DEPARTMENT OF PLANNING, INDUSTRY & ENVIRONMENT

Air Quality Application Programming Interface (API) User Guide

Climate & Atmospheric Science Branch

environment.nsw.gov.au

Cover photo: Darling River campground (Yapara Paaka Thuru), Toorale National Park. Joshua Smith/DPIE

Published by:

Environment, Energy and Science
Department of Planning, Industry and Environment
4 Parramatta Square, 12 Darcy Street, Parramatta NSW 2150
Phone: +61 2 9995 5000 (switchboard)
Phone: 1300 361 967 (Environment, Energy and Science enquiries)
TTY users: phone 133 677, then ask for 1300 361 967
Speak and listen users: phone 1300 555 727, then ask for 1300 361 967
Email: info@environment.nsw.gov.au
Website: www.environment.nsw.gov.au

Report pollution and environmental incidents
Environment Line: 131 555 (NSW only) or info@environment.nsw.gov.au
See also www.environment.nsw.gov.au

ISBN 978 1 922318 71 8
EES 2021/0346
First published in June 2020; second edition published in August 2021

Find out more about your environment at:

www.environment.nsw.gov.au

Contents

List of tables

List of figures

1. Scope

This document describes the process for searching and retrieving Department of Planning, Industry and Environment (DPIE) air quality, meteorological and monitoring site data from the DPIE Azure Cloud Data Warehouse using an Application Programming Interface (API) data service and:

- Excel Power Query
- R programming language
- Python programming language

Although this document describes how to extract DPIE air quality data using the Air Quality API and Excel software, R and Python programming languages, the main purpose of an API is to connect software applications and stream data.

2. Introduction

Currently the DPIE Air Quality webpages provide a facility to search and retrieve static air quality data. Manual intervention is required to retrieve data from the DPIE Air Quality web site. The DPIE Air Quality API is a data service providing an open access Application Programming Interface (API), to enable IT application developers and end-users to integrate current real-time and historical DPIE air quality data, with a variety of software applications.

The scope of applications for which the DPIE Air Quality API data service can provide data for, spans the full breadth of potential uses, from mobile apps, organisational decision-management business systems to dynamic streaming of online air quality data as outlined in Figure 1.

The DPIE Air Quality API data service does not replace the existing DPIE air quality search and retrieve facility, as it is intended for use by software applications, not as a user interface. The DPIE air quality data available through the API, has been fully quality assured, in accordance with DPIE quality assurance procedures.

Further air quality information in relation to air quality data and monitoring sites can be found on the DPIE Air Quality web site:

https://www.environment.nsw.gov.au/topics/air

This Air Quality Application Interface (API) User Guide is an updated version to the document issued in June 2020. The main change has been the replacement of Air Quality Index (AQI) with Air Quality Categories (AQC). This has resulted in Air Quality Index values being removed from the Air Quality API. The reason for the implementation of Air Quality Categories can be found on the DPIE Air Quality web site:

https://www.environment.nsw.gov.au/topics/air/understanding-air-quality-data/air-quality-categories

3. Overview of the DPIE Air Quality API data service

The DPIE Air Quality API (the API) data service provides a standardised RESTful (REpresentational State Transfer) protocol for searching and retrieving data. The Air Quality API architecture is shown in Figure 1. The Client software applications is not exhaustive and is only provided as an example.

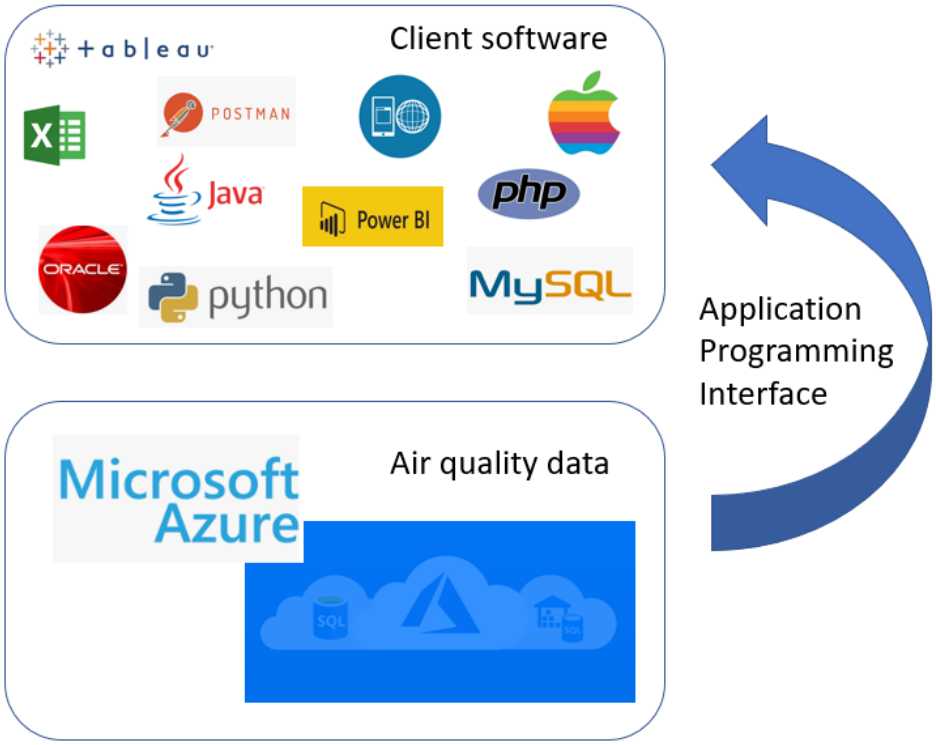


Figure 1 Air Quality API Architecture

3.1 Air Quality API data sets

The Air Quality API provides three data end-points (data sets):

1. **Sites**
   Monitoring site data including the site name, longitude, latitude and region.
   (url = “https://data.airquality.nsw.gov.au/api/Data/get_SiteDetails”)
2. **Parameters**
   Details the air pollutants and meteorological parameters, monitored by the DPIE including parameter averaging periods and exceedances.
   (url = "https://data.airquality.nsw.gov.au/api/Data/get_ParameterDetails”)
3. **Observations**
   Air quality and meteorological observational data collected from the air quality monitoring network, can be searched and downloaded as current real-time hourly data or as historical data. Current observational data is refreshed every hour.
   (url = “https://data.airquality.nsw.gov.au/api/Data/get_Observations”)

4. Search and retrieve air quality data using Air Quality Data API website (swagger)

The DPIE API web service can be used by a variety of third-party software applications as identified in Figure 1, to search and retrieve DPIE air quality data. The following outlines how to use the Air Quality Data API website (swagger) (below) to search and retrieve air quality and related data stored in the DPIE Azure Cloud Data Warehouse. The data is returned as a **json file format**.

To go to the Air Quality Data API website (swagger) click on the link below:
https://data.airquality.nsw.gov.au/docs/index.html

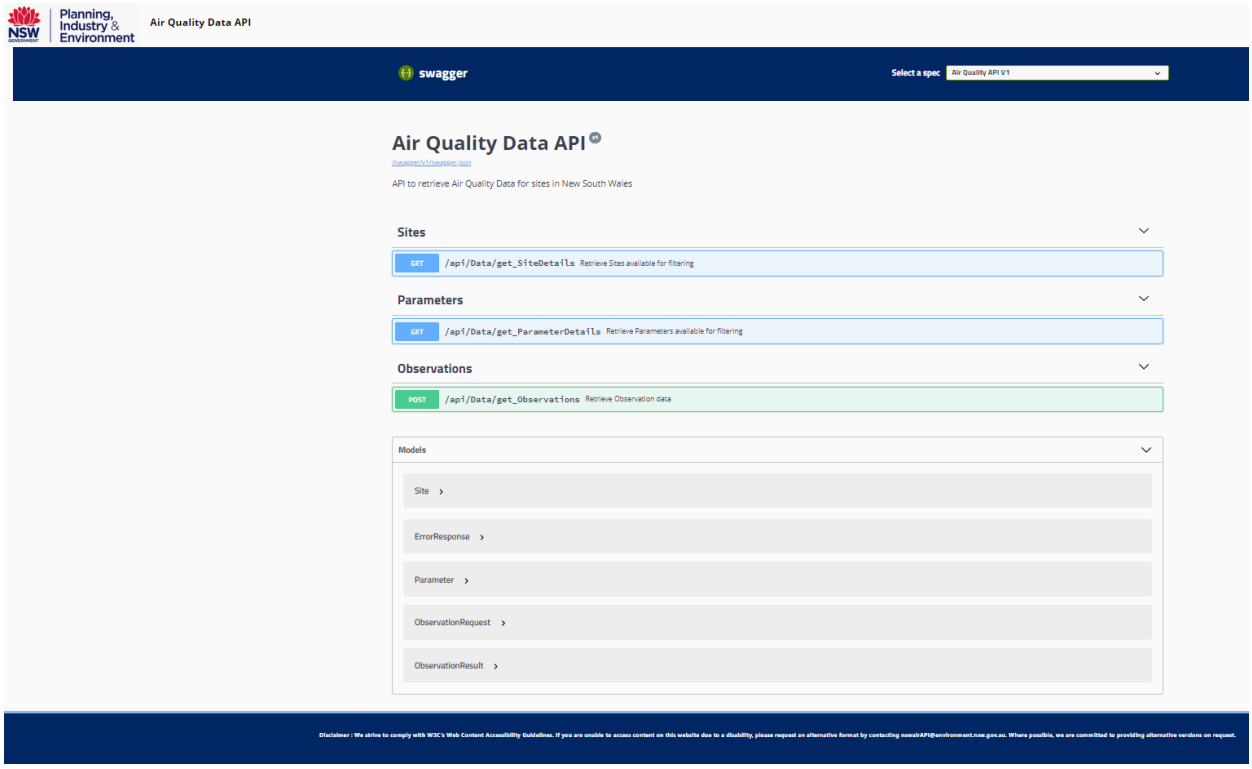


Figure 2 Air Quality Data API - swagger

The Air Quality API provides three data sets:

- Site details data
- Parameter details data
- Observational data. The observational data can be extracted as current real-time hourly data or as historical data by querying data through the body command.

The information under Models provides details on what data is retrieved from Sites, Parameters and Observations API. This is also a Data Dictionary which details the technical details of the API.

4.1 Setting up a query in the Air Quality Data API website (swagger)

The Air Quality Data API website (swagger) provides three data sets:

- Site details data
- Parameter details data
- Observational data.
  The observational data can be extracted as current real-time hourly data or as historical data by querying data through the body query command.

A screenshot of the Air Quality Data API website (swagger) interface is below:

Figure 3 Screenshot of Air Quality Data API website (swagger) interface

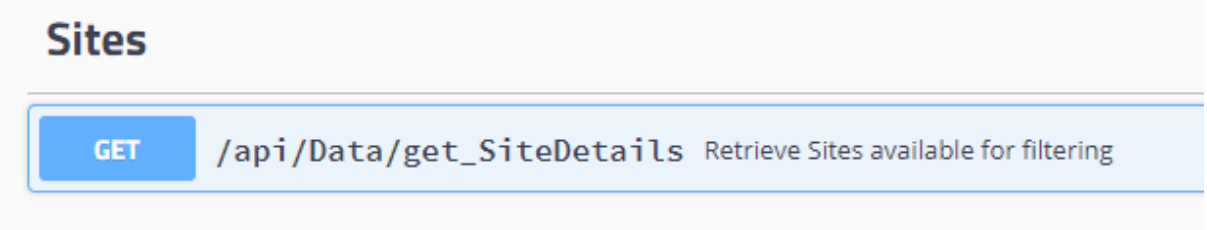
The Site Details and Parameter Details can also be queried through the body command in the body query command. However, since this is static data it is easier to search and filter using a third-party application like Excel. Using the body query command to filter site and parameter details, is not possible in the Air Quality Data API website

The get_SiteDetails and get_ParameterDetails use the **GET** method to retrieve data.

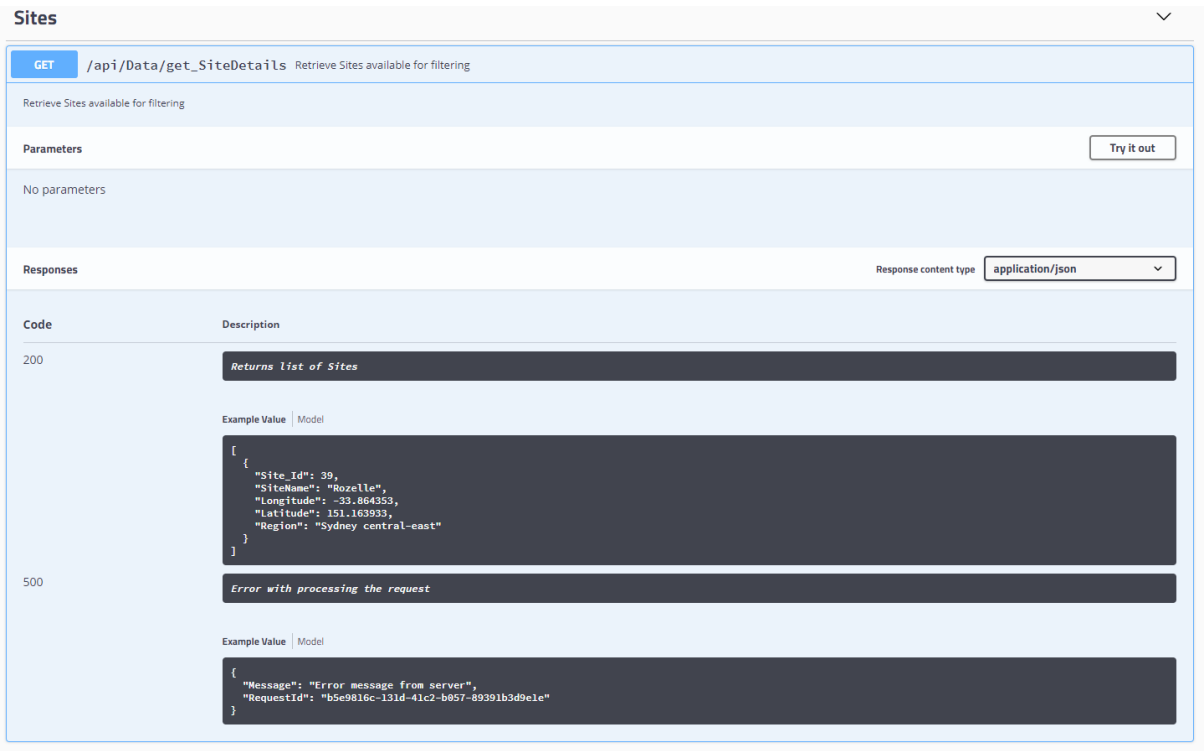
The get_Observations use the **POST** method to retrieve data.

4.1.1 Extract Monitoring Site data using the Air Quality Data API website (swagger)

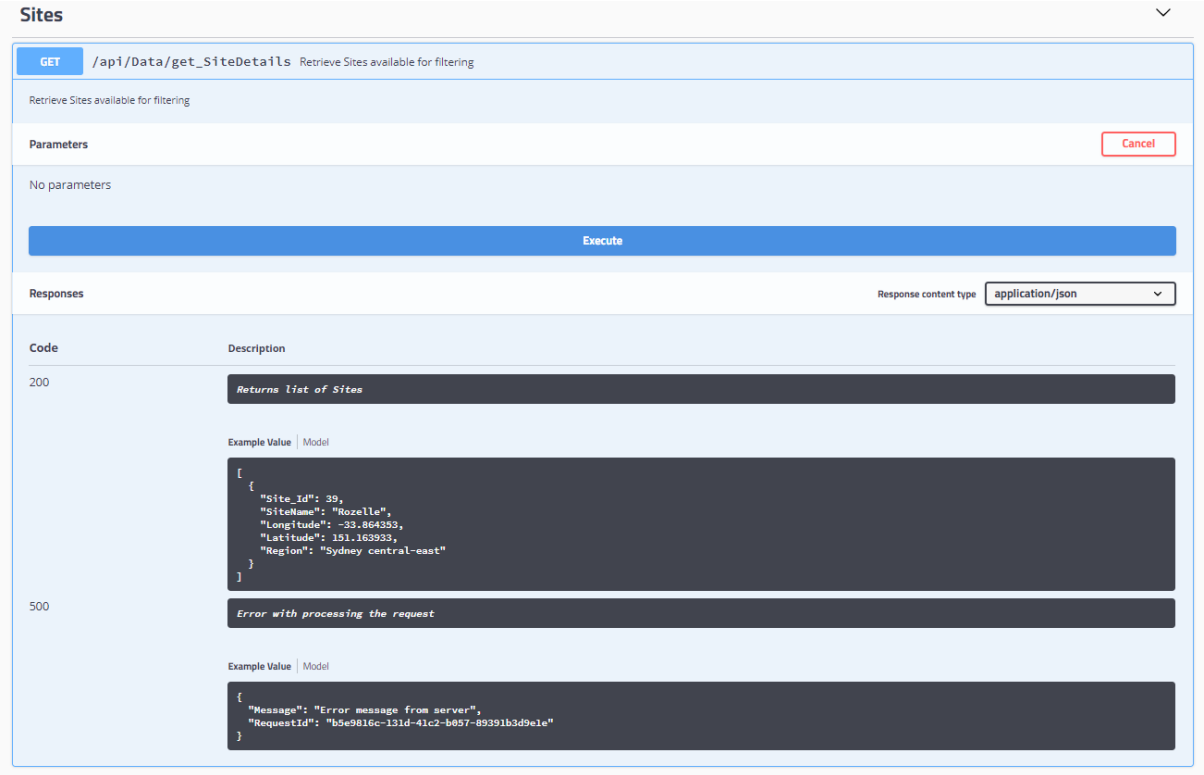
The following instructions outline how to extract air quality monitoring Site data from the DPIE Azure Cloud Data Warehouse using the Air Quality API website. It is not possible to add parameters to filter the Site data.



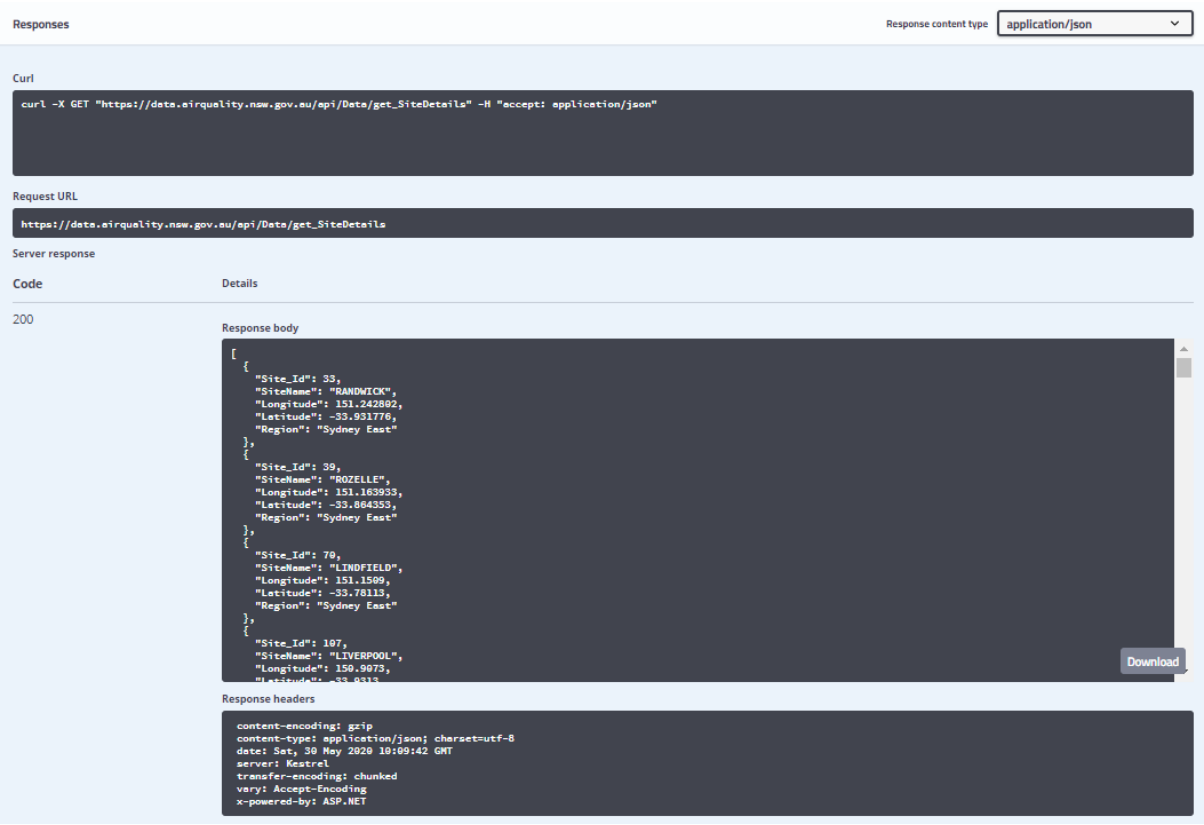
1. Click on the **GET** button.



