New Features in IWFM

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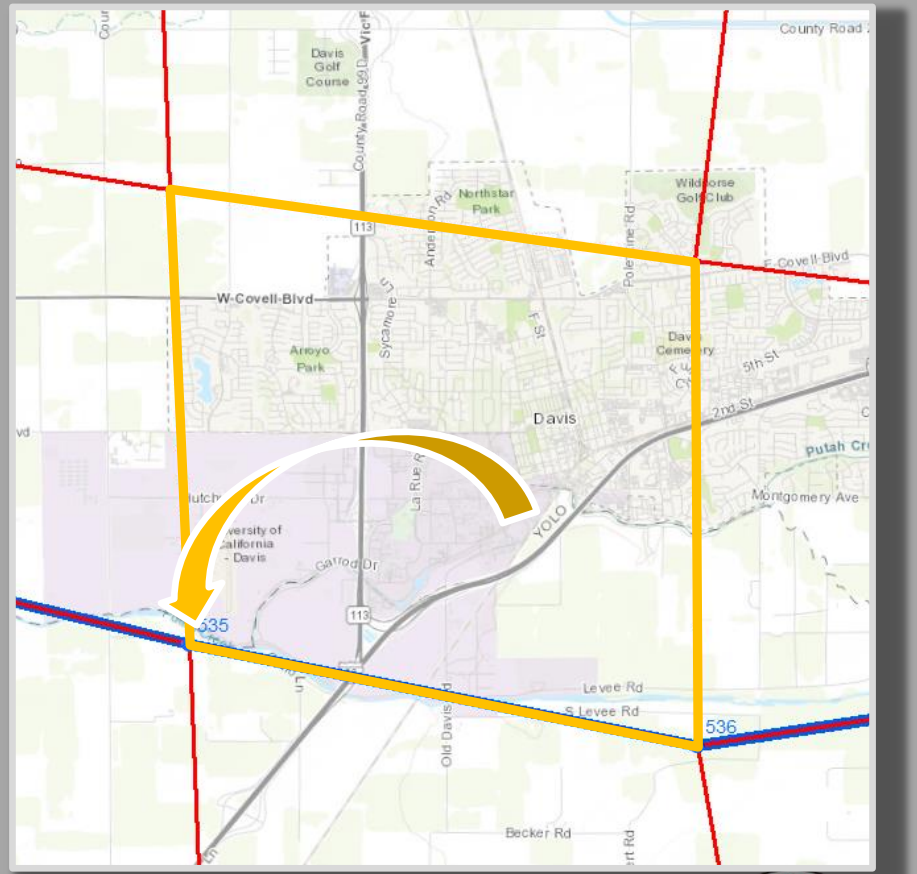
Outline

- New features
  - Treatment of surface flows
  - Stream evaporation
  - Improvements to wide-channel stream simulations
  - Improvements to IWFM-Ops
  - Delayed subsidence
- On-going developments
  - Asymmetric stream-aquifer interaction
  - Solute transport
  - 2-way interaction between the root zone and groundwater
  - Migration of ArcMap utilities to ArcGIS Pro
- Future developments

Treatment of Surface Flows

- Issue:
  - All surface flows (agricultural and urban return flows, rainfall runoff, rice pond drainage) generated at a cell flowed to the same user-defined destination
  - Inability to treat agricultural and urban surface flows separately (e.g urban water treatment plans versus agricultural return flows)



