

NGEE Arctic
Next-Generation Ecosystem Experiments

Integrating Boots-on-the-Ground Observations with the Virtual World of Models to Answer Big Science Questions Across the Arctic



Colleen Iversen
On Behalf of the NGEE Arctic Team

IDEAS-Watersheds
28 May 2024



Acknowledgements

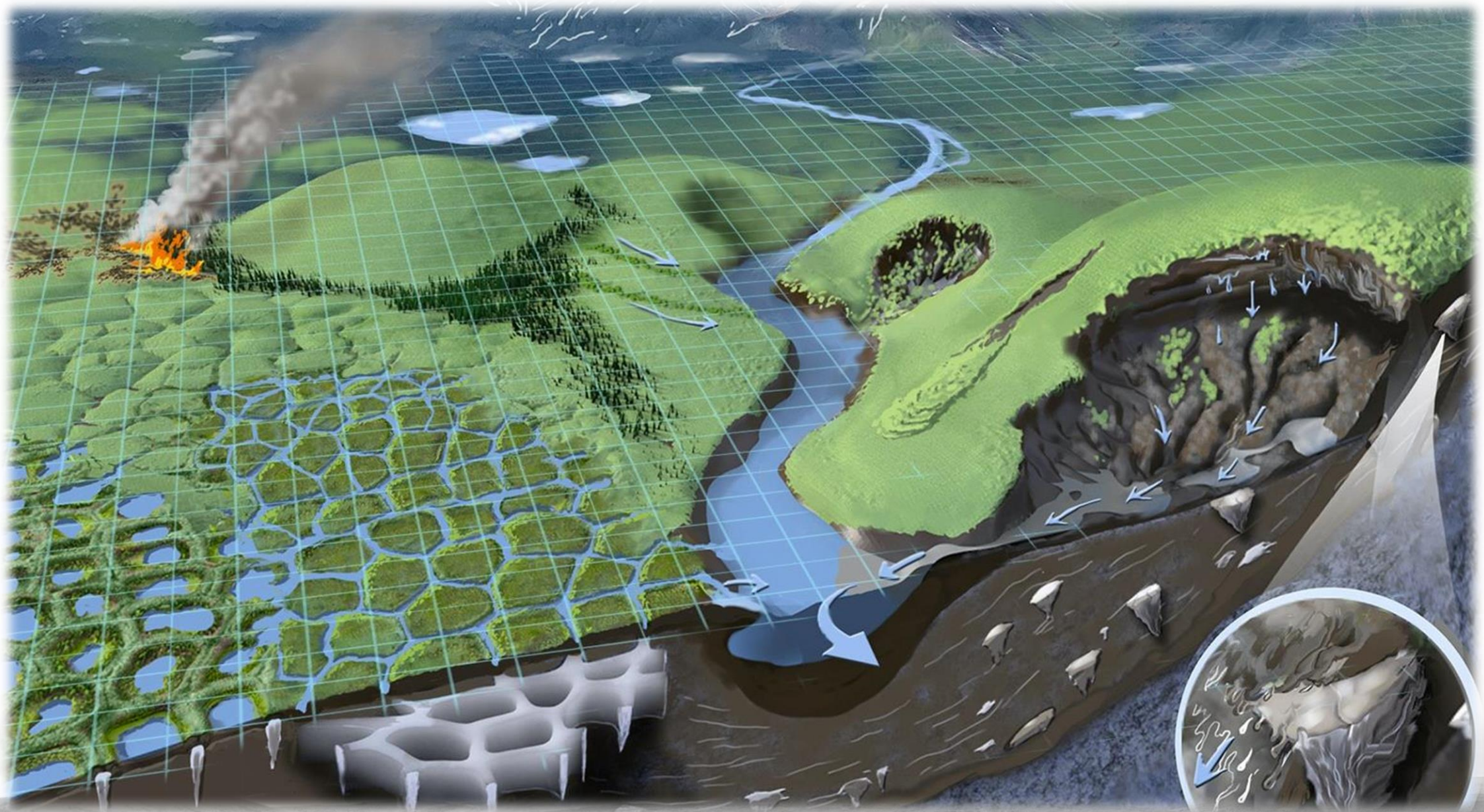
NGEE Arctic is supported by the Biological and Environmental Research Program in the Department of Energy's Office of Science.

We thank our partners from the Native Communities in Alaska for allowing us to conduct our research on the traditional homelands of the Iñupiat, including the UIC Science, Mary's Igloo, Council, Sitnasuak, and Bering Straits Native Corporations.