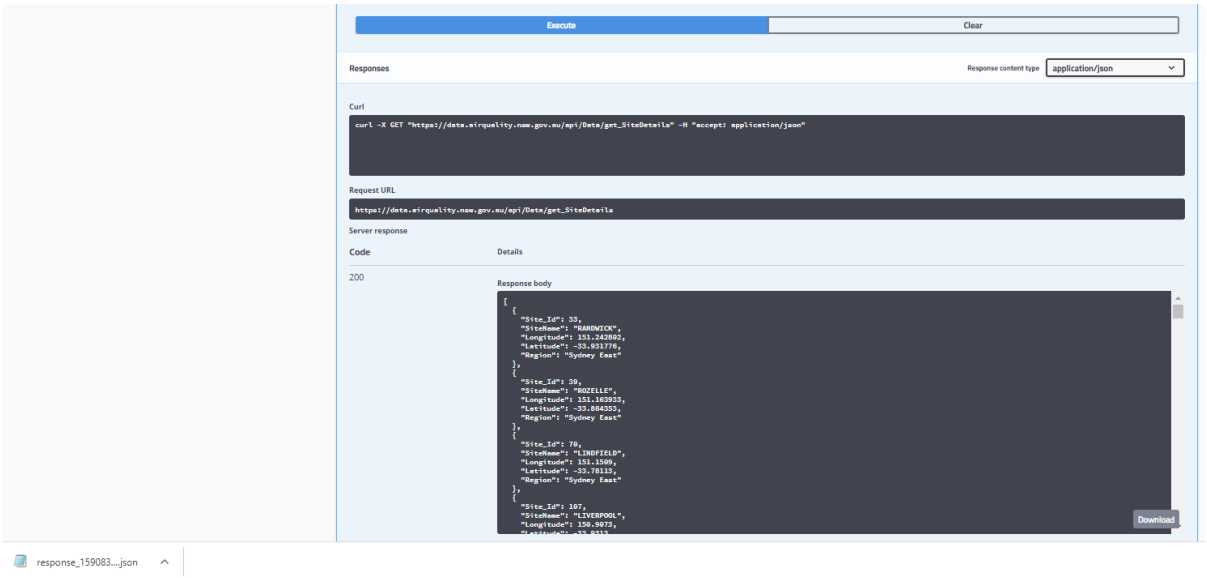
2. Click on *Try it out*
3. Click on *Execute*.



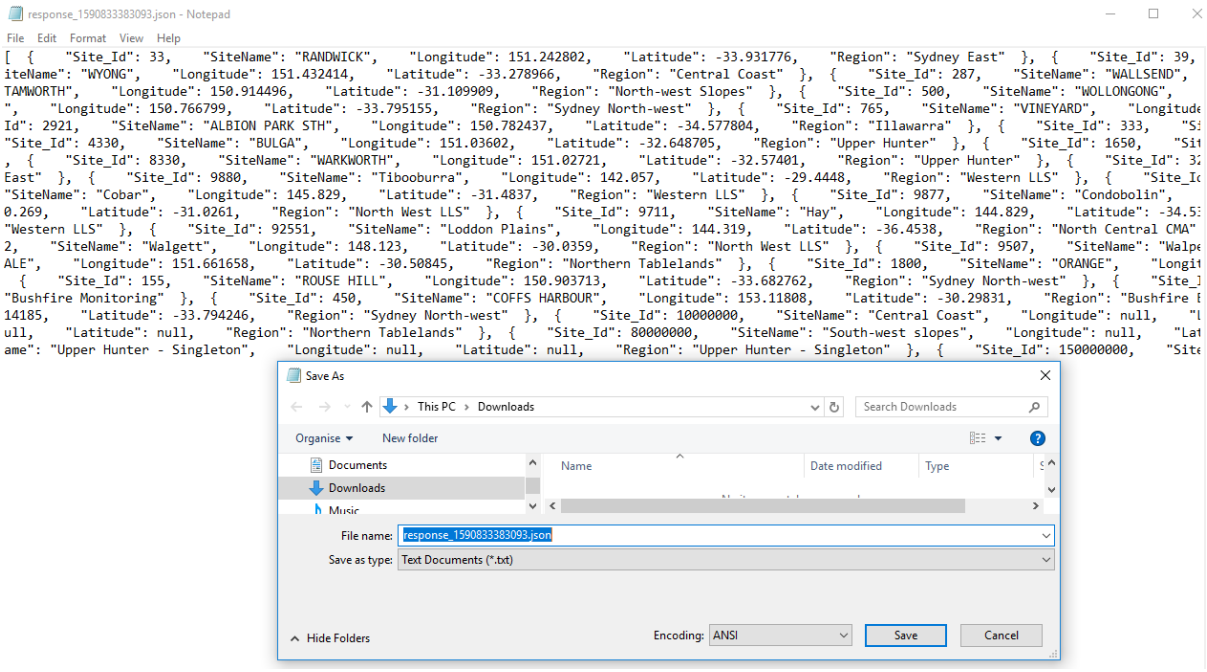
4. Click on *Download*.



5. Click on `response.json`.



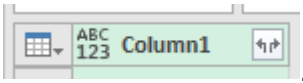
6. Save `response.json`.



To import a *.json* file into Excel

1. Data/Get Data/From File/From JSON
2. Get `response.json` file.
3. Click on *To Table*.
4. Click on *OK*

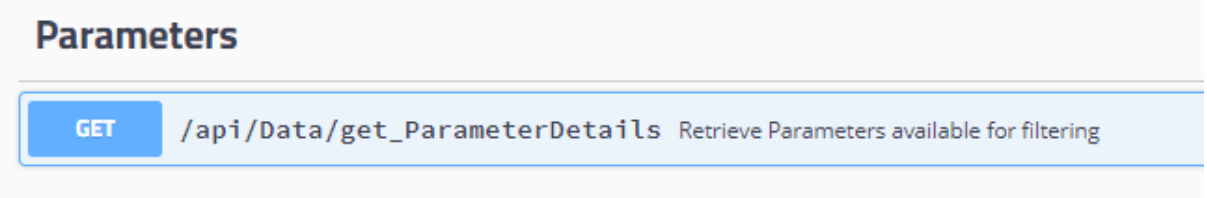
5. Click on the double headed arrow to expand the record set



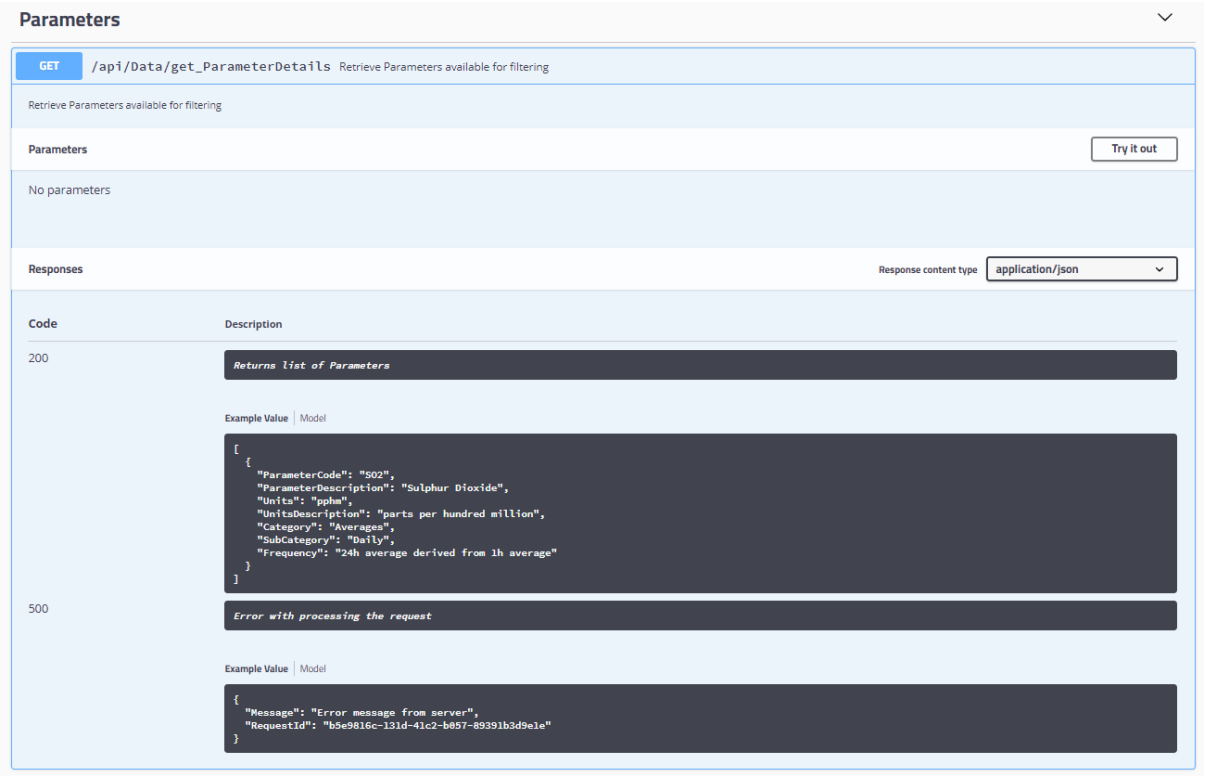
6. Click *OK*
7. Click *Close & Load*. The data is imported into the Excel worksheet.

4.1.2 Extract Parameter data using the Air Quality Data API website

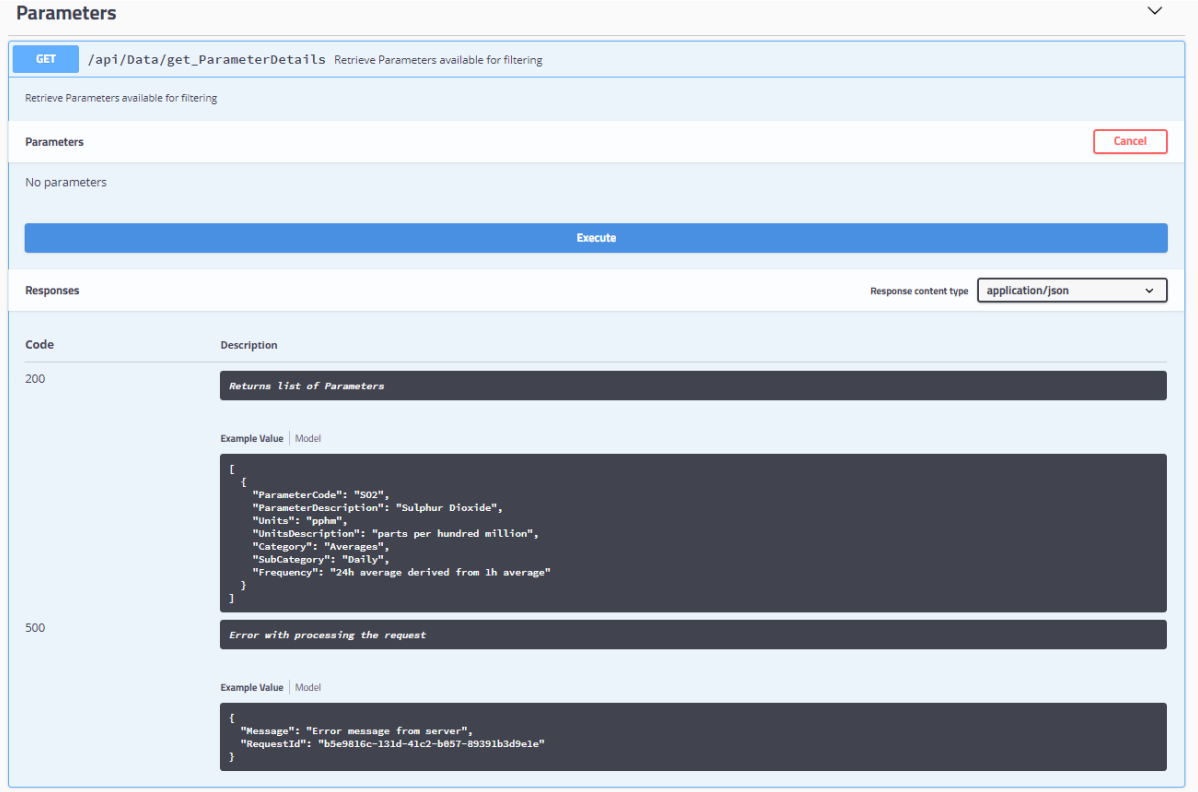
The following instructions outline how to Parameter data from the DPIE Azure Cloud Data Warehouse using the Air Quality API website. It is not possible to add parameters to filter the Parameter data.



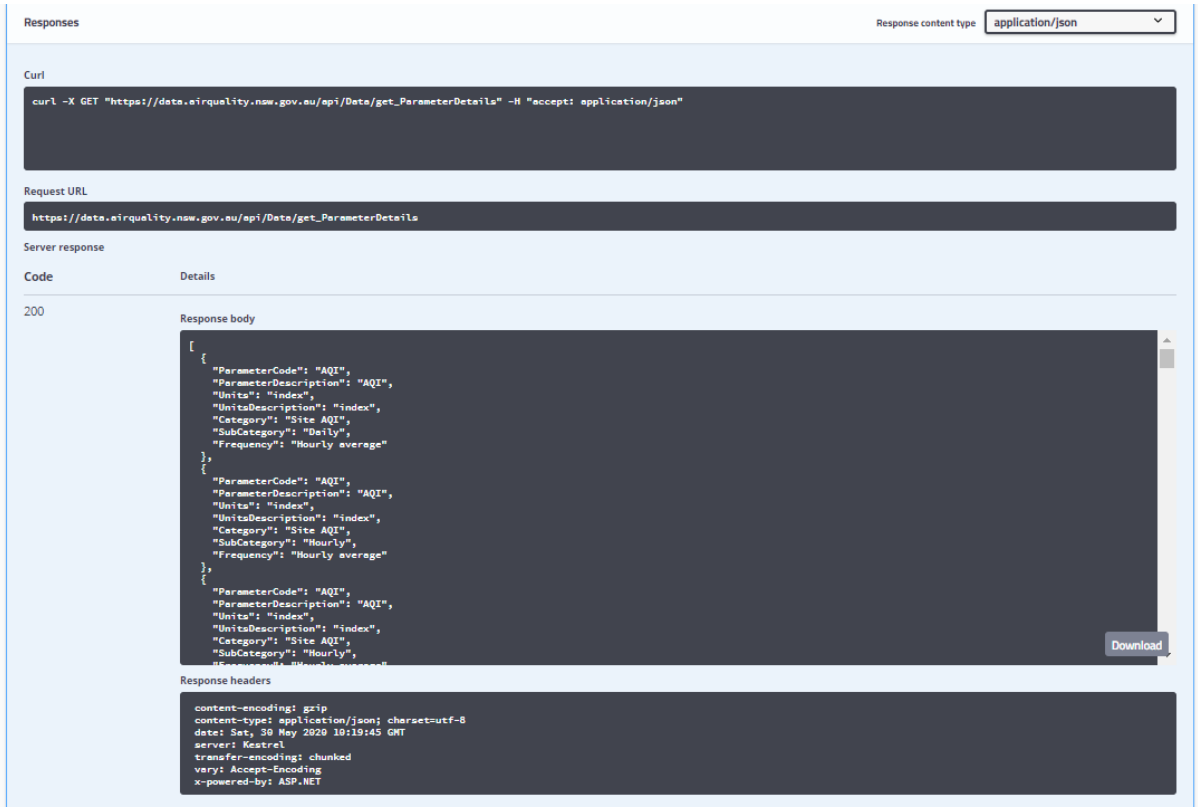
1. Click on the **GET** button.



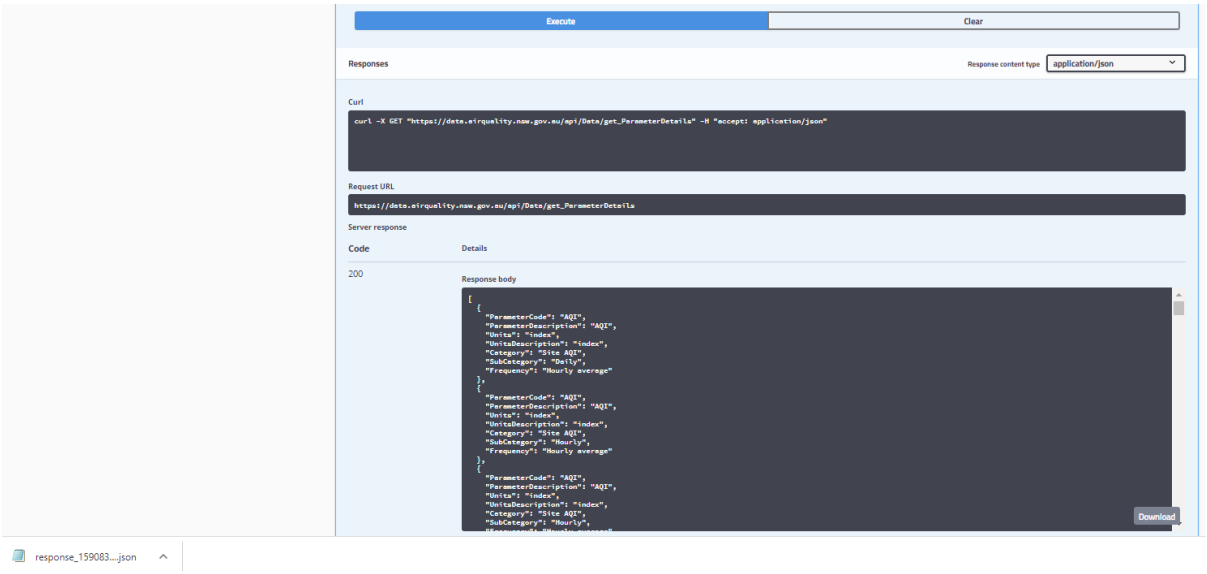
2. Click on *Try it out*.
3. Click on *Execute*.



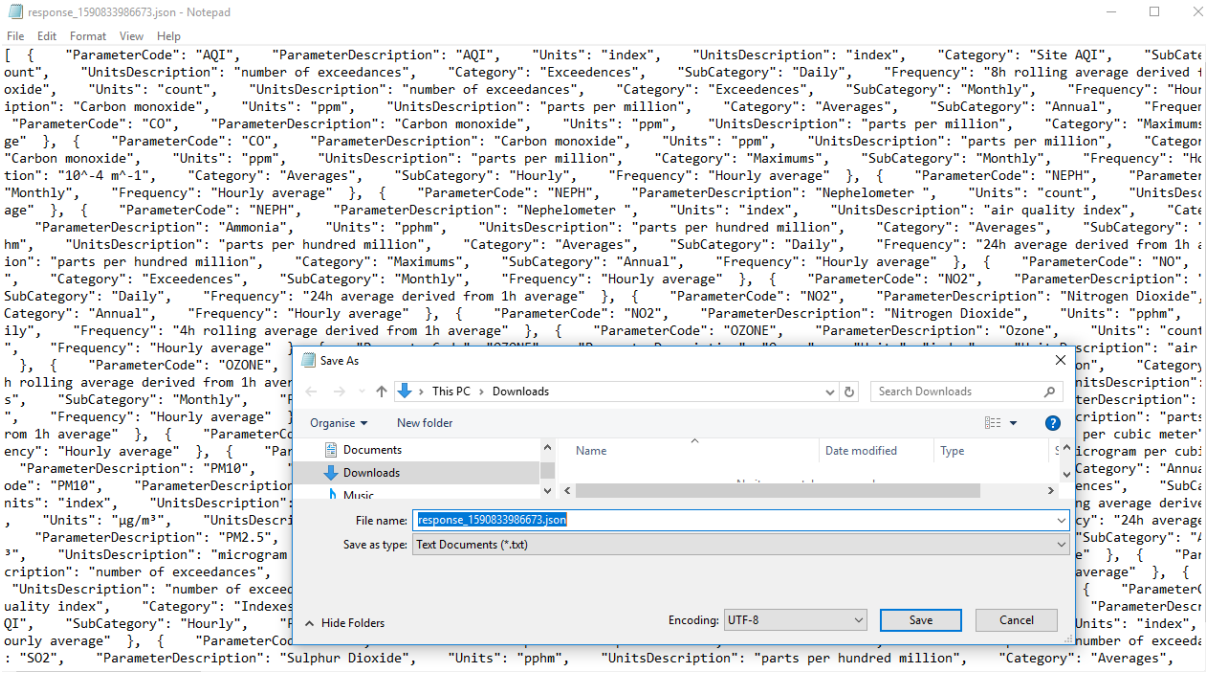
4. Click on *Download*.



