WIS 2.0 Caribbean Training Workshop

June 9-12 2026

Automating
the
WIS 2.0 Process
by
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&
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Presentation Outline

- Background
- Station Operation
- Automation Process
- Conclusion

Background

The Montserrat volcano erupted in June 1997 and destroyed the W.H Bramble Airport and caused mass migration of the population, which went from ~16,000 to now ~ 4,000.

Background

W. H Bramble Airport

Background

At the J.A. Osborne Airport, built in 2005 in the Northern portion of the island in the designated “Safe Zone”

The Air Traffic Controllers are required to do a dual function as ATC and Met. Observers.

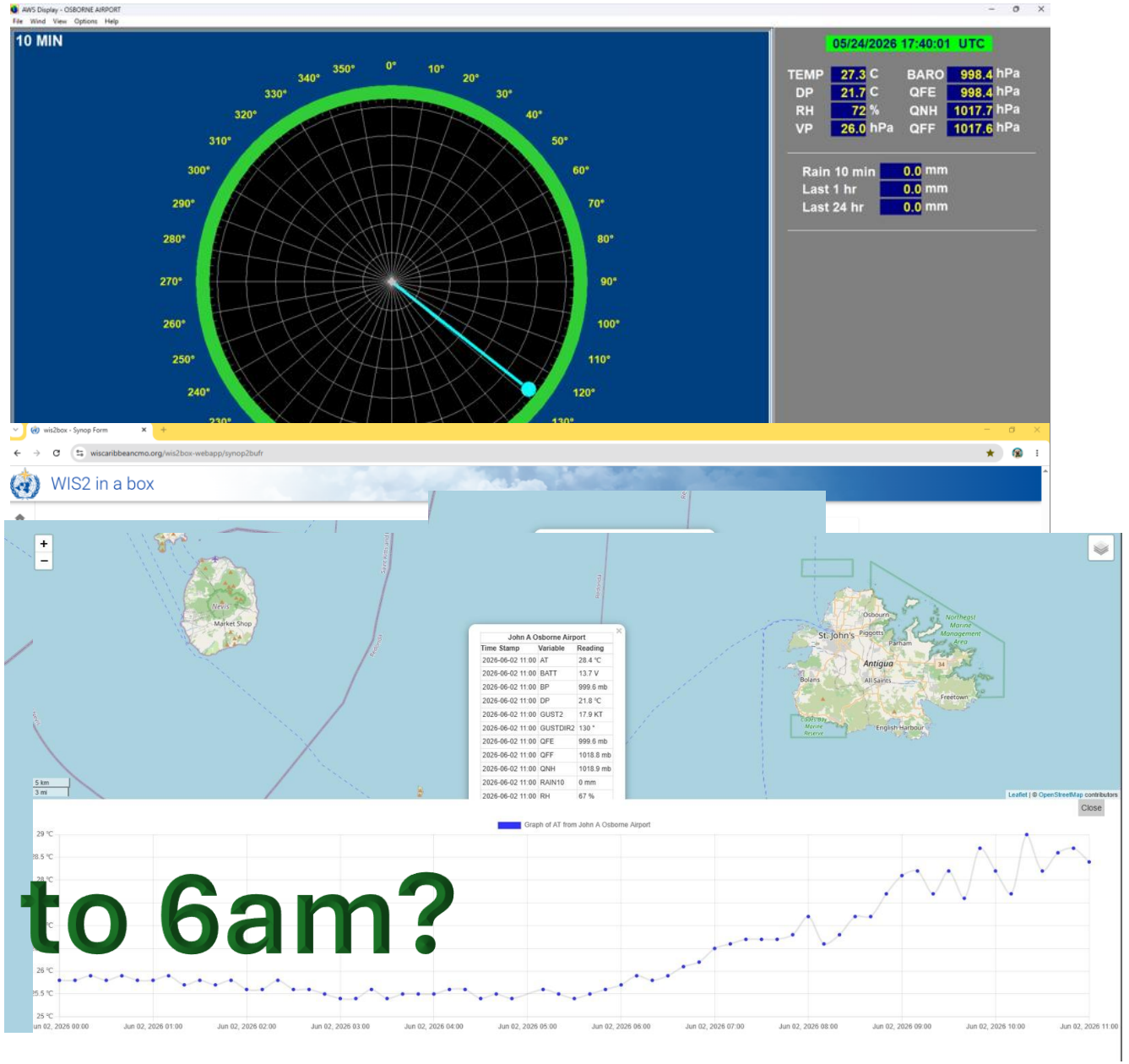
ATC used a Stevenson Screen and an Aneroid Barometer to collect Temperature, Dew Point, QNH and QFE readings as well as anemometers set up for aviation purposes.

Station Background

- Initial Installation May 2023
  - Co-located with older system
- 9210 Data Logger
- Typical sensor suite
  - ATRH
  - Wind
  - Pressure
  - Rain
- Derived parameters
  - 10 min intervals
  - 2 min – WS,WD
- 900 MHz RF Radio (Comms)
- XConnect Setup
  - MySQL vs MS Access (Storage)
- AWS Observer (Operational Viewing)

Station Operation

- AWS used to support Met & ATC operations
  - Observations and METARS
- WIS 2.0 uploads of the METARS (manual)
- Upload of AWS Data to Kaleidoscope
- Sunrise to Sunset
  - 6am to 6pm



6pm to 6am?