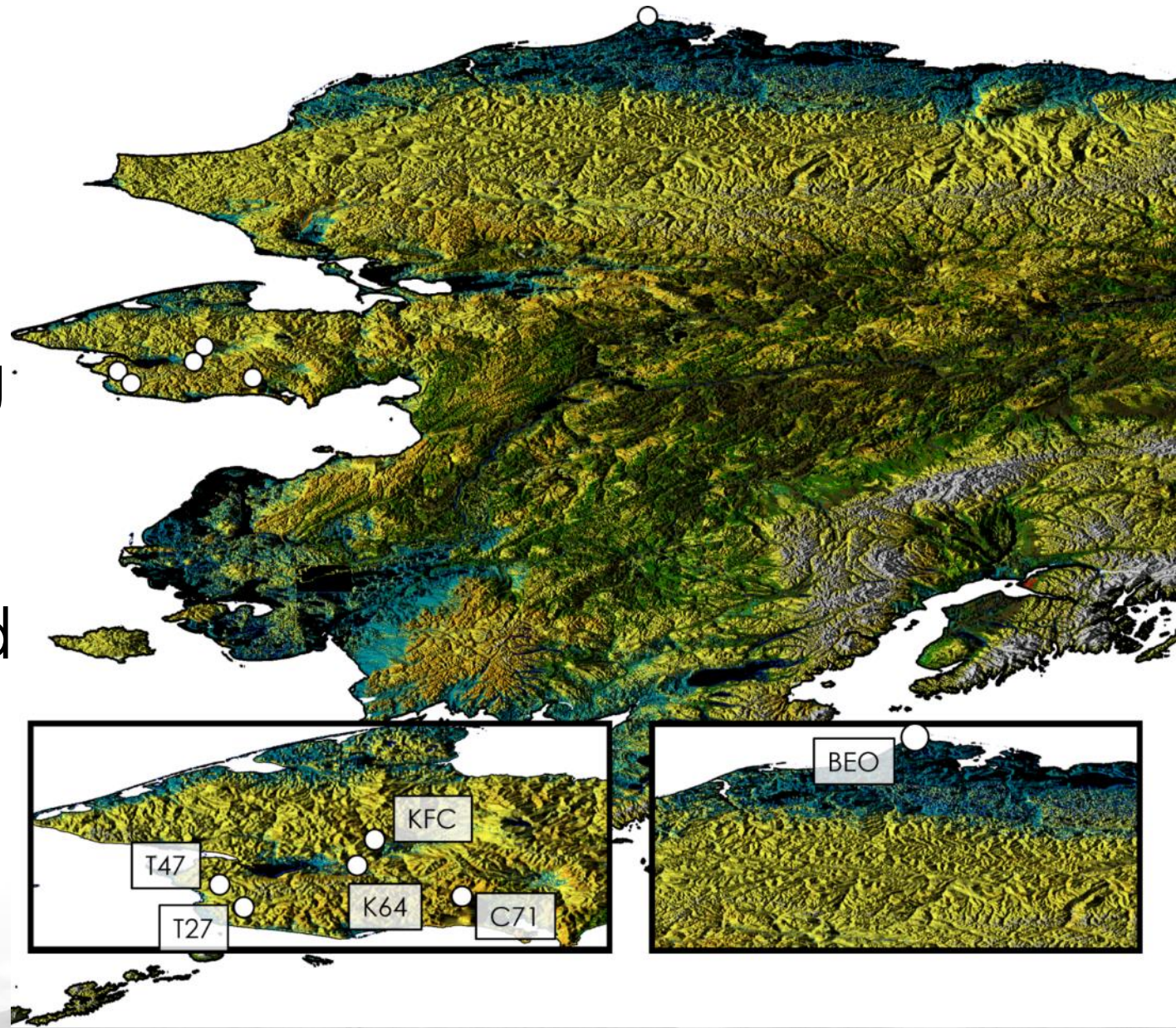
We also thank our Science Advisory Board as well as colleagues in Utqiagvik and Nome, Alaska, for their insights and support.

NGEE Arctic is underscored by a foundation of open science and data sharing and a safe, inclusive project culture.

