

# Manufacturing Analytics With Weather

Thursday, May 14, 2020

Manufacturers need to quickly identify the reasons why there are high amounts of scrap rate to save money and deliver quality product. This demonstration shows how weather was the key driver leading to reducing scrap rate using statistical analysis and dashboards using Cloud Pak For Data (CP4D).

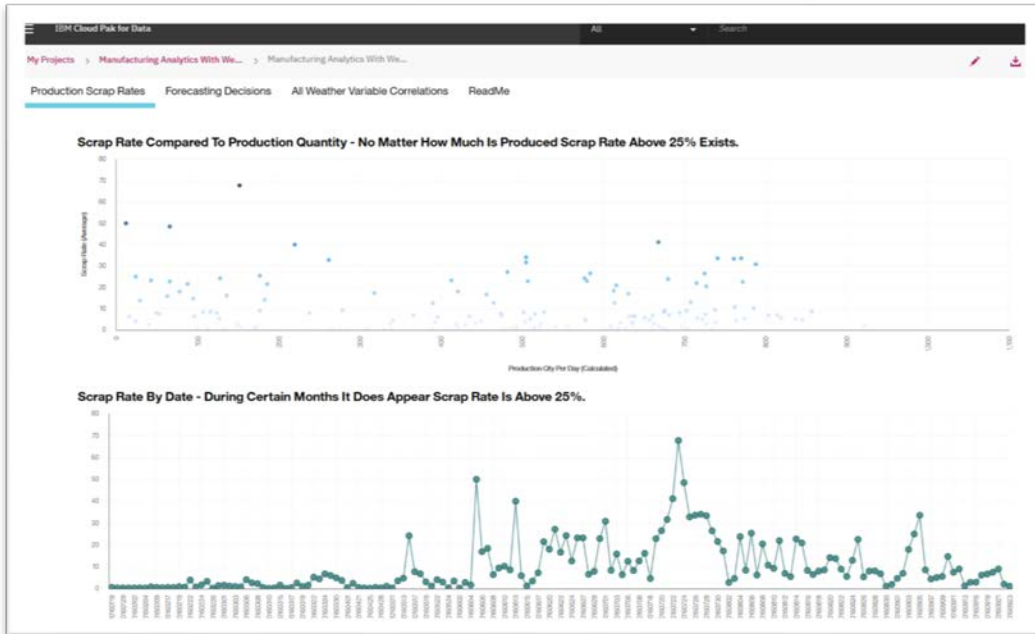
## What's Included?

- 6 csv files
  - ***Prod\_Data.csv*** – mocked up sample historical production data
  - ***WeatherHistory.csv*** – mocked up sample historical weather data
  - ***Scrap\_Data.csv*** – mocked up sample historical scrap rate
  - ***All Weather and Manufacturing Data.csv*** – mocked up historical weather and production data to determine what the weather was at a particular point in time when scrap occurred.
  - ***Manufacturing Weather Forecasts.csv*** – mocked up weather forecast data
  - ***Scrap Rate By Time.csv*** – mocked up historical scrap rate over time
- SPSS Modeler Stream 18.1.1
  - ***Scrap\_Analysis\_Daily\_Official.str***
- 1 Embedded Dashboard
  - ***Manufacturing\_Analytics\_With\_Weather\_Dashboard.json***
- Recording on IBM Community page. **WATCH THIS FIRST!!!**

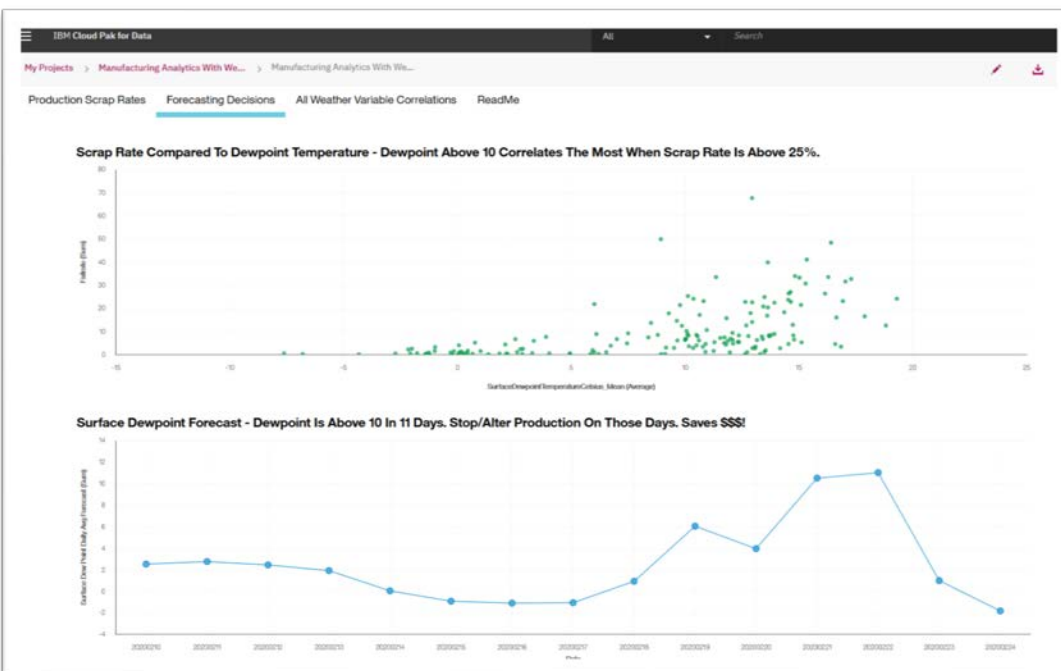
## How does it work?

The dashboard shows that unless one considers the use of weather and statistical analysis, it is difficult to determine the reasons why large amounts of scrap rate exist.

The first tab shows that scrap is not a matter of how much you produce, nor is it really about time of year although it does appear that the summer and spring months are times of the year where higher scrap rate exists but we still don't know why.

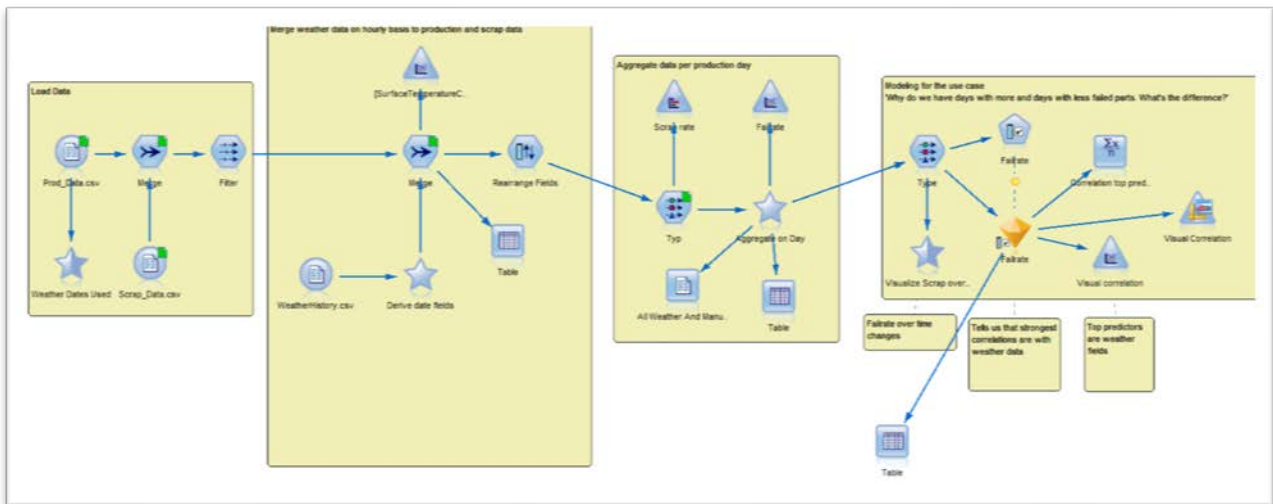


The second tab shows the high correlation of dewpoint to scrap rate and the third tab some other correlation results. Back on the second tab, we see that the forecast calls for dewpoint above 10, therefore, the schedule should be changed to make another product that day or re-allocate resources where more production can be done.

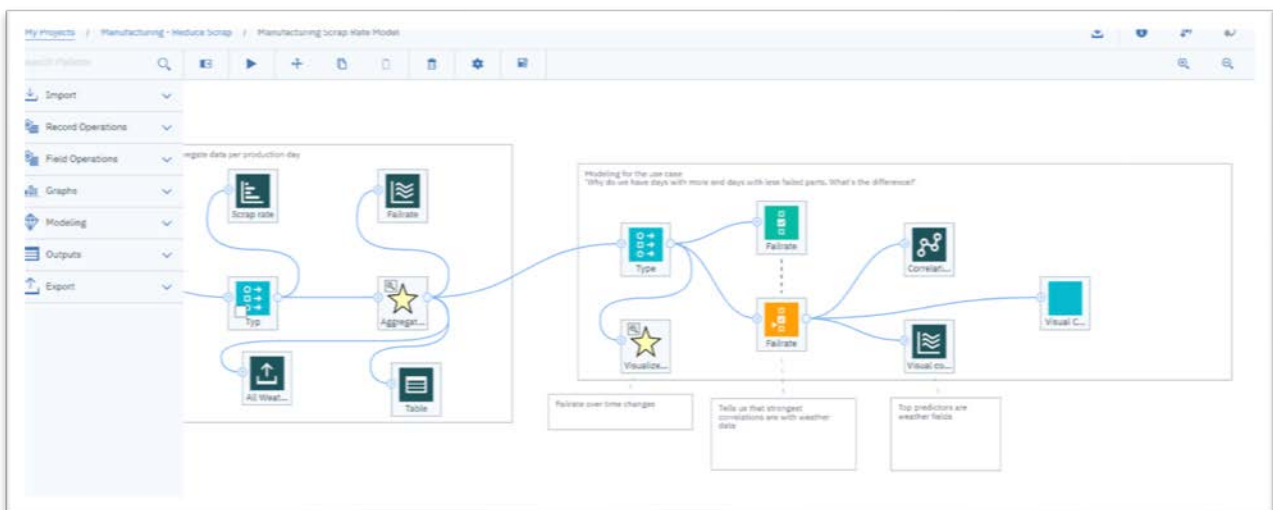


If you have SPSS Modeler Desktop 18.1.x or greater, then, you'll be able to see how the data was combined and correlation analysis was built. If you purchase **Premium Cloud Pak For Data Modeler Flows** then you'll be able to build your SPSS Modeler streams in CP4D or upload your streams from desktop to CP4D!

