OMS3 Overview

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Object Modeling System

- Software Framework and System for Environmental Modeling

  - Used for Development, Application, and Deployment of models
  - Based on ‘state of the art’ software engineering methods
  - Models are based on “Science building blocks” = software components

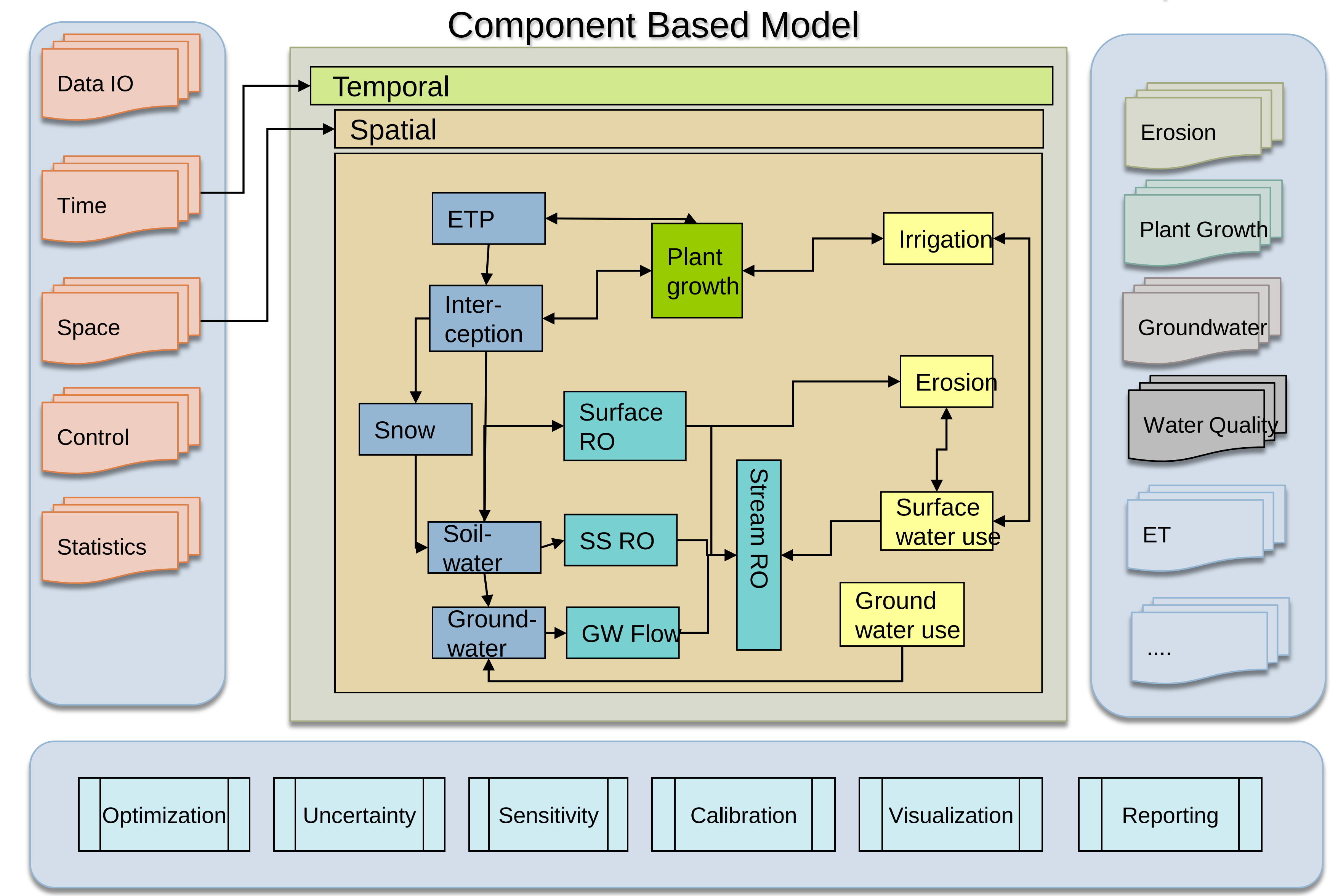
OMS Goals

- Reduce redundancy in model development
- Streamline model technology transfer
- Improve model code quality
- Improve long term model maintainability
- Allow rigorous testing of models
- Allow focus on science and its flexible change
- Decreases development/deployment costs

History of the OMS development

2001/02	2003/04	2005/06	2007/09	2010/11
Initial Prototype Swing based	Netbeans Platform Refactoring Central Version Control Standardize Component API	Modeling Projects USDA CoLab Use Project Plan/Process	Calibration Tools Sensitivity Analysis Uncertainty Analysis Data Provisioning Agency Governance	OMS3 COSU CSIP Cloud Computing Parallelization
ARS/CSU	ARS/NRCS/CSU			
	PRMS - Prototype	PRMS WSF CEAP	J2000(S), PRMS WSF, WWEM, Range,	CEAP-AgEs, AgesUI, PRMS WSF, WWEM, Range, McCabe MWB Hymod, (GeoTop) IAEA Rusle2

OMS Principal Architecture

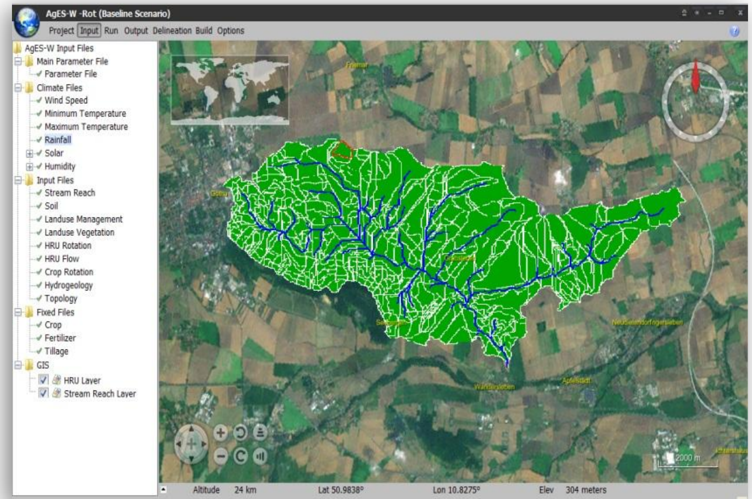


OMS3 Features

- Lightweight, non-invasive, component-based modeling framework
- Parallel processing
- Multi-language support
- Formal knowledge base
- Meta data definitions, Auto-Documentation
- Simulations, Calibration, Uncertainty, and Sensitivity analysis
- Audit Traceability