The Automation Process

SYNOP Standardized CSV format

	A	B	C	D	E
1	Column	Title	FM-12	Units	Data type
2	wsi_series	WIGOS identifier series			Integer
3	wsi_issuer	WIGOS issuer of identifier			Integer
4	wsi_issue_number	WIGOS issue number			Integer
5	wsi_local	WIGOS local identifier			Character
6	wmo_block_number	WMO block number			Integer
7	wmo_station_number	WMO station number			Integer
8	station_type	Type of station			Integer
9	year	Year			Integer
10	month	Month			Integer
11	day	Day	YY		Integer
12	hour	Hour	GG		Integer
13	minute	Minute	gg		Integer
14	latitude	Latitude		degrees	Decimal
15	longitude	Longitude		degrees	Decimal
16	station_height_above_msl	Height of station ground above mean sea level		meters	Decimal
17	barometer_height_above_msl	Height of barometer above mean sea level		meters	Decimal
18	station_pressure	Pressure (station level)	P0P0P0P0	Pa	Decimal
19	msl_pressure	Pressure (MSL)	PPPP	Pa	Decimal
20	geopotential_height	Geopotential height	hhh	gpm	Integer
21	thermometer_height	Thermometer height above local ground		meters	Decimal
22	air_temperature	Air temperature	TTT	Kelvin	Decimal
23	dewpoint_temperature	Dewpoint temperature	TdTdTd	Kelvin	Decimal
24	relative_humidity	Relative humidity	UUU	%	Integer
25	method_of_ground_state_measurement	Method of state of ground measurement		code table	Integer

The Automation Process

SYNOP Standardized CSV format

26	ground_state	State of ground	E or E'	code table	Integer
27	method_of_snow_depth_measurement	Method of snow depth measurement		code table	Integer
28	snow_depth	Total snow depth	sss	meters	Decimal
29	precipitation_intensity	Intensity of precipitation		kg m-2 h-1	Decimal
30	anemometer_height	Anemometer height		meters	Decimal
31	time_period_of_wind	Time period	-5	minutes	Integer
32	wind_direction	Wind direction	dd	degrees	Integer
33	wind_speed	Wind speed	ff (00fff)	ms-1	Decimal
34	maximum_wind_gust_direction_10_minutes	Maximum wind gust direction (10 minutes)		degrees	Integer
35	maximum_wind_gust_speed_10_minutes	Maximum wind gust speed (10 minutes)	fmfm (910fmfm)	ms-1	Decimal
36	maximum_wind_gust_direction_1_hour	Maximum wind gust direction (1 hour)		degrees	Integer
37	maximum_wind_gust_speed_1_hour	Maximum wind gust speed (1 hour)	fxfx (911fxfx)	ms-1	Decimal
38	maximum_wind_gust_direction_3_hours	Maximum wind gust direction (3 hours)		degrees	Integer
39	maximum_wind_gust_speed_3_hours	Maximum wind gust speed (3 hours)	fxfx (911fxfx)	ms-1	Decimal
40	rain_sensor_height	Height of rain sensor		meters	Decimal
41	total_precipitation_1_hour	Total precipitation (1 hour)		kg m-2	Decimal
42	total_precipitation_3_hour	Total precipitation (3 hours)		kg m-2	Decimal
43	total_precipitation_6_hours	Total precipitation (6 hours)		kg m-2	Decimal
44	total_precipitation_12_hours	Total precipitation (12 hours)		kg m-2	Decimal
45	total_precipitation_24_hours	Total precipitation (24 hours)	R24R24R24R24	kg m-2	Decimal
46	solar_radiation	Solar Radiation		Watts per Meter square	Decimal
47					
48	synop_key_entry_data	key_entry	place_holder		

The Automation Process

SYNOP Standardized CSV format

49				
50	wind_indicator	Wind Indicator	iW	iW
51	precipitation_indicator	Precipitation Indicator	iR	iR
52	Station Operation Indicator	Station Operation Indicator	iX	iX
53	Lowest Cloud Height	Lowest Cloud Height	h	metres
54	Visibility	Visibility	VV	km
55	Cloud Cover, Tot	Cloud Cover, Tot	N	N
56	Wind Direction	Wind Direction	ddd dd	degrees
57	Wind Speed	Wind Speed	(fmfm)f f	knots
58	Air Temperature - Dry Bulb	Air Temperature - Dry Bulb	T'T' TTT	celcius
59	Dew Point Temperature	Dew Point Temperature	T'd T'd TdTdTd	celcius
60	Air Temperature - Wet Bulb	Air Temperature - Wet Bulb	T'T' TTT	celcius
61	Relative Humidity	Relative Humidity	UUU	percentage
62	Pressure at Station Level	Pressure at Station Level	P0P0P0	hPa
63	Pressure at Sea Level(hPa)	Pressure at Sea Level(hPa)	PHPHPHPH PPP	hPa
64	Precipitation Since Last Report	Precipitation Since Last Report	RRR	mm
65	Precipitation Period Duration	Precipitation Period Duration	Tr	Tr
66	24-hour Barometric change	24-hour Barometric change	P24P24P24	hPa
67	24-hour Rainfall	24-hour Rainfall	R24R24R24R24	mm
68	Present Weather	Present Weather	ww	ww
69	Past Weather - Type 1	Past Weather - Type 1	W1	W1
70	Past Weather - Type 1	Past Weather - Type 1	W2	W2
71	Observed Cloud Coverage	Observed Cloud Coverage	Nh	Nh