5. Click on `response.json`.



6. Save `response.json`.

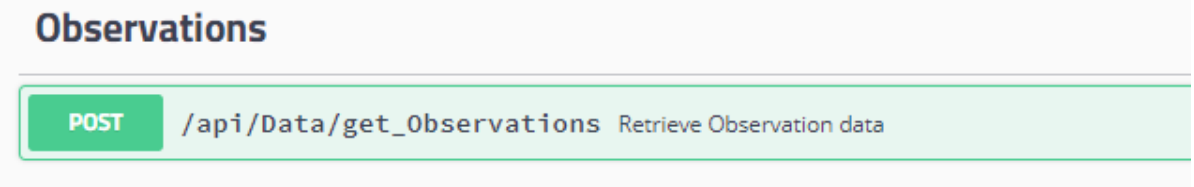


Importing a .json file into Excel

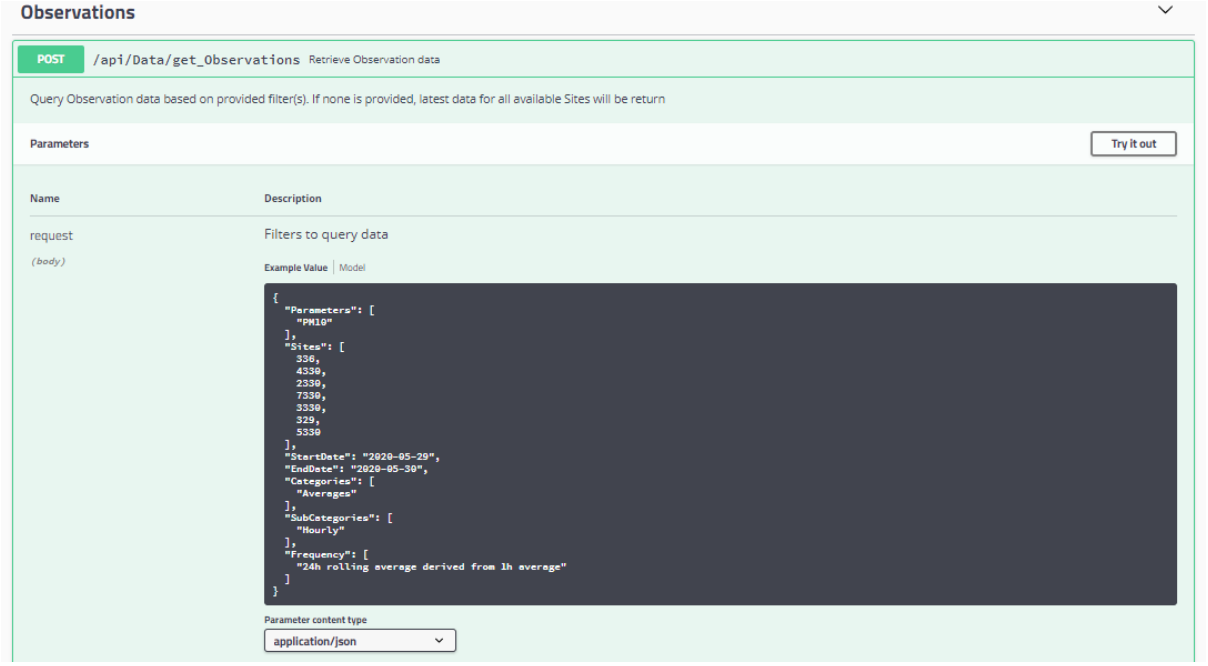
See: *To import a .json file into Excel*.

4.1.3 Extract Current Observed air quality data using the Air Quality Data API website.

The following instructions outline how to extract current observed real time hourly air quality data from the DPIE Azure Cloud Data Warehouse using the Air Quality API website.

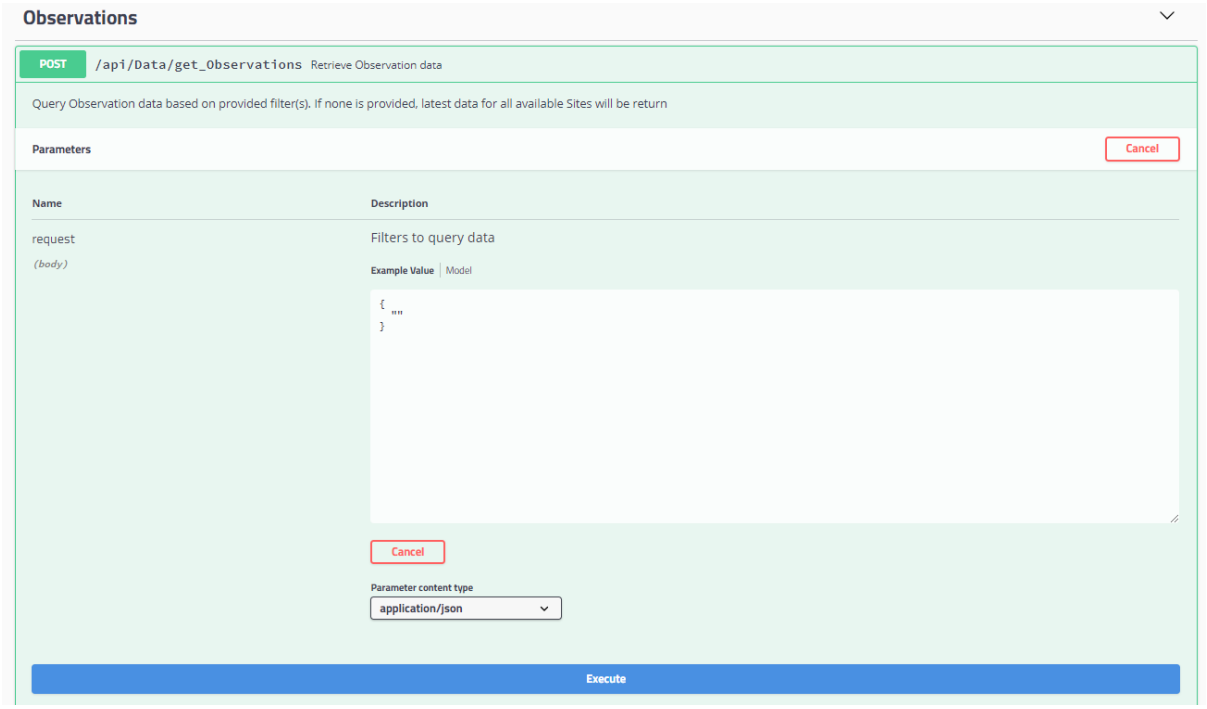


1. Click on the **POST** button.

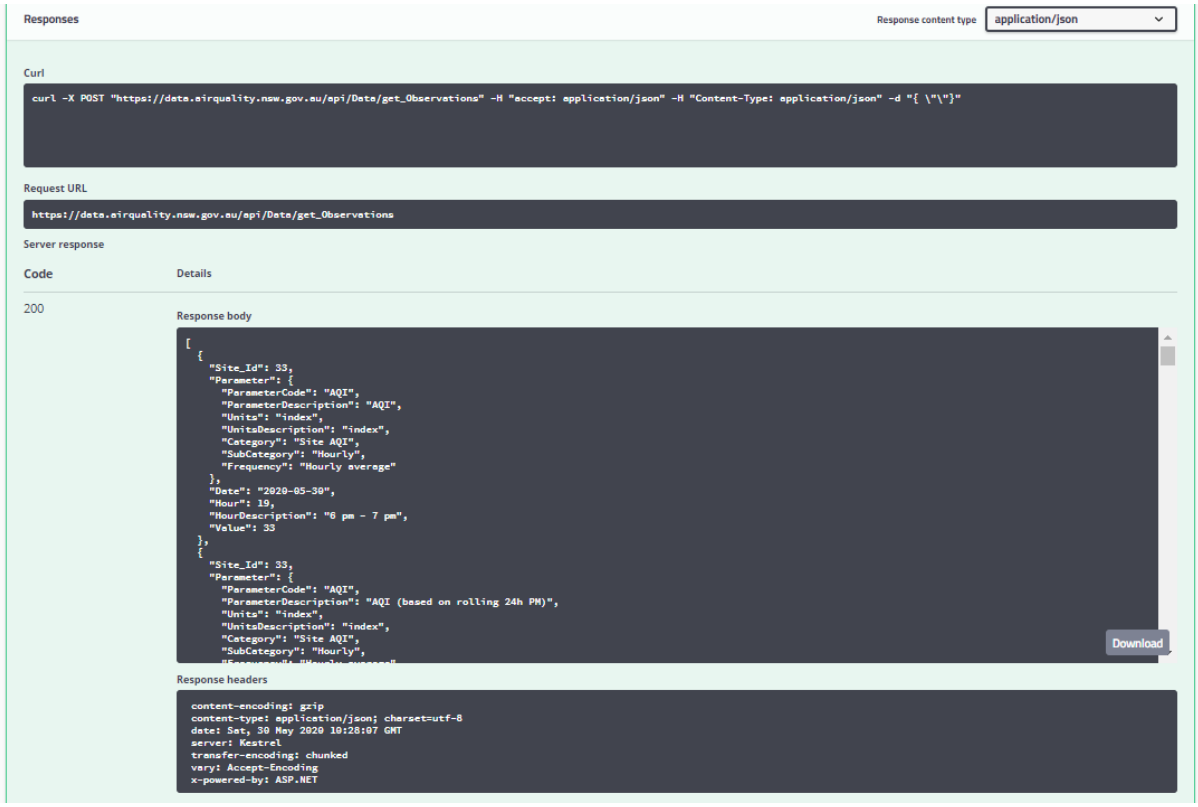


Note the Observations API has parameters (in the black rectangle).
The query is an example.
The query extracts PM10 hourly averages for 24 hour rolling average derived from 1 hour average for Aberdeen (*336*), Bulga (*4330*), Camberwell (*2330*), Jerry's Plains (*7330*), Maison Dieu (*3330*), Merriwa (*329*), Mount Thorley (*5330*) for the previous 2 days.

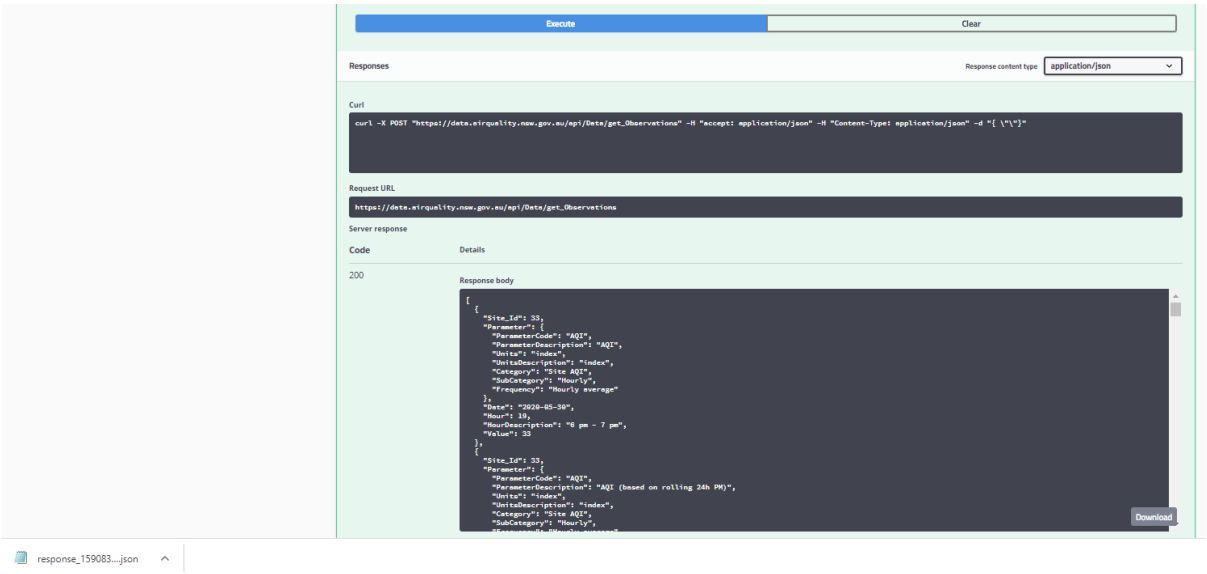
2. Click on *Try it out*
3. Edit the query in the Example value field.
   To get current observed real time hourly data the body command is equal to empty quotations (body = "",).
4. Click on *Execute*



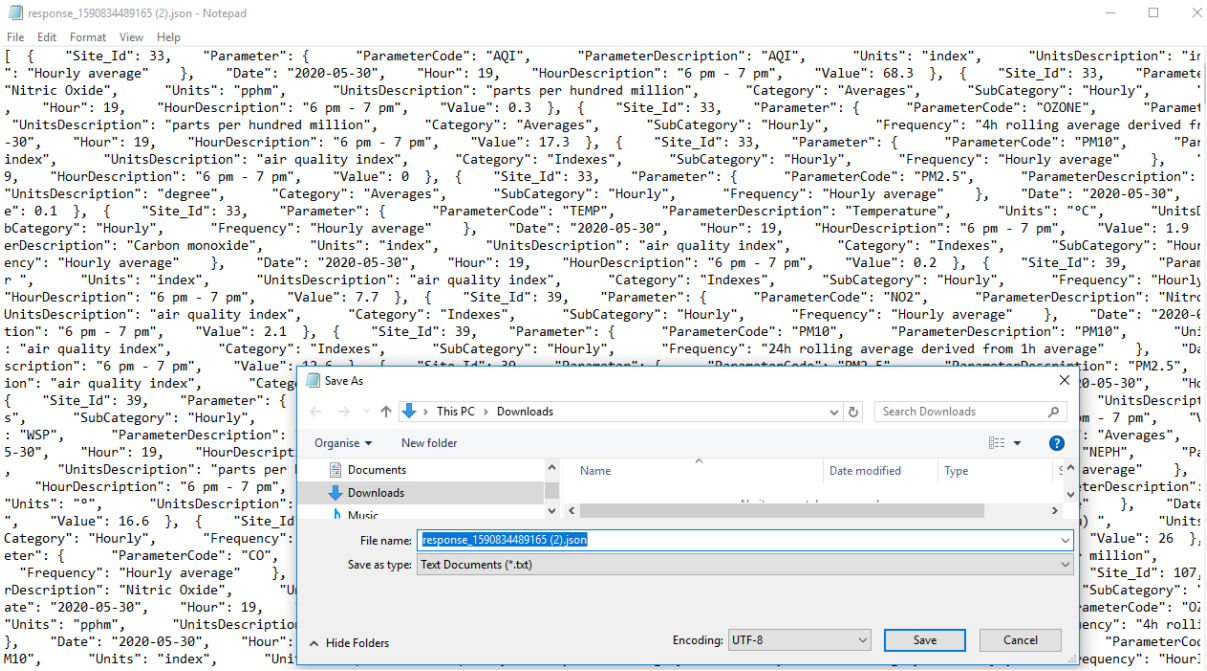
5. Click on *Download*.



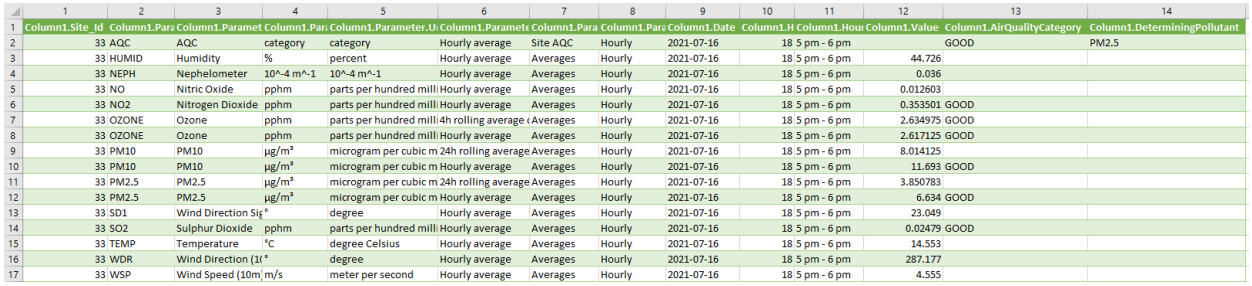
6. Click on `response.json`.



7. Save `response.json`.



8. Import `response.json` into Excel (screenshot below)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Column1.Site_Id	Column1.Para	Column1.Paramet	Column1.Par	Column1.Parameter.U	Column1.Paramete	Column1.Para	Column1.Para	Column1.Date	Column1.H	Column1.Hou	Column1.Value	Column1.AirQualityCategory	Column1.DeterminingPollutant
2	33	AQC	AQC	category	category	Hourly average	Site AQC	Hourly	2021-07-16	18	5 pm - 6 pm		GOOD	PM2.5
3	33	HUMID	Humidity	%	percent	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	44.726		
4	33	NEPH	Nephelometer	10^-4 m^-1	10^-4 m^-1	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.036		
5	33	NO	Nitric Oxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.012603		
6	33	NO2	Nitrogen Dioxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.353501	GOOD	
7	33	OZONE	Ozone	pphm	parts per hundred milli	4h rolling average (	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.634975	GOOD	
8	33	OZONE	Ozone	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.617125	GOOD	
9	33	PM10	PM10	µg/m³	microgram per cubic m	24h rolling average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	8.014125		
10	33	PM10	PM10	µg/m³	microgram per cubic m	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	11.693	GOOD	
11	33	PM2.5	PM2.5	µg/m³	microgram per cubic m	24h rolling average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	3.850783		
12	33	PM2.5	PM2.5	µg/m³	microgram per cubic m	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	6.634	GOOD	
13	33	SD1	Wind Direction Sig	°	degree	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	23.049		
14	33	SO2	Sulphur Dioxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.02479	GOOD	
15	33	TEMP	Temperature	°C	degree Celsius	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	14.553		
16	33	WDR	Wind Direction (1(	°	degree	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	287.177		
17	33	WSP	Wind Speed (10m	m/s	meter per second	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	4.555		

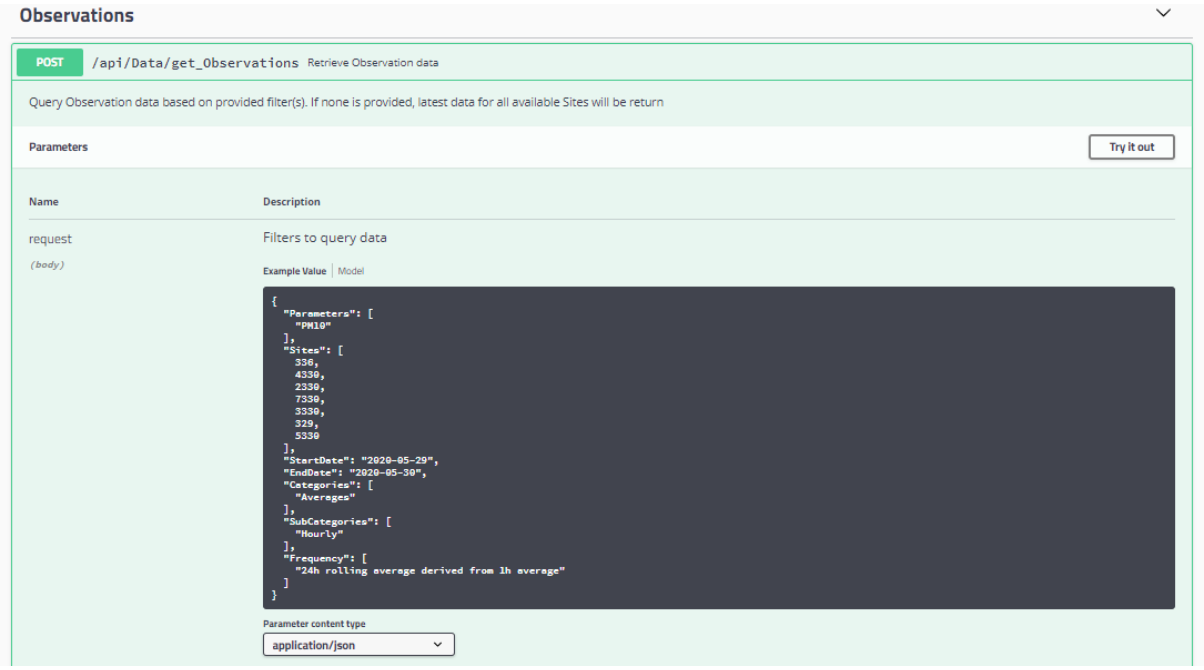
Importing a .json file into Excel

See: *To import a .json file into Excel.*

4.1.4 Extract Historical air quality data using the Air Quality Data API website.

The following instructions outline how to extract historical air quality data from the DPIE Azure Cloud Data Warehouse using the Air Quality API website.

