

## Combining SQL Server Management Studio And ArcMap to Recur Hermine Flood Using ODM Database

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### Introduction

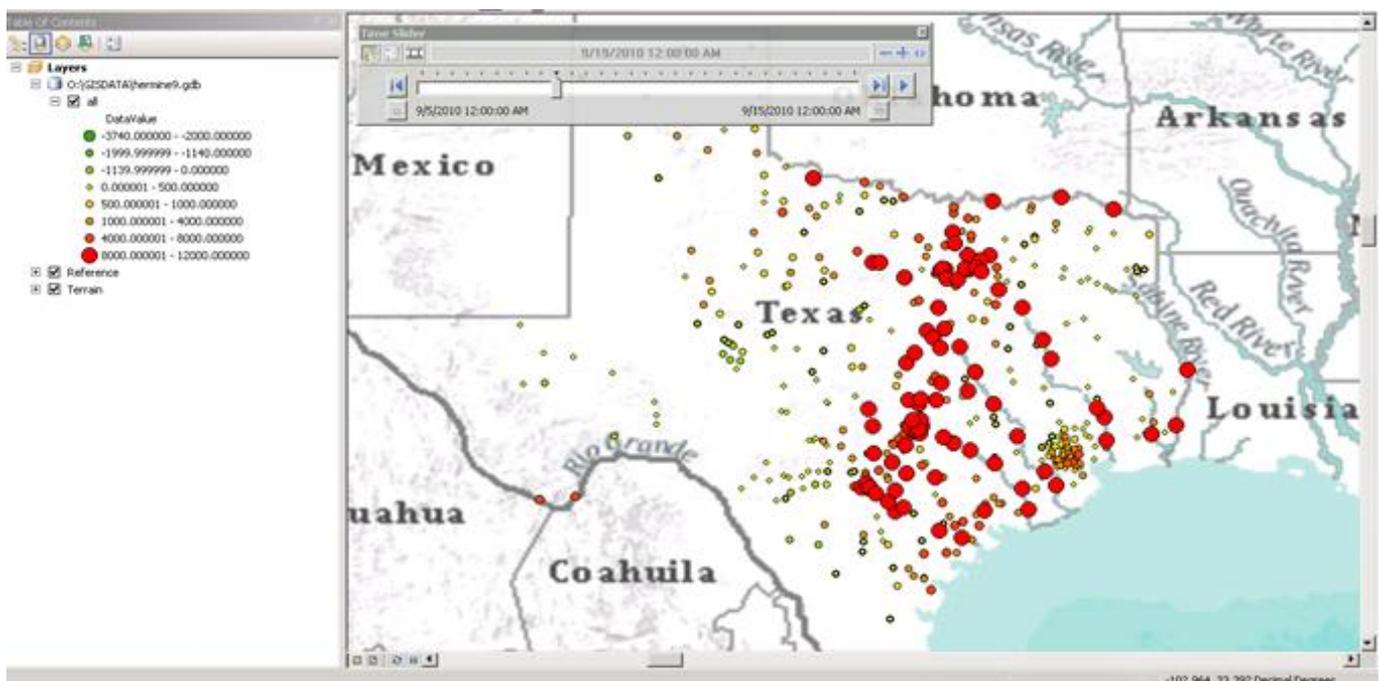


On September 7, 2010, the flood caused by Tropical Storm Hermine swept northward through Texas and into Oklahoma, forcing more than 100 high-water rescues, swamping city neighborhoods, spawning tornadoes and killing at least two people. The storm didn't go away until about September 12 depending on the flood records we have. In addition, the storm caused damage to infrastructure and left many motorists stranded and even fatalities reported. The flood was monitored and recorded every half hour and stored on the USGS web, but they only have one year limit afterwards they got deleted from the web. Fortunately a former student of Dr. Maidment Harish downloaded the data and organized them in the ODM model. The Observations Data Model (ODM) is designed to store hydrologic observations and sufficient ancillary information (metadata) about the data values to provide traceable heritage from raw measurements to usable information allowing them to be unambiguously interpreted and used.

**The goal** of this project is to specify a period of time then create Time-Enabled Feature Layers in ArcMap with ODM flood data for State of Texas which will be executed from the view of SQL Server Management Studio. Then we can recur flood happened in different places in Time-Enabled Feature Layers.

