

Connect Your Modeling Database to Your GIS

Introduction

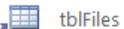
The main purpose of using a database centric approach to dispersion modeling is to house all of your model project data, e.g. inputs and results, in one convenient place. By having all of your data in one place, there is little to need to make multiple (disconnected) copies of the data to use with analysis or reporting applications. Once a disconnect copy of the data has been created, there is the danger of the master data source (model project database) becoming inconsistent with the disconnected copy.

This set of SOPs is broken into three stages: updating database with one additional data table and query, populating the data table, and creating a connection between a GIS application (ArcGIS, in this case) and the model project database.

Updating Model Project Database:

1. Select the **Create** menu item, then click on the Query Design tool
2. The Show Table dialog will appear. Click the Close button.
3. In the lower right-hand corner of the display, click on the SQL tab 
4. The Query1 tabbed form will appear. To create the table tblFiles, copy and paste the following SQL statement:

```
CREATE TABLE tblFiles(  
    file_name varchar(255) NOT NULL,  
    file_type varchar(50) NOT NULL,  
    air_standard varchar(500) NOT NULL,  
    scenario varchar(255) NOT NULL,  
    parent_file varchar(255),  
    met_year int  
)
```

5. Click on the Run tool  to execute the SQL statement. The table should appear in the TOC under Tables 

You can use the same SQL statement to create the table in SQL Server.

6. In Access, to create the table qryResultsForPlotting, copy and paste the following SQL statement to replace the previous statement:

```
SELECT  
    Results.air_contaminant,  
    Results.AVG_TIME,
```

```
Results.scenario,  
Results.X,  
Results.Y,  
Results.CONC,  
Results.standard_value,  
(Round(CDbI([Results].[CONC])/CDbI([Results].[standard_value]),4)) AS FRACT_ESL  
FROM  
(SELECT  
tblAirStandards.air_contaminant,  
tblAERMOD_PLOTFILE.AVG_TIME,  
tblFiles.scenario,  
tblAERMOD_PLOTFILE.X,  
tblAERMOD_PLOTFILE.Y,  
Max(tblAERMOD_PLOTFILE.CONC) AS CONC,  
tblAirStandards.standard_value  
FROM  
tblAERMOD_PLOTFILE  
INNER JOIN  
tblFiles  
ON  
tblAERMOD_PLOTFILE.FILE_NAME = tblFiles.file_name)  
INNER JOIN  
tblAirStandards  
ON  
(tblFiles.air_standard = tblAirStandards.standard_name) AND  
(tblAERMOD_PLOTFILE.AVG_TIME = tblAirStandards.avg_time)  
WHERE  
(((tblFiles.scenario)<>('GENERIC')))  
GROUP BY  
tblAirStandards.air_contaminant,  
tblAERMOD_PLOTFILE.AVG_TIME,  
tblFiles.scenario,  
tblAERMOD_PLOTFILE.X,  
tblAERMOD_PLOTFILE.Y,  
tblAirStandards.standard_value) AS Results;
```

7. In the menu items, select File|Save. Save the query as qryResultsForPlotting.

In SQL Server, queries can be saved as a database view. The SQL statement for the same query is:

```
CREATE VIEW vwResultsForPlotting
AS
SELECT
    Results.air_contaminant,
    Results.AVG_TIME,
    Results.scenario,
    Results.X,
    Results.Y,
    Results.CONC,
    Results.standard_value,
    ROUND((Results.CONC/Results.standard_value),4) AS FRACT_ESL
FROM
(SELECT
    DBO.tblAirStandards.air_contaminant,
    DBO.tblAERMOD_PLOTFILE.AVG_TIME, tblFiles.scenario,
    DBO.tblAERMOD_PLOTFILE.X,
    DBO.tblAERMOD_PLOTFILE.Y,
    MAX(DBO.tblAERMOD_PLOTFILE.CONC) AS CONC,
    DBO.tblAirStandards.standard_value
FROM
    DBO.tblAERMOD_PLOTFILE
INNER JOIN
    DBO.tblFiles
ON
    DBO.tblAERMOD_PLOTFILE.FILE_NAME = DBO.tblFiles.file_name
INNER JOIN
    DBO.tblAirStandards
ON
    DBO.tblFiles.air_standard = DBO.tblAirStandards.air_standard AND
    DBO.tblAERMOD_PLOTFILE.AVG_TIME = DBO.tblAirStandards.avg_time
WHERE
    DBO.tblFiles.scenario<>'GENERIC'
GROUP BY
    DBO.tblAirStandards.air_contaminant,
    DBO.tblAERMOD_PLOTFILE.AVG_TIME,
    DBO.tblFiles.scenario,
    DBO.tblAERMOD_PLOTFILE.X,
    DBO.tblAERMOD_PLOTFILE.Y,
    DBO.tblAirStandards.standard_value) AS Results
```

Populating tblFile

The table **tblFiles** contains six data fields. The values entered have specific requirements depending upon the associated data field. The specifications are given below.

