



Quick Guide for Environment Datasets and APIs Use

Version 0.11

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DOCUMENT RELEASE UPDATES

S/n	Date Issue	Version	Amendments
9	17-Mar-2017	Version 0.11	<ul style="list-style-type: none"> Remove NPSI_PM25_3HR
8	12-Oct-2016	Version 0.10	<ul style="list-style-type: none"> Amend PSI PSI Update to indicate that NPSI_PM25_3HR will be discontinued
7	01-Oct-2016	Version 0.9	<ul style="list-style-type: none"> Amend URLs for all datasets from http://www.nea.gov.sg/api/WebAPI/ to http://api.nea.gov.sg/api/WebAPI/
6	21-Mar-2016	Version 0.8	<ul style="list-style-type: none"> Remove weather datasets for <ul style="list-style-type: none"> NowCast (3 Hrs) 12 Hours ForeCast 3 Days Outlook
5	07-Mar-2016	Version 0.7.2b	<ul style="list-style-type: none"> Amend the Datasets XML tags <ul style="list-style-type: none"> 2 Hr ForeCast (amend tag <issue_dateTime> to <forecastIssue/> and <validTime> tags) 24 Hr ForeCast (amend <freeText> <pastweather>)
4	11-Jan-2016	Version 0.7.2a	<ul style="list-style-type: none"> Replace the following datasets <ul style="list-style-type: none"> NowCast (3 Hrs) to NowCast (2 Hrs) 12 Hours ForeCast to 24 Hours Forecast 3 Days Outlook to 4 Days OutLook
3	12-Nov-2015	Version 0.7.2	<ul style="list-style-type: none"> Amend Forecast icon abbreviation for Nowcast dataset from HZ to HA for
2	20-Oct-2015	Version 0.7.1	<ul style="list-style-type: none"> Amend the Forecast icon abbreviation for 3-Days Outlook dataset from FD to FA for Fair
1	20-Jan-2015	Version 0.7	

1. Introduction

The National Environment Agency offers environmental datasets for public use. You can use these APIs to extract the relevant datasets to create, develop and test innovative web or mobile applications.

2. One-time Registration

Before invoking the APIs, user will have to register for API's access at <https://www.nea.gov.sg/api/>. An email will be sent with a nea-authorization-key to be used with the API.

3. Invoking API for the Environmental Data

A Uniform Resource Locator (URL) is required to initiate a request for the Environmental Data sets with the parameters : <data set name> and a <nea-authorization-key>

3.1 URL format

Each set of data is accessible via the URL in the format as illustrated below:

<code>http://api.nea.gov.sg/api/WebAPI/?dataset=<dataset-name>&keyref=<nea-authorization-key></code>
--

3.2 Return Response from the Download Request

Every download request initiated will return a status response of the request to indicate if the request was successful. The following table is a list of possible responses that can be expected.

Table 3 List of System Responses

Response	Response Description
200	The request was completed successfully.
401	nea-authorization-key used was not valid.
404	Data set requested was not available.

3.3 Environmental DataSets

The list of Environmental Data sets available for access and its corresponding URLs are listed in table 1. More details description, the meta data of each dataset and samples of data in XML format are detailed in Appendix A.

S/N	DATA SET	DESCRIPTION/ URL	DATA REFRESH
1	2hr Nowcast	2hr Nowcast dataset provides regional weather forecast for future 2 hours.	Hourly
		<a href="http://api.nea.gov.sg/api/WebAPI/?dataset=2hr_nowcast&keyref=<nea-authorization-key>">http://api.nea.gov.sg/api/WebAPI/?dataset=2hr_nowcast&keyref=<nea-authorization-key>	
2	24 hrs Forecast	24 hrs Forecast dataset provides forecast for future 24 hours.	Hourly
		<a href="http://api.nea.gov.sg/api/WebAPI/?dataset=24hrs_forecast&keyref=<nea-authorization-key>">http://api.nea.gov.sg/api/WebAPI/?dataset=24hrs_forecast&keyref=<nea-authorization-key>	
3	4 days Outlook	4 days outlook dataset provides weather forecast for future 4 days.	Daily
		<a href="http://api.nea.gov.sg/api/WebAPI/?dataset=4days_outlook&keyref=<nea-authorization-key>">http://api.nea.gov.sg/api/WebAPI/?dataset=4days_outlook&keyref=<nea-authorization-key>	
4	Heavy Rain Warning	Warnings of heavy rain	Hourly
		<a href="http://api.nea.gov.sg/api/WebAPI/?dataset=heavy_rain_warning&keyref=<nea-authorization-key>">http://api.nea.gov.sg/api/WebAPI/?dataset=heavy_rain_warning&keyref=<nea-authorization-key>	
5	UV Index	UV Index value averaged over the past hour	Hourly
		<a href="http://api.nea.gov.sg/api/WebAPI/?dataset=uvi&keyref=<nea-authorization-key>">http://api.nea.gov.sg/api/WebAPI/?dataset=uvi&keyref=<nea-authorization-key>	
6	Earthquake Advisory	Recent Earthquake information and advisory in event of an earthquake occurring in the region	Hourly
		<a href="http://api.nea.gov.sg/api/WebAPI/?dataset=earthquake&keyref=<nea-authorization-key>">http://api.nea.gov.sg/api/WebAPI/?dataset=earthquake&keyref=<nea-authorization-key>	
7	PSI Update	PSI readings in Singapore over 5 regions	Hourly
		<a href="http://api.nea.gov.sg/api/WebAPI/?dataset=psi_update&keyref=<nea-authorization-key>">http://api.nea.gov.sg/api/WebAPI/?dataset=psi_update&keyref=<nea-authorization-key>	
8	PM _{2.5} Update	Hourly PM _{2.5} readings in Singapore over 5 regions	Hourly
		<a href="http://api.nea.gov.sg/api/WebAPI/?dataset=pm2.5_update&keyref=<nea-authorization-key>">http://api.nea.gov.sg/api/WebAPI/?dataset=pm2.5_update&keyref=<nea-authorization-key>	

Table 1: List of Datasets and URLs

4. Sample Code Examples

Developers can explore the sample codes provided on the use of APIs to download environmental data using server-side scripting. The examples illustrated are coded in Java and C# as defined in section 4.1.1 and 4.1.2 respectively.

