m_iss1:units = "W/m" ;
	float Ea_3m_iss1(time) ;
		Ea_3m_iss1:_FillValue = 1.e+37f ;
		Ea_3m_iss1:long_name = "Act. specific enthalpy" ;
		Ea_3m_iss1:short_name = "Ea.3m.iss1" ;
		Ea_3m_iss1:units = "KJ/kg" ;
	float Ba_3m_iss1(time) ;
		Ba_3m_iss1:_FillValue = 1.e+37f ;
		Ba_3m_iss1:long_name = "Act. Web Bulb Temperature" ;
		Ba_3m_iss1:short_name = "Ba.3m.iss1" ;
		Ba_3m_iss1:units = "degC" ;
	float Ad_3m_iss1(time) ;
		Ad_3m_iss1:_FillValue = 1.e+37f ;
		Ad_3m_iss1:long_name = "Act. Air Density" ;
		Ad_3m_iss1:short_name = "Ad.3m.iss1" ;
		Ad_3m_iss1:units = "kg/m" ;
	float La_3m_iss1(time) ;
		La_3m_iss1:_FillValue = 1.e+37f ;
		La_3m_iss1:long_name = "Leaf Wetness" ;
		La_3m_iss1:short_name = "La.3m.iss1" ;
		La_3m_iss1:units = "mV" ;
	float Lb_3m_iss1(time) ;
		Lb_3m_iss1:_FillValue = 1.e+37f ;
		Lb_3m_iss1:long_name = "Leaf Wetness State (0=dry, 1=wet)" ;
		Lb_3m_iss1:short_name = "Lb.3m.iss1" ;
		Lb_3m_iss1:units = "1" ;
	float Dir_3m_iss1(time) ;
		Dir_3m_iss1:_FillValue = 1.e+37f ;
		Dir_3m_iss1:long_name = "Vector wind direction" ;
		Dir_3m_iss1:short_name = "Dir.3m.iss1" ;
		Dir_3m_iss1:units = "deg" ;
	float GPSnsat_iss1(time) ;
		GPSnsat_iss1:_FillValue = 1.e+37f ;
		GPSnsat_iss1:long_name = "Number of GPS satellites tracked" ;
		GPSnsat_iss1:short_name = "GPSnsat.iss1" ;
		GPSnsat_iss1:units = "count" ;
	float GPSstat_iss1(time) ;
		GPSstat_iss1:_FillValue = 1.e+37f ;
		GPSstat_iss1:long_name = "GPS rcvr status: 1=OK(A), 0=warning(V)" ;
		GPSstat_iss1:short_name = "GPSstat.iss1" ;
		GPSstat_iss1:units = "none" ;
```

```
float GPSdiff_iss1(time) ;
        GPSdiff_iss1:_FillValue = 1.e+37f ;
        GPSdiff_iss1:long_name = "GPS NMEA receipt time - NMEA time value" ;
        GPSdiff_iss1:short_name = "GPSdiff.iss1" ;
        GPSdiff_iss1:units = "s" ;
float Rsw_in_2m_iss1(time) ;
        Rsw_in_2m_iss1:_FillValue = 1.e+37f ;
        Rsw_in_2m_iss1:long_name = "Incoming Short Wave, Hukseflux NR01" ;
        Rsw_in_2m_iss1:short_name = "Rsw.in.2m.iss1" ;
        Rsw_in_2m_iss1:units = "W/m^2" ;
float Rsw_out_2m_iss1(time) ;
        Rsw_out_2m_iss1:_FillValue = 1.e+37f ;
        Rsw_out_2m_iss1:long_name = "Outgoing Short Wave, Hukesflux NR01" ;
        Rsw_out_2m_iss1:short_name = "Rsw.out.2m.iss1" ;
        Rsw_out_2m_iss1:units = "W/m^2" ;
float Rpile_in_2m_iss1(time) ;
        Rpile_in_2m_iss1:_FillValue = 1.e+37f ;
        Rpile_in_2m_iss1:long_name = "Incoming Thermopile, Hukseflux NR01" ;
        Rpile_in_2m_iss1:short_name = "Rpile.in.2m.iss1" ;
        Rpile_in_2m_iss1:units = "W/m^2" ;
float Rpile_out_2m_iss1(time) ;
        Rpile_out_2m_iss1:_FillValue = 1.e+37f ;
        Rpile_out_2m_iss1:long_name = "Outgoing Thermopile, Hukesflux NR01" ;
        Rpile_out_2m_iss1:short_name = "Rpile.out.2m.iss1" ;
        Rpile_out_2m_iss1:units = "W/m^2" ;
float Tcase_2m_iss1(time) ;
        Tcase_2m_iss1:_FillValue = 1.e+37f ;
        Tcase_2m_iss1:long_name = "Case temperature, Hukesflux NR01" ;
        Tcase_2m_iss1:short_name = "Tcase.2m.iss1" ;
        Tcase_2m_iss1:units = "degC" ;
float Rainr_1m_iss1(time) ;
        Rainr_1m_iss1:_FillValue = 1.e+37f ;
        Rainr_1m_iss1:long_name = "Rain rate" ;
        Rainr_1m_iss1:short_name = "Rainr.1m.iss1" ;
        Rainr_1m_iss1:units = "mm/h" ;
float Tcell_1m_iss1(time) ;
        Tcell_1m_iss1:_FillValue = 1.e+37f ;
        Tcell_1m_iss1:long_name = "Sensor temperature" ;
        Tcell_1m_iss1:short_name = "Tcell.1m.iss1" ;
        Tcell_1m_iss1:units = "degC" ;
float WX_1m_iss1(time) ;
        WX_1m_iss1:_FillValue = 1.e+37f ;
        WX_1m_iss1:long_name = "Present weather code" ;
        WX_1m_iss1:short_name = "WX.1m.iss1" ;
float Vis_1m_iss1(time) ;
        Vis_1m_iss1:_FillValue = 1.e+37f ;
```