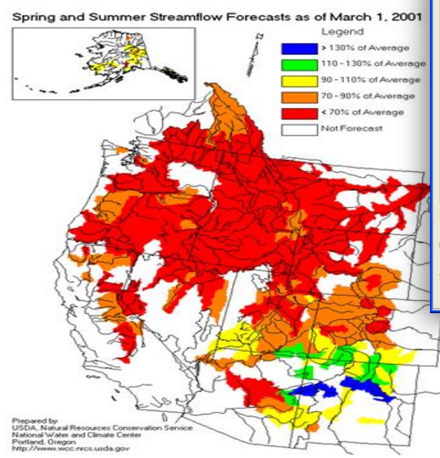
OMS3 Applications

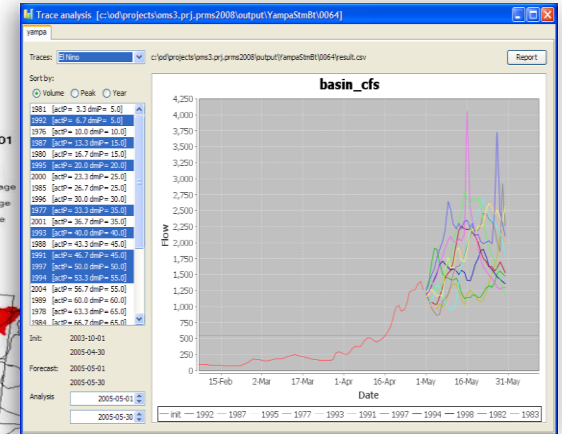
AgroEcosystem-Watershed (AgES)



- ARS CEAP Team/Workgroup 5
- Fully-distributed WQQ watershed model
- 130+ process components
- SWAT/WEPP/PRMS/RZWQM2 and others

Water Supply Forecasting

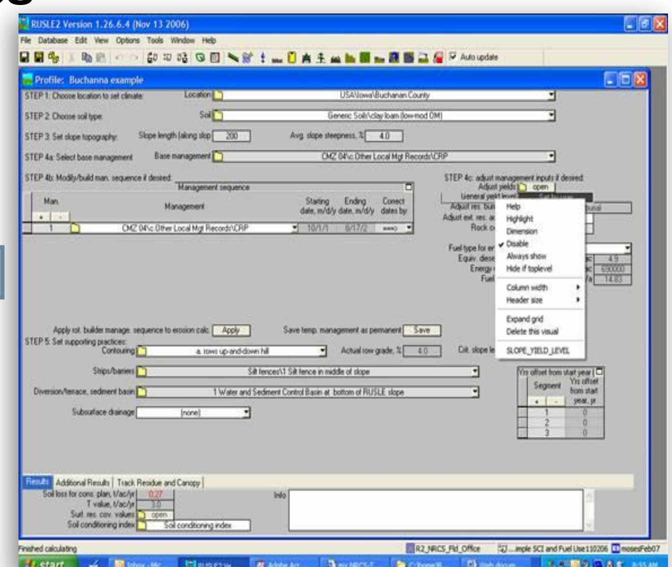




OMS3 Implementation of PRMS (USGS) Model:

- ~25 process components
- Ensemble streamflow prediction, detrended kriging

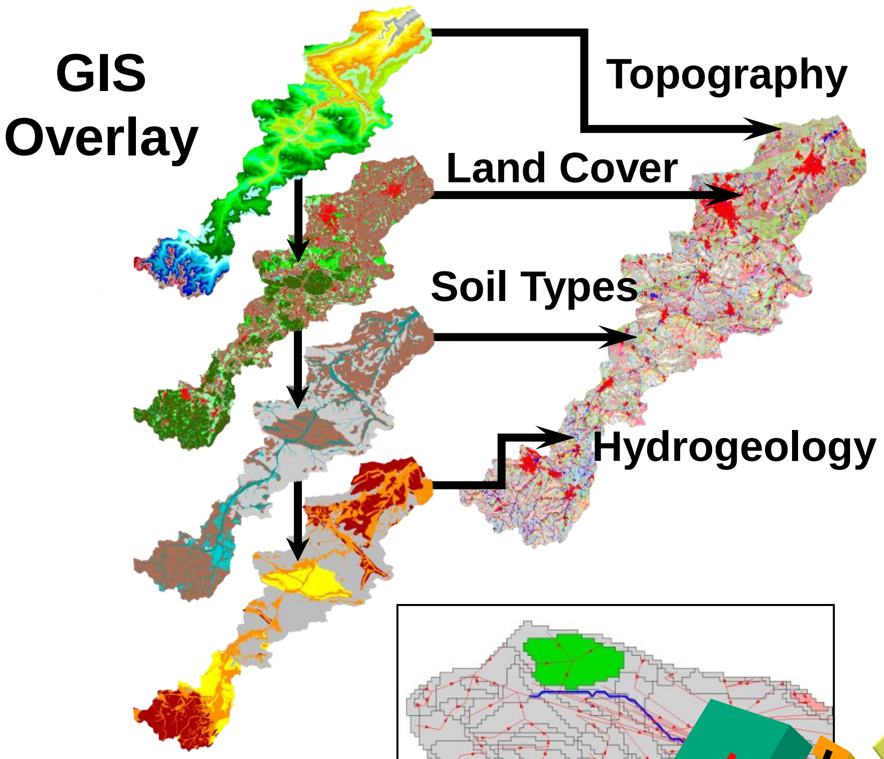
RUSLE2 Mobile/Cloud Under OMS3 (NRCS CSDI)



OMS Collaborators

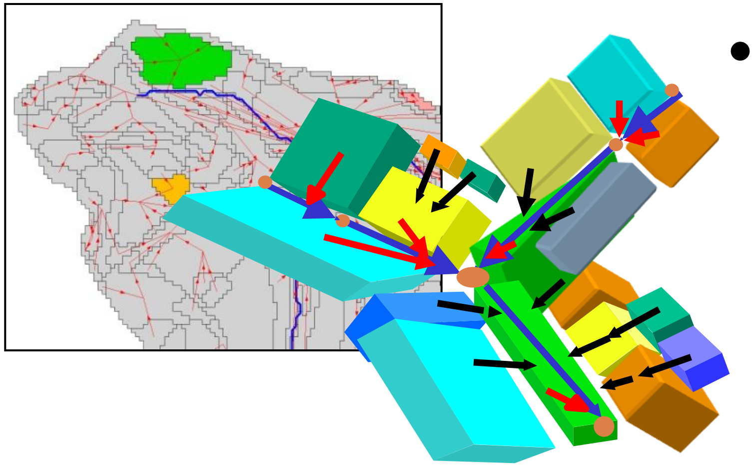
ARS, NRCS, Federal Agencies (USGS, EPA), Universities (CSU, Jena, Trento), Private Business (Riverside Technologies, HydroloGIS), International Societies (iEMSs), Framework Developers (OpenMI, CSDMS, ESMF, CCA)