4.1.1 Sample Code in Java

```
private void callWebAPI(String datasetName, String keyref) throws Exception {

    // Step 1: Construct URL
    String url = "http://api.nea.gov.sg/api/WebAPI/?dataset=" + datasetName +
        "&keyref=" + keyref;

    // Step 2: Call API Url
    URL obj = new URL(url);
    HttpURLConnection con = (HttpURLConnection)obj.openConnection();
    con.setRequestMethod("GET");

    int responseCode = con.getResponseCode();
    System.out.println("\nSending 'GET' request to URL : " + url);
    System.out.println("Response Code : " + responseCode);

    // Step 3: Check the response status
    if(responseCode == 200) {
        // Step 3a: If response status == 200
        // print the received xml
        System.out.println(readStream(con.getInputStream()));
    } else {
        // Step 3b: If response status != 200
        // print the error received from server
        System.out.println("Error in accessing API - " +
            readStream(con.getErrorStream()));
    }
}

// Read the responded result
private String readStream(InputStream inputStream) throws Exception {
    BufferedReader reader = new BufferedReader(
        new InputStreamReader(inputStream));

    String inputLine;
    StringBuffer response = new StringBuffer();

    while((inputLine = reader.readLine()) != null) {
        response.append(inputLine);
    }
    reader.close();

    return response.toString();
}
```

4.1.2 Sample Code in C#.NET

```
public static void callWebAPI(string datasetName, string keyref) {  
  
    // Step 1: Construct URL  
    String url = "http://api.nea.gov.sg/api/WebAPI/?dataset=" + datasetName  
                + "&keyref=" + keyref;  
  
    // Step 2: Call API Url  
    HttpWebRequest request = (HttpWebRequest)WebRequest.Create(url);  
    try {  
  
        // Step 2a: If response status == 200  
        HttpWebResponse response = (HttpWebResponse)request.GetResponse();  
  
        Stream receiveStream = response.GetResponseStream();  
        StreamReader readStream = new StreamReader(receiveStream, Encoding.UTF8);  
  
        // print the received xml  
        Console.WriteLine("Response stream received.");  
        Console.WriteLine(readStream.ReadToEnd());  
    }  
    catch (WebException we){  
  
        // Step 2b: If response status != 200  
        Stream receiveStream = we.Response.GetResponseStream();  
        StreamReader readStream = new StreamReader(receiveStream, Encoding.UTF8);  
  
        // print the error received from Server  
        Console.WriteLine("Error Encountered - ");  
        Console.WriteLine(readStream.ReadToEnd());  
    }  
}
```

Appendix A

This appendix contains the description of the XML schema for the data sets with a sample XML data for each dataset.

A.1 2 Hours Nowcast Dataset

The 2 hours Nowcast dataset provides regional weather forecast for future 2 hours.

Fields	Fields Descriptions
Channel	This indicates the channel of this xml file
title	Title of this channel, defaulted to "2 Hour Forecast"
source	Source of this file, defaulted to "Meteorological Services Singapore"
description	Description of this channel, defaulted to "2 hour Forecast "
Item	List of items of this channel
title	Title of this file; defaulted to "Nowcast Table"
category	Category of the data; defaulted to "Singapore Weather Conditions"
forecastIssue	Forecast Issue Information
time	The forecast issued time in "hh:mm AM/PM" format
date	The forecast issued date in "dd-mm-yyyy" format
validTime	Period of forecast "hh:mm AM/PM" format to in "hh:mm AM/PM" format
weatherForecast	Weather forecast for the issued date time
area	Weather forecast of the area
forecast	Refer to the weather abbreviation interpretation in Appendix B.
lat	Approximate Latitude of the area (Decimal degrees - ddd.dddddddd°)
lon	Approximate Longitude of the area (Decimal degrees – ddd.dddddddd°)
name	The name of area where the forecast is made