```
                Vis_1m_iss1:long_name = "MOR visibility" ;
                Vis_1m_iss1:short_name = "Vis.1m.iss1" ;
                Vis_1m_iss1:units = "m" ;
        float N_1m_iss1(time) ;
                N_1m_iss1:_FillValue = 1.e+37f ;
                N_1m_iss1:long_name = "Number of particles" ;
                N_1m_iss1:short_name = "N.1m.iss1" ;

// global attributes:
                :history = "Created: 2022-01-20 01:05:09 +0000\n",
                        "" ;
                :NIDAS_version = "v1.2-1581" ;
                :calibration_file_path =
"/opt/local/iss-system/iss/configs/cfact/ISFS/cal_files/${SITE}:/opt/local/iss-system/iss/project
s/cfact/ISFS/cal_files/$SITE:/opt/local/iss-system/iss/projects/cfact/ISFS/cal_files/${SITE}" ;
                :project_config =
"/opt/local/iss-system/iss/projects/cfact/ISFS/config/cfact.xml;" ;
                :file_length_seconds = 86400 ;
}
```

Deer Creek Sounding

```
{
dimensions:
        time = UNLIMITED ; // (1440 currently)
variables:
        int base_time ;
                base_time:units = "seconds since 1970-01-01 00:00:00 00:00" ;
        double time(time) ;
                time:units = "seconds since 2022-01-28 00:00:00 00:00" ;
                time:interval\(sec\) = 60. ;
        float T_iss2(time) ;
                T_iss2:_FillValue = 1.e+37f ;
                T_iss2:long_name = "Air Temperature" ;
                T_iss2:short_name = "T.iss2" ;
                T_iss2:units = "degC" ;
        float Td_iss2(time) ;
                Td_iss2:_FillValue = 1.e+37f ;
                Td_iss2:long_name = "Dewpoint Temperature" ;
                Td_iss2:short_name = "Td.iss2" ;
                Td_iss2:units = "degC" ;
        float Tchill_iss2(time) ;
                Tchill_iss2:_FillValue = 1.e+37f ;
                Tchill_iss2:long_name = "Wind Chill Temperature" ;
                Tchill_iss2:short_name = "Tchill.iss2" ;
                Tchill_iss2:units = "degC" ;
```

