IDEAS-Watersheds

Accelerating watershed science through a community-driven software ecosystem
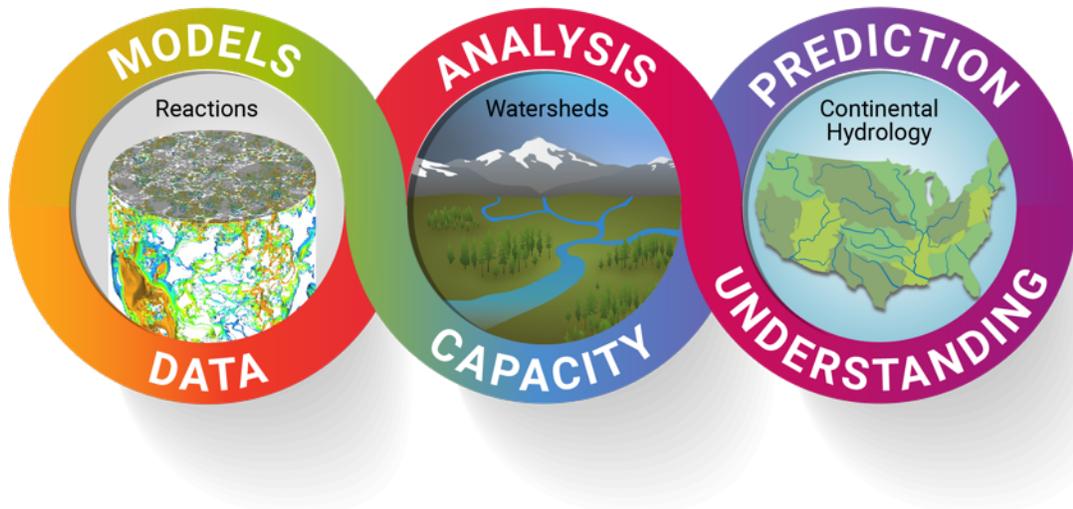
PI: David Moulton   (LANL)

Activity Leads:

Sergi Molins   (LBNL)

Scott Painter   (ORNL)

Xingyuan Chen   (PNNL)

Laura Condon   (UA)

Reed Maxwell   (Mines)

Software Lead:

Steve Smith   (LLNL)

**Project Coordinator:**

Hai Ah Nam   (LANL)

U.S. DEPARTMENT OF **ENERGY** | Office of Science

IDEAS-Watersheds Software Ecosystem
From Silos to an Ecosystem

CODES

LIBRARIES

xSDK

HOST CODES / COMPONENTS
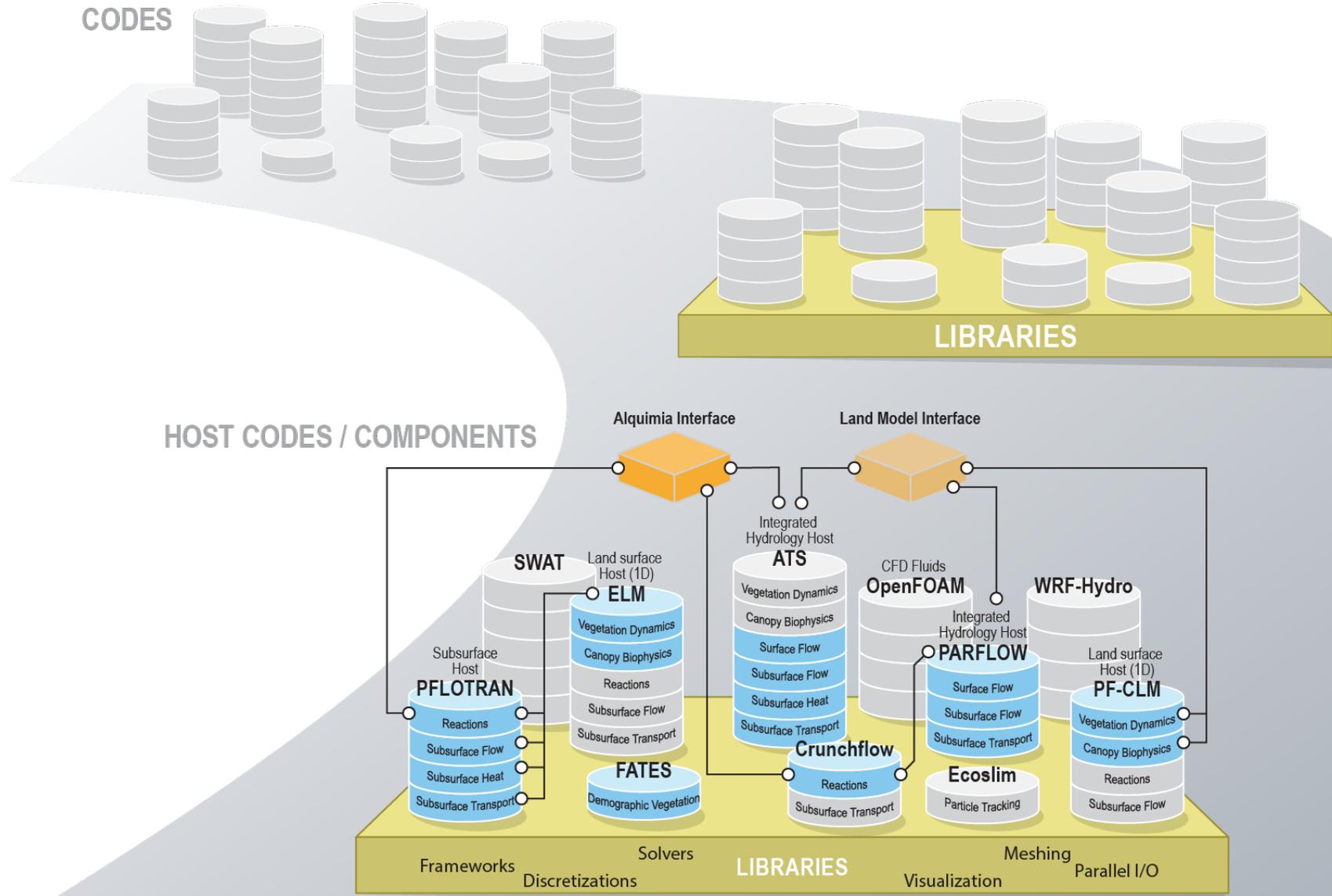
xSDK includes the Libraries, Interface Libraries, and interoperable components.