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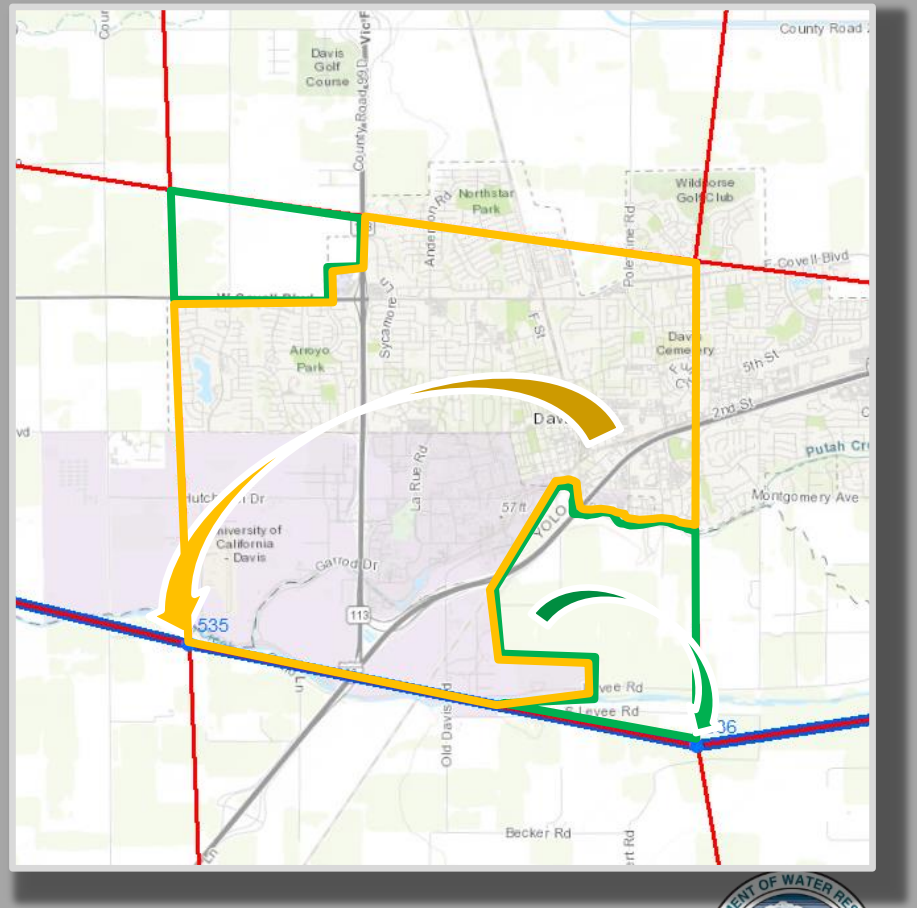
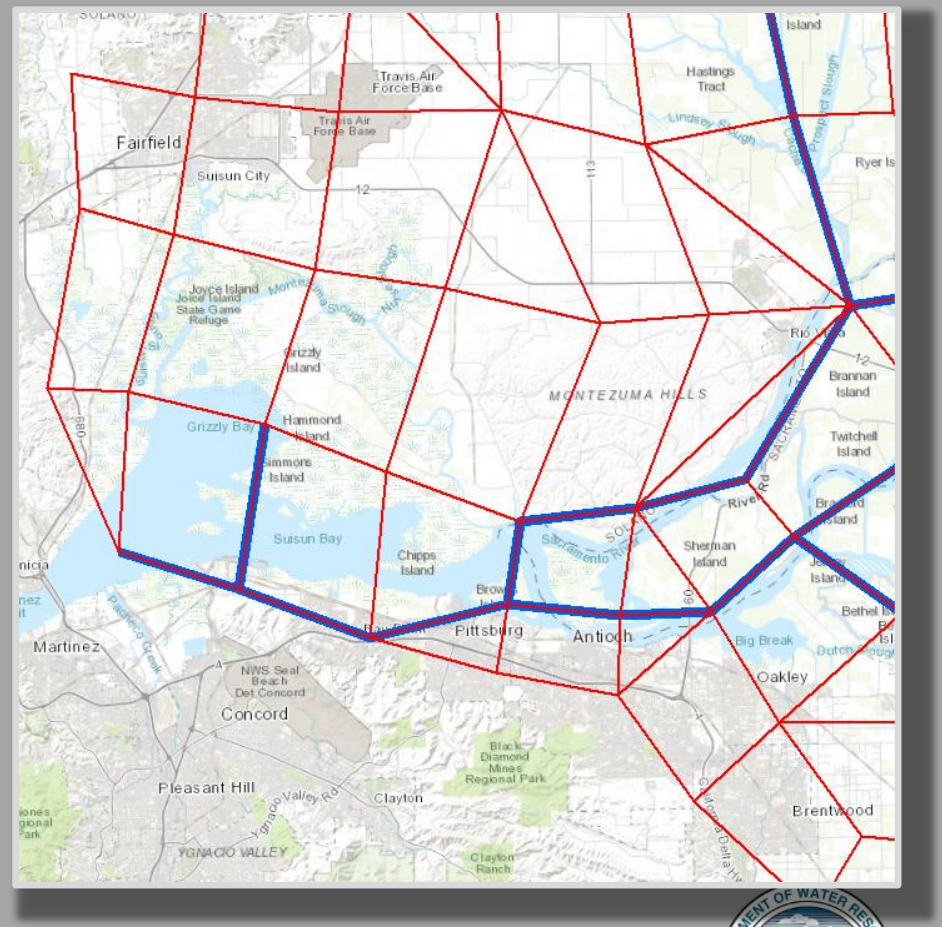
  - Inability to treat agricultural and urban surface flows separately (e.g urban water treatment plans versus agricultural return flows)
- New feature:
  - Surface flows from agricultural, urban indoors, urban outdoors, and native vegetation areas within a cell can flow into different destinations



Simulation of Stream Evaporation

- Stream surface evaporation can be a substantial water budget component (e.g. estimated 620 TAF/year in Central Valley)
- New simulation feature requires evaporation and stream surface area
- Two options available for surface area:
  1. As a function of wetted perimeter and stream reach length
  2. Provided by the user as time-series data
- Ability to simulate at only selected stream nodes