AgES-W Model HRU Delineation



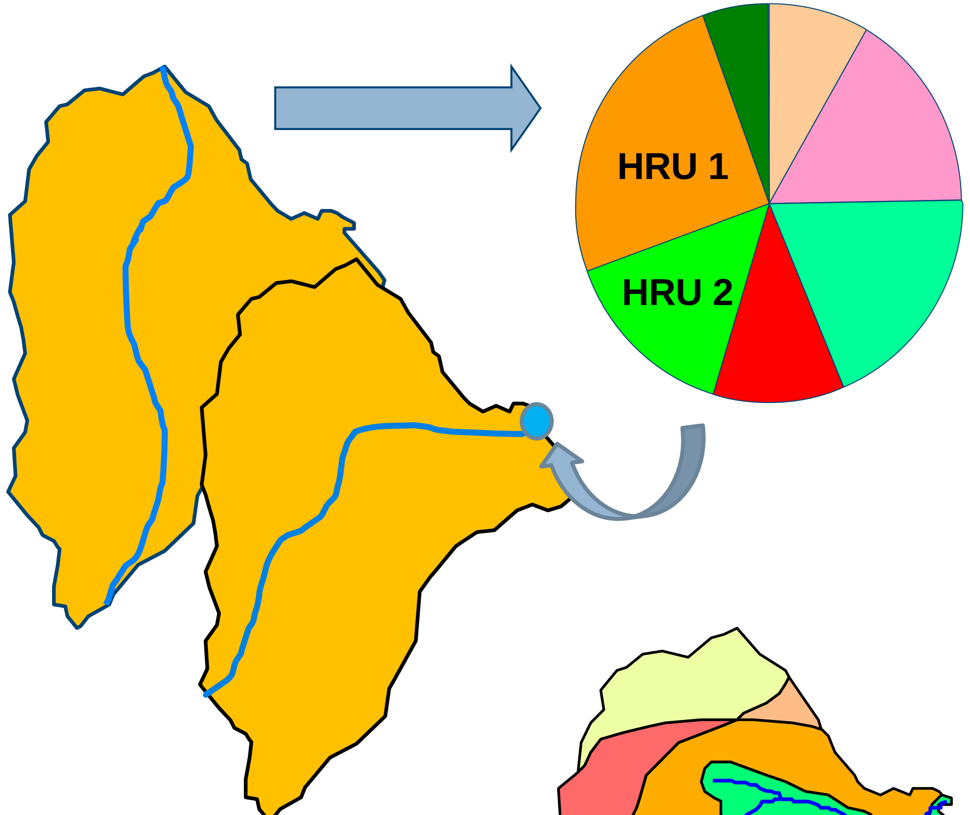
- The scalable **Hydrologic Response Unit (HRU)** distribution concept allows process oriented classification of catchments without loss of important information

- Combined with a topological routing scheme, vertical and lateral processes can be modeled fully distributed

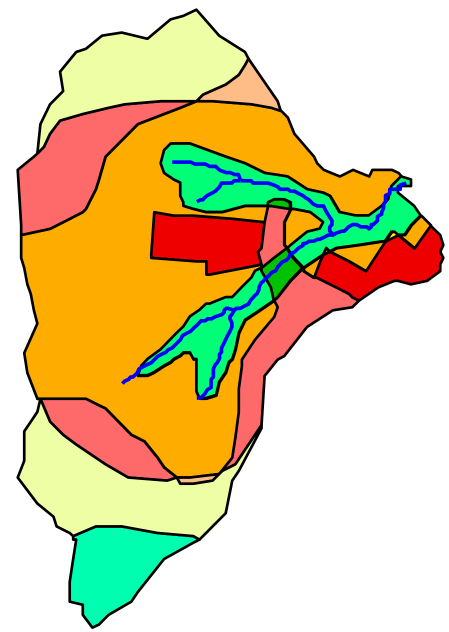


AgES-W Compared to Soil and Water Assessment Tool

- **The semi-distributed SWAT concept considers distributed information within a sub-basin only statistically but not in terms of location**
- **Important processes, e.g., lateral water /nutrient transport, specific management, and conservation effects in sub-basin HRUs cannot be simulated**

