



Research Trends and Opportunities

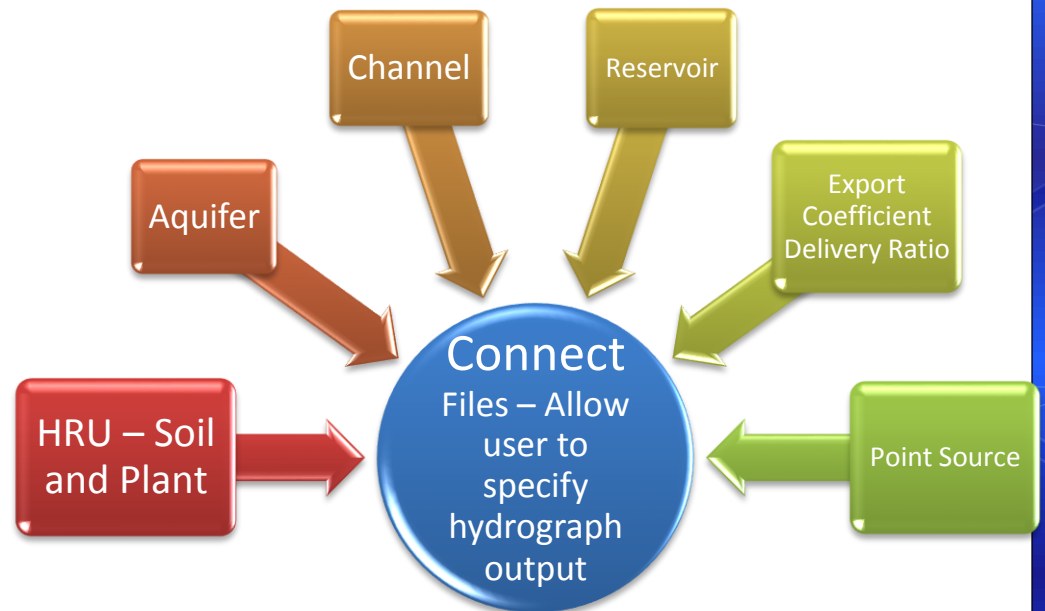


Code
Data
Interfaces
Processes
Output

Sardinia 2015

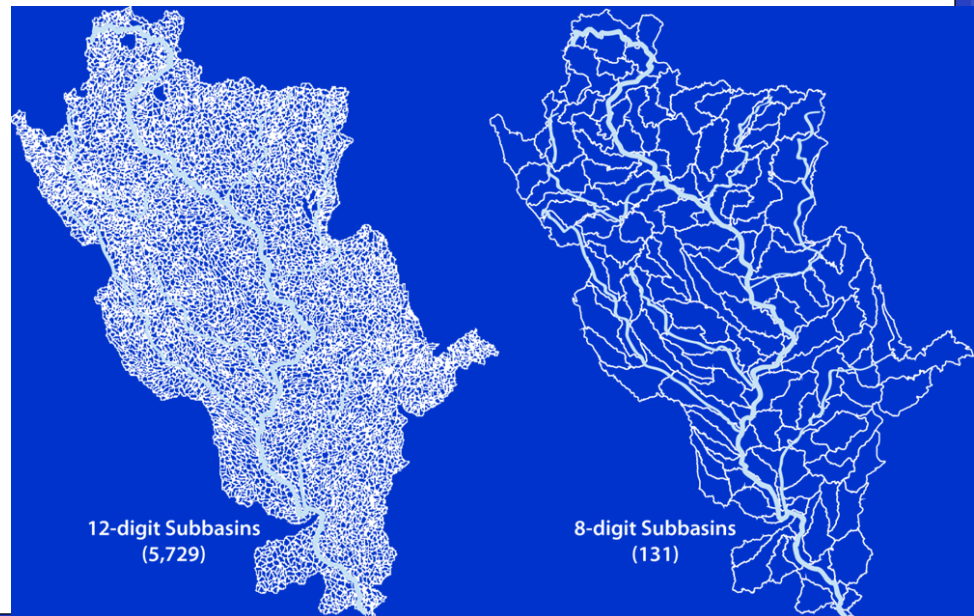


- FORTRAN - continue as language of choice for scientists/engineers.
- MODULAR – Extensive use of data structures and modules. Easier to maintain, link to other models, and add process subroutines.
- RECODING - Spatial objects with new input/output data structure is complete. Continue recoding process subroutines and modules.
- VERSION CONTROL -
Java Forge — similar to CoLab but easier to obtain login.
- PARRELIZE – Continue efforts on code and data



