TEXAS
The University of Texas at Austin

TACC
TEXAS ADVANCED COMPUTING CENTER

FAIR
#WURData

SEEKING SYNERGIES IN DATA SCIENCE AND APPLICATIONS:

How intelligent systems are driving transitions in management for Earth Resource systems

Suzanne A. Pierce
Texas Advanced Computing Center
The University of Texas at Austin

TACC AT A GLANCE

Personnel

130+ Full time staff (~70 PhD)

General Facts

Research Division of UT Austin.
Conference & meeting capability
Key provider to XSEDE national CI

Usage Statistics

Over a Billion compute hours per year
5 Billion files, 50 Petabytes of Data,
100s of Public Datasets, 3000+ Projects

Capacity & Services

HPC, HTC, Visualization, Large scale data storage, Cloud computing
Consulting, Curation and analysis, Code optimization, Portals and Gateways, Web service APIs, Training & Outreach

TACC OPERATES A professionally-supported national science cloud

HPC, HTC, Visualization, Large scale data storage, Cloud computing, Experimental architectures

IS-GEO Research Coordination Network

Intelligent Systems and Geosciences Research Coordination Network aims to support an emerging community of researchers in intelligent systems (IS) and Geosciences (GEO).

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The University of Texas at Austin

INFORMATION ABOUT EARTH IS…

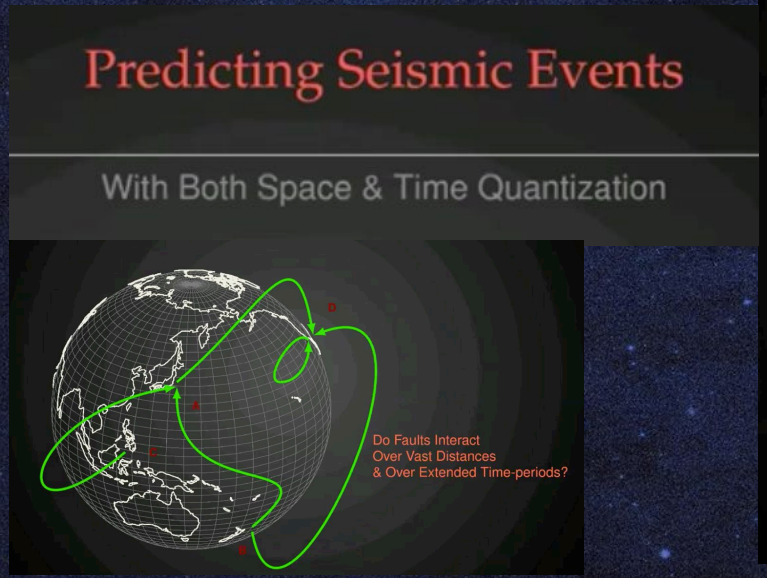
CHALLENGES BECOME OPPORTUNITIES

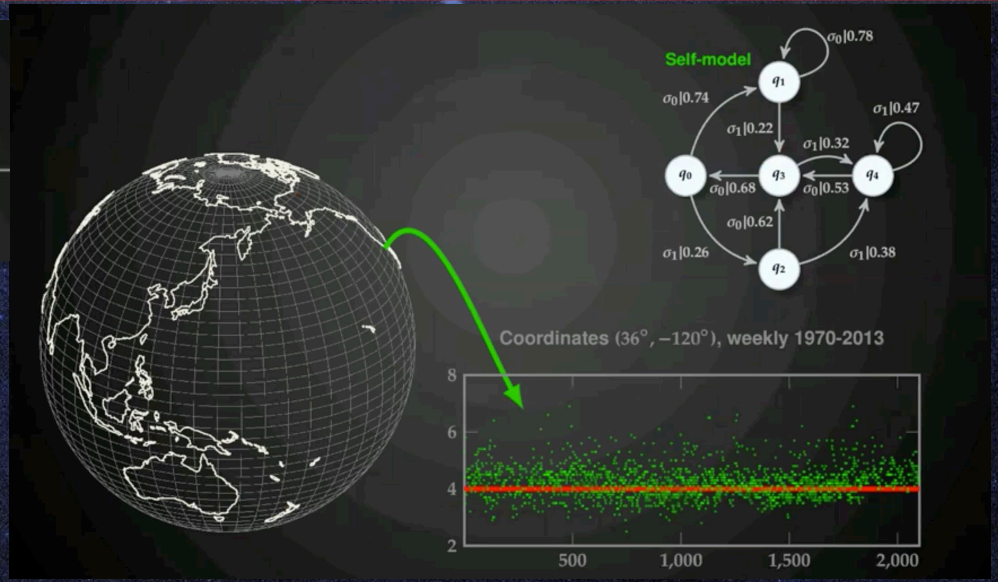
INFORMATION ABOUT EARTH IS…

BIG

PREDICTIVE PATTERN IDENTIFICATION | SPIN NETS ***Machine Inference***

ISHANU CHATTOPADHYAY, University of Chicago





Zero Knowledge for Modeling Stochastic Processes

INFORMATION ABOUT EARTH IS…

BROAD

BIG

HETEROGENEOUS DATA |**The Future of Old Things**

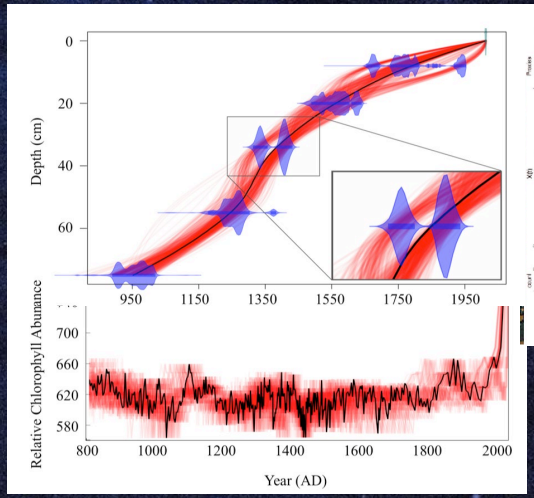
JULIAN EMILE-GEAY, ISI University of Southern California

LinkedEarth is manifesting a better future for paleoscience

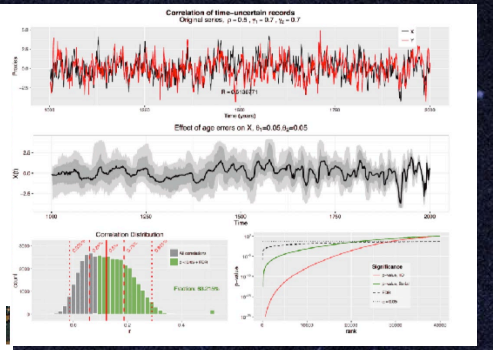
Data-analytic online platform that:

(1) enables curation of publicly-accessible database by paleoclimate experts themselves,

(2) fosters development of community standards.



Interoperable data



RESULT

More rigorous assessments of the magnitude and rates of pre-industrial climate change.