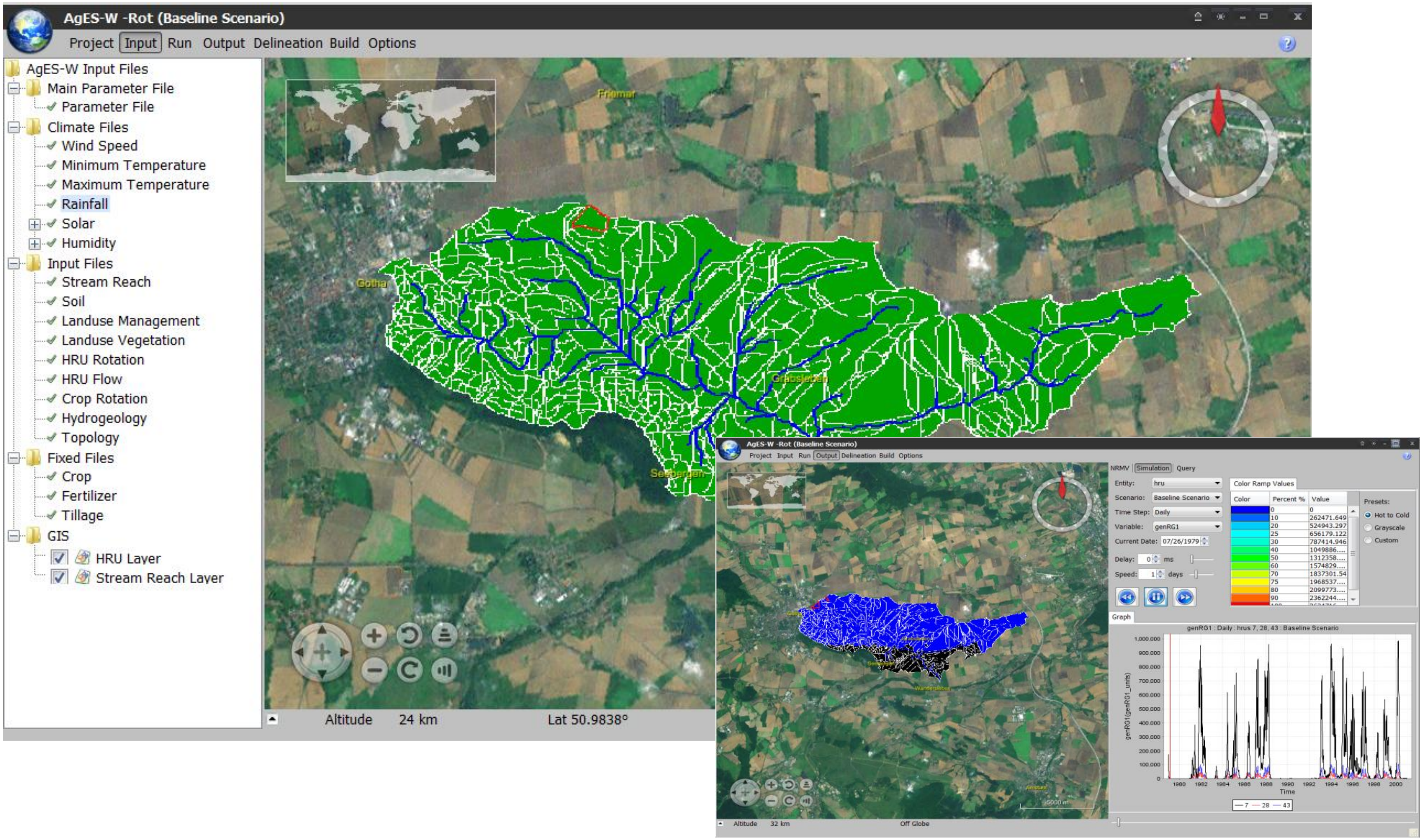


The fully distributed AgES-Watershed Model concept allows the consideration of such processes

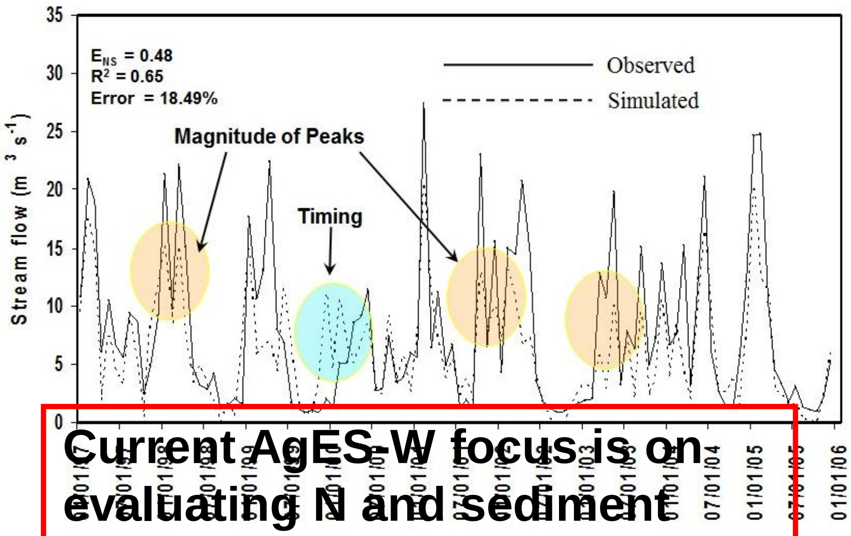


[Ascough 2011]

1) AgES (OMS3 RT)