Sample XML data for 2 Hours Nowcast

```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<channel>
<title>2 Hour Forecast</title>
<source>Meteorological Services Singapore</source>
<description>2 Hour Forecast</description>
<item>
<title>Nowcast Table</title>
<category>Singapore Weather Conditions</category>
<forecastIssue time="10.00 AM" date = "04-02-2015"/>
<validTime >10.00 am to 12:00 pm</validTime>
<area forecast="FA" lat="1.369115" lon="103.845434" name="Ang Mo Kio" />
<area forecast="FA" lat="1.323604" lon="103.927341" name="Bedok" />
<area forecast="FA" lat="1.350772" lon="103.848183" name="Bishan" />
<area forecast="FA" lat="1.33884" lon="103.705546" name="Boon Lay" />
<area forecast="FA" lat="1.359029" lon="103.76368" name="Bukit Batok" />
```



```

<area forecast="FA" lat="1.281905" lon="103.823918" name="Bukit Merah" />
<area forecast="FA" lat="1.377414" lon="103.77195" name="Bukit Panjang" />
<area forecast="FA" lat="1.35" lon="103.783333" name="Bukit Timah" />
<area forecast="FA" lat="1.355153" lon="103.797202" name="Central Water
Catchment" />
<area forecast="FA" lat="1.34501" lon="103.983209" name="Changi" />
<area forecast="FA" lat="1.38398" lon="103.746961" name="Choa Chu Kang" />
<area forecast="FA" lat="1.316181" lon="103.764938" name="Clementi" />
<area forecast="FA" lat="1.286424" lon="103.853288" name="Downtown" />
<area forecast="FA" lat="1.320054" lon="103.891775" name="Geylang" />
<area forecast="FA" lat="1.361218" lon="103.886253" name="Hougang" />
<area forecast="FA" lat="1.359222" lon="103.694178" name="Jalan Bahar" />
<area forecast="FA" lat="1.334308" lon="103.741958" name="Jurong East" />
<area forecast="FA" lat="1.275963" lon="103.676796" name="Jurong Island"
/>
<area forecast="FA" lat="1.34039" lon="103.708988" name="Jurong West" />
<area forecast="FA" lat="1.306797" lon="103.867536" name="Kallang" />
<area forecast="FA" lat="1.430494" lon="103.717332" name="Lim Chu Kang" />
<area forecast="FA" lat="1.410415" lon="103.780932" name="Mandai" />
<area forecast="FA" lat="1.301969" lon="103.897082" name="Marine Parade"
/>
<area forecast="FA" lat="1.320857" lon="103.842432" name="Novena" />
<area forecast="FA" lat="1.372518" lon="103.949516" name="Pasir Ris" />
<area forecast="FA" lat="1.318089" lon="103.892982" name="Paya Lebar" />
<area forecast="FA" lat="1.308169" lon="103.665082" name="Pioneer" />
<area forecast="FA" lat="1.414272" lon="104.038673" name="Pulau Tekong" />
<area forecast="FA" lat="1.412592" lon="103.957908" name="Pulau Ubin" />
<area forecast="FA" lat="1.398446" lon="103.907205" name="Punggol" />
<area forecast="FA" lat="1.294096" lon="103.78576" name="Queenstown" />
<area forecast="FA" lat="1.418987" lon="103.865844" name="Seletar" />
<area forecast="FA" lat="1.449111" lon="103.818495" name="Sembawang" />
<area forecast="FA" lat="1.386812" lon="103.891443" name="Sengkang" />
<area forecast="FA" lat="1.249404" lon="103.830321" name="Sentosa" />
<area forecast="FA" lat="1.355357" lon="103.867871" name="Serangoon" />
<area forecast="FA" lat="1.222101" lon="103.854597" name="Southern
Islands" />
<area forecast="FA" lat="1.407382" lon="103.756192" name="Sungei Kadut" />
<area forecast="FA" lat="1.349591" lon="103.956788" name="Tampines" />
<area forecast="FA" lat="1.298711" lon="103.81814" name="Tanglin" />
<area forecast="FA" lat="1.355406" lon="103.731086" name="Tengah" />
<area forecast="FA" lat="1.334304" lon="103.856327" name="Toa Payoh" />
<area forecast="FA" lat="1.294947" lon="103.630483" name="Tuas" />
<area forecast="FA" lat="1.205926" lon="103.77074" name="Western Islands" />
<area forecast="FA" lat="1.382306" lon="103.696325" name="Western Water
Catchment" />
<area forecast="FA" lat="1.437043" lon="103.786528" name="Woodlands" />
<area forecast="FA" lat="1.429463" lon="103.835182" name="Yishun" />
</weatherForecast>
</item>
</channel>

```

A.2 24 Hours Forecast Dataset

24 hours Forecast dataset provides forecast for future 24 hours, generated 3 to 4 times a day. The dataset includes:

- i. The forecast issue date and time and forecasted weather

- ii. The forecasted temperature, relative humidity, wind direction
- iii. Based on the forecasted issue date and time, the data also include the weather forecast for Morning, Afternoon, and Night by region in Singapore
- iv. A next night weather forecast will be included if the forecast issue date and time is in the early morning, to provide the weather forecast of the next night

Fields	Fields Descriptions
Channel	This indicates the channel of this xml file
title	Title of this channel, defaulted to "Singapore - Nowcast and Forecast"
source	Source of this file, defaulted to "Meteorological Services Singapore"
main	The main forecast for this channel
title	Title of this file, defaulted to "24 Hour Forecast"
forecastIssue	Forecast Issue Information
date	The forecast issued date in "dd-mm-yyyy" format
time	The forecast issued time in "hh:mi AM/PM" format
temperature	Temperature
high	The highest temperature forecast
low	The lowest temperature forecast
unit	The unit of the temperature measured in "Degrees Celsius"
relativeHumidity	Relative Humidity
high	The highest relative humidity forecast
low	The lowest relative humidity forecast
unit	The unit of relative humidity, measured in "Percentage"
Wind	Wind
direction	The direction of the wind
speed	The speed of the wind
wxmain	Abbreviation of the weather forecast for Singapore as a whole Refer to the weather abbreviation interpretation in Appendix B.
forecast	The weather forecast for Singapore as a whole
pastweather	Free text
night	The weather forecast for the night period. Note that the sequence of the <night>, <morn>, <afternoon> may change depending on the date & time of the <forecastIssue>.
timePeriod	The time period of the night under forecast.
wxeast	Weather conditions over the Eastern part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxwest	Weather conditions over the Western part of Singapore.

Fields	Fields Descriptions
	Refer to the weather abbreviation interpretation in Appendix B.
wxnorth	Weather conditions over the Northern part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxsouth	Weather conditions over the Southern part of Singapore Refer to the weather abbreviation interpretation in Appendix B.
wxcentral	Weather conditions over in the Central part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
morn	The weather forecast for the morning period. Note that the sequence of the <night>, <morn>, <afternoon> may change depending on the date & time of the <forecastIssue>.
timePeriod	The time period of the morning under forecast.
wxeast	Weather conditions over the Eastern part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxwest	Weather conditions over the Western part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxnorth	Weather conditions over the Northern part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxsouth	Weather conditions over the Southern part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxcentral	Weather conditions over in the Central part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
afternoon	The weather forecast for the afternoon period. Note that the sequence of the <night>, <morn>, <afternoon> may change depending on the date & time of the <forecastIssue>.
timePeriod	The time period of the afternoon under forecast.
wxeast	Weather conditions over the Eastern part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxwest	Weather conditions over the Western part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxnorth	Weather conditions over the Northern part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxsouth	Weather conditions over the Southern part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxcentral	Weather conditions over in the Central part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
nextnight	The weather forecast for the following night period. Note that the <nextnight> is not always available as it is dependent on the date & time of the <forecastIssue>.