### Progress so far

There are about 448 cities or sites in Texas State were influenced by the Hermine flood which was recorded every thirty minutes. Around 300 million of records are available from the Observations Data Model. First, I got a 2-day time step Time Enable Layer for the ODM data from 7/1/2010 12:00:00 AM to 10/27/2010 3:15:00 PM for the 448 sites. Showing below:



View inSQL:

The screenshot shows a SQL query window with the following table grid:

Column	Alias	Table	Output	Sort Type	Sort Order	Filter	Or...	Or...	Or...
SiteName		Sites	<input checked="" type="checkbox"/>						
Latitude		Sites	<input checked="" type="checkbox"/>						
Longitude		Sites	<input checked="" type="checkbox"/>						
DataValue		DataValues	<input checked="" type="checkbox"/>						
LocalDateTime		DataValues	<input checked="" type="checkbox"/>						
UnitsName		Units	<input checked="" type="checkbox"/>						
LocalDateTime		DataValues	<input type="checkbox"/>						

The SQL code in the window is:

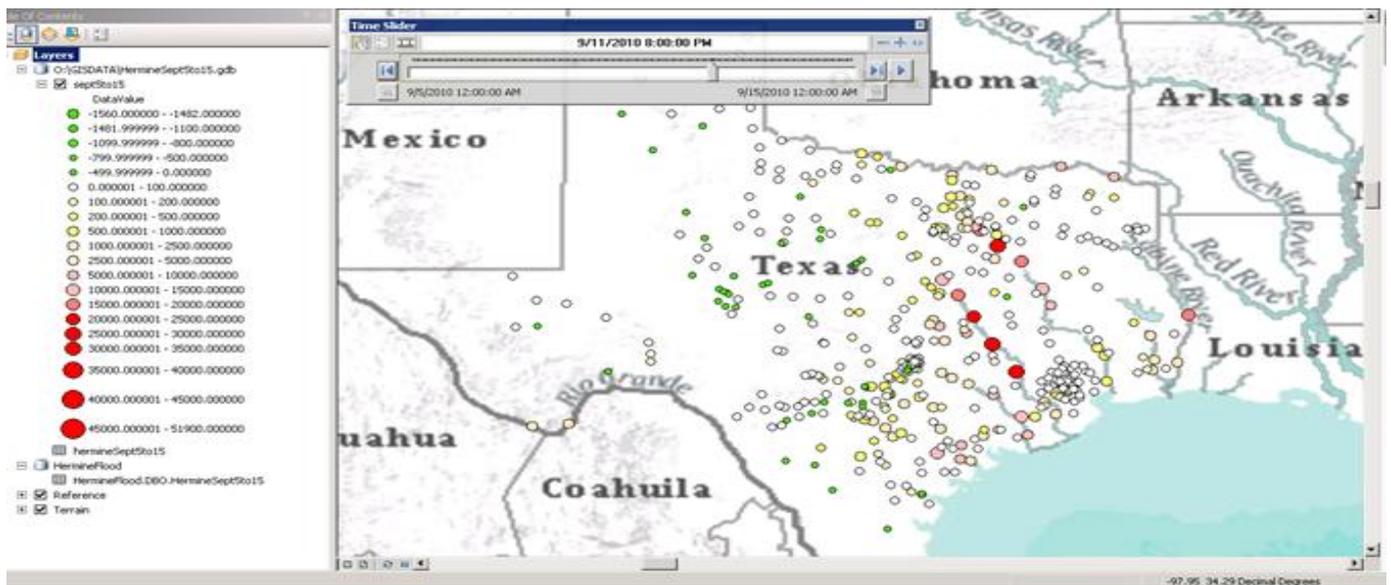
```

SELECT
  dbo.Sites.SiteName, dbo.Sites.Latitude, dbo.Sites.Longitude, dbo.DataValues.DataValue, dbo.DataValues.LocalDateTime, dbo.Units.UnitsName
FROM
  dbo.DataValues INNER JOIN
  dbo.Sites ON (dbo.DataValues.SiteID = dbo.Sites.SiteID) INNER JOIN
  dbo.Variables ON (dbo.DataValues.VariableID = dbo.Variables.VariableID) INNER JOIN
  dbo.Units ON (dbo.Variables.VariableUnitsID = dbo.Units.UnitsID)
  
```

Below the grid, a preview of the data is shown:

SiteName	Latitude	Longitude	DataValue	LocalDateTime	UnitsName
Hickapoo Cr. nr ...	30.907132	-95.089546	0.75	8/27/2010 2:15:...	cubic feet per se...
Hickapoo Cr. nr ...	30.907132	-95.089546	0.75	8/27/2010 2:30:...	cubic feet per se...
Willamson Cr. at ...	30.189378	-97.732504	0.75	8/27/2010 2:55:...	cubic feet per se...
Willamson Cr. at ...	30.189378	-97.732504	0.75	8/27/2010 3:00:...	cubic feet per se...
Hickapoo Cr. nr ...	30.907132	-95.089546	0.75	8/27/2010 3:00:...	cubic feet per se...
Willamson Cr. at ...	30.189378	-97.732504	0.75	8/27/2010 3:10:...	cubic feet per se...