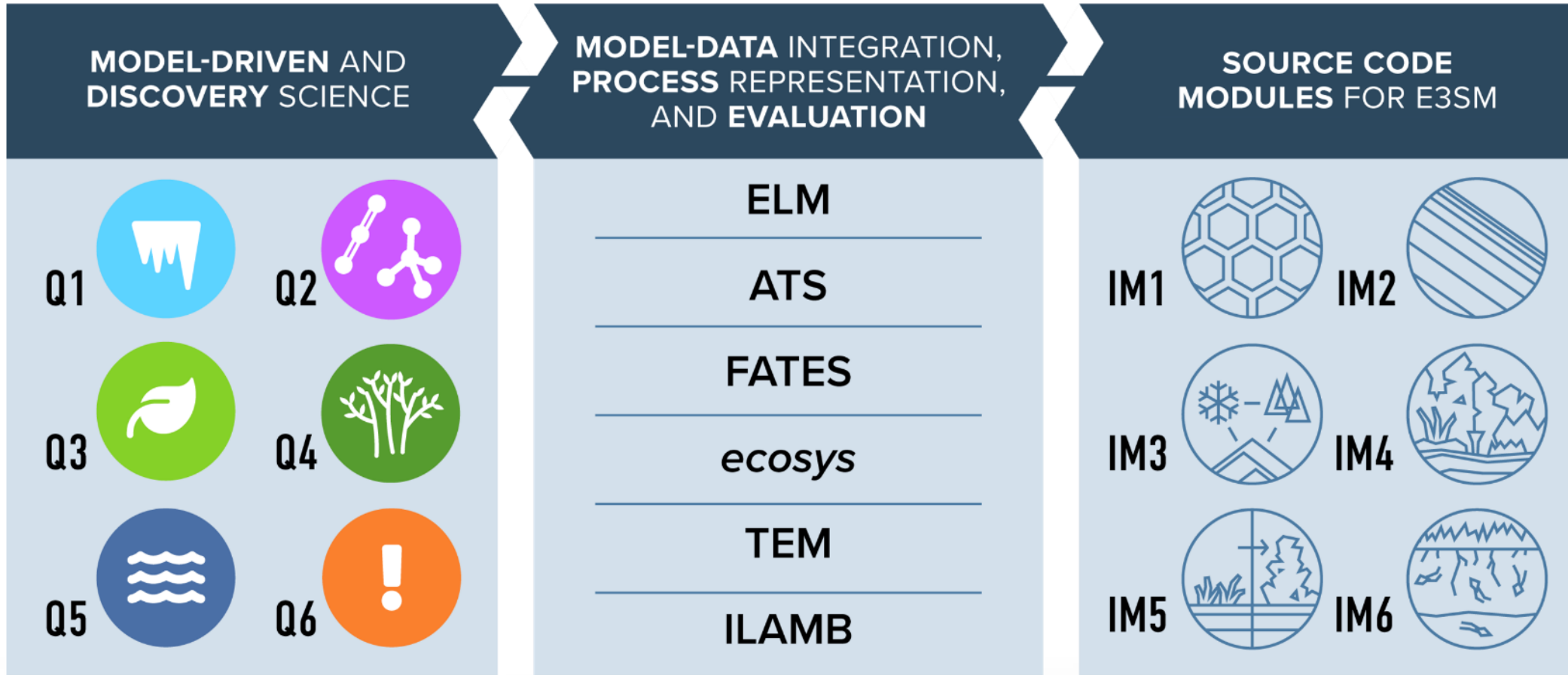




NGEE Arctic is a model-driven, multi-scale research project that leverages a decade-long foundation of model-data integration in arctic Alaska to understand and predict climate-ecosystem feedbacks across the Arctic.



We Emphasize Collaboration Across Disciplines



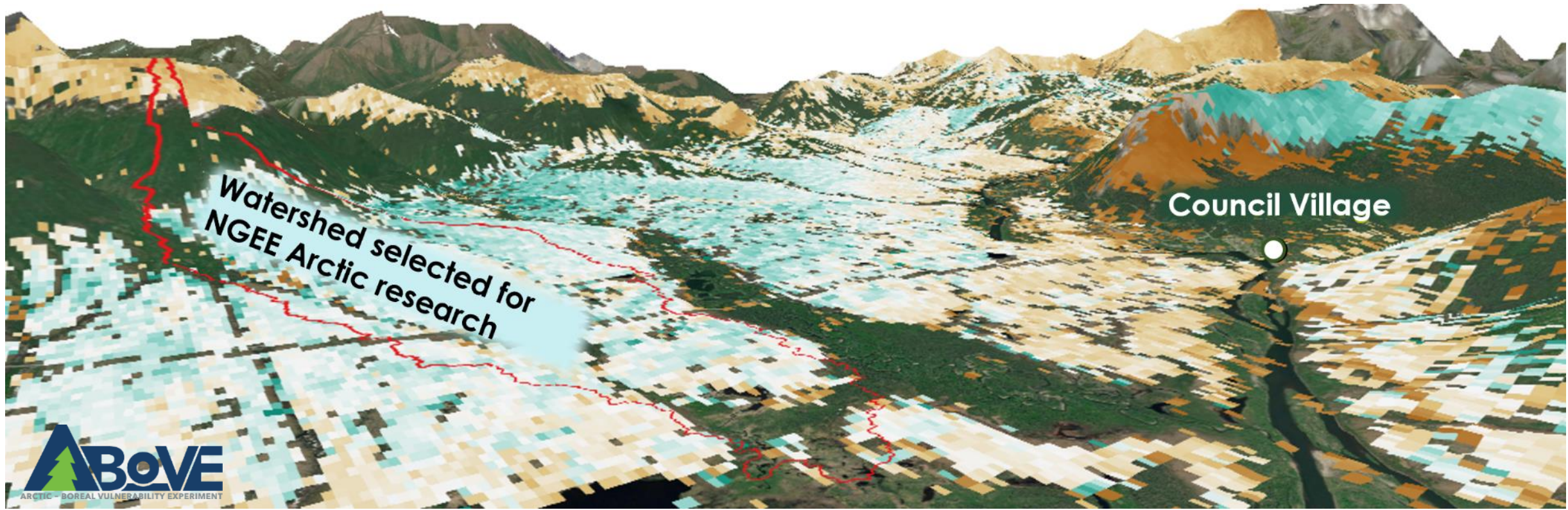
DATA ARCHIVED AT ENVIRONMENTAL SYSTEM SCIENCE DATA INFRASTRUCTURE FOR A VIRTUAL ECOSYSTEM (ESS-DIVE*)

*E3SM is the Department of Energy's Energy Exascale Earth System Model; ELM is the land model.