Data

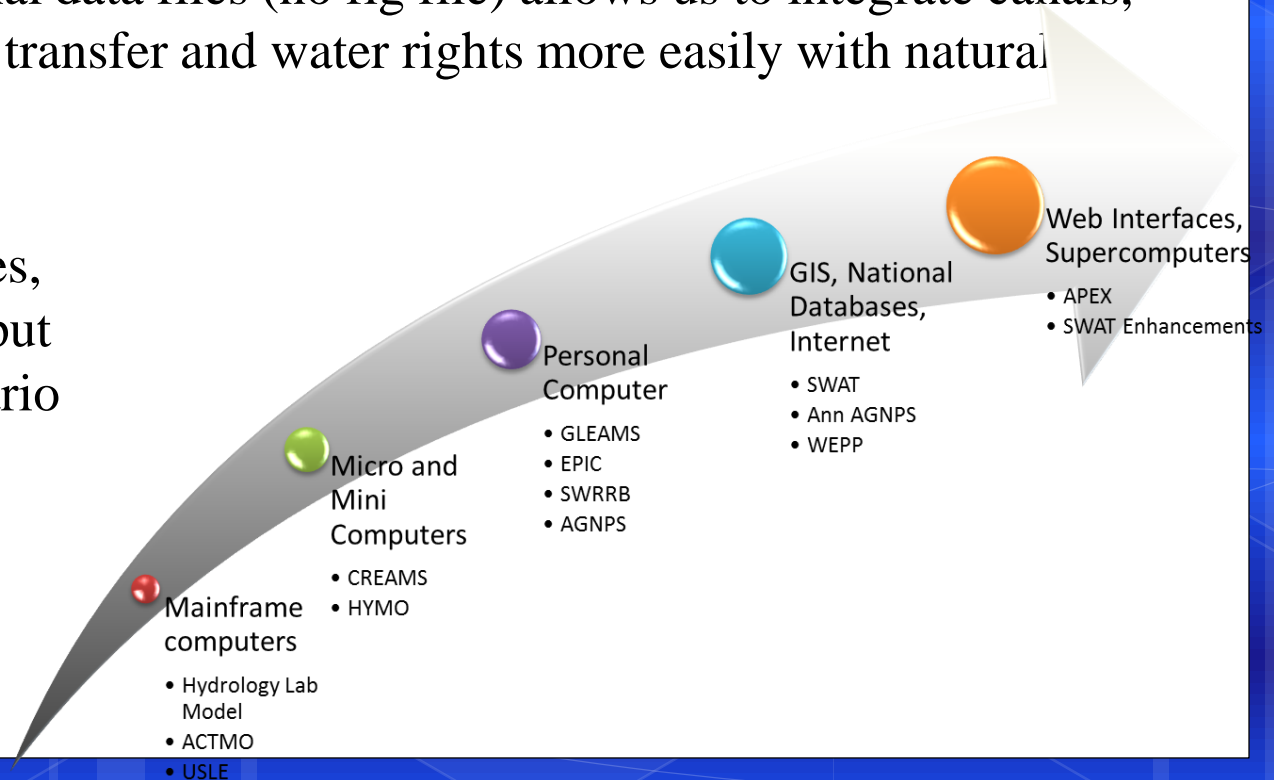
- Support and Maintain Model Input Data Files. The new relational data file structure has created files that can be maintained. In addition to plant, tillage, fertilizer, pesticides – all files are now in a similar format including soils, topography, land use, and management operations.
- Soft Data. Typically validate to hard data – measured time series at a point – stream gage, reservoir/well levels, soil moisture. Soft data of processes to represent water, sediment and nutrient budgets:
 - Base flow ratio – crop yields
 - Sediment sources and sinks
sheet and rill, gullies, stream degradation, flood plain and reservoir deposition.
 - Nutrient balance – crop yields, denitrification, mineralization, soluble phosphorus in tile flow.
- Crowdsourcing data.



Interfaces

- Web-based, parameterized and calibrated. Focus on scenario analysis and decision making. GIS and ultimately the models will be in the background.
- Watershed Discretization/Set up. Currently choose subbasin size and hru's. Future – decide on landscape units, grid cells, fields, etc.
- Link natural topography with irrigation and drainage systems. Modular code and relational data files (no fig file) allows us to integrate canals, reservoirs, water transfer and water rights more easily with natural topography.