Second, since the data amount is very large and the time period I chose was really long, so it cause the Time Enable Layer loading slowly and animation took a long time before there is a change in ArcMap. Then, I chose the ODM data from 9/1/2010 12:00:00 AM to 9/15/2010 12:00:00 AM for 448 sites. The 1-day time step Time Enable Layer is showed below:



View in SQL:

The screenshot shows a SQL query window with the following table grid:

Column	Alias	Table	Output	Sort Type	Sort Order	Filter	Or...	Or...	Or...
SiteName		Sites	<input checked="" type="checkbox"/>						
Latitude		Sites	<input checked="" type="checkbox"/>						
Longitude		Sites	<input checked="" type="checkbox"/>						
DataValue		DataValues	<input checked="" type="checkbox"/>						
LocalDateTime		DataValues	<input checked="" type="checkbox"/>			>= '9/1/2010'			
UnitsName		Units	<input checked="" type="checkbox"/>						
LocalDateTime	Exp1	DataValues	<input checked="" type="checkbox"/>			<= '9/15/2010'			

The SQL code in the window is:

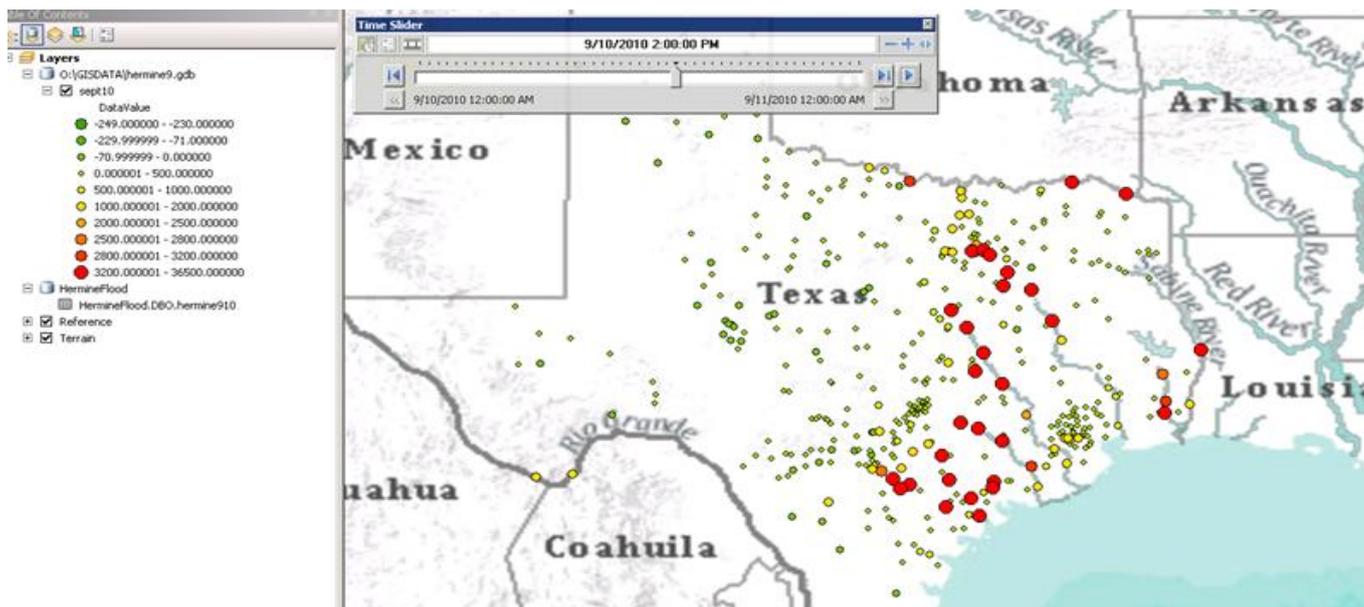
```

SELECT
  dbo.Sites.SiteName, dbo.Sites.Latitude, dbo.Sites.Longitude, dbo.DataValues.DataValue, dbo.DataValues.LocalDateTime, dbo.Units.UnitsName,
  dbo.DataValues.LocalDateTime AS Exp1
FROM
  dbo.DataValues INNER JOIN
  dbo.Sites ON (dbo.DataValues.SiteID = dbo.Sites.SiteID) INNER JOIN
  dbo.Variables ON (dbo.DataValues.VariableID = dbo.Variables.VariableID) INNER JOIN
  dbo.Units ON (dbo.Variables.VariableUnitsID = dbo.Units.UnitsID)
WHERE
  (dbo.DataValues.LocalDateTime >= CONVERT(DATETIME, '2010-09-01 00:00:00', 107) AND (dbo.DataValues.LocalDateTime <= CONVERT(DATETIME, '2010-09-15 00:00:00', 107)))
  