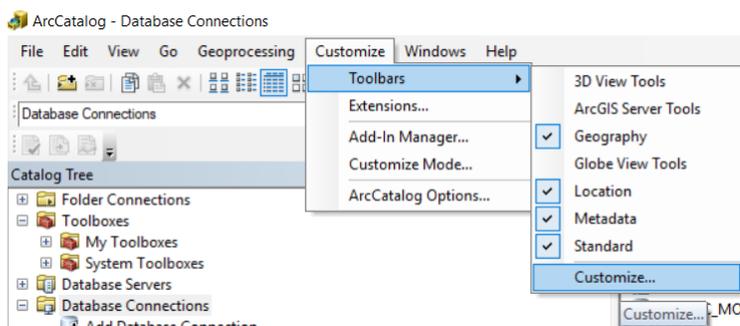
1. For **file_name**, enter the AERMOD input or output file name. Do not include the directory path. For example, if the full file specification is C:\Project1\RUN_001\RUN_001.INP, the value to enter would be RUN_001.INP.
2. For **file_type**, enter either 'AERMOD model input' (do not include quotes) or 'PLOTFILE', whichever is appropriate.
3. For **air_standard**, select an appropriate air_standard from tblAirStandards. It is best to copy and paste the value. When you execute the query to analyze modeling results, the air_standard value between tblFiles and tblAirStandards must match exactly.
4. For **scenario**, if you have a name for the modeling scenario represented in the model input file and associated output files (PLOTFILE or MAXIFILE) for this record, enter the value. If you only have one scenario, enter something like Normal or Routine. You cannot leave it blank (NULL).
5. For **parent_file**, this value only pertains to PLOTFILE or MAXIFILE records. The purpose of this field is to associate the PLOTFILE or MAXIFILE with the model input file that generated the PLOTFILE or MAXIFILE.
6. For **met_year**, if you have a separate model run for each year of meteorology, enter the year in this field.

Creating Connection Between Database and GIS Platform (ArcGIS)

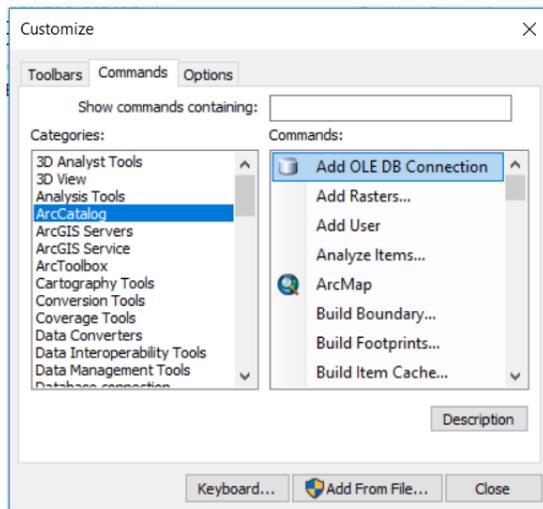
For Access Database

Add OLE DB Connection tool to toolbar

1. Launch ArcCatalog
2. From the menu items, select Customize | Toolbars | Customize...



Customize dialog appears.

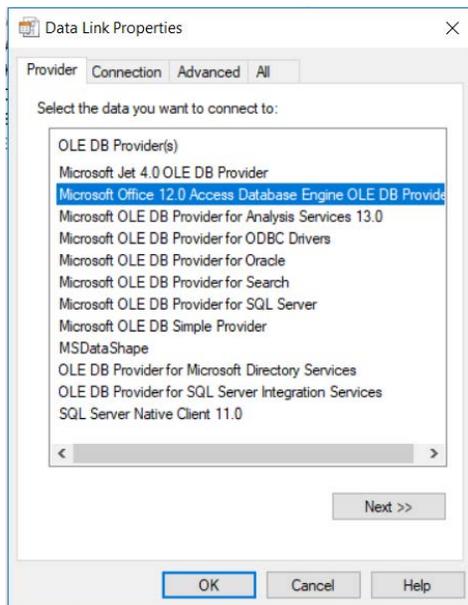


Select the Commands tab. Under Categories: select ArcCatalog. Under Commands: click on Add OLE DB Connection (it should highlight in blue) and drag to the toolbar.