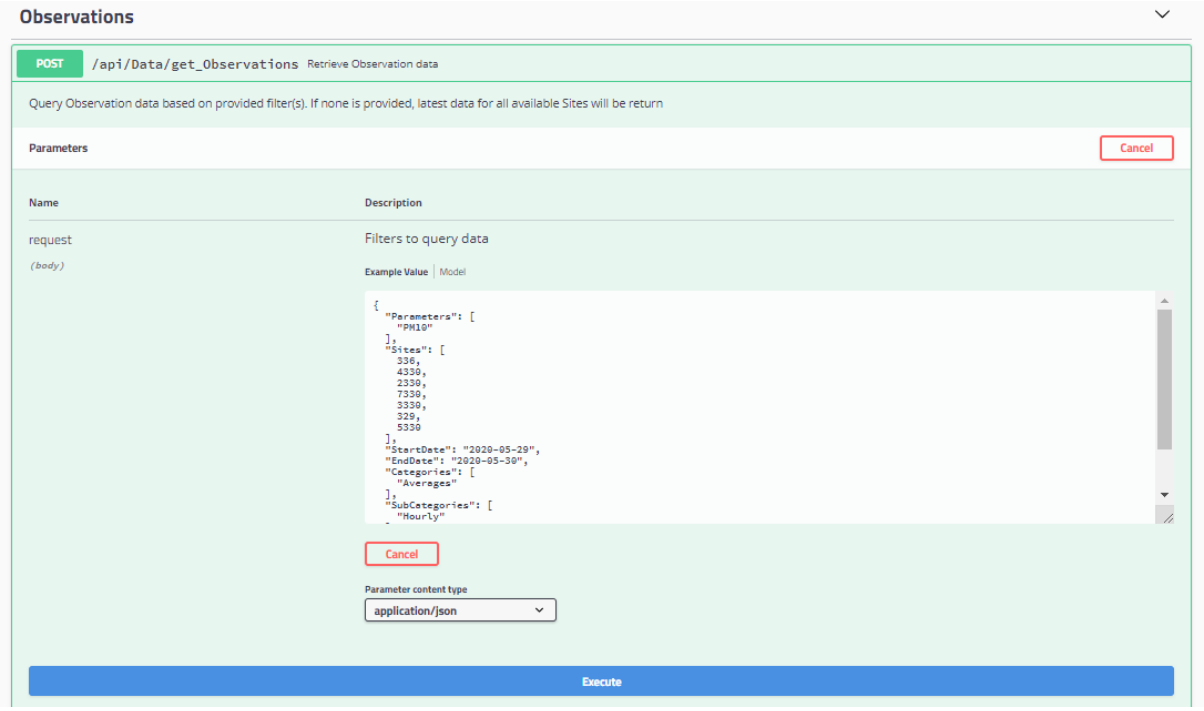
1. Click on the **POST** button.



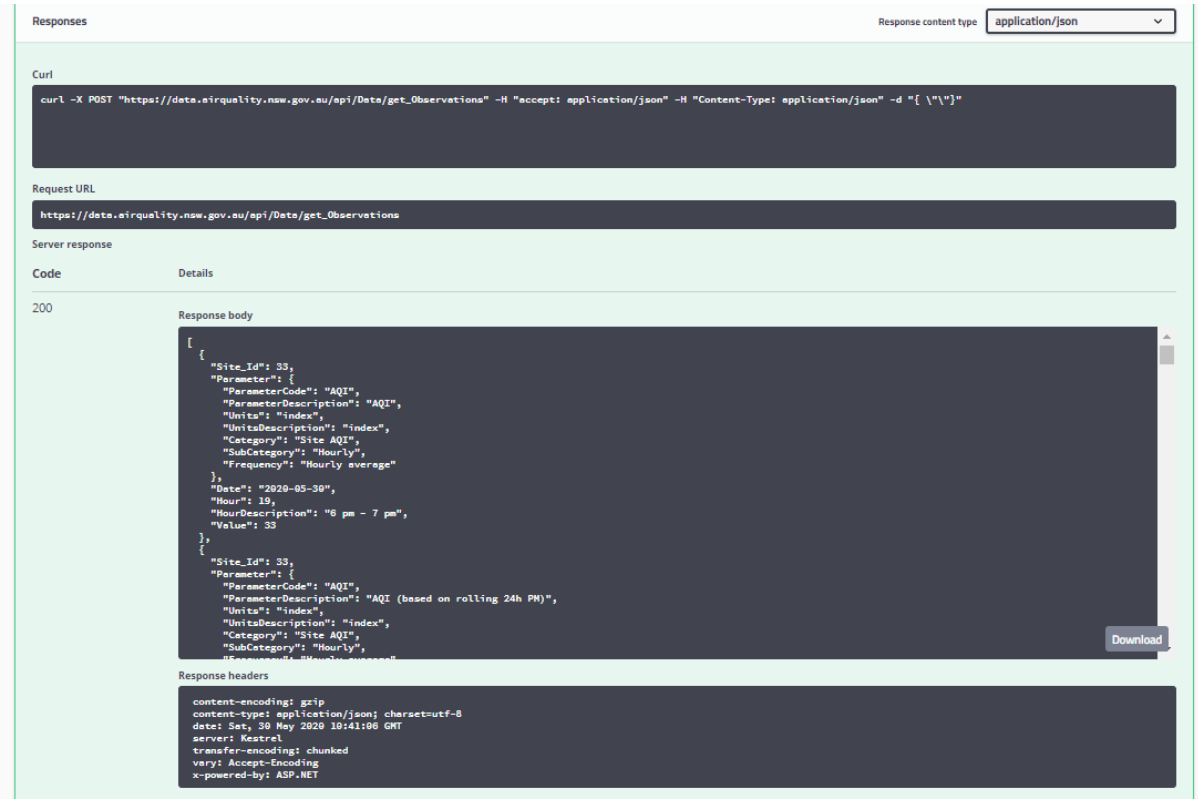
Note: the Observations API has parameters. (in the black rectangle)
The query is an example of extracting historical air quality data.
The query extracts PM10 hourly averages for 24 hour rolling average derived from 1 hour average for Aberdeen (*336*), Bulga (*4330*), Camberwell (*2330*), Jerry's Plains (*7330*), Maison Dieu (3330), Merriwa (*329*), Mount Thorley (*5330*) for the previous 2 days.

Note: the parameter body query command has only single quotes. Excel Power query has double quotes.

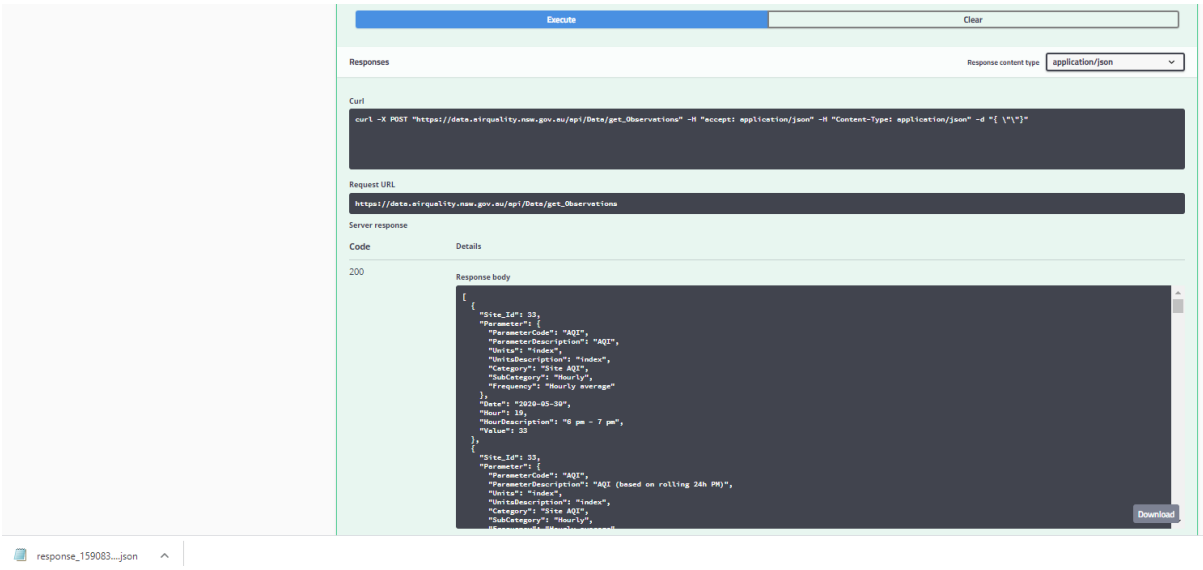
2. Click on *Try it out*
3. Click on *Execute*.



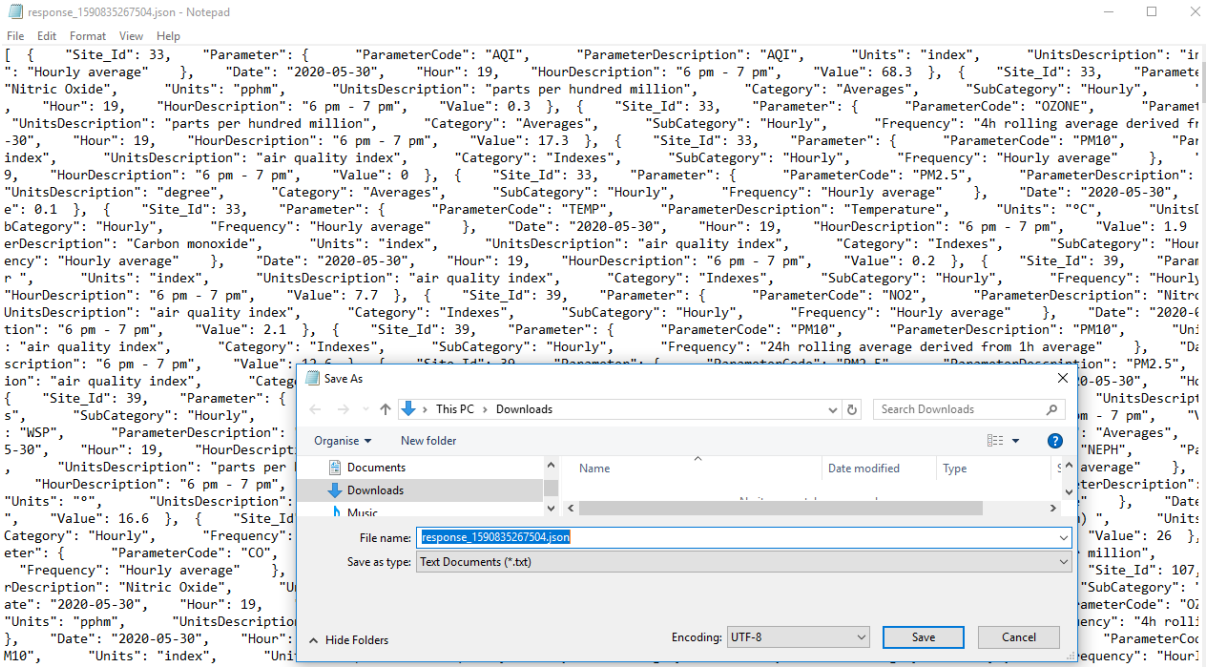
4. Click on *Download*.



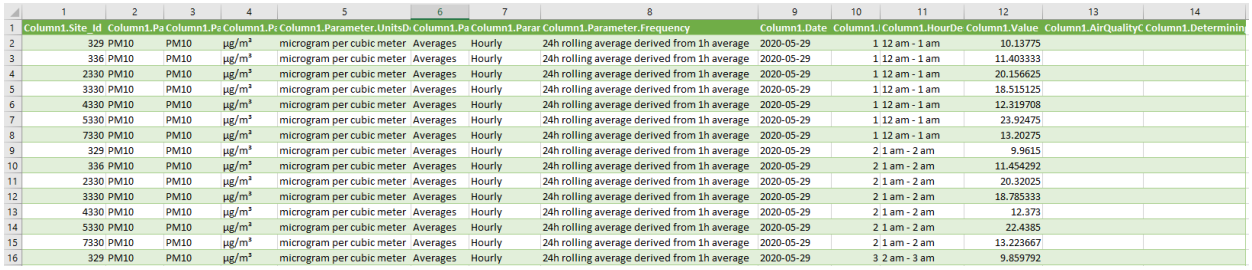
5. Click on `response.json`.



6. Save `response.json`.



7. Import `response.json` into Excel (screenshot below)



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Column1.Site_Id	Column1.Pa	Column1.Pa	Column1.P	Column1.Parameter.UnitsD	Column1.Pa	Column1.Parar	Column1.Parameter.Frequency	Column1.Date	Column1.I	Column1.HourDe	Column1.Value	Column1.AirQualityC	Column1.Determinin
2	329	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	1	12 am - 1 am	10.13775		
3	336	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	1	12 am - 1 am	11.403333		
4	2330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	1	12 am - 1 am	20.156625		
5	3330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	1	12 am - 1 am	18.515125		
6	4330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	1	12 am - 1 am	12.319708		
7	5330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	1	12 am - 1 am	23.92475		
8	7330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	1	12 am - 1 am	13.20275		
9	329	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	2	1 am - 2 am	9.9615		
10	336	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	2	1 am - 2 am	11.454292		
11	2330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	2	1 am - 2 am	20.32025		
12	3330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	2	1 am - 2 am	18.785333		
13	4330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	2	1 am - 2 am	12.373		
14	5330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	2	1 am - 2 am	22.4385		
15	7330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	2	1 am - 2 am	13.223667		
16	329	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2020-05-29	3	2 am - 3 am	9.859792		

Importing a .json file into Excel

See: *To import a .json file into Excel*.

5. Search and retrieve air quality data using Excel and API

The DPIE Air Quality API data service can be used by a variety of third-party software applications as identified in Figure 1, to search and retrieve DPIE air quality data. The following instructions outline how to deploy the API using Excel Power Query to search and retrieve air quality and related data stored in the DPIE Azure Cloud Data Warehouse. The remainder of Section 5 is in the downloadable `air-quality-api-excel-power-query.xlsx` Excel file, if you do not want to go through the set-up.

5.1 Setting up a Power Query in Excel using the API

The API provides three data sets:

- Site details data
- Parameter details data
- Observational data. The observational data can be extracted as current real-time hourly data or as historical data by querying data through the body command in the power query.

The Site details and Parameter details can also be queried through the body command in the Power Query in Excel. However, since this is primarily static data it is easier to search using the filter in Excel. Using the body command to filter Site and Parameter details, will not be considered in this document.

Before extracting air quality data, using Excel and the API

1. Open a blank workbook in Excel.
2. Go to *File, Options and Trust Centre*.
3. Click on the *Trust Centre Settings* button.
4. Set the Trust Centre settings by clicking the radio button next to *Enable all Data Connections (not recommended)* as shown in Figure 4. This enables Excel to connect to the API.

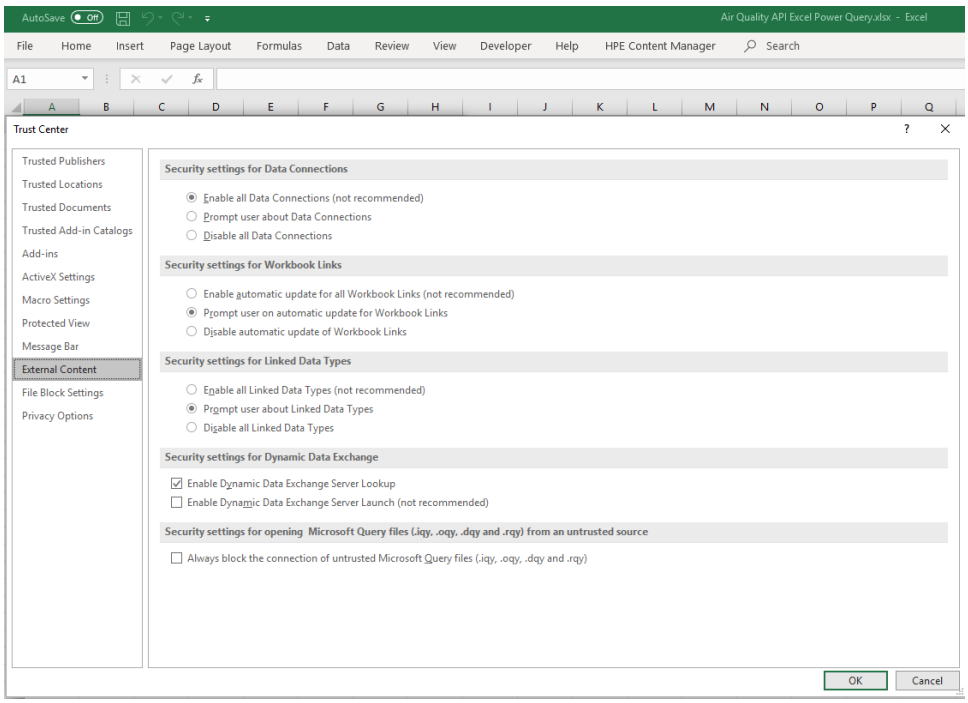


Figure 4 Excel – Enable all Data Connections (not recommended)

5.1.1 Extract Monitoring Site data using Excel and API

The following instructions outline how to extract monitoring site data from the DPIE Azure Cloud Data Warehouse using Excel Power Query and the DPIE Air Quality API.

1. Open a blank Excel workbook.
2. Click on *Data* on the menu bar
3. Select *Get Data*.
4. Select *From Other Sources.*
5. *Select* then *Blank Query.* See Figure 5 below.

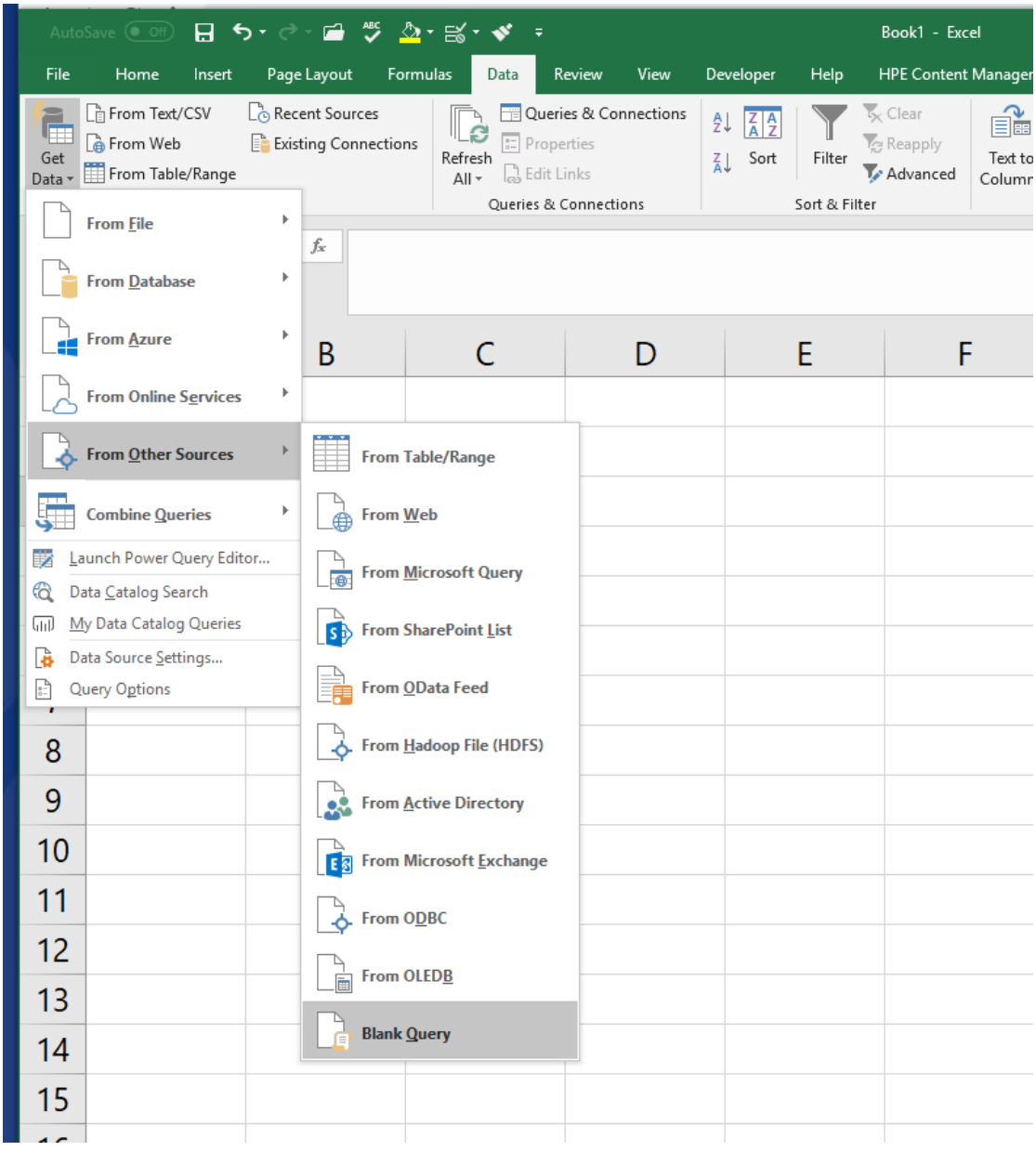
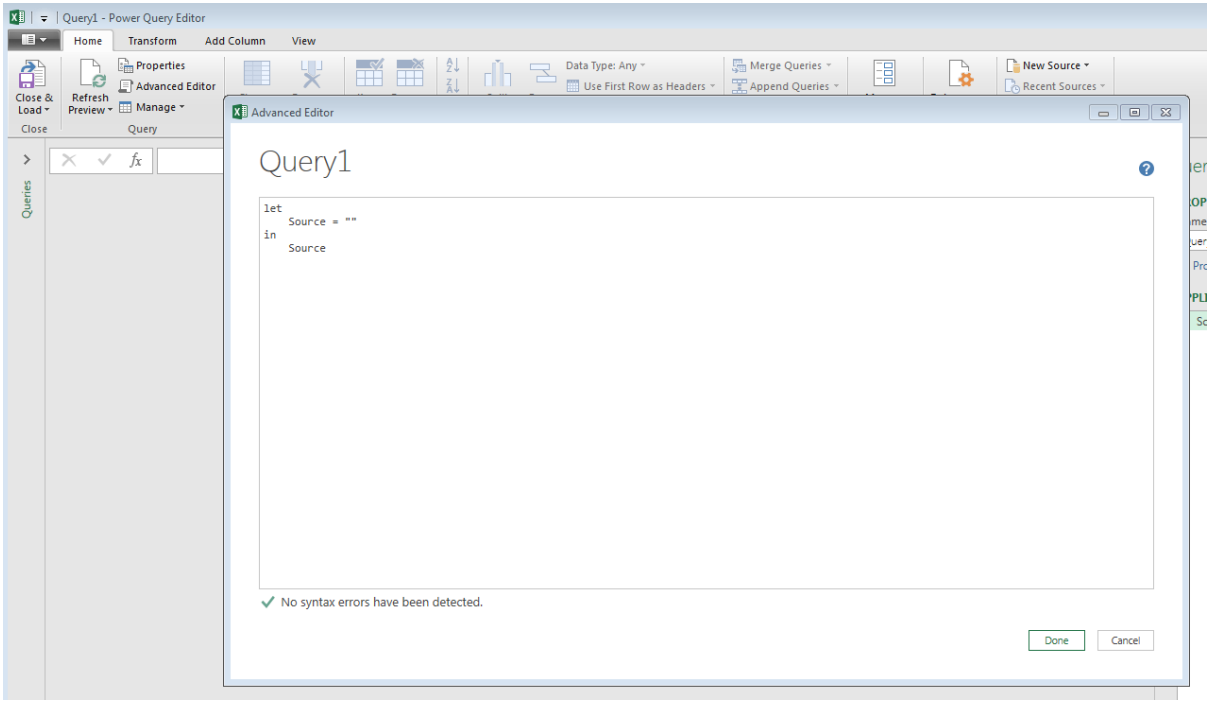