Fields	Fields Descriptions
timePeriod	The time period of the next night under forecast.
wxeast	Weather conditions over the Eastern part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxwest	Weather conditions over the Western part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxnorth	Weather conditions over the Northern part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxsouth	Weather conditions over the Southern part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.
wxcentral	Weather conditions over in the Central part of Singapore. Refer to the weather abbreviation interpretation in Appendix B.

Sample XML data for 24 Hours Forecast Dataset

```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<channel>
  <title>Singapore - Nowcast and Forecast</title>
  <source>Meteorological Services Singapore</source>
  <main>
    <title>24 Hour Forecast</title>
    <forecastIssue date="05-02-2015" time="01:03 AM" />
    <temperature high="32" low="26" unit="Degrees Celsius" />
    <relativeHumidity high="85" low="55" unit="Percentage" />
    <wind direction="NNE" speed="5-15" />
    <wxmain>WD</wxmain>
    <forecast>Fair and occasionally windy.</forecast>
    <pastweather>Nil</pastweather>
  </main>
  <night>
    <timePeriod>Midnight to 6AM 06Feb</timePeriod>
    <wxeast>WD</wxeast>
    <wxwest>WD</wxwest>
    <wxnorth>WD</wxnorth>
    <wxsouth>WD</wxsouth>
    <wxcentral>WD</wxcentral>
  </night>
  <morn>
    <timePeriod>6.00 AM to Midday 06Feb</timePeriod>
    <wxeast>WD</wxeast>
    <wxwest>WD</wxwest>
    <wxnorth>WD</wxnorth>
    <wxsouth>WD</wxsouth>
    <wxcentral>WD</wxcentral>
  </morn>
  <afternoon>
    <timePeriod>Midday to 6:00 PM 06Feb</timePeriod>
    <wxeast>WD</wxeast>
```

```
<wxwest>WD</wxwest>
<wxnorth>WD</wxnorth>
<wxsouth>WD</wxsouth>
<wxcentral>WD</wxcentral>
</afternoon>
<nextnight>
  <timePeriod>6:00 PM to Midnight 07Feb</timePeriod>
  <wxeast>WD</wxeast>
  <wxwest>WD</wxwest>
  <wxnorth>WD</wxnorth>
  <wxsouth>WD</wxsouth>
  <wxcentral>WD</wxcentral>
</nextnight>
</channel>
```

A.3 4-Days Outlook Dataset

4 Days Outlook dataset provides weather forecast for future 4 days.

Fields	Field Descriptions
Channel	This indicates the channel of this xml file
title	Title of this channel, defaulted to "Singapore - Nowcast and Forecast"
source	Source of this file, defaulted to "Meteorological Services Singapore"
Item	List of items of this channel
title	Title of this file, defaulted to "4 Day Forecast"
forecastIssue	The date and time of the issue of the weather forecast
date	The issue date of forecast, in "dd-mmm-yyyy" format
time	The issue time of forecast, in "hh:mi AM/PM" format
weatherForecast	The weather forecast details
day	Day 1 of the forecast (e.g.: Saturday)
forecast	Weather forecast of Singapore for day 1
icon	The forecast icon for this day. Refer to Appendix B for interpretation of the icon.
temperature	Temperature forecast
high	The highest temperature forecast
low	The lowest temperature forecast
unit	The unit of temperature, measured in "Degrees Celsius"
relativeHumidity	Relative Humidity
high	The highest relative humidity forecast
low	The lowest relative humidity forecast
unit	The unit of relative humidity, measured in "Percentage"
wind	Wind
direction	The direction of the wind
speed	The speed of the wind
day	Day 2 of the forecast (e.g.: Sunday)
forecast	Weather forecast of Singapore for day 2
icon	The forecast icon for this day. Refer to Appendix B for interpretation of the icon.
temperature	Temperature forecast
high	The highest temperature forecast
low	The lowest temperature forecast
unit	The unit of temperature, measured in "Degrees Celsius"

relativeHumidity	Relative Humidity
high	The highest relative humidity forecast
low	The lowest relative humidity forecast
unit	The unit of relative humidity, measured in “Percentage”
wind	Wind
direction	The direction of the wind
speed	The speed of the wind
day	Day 3 of the forecast (e.g.: Monday)
forecast	Weather forecast of Singapore for day 3
icon	The forecast abbreviation.
temperature	Temperature forecast
high	The highest temperature forecast
low	The lowest temperature forecast
unit	The unit of temperature, measured in “Degrees Celsius”
relativeHumidity	Relative Humidity
high	The highest relative humidity forecast
low	The lowest relative humidity forecast
unit	The unit of relative humidity, measured in “Percentage”
wind	Wind
direction	The direction of the wind
speed	The speed of the wind
day	Day 4 of the forecast (e.g.: Tuesday)
forecast	Weather forecast of Singapore for day 4
icon	The forecast icon for this day. Refer to Appendix B for interpretation of the icon.
temperature	Temperature forecast
high	The highest temperature forecast
low	The lowest temperature forecast
unit	The unit of temperature, measured in “Degrees Celsius”
relativeHumidity	Relative Humidity
high	The highest relative humidity forecast
low	The lowest relative humidity forecast
unit	The unit of relative humidity, measured in “Percentage”
wind	Wind