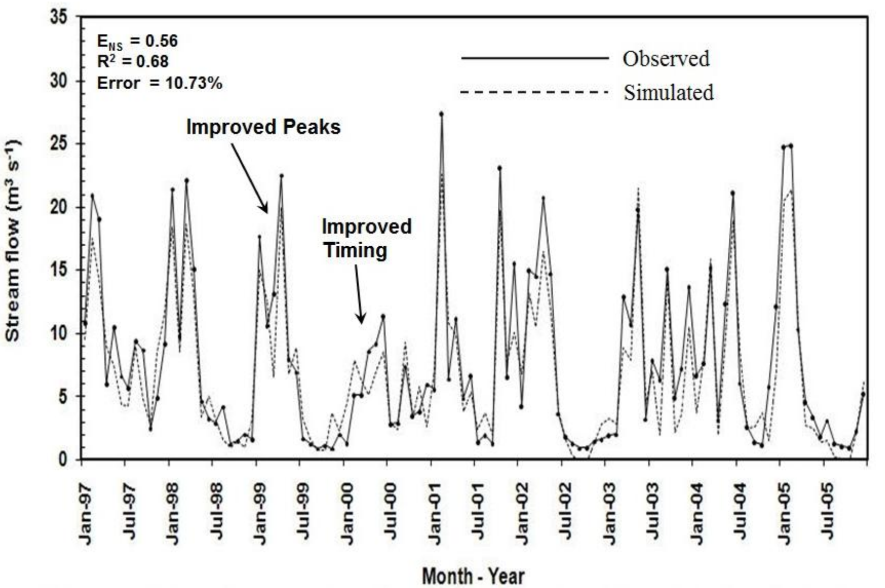


AgES-W Evaluation

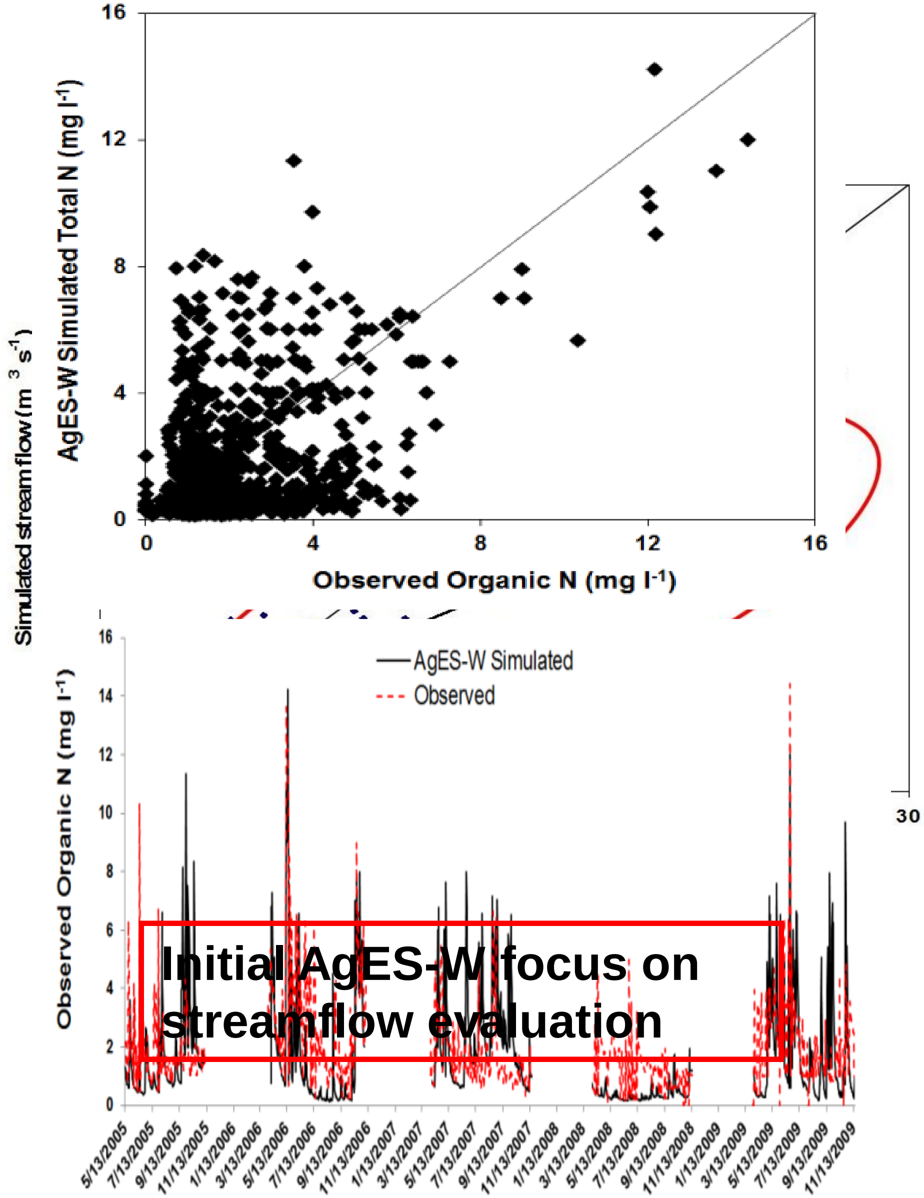


Current AgES-W focus is on evaluating N and sediment (MUSLE erosion) components

Cedar Creek Watershed monthly observed and AgES Watershed Model simulated stream flow (1997-2005)



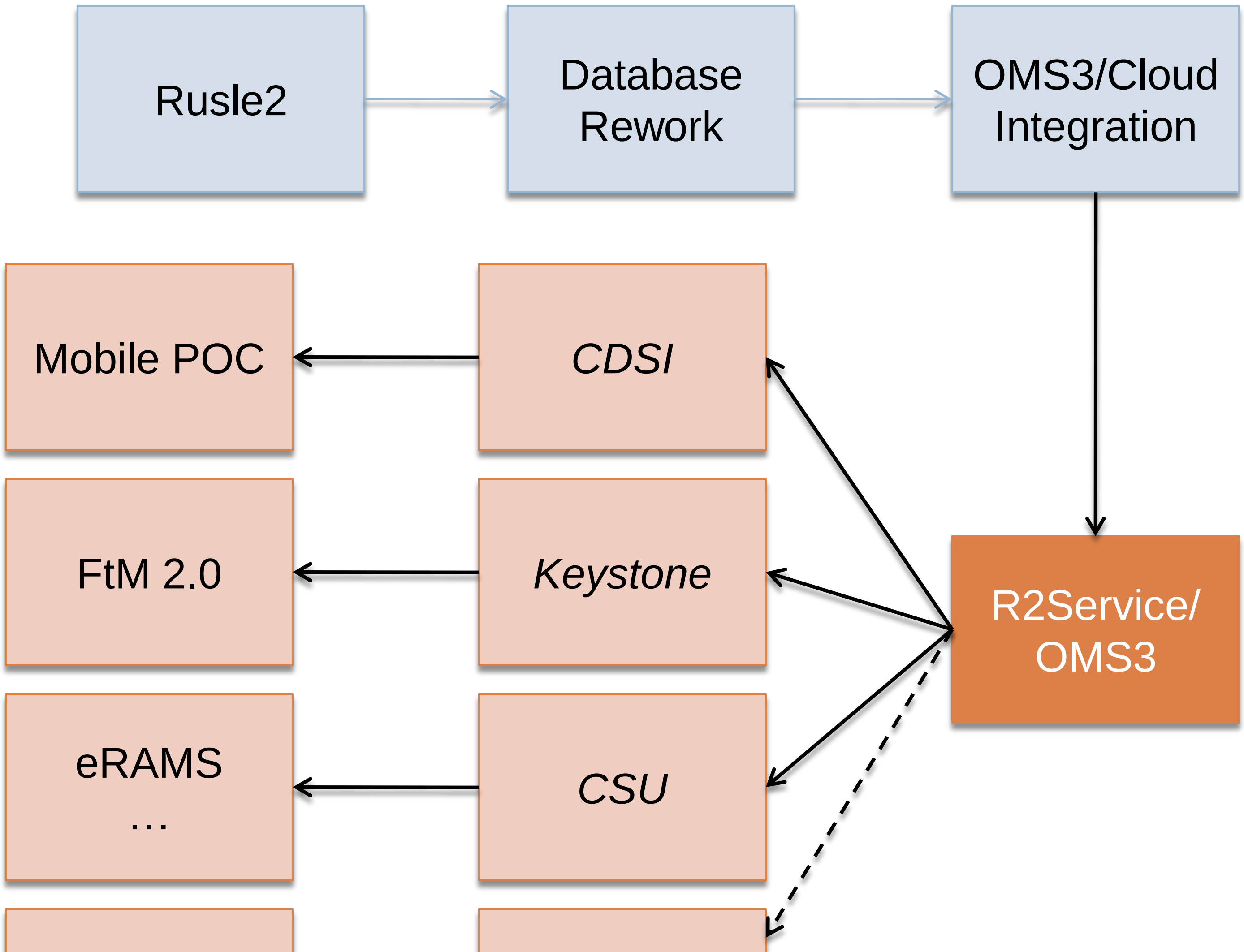
CCW monthly observed and AgES Watershed Model simulated stream flow (1997-2005) using a manually calibrated parameter set