Alquimia Interface

Land Model Interface

Integrated Hydrology Host

SWAT

Land surface Host (1D)

ELM
- Vegetation Dynamics
- Canopy Biophysics
- Reactions
- Subsurface Flow
- Subsurface Transport

ATS
- Vegetation Dynamics
- Canopy Biophysics
- Surface Flow
- Subsurface Flow
- Subsurface Heat
- Subsurface Transport

CFD Fluids
OpenFOAM

WRF-Hydro

Integrated Hydrology Host

PARFLOW
- Surface Flow
- Subsurface Flow
- Subsurface Transport

Land surface Host (1D)

PF-CLM
- Vegetation Dynamics
- Canopy Biophysics
- Reactions
- Subsurface Flow

Subsurface Host

PFLOTRAN
- Reactions
- Subsurface Flow
- Subsurface Heat
- Subsurface Transport

FATES
- Demographic Vegetation

Crunchflow
- Reactions
- Subsurface Transport

Ecoslim
- Particle Tracking

LIBRARIES

Frameworks
Discretizations
Solvers
Visualization
Meshing
Parallel I/O

IDEAS Watersheds

IDEAS-Watersheds Activities

Reactions

Biogeochemical reaction networks

- Enhance capabilities of geochemistry engine
- Leverage genomic and molecular advances, e.g.
  - DOE Systems Biology Knowledgebase (KBase)
  - DOE Environmental Molecular Sciences Laboratory (EMSL)
- Improve interoperability by advancing Alquimia interface library

Watershed hydrobiogeochemistry

Scaling to watersheds

- Hydrological exchange flows and biogeochemical processes interact to control system function
- Advance stream and river corridor frameworks

Basin to continental hydrology

Connecting across watersheds

- Hydrological context for SFA testbeds
- Infrastructure for upscaling

Fine-scale SFAs Partnership
LLNL, ANL, SLAC
BGC Reaction Networks

LBNL Partnership
Watershed function
Headwater Streams

ORNL Partnership
Stream Corridor HBGC
4th Order Stream

PNNL Partnership
River Corridor HBGC
8th Order River
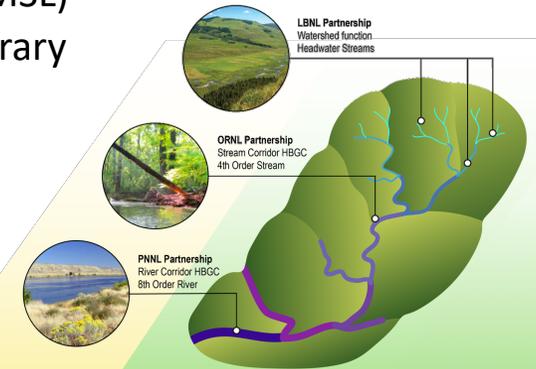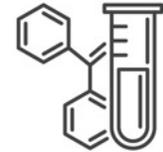
Continental Hydrology

IDEAS-Watersheds Shared Infrastructure

IDEAS
Watersheds