MAGNITUDE & RATES OF CHANGE

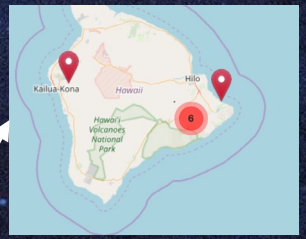
INFORMATION IN THE WILD…

DYNAMIC

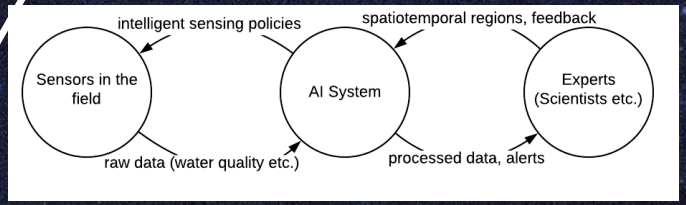
BROAD

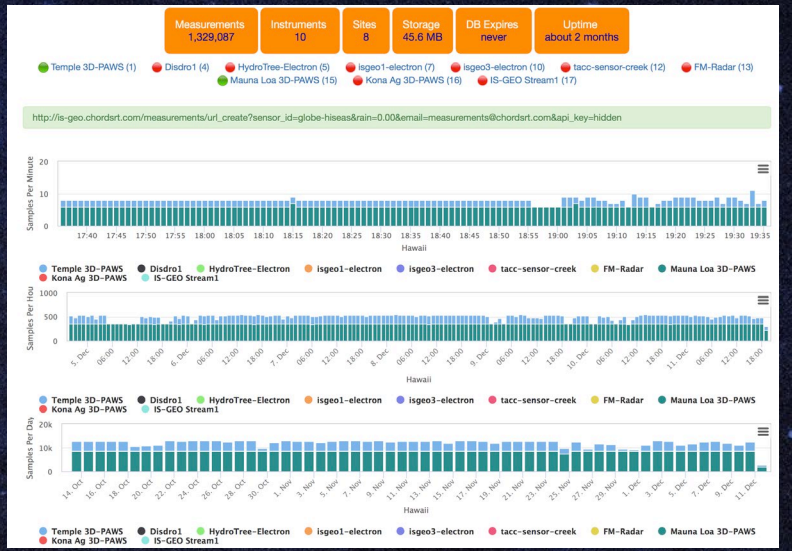
BIG

VELOCITY & SCIENCE GATEWAYS| FOSS HARDWAREX DESIGN
PETE MARCHETTO, UNIVERSITY OF MINNESOTA



Designed & deployed 8 observation sites in ~48 hours





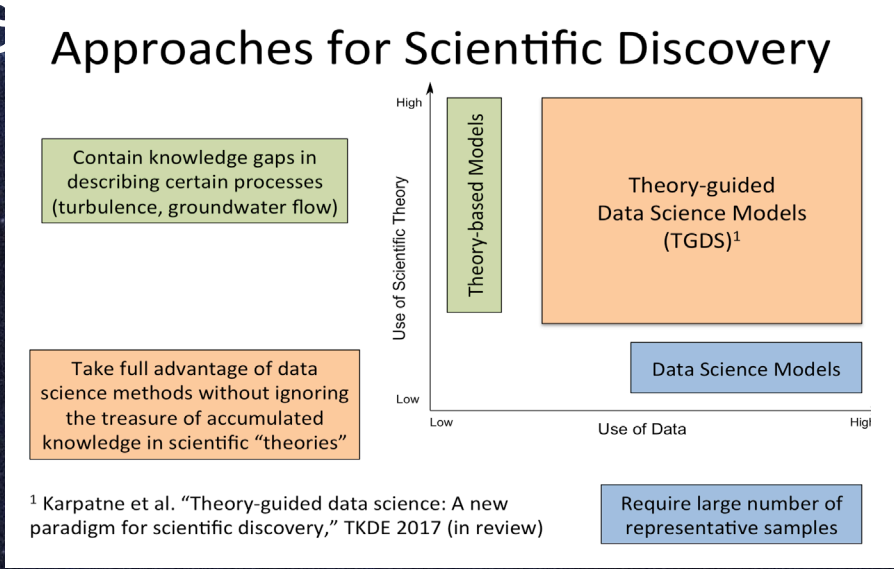
ADAPTIVE SENSING

Data http://is-geo.chordsrt.com/

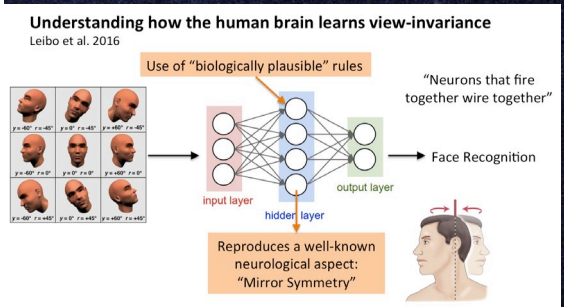
INFORMATION ABOUT EARTH IS…

ILL-
STRUCTURED
DYNAMIC
BROAD
BIG

THEORY-GUIDED | KARPATNE & KUMAR, VIRGINA TECH AND UMN



"Black-box" data science models not sufficient for knowledge discovery in scientific domains