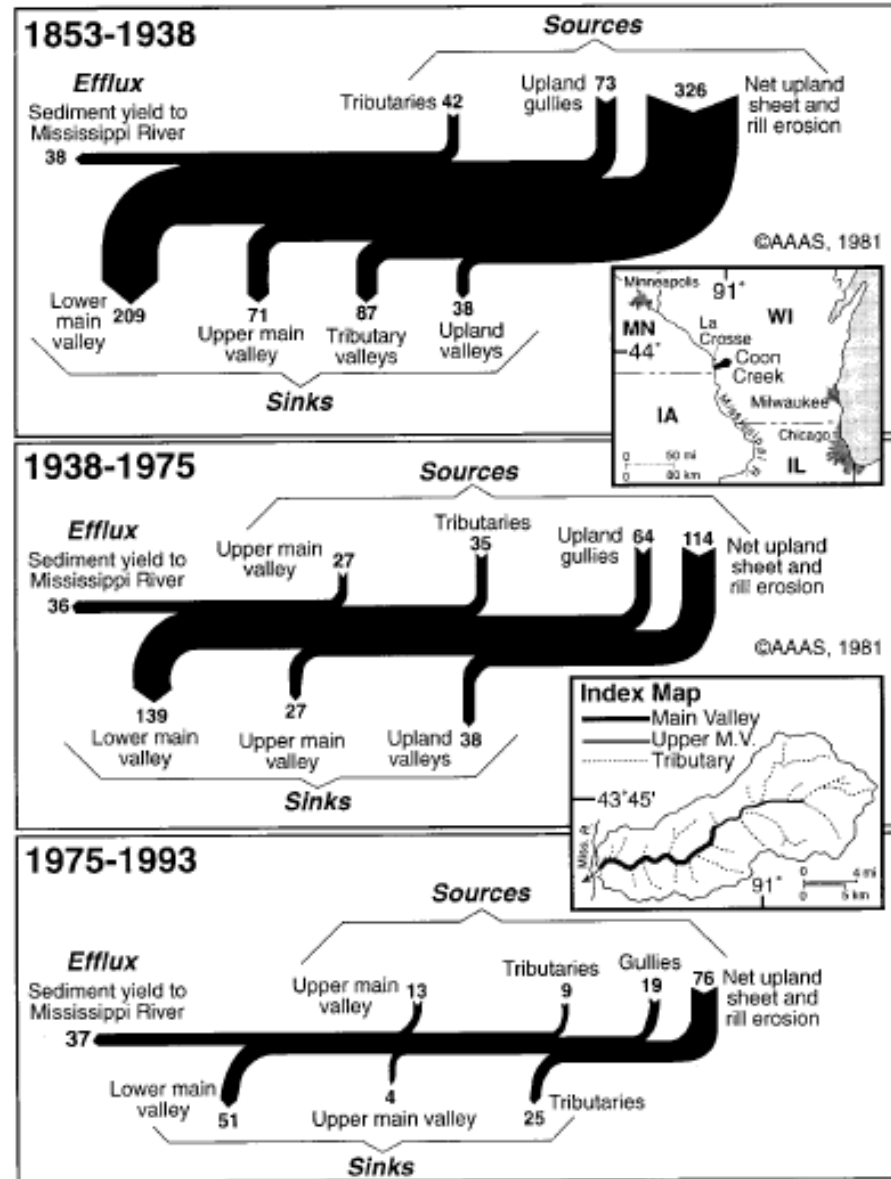
- Integration of Tools. Interfaces, calibration, output diagrams, scenario tools, SWAT-Check.



- Numerous opportunities for publishing and advancing the models
- Carbon – A) link carbon and nutrient models, B) simple greenhouse gas model C) Dept. of Energy wants river basin carbon balance.
- Irrigation management – A) Real time water management, B) water rights, C) reservoir management
- Drainage management – A) 2 stage ditch, B) controlled drainage, C) phosphorus in tiles.
- River-Landscape continuum – A) Stream-landscape interaction, B) stream-aquifer interaction, C) wetland-groundwater interaction, D) valley bottom deposition, E) variable source hydrology
- Plant growth – A) plant competition – CO₂ tunnel, B) tropical plant growth.

Output

- Spatial maps will become more effective when we start using landscape units and grid cells.
- Sankey diagrams for budget outputs. Used by Trimble in his Science papers. Effective way to display water, sediment and nutrient budgets



- Developer's web site that will include code and test data sets.
- Book for teaching/training.
- Short You-Tube videos for training - enhance current training.
- Virtual community with Facebook and Twitter - enhance current conferences and workshops.

- Develop and support the engines for global environmental and conservation decision making.
- We are moving ahead in all the right areas. We need to continue to move together with a shared vision and purpose.
- Thank you.