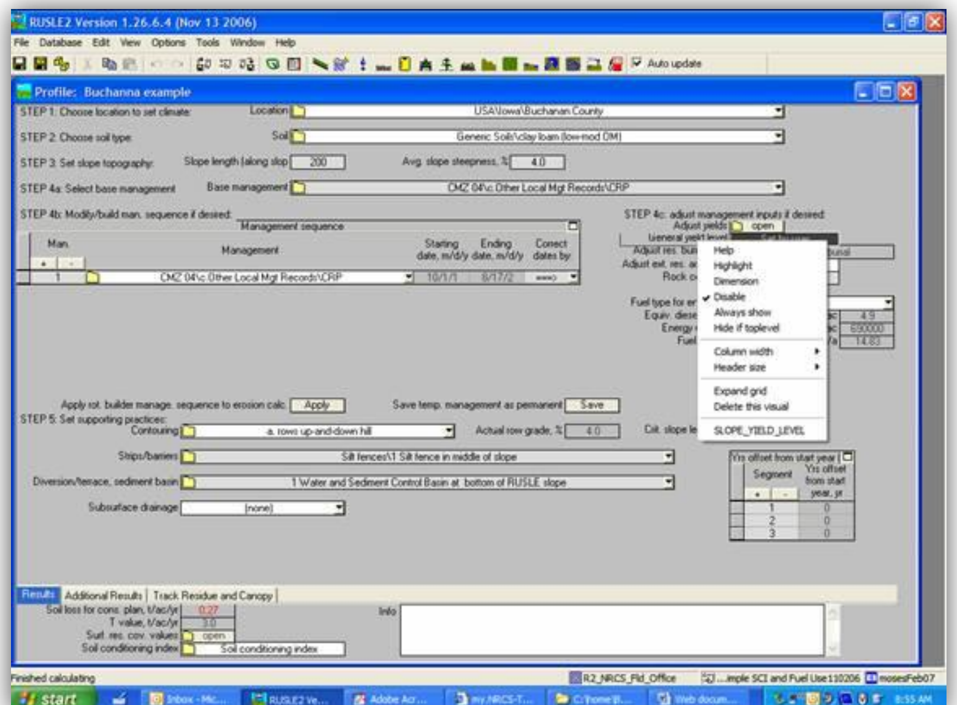
Initial AgES-W focus on streamflow evaluation

[Ascough, Ahuja]