*ESS-DIVE is a freely accessible online platform for data sharing funded by DOE.



We Gratefully Conduct Science on Native Lands



Data are Openly Shared and Publicly Available



NGEE Arctic - Data Search

Next-Generation Ecosystem Experiments
Improving climate model predictions through advanced understanding of coupled processes in Arctic terrestrial ecosystems

HOME NGENE ARCTIC WEBSITE CREATE METADATA HELP

Use suggestions from type-ahead feature or use quotes around search


246

Results

CURRENT SELECTION(S):

✖ datasource:"NGEE Arctic"

Hosted by **ESS-DIVE**



Next-Generation Ecosystem Experiments Arctic (NGEE Arctic)

The Next-Generation Ecosystem Experiments (NGEE Arctic) is a project to improve the predictive understanding of carbon (C)-rich Arctic system processes and feedbacks to climate. This is achieved through experiments, observations, and synthesis of existing datasets that strategically inform model process representation and parameterization, and that enhance the knowledge base required for model initialization, calibration, and evaluation.

Data Metrics About

Search

Search these datasets

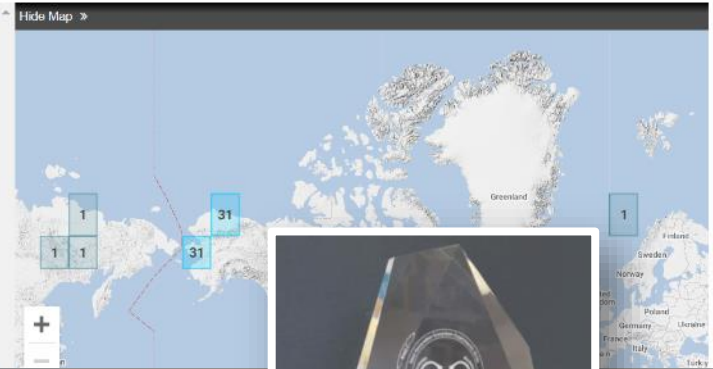
DATASETS 1 TO 25 OF 64

1 2 3 Next Sort by: Most recent

Fiolleau S; Dafflon B; Uhlemann S; Wielandt S; Wang C; Shirley I; Lamb J (2023): **Continuous soil temperature and soil deformation measurements, Teller road Mile 47, Nome, Alaska.** Next-Generation Ecosystem Experiments (NGEE) Arctic, ESS-DIVE repository. Dataset. doi:10.15485/2251663

Serbin S; Lieberman-Cribbin W; Ely K; Rogers A (2019): **NGEE Arctic Leaf Spectral Reflectance and Transmittance, Barrow, Alaska, 2014-2016.** Next-Generation Ecosystem Experiments (NGEE) Arctic, ESS-DIVE repository. Dataset doi:10.5440/1437044

Serbin S; Rogers A (2019): **NGEE Arctic Leaf Spectral Reflectance, Kougarak Road, Seward Peninsula, Alaska, 2016.** Next-Generation Ecosystem Experiments (NGEE) Arctic, ESS-DIVE repository. Dataset. doi:10.5440/1430079



Data Source

NGEE Arctic (246)

Access Restriction

< 1 2 3 ... 24 25 > displaying 1 to 10 of 246

Results: 10 Sort By: End Date

Plant Root Characteristics and Dynamics in Arctic Tundra Ecosystems, 1960-2012

NGEE Public Dataset

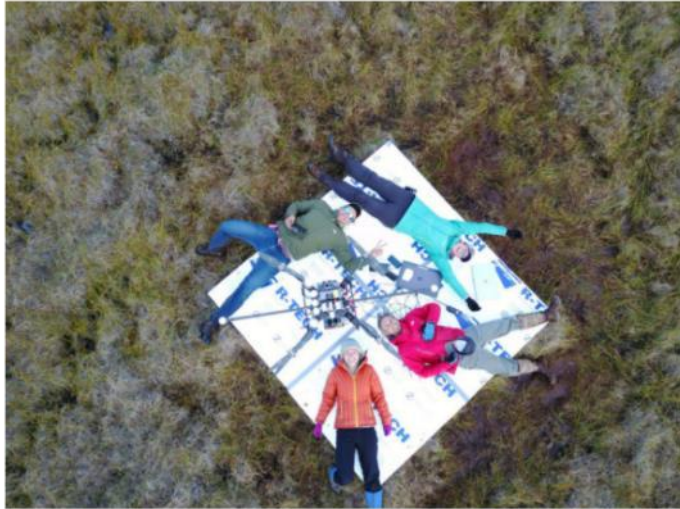
Data Source: NGEE Arctic
Federal Agency: Department of Energy

Begin Date: 01/01/1960 End Date: 01/01/2012



We Build a Culture of Safety, Trust in Team Science

An Arctic research team of 150 members that implemented a culture of safety, inclusion, and trust as the foundation for cross-disciplinary science shares lessons from its experiences.