The Automation Process

SYNOP Standardized CSV format

72	Low Cloud Type	Low Cloud Type	CL	CL
73	Middle Cloud Type	Middle Cloud Type	CM	CM
74	High Cloud Type	High Cloud Type	CH	CH
75	State of Sky	State of Sky	CS	CS
76	Direction of CL CLouds	Direction of CL CLouds	DL	DL
77	Direction of CM CLouds	Direction of CM CLouds	DM	DM
78	Direction of CH Clouds	Direction of CH Clouds	DH	DH
79	Air Temperature - Dry Bulb [MAX]	Air Temperature - Dry Bulb [MAX]	TnTnTn	celcius
80	Air Temperature - Dry Bulb [MAX]	Air Temperature - Dry Bulb [MAX]	TXTXTX	celcius
81	Cloud Coverage - Level 1	Cloud Coverage - Level 1	NS	NS
82	Genus of Cloud - Level 1	Genus of Cloud - Level 1	C	C
83	Height of Cloud Base - Level 1	Height of Cloud Base - Level 1	hShS	hShS
84	Cloud Coverage - Level 2	Cloud Coverage - Level 2	NS	NS
85	Genus of Cloud - Level 2	Genus of Cloud - Level 2	C	C
86	Height of Cloud Base - Level 2	Height of Cloud Base - Level 2	hShS	hShS
87	Cloud Coverage - Level 3	Cloud Coverage - Level 3	NS	NS
88	Genus of Cloud - Level 3	Genus of Cloud - Level 3	C	C
89	Height of Cloud Base - Level 3	Height of Cloud Base - Level 3	hShS	hShS
90	Cloud Coverage - Level 4	Cloud Coverage - Level 4	NS	NS
91	Genus of Cloud - Level 4	Genus of Cloud - Level 4	C	C
92	Height of Cloud Base - Level 3	Height of Cloud Base - Level 3	hShS	hShS
93	Special Phenomenom	Special Phenomenom	9SPSPsPsP	9SPSPsPsP
94				
95				

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6	wmo_block_number	WMO block number			Integer
7	wmo_station_number	WMO station number			Integer
8	station_type	Type of station			Integer
9	year	Year			Integer
10	month	Month			Integer
11	day	Day	YY		Integer
12	hour	Hour	GG		Integer
13	minute	Minute	gg		Integer
14	latitude	Latitude		degrees	Decimal
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constants readings control “constants” disregard

The Automation Process

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43	total_precipitation_6_hours	Total precipitation (6 hours)		kg m-2	Decimal
44	total_precipitation_12_hours	Total precipitation (12 hours)		kg m-2	Decimal
45	total_precipitation_24_hours	Total precipitation (24 hours)	R24R24R24R24	kg m-2	Decimal
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constants readings control “constants” disregard

The Automation Process

Where do you intercept or gather your data in the workflow?

XConnect

MySQL

Python Script
MySQL Connector

Direct Readout Variables

AT,RH,DP,BARO

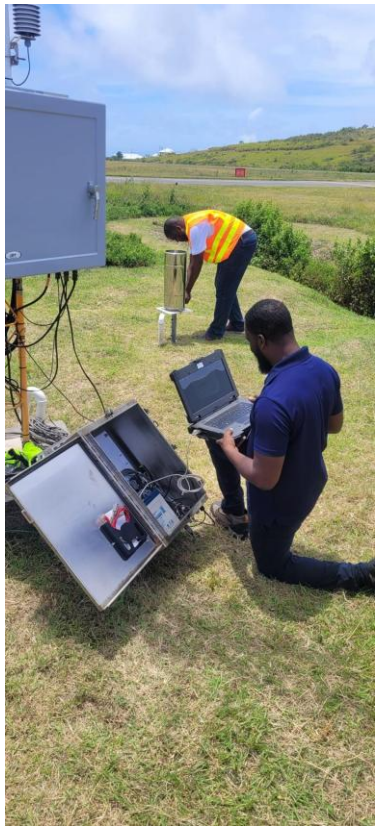
Aggregated Variables

1,6,12,24hr Rain, Winds

gbon_210520206_1900.csv
gbon_210520206_2000.csv
gbon_210520206_2100.csv
gbon_210520206_2200.csv
gbon_210520206_2300.csv
gbon_220520206_0000.csv
gbon_220520206_0100.csv
.....
gbon_220520206_0500.csv

Python Script
MinIO

WIS 2.0



The Automation Process

```
import mysql.connector
from datetime import datetime,timedelta

def rounding(rainval):
    return round(float(rainval),1)

def populate_dict(dict_var,readings):
    for row in readings:
        dict_var.update({row[0]:row[3]})

def degreesC_To_Kelvin(tempval):
    return round((float(tempval) + 273.15),1)

def knots_to_meters_per_second(speed_val):
    return round((float(speed_val) * 0.514444),1)
```

The Automation Process

```
import mysql.connector
from datetime import datetime

def rounding(rainval):
    return round(float(rainva

def populate_dict(dict_var,re
    for row in readings:
        dict_var.update({row[

def degreesC_To_Kelvin(tempva
    return round((float(tempv

def knots_to_meters_per_secon
    return round((float(speed
```

```
if __name__ == '__main__':
    LATITUDE = 16.7911111111
    LONGITUDE = -62.1933333333
    WSI_SERIES = 0
    WSI_ISSUER = 20000
    WSI_Issue_Number = 0
    WSI_LOCAL = 78850
    WMO_BLOCK = ''
    WMO_STATION_NUMBER =''
    STATION_TYPE = 0

    GEOPOTENTIAL_HEIGHT = ''

    METHOD_OF_GROUND_STATE_MEAS = ''

    GROUND_STATE=''
    PRECIP_INTEN = ''

    TIME_PERIOD = -10
```

