An Interface System to Couple the SWAT2005 Model with HyGIS(HyGIS–SWAT)

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- Korean GIS software
- Not includes hydro module

- HyGIS was developed in 2007
- Added on GEOMania universal GIS tool (GMMap)
- Includes hydro module

- A modeling system cooperates with HyGIS

Technology for GIS based Hydro System
HyGIS?

Overview

- HyGIS (Hydro Geographic Information System)
- Helps users can apply GIS to water resources analysis and management efficiently
- Database system (spatial, non-spatial, time series / static, dynamic)
- Component based system
- Operated as extension module of GEOMania
HyGIS?

Features

- DEM analysis
  - Smoothing, sink & flat area treatment, burning
- Extract spatial information
  - Stream, watershed, hydrological geospatial parameters
- Construct stream network
  - Enables linear referencing, network searching
- Develop applications
  - Base system framework
  - Watershed management system
  - GIS based hydrologic, hydraulic, water quality modeling system, etc.
• HyGIS application
• Comprehensive name of the models operated in connection with HyGIS
• Using GDK(GEOMania Development Kits), HyGIS component, COM based programming language(Visual Basic .NET…)
• Added on GEOMania GIS tool as extension modules
HyGIS-Model

Extension modules

HyGIS-HMS
HyGIS-RAS
HyGIS-QUAL2E
HyGIS-TOPMODEL
HyGIS-GRM

HyGIS-SWAT (SWAT2005)
• HyGIS / HyGIS-Model are database system
  • 6 conceptual databases (mdb)
    - Static/dynamic and spatial/non-spatial/time series
• RDB environment confirms stable and efficient database operation
• Input data are extracted from static DB and modeling results are stored in dynamic DB
SWAT

- SWAT (Soil and Water Assessment Tool)
  - USDA Agricultural Research Service (ARS), Jeff Arnold.
- Predicts the impact of land management on water, sediment and agricultural chemical
- Uses any amount of topographic data, time series data, non-spatial data
- Coorporated with GIS software (ArcView, ArcGIS)
- BASINS (Better Assessment Science Integrating point and Nonpoint Sources, EPA)
• Srinivasan and Arnold (1994)
  - SWAT 1990 / GRASS – C programming language
• Bian et al. (1998)
  - SWAT 1990 / ArcInfo – Arc Macro Language (AML)
• Di Luzio et al. (1998) - SWAT 1996 / ArcView – Avenue
• Di Luzio et al. (2002)
  - SWAT 2000 / ArcView – Avenue (AVSWAT2000)
• Di Luzio et al. (2002)
  - Improved 1998 interface and was incorporated in BASINS (BASINS SWAT)
• Francisco Olivera and Milver Valenzuela (2004)
  - SWAT2000 / ArcGIS – Visual Basic (ArcGIS-SWAT)
  - SWAT2005 / ArcGIS - ArcSWAT2.1
  - SWAT2009 / ArcGIS – ArcSWAT2009
HyGIS-SWAT

- for the SWAT2000 model in 2007 (Ref. AVSWAT2000)
- for the SWAT2005 model in 2009

- Interface system to run SWAT2005 in HyGIS
- Make input files and treat modeling results
- Call SWAT2005.exe
- Using GDK (GEOMania Development Kits) and Visual Basic .NET
- Added on GMMMap as extension module
• Interchange
  - Separated GUI, interchanging input files by user

• Interface
  - Pre/post processing, running model, user interface

• Integration
  - Integrate more than one system into one system.
HyGIS-SWAT

Environment

- **HyGIS, HyGIS-Model**
  - Interface system based on GIS and database

- **Spatial database**: GSS (from GEOMania GIS)
  - GEOMania Pro/3D, GMMap

- **Non-spatial, timeseries database**: MDB
  - MS Access

- **Using GDK, VS2008, VB.NET (.NET framework 3.5)**
HyGIS-SWAT

Implementation

• Model (SWAT2005) analysis (vs. SWAT2000)
  - Input/output files format, parameters
  - New or removed variables/renamed or moved variables
  - New input file, renamed filename, file format changes
  - Applying sub-hourly precipitation

• Upgrade HyGIS-SWAT (for the SWAT2000)
  - Visual basic 6 -> Visual basic .NET
  - Add new GUIs, functions, and processes for new variables and new input files format
HyGIS-SWAT data model

- HyGIS spatial data model: adopts the concept of Arc Hydro data model
- HyGIS-SWAT data model: the application of HyGIS data model
- Spatial data model: drainage area, main stream, monitoring point, network information
- Monitoring point is connected with time series database
- Time series database table: TSType, TSMeta, TSData

[Spatial data model]  [Time series data model]
- Default value of SWAT input
- Physical values of land cover, soil, crop, fertilizer, etc.
- Weather station DB to generate weather data
- Set many parameters of SWAT using this DB
- Used to make dynamic DB
HyGIS-SWAT data model

- Composed of three groups - HRU, input, output
- HRU group: HRU calculation
- Input group: directly used to make SWAT input files
- Output group: main output files of sub, rch, hru, etc.
- Users can analyze output using tables and chart.
[Data flow of HyGIS-SWAT in HyGIS-Model environment]
Conclusions

✓ Develop the HyGIS–SWAT system

✓ Provide easy and convenient modeling environment with GIS and database

✓ Can make effectively the input database of SWAT model appropriate to Korea

✓ Obtain the technology for the nation wide modeling support system based on GIS and database

✓ Expect to be used as the convenient tool for applying the SWAT model
THANK YOU...
(http://hygis.kict.re.kr)