```
float RH_iss2(time) ;
        RH_iss2:_FillValue = 1.e+37f ;
        RH_iss2:long_name = "Relative Humidity" ;
        RH_iss2:short_name = "RH.iss2" ;
        RH_iss2:units = "%" ;
float P_iss2(time) ;
        P_iss2:_FillValue = 1.e+37f ;
        P_iss2:long_name = "Relative Air Pressure" ;
        P_iss2:short_name = "P.iss2" ;
        P_iss2:units = "mb" ;
float Spd_iss2(time) ;
        Spd_iss2:_FillValue = 1.e+37f ;
        Spd_iss2:long_name = "Wind Speed" ;
        Spd_iss2:short_name = "Spd.iss2" ;
        Spd_iss2:units = "m/s" ;
float raina_iss2(time) ;
        raina_iss2:_FillValue = 1.e+37f ;
        raina_iss2:long_name = "Precipitation quantity" ;
        raina_iss2:short_name = "raina.iss2" ;
        raina_iss2:units = "mm" ;
float preciptype_iss2(time) ;
        preciptype_iss2:_FillValue = 1.e+37f ;
        preciptype_iss2:long_name = "Precipitation type" ;
        preciptype_iss2:short_name = "preciptype.iss2" ;
        preciptype_iss2:units = "1" ;
float rainr_iss2(time) ;
        rainr_iss2:_FillValue = 1.e+37f ;
        rainr_iss2:long_name = "Precipitation intensity" ;
        rainr_iss2:short_name = "rainr.iss2" ;
        rainr_iss2:units = "mm/hr" ;
float Sn_iss2(time) ;
        Sn_iss2:_FillValue = 1.e+37f ;
        Sn_iss2:long_name = "Min. wind speed" ;
        Sn_iss2:short_name = "Sn.iss2" ;
        Sn_iss2:units = "m/s" ;
float Sx_iss2(time) ;
        Sx_iss2:_FillValue = 1.e+37f ;
        Sx_iss2:long_name = "Max. wind speed" ;
        Sx_iss2:short_name = "Sx.iss2" ;
        Sx_iss2:units = "m/s" ;
float Sg_iss2(time) ;
        Sg_iss2:_FillValue = 1.e+37f ;
        Sg_iss2:long_name = "Avg. wind speed" ;
        Sg_iss2:short_name = "Sg.iss2" ;
        Sg_iss2:units = "m/s" ;
float Sv_iss2(time) ;
```

```
        Sv_iss2:_FillValue = 1.e+37f ;
        Sv_iss2:long_name = "Vct. wind speed" ;
        Sv_iss2:short_name = "Sv.iss2" ;
        Sv_iss2:units = "m/s" ;
float Da_iss2(time) ;
        Da_iss2:_FillValue = 1.e+37f ;
        Da_iss2:long_name = "Act. wind direction" ;
        Da_iss2:short_name = "Da.iss2" ;
        Da_iss2:units = "deg" ;
float Dn_iss2(time) ;
        Dn_iss2:_FillValue = 1.e+37f ;
        Dn_iss2:long_name = "Min. wind direction" ;
        Dn_iss2:short_name = "Dn.iss2" ;
        Dn_iss2:units = "deg" ;
float Dx_iss2(time) ;
        Dx_iss2:_FillValue = 1.e+37f ;
        Dx_iss2:long_name = "Max. wind direction" ;
        Dx_iss2:short_name = "Dx.iss2" ;
        Dx_iss2:units = "deg" ;
float Dv_iss2(time) ;
        Dv_iss2:_FillValue = 1.e+37f ;
        Dv_iss2:long_name = "Vct. wind direction" ;
        Dv_iss2:short_name = "Dv.iss2" ;
        Dv_iss2:units = "deg" ;
float Ca_iss2(time) ;
        Ca_iss2:_FillValue = 1.e+37f ;
        Ca_iss2:long_name = "Act. compass heading" ;
        Ca_iss2:short_name = "Ca.iss2" ;
        Ca_iss2:units = "deg" ;
float Ga_iss2(time) ;
        Ga_iss2:_FillValue = 1.e+37f ;
        Ga_iss2:long_name = "Act. global radiation" ;
        Ga_iss2:short_name = "Ga.iss2" ;
        Ga_iss2:units = "W/m" ;
float Gn_iss2(time) ;
        Gn_iss2:_FillValue = 1.e+37f ;
        Gn_iss2:long_name = "Min. global radiation" ;
        Gn_iss2:short_name = "Gn.iss2" ;
        Gn_iss2:units = "W/m" ;
float Gx_iss2(time) ;
        Gx_iss2:_FillValue = 1.e+37f ;
        Gx_iss2:long_name = "Max. global radiation" ;
        Gx_iss2:short_name = "Gx.iss2" ;
        Gx_iss2:units = "W/m" ;
float Gg_iss2(time) ;
        Gg_iss2:_FillValue = 1.e+37f ;
```