direction	The direction of the wind
speed	The speed of the wind

Sample XML data for 4-Days Outlook

```
<?xml version="1.0" encoding="UTF-8" standalone="no" ?>
<channel>
  <title>Singapore - Nowcast and Forecast</title>
  <source>Meteorological Services Singapore</source>
  <item>
    <title>4 Day Forecast</title>
    <forecastIssue date="04-Feb-2015" time="10:38 AM" />
    <weatherForecast>
      <day>Wednesday</day>
      <forecast>Fair</forecast>
      <icon>FA</icon>
      <temperature high="32" low="23" unit=" Degrees Celsius " />
      <relativeHumidity high="95" low="55" unit="Percentage" />
      <wind direction="N" speed="5-15" />
      <day>Thursday</day>
      <forecast>Rain</forecast>
      <icon>SH</icon>
      <temperature high="32" low="23" unit=" Degrees Celsius " />
      <relativeHumidity high="90" low="50" unit="Percentage" />
      <wind direction="NE" speed="10-20" />
      <day>Friday</day>
      <forecast>Partly Cloudy</forecast>
      <icon>PD</icon>
      <temperature high="32" low="23" unit=" Degrees Celsius " />
      <relativeHumidity high="85" low="45" unit="Percentage" />
      <wind direction="E" speed="15-25" />
      <day>Saturday</day>
      <forecast>Fair</forecast>
      <icon>FA</icon>
      <temperature high="32" low="23" unit=" Degrees Celsius " />
      <relativeHumidity high="80" low="40" unit="Percentage" />
      <wind direction="W" speed="20-25" />
    </weatherForecast>
  </item>
</channel>
```


A.4 Heavy Rain Warning

Heavy Rain Warning dataset provides warning for heavy rain and includes the following information:

- i. Rain area image
- ii. Satellite image of rain area

Fields	Field Descriptions
Channel	This indicates the channel of this xml file
title	Title of this channel, defaulted to “Heavy Rain Warning”
source	Source of this file, defaulted to “Meteorological Services Division”
Item	List of items of this channel
title	Title of this file, defaulted to “HEAVY RAIN WARNING”
Issue_datentime	The issue date and timestamp, in “yyyy-mm-dd hh:mm:ss” format
Warning	The heavy rain warning message
Rain_area_image *	Image of rain area
Metadata	Metadata of the image, in Base64 format
Satellite_area_image *	Satellite image of rain area
Metadata	Metadata of the satellite image, in Base64 format

* Note: Currently, there will be no data provision of Rain_area_Image

Sample XML data for Heavy Rain Warning

```
<?xml version='1.0' encoding='iso-8859-2' ?>
<channel>
  <title>Heavy Rain Warning</title>
  <source>Meteorological Service Singapore</source>
  <item>
    <title>HEAVY RAIN WARNING</title>
    <issue_datentime>2013-10-14 21:56:05</issue_datentime>
    <warning>NIL</warning>
  </item>
  <rain_area_image>
    <metadata>
    </metadata>
  </rain_area_image>
  <satellite_image>
    <metadata>
    </metadata>
  </satellite_image>
</channel>
```

A.5 UV Index

Ultraviolet (UV) Index dataset provides UV Index value averaged over the past hour.

Fields	Field Descriptions
uvindex	The start tag for UVI Index.
date	Date of the UV index in “dd-mmm-YYYY” format.
data*	List of UV data for the day.
uv	UV index for the day and hour.
hr	Hour of the day in “HHam” or “HHpm” format.

*Note: This <data> section will updated with each hour, between 7am and 7pm for the <date>.

Sample XML data for UV Index

```
<?xml version="1.0" encoding="UTF-8"?>
<uvindex>
<date>15 Jan 2015</date>
<data>
<uv hr="05pm">4</uv>
<uv hr="04pm">7</uv>
<uv hr="03pm">9</uv>
<uv hr="02pm">10</uv>
<uv hr="01pm">10</uv>
<uv hr="12pm">7</uv>
<uv hr="11am">4</uv>
<uv hr="10am">2</uv>
<uv hr="09am">0</uv>
<uv hr="08am">0</uv>
<uv hr="07am">0</uv>
</data>
</uvindex>
```

A.6 Earthquake Advisory

Earthquake Advisory dataset provides the following information:

- i. Earthquake details
- ii. Earthquake location in image
- iii. External links about earthquake
- iv. Recent reported earthquake

Fields	Field Descriptions
Channel	This indicates the channel of this xml file
Title	Title of this channel, defaulted to "Singapore - Latest Earthquake Activity"
Source	Source of this channel defaulted to "Meteorological Services Division, NEA"
Item	List of items of this channel
Title	Title of this file, defaulted to "Regional Earthquake Alert"
update	The earthquake alert information
note	The note provided for additional information
details	The details of earthquake activity
report	Reports of earthquake activity, if any
earthquake details	The earthquake details
magnitude	The magnitude of earthquake
coordinate_of_epicenter	The coordinate of epicenter of the earthquake, in "degree N degree E" format
estimated_depth	The estimated depth of earthquake, measured in "km"
location	The location of the earthquake
detected_at	The date and timestamp that earthquake is detected
assessment	Assessment of tsunami threat
image	The image showing earthquake location
metadata	The metadata of earthquake image, in Base64 format
external_links	External links of earthquake and tsunami information
tsunami_bulletins	Tsunami bulletins
ptwc	Link to PTWC bulletin
url	The url link of the bulletin
name	The name of the bulletin (places name)
jma	Link to JMA bulletin
url	The url link of the bulletin
name	The name of the bulletin
Earthquake_bulletins	Earthquake bulletin
us_geo_survey	Bulletin from USGS
url	The url link of the bulletin
name	The name of the bulletin

