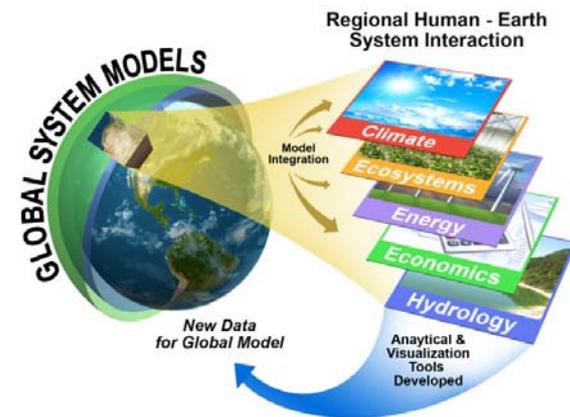


# Leveraging the Earth System Grid for the integrated Regional Earth System Model

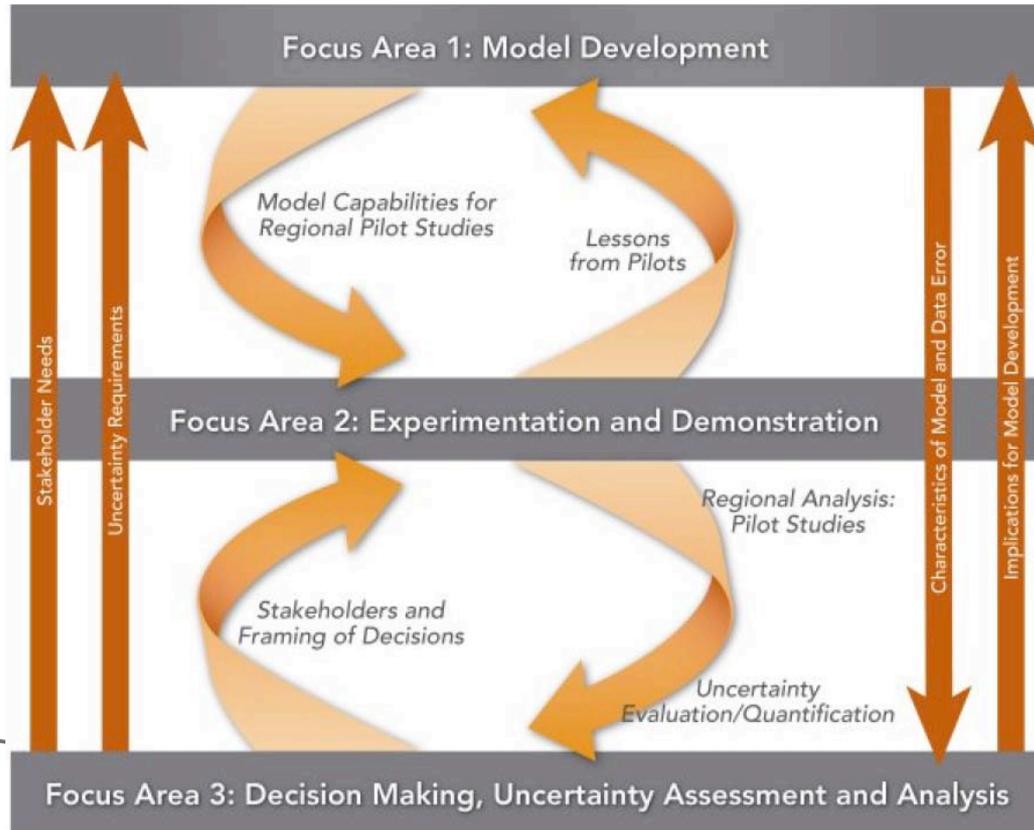
Eric Stephan, Abigail Corrigan, Patrick Paulson, Kathleen  
Hibbard, Kerstin Kleese-Van Dam

# Purpose of Attending GO-ESSP

- ▶ Share our use of the Earth System Grid to date
- ▶ Develop a more sophisticated understanding about partnering both technologically and through standards development.