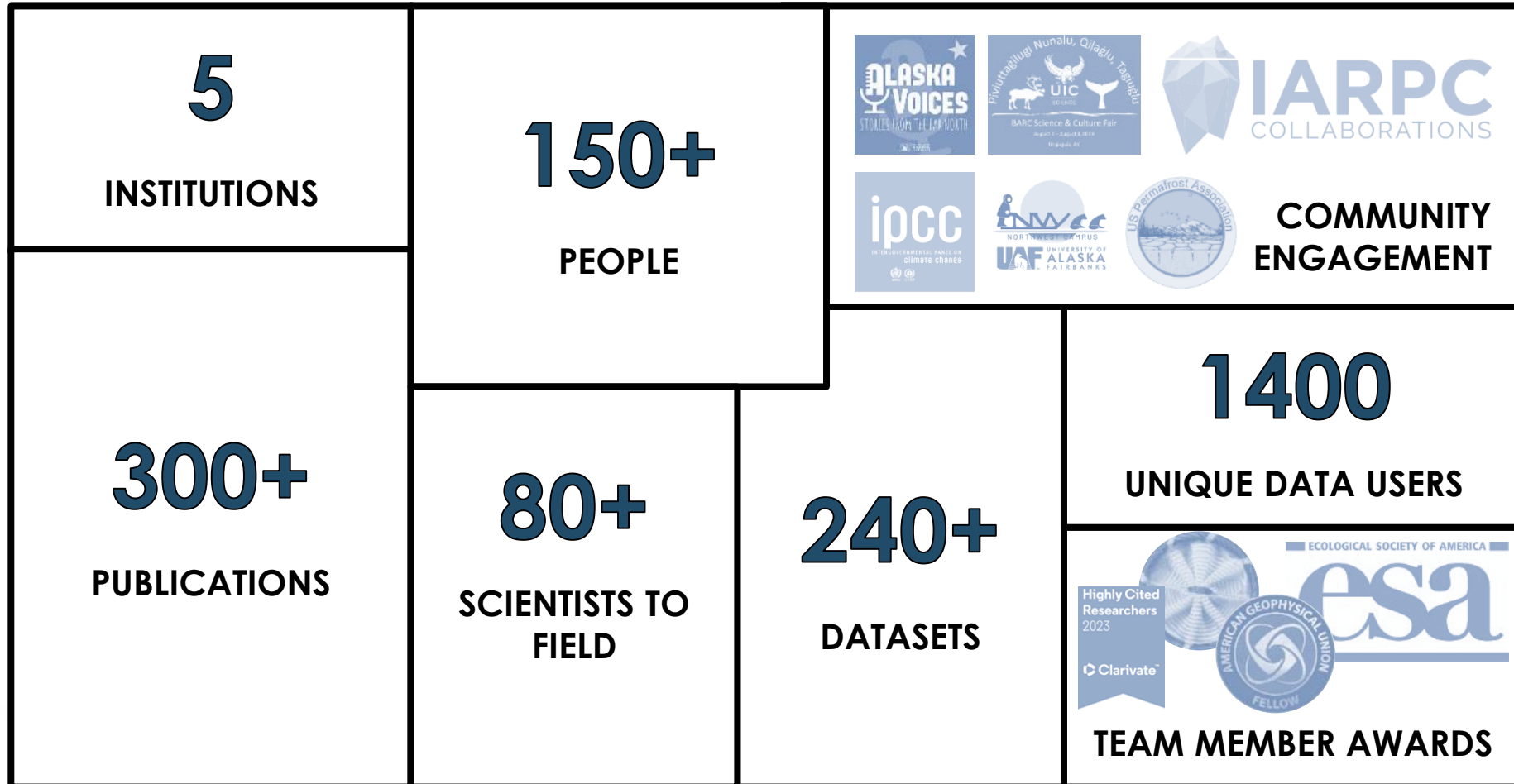
Members of the Next-Generation Ecosystem Experiments–Arctic (NGEE Arctic) unmanned aerial laser altimeter team (Christian Andresen, Lauren Charsley-Groffman, Adam Collins, and Erika Swanson) take a break on a portable drone landing pad at a field site outside Nome, Alaska. Credit: Christian Andresen, University of Wisconsin, Madison

By Colleen M. Iversen, W. Robert Bolton, Alistair Rogers, Cathy J. Wilson, and Stan D. Wullschlegel ©
21 April 2020

“As scientists become part of larger teams and join broader and more diverse scientific endeavors, they must all become leaders in creating cultures of safety, inclusion, and trust.”