```
		Gg_iss2:long_name = "Avg. global radiation" ;
		Gg_iss2:short_name = "Gg.iss2" ;
		Gg_iss2:units = "W/m" ;
	float Ea_iss2(time) ;
		Ea_iss2:_FillValue = 1.e+37f ;
		Ea_iss2:long_name = "Act. specific enthalpy" ;
		Ea_iss2:short_name = "Ea.iss2" ;
		Ea_iss2:units = "KJ/kg" ;
	float Ba_iss2(time) ;
		Ba_iss2:_FillValue = 1.e+37f ;
		Ba_iss2:long_name = "Act. Web Bulb Temperature" ;
		Ba_iss2:short_name = "Ba.iss2" ;
		Ba_iss2:units = "degC" ;
	float Ad_iss2(time) ;
		Ad_iss2:_FillValue = 1.e+37f ;
		Ad_iss2:long_name = "Act. Air Density" ;
		Ad_iss2:short_name = "Ad.iss2" ;
		Ad_iss2:units = "kg/m" ;
	float La_iss2(time) ;
		La_iss2:_FillValue = 1.e+37f ;
		La_iss2:long_name = "Leaf Wetness" ;
		La_iss2:short_name = "La.iss2" ;
		La_iss2:units = "mV" ;
	float Lb_iss2(time) ;
		Lb_iss2:_FillValue = 1.e+37f ;
		Lb_iss2:long_name = "Leaf Wetness State (0=dry, 1=wet)" ;
		Lb_iss2:short_name = "Lb.iss2" ;
		Lb_iss2:units = "1" ;
	float Dir_iss2(time) ;
		Dir_iss2:_FillValue = 1.e+37f ;
		Dir_iss2:long_name = "Vector wind direction" ;
		Dir_iss2:short_name = "Dir.iss2" ;
		Dir_iss2:units = "deg" ;
	float P_ptb_iss2(time) ;
		P_ptb_iss2:_FillValue = 1.e+37f ;
		P_ptb_iss2:long_name = "Barometric Pressure, Vaisala PTB 210" ;
		P_ptb_iss2:short_name = "P.ptb.iss2" ;
		P_ptb_iss2:units = "mb" ;
	float P_P__ptb_iss2(time) ;
		P_P__ptb_iss2:_FillValue = 1.e+37f ;
		P_P__ptb_iss2:long_name = "2nd moment" ;
		P_P__ptb_iss2:short_name = "P\'P\'.ptb.iss2" ;
		P_P__ptb_iss2:units = "(mb)^2" ;
	float GPSnsat_iss2_1(time) ;
		GPSnsat_iss2_1:_FillValue = 1.e+37f ;
		GPSnsat_iss2_1:long_name = "Number of GPS satellites tracked" ;
```

```
		GPSnsat_iss2_1:short_name = "GPSnsat.iss2" ;
		GPSnsat_iss2_1:units = "count" ;
	float GPSstat_iss2_1(time) ;
		GPSstat_iss2_1:_FillValue = 1.e+37f ;
		GPSstat_iss2_1:long_name = "GPS rcvr status: 1=OK(A), 0=warning(V)" ;
		GPSstat_iss2_1:short_name = "GPSstat.iss2" ;
		GPSstat_iss2_1:units = "none" ;
	float GPSdiff_iss2_1(time) ;
		GPSdiff_iss2_1:_FillValue = 1.e+37f ;
		GPSdiff_iss2_1:long_name = "GPS NMEA receipt time - NMEA time value" ;
		GPSdiff_iss2_1:short_name = "GPSdiff.iss2" ;
		GPSdiff_iss2_1:units = "s" ;