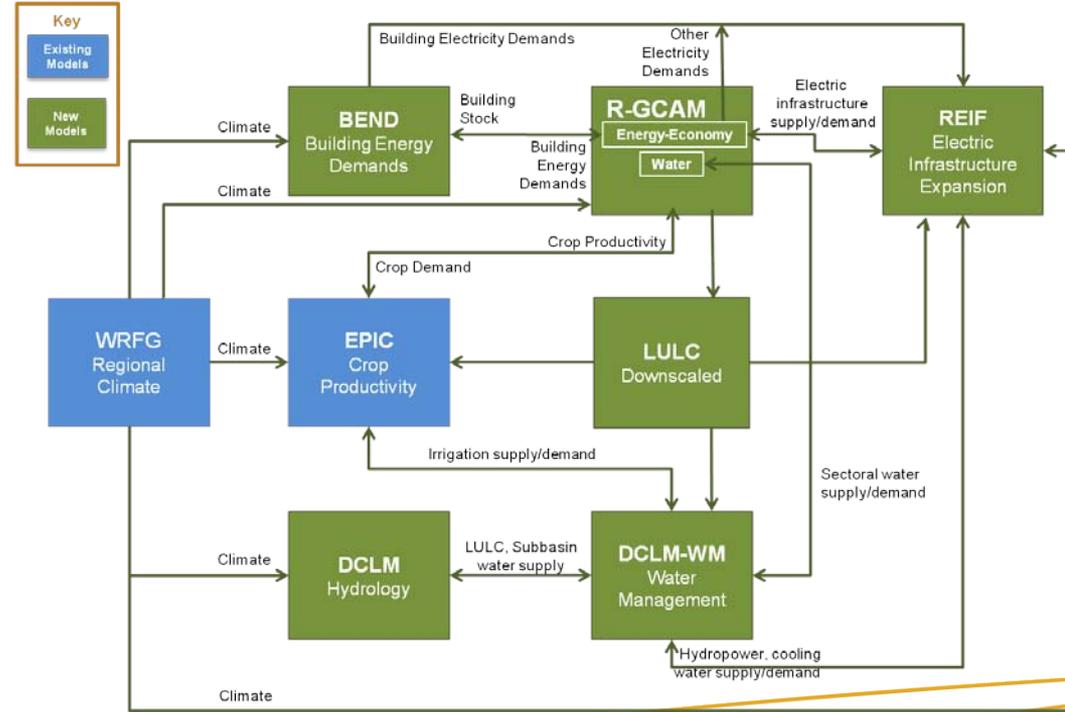
# Overview of integrated Regional Earth System Model (iRESM)