This was the initial SPSS Modeler stream developed using the desktop version (SPSS Modeler additional)



Here's the model above imported into our project as a Modeler Flow in CP4D. (Premium)



At the end of this README are steps to run the model in SPSS Modeler Desktop and as a CP4D Modeler Flow. The output of the model (both are the same) is **All Weather and Manufacturing Data.csv**, the merged data set that provides what the weather was for that day when scrap occurred. **Scrap Rate By Time.csv** and **Manufacturing Weather Forecast.csv** are used in the dashboard to show the existing problem with scrap rate, the upcoming 15 day forecast and how Dewpoint correlates the most to scrap rate. The remaining csv files are used in the model as inputs to **All Weather and Manufacturing Data.csv**. The SPSS Modeler/Modeler Flow also provides additional visualizations and correlation analysis that was used as a guide when the dashboard was built.

## Prerequisites

Required services: To use the industry accelerators, you must install one or more of the following services on IBM® Cloud Pak for Data

Service/Software	Required Info
Watson Studio	Importing data science assets to an analytics project. See <a href="#">Installing Watson Studio</a> .
(Optional) SPSS Modeler 18.1.x	(Optional) If user wants to investigate the model ( <b>Scrap_Analysis_Daily_Official.str</b> ) they can use SPSS Modeler Desktop to do so. It's a code free (R and Python also) desktop data science tool that can be imported into CP4D as a Modeler Flow. Modeler Flows are not required to use SPSS Modeler Desktop with CP4D.
(Optional) Modeler Flows	(Optional) Used as a code free data mining and data science tool within CP4D. Users can build streams like those using SPSS Modeler Desktop as Modeler Flows in CP4D. SPSS Modeler Desktop is not required to use CP4D Modeler Flows. CP4D Modeler Flows can be built independent of SPSS Modeler Desktop. It's important to know that you can import SPSS Modeler streams as CP4D Modeler Flows into CP4D. Get a trial to SPSS Modeler <a href="#">here</a> .

## Importing the accelerator

- 1) Go to your Data Assets and choose to Download

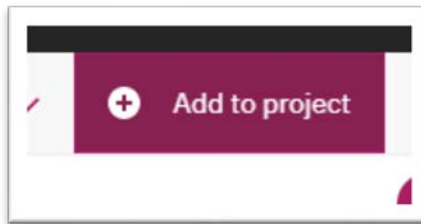
***Manufacturing\_Analytics\_With\_Weather\_Dashboard.json***

▼ Data assets

0 asset selected.

<input type="checkbox"/>	NAME	LAST MODIFIED ▼	ACTIONS
<input type="checkbox"/>	JSON <b>Manufacturing Analytics With Weather Dashboard.json</b>	15 May 2020, 2:21:16 pm	<input type="checkbox"/>
<input type="checkbox"/>	CSV All Weather And Manufacturing Data.csv	15 May 2020, 2:20:28 pm	<div><div>Publish to Catalog</div><div>Refine</div><div><b>Download</b></div><div>Promote</div><div>Remove</div></div>
<input type="checkbox"/>	CSV Scrap Rate By Time.csv	15 May 2020, 2:20:28 pm	
<input type="checkbox"/>	CSV Manufacuturing Weather Forecast.csv	15 May 2020, 2:20:28 pm	
<input type="checkbox"/>	PDF Manufacturing And Weather README.pdf	14 May 2020, 4:54:23 pm	
<input type="checkbox"/>	CSV WeatherHistory.csv	10 Apr 2020, 11:23:54 am	
<input type="checkbox"/>	📄 Scrap_Analysis_Daily_Official.str	10 Apr 2020, 11:23:54 am	
<input type="checkbox"/>	CSV Scrap_Data.csv	10 Apr 2020, 11:23:54 am	
<input type="checkbox"/>	CSV Prod_Data.csv	10 Apr 2020, 11:23:54 am	

- 2) To Import the dashboard, In the upper right portion of your screen, click **Add to project**



- 3) Select *Dashboard*, choose **From File**.

Choose the file you downloaded called **Manufacturing\_Weather\_Dashboard.json**

Enter the name **Manufacturing Weather Dashboard**.

Add the description **Manufacturing Weather Dashboard**.

Click **Create**

A screenshot of a web form titled 'New Dashboard'. At the top, there are two tabs: 'Blank' and 'From file', with 'From file' being the active tab. Below the tabs, there is a section for 'Dashboard file\*' with a 'Choose File' button and the text 'Manufacturin...hboard.json'. Underneath this is the instruction 'Import a dashboard JSON file from your local device'. The next section is 'Name\*' with a text input field containing 'Manufacturing Weather Dashboard'. The final section is 'Description' with a larger text area containing 'Manufacturing Weather Dashboard|'. The form has a clean, modern design with light gray backgrounds and purple accents.

- 4) You'll likely be prompted to point to the correct files for **Scrap Rate By Time.csv**. Click Re-link.

A screenshot of a dialog box titled 'Missing Data Asset (1/3)'. The text inside reads: 'An associated data set (Scrap Rate By Time.csv) couldn't be found. Would you like to re-link the asset now?'. The dialog has a light gray background and a thin black border.

- 5) Choose **Scrap Rate By Time.csv.csv**

### Select connection source

Manufacturing Reducing Scra...	Data assets
Assets (2)	Data assets (7)
Connections >	All Weather And Manufacturing Data.csv
Data assets >	Manufacuturing Weather Forecast.csv
	Prod_Data.csv
	Scrap Rate By Time.csv
	Scrap_Analysis_Daily_Official.str
	Scrap_Data.csv
	WeatherHistory.csv

- 6) Next, you'll be prompted to point to the second required csv for the dashboard **All Weather And Manufacturing Data.csv** Click **Re-link**

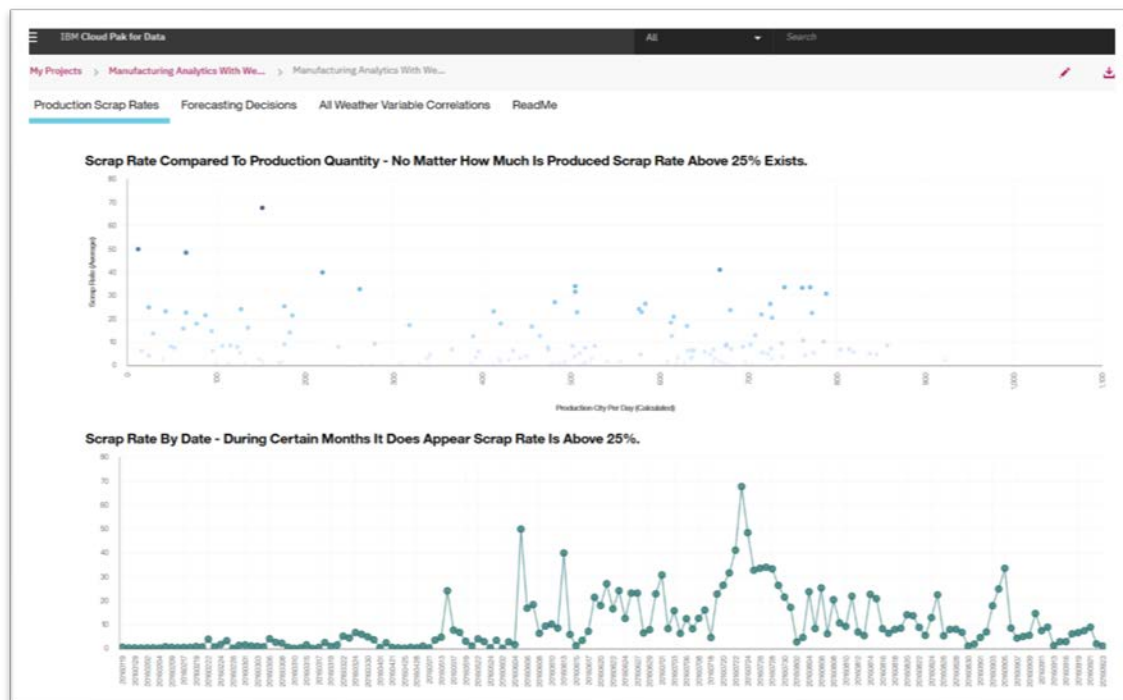
### Missing Data Asset (2/3)