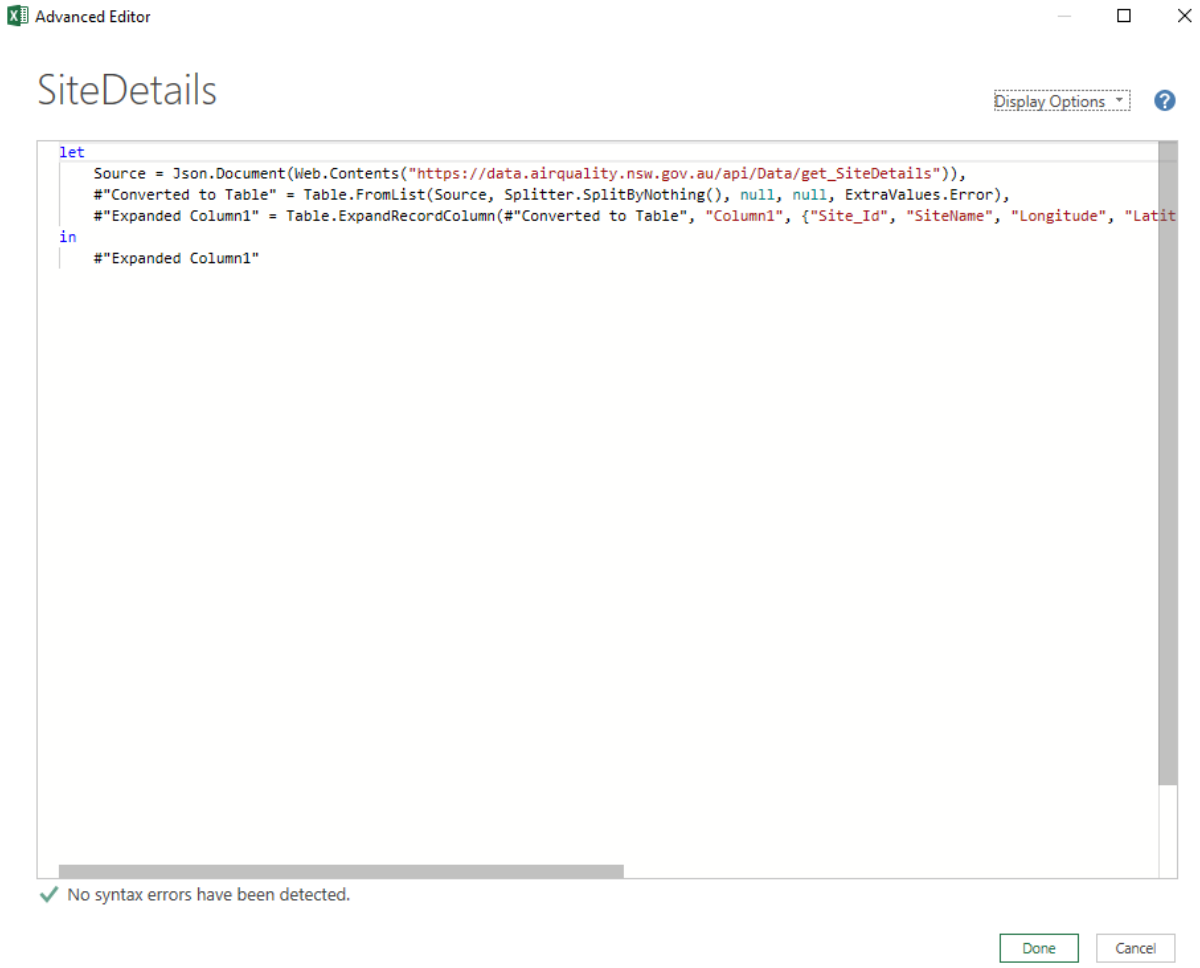
Figure 5 Excel – Blank query

6. The Power Query Editor opens.
7. Click on *Advanced Editor*.

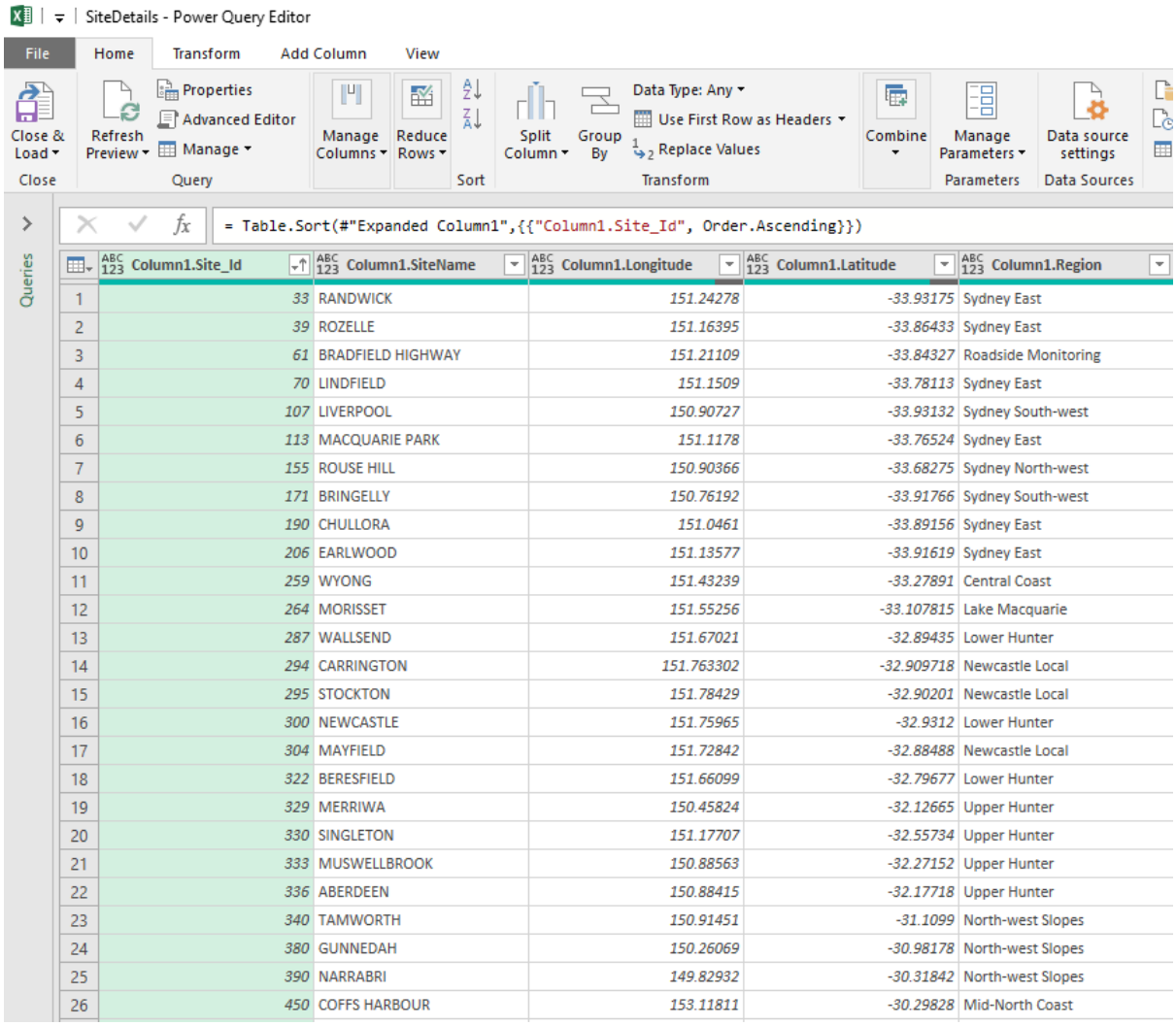


8. Remove paragraph markers from this document by going to *File/Options/Display* and unselecting *Show all formatting marks.* (you need to do this since the Power Query Editor cannot interpret paragraph markers).
9. Copy and paste the code below into Query 1. Copy the code between the horizontal lines below.

```
let
  Source =
  Json.Document(Web.Contents("https://data.airquality.nsw.gov.au/api/D
  ata/get_SiteDetails")),
  #"Converted to Table" = Table.FromList(Source,
  Splitter.SplitByNothing(), null, null, ExtraValues.Error),
  #"Expanded Column1" = Table.ExpandRecordColumn(#"Converted to
  Table", "Column1", {"Site_Id", "SiteName", "Longitude", "Latitude",
  "Region"}, {"Column1.Site_Id", "Column1.SiteName",
  "Column1.Longitude", "Column1.Latitude", "Column1.Region"})
in
  #"Expanded Column1"
```



10. Click on *Done*.
11. The Site details data are extracted into the Excel Power Query Editor.



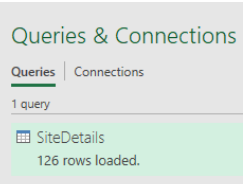
	Column1.Site_Id	Column1.SiteName	Column1.Longitude	Column1.Latitude	Column1.Region
1	33	RANDWICK	151.24278	-33.93175	Sydney East
2	39	ROZELLE	151.16395	-33.86433	Sydney East
3	61	BRADFIELD HIGHWAY	151.21109	-33.84327	Roadside Monitoring
4	70	LINDFIELD	151.1509	-33.78113	Sydney East
5	107	LIVERPOOL	150.90727	-33.93132	Sydney South-west
6	113	MACQUARIE PARK	151.1178	-33.76524	Sydney East
7	155	ROUSE HILL	150.90366	-33.68275	Sydney North-west
8	171	BRINGELLY	150.76192	-33.91766	Sydney South-west
9	190	CHULLORA	151.0461	-33.89156	Sydney East
10	206	EARLWOOD	151.13577	-33.91619	Sydney East
11	259	WYONG	151.43239	-33.27891	Central Coast
12	264	MORISSET	151.55256	-33.107815	Lake Macquarie
13	287	WALLSEND	151.67021	-32.89435	Lower Hunter
14	294	CARRINGTON	151.763302	-32.909718	Newcastle Local
15	295	STOCKTON	151.78429	-32.90201	Newcastle Local
16	300	NEWCASTLE	151.75965	-32.9312	Lower Hunter
17	304	MAYFIELD	151.72842	-32.88488	Newcastle Local
18	322	BERESFIELD	151.66099	-32.79677	Lower Hunter
19	329	MERRIWA	150.45824	-32.12665	Upper Hunter
20	330	SINGLETON	151.17707	-32.55734	Upper Hunter
21	333	MUSWELLBROOK	150.88563	-32.27152	Upper Hunter
22	336	ABERDEEN	150.88415	-32.17718	Upper Hunter
23	340	TAMWORTH	150.91451	-31.1099	North-west Slopes
24	380	GUNNEDAH	150.26069	-30.98178	North-west Slopes
25	390	NARRABRI	149.82932	-30.31842	North-west Slopes
26	450	COFFS HARBOUR	153.11811	-30.29828	Mid-North Coast

12. Click on *Close & Load.* The Site Details data are extracted into an Excel worksheet.

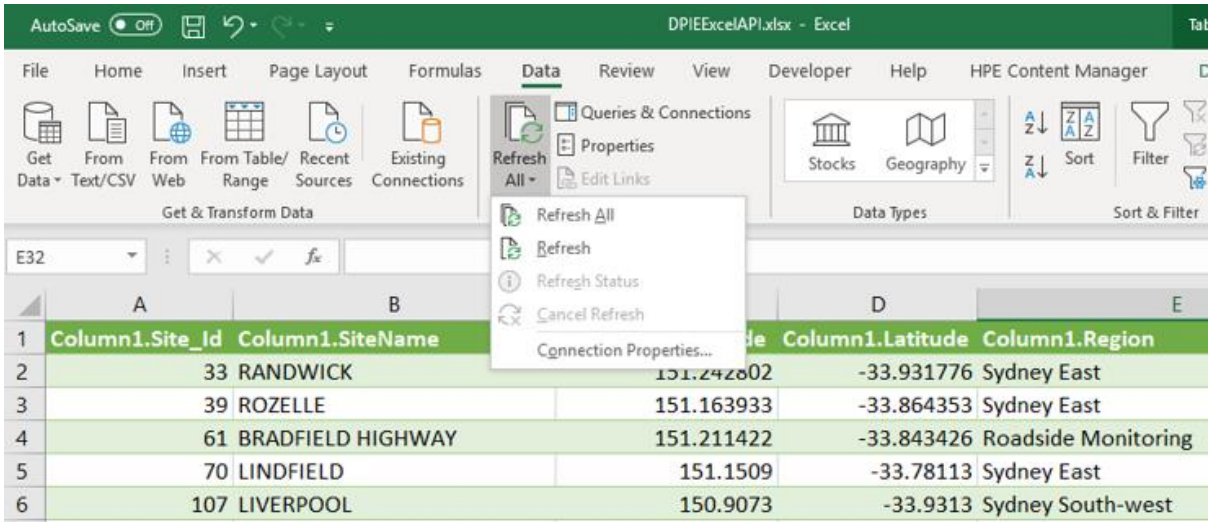
	A	B	C	D	E
1	Column1.Site_Id	Column1.SiteName	Column1.Longit	Column1.Lat	Column1.Region
2	33	RANDWICK	151.24278	-33.93175	Sydney East
3	39	ROZELLE	151.16395	-33.86433	Sydney East
4	61	BRADFIELD HIGHWAY	151.21109	-33.84327	Roadside Monitoring
5	70	LINDFIELD	151.1509	-33.78113	Sydney East
6	107	LIVERPOOL	150.90727	-33.93132	Sydney South-west
7	113	MACQUARIE PARK	151.1178	-33.76524	Sydney East
8	155	ROUSE HILL	150.90366	-33.68275	Sydney North-west
9	171	BRINGELLY	150.76192	-33.91766	Sydney South-west
10	190	CHULLORA	151.0461	-33.89156	Sydney East
11	206	EARLWOOD	151.13577	-33.91619	Sydney East
12	259	WYONG	151.43239	-33.27891	Central Coast
13	264	MORISSET	151.55257	-33.10801	Lake Macquarie
14	287	WALLSEND	151.67021	-32.89435	Lower Hunter
15	294	CARRINGTON	151.76335	-32.90964	Newcastle Local
16	295	STOCKTON	151.78429	-32.90201	Newcastle Local
17	300	NEWCASTLE	151.75965	-32.9312	Lower Hunter
18	304	MAYFIELD	151.72842	-32.88488	Newcastle Local
19	322	BERESFIELD	151.66099	-32.79677	Lower Hunter
20	329	MERRIWA	150.45824	-32.12665	Upper Hunter
21	330	SINGLETON	151.17707	-32.55734	Upper Hunter
22	333	MUSWELLBROOK	150.88563	-32.27152	Upper Hunter
23	336	ABERDEEN	150.88415	-32.17718	Upper Hunter
24	340	TAMWORTH	150.91451	-31.1099	North-west Slopes
25	380	GUNNEDAH	150.26069	-30.98178	North-west Slopes
26	390	NARRABRI	149.82932	-30.31842	North-west Slopes
27	450	COFFS HARBOUR	153.11811	-30.29828	Mid-North Coast
28	500	WOLLONGONG	150.88733	-34.41706	Illawarra

13. Change the name of Query1 and Sheet1 to *SiteDetails.* This is the name in the `air-quality-api-excel-power-query.xlsx` Excel workbook.

	1	2	3	4	5
1	Column1.Site_Id	Column1.SiteName	Column1.Longitude	Column1.Latitude	Column1.Region
2	33	RANDWICK	151.24278	-33.93175	Sydney East
3	39	ROZELLE	151.16395	-33.86433	Sydney East
4	61	BRADFIELD HIGHWAY	151.21109	-33.84327	Roadside Monitoring
5	70	LINDFIELD	151.1509	-33.78113	Sydney East
6	107	LIVERPOOL	150.90727	-33.93132	Sydney South-west
7	113	MACQUARIE PARK	151.1178	-33.76524	Sydney East
8	155	ROUSE HILL	150.90366	-33.68275	Sydney North-west
9	171	BRINGELLY	150.76192	-33.91766	Sydney South-west
10	190	CHULLORA	151.0461	-33.89156	Sydney East
11	206	EARLWOOD	151.13577	-33.91619	Sydney East
12	259	WYONG	151.43239	-33.27891	Central Coast
13	264	MORISSET	151.55257	-33.10801	Lake Macquarie
14	287	WALLSEND	151.67021	-32.89435	Lower Hunter
15	294	CARRINGTON	151.76335	-32.90964	Newcastle Local
16	295	STOCKTON	151.78429	-32.90201	Newcastle Local
17	300	NEWCASTLE	151.75965	-32.9312	Lower Hunter
18	304	MAYFIELD	151.72842	-32.88488	Newcastle Local
19	322	BERESFIELD	151.66099	-32.79677	Lower Hunter
20	329	MERRIWA	150.45824	-32.12665	Upper Hunter
21	330	SINGLETON	151.17707	-32.55734	Upper Hunter
22	333	MUSWELLBROOK	150.88563	-32.27152	Upper Hunter
23	336	ABERDEEN	150.88415	-32.17718	Upper Hunter
24	340	TAMWORTH	150.91451	-31.1099	North-west Slopes
25	380	GUNNEDAH	150.26069	-30.98178	North-west Slopes
26	390	NARRABRI	149.82932	-30.31842	North-west Slopes
27	450	COFFS HARBOUR	153.11811	-30.29828	Mid-North Coast
28	500	WOLLONGONG	150.88733	-34.41706	Illawarra
29	526	KEMBLA GRANGE	150.81913	-34.47408	Illawarra
30	573	RICHMOND	150.74731	-33.61641	Sydney North-west



14. To refresh the data, go to *Data/RefreshAll/Refresh.*



5.1.2 Extract Parameter data using Excel and API

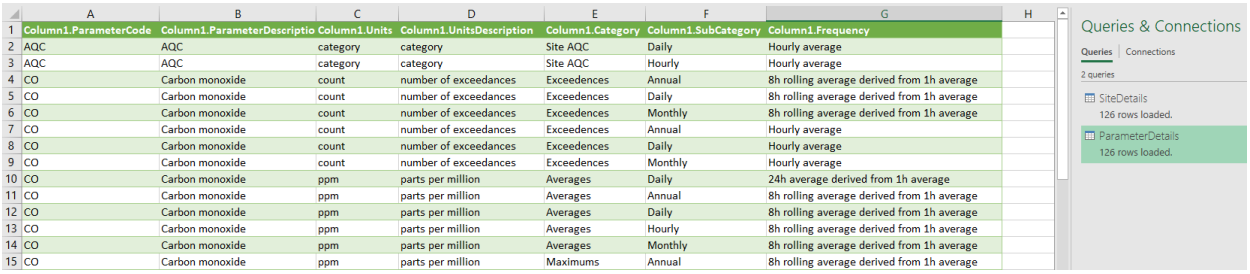
The following instructions outline how to extract Parameter data from the DPIE Azure Cloud Data Warehouse using Excel Power Query and the DPIE API.