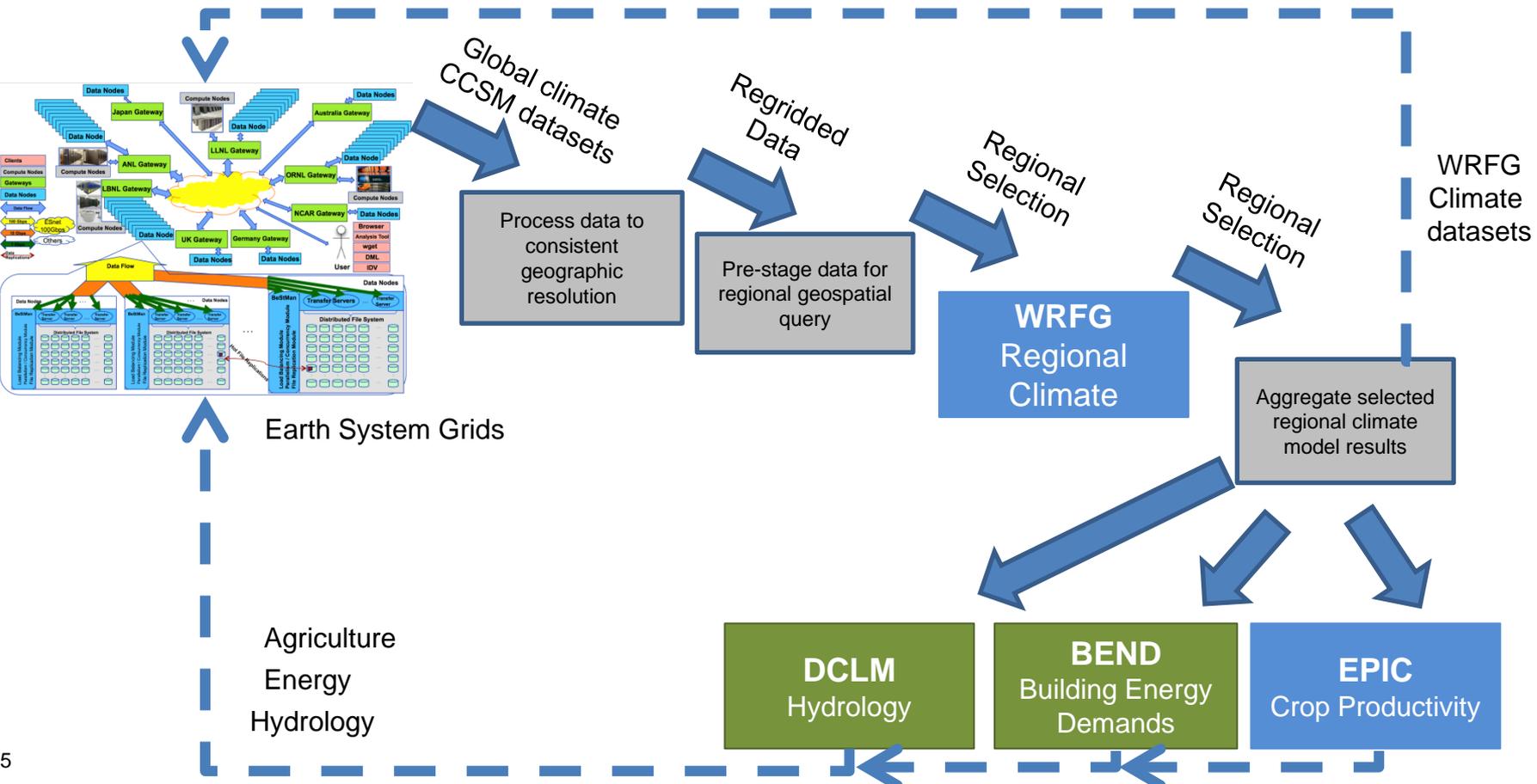
- ▶ At PNNL, we are developing a capability to evaluate the interactions between climate, energy and socio-economics at regional scales to support decision makers and policy makers.
- ▶ Our goal is to understand the implications of different options for mitigating and adapting to climate change.

# Regional Integrated Model Components

Regional Integrated Model	
Capability	Model
Regional–Global Change Assessment	R-GCAM
Building Energy Demands	BEND
Energy Infrastructure Expansion <ul style="list-style-type: none"> <li>Electricity Demand</li> <li>Electric Capacity Siting</li> <li>Electric Operations</li> </ul>	REIF MELD SITE EOM
Crop Productivity	EPIC
Downscaled Land Use, Land Cover	LULC
Sub-basin Hydrology	DCLM
Water Management	DCLM-WM



# Use Case: Regional models to assess building energy, agriculture, and hydrology impacts



# Data Challenges

- **Significant variability in spatial scale (remote sensing, area coverage, point observation, trajectories)**
- **Temporal scales (minutes to hours, long term time series to intermittent or time limited observations)**
- **Different data formats and variable names e.g.between different observational data collections**
- **Structure (e.g. multiple independent streams versus gridded values)**
- **Representations (between simulation and observation) as well as semantic differences between the different scientific domains involved.**

# Current Status

## ► Needs:

- Server side processing (e.g. regional selection)
- Programmatic access for ad-hoc searches and data retrieval
- Provenance in existing data
- Ability to publish intermediate results and reference data sets.