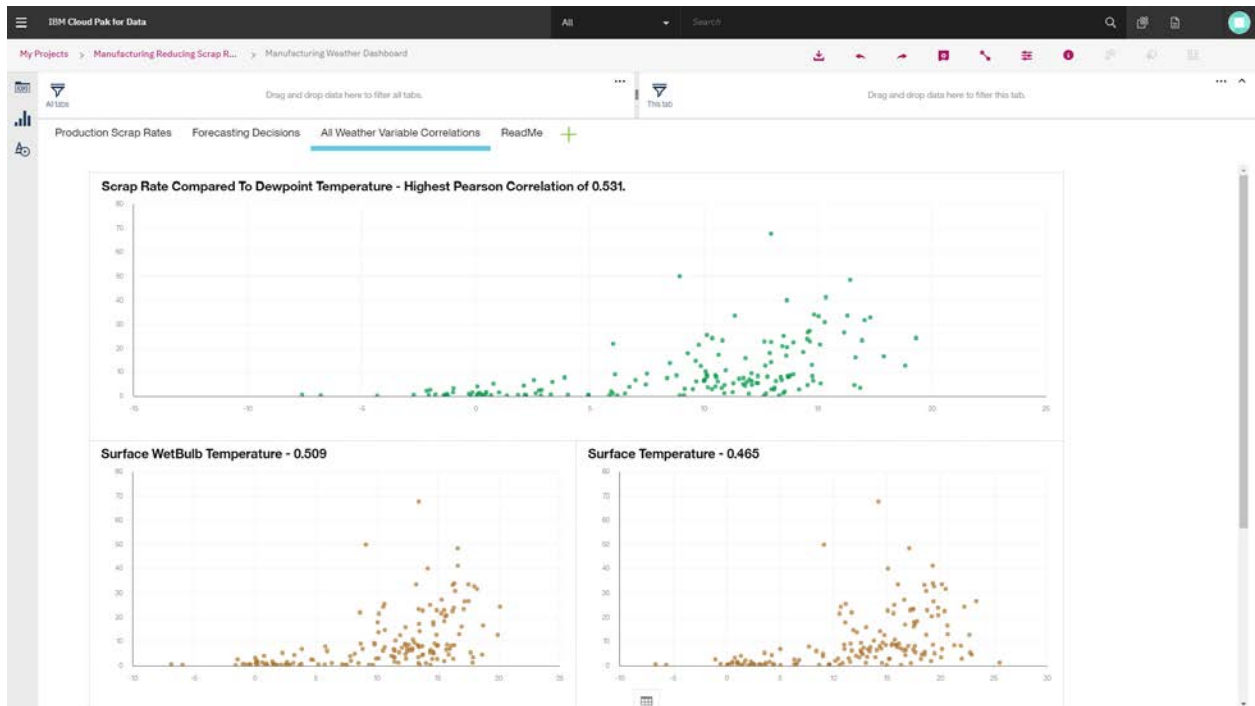
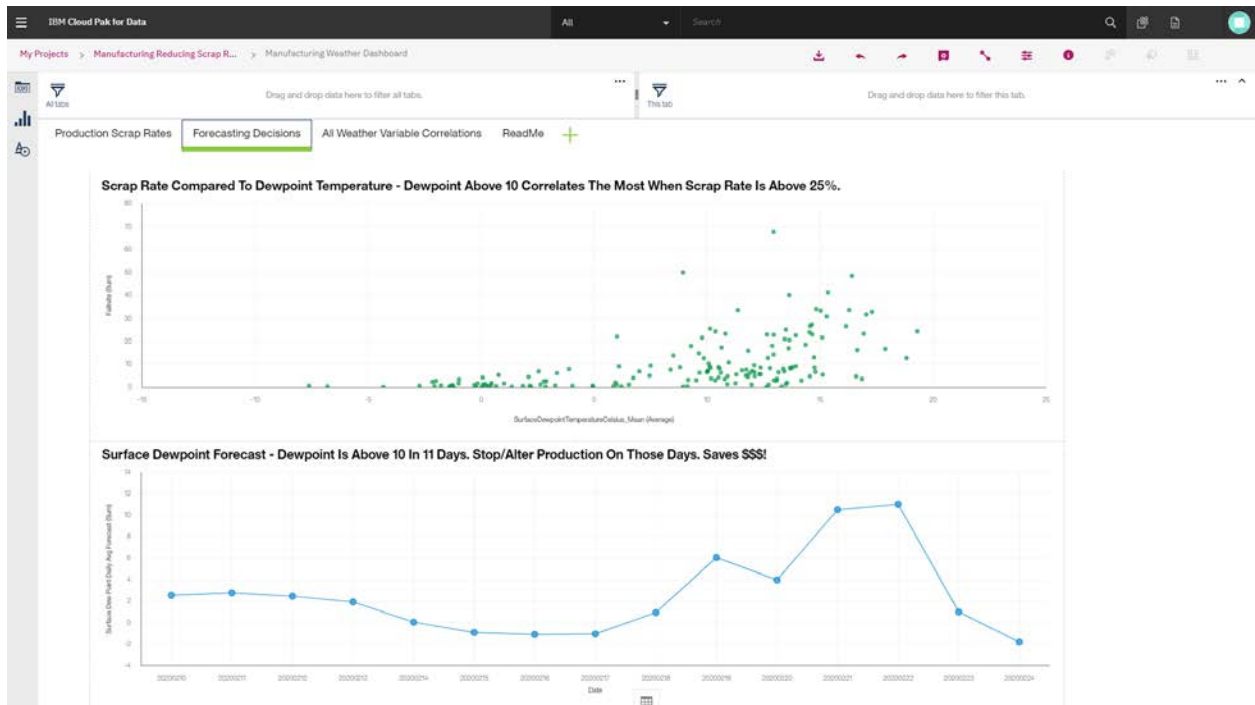
An associated data set (**All Weather And Manufacturing Data.csv**) couldn't be found. Would you like to re-link the asset now?

[Skip](#) [Re-link](#)

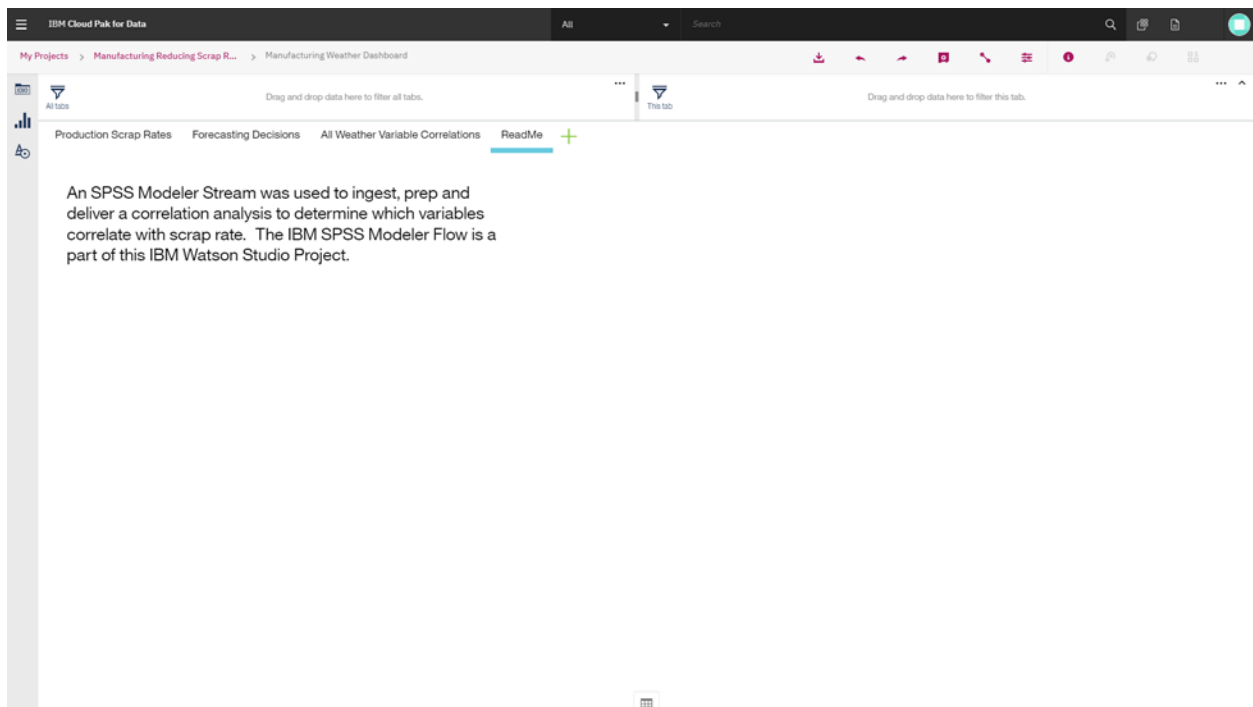
Manufacturing Reducing Scra...	Data assets
Assets (2)	Data assets (7)
Connections	All Weather And Manufacturing Data.csv
Data assets	Manufacturing Weather Forecast.csv
	Prod_Data.csv
	Scrap Rate By Time.csv
	Scrap_Analysis_Daily_Official.str
	Scrap_Data.csv
	WeatherHistory.csv

- 7) Re-link the last csv called **Manufacturing Weather Forecast.csv**  
-----No snapshots taken----- See above
- 8) The dashboard should open and look as such with each slide telling the story how Dewpoint was shown to statistically correlate the most with scrap rate when the dewpoint was above 1