Iversen et al. 2020 (Eos)

NGEE Arctic: By the Numbers



NGEE Arctic Phases 1–4

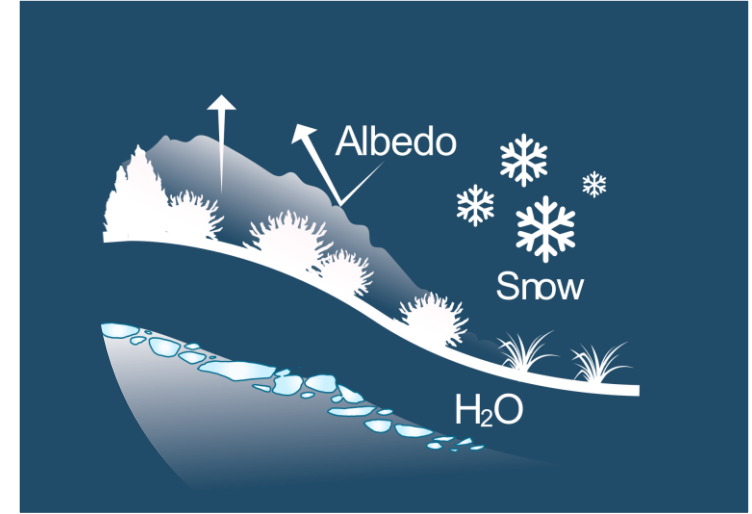
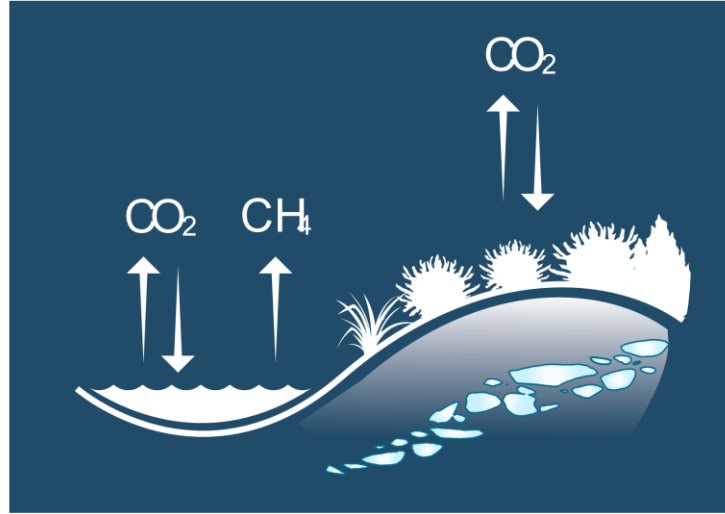
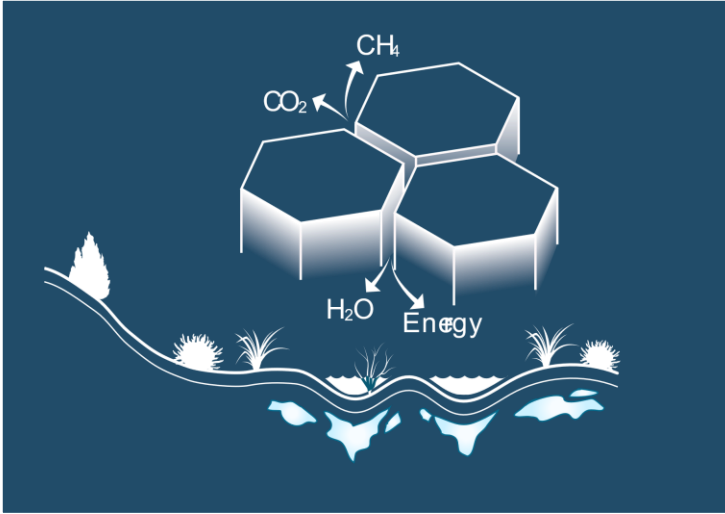
Phase 1 (2012–2014): Modeling approach driven by the failure of current models to capture tundra processes.

Phase 2 (2015–2018): Multiscale modeling approach informed hypotheses about model priorities.

Phase 3 (2019–2024): Observations and model scaling inform integrated model modules in DOE's E3SM land model.

Phase 4 (2025–2027): Models trained on observations from arctic Alaska will be evaluated against current observations and projected climate changes from across the Arctic.