```

Below the grid, a preview of the data is shown:

SiteName	Latitude	Longitude	DataValue	LocalDateTime	UnitsName	Exp1
Pine Island Bayo...	30.178622	-94.188794	-249	9/1/2010 10:00:00 AM	cubic feet per se...	9/1/2010 10:00:00 AM
Pine Island Bayo...	30.178622	-94.188794	-220	9/1/2010 10:30:00 AM	cubic feet per se...	9/1/2010 10:30:00 AM
Pine Island Bayo...	30.178622	-94.188794	-219	9/1/2010 9:30:00 AM	cubic feet per se...	9/1/2010 9:30:00 AM
Pine Island Bayo...	30.178622	-94.188794	-219	9/1/2010 11:00:00 PM	cubic feet per se...	9/1/2010 11:00:00 PM
Pine Island Bayo...	30.178622	-94.188794	-218	9/1/2010 10:30:00 PM	cubic feet per se...	9/1/2010 10:30:00 PM
Pine Island Bayo...	30.178622	-94.188794	-218	9/1/2010 10:45:00 PM	cubic feet per se...	9/1/2010 10:45:00 PM
Pine Island Bayo...	30.178622	-94.188794	-191	9/1/2010 11:30:00 AM	cubic feet per se...	9/1/2010 11:30:00 AM

Third, 24 hour-period of time from 9/10/2010 12:00:00 AM to 9/11/2010 12:00:00 AM for 448 sites, time step 0.5 hour Time Enable Layer was showed in the picture below:



View in SQL:

CRWR-IDIS.Her...SeriesCatalog CRWR-IDIS.Herm... dbo.AllSites\* CRWR-IDIS.He...bo.sept5to15\* CRWR-IDIS.Her...d - dbo.Sites CRWR-IDIS.Her...- dbo.sept10\*

**DataValues**

- \* (All Columns)
- ValueID
- DataValue
- ValueAccuracy
- LocalDateTime

**Sites**

- \* (All Columns)
- SiteID
- SiteCode
- SiteName
- Latitude

**Variables**

- \* (All Columns)
- VariableID
- VariableCode
- VariableName
- Speciation

**Units**

- \* (All Columns)
- UnitsID
- UnitsName
- UnitsType
- UnitsAbbreviation

Column	Alias	Table	Output	Sort Type	Sort Order	Filter	Or...	Or...	Or...
SiteName		Sites	<input checked="" type="checkbox"/>						
Latitude		Sites	<input checked="" type="checkbox"/>						
Longitude		Sites	<input checked="" type="checkbox"/>						
DataValue		DataValues	<input checked="" type="checkbox"/>						
LocalDateTime		DataValues	<input checked="" type="checkbox"/>			>= '9/10/2010'			
UnitsName		Units	<input checked="" type="checkbox"/>						
LocalDateTime	Expr1	DataValues	<input checked="" type="checkbox"/>			<= '9/11/2010'			

```

SELECT dbo.Sites.SiteName, dbo.Sites.Latitude, dbo.Sites.Longitude, dbo.DataValues.DataValue, dbo.DataValues.LocalDateTime AS Expr1
FROM dbo.DataValues INNER JOIN
      dbo.Sites ON dbo.DataValues.SiteID = dbo.Sites.SiteID INNER JOIN
      dbo.Variables ON dbo.DataValues.VariableID = dbo.Variables.VariableID INNER JOIN
      dbo.Units ON dbo.Variables.VariableUnitsID = dbo.Units.UnitsID
WHERE (dbo.DataValues.LocalDateTime >= CONVERT(DATETIME, '2010-09-10 00:00:00', 102)) AND (dbo.DataValues.LocalDateTime <= CONVERT(DATETIME,

```

SiteName	Latitude	Longitude	DataValue	LocalDateTime	UnitsName	Expr1
Pine Island Bayo...	30.178822	-94.188794	-249	9/10/2010 10:00:00 AM	cubic feet per se...	9/10/2010 10:00:00 AM
Pine Island Bayo...	30.178822	-94.188794	-220	9/10/2010 10:30:00 AM	cubic feet per se...	9/10/2010 10:30:00 AM
Pine Island Bayo...	30.178822	-94.188794	-219	9/10/2010 9:30:00 AM	cubic feet per se...	9/10/2010 9:30:00 AM

Next step will be doing some deeper analysis to those data...