Earthquake_safety_tips	Earthquake safety tips
url	The url link of earthquake safety tips
name	The name of earthquake safety tips
Tsunami_safety_tips	Tsunami safety tips
url	The url link of tsunami safety tips
name	The name of tsunami safety tips
recent_reported_earthquake	The recent reported earthquake details
report	The report of recent earthquake
east_to	Longitude of eastern boundary of domain
east_from	Longitude of western boundary of domain
south	Latitude of lower boundary of domain
north	Latitude of upper boundary of domain
description	The description of the report
details	The details of recent earthquake
region	The region of recent earthquake
magnitude	The magnitude of recent earthquake
latitude	The latitude of recent earthquake
degrees	The degrees of latitude
direction	The direction of latitude
longitude	The longitude of recent earthquake
degrees	The degrees of longitude
direction	The direction of longitude
singapore_time	Singapore time when earthquake happened, in "dd month yyyy at hh:mmAM/PM" format
pixel_values	Pixel values
image	The image of recent earthquake
metadata	The metadata of recent earthquake image, in Base64 format
update_datetime	The date and timestamp of records updated, in "dd month yyyy at hh:mmAM/PM" format

Sample XML data for Earthquake Advisory

```
<?xml version="1.0" encoding="iso-8859-2" ?>
<channel>
  <title>Singapore - Latest Earthquake Activity </title>
  <source>Meteorological Service Division, NEA</source>
  <item>
    <title>Regional Earthquake Alert</title>
    <update>Latest update of earthquake of magnitude 5.5 or above detected
      within the region bounded by 20 North - 10 South, 90 East - 130
      East.
    </update>
    <note>Information will be updated upon availability of new data.
      Estimation of the earthquake magnitude may differ from other
      centres, due to varying factors in its determination
    </note>
```

```

<details>
  <report>
</report>
  <earthquake_details>
    <magnitude>5.65</magnitude>
    <coordinate_of_epicenter>1.32 North, 128.21 East
  </coordinate_of_epicenter>
    <estimated_depth>70.0km
  </estimated_depth>
    <location>HALMAHERA Approximately 1447km ESE from Kota Kinabalu,
      2716km E from Singapore </location>
    <detected_at>04 October 2013 at 20:44 (Singapore Time)
  </detected_at>
    <assessment>No tsunami threat to Singapore</assessment>
  </earthquake_details>
  <image>
    <metadata>
iVBORw0KGgoAAAASUgAAAYAAAAJYCAyAAAHtcblmAAAgAE1EQVR4nOydelxUdf7/n4
AwNNxkEMwBFvEu3lHBbmYBiPl1Sbnaql3MihR1yza1TXHS2nrLdkyS82SLDRbNS9AmeY
qqCTlDWTWQRYcEAeUyAiPw++PM58M5MwOi1Xf3j9/r8eDBXM6ZOfn5n8/7fnGiYV4D/x//
FTQwDyfm3siktcVMWhsrACHgRzbkcyUX7VMVqVTCkQolNqdcDT8Q5EEQhiUzvgxAzVMvm
6F+lWVD+X3D23yz8rP8vuFty34CJf3zqSwbSkPzfVovvE3sKx9PwK+XJECKOmNtZZBBBh
lkkEEGWSQwRmECNWWzwHpc4Rq7Wd1u65PtZ3Xff3g/wBPAHaPk2NPBgAAAABJRu5ErkJ
ggg==
    </metadata>
  </image>
</details>
  <external_links>
    <tsunami_bulletins>
      <ptwc url="http://www.prh.noaa.gov/ptwc/" name="Hawaii" />
      <jma url="http://www.jma.go.jp/en/tsunami/" name="Japan
Meteorological Agency" />
    </tsunami_bulletins>
    <earthquake_bulletins>
      <us_geo_survey
url="http://earthquake.usgs.gov/earthquakes/map/" name="US Geological
Survey"
      />
    </earthquake_bulletins>
    <earthquake_safety_tips
url="http://www.scdf.gov.sg/content/dam/scdf_inter/download/Publication/eBoo
k_English.pdf" name="Earthquake Safety Tips"
    />
    <tsunami_safety_tips
url="http://www.scdf.gov.sg/content/scdf_internet/en/community-and-
volunteers/publications/_jcr_content/par/download_cdc1/file.res/EmergencyHan
dbook2010Edition_english.pdf" name="Tsunami Safety Tips"
    />
  </external_links>
  <recent_reported_earthquake>
    <report east_to="180" east_from="60" south="50" north="60"
description="Recent earthquakes of magnitude 6.0 or above
detected within the region bounded by" />
    <details>
      <region>KERMADEC ISLANDS REGION</region>
      <magnitude>6.1</magnitude>
      <latitude>

```

```

        <degrees>29.11</degrees>
        <direction>S</direction>
    </latitude>
    <longitude>
        <degrees>179.56</degrees>
        <direction>E</direction>
    </longitude>
    <singapore_time>04 October 2013 at 01:33AM</singapore_time>
    <pixel_values>836,623,5</pixel_values>
</details>
<image>
    <metadata>
        iVBORw0KGgoAAAANSUhEUgAAA0gAAAMCCAYAAAEkI9ZHAAAgAE1EQVR4nOydeXgU
        Vdb/P01WQxJIQgI0IASBsO8EUWCUJB0ERAQHURHxh6CoLCO4EAXCEBADA+KYUeQV
        kFFcAEFAIknUFwaBlWmFrGSWn91VgY5OfVzQtUa6/Hei4TJe+vAhZZv5iTc2GWz9
        xVYTGRERB8BsMvfCwrtDtrPXade8TASrtDoseFlcJDfz22TXR+usOR27b3H5LuU1
        EqcQkUlafqdsW0gZDYFVUaGcAawy/de4/wGsMrbROrtNVidfzu6xLly4cOHChQsX
        Lly4cOEU/x/fZicwkuC0QAAAAABJRU5ErkJggg==
    </metadata>
</image>
</recent_reported_earthquake>
<update_datentime>
    Page last modified on 04 October 2013 at 08:55PM (Singapore
Time).
    </update_datentime>
</item>
</channel>

```

A.7 PSI Update

PSI Update dataset provides overall and regional PSI data and includes the following information:

- i. 24-hr PSI
- ii. 3-hr PSI
- iii. Pollutant Concentration and Sub-index.