The Automation Process

```
import mysql.connector
from datetime import datetime

def rounding(rainval):
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def populate_dict(dict_var,re
    for row in readings:
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def degreesC_To_Kelvin(tempva
    return round((float(tempv

def knots_to_meters_per_secon
    return round((float(speed
```

```
if __name__
    LATITUI
    LONGITU
    WSI_SEF
    WSI_ISS
    WSI_Iss
    WSI_LOC
    WMO_BLC
    WMO_STA
    STATION

    GEOPOTE

    METHOD_

    GROUND_
    PRECIP_

    TIME_PE
```

```
Traditional_Station_identifier = 78850
Wigos_Station_Identifier = '0-20000-0-78850'
current_time = datetime.now()
year = current_time.strftime("%Y")
month = current_time.strftime("%m")
day = current_time.strftime("%d")
hour = current_time.strftime("%H")
minute = 0
baro_height = 166.67
station_height = 166.67

thermometer_height = 2.2

rain_senor_height = 0.5

anemometer_height = 10

time_diff = 2

last_ten_minute_time = current_time - timedelta(minutes=10)
last_one_hour_time = current_time - timedelta(hours=1,minutes=time_diff)
last_three_hour_time = current_time - timedelta(hours=3,minutes=time_diff)
last_six_hour_time = current_time - timedelta(hours=6,minutes=time_diff)
last_twelve_hour_time = current_time - timedelta(hours=12,minutes=time_diff)
last_24_hour_time = current_time - timedelta(hours=24,minutes=time_diff)
```

The Automation Process

```
import mysql.connector
from datetime import datetime

def rounding(rainval):
    return round(float(rainva

def populate_dict(dict_var,re
    for row in readings:
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```

```
if __name__
    LATITUI
    LONGITU
    WSI_SEI
    WSI_ISS
    WSI_Iss
    WSI_LOC
    WMO_BLC
    WMO_STA
    STATION
    GEOPOTE
    METHOD_
    GROUND_
    PRECIP_
    TIME_PE
```

```
Traditional_Station_identifier = 78850
Wigos_Station_Identifier = '0-20000-0-78850'
current_time = datetime.now()
year = current_time.strftime("%Y")
month = curr
day = curre
hour = curr
minute = 0
baro_height
station_hei
thermometer_
rain_senor_I
anemometer_I
time_diff = 2

dict_10m = dict()
dict_1h = dict()
dict_3h = dict()
dict_6h = dict()
dict_12h = dict()
dict_24h = dict()

file_stamp = current_time.strftime("%d%m%Y%H%M")
main()

last_ten_minute_time = current_time - timedelta(minutes=10)
last_one_hour_time = current_time - timedelta(hours=1,minutes=time_diff)
last_three_hour_time = current_time - timedelta(hours=3,minutes=time_diff)
last_six_hour_time = current_time - timedelta(hours=6,minutes=time_diff)
last_twelve_hour_time = current_time - timedelta(hours=12,minutes=time_diff)
last_24_hour_time = current_time - timedelta(hours=24,minutes=time_diff)
```

The Automation Process

```
def main():
    db_config = {
        "host":"localhost",
        "user":"XConnect",
        "password":"xconnect",
        "database":"xc_data"}
    try:
        conn = mysql.connector.connect(**db_config)
        cursor = conn.cursor()
        sql = f"SELECT SENSORNAME,TIME_TAG,SOURCE,ORIG_VALUE,ED_VALUE FROM xc_data1 WHERE TIME_TAG BETWEEN '{last_ten_minute_time.strftime(
        print(sql)
        cursor.execute(sql)
        rows = cursor.fetchall()
        populate_dict(dict_10m,rows)

        #one Hour readings
        sql = f"SELECT SENSORNAME,TIME_TAG,SOURCE,ORIG_VALUE,ED_VALUE FROM xc_data1 WHERE TIME_TAG = '{last_one_hour_time.strftime("%Y-%m-%
        print(sql)
        cursor.execute(sql)
        rows = cursor.fetchall()
        populate_dict(dict_1h,rows)
```

The Automation Process

```
except mysql.connector.Error as err:
    print(f"Error: {err}")
except Exception as e:
    print(f"This error occured - {e}")

finally:
    if cursor:
        cursor.close()
    if conn:
        conn.close()

print(dict_10m)
print(dict_1h)
print(dict_3h)
print(dict_6h)
print(dict_12h)
print(dict_24h)

print(round(float(rain_1_hr),1))
print(round(float(rain_3_hr),1))
print(round(float(rain_6_hr),1))
print(round(float(rain_12_hr),1))
print(round(float(rain_24_hr),1))
```

The Automation Process

```
except mysql.connector.Error as err:
    print(f"Error: {err}")
except Exception as e:
    print(f"This error occured - {e}")

finally:
    if cursor:
        c
    if cc
        c

print(dic
print(dic
print(dic
print(dic
print(dict_12h)
print(dict_24h)

print(round(float(rain_1_hr),1))
print(round(float(rain_3_hr),1))
print(round(float(rain_6_hr),1))
print(round(float(rain_12_hr),1))
print(round(float(rain_24_hr),1))
```