Improvements to Wide-Channel Stream Simulation

- Two options to define wetted perimeter for each groundwater node connected to a stream node:
  1. Allow IWFM to distribute wetted perimeter to individual groundwater nodes
  2. User defines wetted perimeter at each groundwater node

Improvements to IWFM-Ops

- Simulation of bypasses (method to represent flow bifurcation in IWFM) as part of surface water operations
  1. Upstream-flow driven bypasses (e.g. Yolo bypass)
  2. Downstream-demand driven bypasses (e.g. Glenn-Colusa Canal)
- ANN-based Water Supply Adjustment (i.e. closure terms) terms calculated dynamically for proper simulation of reservoir operations
- Improvements in referencing future water demands using time array notation (from 220 lines of WRESL code per diversion to 40 lines)

Other Improvements

- Simulation of delayed subsidence
  - Alternative to currently available instantaneous subsidence approach
  - MODFLOW-like approach with some modifications
  - Detailed presentation by Vivek Bedekar (SSP&A), Session 37, Wednesday, 3:15-5:00pm
- Improvements to run times
  - Improved parallel processing; up to 50% decrease in runtimes
  - Smoothing of Max / Min functions in simulating stream-aquifer interaction, groundwater pumping, drying/rewetting of groundwater nodes
  - Tweaks to compiler flags

Ongoing Developments

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  - Theory developed by late Dr. Hubert Morel-Seytoux (1932-2022)

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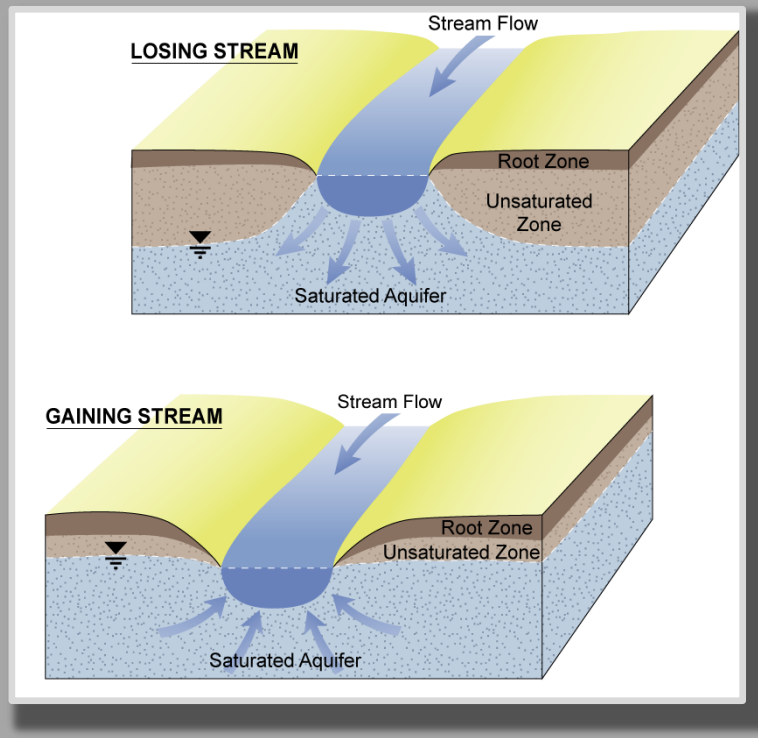
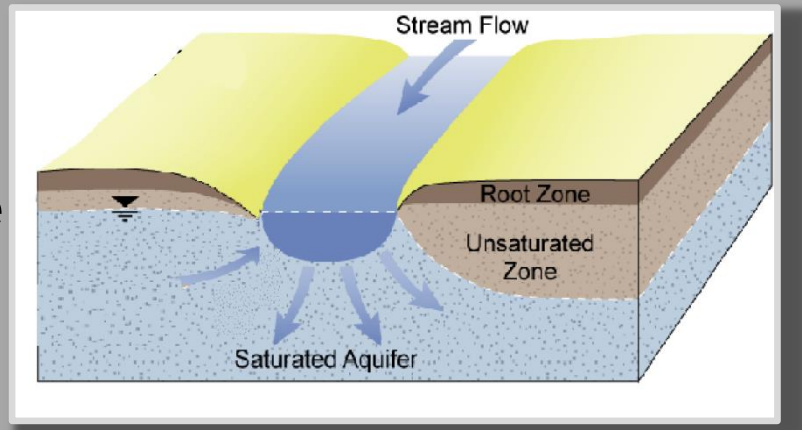