"Black-box" data science models are insufficient

INFORMATION ABOUT EARTH IS…

UNCERTAIN

ILL-STRUCTURED

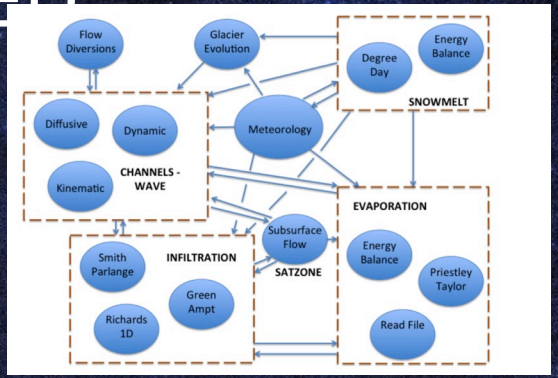
DYNAMIC

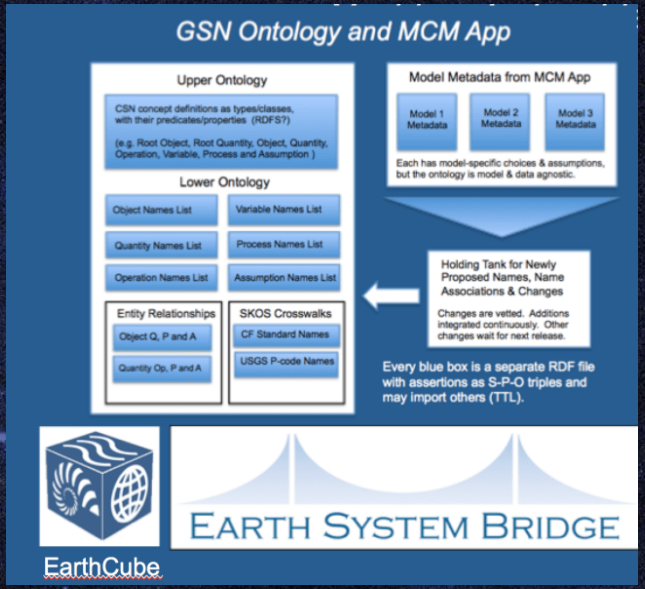
BROAD

BIG

MACHINE READABILITY | **Simplifying the Reuse of Datasets & Models**

PECKHAM, NCAR UNIVERSITY OF COLORADO





Establishing shared data models and naming

INFORMATION ABOUT EARTH IS…

COMPLEX

UNCERTAIN

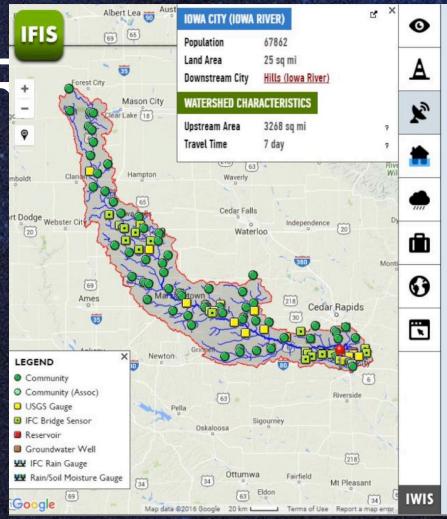
ILL-STRUCTUR

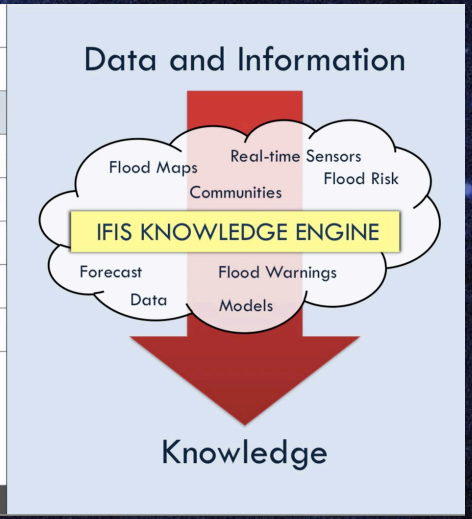
DYNAMIC

BROAD

BIG

MACHINE READABILITY | **FLOOD AI ALPHA**
IBRAHIM DEMIR, UNIVERSITY OF IOWA



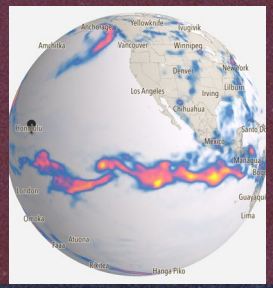


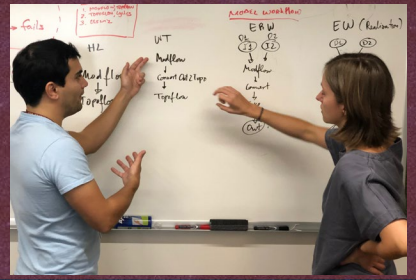
Artificial-intelligence to help the general public prepare for flooding and other natural disasters. Part of Iowa Flood Information System (IFIS), Users can ask it questions about rainfall and river levels and receive immediate answers.

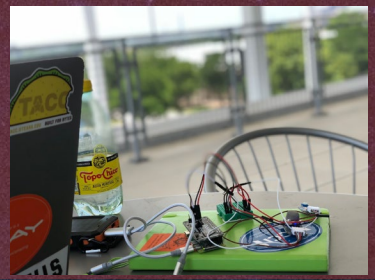
AI to aid emergency response

ACCELERATING BY COLLABORATING…

- ~42 - 57 diverse participants
- 1 active volcano & hurricane Hector



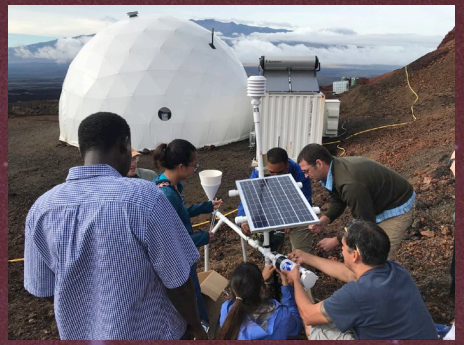




Better interdisciplinary collaboration IS-GEO

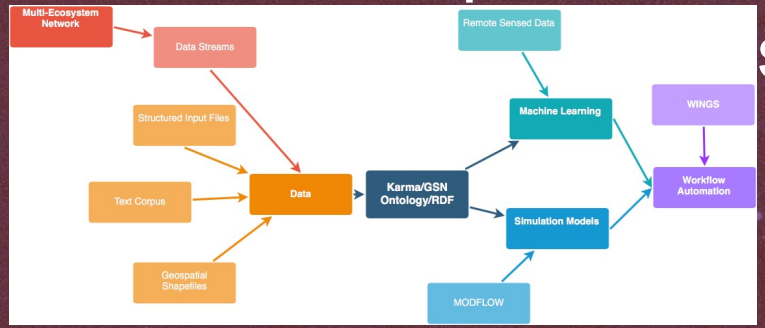
ACCELERATING SCIENCE BY SHARING…

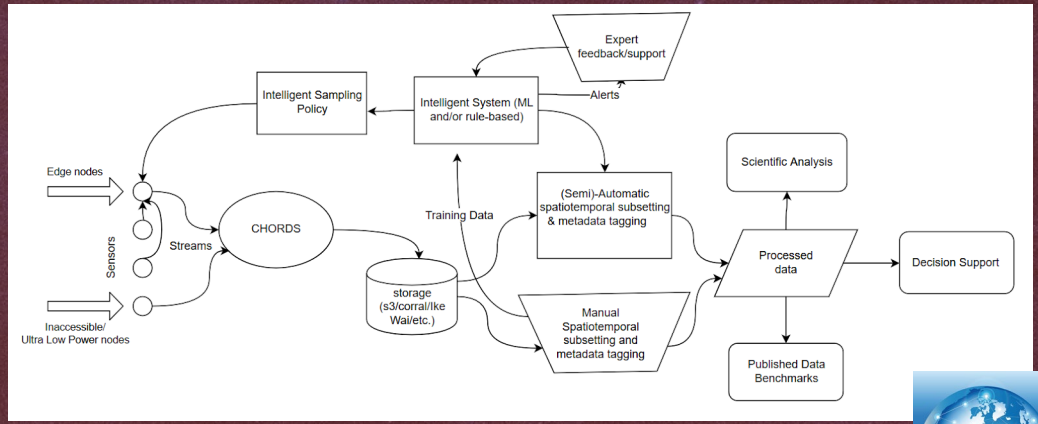
Discovery using FM radio device



Connected new modules to IM

2-4 manuscripts, 2-3 s






PLANET
TEXAS 2050
A UT Austin Grand Challenge
Cyberinfrastructure Ecosystem
To support Socio-technical and Knowledge Centric Approaches for Complex, Resilience Problems

PLANET TEXAS 2050

A UT Austin Grand Challenge

Texas' population is projected to nearly double by 2050.

We will experience more extreme weather events: more floods, more droughts, and more heat.

We need to better manage our state's resources to support these demands.

Making Texas resilient is our grand challenge.