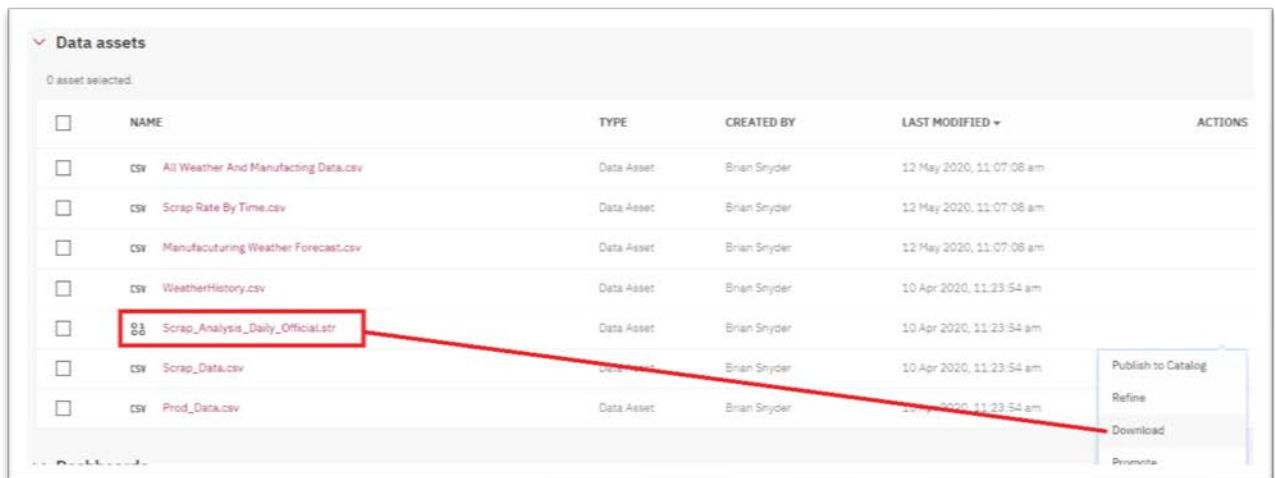




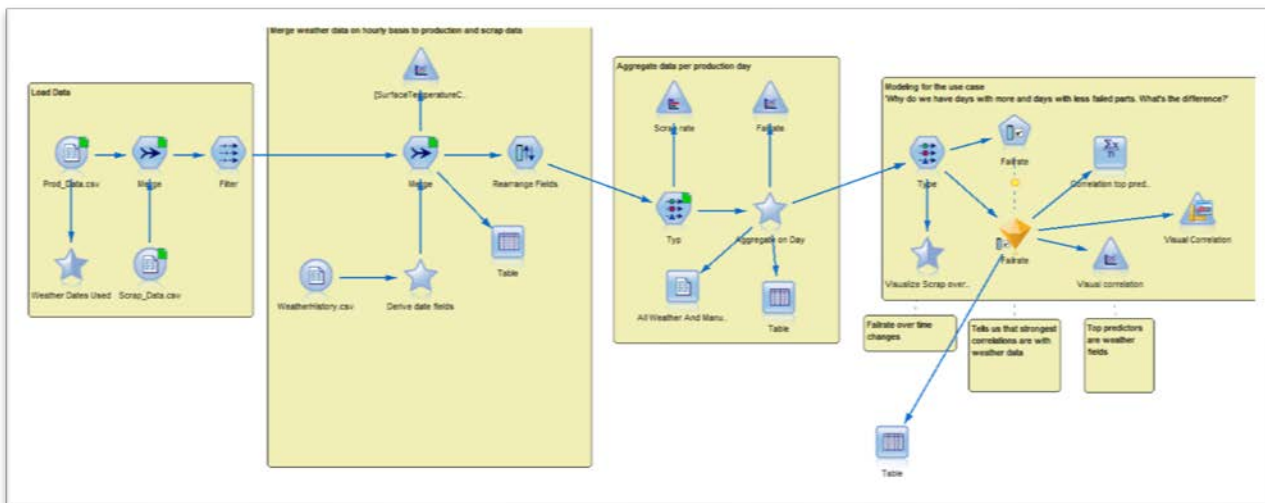


## Working With SPSS Modeler 18.1.x

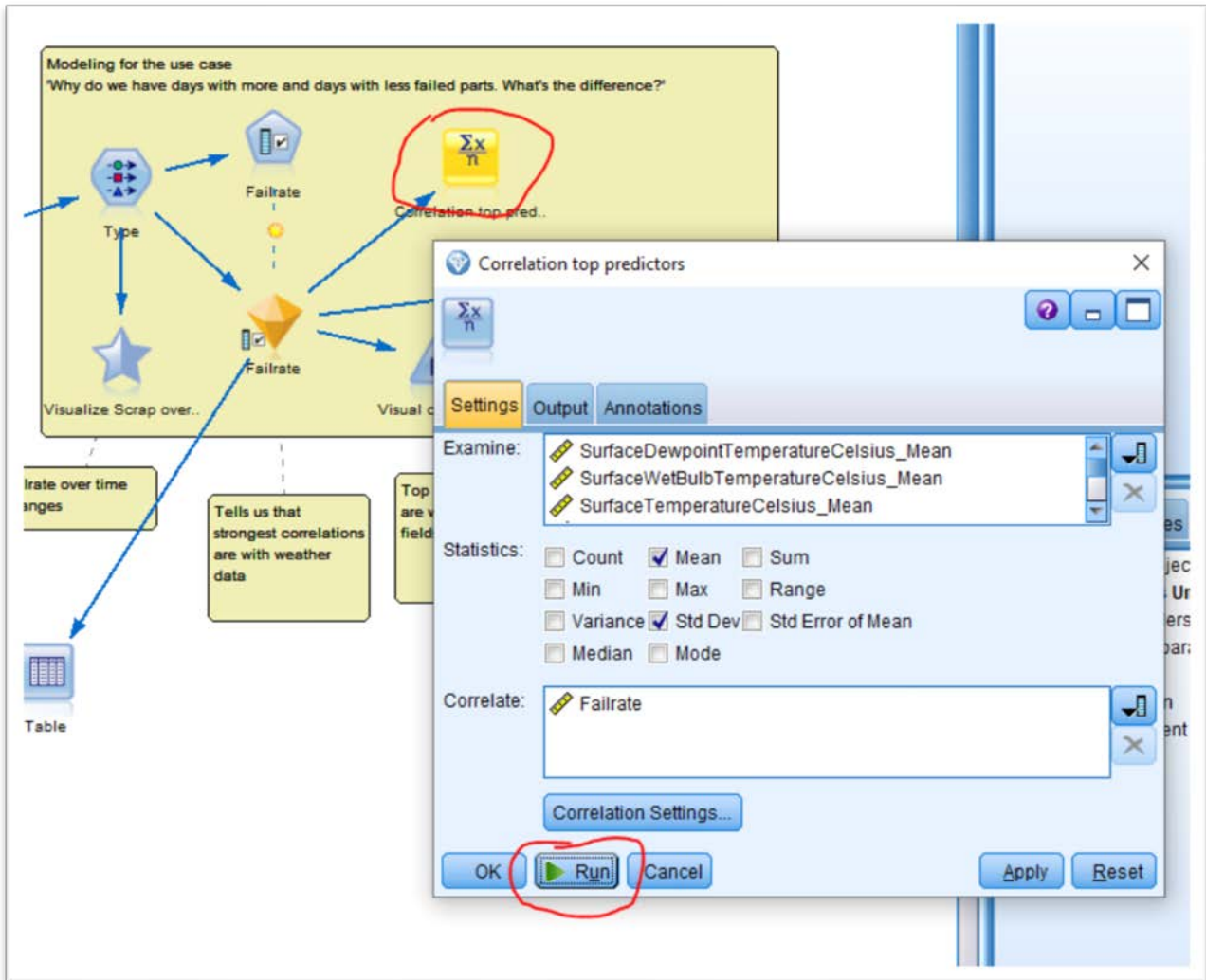
- 1) Download file **Scrap\_Analysis\_Daily\_Official.str** from your Data Assets.



- 2) Open SPSS Modeler Desktop. Open the file **Scrap\_Analysis\_Daily\_Official.str**



- 3) To view which weather variable correlates the most to failure rate, double click and Run the **Correlation top predictors** node.



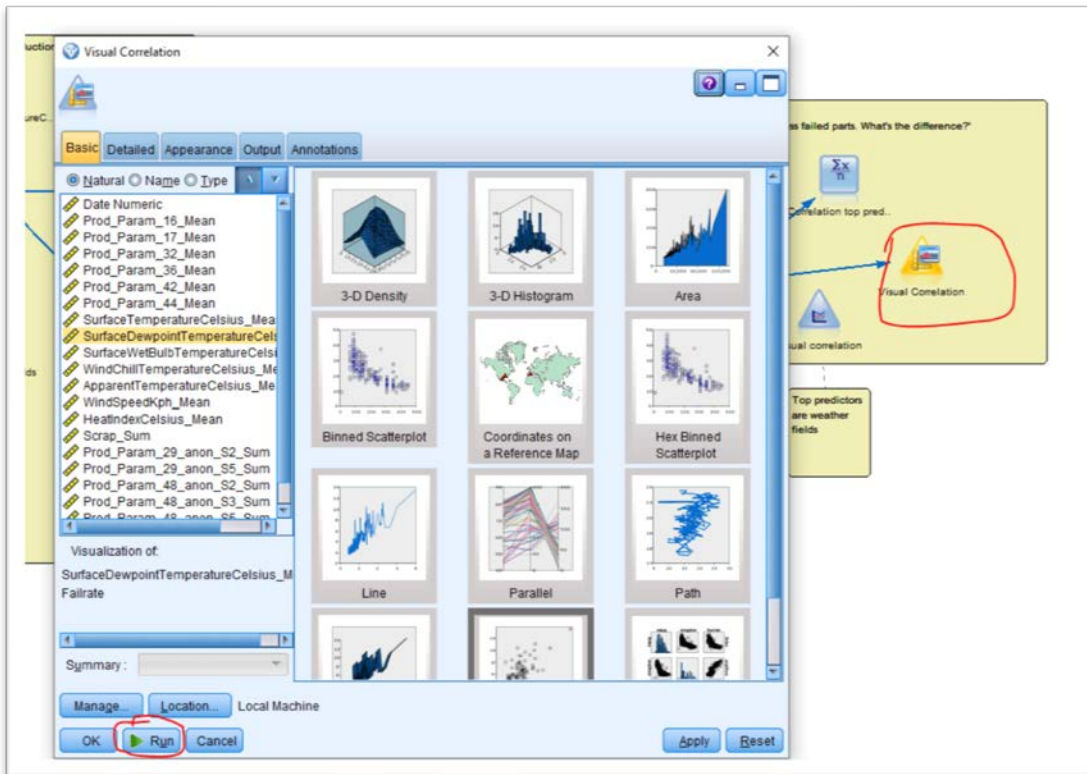
- 4) Notice that **SurfaceDewpointTemperatureCelsius\_Mean** correlates the most and is the leading contributor to scrap rate with a confidence score of 53.1%.

The screenshot displays a software window titled "Correlation top predictors". It features a menu bar with "File", "Edit", and "Generate" options, along with icons for file operations and help. Below the menu bar are tabs for "Statistics" and "Annotations", and buttons for "Collapse All" and "Expand All". The main content area lists several predictors, each with its own "Statistics" and "Pearson Correlations" sub-sections. The predictors listed are:

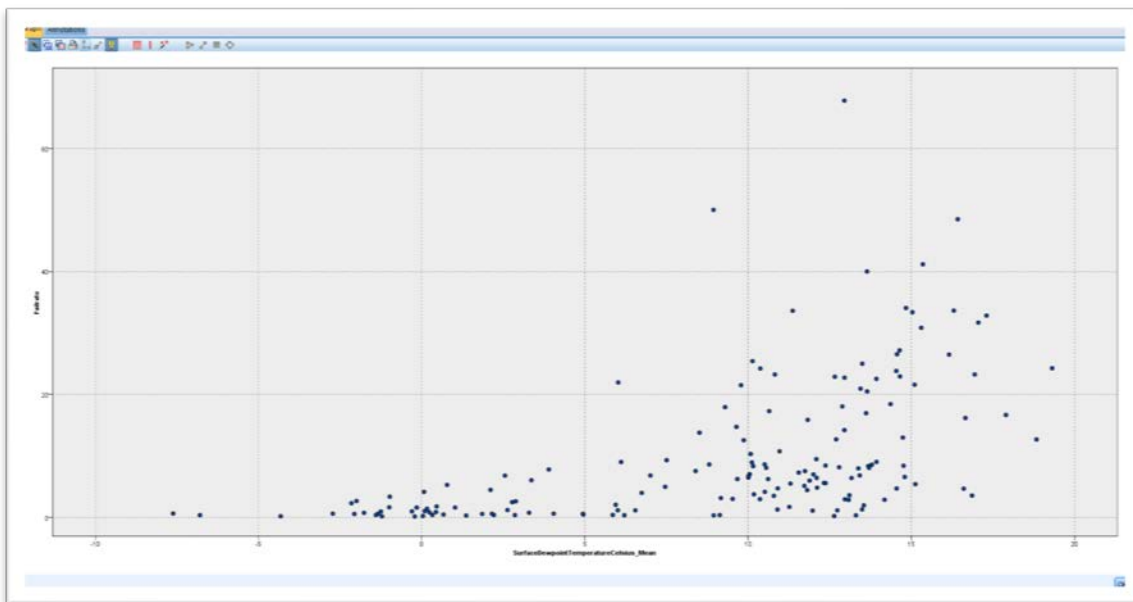
- SurfaceDewpointTemperatureCelsius\_Mean** (highlighted with a red circle):
  - Statistics: Mean = 8.886, Standard Deviation = 5.990
  - Pearson Correlations: Failrate = 0.531, Stark
- SurfaceWetBulbTemperatureCelsius\_Mean**:
  - Statistics: Mean = 10.234, Standard Deviation = 6.063
  - Pearson Correlations: Failrate = 0.509, Stark
- SurfaceTemperatureCelsius\_Mean**:
  - Statistics: Mean = 12.145, Standard Deviation = 6.908
  - Pearson Correlations: Failrate = 0.465, Stark
- WindChillTemperatureCelsius\_Mean**:
  - Statistics: Mean = 11.335, Standard Deviation = 8.065
  - Pearson Correlations: Failrate = 0.473, Stark
- ApparentTemperatureCelsius\_Mean**:
  - Statistics: Mean = 11.342, Standard Deviation = 8.075
  - Pearson Correlations: (partially visible)

An "OK" button is located at the bottom right of the window.

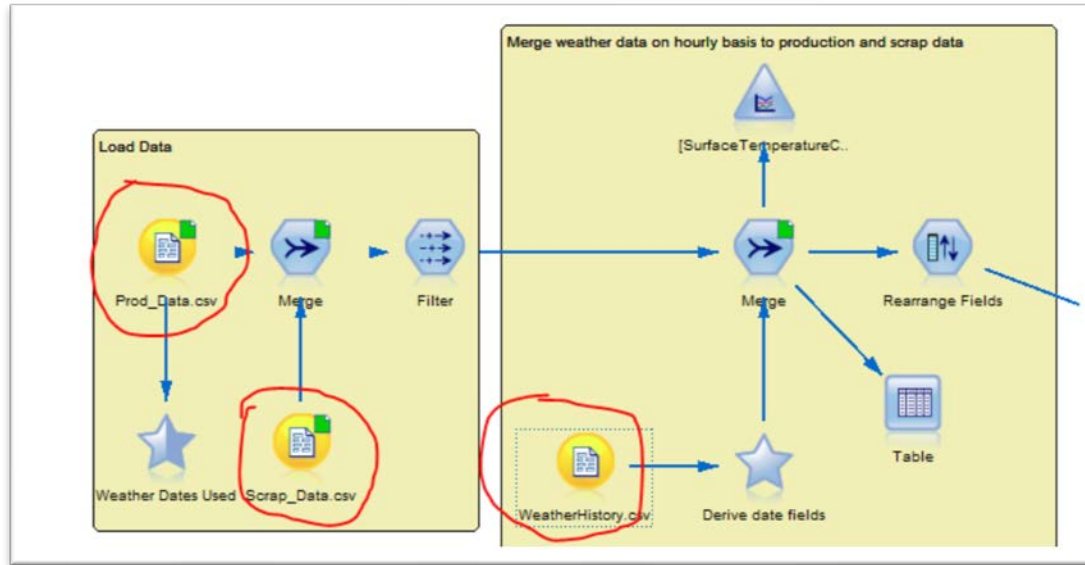
- 5) Next, let's see the comparison of Dewpoint Vs Scrap Rate. This is the visualization we built into the dashboard. On the third tab we show the remaining that have lower confidence levels. Double click in **Visual Correlation** and click **Run**.



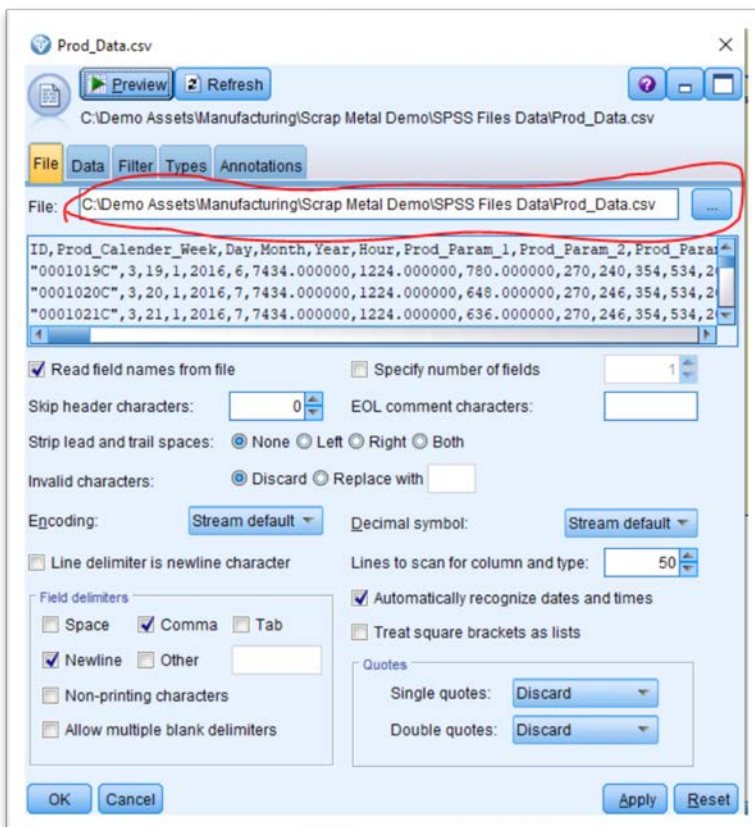
This is the same chart we added to the dashboard.



NOTE: You'll need to repoint the csv files to their new location

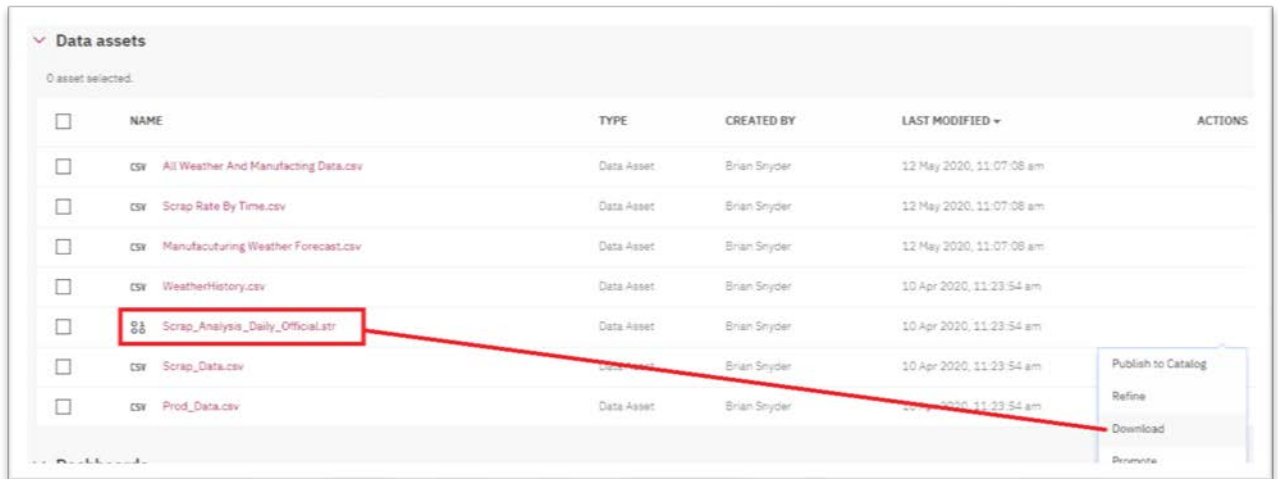


Just double click on the node and choose the file location. Here's a snapshot of one of them.



## Working with Modeler Streams

- 1) Download file **Scrap\_Analysis\_Daily\_Official.str** from your Data Assets.



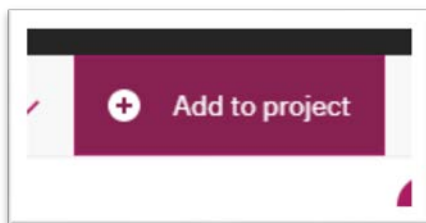
**Data assets**

0 asset selected.

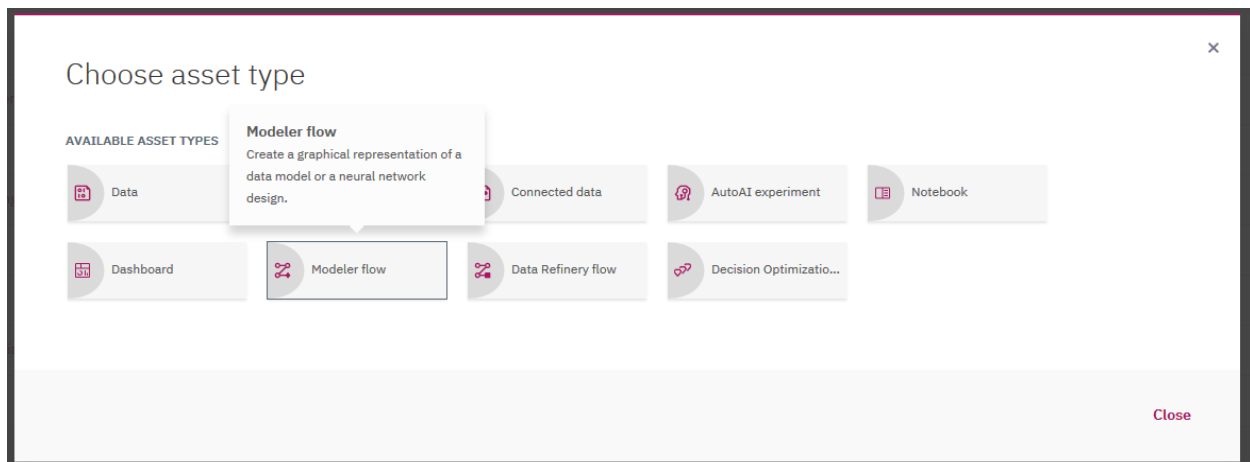
<input type="checkbox"/>	NAME	TYPE	CREATED BY	LAST MODIFIED	ACTIONS
<input type="checkbox"/>	CSV All Weather And Manufacturing Data.csv	Data Asset	Brian Snyder	12 May 2020, 11:07:08 am	
<input type="checkbox"/>	CSV Scrap Rate By Time.csv	Data Asset	Brian Snyder	12 May 2020, 11:07:08 am	
<input type="checkbox"/>	CSV Manufacturing Weather Forecast.csv	Data Asset	Brian Snyder	12 May 2020, 11:07:08 am	
<input type="checkbox"/>	CSV WeatherHistory.csv	Data Asset	Brian Snyder	10 Apr 2020, 11:23:54 am	
<input type="checkbox"/>	<b>Scrap_Analysis_Daily_Official.str</b>	Data Asset	Brian Snyder	10 Apr 2020, 11:23:54 am	
<input type="checkbox"/>	CSV Scrap_Data.csv	Data Asset	Brian Snyder	10 Apr 2020, 11:23:54 am	
<input type="checkbox"/>	CSV Prod_Data.csv	Data Asset	Brian Snyder	10 Apr 2020, 11:23:54 am	