1. Create a new blank query by following the procedure as described in section 5.1.1, up to after clicking on the Advanced editor.
2. Replace the code in Query 1 with the code below: (remove paragraph markers)
3. Copy the code between the horizontal lines below.

```
let
  Source =
  Json.Document(Web.Contents("https://data.airquality.nsw.gov.au/api/D
  ata/get_ParameterDetails")),
  #"Converted to Table" = Table.FromList(Source,
  Splitter.SplitByNothing(), null, null, ExtraValues.Error),
  #"Expanded Column1" = Table.ExpandRecordColumn(#"Converted to
  Table", "Column1", {"ParameterCode", "ParameterDescription",
  "Units", "UnitsDescription", "Category", "SubCategory",
  "Frequency"}, {"Column1.ParameterCode",
  "Column1.ParameterDescription", "Column1.Units",
  "Column1.UnitsDescription", "Column1.Category",
  "Column1.SubCategory", "Column1.Frequency"})
in
  #"Expanded Column1"
```

---

4. Click on *Done.*
5. The Parameter details data are extracted into the Excel Power Query Editor.
6. Click on *Close & Load.* The Parameter Details data are extracted into an Excel worksheet.
7. Change the name of Query1 and Sheet1 to *ParameterDetails.* This is the name in the `air-quality-api-excel-power-query.xlsx` Excel workbook.



	A	B	C	D	E	F	G	H
1	Column1.ParameterCode	Column1.ParameterDescriptio	Column1.Units	Column1.UnitsDescription	Column1.Category	Column1.SubCategory	Column1.Frequency	
2	AQC	AQC	category	category	Site AQC	Daily	Hourly average	
3	AQC	AQC	category	category	Site AQC	Hourly	Hourly average	
4	CO	Carbon monoxide	count	number of exceedances	Exceedences	Annual	8h rolling average derived from 1h average	
5	CO	Carbon monoxide	count	number of exceedances	Exceedences	Daily	8h rolling average derived from 1h average	
6	CO	Carbon monoxide	count	number of exceedances	Exceedences	Monthly	8h rolling average derived from 1h average	
7	CO	Carbon monoxide	count	number of exceedances	Exceedences	Annual	Hourly average	
8	CO	Carbon monoxide	count	number of exceedances	Exceedences	Daily	Hourly average	
9	CO	Carbon monoxide	count	number of exceedances	Exceedences	Monthly	Hourly average	
10	CO	Carbon monoxide	ppm	parts per million	Averages	Daily	24h average derived from 1h average	
11	CO	Carbon monoxide	ppm	parts per million	Averages	Annual	8h rolling average derived from 1h average	
12	CO	Carbon monoxide	ppm	parts per million	Averages	Daily	8h rolling average derived from 1h average	
13	CO	Carbon monoxide	ppm	parts per million	Averages	Hourly	8h rolling average derived from 1h average	
14	CO	Carbon monoxide	ppm	parts per million	Averages	Monthly	8h rolling average derived from 1h average	
15	CO	Carbon monoxide	ppm	parts per million	Maximums	Annual	8h rolling average derived from 1h average	

8. To refresh the data, go to *Data/RefreshAll/Refresh.*

5.1.3 Extract Current Observed air quality data using Excel and API

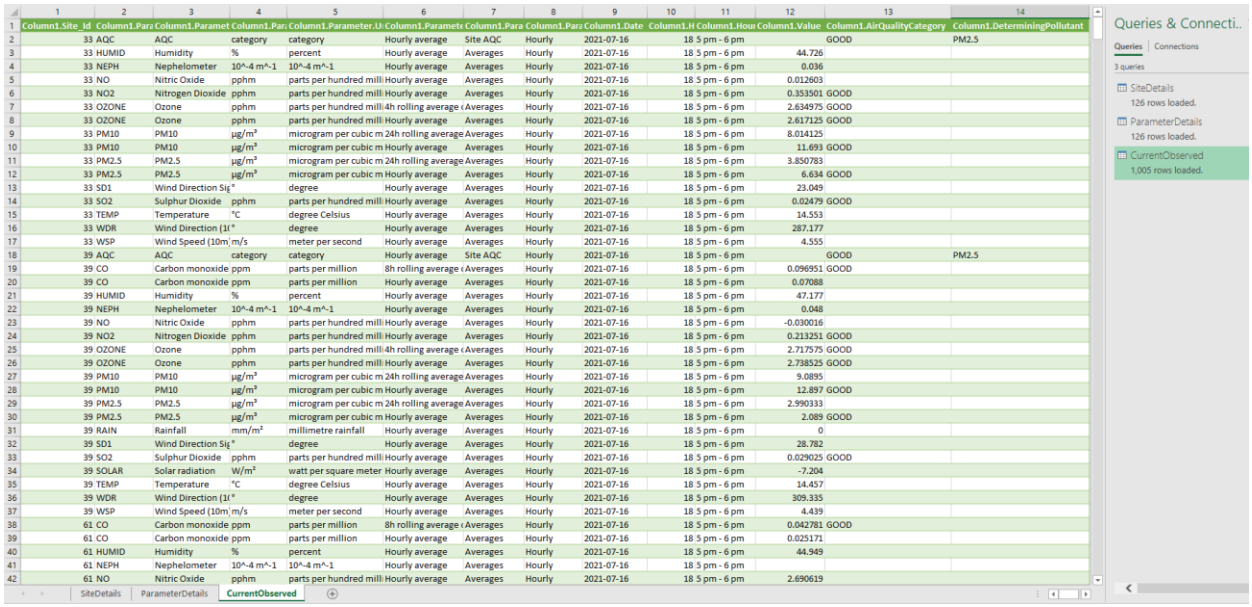
The following instructions outline how to extract current observed real time hourly air quality data from the DPIE Azure Cloud Data Warehouse using Excel Power Query and the DPIE API.

1. Create a new blank query by following the procedure as described in 5.1.1 (above), up to after clicking on the Advanced editor.
2. Replace the code in Query 1 with the code below: (remove paragraph markers)
   Copy the code between the horizontal lines below.

```
let
    url = "https://data.airquality.nsw.gov.au/api/Data/get_Observations",
    body  = "",
    Parsed_JSON = Json.Document(body),
    BuildQueryString = Uri.BuildQueryString(Parsed_JSON),
    Source = Json.Document(Web.Contents(url,[Headers = [#"Content-
Type"="application/json"], Content = Text.ToBinary(body) ] )),
    #"Converted to Table" = Table.FromList(Source, Splitter.SplitByNothing(), null, null,
ExtraValues.Error),
    #"Expanded Column1" = Table.ExpandRecordColumn(#"Converted to Table", "Column1",
{"Site_Id", "Parameter", "Date", "Hour", "HourDescription", "Value", "AirQualityCategory",
"DeterminingPollutant"}, {"Column1.Site_Id", "Column1.Parameter", "Column1.Date",
"Column1.Hour", "Column1.HourDescription", "Column1.Value",
"Column1.AirQualityCategory", "Column1.DeterminingPollutant"}),
    #"Expanded Column1.Parameter" = Table.ExpandRecordColumn(#"Expanded Column1",
"Column1.Parameter", {"ParameterCode", "ParameterDescription", "Units",
"UnitsDescription", "Frequency", "Category", "SubCategory"},
{"Column1.Parameter.ParameterCode", "Column1.Parameter.ParameterDescription",
"Column1.Parameter.Units", "Column1.Parameter.UnitsDescription",
"Column1.Parameter.Frequency", "Column1.Parameter.Category",
"Column1.Parameter.SubCategory"})
in
    #"Expanded Column1.Parameter"
```

---

3. Click on *Done.* The Current Observed air quality details data, for the current hour, are extracted into the Excel Power Query Editor.
4. Click on *Close & Load.* The Current Observed details data are extracted into an Excel worksheet.
5. Change the name of Query 1 and Sheet1 to *CurrentObserved.* This is the name in the `air-quality-api-excel-power-query.xlsx` Excel workbook.



Column1.Site_Id	Column1.Para	Column1.Paramet	Column1.Par	Column1.Parameter.U	Column1.Paramete	Column1.Para	Column1.Para	Column1.Date	Column1.H	Column1.Hour	Column1.Value	Column1.AirQualityCategory	Column1.DeterminingPollutant
33	AQC	AQC	category	category	Hourly average	Site AQC	Hourly	2021-07-16	18	5 pm - 6 pm	GOOD		PM2.5
33	HUMID	Humidity	%	percent	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	44.726		
33	NEPH	Nephelometer	10^-4 m^-1	10^-4 m^-1	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.036		
33	NO	Nitric Oxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.012603		
33	NO2	Nitrogen Dioxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.353501	GOOD	
33	OZONE	Ozone	pphm	parts per hundred milli	4h rolling average (	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.634975	GOOD	
33	OZONE	Ozone	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.617125	GOOD	
33	PM10	PM10	µg/m³	microgram per cubic m	24h rolling average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	8.014125		
33	PM10	PM10	µg/m³	microgram per cubic m	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	11.693	GOOD	
33	PM2.5	PM2.5	µg/m³	microgram per cubic m	24h rolling average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	3.850783		
33	PM2.5	PM2.5	µg/m³	microgram per cubic m	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	6.634	GOOD	
33	SD1	Wind Direction Sig	°	degree	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	23.049		
33	SO2	Sulphur Dioxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.02479	GOOD	
33	TEMP	Temperature	°C	degree Celsius	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	14.553		
33	WDR	Wind Direction (1(	°	degree	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	287.177		
33	WSP	Wind Speed (10m	m/s	meter per second	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	4.555		
39	AQC	AQC	category	category	Hourly average	Site AQC	Hourly	2021-07-16	18	5 pm - 6 pm	GOOD		PM2.5
39	CO	Carbon monoxide	ppm	parts per million	8h rolling average (	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.096951	GOOD	
39	CO	Carbon monoxide	ppm	parts per million	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.07088		
39	HUMID	Humidity	%	percent	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	47.177		
39	NEPH	Nephelometer	10^-4 m^-1	10^-4 m^-1	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.048		
39	NO	Nitric Oxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	-0.030016		
39	NO2	Nitrogen Dioxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.213251	GOOD	
39	OZONE	Ozone	pphm	parts per hundred milli	4h rolling average (	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.717575	GOOD	
39	OZONE	Ozone	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.738525	GOOD	
39	PM10	PM10	µg/m³	microgram per cubic m	24h rolling average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	9.0895		
39	PM10	PM10	µg/m³	microgram per cubic m	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	12.897	GOOD	
39	PM2.5	PM2.5	µg/m³	microgram per cubic m	24h rolling average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.990333		
39	PM2.5	PM2.5	µg/m³	microgram per cubic m	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.089	GOOD	
39	RAIN	Rainfall	mm/m²	millimetre rainfall	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0		
39	SD1	Wind Direction Sig	°	degree	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	28.782		
39	SO2	Sulphur Dioxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.029025	GOOD	
39	SOLAR	Solar radiation	W/m²	watt per square meter	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	-7.204		
39	TEMP	Temperature	°C	degree Celsius	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	14.457		
39	WDR	Wind Direction (1(	°	degree	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	309.335		
39	WSP	Wind Speed (10m	m/s	meter per second	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	4.439		
61	CO	Carbon monoxide	ppm	parts per million	8h rolling average (	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.042781	GOOD	
61	CO	Carbon monoxide	ppm	parts per million	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.025171		
61	HUMID	Humidity	%	percent	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	44.949		
61	NEPH	Nephelometer	10^-4 m^-1	10^-4 m^-1	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm			
61	NO	Nitric Oxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.690619		

6. To refresh the data, go to *Data/RefreshAll/Refresh.*

Current Observed air quality data

In the code above, the body command is equal to empty quotations (body = "",). This is important, since this is the **default state** for extracting DPIE air quality data and means that only the current hourly data for all sites and all parameters will be extracted from the Azure Cloud Data Warehouse. If historical or filtered air quality data is required than the body needs to be filled with the specific parameters and this is detailed in section 5.1.4.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Column1.Site_Id	Column1.Para	Column1.Paramet	Column1.Par	Column1.Parameter.U	Column1.Paramete	Column1.Para	Column1.Para	Column1.Date	Column1.H	Column1.Hou	Column1.Value	Column1.AirQualityCategory	Column1.DeterminingPollutant
2	33	AQC	AQC	category	category	Hourly average	Site AQC	Hourly	2021-07-16	18	5 pm - 6 pm		GOOD	PM2.5
3	33	HUMID	Humidity	%	percent	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	44.726		
4	33	NEPH	Nephelometer	10^-4 m^-1	10^-4 m^-1	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.036		
5	33	NO	Nitric Oxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.012603		
6	33	NO2	Nitrogen Dioxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.353501	GOOD	
7	33	OZONE	Ozone	pphm	parts per hundred milli	4h rolling average (	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.634975	GOOD	
8	33	OZONE	Ozone	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.617125	GOOD	
9	33	PM10	PM10	µg/m³	microgram per cubic m	24h rolling average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	8.014125		
10	33	PM10	PM10	µg/m³	microgram per cubic m	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	11.693	GOOD	
11	33	PM2.5	PM2.5	µg/m³	microgram per cubic m	24h rolling average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	3.850783		
12	33	PM2.5	PM2.5	µg/m³	microgram per cubic m	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	6.634	GOOD	
13	33	SD1	Wind Direction Sig	°	degree	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	23.049		
14	33	SO2	Sulphur Dioxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.02479	GOOD	
15	33	TEMP	Temperature	°C	degree Celsius	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	14.553		
16	33	WDR	Wind Direction (1(	°	degree	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	287.177		
17	33	WSP	Wind Speed (10m	m/s	meter per second	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	4.555		
18	39	AQC	AQC	category	category	Hourly average	Site AQC	Hourly	2021-07-16	18	5 pm - 6 pm		GOOD	PM2.5
19	39	CO	Carbon monoxide	ppm	parts per million	8h rolling average (	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.096951	GOOD	
20	39	CO	Carbon monoxide	ppm	parts per million	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.07088		
21	39	HUMID	Humidity	%	percent	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	47.177		
22	39	NEPH	Nephelometer	10^-4 m^-1	10^-4 m^-1	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.048		
23	39	NO	Nitric Oxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	-0.030016		
24	39	NO2	Nitrogen Dioxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.213251	GOOD	
25	39	OZONE	Ozone	pphm	parts per hundred milli	4h rolling average (	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.717575	GOOD	
26	39	OZONE	Ozone	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.738525	GOOD	
27	39	PM10	PM10	µg/m³	microgram per cubic m	24h rolling average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	9.0895		
28	39	PM10	PM10	µg/m³	microgram per cubic m	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	12.897	GOOD	
29	39	PM2.5	PM2.5	µg/m³	microgram per cubic m	24h rolling average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.990333		
30	39	PM2.5	PM2.5	µg/m³	microgram per cubic m	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	2.089	GOOD	
31	39	RAIN	Rainfall	mm/m²	millimetre rainfall	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0		
32	39	SD1	Wind Direction Sig	°	degree	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	28.782		
33	39	SO2	Sulphur Dioxide	pphm	parts per hundred milli	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	0.029025	GOOD	
34	39	SOLAR	Solar radiation	W/m²	watt per square meter	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	-7.204		
35	39	TEMP	Temperature	°C	degree Celsius	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	14.457		
36	39	WDR	Wind Direction (1(	°	degree	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	309.335		
37	39	WSP	Wind Speed (10m	m/s	meter per second	Hourly average	Averages	Hourly	2021-07-16	18	5 pm - 6 pm	4.439		

5.1.4 Extract Historical air quality data using Excel and API

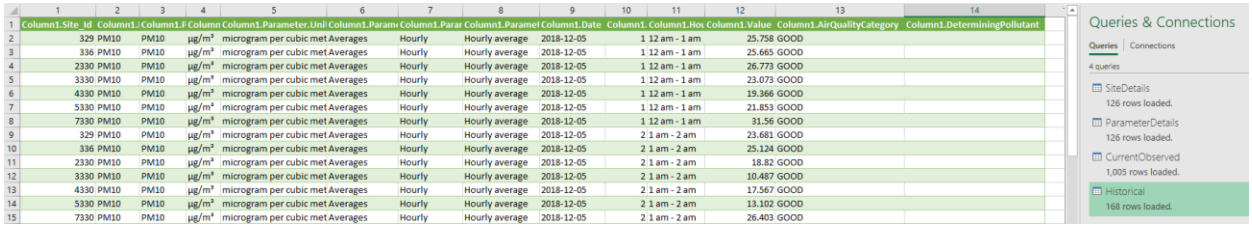
The following instructions outline how to extract historical air quality data from the DPIE Azure Cloud Data Warehouse using Excel Power Query and the DPIE API.

1. Create a new blank query by following the procedure as described in section 5.1.1, up to after clicking on the Advanced editor.
2. Replace the code in Query 1 with the code below: (remove paragraph markers). Copy the code between the horizontal lines below.

```
let
    url = " https://data.airquality.nsw.gov.au/api/Data/get_Observations",
    body  = "{
    ""Parameters"": [""PM10""],
    ""Sites"": [329, 336, 2330, 3330, 4330, 5330, 7330],
    ""StartDate"": ""2018-12-05"",
    ""EndDate"": ""2018-12-06"",
    ""Categories"": [""Averages""],
    ""Subcategories"": [""Hourly""],
    ""Frequency"": [""Hourly average""]
    }",
    Parsed_JSON = Json.Document(body),
    BuildQueryString = Uri.BuildQueryString(Parsed_JSON),
    Source = Json.Document(Web.Contents(url,[Headers = [#"Content-
    Type"="application/json"], Content = Text.ToBinary(body) ] )),
    #"Converted to Table" = Table.FromList(Source, Splitter.SplitByNothing(), null, null,
    ExtraValues.Error),
    #"Expanded Column1" = Table.ExpandRecordColumn(#"Converted to Table", "Column1",
    {"Site_Id", "Parameter", "Date", "Hour", "HourDescription", "Value", "AirQualityCategory",
    "DeterminingPollutant"}, {"Column1.Site_Id", "Column1.Parameter", "Column1.Date",
    "Column1.Hour", "Column1.HourDescription", "Column1.Value",
    "Column1.AirQualityCategory", "Column1.DeterminingPollutant"}),
    #"Expanded Column1.Parameter" = Table.ExpandRecordColumn(#"Expanded Column1",
    "Column1.Parameter", {"ParameterCode", "ParameterDescription", "Units",
    "UnitsDescription", "Category", "SubCategory", "Frequency"},
    {"Column1.Parameter.ParameterCode", "Column1.Parameter.ParameterDescription",
    "Column1.Parameter.Units", "Column1.Parameter.UnitsDescription",
    "Column1.Parameter.Category", "Column1.Parameter.SubCategory",
    "Column1.Parameter.Frequency"})
in
    #"Expanded Column1.Parameter"
```

---

3. Click on *Done.* The Historical air quality details data are extracted into the Excel Power Query Editor.
4. Click on *Close & Load.* This extracts the Historical details data into an Excel worksheet.
5. Change the name of Query 1 and Sheet1 to *Historical.* This is the name in the `air-quality-api-excel-power-query.xlsx` Excel workbook.



	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Column1.Site_Id	Column1.I	Column1.F	Column	Column1.Parameter.Uni	Column1.Param	Column1.Parar	Column1.Paramet	Column1.Date	Column1.	Column1.Hou	Column1.Value	Column1.AirQualityCategory	Column1.DeterminingPollutant
2	329	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	25.758	GOOD	
3	336	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	25.665	GOOD	
4	2330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	26.773	GOOD	
5	3330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	23.073	GOOD	
6	4330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	19.366	GOOD	
7	5330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	21.853	GOOD	
8	7330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	31.56	GOOD	
9	329	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am	23.681	GOOD	
10	336	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am	25.124	GOOD	
11	2330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am	18.82	GOOD	
12	3330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am	10.487	GOOD	
13	4330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am	17.567	GOOD	
14	5330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am	13.102	GOOD	
15	7330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am	26.403	GOOD	

6. To refresh the data, go to *Data/RefreshAll/Refresh.*

Historical Observed air quality data

The only **difference between the CurrentObserved and Historical data sets** is the body of the text in the Power Query. To get the current observed hourly data, that is refreshed every hour, the body is empty between the double quotes. (body = "",). To extract historical or filter data, then specific parameter information is required between the quotes of the body command. For instance:

```
body = "{
""Parameters"": [""PM10""],
""Sites"": [336, 4330, 2330, 7330, 3330, 329, 5330],
""StartDate"": ""2018-12-05"",
""EndDate"": ""2018-12-06"",
""Categories"": [""Averages""],
""Subcategories"":[""Hourly""],
""Frequency"":[""Hourly average""],
}",
```

In the example above:

Parameters: *PM10*. Full list in the Parameter Details worksheet.

Sites: Aberdeen (*336*), Bulga (*4330*), Camberwell (*2330*), Jerry's Plains (*7330*), Maison Dieu (*3330*), Merriwa (*329*), Mount Thorley (*5330*). Full list in the Site Details worksheet.

StartDate: *2018-12-05* 5th Dec 2018. The start date of the filter

EndDate: *2018-12-05* 5th Dec 2018. The end date of the filter.

Category: *Averages*. The statistical value. Full list in the Parameter Details worksheet.

Subcategory: *Hourly*. The time-period. Full list in the Parameter Details worksheet.

Frequency: *Hourly average*. The frequency time-period. Full list in the Parameter Details worksheet.