```
    gbon_data = f"{WSI_SERIES},{WSI_ISSUER},{WSI_Issue_Number},{WSI_LOCAL},{WMO_BLOCK},{WMO_STATION_NUMBER},{STATION_TYPE},{year},{month},{d
    print(gbon_data)
    with open(r"C:\Users\XCUSER\Desktop\Montserrat\gbon_headers.txt",'r') as input,open(rf"C:\Users\XCUSER\Desktop\Montserrat\GBON\gbon_{file_stamp}.
        headers = input.readline()
        output.write(headers)
        output.write("\n")
        output.write(gbon_data)
```

The Automation Process

```
gbon_data = f"{WSI_SERIES},{WSI_ISSUER},{WSI_Issue_Number},{WSI_LOCAL},{WMO_BLOCK},{WMO_STATION_NUMBER},{STATION_TYPE},{year},{month},{d
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```

```
wsi_series,wsi_issuer,wsi_issue_number,wsi_local,wmo_block_number,wmo_station_number,station_type,year,month,day,hour,minute,latitude,longitude,station_height
_above_msl,barometer_height_above_msl,station_pressure,msl_pressure,geopotential_height,thermometer_height,air_temperature,dewpoint_temperature,relative_humid
ity,method_of_ground_state_measurement,ground_state,method_of_snow_depth_measurement,snow_depth,precipitation_intensity,anemometer_height,time_period_of_wind,
wind_direction,wind_speed,maximum_wind_gust_direction_10_minutes,maximum_wind_gust_speed_10_minutes,maximum_wind_gust_direction_1
_hour,maximum_wind_gust_speed_1_hour,maximum_wind_gust_direction_3_hours,maximum_wind_gust_speed_3_hours,rain_sensor_height,total_precipitation_1
_hour,total_precipitation_3_hours,total_precipitation_6_hours,total_precipitation_12_hours,total_precipitation_24_hours
```

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	
1	wsi_series	wsi_issuer	wsi_issue_	wsi_local	wmo_bloc	wmo_stati	station_ty	year	month	day	hour	minute	latitude	longitude	station_he	barometer	station_pr	msl_press	geopotent	the
2	0	20000	0	78850			0	2025	02	26	11	0	16.79111	-62.1933	166.67	166.67	9982	10176		
3																				
4																				
5																				

The Automation Process

MinIO – Sending to the wis2box

MinIO – Is a high-performance is an open-source object storage system, released under the AGPLv3 license

Fully compatible with Amazon (AWS) S3 API

Designed for speed and scalability to store unstructured data and can operate in demanding storage workload scenarios

MinIO Python Client package available on pypi (Python Package Index)