Discovery Science Improves Model Predictions



PNAS

Drying of tundra landscapes will limit subsidence-induced acceleration of permafrost thaw

[Scott L. Painter](#), [Ethan T. Coon](#), [Ahmad Jan Khattak](#), and [Julie D. Jastrow](#) [Authors Info &](#)

JGR Biogeosciences

Research Article | [Free Access](#)

Topographical Controls on Hillslope-Scale Hydrology Dr Shrub Distributions on the Seward Peninsula, Alaska

[Zelalem A. Mekonnen](#), [William J. Riley](#), [Robert F. Grant](#), [Verity G. Salmon](#), [Colleen M. Iversen](#), [Sébastien C. Biraud](#), [Amy L. Breen](#), [Mark J. Lara](#)

EGU European Geosciences Union

Research article

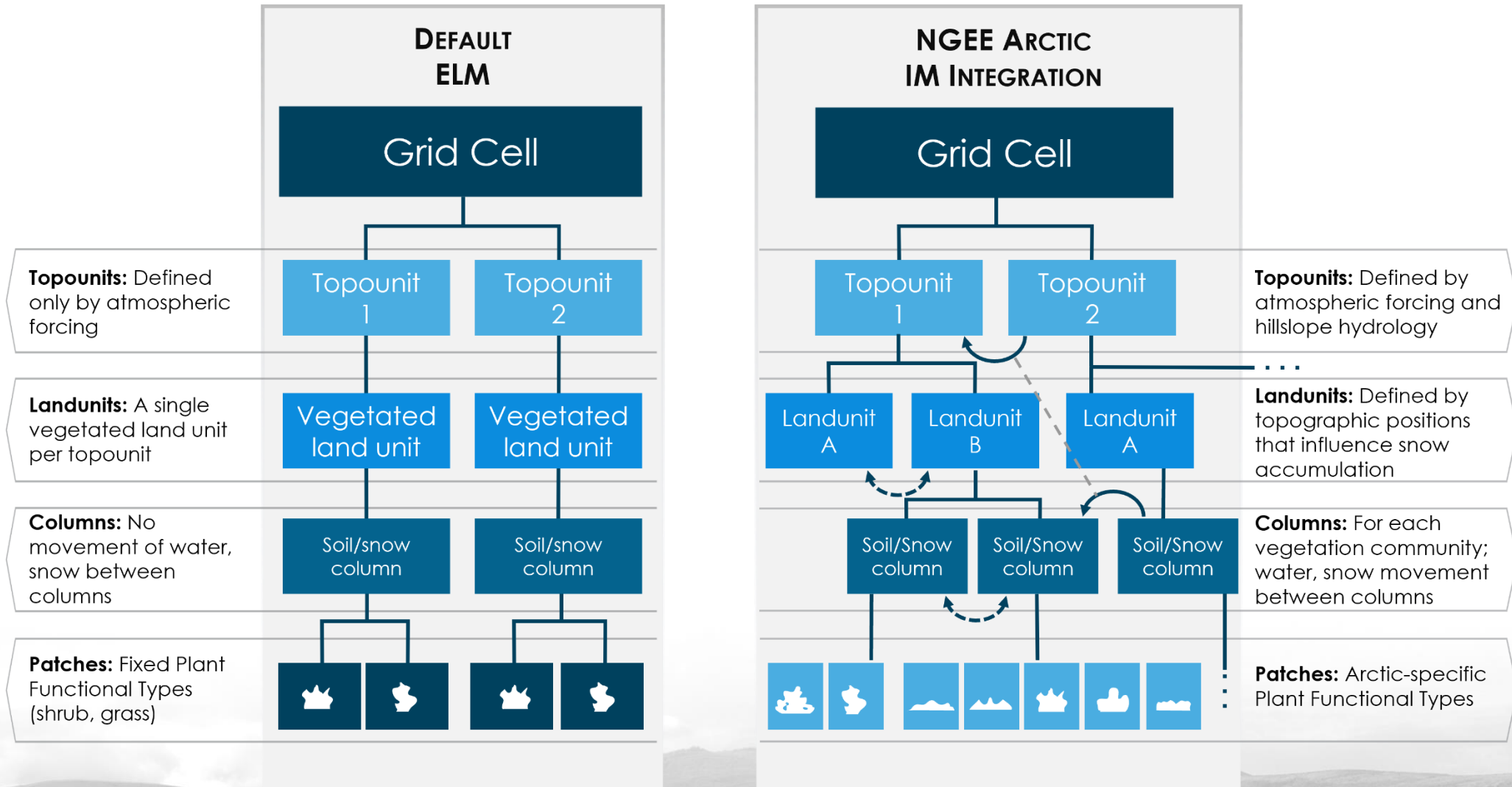
The Cryosphere

Spatial patterns of snow distribution in the sub-Arctic

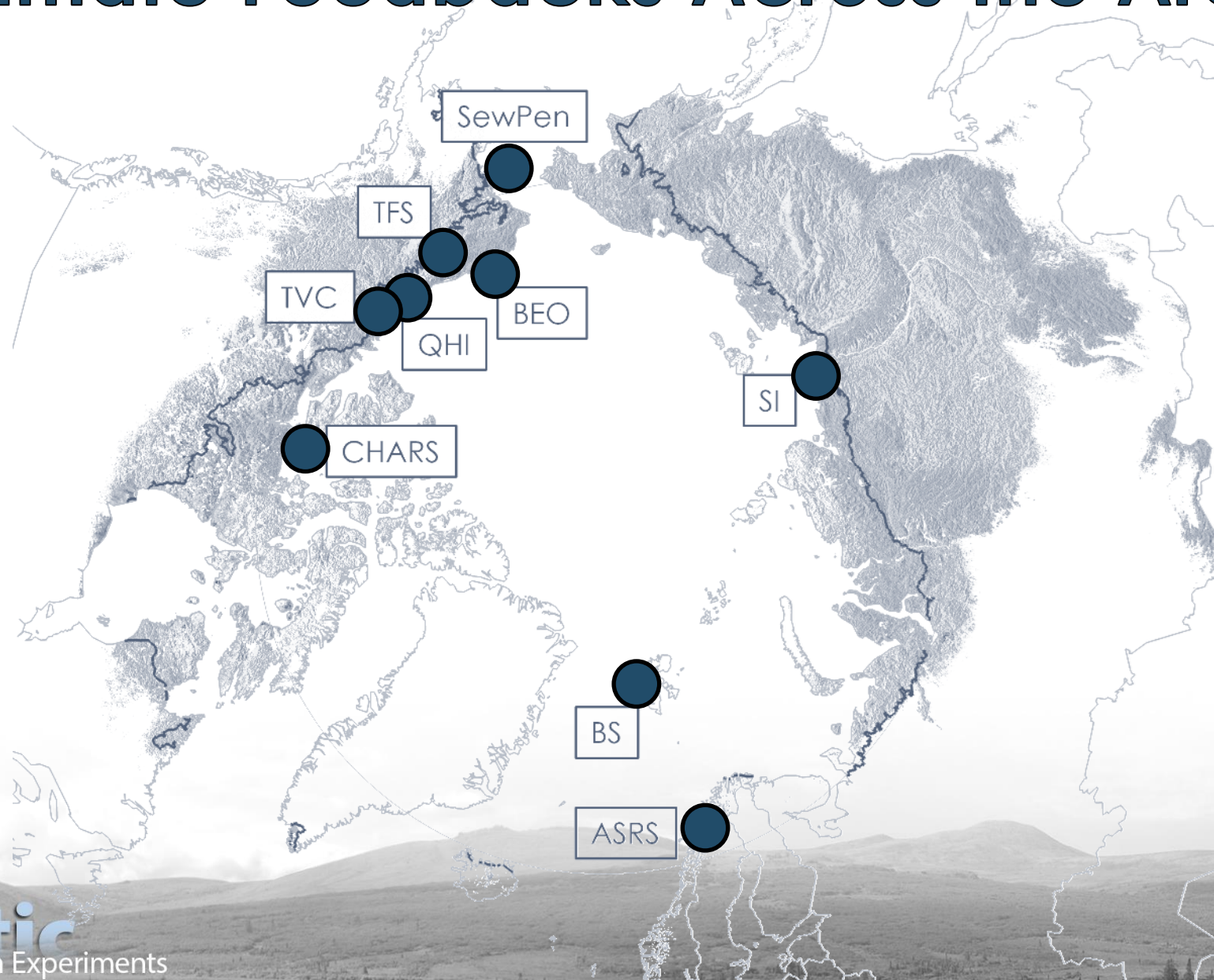