Fields	Field Descriptions
Channel	This indicates the channel of this xml file
Title	Title of this file, defaulted to "PSI Update"
Source	Source of this channel, defaulted to "AirViro"
Item	List of items of this channel
Region	Regional PSI information
Id	Abbreviation for regional code where: : <ul style="list-style-type: none"> - NRS for National Reporting Stations - rNO for North Region - rSO for South Region - rCE for Central Region - rWE for West Region - rEA for East Region
Latitude	The latitude of the region area (Decimal degrees - ddd.ddddd°), for display purpose
Longitude	The longitude of the region area (Decimal degrees - ddd.ddddd°), for display purpose
record timestamp	The date timestamp of the record, in "yyyymmhhmmss" format
Reading	The reading type and value information of air pollutants
Value	The reading of the corresponding type.
Type	The type of reading, interpreted as: <ul style="list-style-type: none"> - NPSI for 24-hr PSI - NO2_1HR_MAX for 1-hr NO₂ concentration, measured in "µg/m³" - PM10_24HR for 24-hrs PM₁₀ concentration, measured in "µg/m³" - PM25_24HR for 24-hrs PM_{2.5} concentration, measured in "µg/m³" - SO2_24HR for 24-hrs SO₂ concentration, measured in "µg/m³" - CO_8HR_MAX for 8-hrs CO concentration, measured in "mg/m³" - O3_8HR_MAX for 8-hrs O₃ concentration, measured in "µg/m³" - NPSI_CO for CO sub-index - NPSI_NO2 for NO₂ sub-index - NPSI_O3 for O₃ sub-index - NPSI_PM10 for PM₁₀ sub-index - NPSI_PM25 for PM_{2.5} sub-index - NPSI_SO2 for SO₂ sub-index

Sample XML data for PSI Update

```
<?xml version="1.0" encoding="utf-8" ?>
<channel>
<title>PSI Update</title>
<source>Airviro</source>
<item>
  <region>
    <id>rNO</id>
    <latitude>1.41803</latitude>
    <longitude>103.82000</longitude>
    <record timestamp="20150120170000">
      <reading value="53" type="NPSI"/>
      <reading value="28" type="NO2_1HR_MAX"/><reading
value="29" type="PM10_24HR"/>
      <reading value="14" type="PM25_24HR"/>
      <reading value="10" type="SO2_24HR"/>
      <reading value="0.34" type="CO_8HR_MAX"/>
      <reading value="45" type="O3_8HR_MAX"/>
      <reading value="3" type="NPSI_CO"/>
      <reading value="19" type="NPSI_O3"/>
      <reading value="29" type="NPSI_PM10"/>
      <reading value="53" type="NPSI_PM25"/>
      <reading value="6" type="NPSI_SO2"/>
    </record>
  </region>
  <region>
    <id>NRS</id>
    <latitude>0</latitude>
    <longitude>0</longitude>
    <record timestamp="20150120170000">
      <reading value="58" type="NPSI"/>
      <reading value="28" type="NO2_1HR_MAX"/>
      <reading value="37" type="PM10_24HR"/>
      <reading value="18" type="PM25_24HR"/>
      <reading value="11" type="SO2_24HR"/>
      <reading value="0.39" type="CO_8HR_MAX"/>
      <reading value="71" type="O3_8HR_MAX"/>
      <reading value="4" type="NPSI_CO"/>
      <reading value="30" type="NPSI_O3"/>
      <reading value="37" type="NPSI_PM10"/>
      <reading value="58" type="NPSI_PM25"/>
      <reading value="7" type="NPSI_SO2"/>
    </record>
  </region>
  <region>
    <id>rCE</id>
    <latitude>1.35735</latitude>
    <longitude>103.82000</longitude>
    <record timestamp="20150120170000">
      <reading value="53" type="NPSI"/>
      <reading value="18" type="NO2_1HR_MAX"/>
      <reading value="34" type="PM10_24HR"/>
      <reading value="14" type="PM25_24HR"/>
      <reading value="8" type="SO2_24HR"/>
      <reading value="0.28" type="CO_8HR_MAX"/>
    </record>
  </region>
</item>
</channel>
</source>
</title>
</channel>
```



```

        <reading value="71" type="O3_8HR_MAX"/>
        <reading value="3" type="NPSI_CO"/>
        <reading value="30" type="NPSI_O3"/>
        <reading value="34" type="NPSI_PM10"/>
        <reading value="53" type="NPSI_PM25"/>
        <reading value="5" type="NPSI_SO2"/>
    </record>
</region>
<region>
    <id>rEA</id>
    <latitude>1.35735</latitude>
    <longitude>103.94000</longitude>
    <record timestamp="20150120170000">
        <reading value="56" type="NPSI"/>
        <reading value="6" type="NO2_1HR_MAX"/>
        <reading value="27" type="PM10_24HR"/>
        <reading value="17" type="PM25_24HR"/>
        <reading value="6" type="SO2_24HR"/>
        <reading value="0.30" type="CO_8HR_MAX"/>
        <reading value="71" type="O3_8HR_MAX"/>
        <reading value="3" type="NPSI_CO"/>
        <reading value="30" type="NPSI_O3"/>
        <reading value="27" type="NPSI_PM10"/>
        <reading value="56" type="NPSI_PM25"/>
        <reading value="4" type="NPSI_SO2"/>
    </record>
</region>
<region>
    <id>rWE</id>
    <latitude>1.35735</latitude>
    <longitude>103.70000</longitude>
    <record timestamp="20150120170000">
        <reading value="58" type="NPSI"/>
        <reading value="7" type="NO2_1HR_MAX"/>
        <reading value="36" type="PM10_24HR"/>
        <reading value="18" type="PM25_24HR"/>
        <reading value="2" type="SO2_24HR"/>
        <reading value="0.39" type="CO_8HR_MAX"/>
        <reading value="68" type="O3_8HR_MAX"/>
        <reading value="4" type="NPSI_CO"/>
        <reading value="29" type="NPSI_O3"/>
        <reading value="36" type="NPSI_PM10"/><reading value="58"
type="NPSI_PM25"/>
        <reading value="1" type="NPSI_SO2"/>
    </record>
</region>
<region>
    <id>rSO</id>
    <latitude>1.29587</latitude>
    <longitude>103.82000</longitude>
    <record timestamp="20150120170000">
        <reading value="57" type="NPSI"/>
        <reading value="4" type="NO2_1HR_MAX"/>
        <reading value="37" type="PM10_24HR"/>
        <reading value="17" type="PM25_24HR"/>
        <reading value="11" type="SO2_24HR"/>
        <reading value="0.34" type="CO_8HR_MAX"/>