// global attributes:
		:history = "Created: 2022-01-28 00:01:08 +0000\n",
			"" ;
		:NIDAS_version = "v1.2-1548" ;
		:calibration_file_path =
"/opt/local/iss-system/iss/configs/cfact/ISFS/cal_files/${SITE}:/opt/local/iss-system/iss/project
s/cfact/ISFS/cal_files/$SITE:/opt/local/iss-system/iss/projects/cfact/ISFS/cal_files/${SITE}" ;
		:project_config =
"/opt/local/iss-system/iss/projects/cfact/ISFS/config/cfact.xml;" ;
		:file_length_seconds = 86400 ;
}
```

PurpleAir SD card CSV File Header Descriptions

URL Reference

The SD Card version of the PA-II (PA-II-SD) has a built in real time clock and OPENLOG serial logger. The SD card contains data in CSV format with the following headers:

UTCDateTime, mac_address, firmware_ver, hardware, current_temp_f, current_humidity, current_dewpoint_f, pressure, adc, mem, rssi, uptime, pm1_0_atm, pm2_5_atm, pm10_0_atm, pm1_0_cf_1, pm2_5_cf_1, pm10_0_cf_1, p_0_3_um, p_0_5_um, p_1_0_um, p_2_5_um, p_5_0_um, p_10_0_um, pm1_0_atm_b, pm2_5_atm_b, pm10_0_atm_b, pm1_0_cf_1_b, pm2_5_cf_1_b, pm10_0_cf_1_b, p_0_3_um_b, p_0_5_um_b, p_1_0_um_b, p_2_5_um_b, p_5_0_um_b, p_10_0_um_b

UTCDateTime: The Date and time derived from the Real Time Clock and synced with NTP where possible (in UTC).

Mac_address: The MAC address of the WiFi module on the sensor (used as an ID for the unit).

Firmware_ver: Firmware version of the control board.

Hardware: Hardware the control board has detected.

current_temp_f: Current temperature in F.

Current_humidity: Current Humidity in %.

Current_dewpoint_f: Calculated dew point in F.

Pressure: Current pressure in millibars.

Adc: The voltage reading on the analog input of the control board.

Mem: Free HEAP memory on the control board.

Rssi: WiFi signal strength in dBm

Uptime: Firmware uptime in seconds.

Pm1_0_atm: Channel A ATM PM1.0 particulate mass in ug/m3

Pm2_5_atm: Channel A ATM PM2.5 particulate mass in ug/m3

Pm10_0_atm: Channel A ATM PM10.0 particulate mass in ug/m3

Pm1_0_cf_1: Channel A CF=1 PM1.0 particulate mass in ug/m3

Pm2_5_cf_1: Channel A CF=1 PM2.5 particulate mass in ug/m3

Pm10_0_cf_1: Channel A CF=1 PM10.0 particulate mass in ug/m3

P_0_3_um: Channel A 0.3 micrometer particle counts per deciliter of air

P_0_5_um: Channel A 0.5 micrometer particle counts per deciliter of air

P_1_0_um: Channel A 1.0 micrometer particle counts per deciliter of air

P_2_5_um: Channel A 2.5 micrometer particle counts per deciliter of air

P_5_0_um: Channel A 5.0 micrometer particle counts per deciliter of air

P_10_0_um: Channel A 10.0 micrometer particle counts per deciliter of air

Pm1_0_atm_b: Channel B ATM PM1.0 particulate mass in ug/m3.

Pm2_5_atm_b: Channel B ATM PM2.5 particulate mass in ug/m3

Pm10_0_atm_b: Channel B ATM PM10.0 particulate mass in ug/m3

Pm1_0_cf_1_b: Channel B CF=1 PM1.0 particulate mass in ug/m3

Pm2_5_cf_1_b: Channel B CF=1 PM2.5 particulate mass in ug/m3

Pm10_0_cf_1_b: Channel B CF=1 PM10.0 particulate mass in ug/m3

P_0_3_um_b: Channel B 0.3 micrometer particle counts per deciliter of air

P_0_5_um_b: Channel B 0.5 micrometer particle counts per deciliter of air

P_1_0_um_b: Channel B 1.0 micrometer particle counts per deciliter of air

P_2_5_um_b: Channel B 2.5 micrometer particle counts per deciliter of air

P_5_0_um_b: Channel B 5.0 micrometer particle counts per deciliter of air

P_10_0_um_b: Channel B 10.0 micrometer particle counts per deciliter of air

PA-II NOTES:

Each sensor contains two identical laser counters, hence channel A and B. If these two channels do not agree to some extent then there is something wrong with one or both channels.

Plantower PMS sensor notes:

ATM is "atmospheric", meant to be used for outdoor applications

CF=1 is meant to be used for indoor or controlled environment applications

However, PurpleAir uses CF=1 values on the map. This value is lower than the ATM value in higher measured concentrations.