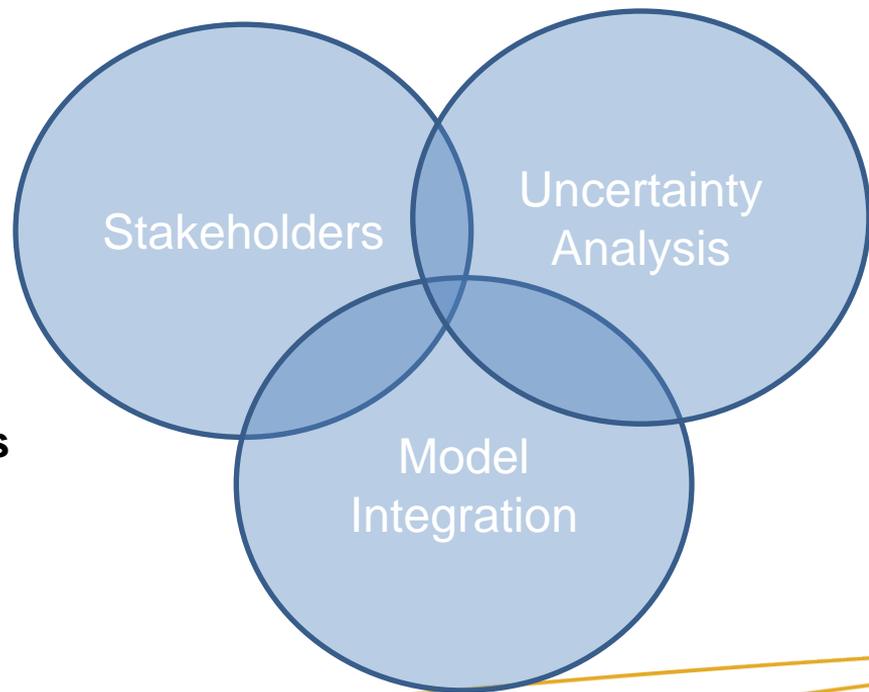
## ► Investigating:

- Use of OpenDAP on the ESG data node.
- Incorporating semantic technologies for iRESM related metadata and search requirements.
  - SSWAP (simple semantic web protocol)
  - Knowledge to support all iRESM focus areas
  - Leveraging existing work:

- ◆ Joslyn CA, LA McCue, CS Lansing, ZC Guillen, AL Corrigan, WR Cannon, GA Anderson, MF Romine, and K Kleese van Dam. 2010. "Final Evaluation Report for the Semantic Driven Knowledge Discovery and Integration in the System Biology Knowledgebase Project."

# Data/Knowledge Solutions

- ▶ The project will leverage existing metadata standards (Dublin Core, Open Provenance Model, Proof Markup Language (PML) W3C Provenance Working Group, NetCDF CF) and community formats (NetCDF).
- ▶ Controlled Vocabularies/Ontologies (e.g. CF, SWEET) will provide necessary linkage connecting different terms referring to the same variables and concepts and differentiating between terms and concepts with similar terms but varying meanings, potentially referring to required transformations between these.
- ▶ Rules to express constraints and logical relationships



**Knowledge Scope**



# Conclusions

- ▶ Currently 18 months underway of a five year effort, semantic work started 6 months ago
- ▶ Interested in advancing the way iRESM researchers access the Earth System Grid.
- ▶ Highly interested in leveraging data, metadata and ontological standards

# Questions?

▶ Contact: [eric.stephan@pnl.gov](mailto:eric.stephan@pnl.gov)

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