The  icon should appear on the ArcCatalog toolbar.

Create OLE DB Connection

1. Click on OLE DB Connection icon, 
2. Under OLE DB Providers, select Microsoft Office 12.0 Access Database Engine OLE DB Provider,



then click Next

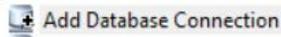
If there is no OLE DB provider for Access on your computer, go to <https://www.microsoft.com/en-us/download/details.aspx?id=54920>.

3. In the Data Source text box, enter the full file path and file name to the Access database you are wanting to connecting to.
4. If your database is not password protected, check the Blank password check box, then click the Test Connection button. You should get a Test connection succeeded message if there were no issues or errors. Then click OK.
5. In the Catalog Tree on the left side of the screen, right-mouse click on Database Connections, then select Refresh, then click on the + to expand the tree view under Database Connections
6. The connection you just created should show up as OLE DB Connection.odc. Right-mouse click on the OLE DB Connection.odc entry, then select Rename and give the connection are more descriptive name.
7. Double click on the entry. All database tables and queries will be listed.

For SQL Server

Add Database Connection

1. Launch ArcCatalog
2. In the Catalog Tree on the left side of the screen, double click on Add Database Connection



3. In the Database Connection dialog,

A screenshot of the "Database Connection" dialog box. It has a title bar with a close button (X). The dialog contains several fields: "Database Platform:" with a dropdown menu showing "SQL Server"; "Instance:" with an empty text box; "Authentication Type:" with a dropdown menu showing "Operating system authentication"; "User name:" and "Password:" with empty text boxes; and "Database:" with a dropdown menu showing "Modeling_DB". At the bottom, there is a blue link "About Database Connections" and two buttons: "OK" and "Cancel".

enter your Database Platform and Instance name. Enter the authentication type for your database platform: Either Operating system authentication (your OS login) or database [server] authentication with its own login. Enter the name of the Database you are connecting to. If you do not know the values of the entries, consult with your IT support or DB administrator.

4. When all the values in the Database Connection dialog are entered, click OK.
5. In the Catalog Tree under Database Connections, the entry for the connection you just created will appear as Connection to <Database Instance Name>.sde.
6. Double click on the entry. All database tables and views will be listed.

Displaying Data

1. Launch ArcMap
2. Click on the **Add Data** icon in the main toolbar 
3. In the Add Data dialog, find the listing for **Database Connections**, double click, find the data connection you created earlier, double click to see all the database tables and queries (views) available. Select the tables you want to display (tblSources, tblReceptors, qryResultsForPlotting (Access) or dbo.vwResultsForPlotting (SQL Server)). Then click Add.
4. For each table in the TOC, right-mouse click, then select Open to view the contents of the table. Each should have a coord_sys field that lists the EPSC code for coordinate system of the spatial coordinates in the table. See <http://spatialreference.org/ref/epsg/> for listing for other coordinate systems.
5. To display the table data, right-mouse click on a table in the TOC, select **Display XY Data...**
6. Select the table fields that correspond to the X and Y spatial fields. Then click on the **Edit...** button. Select the appropriate coordinate for the data you want to display. Click OK, then click OK again. A point feature is created and displayed in the TOC as <table name> Events

Displaying Model Results

1. In the ArcMap TOC, right-mouse click on qryResultsForPlotting Events (Access) or vwResultsForPlotting Events, and select Properties
2. Click on the **Symbology** tab
3. Under **Show:** click on **Quantities** and select **Graduated color**.
4. Under **Draw quantities using color to show values** and Fields, select FRACT_ESL for the Vale
5. Select a **color ramp**.
6. At this point, ArcMap will automatically generate range categories for the data. You can edit the ranges and the associated labels that better show the data.
7. Click on the **Definition Query** tab. Click on **Query Builder...** button
8. The Definition Query allows you to filter the data. Since the data set includes results for all air contaminants, averaging times, and modeling scenarios, the query builder tool allows you to build a query to select only the data you want to display. To build a query, double click on one of the fields listed. Select one of the operators (=, >, <, etc.). Click on the Get Unique Values button to select specific values. Double click on a value to select.

Use the AND or OR operators to include other field values for your filter criteria

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9. To filter for a specific air contaminant, averaging time, and modeling scenario combination, the filter criteria would look like `air_contaminant = '<value>' AND AVG_TIME = '<value>' AND scenario = '<value>'`. Click OK and OK again.
10. Change the values to view the data desired.