Vision: a healthy, safe, just, ecologically + economically vibrant Texas by 2050

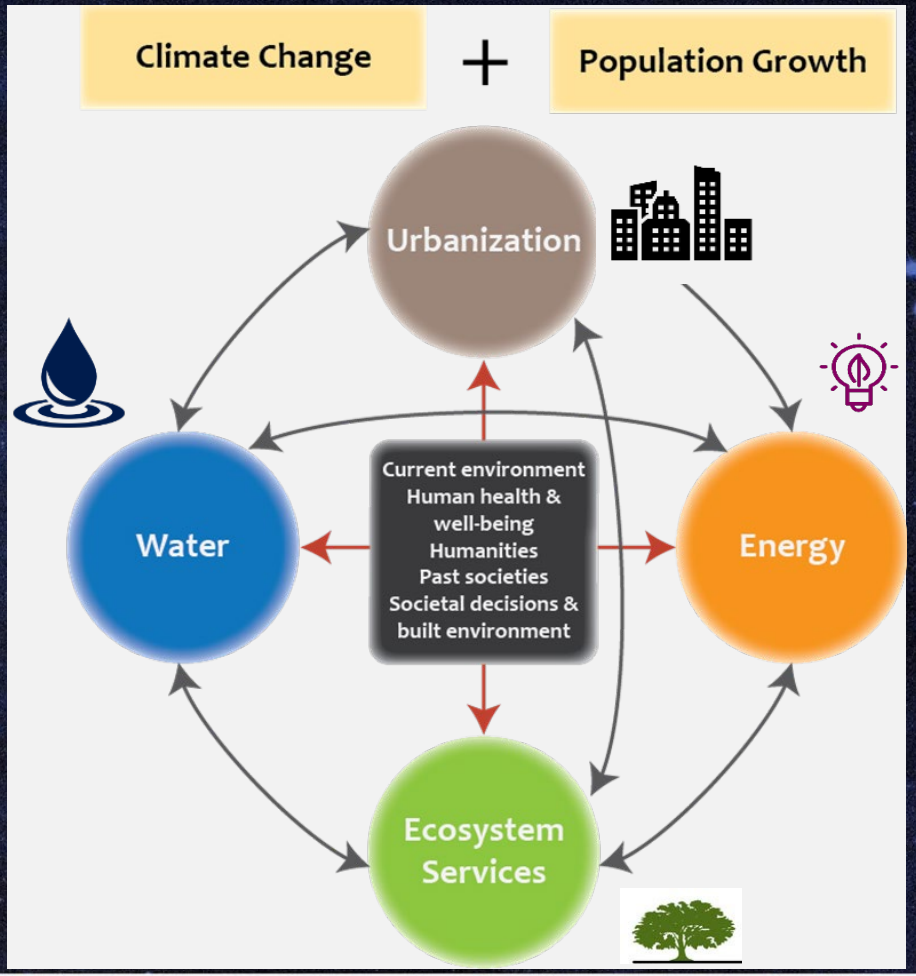
To get there ….

- Fundamental sciences
- Applied sciences
- Health sciences
- Behavioral sciences
- Humanities & communications
- Engineering
- Planning
- More …..
- Past, present, future

DataX Integration

Model Development

Simulations, Strategies, and Policies



How can scientists present information to stakeholders and decision makers in a way that supports dialogue And leads to science-based decision making?

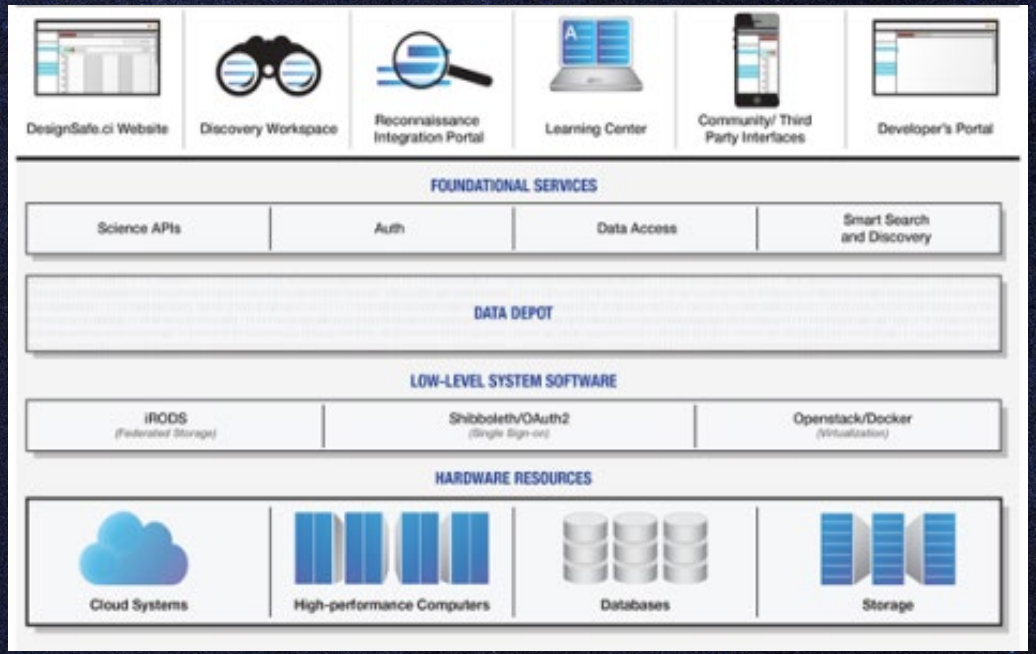
What features and specifications can create a reusable and intelligent decision support system?

Designing intelligent Decision Support Systems

TACC OPERATES A professionally-supported national science cloud / PT2050 is leveraging it

Ease of Use

Ease of Re-use



User-facing applications

Domain-aware Web Services

Structured Data Management

Established software and CI

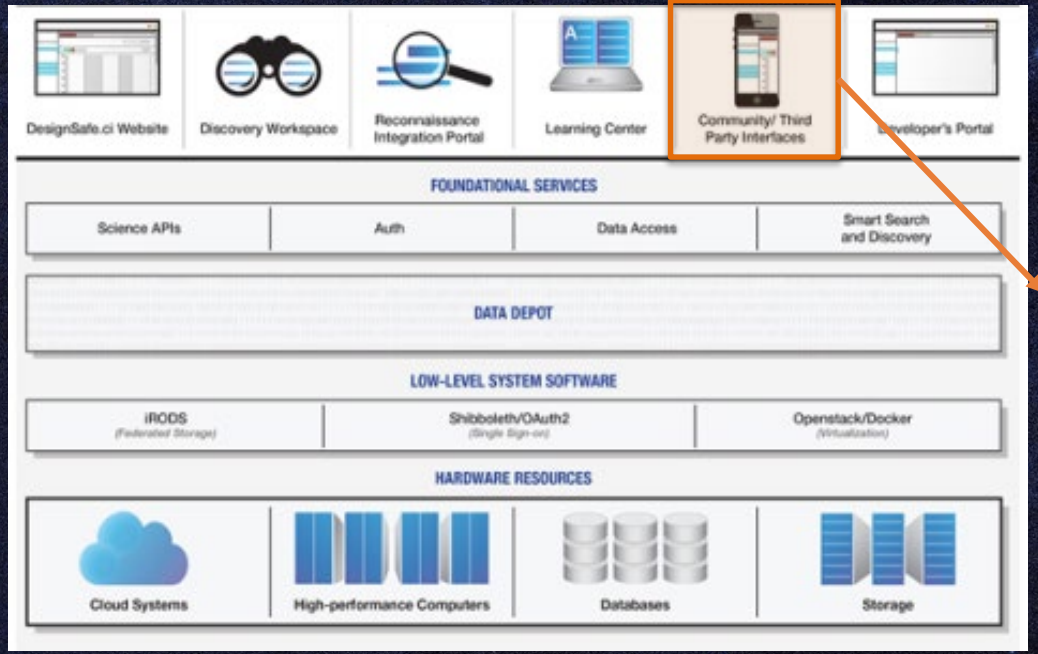
Exascale physical systems

Broad Interoperability
(even across data centers)

INTEGRATED MODELING with linked data and model catalogs connect to workflows & HPC job queues