- pip install minio

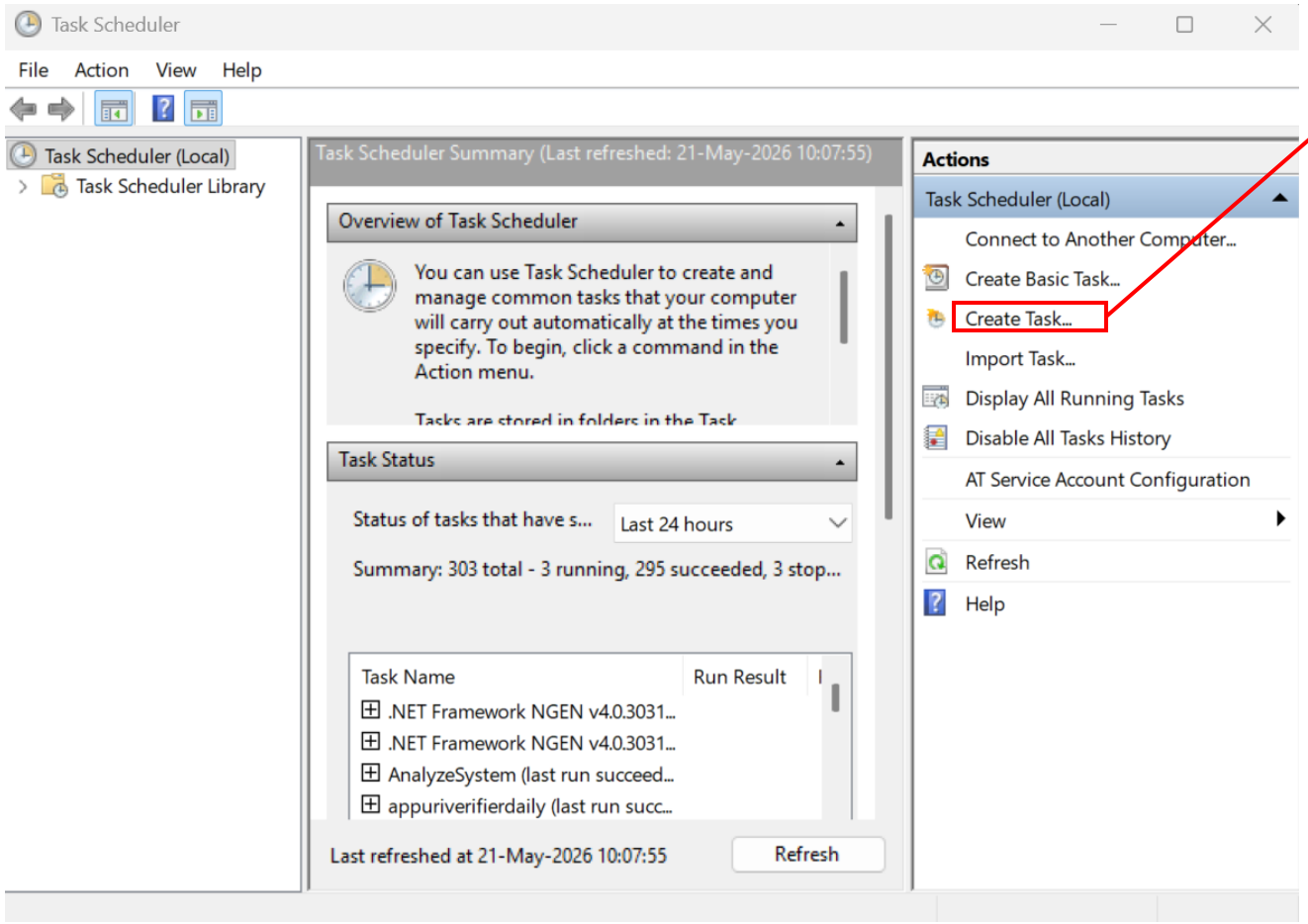
The Automation Process

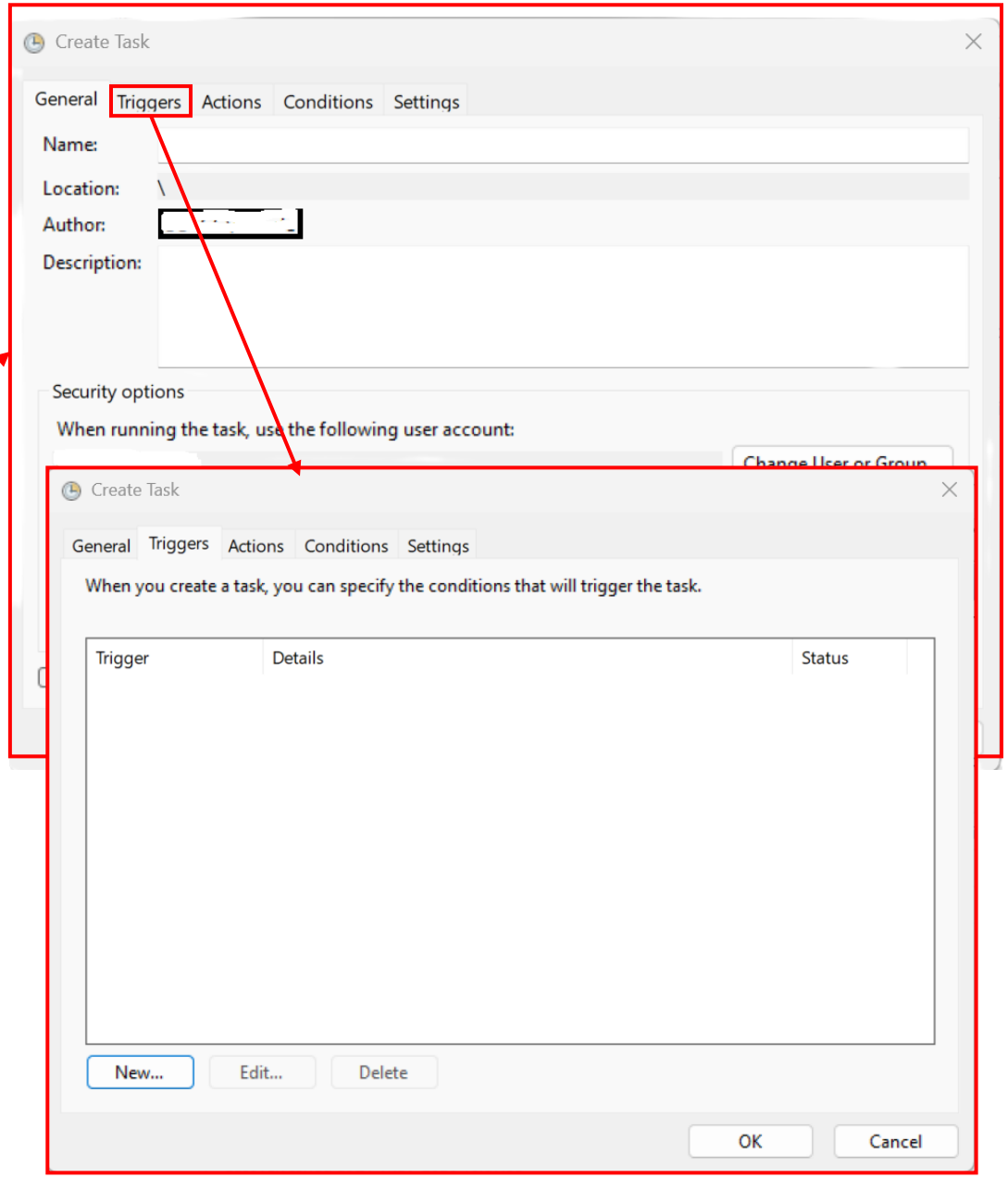
Minio – Sending to the wis2box

```python
from minio import Minio

filepath = 'GBON\gbon_260220250002.csv'

minio_path = "ms-metservice/data/core/weather/surface-based-observations/synop"

# endpoint = "http://localhost:9000"
endpoint = "18.198.42.212:9000"
WIS2BOX_STORAGE_USERNAME = 'wis2box'
WIS2BOX_STORAGE_PASSWORD = [redacted]

client = Minio(endpoint=endpoint,access_key=WIS2BOX_STORAGE_USERNAME,secret_key=WIS2BOX_STORAGE_PASSWORD,secure=False)
print(client)
filename = filepath.split('\\')[-1]
print(filename)
client.fput_object('wis2box-incoming',minio_path+filename,filepath)
```