For the query above the following data will be extracted.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Column1.Site	Id	Column1.i	Column1.F	Column	Column1.Parameter.Uni	Column1.Param	Column1.Parar	Column1.Parame	Column1.Date	Column1.	Column1.Ho	Column1.Value	Column1.AirQualityCategory	Column1.DeterminingPollutant
2	329	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am		25.76	GOOD	
3	336	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am		25.67	GOOD	
4	2330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am		26.77	GOOD	
5	3330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am		23.07	GOOD	
6	4330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am		19.37	GOOD	
7	5330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am		21.85	GOOD	
8	7330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am		31.56	GOOD	
9	329	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am		23.68	GOOD	
10	336	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am		25.12	GOOD	
11	2330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am		18.82	GOOD	
12	3330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am		10.49	GOOD	
13	4330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am		17.57	GOOD	
14	5330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am		13.10	GOOD	
15	7330	PM10	PM10	µg/m³	microgram per cubic met	Averages	Hourly	Hourly average	2018-12-05	2	1 am - 2 am		26.40	GOOD	

To retrieve the hourly averages for PM10 remove the Frequency parameter. This will give all the hourly averages including the *Hourly average* and the *24h rolling average derived from 1h average*.

```
body  = "{
""Parameters"": [""PM10""],
""Sites"": [336, 4330, 2330, 7330, 3330, 329, 5330],
""StartDate"": ""2018-12-05"",
""EndDate"": ""2018-12-06"",
""Categories"": [""Averages""],
""Subcategories"":[""Hourly""]
}",
```

The data extracted from the query above is shown below.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Column1.Site_Id	Column1.Par	Column1.Param	Column1.P	Column1.Parameter.UnitsDe	Column1.Para	Column1.Pa	Column1.Parameter.Frequency	Column1.Date	Column1	Column1.HourDescription	Column1.Value	Column1.AirQualityCategory	Column1.DeterminingPollutant
2	329	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2018-12-05	1	12 am - 1 am	30.55425		
3	329	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	25.758	GOOD	
4	336	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2018-12-05	1	12 am - 1 am	27.8925		
5	336	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	25.665	GOOD	
6	2330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2018-12-05	1	12 am - 1 am	48.39175		
7	2330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	26.773	GOOD	
8	3330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2018-12-05	1	12 am - 1 am	39.499167		
9	3330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	23.073	GOOD	
10	4330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2018-12-05	1	12 am - 1 am	27.333125		
11	4330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	19.366	GOOD	
12	5330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2018-12-05	1	12 am - 1 am	46.7175		
13	5330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	21.853	GOOD	
14	7330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	24h rolling average derived from 1h average	2018-12-05	1	12 am - 1 am	39.079		
15	7330	PM10	PM10	µg/m³	microgram per cubic meter	Averages	Hourly	Hourly average	2018-12-05	1	12 am - 1 am	31.56	GOOD	

Note: the *24h rolling average derived from 1h average* does not have an Air Quality Category.

5.1.5 Explanation of the parameters within the body command

The ParameterDetails data will identify the **correct combination** of Parameters, Categories, Subcategory and Frequency that can be added to the body command. If the correct combination of Parameters, Categories, Subcategory and Frequency is not used then an error message will result.

Worked examples of extracting historical data are detailed in Appendix 1 and 2. The following examples highlight the need to have the correct combination of parameters, categories, subcategory and frequency.

Example 1
All the meteorological parameters (temperature, humidity, rain, wind speed and wind direction) **only have hourly averages** as shown in the data set below.

Column1.P	Column1.ParameterDescriptio	Column1.Units	Column1.UnitsDescription	Column1.Frequency	Column1.Category	Column1.SubCategory
HUMID	Humidity	%	percent	Hourly average	Averages	Hourly
RAIN	Rainfall	mm/m²	millimetre rainfall	Hourly average	Averages	Hourly
SD1	Wind Direction Sigma Theta	°	degree	Hourly average	Averages	Hourly
TEMP	Temperature	°C	degree Celsius	Hourly average	Averages	Hourly
WDR	Wind Direction (10m)	°	degree	Hourly average	Averages	Hourly
WSP	Wind Speed (10m)	m/s	meter per second	Hourly average	Averages	Hourly

Example 2
The parameters PM10 and PM2.5 are the only parameters that have 24 hour rolling averages

Column1.ParameterCo	Column1.Paran	Column1.Un	Column1.UnitsDescription	Column1.Frequency	Column1.Categ	Column1.SubCateg
PM10	PM10	µg/m³	microgram per cubic meter	24h rolling average derived from 1h average	Averages	Hourly
PM2.5	PM2.5	µg/m³	microgram per cubic meter	24h rolling average derived from 1h average	Averages	Hourly

Detailed below is a brief summary of the parameters that can be added to the body command.

Parameters

The list below identifies the possible parameters that can be placed in the Parameters command. *(in italics)*

Air Quality

Gas

CO, NEPH, NH3, NO, NO2, OZONE, SO2

Particles

NEPH, PM10, PM10d, PM2.5, PM2.5d, TSPd

Meteorological

HUMID, RAIN, SOLAR, TEMP, SD1, WDR, WSP

Sites

The complete list of Sites is in the SiteDetails data.

To extract regional AQC (RAQC) data you need to use the site id for the regions.

Category and Subcategory

Table 1 below identifies the various Category and Subcategory combinations that can be in the Category and Subcategory command.

Table 1 Category and Subcategory combinations

Category	Subcategory	Comment
Averages	Hourly	Hourly average
	Daily	Daily average
	Monthly	Monthly average
	Annual	Annual average
Exceedances	Daily	Number of exceedances in a day
	Monthly	Number of exceedances in a month
	Annual	Number of exceedances in a year
	Yearly	Number of exceedances over years.
Maximums	Daily	Daily maximum
	Monthly	Monthly maximum
	Annual	Annual maximum
Site AQC	Hourly	Hourly site Air Quality Category (AQC)
	Daily	Daily site Air Quality Category (AQC)
Regional AQC	Hourly	Hourly regional Air Quality Category (RAQC)
	Daily	Daily regional Air Quality Category (RAQC)

6. Search and retrieve air quality data using the R programming language and API

The DPIE Air Quality API data service can be used by a variety of third-party software applications as identified in Figure 1, to search and retrieve DPIE air quality data. The following outlines how to deploy the API using the R programming language. Instructions on installing the R programming language can be found by clicking the link below:

https://rstudio.com/

To extract the Air Quality data using the API you must be familiar with the R programming language environment. The code below is written in RStudio Version 1.2.1335.

6.1 Deploying the API using the R programming language

The API provides three data sets:

- Site details data
- Parameter details data
- Observational data. The observational data can be extracted as current real-time hourly data or as historical data by querying data through the **POST** function in R.

The Site Details and Parameter Details can be queried through setting the body value in the **GET** function to list().

6.1.1 Extract Monitoring Site data using R programming language and API

The following instructions outline how to extract monitoring Site data from the DPIE Azure Cloud Data Warehouse using R programming language and the API.

1. Reproduce the R code below, that is between the horizontal lines, into the source/workspace area in the R Studio software.
2. Highlight the code.
3. Click *Run*.

The Site Details data is written into the df_site_details datafame and then to the `SiteDetails.csv` file, in the working directory.

```
#_____________________________________________________________________________

#Install 'dplyr', 'httr', and 'jsonlite' libraries to extract Air Quality API data.
library(dplyr)
library(httr)
library(jsonlite)

# Site details
path_site_details <- 'https://data.airquality.nsw.gov.au/api/Data/get_SiteDetails'

df_site_details <- path_site_details %>%
  GET(body = list(),
      add_headers(`Content-Type`="application/json")) %>%
  content(as = "text", encoding = "UTF-8") %>%
  fromJSON(flatten = TRUE) %>%
  data.frame()

df_site_details

# Save Site Details in a csv file in the working directory
write.csv(df_site_details, file="SiteDetails")

#_____________________________________________________________________________
```

6.1.2 Extract Parameter data using R programming language and API

The following instructions outline how to extract Parameter data from the DPIE Azure Cloud Data Warehouse using R programming language and the DPIE API.

1. Reproduce the R code below, that is between the horizontal lines, into the source/workspace area in the R Studio software.
2. Highlight the code.
3. Click *Run*.

The Parameter Details data is written to the df_param_details dataframe and then to the `ParameterDetails.csv` file, in the working directory.

```
#_____________________________________________________________________________________

#Install 'dplyr', 'httr', and 'jsonlite' libraries to extract Air Quality API data.
library(dplyr)
library(httr)
library(jsonlite)

# Parameter details
path_param_details <- 'https://data.airquality.nsw.gov.au/api/Data/get_ParameterDetails'

df_param_details <- path_param_details %>%
  GET(body = list(),
      add_headers(`Content-Type`="application/json")) %>%
  content(as = "text", encoding = "UTF-8") %>%
  fromJSON(flatten = TRUE) %>%
  data.frame()

df_param_details

# Save Parameter Details in a csv file in the working directory
write.csv(df_param_details, file="ParameterDetails")

#_____________________________________________________________________________________
```

6.1.3 Extract Current Observed air quality data using R programming language and API.

The following instructions outline how to extract current observed hourly air quality data from the DPIE Azure Cloud Data Warehouse using R programming language and the DPIE API.

4. Reproduce the R code below, that is between the horizontal lines, into the source/workspace area in the R Studio software.
5. Highlight the code.
6. Click *Run*.

The Current Observed air quality data, for the current hour, is written to the df_current_obs dataframe and then to the `CurrentObs.csv` file in the working directory.

```
#_____________________________________________________________________________________

#Install 'dplyr', 'httr', and 'jsonlite' libraries to extract Air Quality API data.
library(dplyr)
library(httr)
library(jsonlite)

# Current Observations
path_current_obs <- 'https://data.airquality.nsw.gov.au/api/Data/get_Observations'

df_current_obs <- path_current_obs %>%
  POST(body = list(),
       add_headers(`accept`="application/json",
                   `Content-Type`="application/json")) %>%
  content(as = "text", encoding = "UTF-8") %>%
  fromJSON(flatten = TRUE) %>%
  data.frame()

df_current_obs

# Save Current Observations in a csv file in the working directory
write.csv(df_current_obs, file="CurrentObs")

#_____________________________________________________________________________________
```

6.1.4 Extract Historical air quality data using R programming language and API

The following instructions outline how to extract historical air quality data from the DPIE Azure Cloud Data Warehouse using R programming language and the DPIE API.

1. Reproduce the R code below, that is between the horizontal lines, into the source/workspace area in the R Studio software.
2. Highlight the code.
3. Click *Run*.

The Historical Observed PM_{10} air quality data, is written to the df_historical_obs dataframe and then to the `HistoricalObs.csv` file in the working directory.

```
#_____________________________________________________________________________________________

#Install 'dplyr', 'httr', and 'jsonlite' libraries to extract Air Quality API data.
library(dplyr)
library(httr)
library(jsonlite)

# Historical air quality data
path_historical_obs <- 'https://data.airquality.nsw.gov.au/api/Data/get_Observations'

bodyparam  <- '{ "Parameters": [ "PM10" ],
"Sites": [ 336, 4330, 2330, 7330, 3330, 329, 5330 ],
"StartDate": "2018-12-05",
"EndDate": "2018-12-06",
"Categories": [ "Averages" ],
"SubCategories": [ "Hourly" ],
"Frequency": [ "Hourly average" ]}'

df_historical_obs <- path_historical_obs %>%
  POST(body = bodyparam,
       add_headers(c(
         `accept` = 'application/json',
         `Content-Type` = 'application/json'
       ))) %>%
  content(as = "text", encoding = "UTF-8") %>%
  fromJSON(flatten = TRUE) %>%
  data.frame()

df_historical_obs

# Save Historical Observations in a csv file in the working directory
write.csv(df_historical_obs, file="HistoricalObs")

#_____________________________________________________________________________________________
```

Citation.

R Core Team (2019). R: A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. URL https://www.R-project.org/.

7. Search and retrieve air quality data using Python programming language and API

The DPIE Air Quality API data service can be used by a variety of third-party software applications as identified in Figure 1, to search and retrieve DPIE air quality data. The following outlines how to deploy the API using the Python programming language.

To extract the Air Quality data using the API you must be familiar with the Python programming language environment. The code below is written in Python 3.8.2.

7.1 Deploying the API using the Python programming language

The API provides three data sets:

- Site details data
- Parameter details data
- Observational data.
  The observational data can be extracted as current real-time hourly data or as historical data by querying data through the **POST** function in Python.

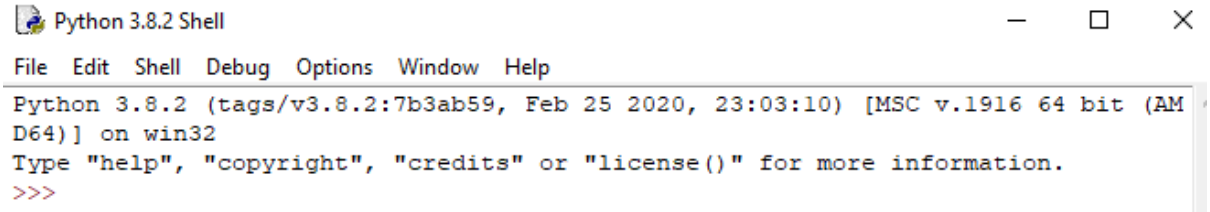
The Site Details and Parameter Details can be queried through the **GET** function in Python.

7.1.1 Extract Monitoring Site data using Python programming language and API

The following instructions outline how to extract monitoring Site data from the DPIE Azure Cloud Data Warehouse using Python programming language and the API.

1. Create a text file from the code below.
2. Open the file in the Python shell environment.
3. Click F5 to run the code.

The Site details data is written to the `SiteDetails.txt` file in the working directory.



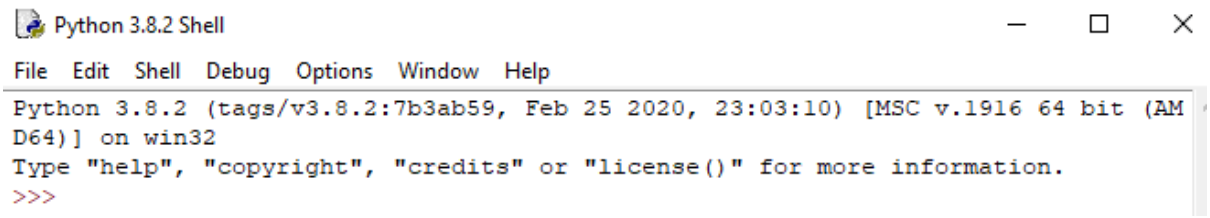

```
import os
import sys
import requests
import logging
import urllib
import json
#################################################################################################
class aqms_api_class(object):
    """
    This class defines and configures the API to query the Azure DataWarehouse
    """
    def __init__(self, ):

        self.logger = logging.getLogger(__file__)
        self.url_api = "https://data.airquality.nsw.gov.au"
        self.headers = {'content-type': 'application/json', 'accept': 'application/json'}
        self.get_site_url = "/api/Data/get_SiteDetails"
        return
#################################################################################################
    def get_site_details(self, ):
        '''
        Build a query to return all the sites details
        '''
        query = urllib.parse.urljoin(self.url_api, self.get_site_url)
        response = requests.get(url = query, data = '')
        return response
#################################################################################################
if __name__ == '__main__':
    AQMS =  aqms_api_class()
    AllSites = AQMS.get_site_details()
    '''
    Save Site Details to a text file
    '''
    f = open('SiteDetails.txt', 'w') # open a file in write mode
    for item in AllSites:    # iterate over the list items
        item = item.decode("ISO-8859-1") # remove b from check process
        f.write(str(item) + '\n') # write to the file in working directory
    f.close()
#################################################################################################
```

7.1.2 Extract Parameter data using Python programming language and API

The following instructions outline how to the Parameter data from the DPIE Azure Cloud Data Warehouse using Python programming language and the DPIE API.

1. Create a text file from the code below.
2. Open the file in the Python shell environment.
3. Click F5 to run the code.

The Parameter details data is written to the `ParameterDetails.txt` file in the working directory.



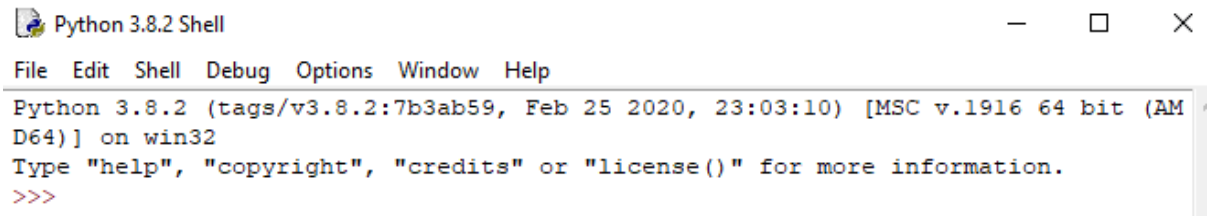

```
import os
import sys
import requests
import logging
import urllib
import datetime as dt
import json
#################################################################################################
class aqms_api_class(object):
    """
    This class defines and configures the API to query the Azure DataWarehouse
    """
    def __init__(self, ):

        self.logger = logging.getLogger(__file__)
        self.url_api = "https://data.airquality.nsw.gov.au"
        self.headers = {'content-type': 'application/json', 'accept': 'application/json'}
        self.get_parameters = "/api/Data/get_ParameterDetails"
        return
#################################################################################################
    def get_parameters_details(self, ):
        '''
        Build a query to return all the parameter details
        '''
        query = urllib.parse.urljoin(self.url_api, self.get_parameters)
        response = requests.get(url = query, data = '')
        return response
#################################################################################################
if __name__ == '__main__':
    AQMS =  aqms_api_class()
    Allparameters = AQMS.get_parameters_details()
    '''
    Save Parameter Details to a text file
    '''
    f = open('ParameterDetails.txt', 'w') # open a file in write mode
    for item in Allparameters:
        item = item.decode("ISO-8859-1") # iterate over the list items
        f.write(str(item) + '\n') # write to the file in working directory
    f.close()
#################################################################################################
```

7.1.3 Extract Current Observed air quality data using Python programming language and API

The following outlines how to extract current observed hourly air quality data from the DPIE Azure Cloud Data Warehouse using Python programming language and the DPIE API.

1. Create a text file from the code below.
2. Open the file in the Python shell environment.
3. Click F5 to run the code.

The current hourly observed air quality data, for the current hour, is written to the `CurrentObs.txt` file in the working directory file.



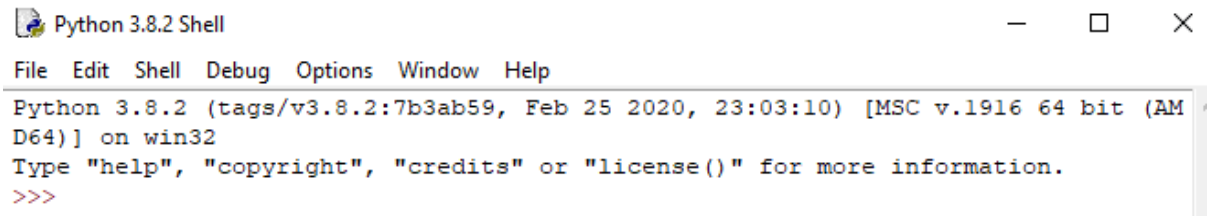

```
import os
import sys
import requests
import logging
import urllib
import datetime as dt
import json
#################################################################################################
class aqms_api_class(object):
    """
    This class defines and configures the api to query the aqms database
    """
    def __init__(self, ):
        self.logger = logging.getLogger(__file__)
        self.url_api = "https://data.airquality.nsw.gov.au"
        self.headers = {'content-type': 'application/json', 'accept': 'application/json'}

        self.get_site_url = 'api/Data/get_SiteDetails'
        self.get_parameters = 'api/Data/get_ParameterDetails'
        self.get_observations = 'api/Data/get_Observations'
        return
#################################################################################################
    def get_Obs(self, ):
        '''
        Build a query to return all the Current hourly observations
        '''
        query = urllib.parse.urljoin(self.url_api, self.get_observations)
        response = requests.post(url = query, data = '', headers = self.headers)
        return response
#################################################################################################
if __name__ == '__main__':
    AQMS =  aqms_api_class()
    AllCurrentObs = AQMS.get_Obs()
    # Save Current hourly observations to a text file
    f = open('CurrentObs.txt', 'w') # open a file in write mode
    for item in AllCurrentObs:
        item = item.decode("ISO-8859-1") # iterate over the list items
        f.write(str(item) + '\n') # write to the file in working directory
    f.close()
#################################################################################################
```

7.1.4 Extract Historical air quality data using Python programming language and API

The following outlines how to extract current historical air quality data from the DPIE Azure Cloud Data Warehouse using Python programming language and the DPIE API.

1. Create a text file from the code below.
2. Open the file in the Python shell environment.
3. Click F5 to run the code.