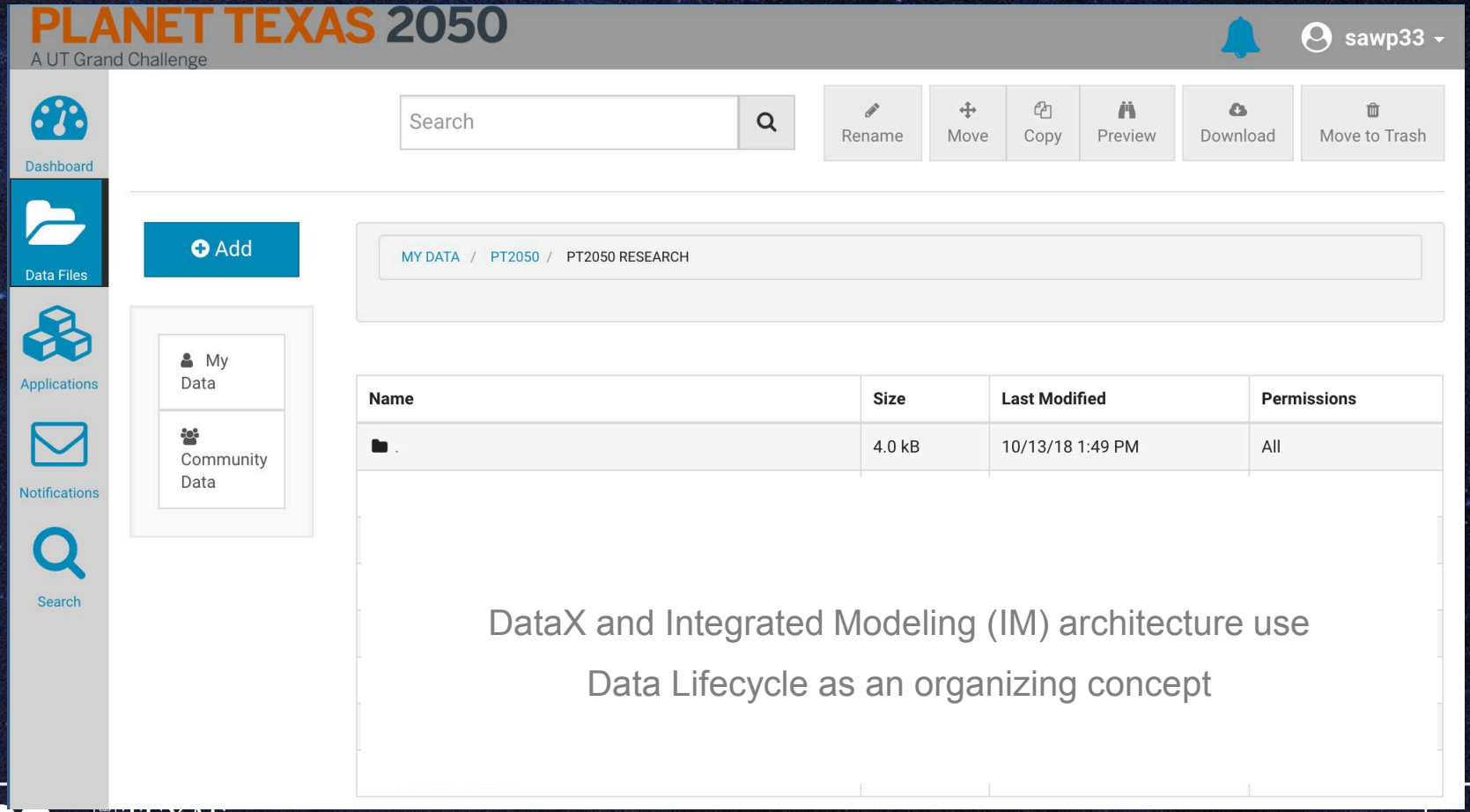
Ease of Use

Ease of Re-use

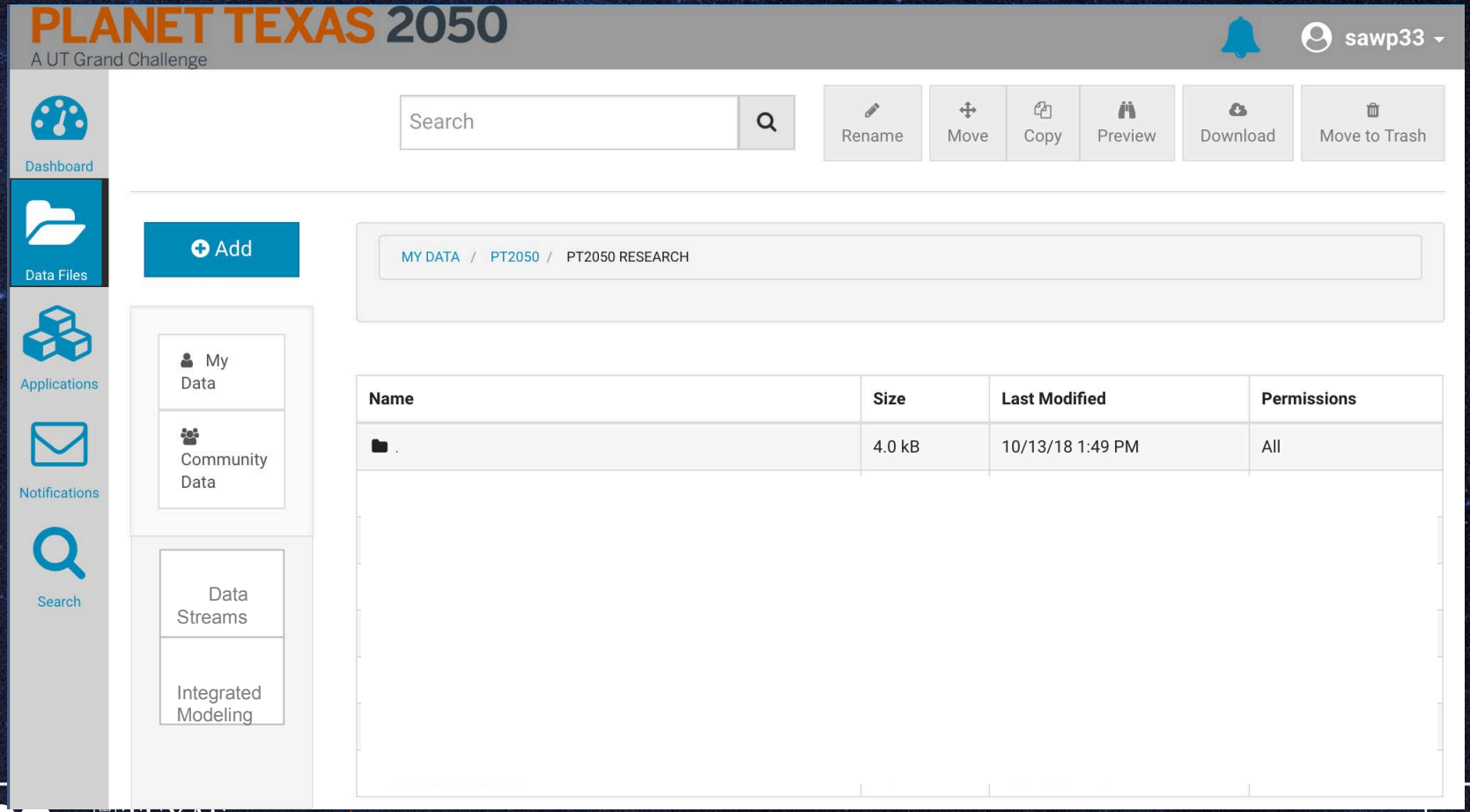


Broad Interoperability (even across data centers)