Actions menu: Publish to Catalog, Refine, Download, Remove

- 1) To add a Modeler Flow, click **Add to project**



- 2) Choose **Modeler Flow**



- 3) Choose From File and use the file labeled *Scrap\_Analysis\_Daily\_Official.str*



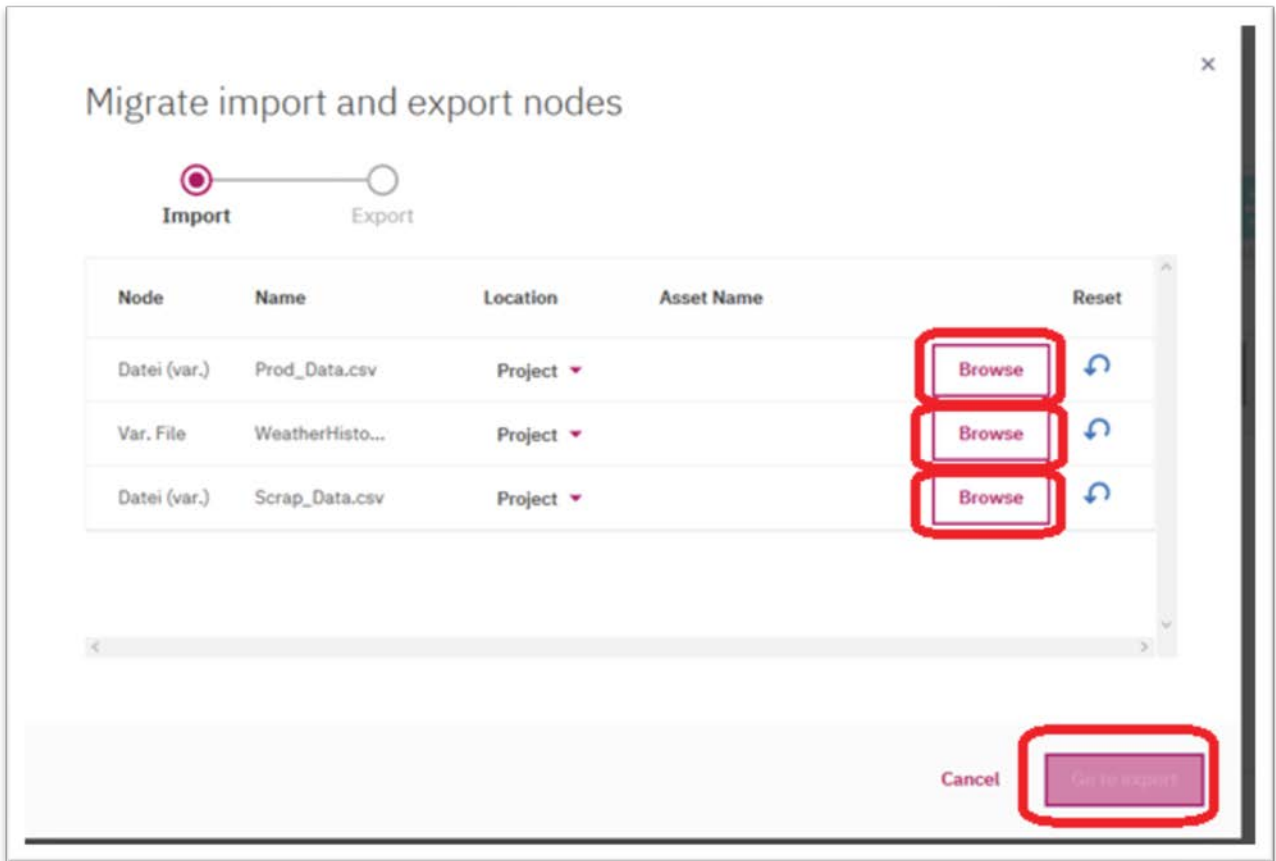
The screenshot shows the 'New modeler flow' page in IBM Cloud Pak for Data. At the top, there is a dark header with a hamburger menu icon and the text 'IBM Cloud Pak for Data'. Below the header, the title 'New modeler flow' is centered. There are three tabs: 'New', 'From File', and 'From Example'. The 'From File' tab is selected and underlined. Below the tabs, there is a 'Name\*' field with the text 'Scrap\_Analysis\_Daily\_Official'. Below that is a 'Description' field with the placeholder text 'Type description here.'. At the bottom, there is an 'Upload flow file\*' section with a dashed box containing the text 'Drag and drop an SPSS Modeler flow file here or [browse](#) your local device to select a file.' Below the dashed box, the file name 'Scrap\_Analysis\_Daily\_Official.str' is displayed.

4) Choose **Yes** when prompted *Migrate Nodes?*

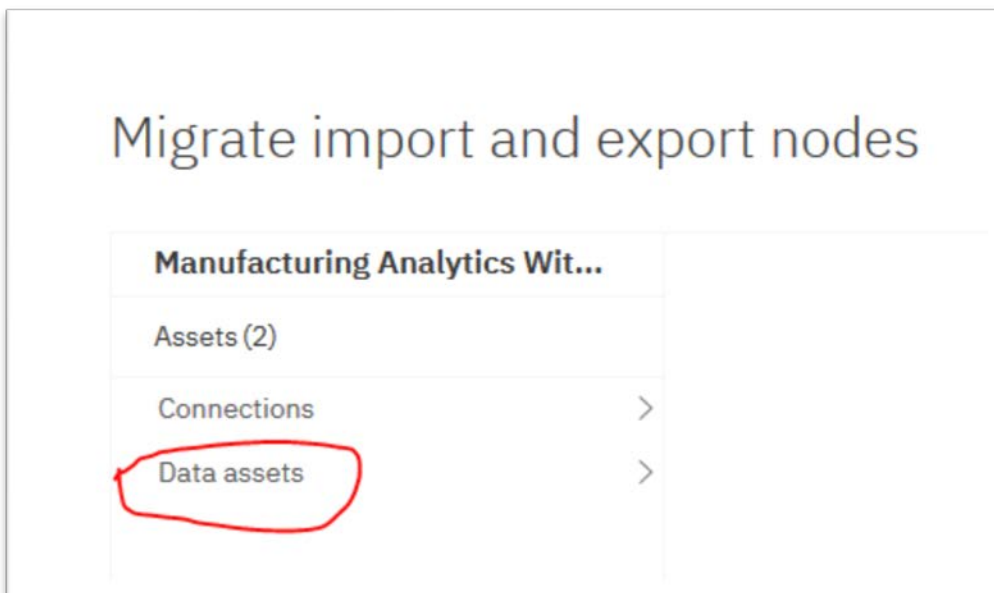
The screenshot shows a dialog box titled 'Migrate nodes?'. The text inside reads: 'To run this flow, you must migrate the Import and Export nodes to Data Asset nodes. You will need to associate data assets for import. Export nodes can be configured to export to your project or to a connection. Migrate all nodes now, or click No to migrate nodes individually at any time.' At the bottom right, there are two buttons: 'No' and 'Yes'. The 'Yes' button is highlighted with a red square border.

5) Find the corresponding csv file name like we did for the dashboard. First we ingest the import data and then point to the export files generated by the model.