The Automation Process

Running at fixed intervals - Windows





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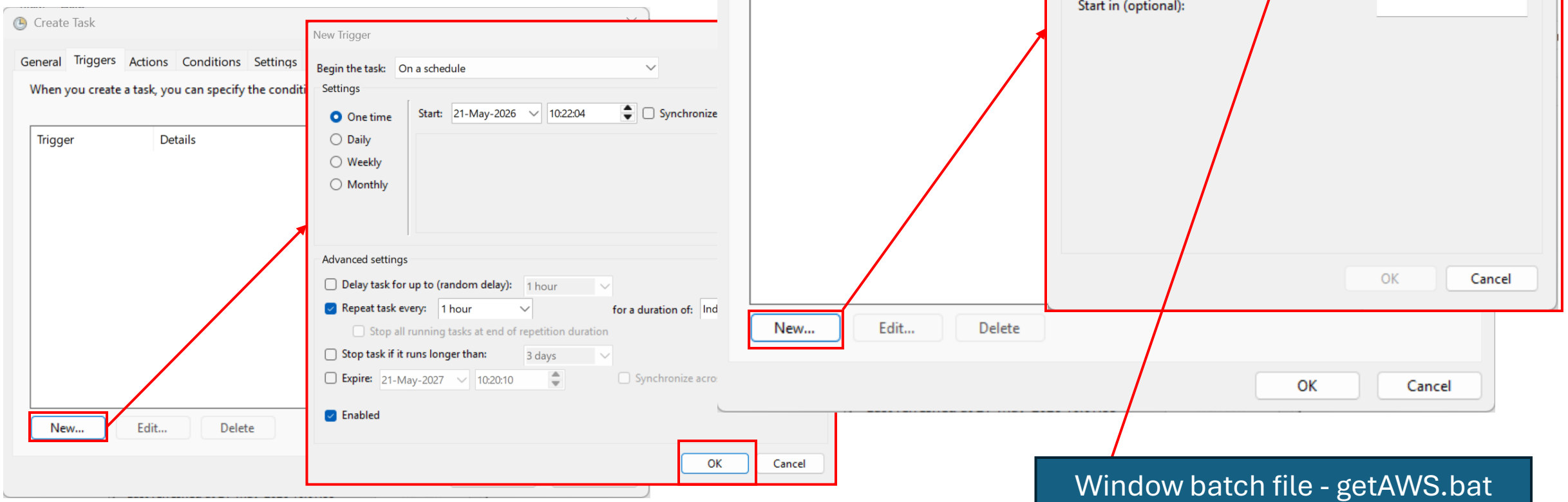
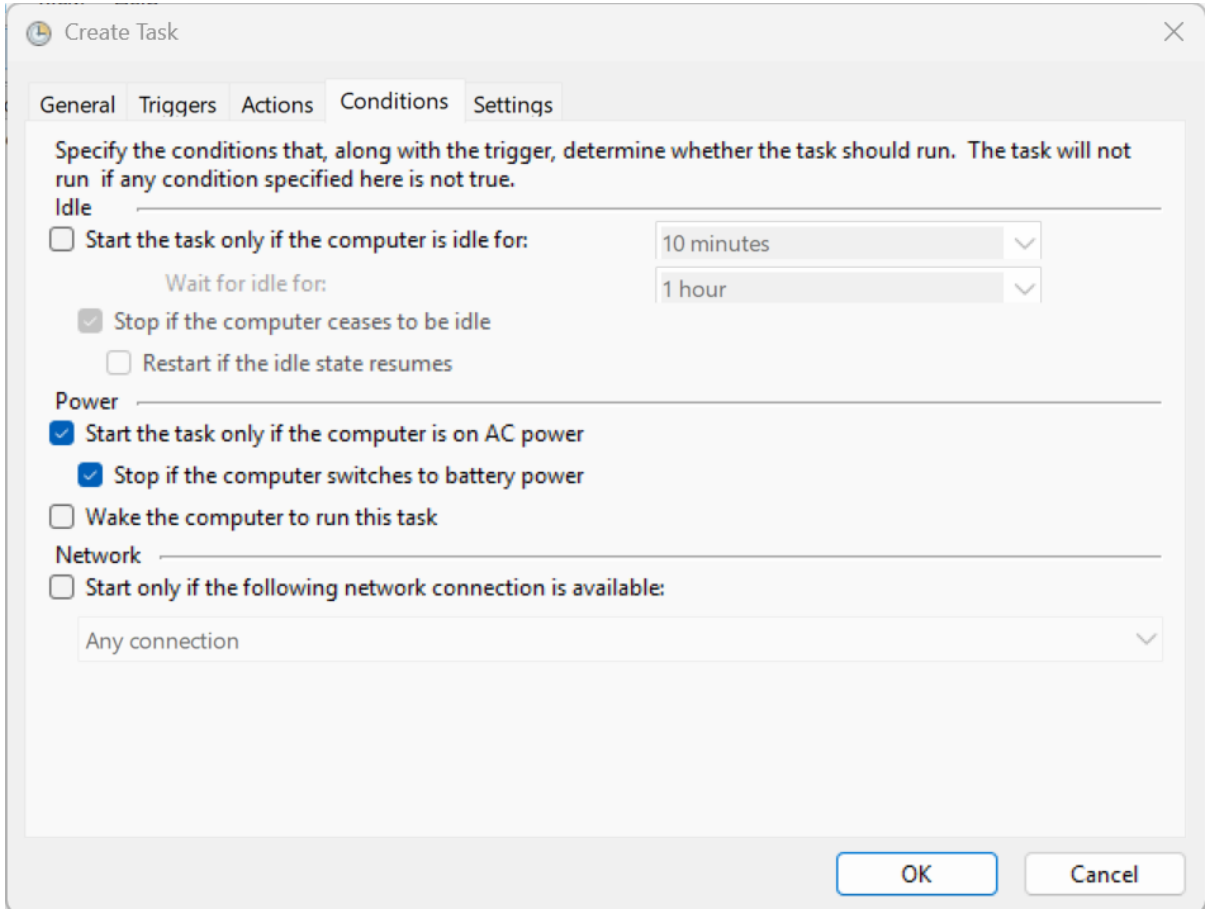