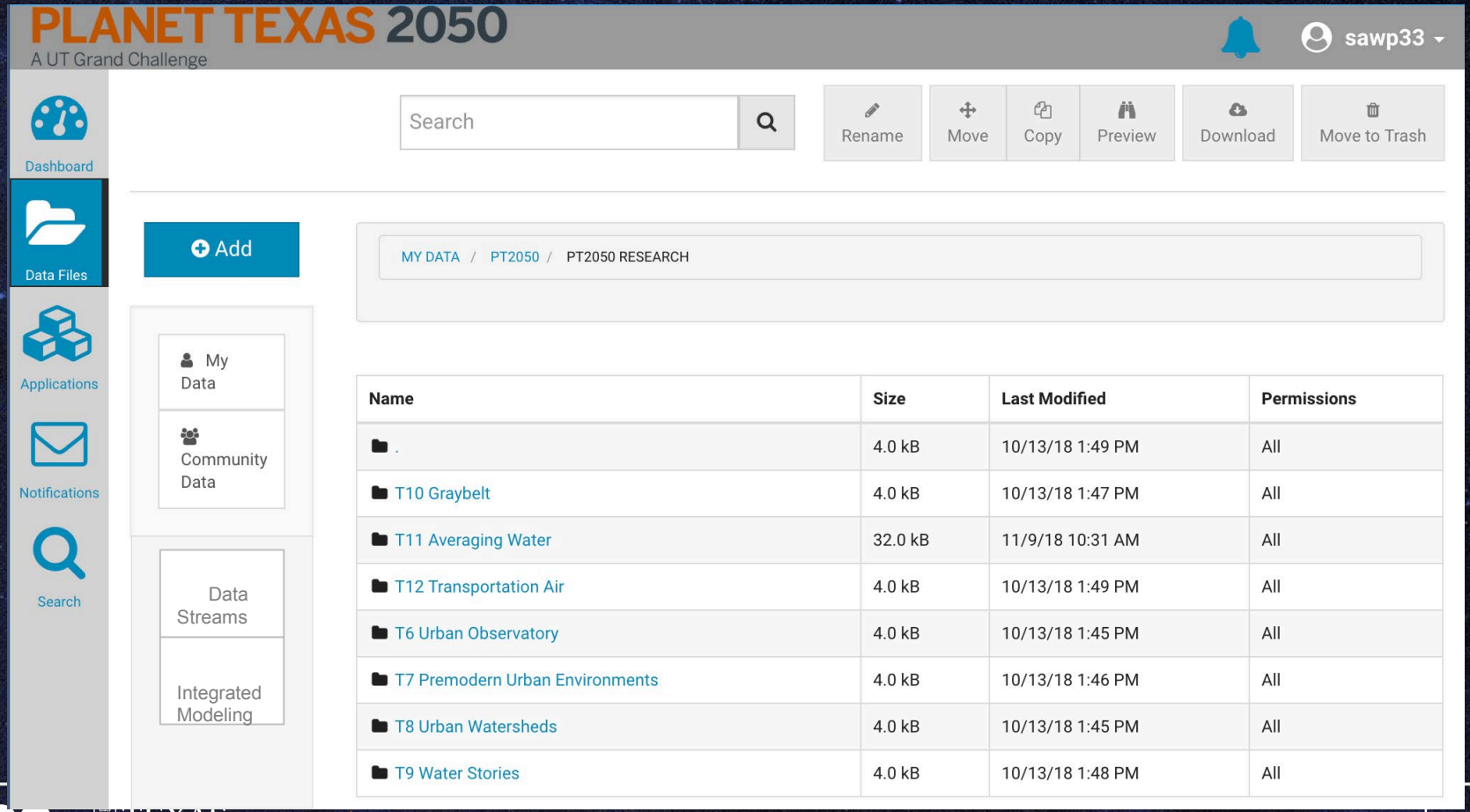
Cyberinfrastructure Ecosystem



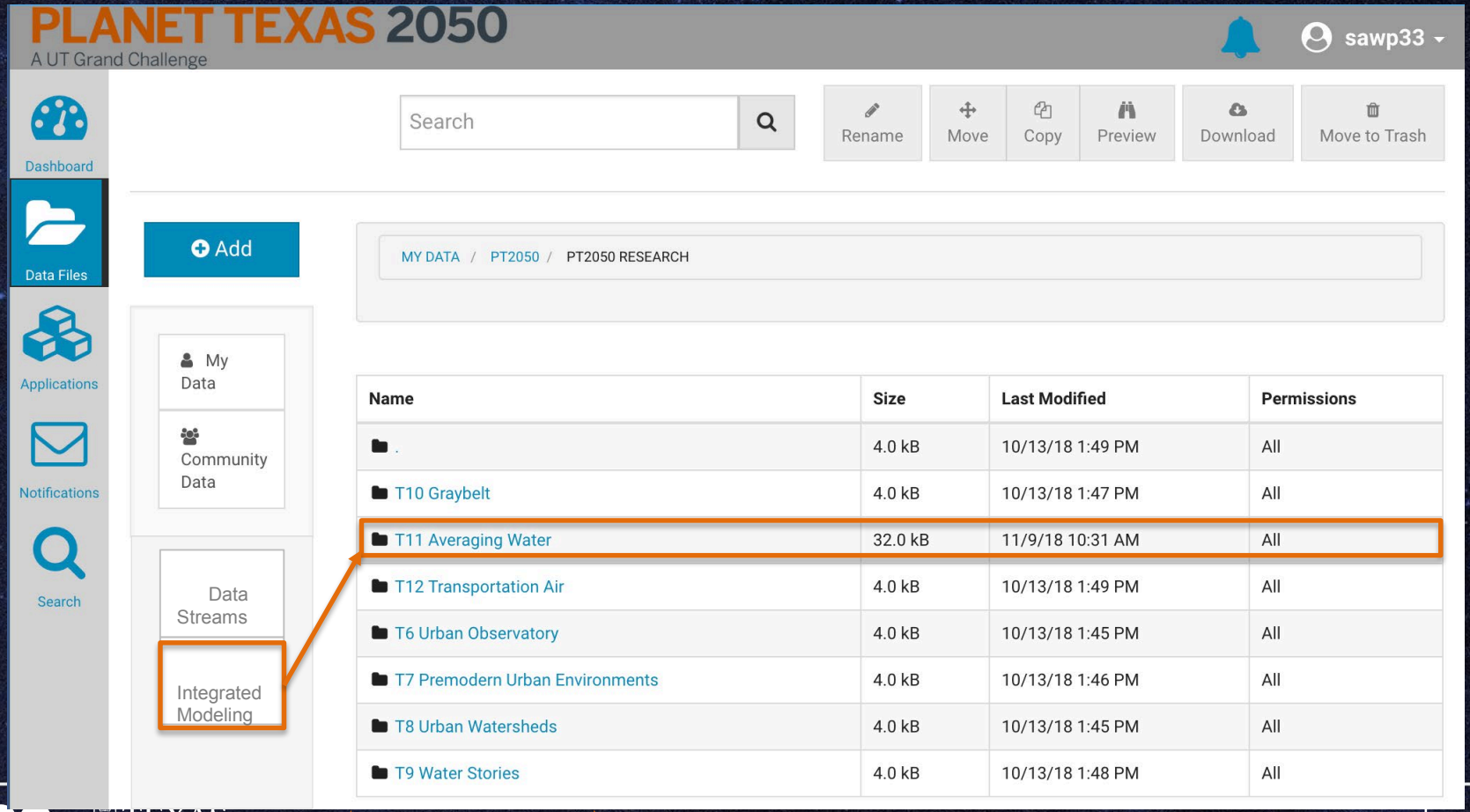
Cyberinfrastructure Ecosystem



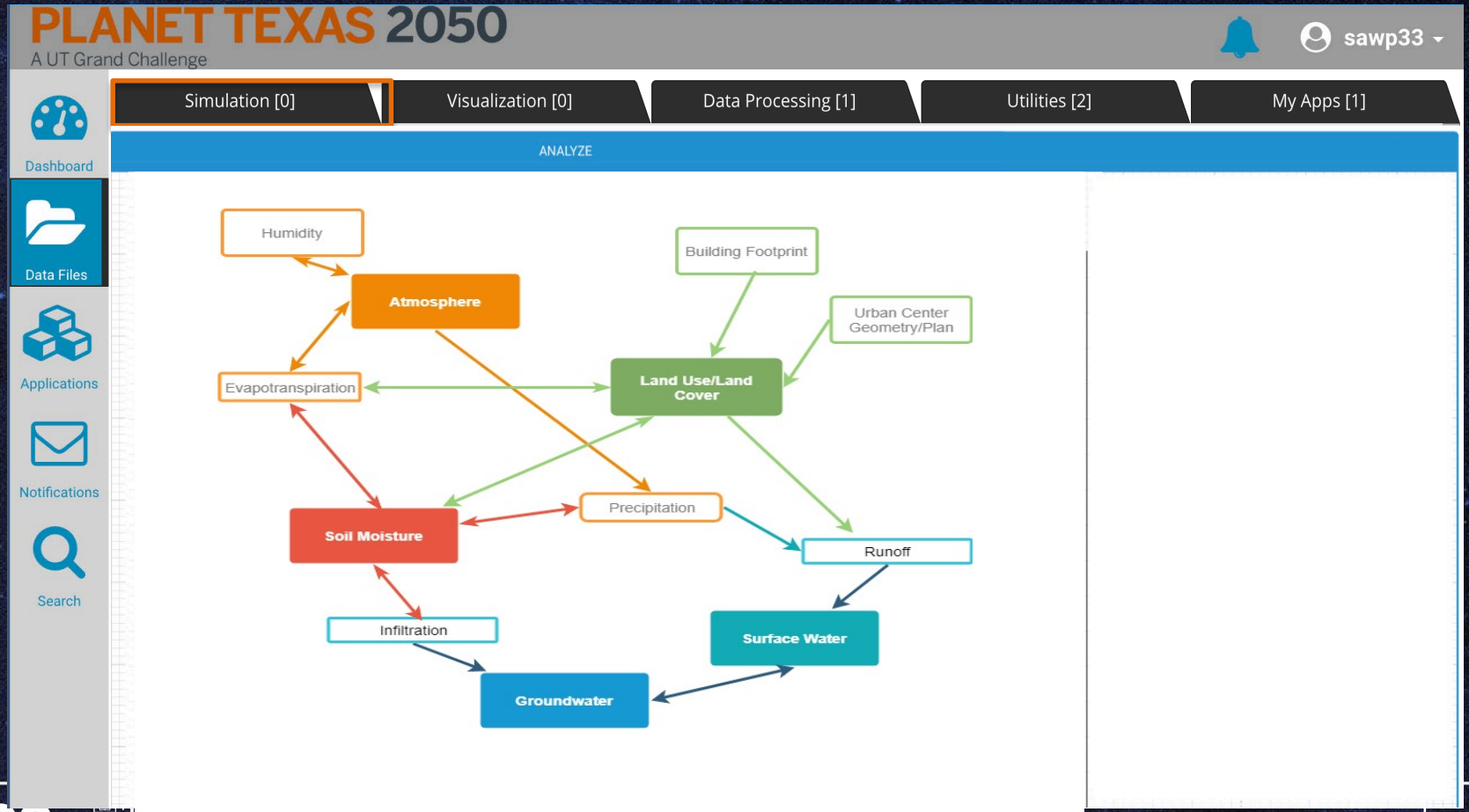
Cyberinfrastructure Ecosystem



Cyberinfrastructure Ecosystem



Concept Model to CAG



High Level Workflow Template

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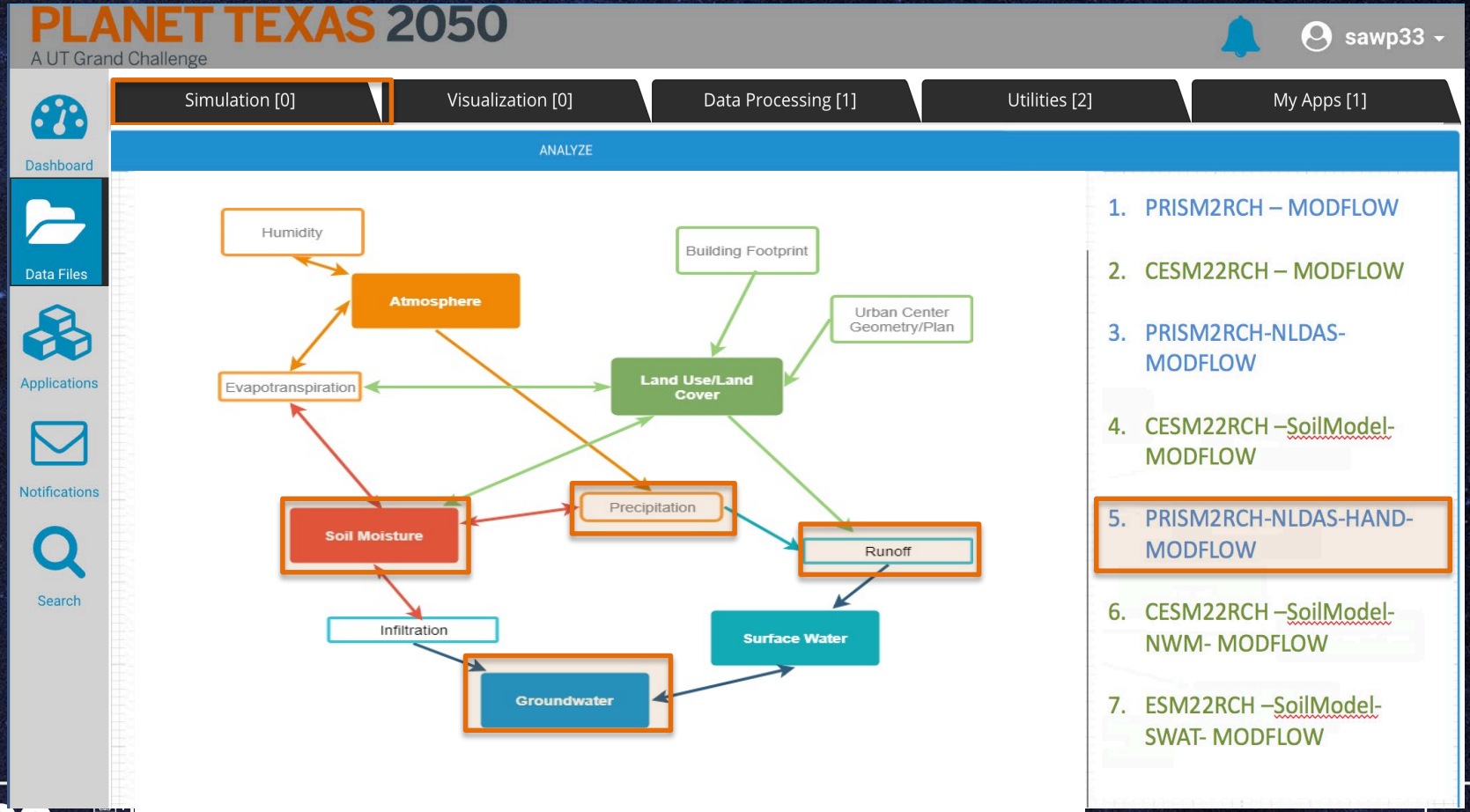
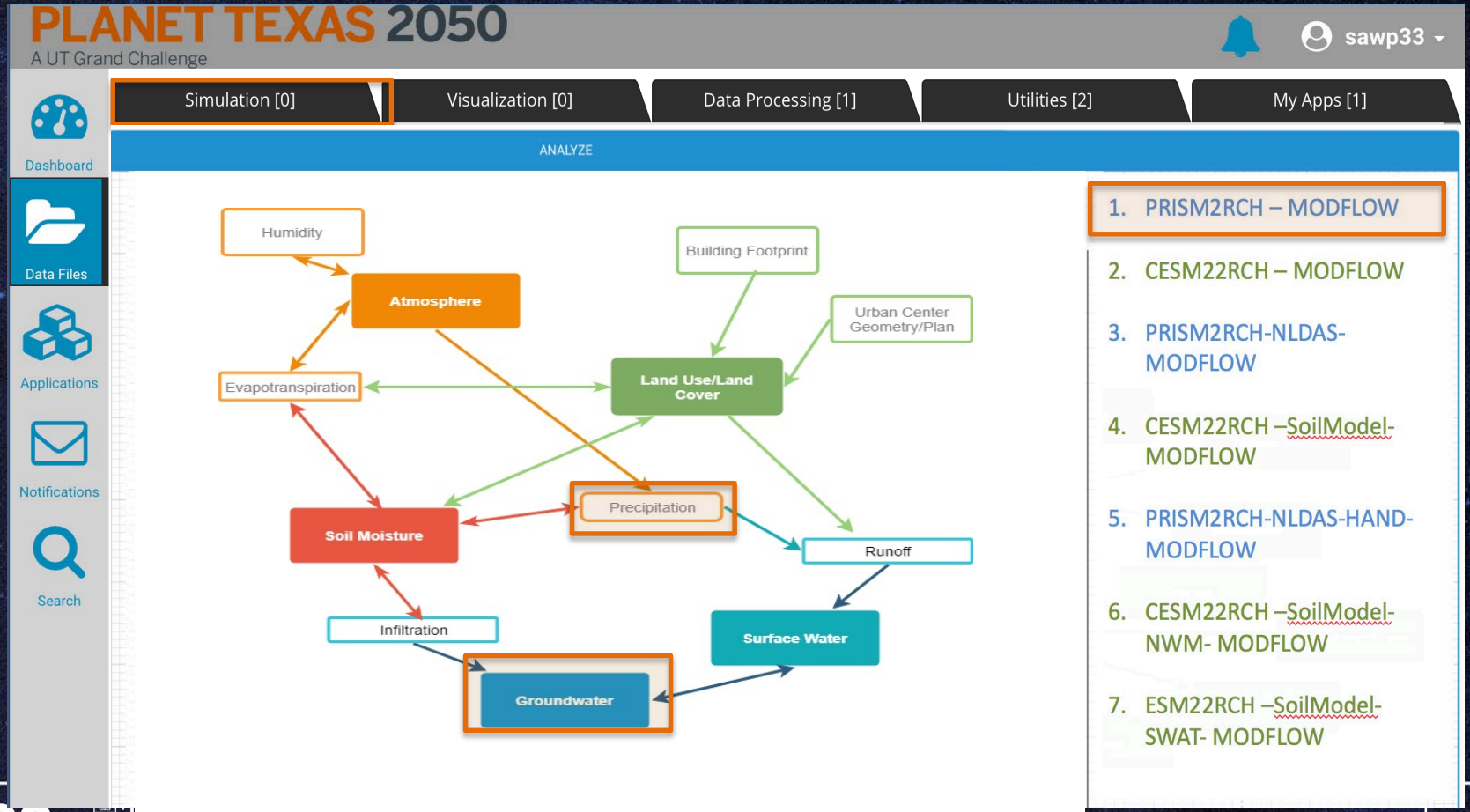