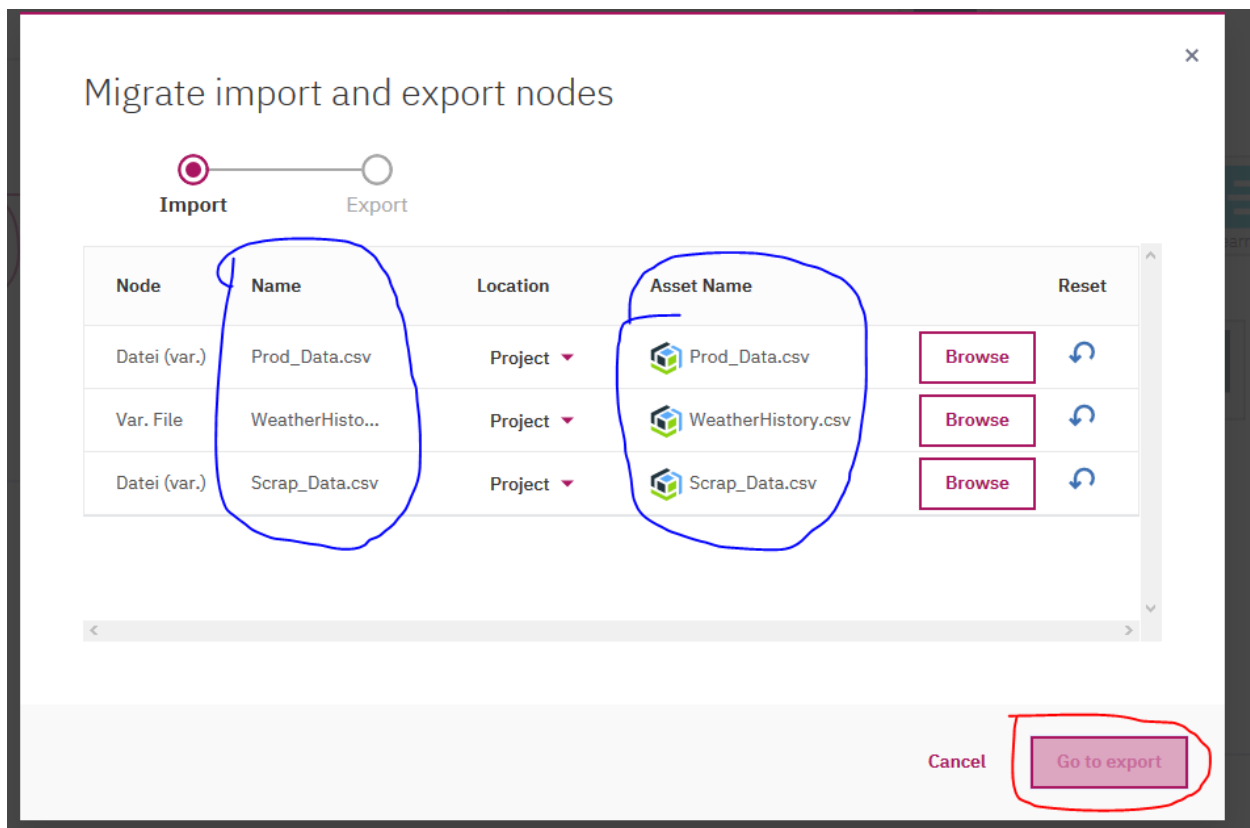
6) Choose Data Assets to find the corresponding file name.



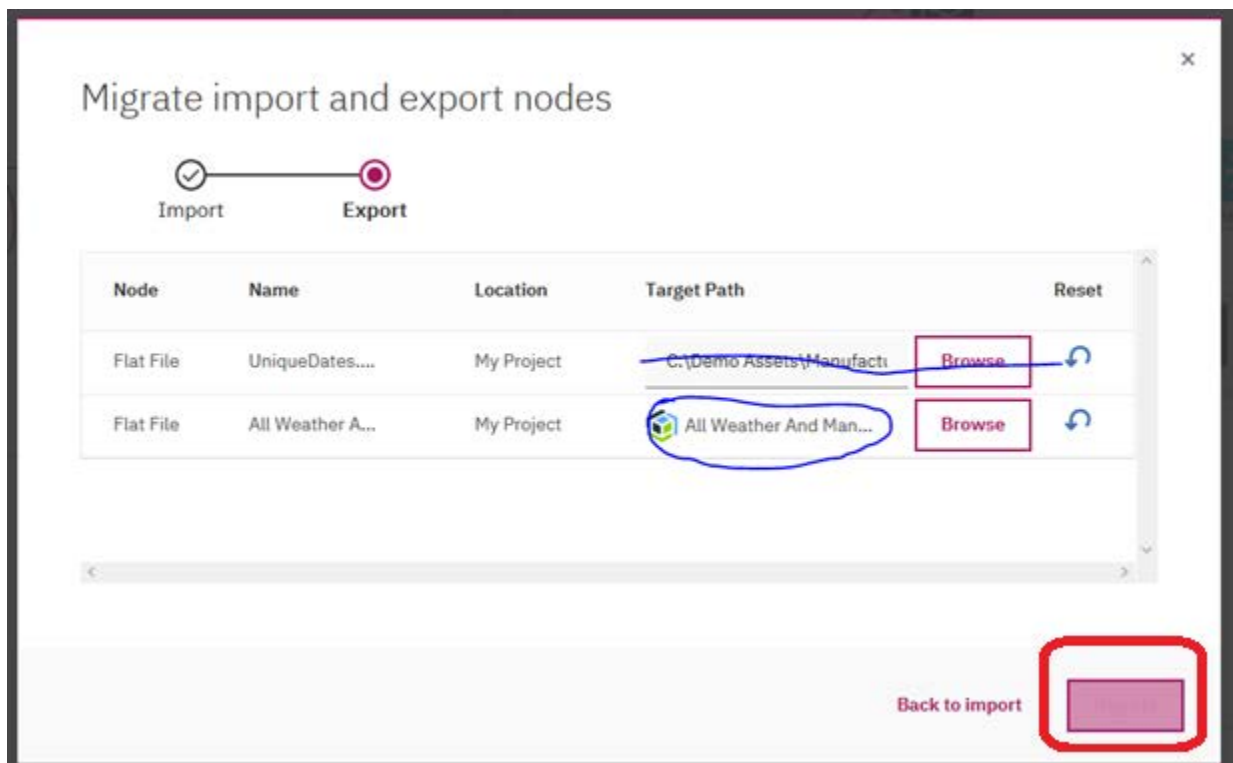
## Migrate import and export nodes

Manufacturing Analytics Wit...		Data assets
Assets (2)		Data assets (7)
Connections	>	All Weather And Manufacturing Data.csv
Data assets	>	Manufacuturing Weather Forecast.csv
		Prod_Data.csv
		Scrap Rate By Time.csv
		Scrap_Analysis_Daily_Official.str
		Scrap_Data.csv
		WeatherHistory.csv

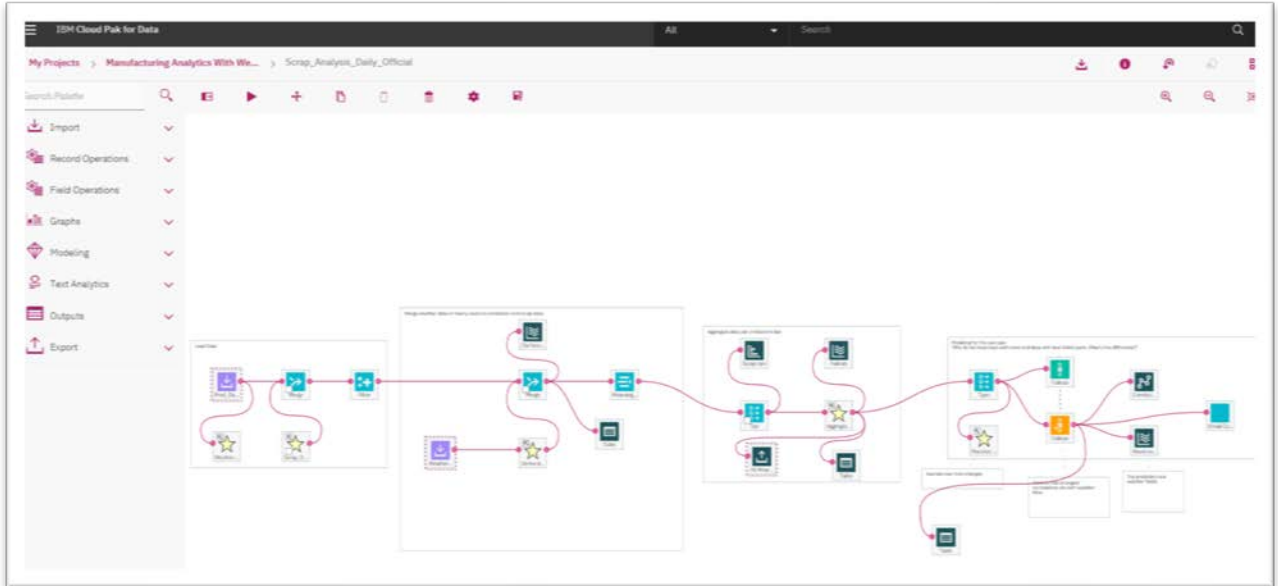
7) This is what it should like once all 3 have been populated. Click **Go To Export**



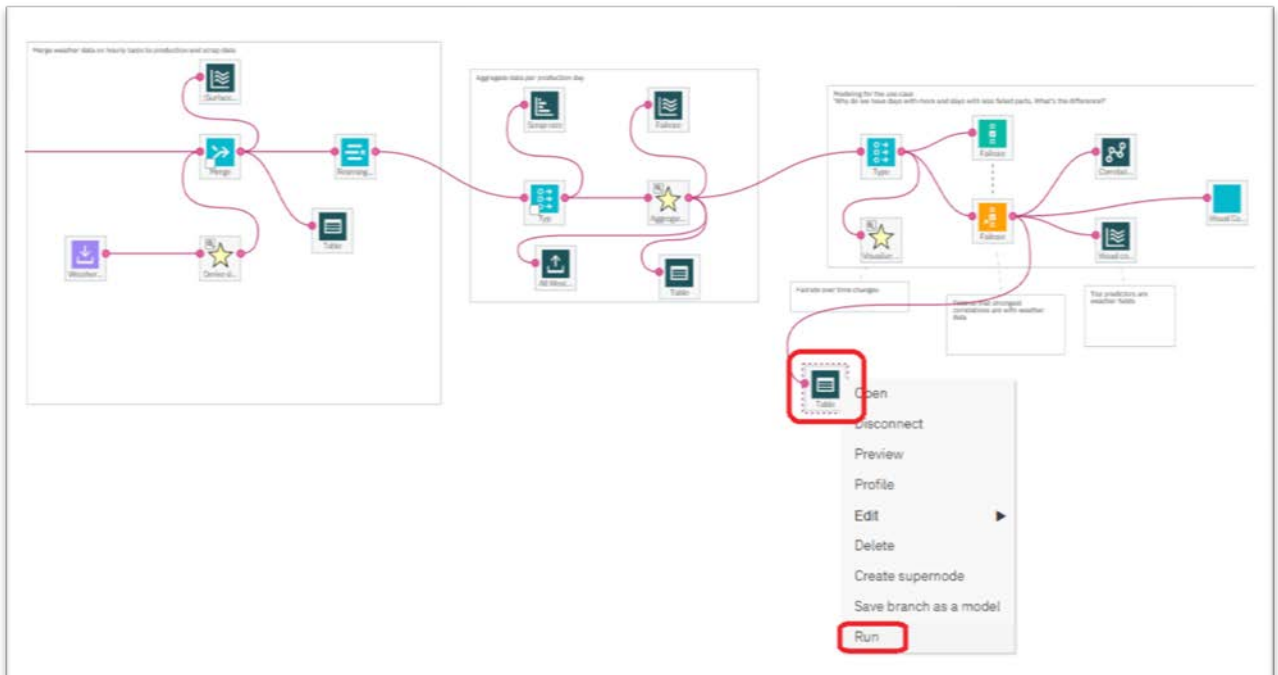
- 8) We're only choosing one file here. We're not utilizing the other. Choose **All Weather an Manufacturing Data.csv** only. Click **Migrate**