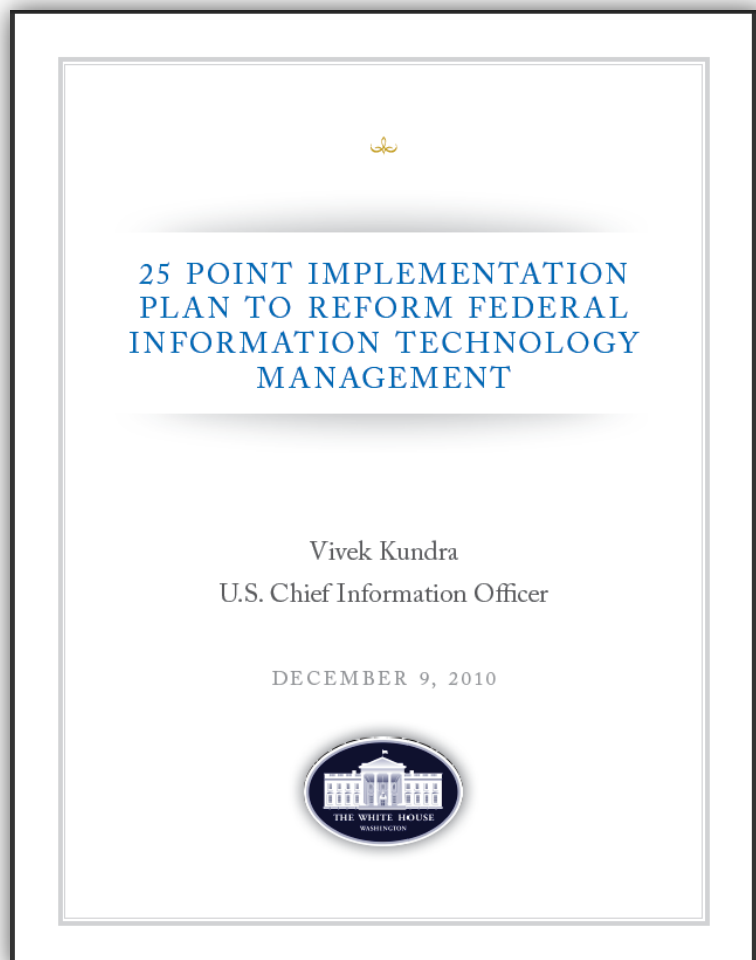
Example : Rusle2 CSIP



Rusle2 on Cloud Services Innovation Platform



Cloud First policy



25 POINT IMPLEMENTATION PLAN TO REFORM FEDERAL INFORMATION TECHNOLOGY MANAGEMENT

Vivek Kundra

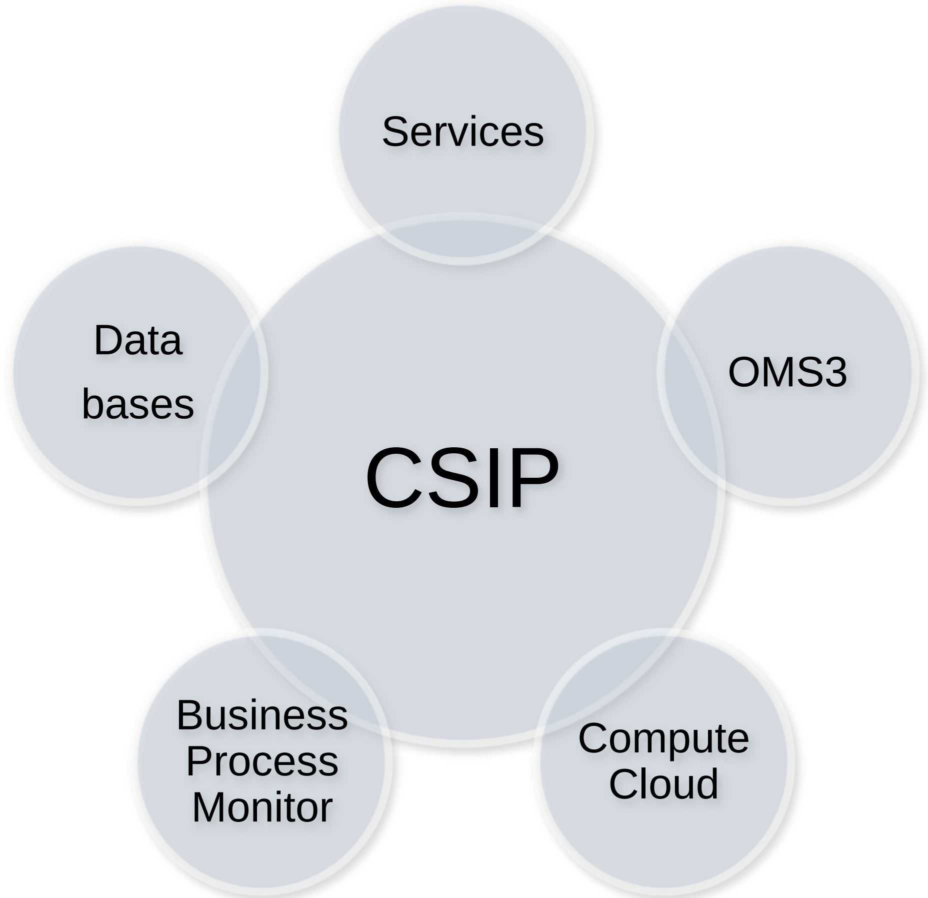
U.S. Chief Information Officer

DECEMBER 9, 2010

THE WHITE HOUSE

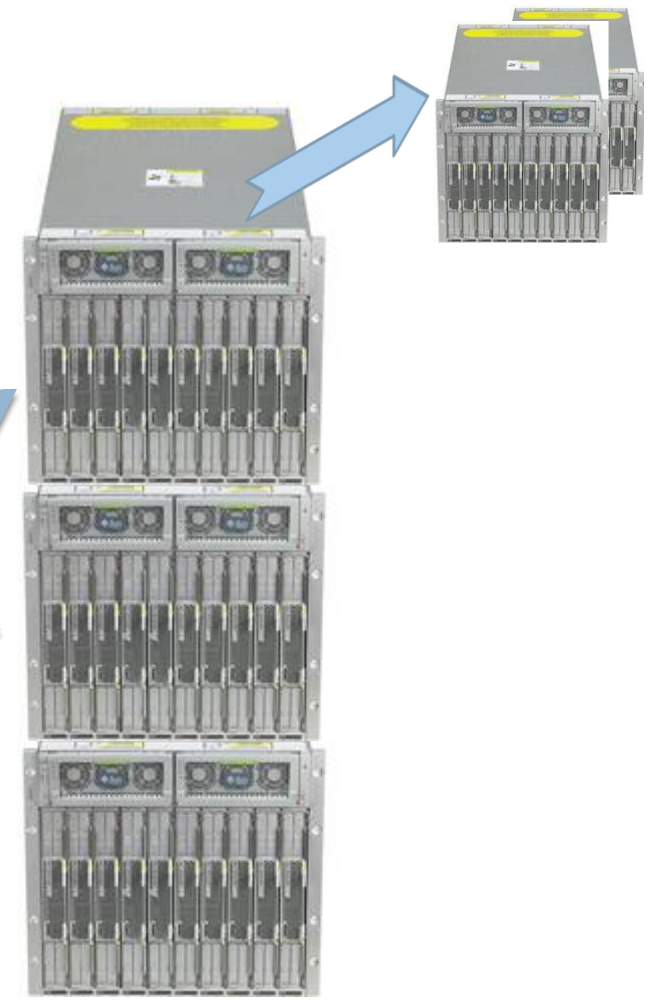
WASHINGTON

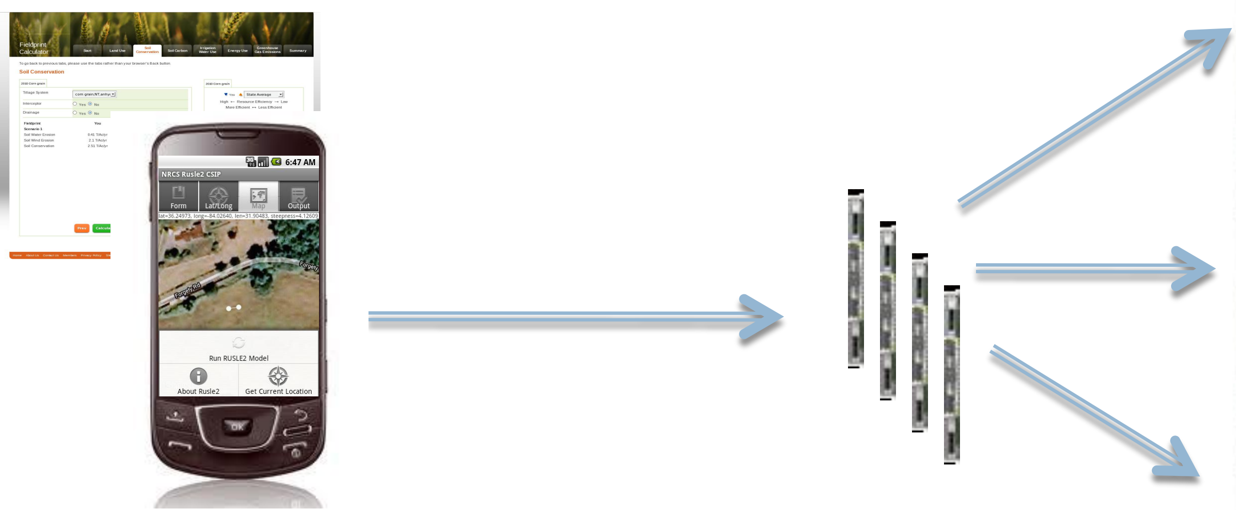
Cloud Services Innovation Platform



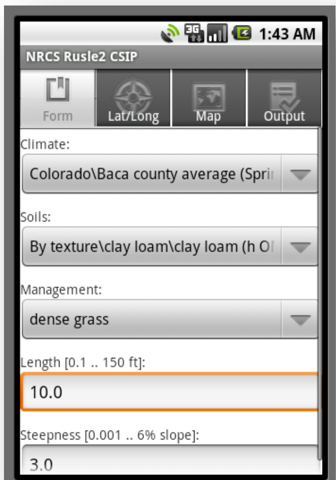
CSIP Cloud

- ❑ CSU / NRCS / ARS Collaboration
- ❑ Innovative model technology deployment
- ❑ High scalability of modeling resources
- ❑ OMS Models as service
- ❑ Commercial cloud migration