High Level Workflow Template



Execution Ready Workflow

PLANET TEXAS 2050
A UT Grand Challenge

sawp33

Simulation [0] | Visualization [0] | Data Processing [1] | Utilities [2] | My Apps [1]

Dashboard
Data Files
Applications
Notifications
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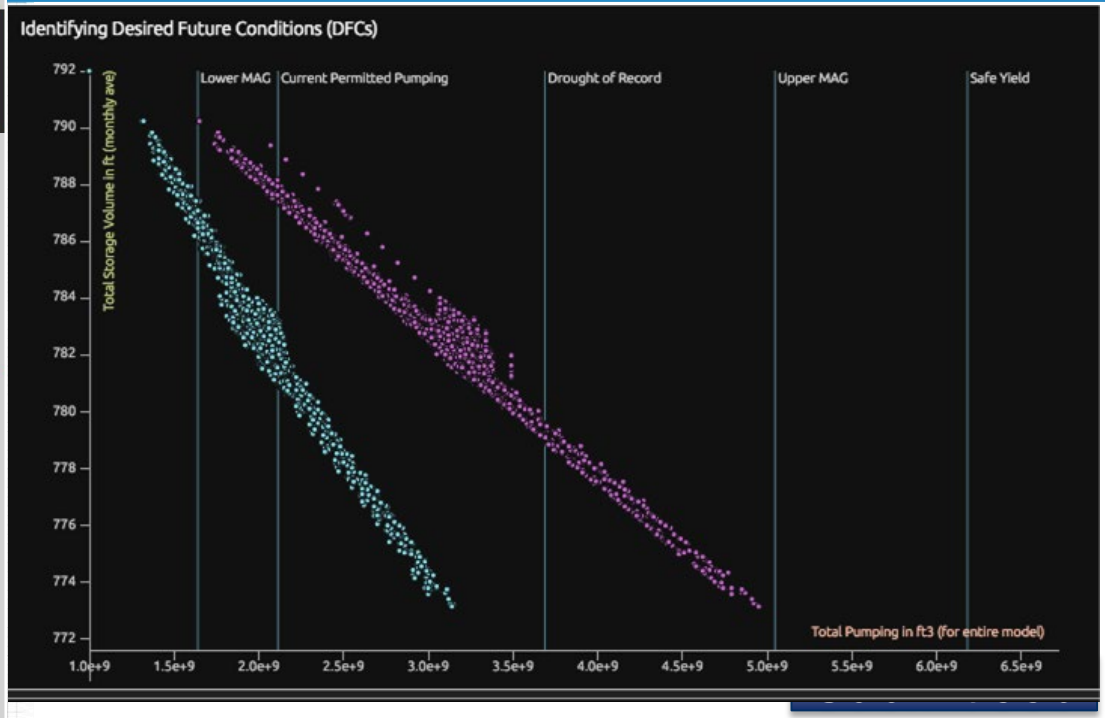
ANALYZE



1. PRISM2RCH – MODFLOW
2. CESM22RCH – MODFLOW
3. PRISM2RCH-NLDAS-MODFLOW
4. CESM22RCH –SoilModel-MODFLOW
5. PRISM2RCH-NLDAS-HAND-MODFLOW
6. CESM22RCH –SoilModel-NWM- MODFLOW
7. ESM22RCH –SoilModel-SWAT- MODFLOW

TACC

Data Ingest → Storage → Analyze → Process

EarthCube RCN IS-GEO, National Science Foundation
award number 1632211

Planet Texas 2050, The University of Texas at Austin

MINT Team, DARPA, World Modelers program

Thank You!

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