```

```
        <reading value="52" type="O3_8HR_MAX"/>
        <reading value="3" type="NPSI_CO"/>
        <reading value="22" type="NPSI_O3"/>
        <reading value="37" type="NPSI_PM10"/>
        <reading value="57" type="NPSI_PM25"/>
        <reading value="7" type="NPSI_SO2"/>
    </record>
</region>
</item>
</channel>
```

A.8 PM_{2.5} Update

PM_{2.5} Update dataset provides regional hourly PM_{2.5} concentration.

Fields	Field Descriptions
Channel	This indicates the channel of this xml file
title	Title of this file, defaulted to "PM2.5 Update"
source	Source of this channel, defaulted to "AirViro"
Item	List of items of this channel
region	Region with PM _{2.5} details
id	Abbreviation for region code where rNO for North Region - rSO for South Region - rCE for Central Region - rWE for West Region - rEA for East Region
latitude	The latitude of the region area (Decimal degrees - ddd.ddddd°), for display purpose only
longitude	The longitude of the region area (Decimal degrees - ddd.ddddd°), for display purpose only
record timestamp	The date and timestamp of the record, in "yyyymmhhmmss" format
reading	The reading type and value of the region.
value	The regional 1-hr PM _{2.5} reading
type	The type of reading, interpreted as: - PM25_RGN_1HR for regional 1-hr PM _{2.5} measured in "µg/m ³ "

Sample XML data for PM_{2.5} Update

```
<?xml version="1.0" encoding="utf-8" ?>
<channel>
  <title>PM2.5 Update</title>
  <source>Airviro</source>
  <item>
    <region>
      <id>rNO</id>
      <latitude>1.418</latitude>
      <longitude>103.82</longitude>
      <record timestamp="20141021100000">
        <reading value="10.23" type="PM25_RGN_1HR" />
      </record>
    </region>
    <region>
      <id>rSO</id>
      <latitude>1.296</latitude>
      <longitude>103.82</longitude>
      <record timestamp="20141021100000">
        <reading value="9.12" type="PM25_RGN_1HR" />
      </record>
    </region>
  </item>
</channel>
```

```

</region>
<region>
  <id>rCE</id>
  <latitude>1.357</latitude>
  <longitude>103.82</longitude>
  <record timestamp="20141021100000">
    <reading value="12.33" type="PM25_RGN_1HR" />
  </record>
</region>
<region>
  <id>rWE</id>
  <latitude>1.357</latitude>
  <longitude>103.7</longitude>
  <record timestamp="20141021100000">
    <reading value="7.23" type="PM25_RGN_1HR" />
  </record>
</region>
<region>
  <id>rEA</id>
  <latitude>1.357</latitude>
  <longitude>103.94</longitude>
  <record timestamp="20141021100000">
    <reading value="9.23" type="PM25_RGN_1HR" />
  </record>
</region>
</item>
</channel>

```

Note: for Display of 1-hr PM2.5 with Range and Banding values

For 1-hr PM2.5 range, you will need to read values from the **PM2.5_Update** dataset for the 5 different regions.

1-hr PM2.5 range will be the lowest to the highest value PM25_RGN_1HR values.

The banding values can be referred here <http://www.haze.gov.sg/air-quality-information>

- If 1-hr PM2.5 range falls between 2 different banding ranges e.g. 33-151, banding will be reflected as (I-III)
- if 1-hr PM2.5 range falls within the same banding range e.g. 8-33, banding will be reflected as (I)

Appendix B

B.1 List of weather forecast Abbreviations Used:

Weather Forecast Abbreviation used in XML	Interpretation
BR	Mist
CL	Cloudy
DR	Drizzle
FA	Fair (Day)
FG	Fog
FN	Fair (Night)
FW	Fair & Warm
HG	Heavy Thundery Showers with Gusty Winds
HR	Heavy Rain
HS	Heavy Showers
HT	Heavy Thundery Showers
HZ	Hazy
LH	Slightly Hazy
LR	Light Rain
LS	Light Showers
OC	Overcast
PC	Partly Cloudy (Day)
PN	Partly Cloudy (Night)
PS	Passing Showers
RA	Moderate Rain
SH	Showers
SK	Strong Winds, Showers
SN	Snow
SR	Strong Winds, Rain
SS	Snow Showers
SU	Sunny
SW	Strong Winds
TL	Thundery Showers
WC	Windy, Cloudy
WD	Windy
WF	Windy, Fair
WR	Windy, Rain
WS	Windy, Showers