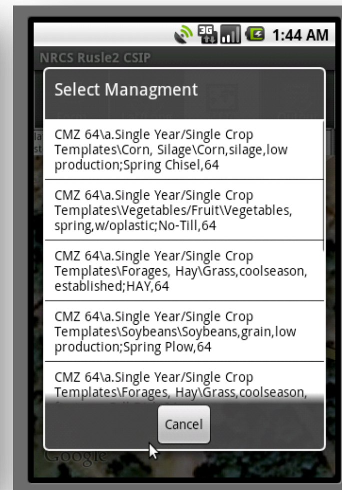
Rusle2 Mobile POC



Manual Parameter Selection

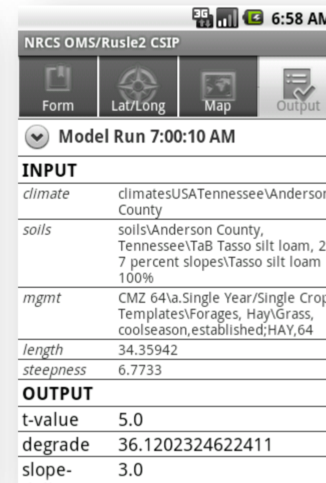
Transect Definition

USGS Elevation service



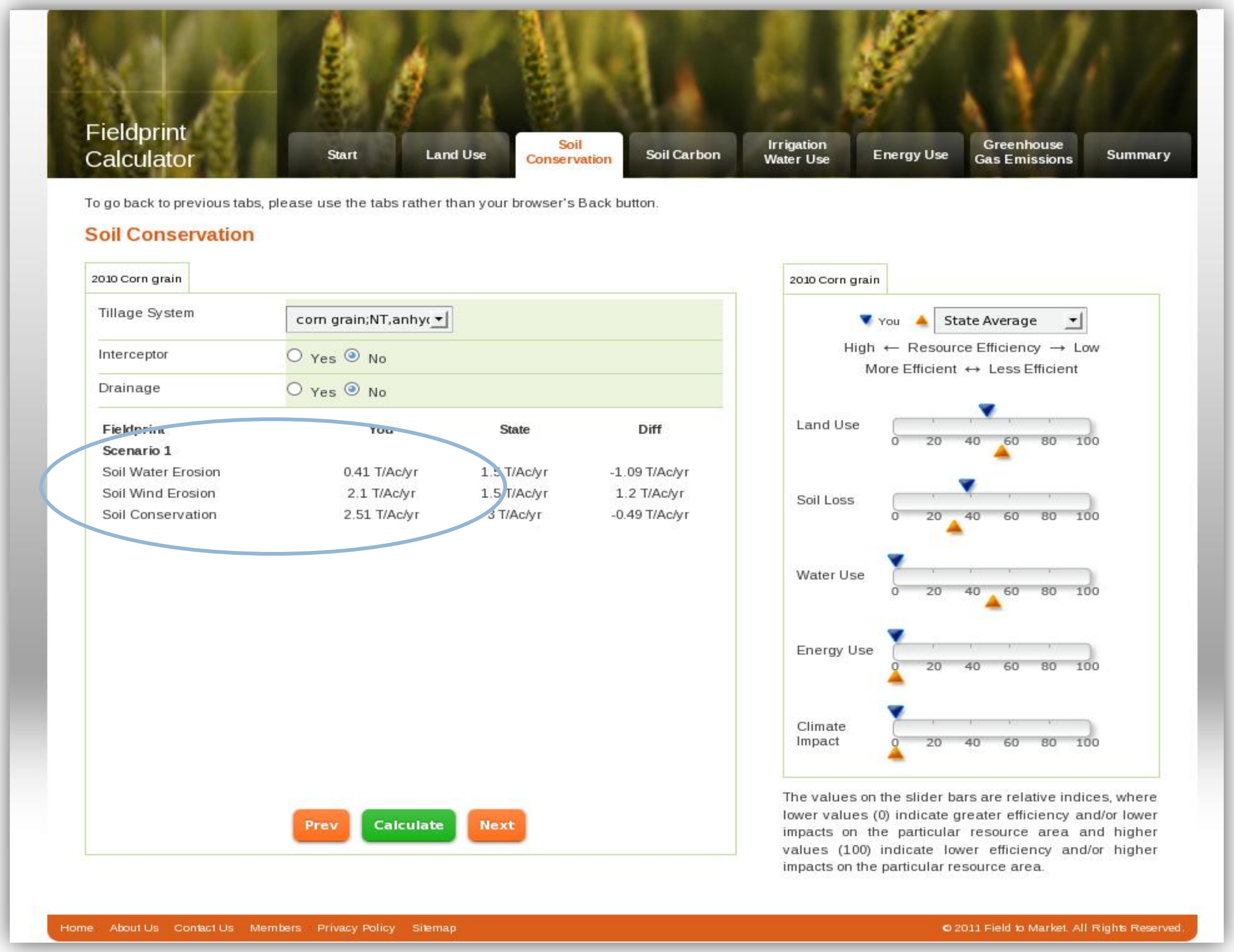
Location based Management Selection

Remote Model Execution of Rusle 2 in CSIP/OMS3



Model Results

Keystone Alliance
Field to Market Calculator 2.0 Design
Soil Conservation Metric Screen



OMS3 increases efficiency

- 1) OMS3 Invasiveness Study (Lloyd 2010)
  - Cross Language/Framework Model implementation and Model Metrics Analysis
  - Size & complexity reduction ~10 - 15%

- 2) Detailed COCOMO (Boehm 1981)

→ **40% - 50% reduction in model development/deployment costs using OMS3 vs traditional approaches**

OMS3 Conclusion

- Supports both: model development in ARS research and NRCS model use for enhanced decision making.
- Emphasizes on science components supporting conservation planning for CDSI
- Streamlines ARS model deployment for NRCS
- Mature modeling framework applied with a range of ARS/NRCS and external models.
- Increases efficiency in model development; thus ensures rapid deployment

Implications

- For ARS research: OMS3 can consolidate and streamline the process of model development and applications for creating new science
- For NRCS deployment: OMS3 can facilitate and streamline the delivery of emerging conservation assessment technology for S&T