The Historical Observed PM10 air quality data, is written to the `HistoricalObs.txt` file in the working directory file.




```
import os
import sys
import requests
import logging
import urllib
import datetime as dt
import json
#############################################################################################################
class aqms_api_class(object):
    """
    This class defines and configures the api to query the aqms database
    """
    def __init__(self, ):
        self.logger = logging.getLogger(__file__)
        self.url_api = "https://data.airquality.nsw.gov.au"
        self.headers = {'content-type': 'application/json', 'accept': 'application/json'}
        self.get_observations = 'api/Data/get_Observations'
        return
#############################################################################################################
    def get_Obs(self, ObsRequest):
        '''
        Build a query to return all the observation details
        '''
        query = urllib.parse.urljoin(self.url_api, self.get_observations)
        response = requests.post(url = query, data = json.dumps(ObsRequest), headers = self.headers)
        return response
#############################################################################################################
```

```
###########################################################################################################
    def ObsRequest_init(self, ):
        '''
        Build a query to return all historical observations
        '''
        ObsRequest = {}
        ObsRequest['Parameters'] = ['PM10']
        ObsRequest['Sites'] = [336, 4330, 2330, 7330, 3330, 329, 5330]
        StartDate = dt.date(2018,12,5)
        EndDate = dt.date(2018,12,6)
        ObsRequest['StartDate'] = StartDate.strftime('%Y-%m-%d')
        ObsRequest['EndDate'] = EndDate.strftime('%Y-%m-%d')
        ObsRequest['Categories'] = ['Averages']
        ObsRequest['SubCategories'] = ['Hourly']
        ObsRequest['Frequency'] = ['Hourly average']
        return ObsRequest
###########################################################################################################

if __name__ == '__main__':
    AQMS =  aqms_api_class()
    ObsRequest = AQMS.ObsRequest_init()
    AllHistoricalObs = AQMS.get_Obs(ObsRequest)
    '''
    Save Historical Obserations to a text file
    '''
    f = open('HistoricalObs.txt', 'w') # open a file in write mode
    for item in AllHistoricalObs:    # iterate over the list items
        item = item.decode("ISO-8859-1") # remove b from check process
        f.write(str(item) + '\n') # write to the file in working directory
    f.close()
###########################################################################################################
```

8. Appendix 1: worked examples Extract Historical air quality data using Excel and API

8.1 Example 1

How do I extract Daily Maximum Values and the Air Quality Category for Ozone 4 hour rolling averages at Chullora monitoring site for December 2018?

Step 1

Open the ParameterDetails worksheet and filter on OZONE, Maximums and Daily. This filtering verifies this is the correct combination of Parameter, Category, SubCategory and Frequency that can be added to the body command.

Column1.ParameterCode	Column1.Frequency	Column1.Category	Column1.SubCategory
OZONE	4h rolling average derived from 1h average	Maximums	Daily

Parameter: OZONE

Sites: 190 (Chullora).

Start date: 2018-12-01

End date: 2019-01-01

Categories: Maximums

Subcategories: Daily

Frequency: 4h rolling average derived from 1h average

Step 2

Copy the code from 5.1.4 and replace the body of the command with

```
body  = "{
""Parameters"": [""OZONE""],
""Sites"": [190],
""StartDate"": ""2018-12-01"",
""EndDate"": ""2019-01-01"",
""Categories"": [""Maximums""],
""Subcategories"": [""Daily""],
""Frequency"": [""4h rolling average derived from 1h average""]
}",
```

Below is the data set for the query in the body command. The query will extract the ozone 4-hour rolling average daily maximum value and air quality category. Below is a screenshot for 1 and 2 December 2018. The name of the worksheet in the `air-quality-api-excel-power-query.xlsx` Excel workbook is *ChulloraOzone*.

Column1.Site_Id	Column1.	Column1	Column1.P	Colu	Column1.Pa	Column	Column1.Parameter.Frequency	Column1.Date	Col	Column1.Hou	Colum	Column1.
190	OZONE	Ozone	pphm	parts	Maximums	Daily	4h rolling average derived from 1h average	2018-12-01	1	12 am - 1 am	4.01	GOOD
190	OZONE	Ozone	pphm	parts	Maximums	Daily	4h rolling average derived from 1h average	2018-12-02	1	12 am - 1 am	3.80	GOOD

8.2 Example 2

How do I extract Annual averages for PM10 and PM2.5 at Earlwood monitoring site from 2015 to 2018?

Step 1

Open the ParameterDetails worksheet and filter on PM10 and PM2.5, Averages and Annual. This filtering verifies this is the correct combination of Parameter, Category, SubCategory and Frequency that can be added to the body command.

Column1.ParameterCo	Column1.Frequency	Column1.Categ	Column1.SubCateg
PM10	24h average derived from 1h average	Averages	Annual
PM2.5	24h average derived from 1h average	Averages	Annual

Parameter: PM10, PM2.5

Sites: 206 (Earlwood).

Start date: 2015-01-01

End date: 2019-01-01

Categories: Averages

Subcategories: Annual

Frequency: 24h average derived from 1h average

Step 2

Copy the code from 5.1.4 and replace the body of the command with:

```
body  = "{
""Parameters"": [""PM10"", ""PM2.5""],
""Sites"": [206],
""StartDate"": ""2015-01-01"",
""EndDate"": ""2019-01-01"",
""Categories"": [""Averages""],
""Subcategories"":[""Annual""],
""Frequency"": [""24h average derived from 1h average""]
}",
```

Below is the data set for the query in the body command. The query will extract the annual averages for PM10 and PM2.5 at Earlwood for the years from 2015 to 2018. The name of the worksheet in the `air-quality-api-excel-power-query.xlsx` Excel workbook is *EarlwoodPM10PM25AnnualAvg*.

Column1.Site_Id	Column1.Parameter.	Column1.Parameter.Par	Column1.Pa	Column1.Parameter.UnitsDescription	Column1.Parameter.Frequency	Column1.Para	Column1.Parameter.Su	Column1.Date	Column1.Ho	Column1.HourD	Column1.V
206	PM10	PM10	µg/m³	microgram per cubic meter	24h average derived from 1h averag	Averages	Annual	2015-12-31	1	12 am - 1 am	17.15
206	PM2.5	PM2.5	µg/m³	microgram per cubic meter	24h average derived from 1h averag	Averages	Annual	2015-12-31	1	12 am - 1 am	8.54
206	PM10	PM10	µg/m³	microgram per cubic meter	24h average derived from 1h averag	Averages	Annual	2016-12-31	1	12 am - 1 am	17.59
206	PM2.5	PM2.5	µg/m³	microgram per cubic meter	24h average derived from 1h averag	Averages	Annual	2016-12-31	1	12 am - 1 am	8.08
206	PM10	PM10	µg/m³	microgram per cubic meter	24h average derived from 1h averag	Averages	Annual	2017-12-31	1	12 am - 1 am	18.02
206	PM2.5	PM2.5	µg/m³	microgram per cubic meter	24h average derived from 1h averag	Averages	Annual	2017-12-31	1	12 am - 1 am	7.28
206	PM10	PM10	µg/m³	microgram per cubic meter	24h average derived from 1h averag	Averages	Annual	2018-12-31	1	12 am - 1 am	19.77
206	PM2.5	PM2.5	µg/m³	microgram per cubic meter	24h average derived from 1h averag	Averages	Annual	2018-12-31	1	12 am - 1 am	7.84

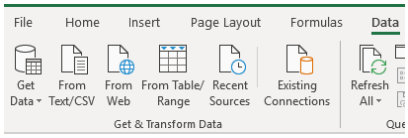
9. Appendix 2: worked examples Extract Historical air quality data using R programming language and API

9.1 Example 1.

How do I extract Daily Maximum Values and the Air Quality Category for Ozone 4 hour rolling averages at Chullora monitoring site for December 2018?

Step 1

Import the `ParameterDetails.csv` file that was created in section 5.1.2 by opening Excel; and clicking on the Data and From Text/CSV on the Excel menu. This will import the Parameter data into an Excel worksheet.



Filter on OZONE, Maximums and Daily. This filtering verifies this is the correct combination of Parameter, Category, SubCategory and Frequency that can be added to the body command.

Column1.ParameterCode	Column1.Frequency	Column1.Category	Column1.SubCategory
OZONE	4h rolling average derived from 1h average	Maximums	Daily

Parameter: OZONE

Sites: 190 (Chullora).

Start date: 2018-12-01

End date: 2019-01-01

Categories: Maximums

Subcategories: Daily

Frequency: 4h rolling average derived from 1h average

Step 2

Reproduce the R code below, that is between the horizontal lines, into the source/workspace area in the R Studio software, highlight the code, and click run.

The Historical Observed Ozone air quality data, is written to the df_historical_ozone dataframe and then to the `HistoricalOzone.csv` file in the working directory of R Studio.

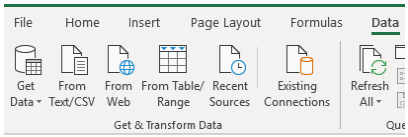
```
#_____________________________________________________________________________________________________

#Install 'dplyr', 'httr', and 'jsonlite' libraries to extract Air Quality API data.
library(dplyr)
library(httr)
library(jsonlite)

# Historical air quality data - Example 1
# How do I extract Daily Maximum values and the Air Quality Category for Ozone for 4 hour rolling averages at
# Chullora monitoring site for December 2018?

path_historical_ozone <- 'https://data.airquality.nsw.gov.au/api/Data/get_Observations'

bodyparam  <- '{ "Parameters": [ "OZONE" ],
"Sites": [ 190 ],
"StartDate": "2018-12-01",
"EndDate": "2019-01-01",
"Categories": [ "Maximums" ],
"SubCategories": [ "Daily" ],
"Frequency": [ "4h rolling average derived from 1h average" ]}'

df_historical_ozone <- path_historical_ozone %>%
  POST(body = bodyparam,
       add_headers(c(
         `accept` = 'application/json',
         `Content-Type` = 'application/json'
       ))) %>%
  content(as = "text", encoding = "UTF-8") %>%
  fromJSON(flatten = TRUE) %>%
  data.frame()

df_historical_ozone

# Save Historical Ozone Observations in a csv file in the working directory
write.csv(df_historical_ozone, file="HistoricalOzone")

#_____________________________________________________________________________________________________
```

9.2 Example 2

How do I extract Annual averages for PM10 and PM2.5 at Earlwood monitoring site from 2015 to 2018?

Step 1

Import the `ParameterDetails.csv` file that was created in section 5.1.2 by opening Excel; and clicking on the Data and From Text/CSV on the Excel menu. This will import the Parameter data into an Excel worksheet.



Filter on PM10 and PM2.5, Averages and Annual. This filtering verifies this is the correct combination of Parameter, Category, SubCategory and Frequency that can be added to the body command.

Column1.ParameterCo	Column1.Frequency	Column1.Categ	Column1.SubCateg
PM10	24h average derived from 1h average	Averages	Annual
PM2.5	24h average derived from 1h average	Averages	Annual

Parameter: PM10, PM2.5

Sites: 206 (Earlwood).

Start date: 2015-01-01

End date: 2019-01-01

Categories: Averages

Subcategories: Annual

Frequency: 24h average derived from 1h average

Step 2

Reproduce the R code below, that is between the horizontal lines, into the source/workspace area in the R Studio software, highlight the code, and click run.

The Historical Observed Particle Matter (PM10 and PM2.5) air quality data, is written to the df_historical_pm dataframe and then to the `HistoricalPM.csv` file in the working directory of R Studio.

```
#_____________________________________________________________________________________________

#Install 'dplyr', 'httr', and 'jsonlite' libraries to extract Air Quality API data.
library(dplyr)
library(httr)
library(jsonlite)

# Historical air quality data - Example 2
# How do I extract Annual averages for PM10 and PM2.5 at Earlwood monitoring site from 2015 to 2018?

path_historical_pm <- 'https://data.airquality.nsw.gov.au/api/Data/get_Observations'

bodyparam  <- '{ "Parameters": [ "PM10", "PM2.5"],
"Sites": [ 206 ],
"StartDate": "2015-01-01",
"EndDate": "2019-01-01",
"Categories": [ "Averages" ],
"SubCategories": [ "Annual" ],
"Frequency": [ "24h average derived from 1h average" ]}'

df_historical_pm <- path_historical_pm %>%
  POST(body = bodyparam,
       add_headers(c(
         `accept` = 'application/json',
         `Content-Type` = 'application/json'
       ))) %>%
  content(as = "text", encoding = "UTF-8") %>%
  fromJSON(flatten = TRUE) %>%
  data.frame()

df_historical_pm

# Save Historical Particle Matter Observations in a csv file in the working directory
write.csv(df_historical_pm, file="HistoricalPM")
#_____________________________________________________________________________________________
```

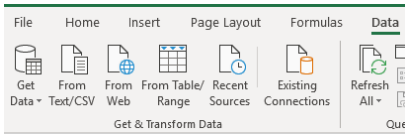
10. Appendix 3: worked examples Extract Historical air quality data using Python programming language and API

10.1 Example 1.

How do I extract Daily Maximum Values and the Air Quality Category for Ozone 4 hour rolling averages at Chullora monitoring site for December 2018?

Step 1

Import the `ParameterDetails.csv` file that was created in section 5.1.2 by opening Excel; and clicking on the Data and From Text/CSV on the Excel menu. This will import the Parameter data into an Excel worksheet.



Filter on OZONE, Maximums and Daily. This filtering verifies this is the correct combination of Parameter, Category, SubCategory and Frequency that can be added to the body command.

Column1.ParameterCode	Column1.Frequency	Column1.Category	Column1.SubCategory
OZONE	4h rolling average derived from 1h average	Maximums	Daily

Parameter: OZONE

Sites: 190 (Chullora).

Start date: 2018-12-01

End date: 2019-01-01

Categories: Maximums

Subcategories: Daily

Frequency: 4h rolling average derived from 1h average

Step 2

Create a text file from the code below and then open the file in the Python shell environment and click F5 to run the code. The Historical Observed Ozone air quality data, is written to the `HistoricalOzone.txt` file in the working directory file.

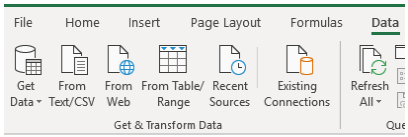
```
import sys
import requests
import logging
import urllib
import datetime as dt
import json
#################################################################################################################
class aqms_api_class(object):
    """
    This class defines and configures the api to query the aqms database
    """
    def __init__(self, ):
        self.logger = logging.getLogger(__file__)
        self.url_api = "https://data.airquality.nsw.gov.au"
        self.headers = {'content-type': 'application/json', 'accept': 'application/json'}
        self.get_observations = 'api/Data/get_Observations'
        return
#################################################################################################################
    def get_Obs(self, ObsRequest):
        '''
        Build a query to return all the observation details
        '''
        query = urllib.parse.urljoin(self.url_api, self.get_observations)
        response = requests.post(url = query, data = json.dumps(ObsRequest), headers = self.headers)
        return response
#################################################################################################################

    def ObsRequest_init(self, ):
        '''
        Build a query to return all historical observations
        '''
        ObsRequest = {}
        ObsRequest['Parameters'] = ['OZONE']
        ObsRequest['Sites'] = [190]
        StartDate = dt.date(2018,12,1)
        EndDate = dt.date(2019,1,1)
        ObsRequest['StartDate'] = StartDate.strftime('%Y-%m-%d')
        ObsRequest['EndDate'] = EndDate.strftime('%Y-%m-%d')
        ObsRequest['Categories'] = ['Maximums']
        ObsRequest['SubCategories'] = ['Daily']
        ObsRequest['Frequency'] = ['4h rolling average derived from 1h average']
        return ObsRequest
#################################################################################################################
if __name__ == '__main__':
    AQMS =  aqms_api_class()
    ObsRequest = AQMS.ObsRequest_init()
    AllHistoricalOzone = AQMS.get_Obs(ObsRequest)
    '''
    Save Historical Ozone obserations to a text file
    '''
    f = open('HistoricalOzone.txt', 'w') # open a file in write mode
    for item in AllHistoricalOzone:    # iterate over the list items
        item = item.decode("ISO-8859-1") # remove b from check process
        f.write(str(item) + '\n') # write to the file in working directory
    f.close()
#################################################################################################################
```

10.2 Example 2

How do I extract Annual averages for PM10 and PM2.5 at Earlwood monitoring site from 2015 to 2018?

Step 1

Import the `ParameterDetails.csv` file that was created in section 5.1.2 by opening Excel; and clicking on the Data and From Text/CSV on the Excel menu. This will import the Parameter data into an Excel worksheet.



Filter on PM10 and PM2.5, Averages and Annual. This filtering verifies this is the correct combination of Parameter, Category, SubCategory and Frequency that can be added to the body command.

Column1.ParameterCo	Column1.Frequency	Column1.Categ	Column1.SubCateg
PM10	24h average derived from 1h average	Averages	Annual
PM2.5	24h average derived from 1h average	Averages	Annual

Parameter: PM10, PM2.5

Sites: 206 (Earlwood).

Start date: 2015-01-01

End date: 2019-01-01

Categories: Averages

Subcategories: Annual

Frequency: 24h average derived from 1h average

Step 2

Create a text file from the code below and then open the file in the Python shell environment and click F5 to run the code. The Historical Observed Particle Matter (PM10 and PM2.5) air quality data, is written to the `HistoricalPM.txt` file in the working directory file.

```
import os
import sys
import requests
import logging
import urllib
import datetime as dt
import json
#######################################################################################################
class aqms_api_class(object):
    """
    This class defines and configures the api to query the aqms database
    """
    def __init__(self, ):
        self.logger = logging.getLogger(__file__)
        self.url_api = "https://data.airquality.nsw.gov.au"
        self.headers = {'content-type': 'application/json', 'accept': 'application/json'}
        self.get_observations = "/api/Data/get_Observations"
        return
#######################################################################################################
    def get_Obs(self, ObsRequest):
        '''
        Build a query to return all the observation details
        '''
        query = urllib.parse.urljoin(self.url_api, self.get_observations)
        response = requests.post(url = query, data = json.dumps(ObsRequest), headers = self.headers)
        return response
#######################################################################################################
```

```
    def ObsRequest_init(self, ):
        '''
        Build a query to return all historical PM10 and PM2.5 annual averages
        at Earlwood (site id 206)
        '''
        ObsRequest = {}
        ObsRequest['Parameters'] = ['PM10', 'PM2.5']
        ObsRequest['Sites'] = [206]
        StartDate = dt.date(2015,1,1)
        EndDate = dt.date(2019,1,1)
        ObsRequest['StartDate'] = StartDate.strftime('%Y-%m-%d')
        ObsRequest['EndDate'] = EndDate.strftime('%Y-%m-%d')
        ObsRequest['Categories'] = ['Averages']
        ObsRequest['SubCategories'] = ['Annual']
        ObsRequest['Frequency'] = ['24h average derived from 1h average']
        return ObsRequest
#######################################################################################################
if __name__ == '__main__':
    AQMS =  aqms_api_class()
    ObsRequest = AQMS.ObsRequest_init()
    AllHistoricalPM = AQMS.get_Obs(ObsRequest)
    '''
    Save Historical PM10 and PM2.5 obserations at Earlwood to a text file
    '''
    f = open('HistoricalPM.txt', 'w') # open a file in write mode
    for item in AllHistoricalPM:    # iterate over the list items
        item = item.decode("ISO-8859-1") # remove b from check process
        f.write(str(item) + '\n') # write to the file in working directory
    f.close()
#######################################################################################################
```

11. Appendix 4: Data dictionary for air quality data

Table 2 Air Quality data set and descriptions

Data set	Field name	Description	Example	Data type
Site details				
get_SiteDetails	Site ID	Unique ID for each site. To be used as a filter on get_Observations	39	integer
	Site Name	The name of the site.	Rozelle	string
	Longitude	The longitude of the site.	-33.864353	number
	Latitude	The latitude of the site.	151.163933	number
	Region	The region where the site belongs.	Sydney central-east	string
Parameter details				
get_ParameterDetails	Parameter Code	The code for each parameter	SO2	string
	Parameter Description	The description of the parameter.	Sulphur Dioxide	string
	Parameter Units	The units used to measure the parameter	pphm	string
	Unit Description	The description of the unit of measurement	parts per hundred million	string
	Frequency	The frequency at which the parameter is recorded or calculated	Hourly average	string
	Category	The category to which the parameter belongs	Averages	string
Observations				
get_Observations	Site ID	The ID of the site where the value was recorded.	39	integer
	Parameter Code	The code for each parameter	SO2	string
	Parameter Description	The description of the parameter.	Sulphur Dioxide	string
	Parameter Units	The units used to measure the parameter	pphm	string

Data set	Field name	Description	Example	Data type
	Unit Description	The description of the unit of measurement	parts per hundred million	string
	Parameter Frequency	The frequency at which the parameter is recorded or calculated	Hourly average	string
	Parameter Category	The category to which the parameter belongs	Averages	string
	Parameter Sub Category	The sub-category to which the parameter belongs.	Hourly	string
	Date	The date the observed data is collected	2019-10-18	string
	Hour	The hour the observed data is collected. The values are collected every minute and averaged over an hour.	8	string
	Hour Description	The description of the hour. This identifies which hour the data has been collected.	7am – 8am	string
	Value	The recorded/calculated value	0.4	number
	Air Quality Category	Categorisation of each pollutant into Good, Fair, Poor, Very Poor or Extremely Poor.	Fair	string
	Determining pollutant	The pollutant that determines the Site or Regional Air Quality Category.	PM2.5	string