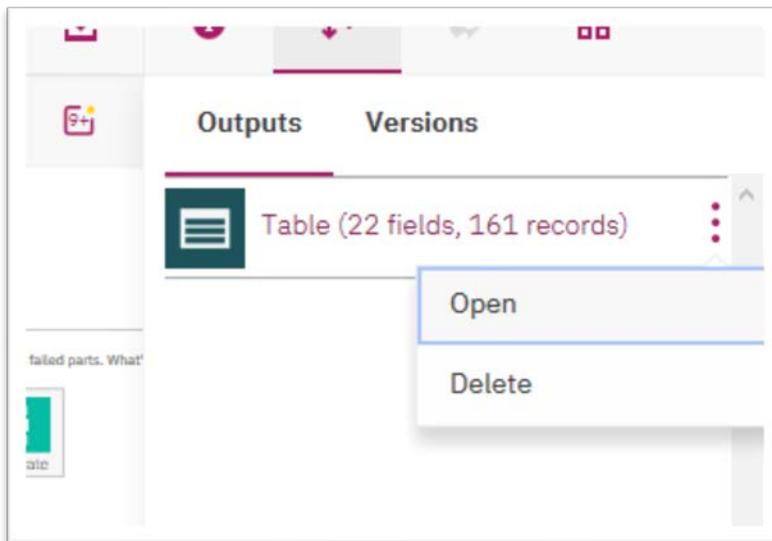
9) Here's what the model looks like once it loads.



10) Modeler Flows go from left to right. To ingest the import files, merge them, add some calculations and view it, choose the Table node's triple dots , choose **Run**



11) In the upper right portion of your screen, you can choose **Open** to view the merged results of production line data and the historical weather when activity was collected.

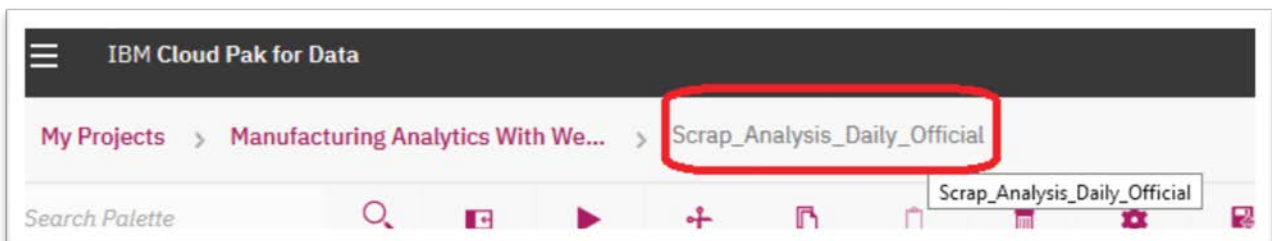


12) The results.

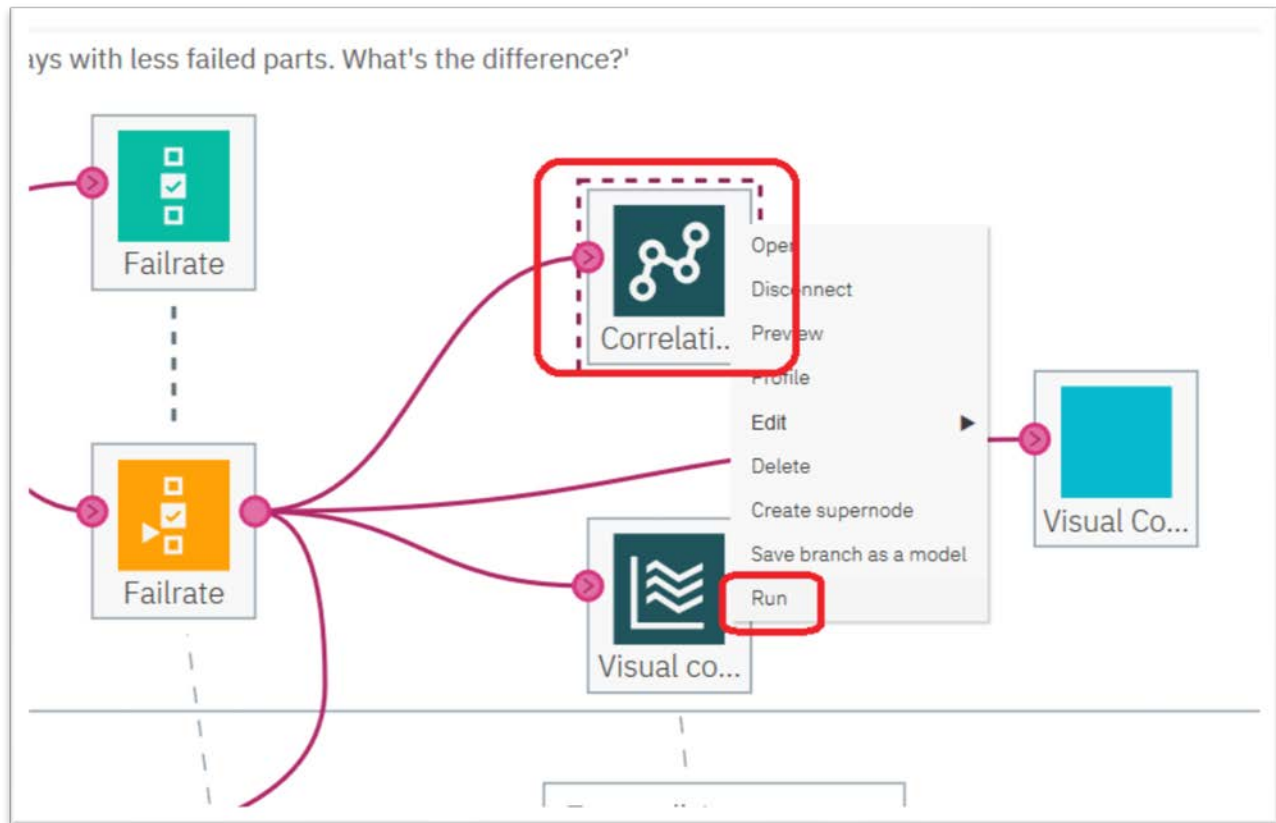
The screenshot shows the IBM Cloud Pak for Data interface. At the top, there is a header bar with the text 'IBM Cloud Pak for Data'. Below the header bar, there is a breadcrumb trail: 'My Projects > Manufacturing Analytics With We... > Scrap\_Analysis\_Daily\_Official > Table (22 fields, 161 records)'. The table displays data for various production parameters over time. The columns are: Date, Date Numeric, Prod\_Param\_16\_Mean, Prod\_Param\_17\_Mean, Prod\_Param\_32\_Mean, Prod\_Param\_36\_Mean, Prod\_Param\_42\_Mean, and Prod\_Param\_44\_Mean. The rows show data for dates from 02/01/2016 to 09/01/2016.

Date	Date Numeric	Prod_Param_16_Mean	Prod_Param_17_Mean	Prod_Param_32_Mean	Prod_Param_36_Mean	Prod_Param_42_Mean	Prod_Param_44_Mean
02/01/2016	20160201	1426.926	2074.847	383.368	5863.874	360.000	64123.993
03/01/2016	20160301	11933.002	2222.410	590.495	5664.831	360.000	100345.063
04/01/2016	20160401	2524.485	2072.115	497.646	6312.877	360.000	139294.168
07/01/2016	20160701	1514.211	1195.820	469.424	5778.856	1459.104	270.773
09/01/2016	20160901	5172.347	5027.686	492.973	6615.636	1513.768	75071.794

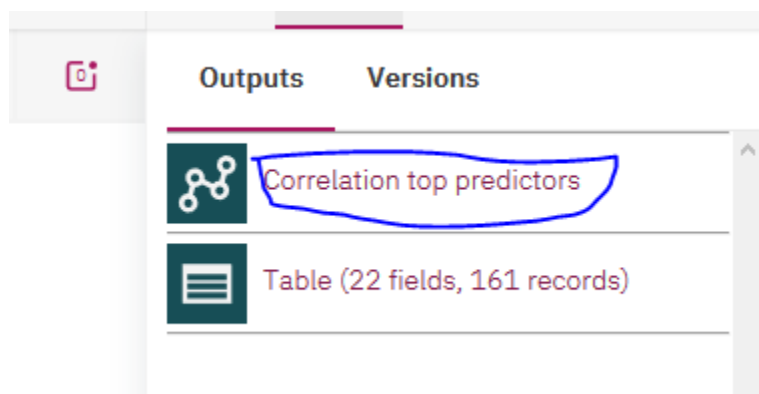
13) To return to the model, please click *Scrap\_Analysis\_Daily\_Official* in the breadcrumb trail at the top left portion of your screen.



14) To view the correlation analysis like we did in SPSS Modeler, click the **Correlation** node and choose **Run**



15) Once execution has completed, click **Correlation top predictors** to view the results.



16) Here's the result. Notice **SurfaceDewpointTemperatureCelcius\_Mean** correlated the most when comparing failure rate to all weather variables with a confidence score of 53.1%

IBM Cloud Pak for Data

My Projects

>

Manufacturing Analytics With We...

>

Scrap\_Analysis\_Daily\_Official

>

urfaceDewpointTemperatureCelsius\_Mean

tatistics

Mean

8.886

Standard Deviation

5.990

Pearson Correlations

Mailrate

0.531

Stark

urfaceWetBulbTemperatureCelsius\_Mean

tatistics

Mean

10.234

Standard Deviation

6.063

Pearson Correlations

Mailrate

0.509

Stark

urfaceTemperatureCelsius\_Mean

tatistics

Mean

12.145

Standard Deviation

6.908

Pearson Correlations

Mailrate

0.465

Stark

WindChillTemperatureCelsius\_Mean

tatistics

Mean

11.335

Standard Deviation

8.065

Thanks for using this demo asset with weather.

If you have any questions, please reach out to [bsnyder@us.ibm.com](mailto:bsnyder@us.ibm.com).