Ongoing Developments

- Asymmetric stream-aquifer interaction
  - Theory developed by late Dr. Hubert Morel-Seytoux (1932-2022)
  - Traditional approach is to assume groundwater table is symmetric around streams
  - Different groundwater operations on either side of streams can lead to asymmetric stream-aquifer interaction
  - SGMA requires GSAs to quantify groundwater impact on streams
  - Detailed presentation by Giorgos Kourakos (UC Davis), Session 28, Wednesday, 8:00-9:45am

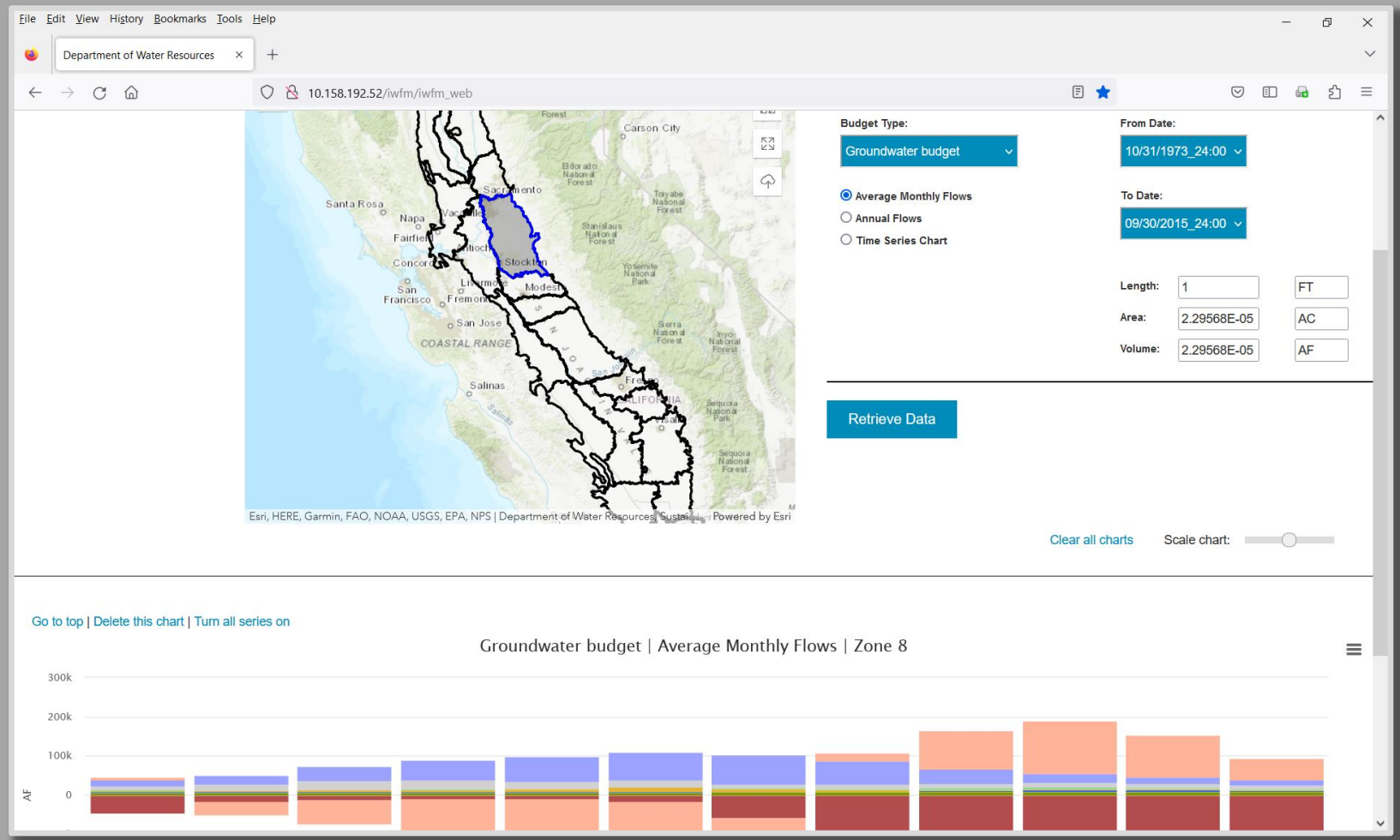


Ongoing Developments

- Development of a solute transport module (Uditha Bandara)
- Physically-based 2-way interaction between the root zone and groundwater (Morteza Sadeghi)
- Migration of ArcMap GIS tools (Soil Data Builder, Mesh Generator, GUI) to ArcGIS Pro environment (Thi Pham)

Ongoing Developments

- C2VSimFG / IWFM web application



Future Developments

- Simulation of SGMA-imposed constraints on groundwater operations in IWFM-Ops
- Implementation of Jacobian Free Newton Krylov method in IWFM for faster runtimes
- Dynamic simulation of agricultural crop acreages based on water supply availability and economics
- Simulation of multiple native vegetation classes

Questions?