Linkage of the ArcHydro Data Model with SWAT

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Model Integration

- **Sharing of information** between models is necessary to capture the complexity of natural hydrologic processes.

- This sharing of information between models in a systematic fashion is called here *model integration.*
Model Integration

Connection on a two-model basis. Depends on the already connected models.
Model Integration

Connection on a *hub* basis. Independent of the already connected models.
Arc Hydro can be used as the *hub* for connecting hydrologic models.
Arc Hydro

ArcGIS Hydro Data Model
http://arconline.esri.com/arconline/datamodels/water.cfm
http://www.crwr.utexas.edu/giswr

GIS in Water Resources Consortium
Arc Hydro is a **geodatabase**, that is, a relational database that contains geographic information.

Arc Hydro is a **standard data model** for spatial and temporal hydrologic data.

A **data model** is a template for organizing data, so that it can be found and retrieved easily.
ArcGIS-SWAT is an ArcView 8.x preprocessor for the Soil Water Assessment Tool (SWAT) compatible with the Arc Hydro data model developed by Texas A&M University – Civil Engineering and Forest Sciences with support of the U.S. Army Corps of Engineers.

Improvement with respect to AVSWAT developed by Di Luzio et al.

Bian et al. (1998): SWAT 1990 / ArcInfo – Arc Macro Language (AML)


Di Luzio et al. (2002): Improved 1998 interface and was incorporated in BASINS.

Olivera et al. (2003): Improved 2002 interface for ArcView 8.x – Visual Basic
What's new?

- Compatible with the latest ESRI GIS software package ArcView 8.x and programming standards.
- Uses a geodatabase data structure to store (and relate) spatial features, parameter tables and time series tables.
- Stores the location of the hydrologic response units (HRU).
- Includes a Monte Carlo parameter simulation utility.
ArcGIS-SWAT Toolbar
Watershed Delineator

- Delineates streams and watersheds

Input: DEM, mask, threshold value, vector stream network, outlets.

Output: Watershed, Reach, Outlet, MonitoringPoint, Basin, and LongestPath.
Watershed Delineator
Features Classes

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ArcGIS SWAT Data Model (Dynamic Geodatabase)

Outlet
{GeometryType = esriGeometryPoint}
-GRIDCODE : esriFieldTypeInteger
-XPR : esriFieldTypeDouble
-YPR : esriFieldTypeDouble
-LAT : esriFieldTypeDouble
-LONG : esriFieldTypeDouble
-TYPE : MonitoringPointType
-HYDROID : esriFieldTypeInteger

MonitoringPoint
{GeometryType = esriGeometryPoint}
-GRIDCODE : esriFieldTypeInteger
-XPR : esriFieldTypeDouble
-YPR : esriFieldTypeDouble
-LAT : esriFieldTypeDouble
-LONG : esriFieldTypeDouble
-TYPE : MonitoringPointType
-HYDROID : esriFieldTypeInteger
-OUTLETID : esriFieldTypeInteger

SWAT Dataset
- Watershed – Outlet: One-to-one relationship class.
Reach – Outlet: One-to-one relationship class.
Soils

- STATSGO soils data
Land use / land cover

- National Land Cover Dataset (NLCD)
Soils and Land Use Data
Hydrologic Response Units

- HRU are generated by intersecting watershed, soil and land-use polygons.
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ArcGIS SWAT Data Model (Dynamic Geodatabase)

Features Classes
HRU – Watershed: Many-to-one relationship class.
Weather
Weather
Editing Input Data
Editing Static Geodatabase
Time Series

**SWATDataset: MonitoringPoint**
- GRIDCODE: esriFieldTypeInteger
- XPR: esriFieldTypeDouble
- YPR: esriFieldTypeDouble
- LAT_: esriFieldTypeDouble
- LONG_: esriFieldTypeDouble
- TYPE: MonitoringPointType
- HYDROID: esriFieldTypeInteger
- OUTLETID: esriFieldTypeInteger

**SWATDataset: PolyHRU**
- SUBBASIN: esriFieldTypeInteger
- LU_NUM: esriFieldTypeInteger
- LU_CODE: esriFieldTypeString
- SOIL_NUM: esriFieldTypeInteger
- SOIL_CODE: esriFieldTypeString
- MEAN_SLOPE: esriFieldTypeDouble
- AREA: esriFieldTypeDouble
- HRUID: esriFieldTypeString

**TIMESERIES**
- FEATUREID: esriFieldTypeInteger
- TSTYPEID: esriFieldTypeInteger
- TSDATETIME: esriFieldTypeDate
- TSVVALUE: esriFieldTypeDouble

**TSTYPE**
- TSTYPEID: esriFieldTypeInteger
- VARIABLE: esriFieldTypeString
- UNITS: esriFieldTypeString
- SREGULAR: esriFieldTypeBoolean
- TSINTERVAL: esriFieldTypeString
- DATATYPE: esriFieldTypeString
- ORIGIN: esriFieldTypeString

**MonitoringPointHasTimeSeries**

**PolyHRUHasTimeSeries**

**ESRI Classes:** Object
+ OBJECTID: esriFieldTypeOID
Monte Carlo Simulator
Conclusions

- A new **SWAT** interface for **ArcView 8.x** has been developed.

- Development of an ArcView 8.x interface for SWAT requires to develop an application-specific geodatabase not to build geometric networks or create/edit relationship classes.

- The hub for data-sharing should be time series at points and not the entire spatial representation of the hydrologic features.

- **XML** applicability to read geodatabases and write XML files will be studied.