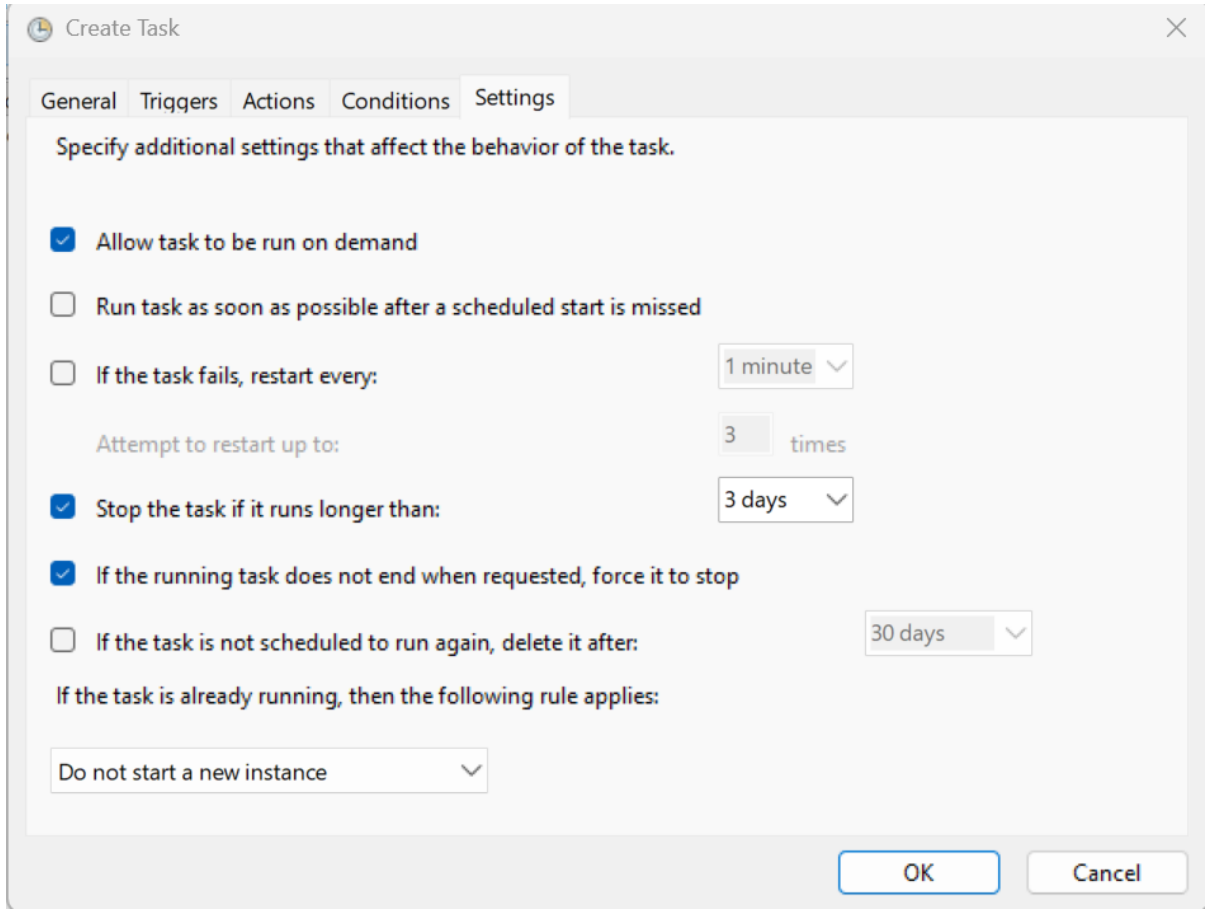
Window batch file - getAWS.bat

```
ECHO OFF
python C:\Users\XCUSER\Desktop\Montserrat\get_last_ten_KS.py
```

The Automation Process

Running at fixed intervals - Windows





The Automation Process

Running at fixed intervals - Linux

- Make python script executable
  - sudo chmod +x /home/path/to/getAWS.py
- cronjob
  - */10 * * * * /usr/bin/python3 /home/path/to/getAWS.py

Conclusion

Things to consider?

- Evolution of modern instruments and instrumentation
- Greater demand for the data
    - Newer data communication protocols (APIs/ MQTT / Webhooks)
- Embrace the new skills that are needed to “keep up”
    - Information and Communication Technology (ICT) personnel within the services
    - No need for expensive system to get started (Raspberry Pi, repurposed Laptops)
- Knowledge sharing opportunities like this


THANK YOU