[Katrina E. Bennett](#), [Greta Miller](#), [Robert Busey](#), [Min Chen](#), [Emma R. Lathrop](#), [Julian B. Dann](#), [Mara Nutt](#), [Ryan Crumley](#), [Shannon L. Dillard](#), [Baptiste Dafflon](#), [Jitendra Kumar](#), [W. Robert Bolton](#), [Cathy J. Wilson](#), [Colleen M. Iversen](#), and [Stan D. Wullschlegel](#)

NGEE Arctic
Next-Generation Ecosystem Experiments

Phase 3: We Will Deliver an Arctic-Informed ELM



Does Our Arctic-Informed Model Accurately Predict Climate Feedbacks Across the Arctic?



Phase 4: Overarching Science Question:

What are the climate–ecosystem feedbacks from interacting processes across a rapidly warming Arctic?

Model-Inspired Questions Drive Phase 4

SYNTHESIS & EVALUATION



E3SM INTEGRATION



SCALING



DYNAMICS & DISTURBANCE



OVERARCHING SCIENCE QUESTION

Climate–ecosystem feedbacks from interactions across a warming arctic?

MEQ1



Co-evolution of permafrost, topography, and hydrology?

MEQ2

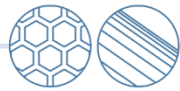


Hydrology, disturbance, edaphic properties drive vegetation and biogeochemistry?

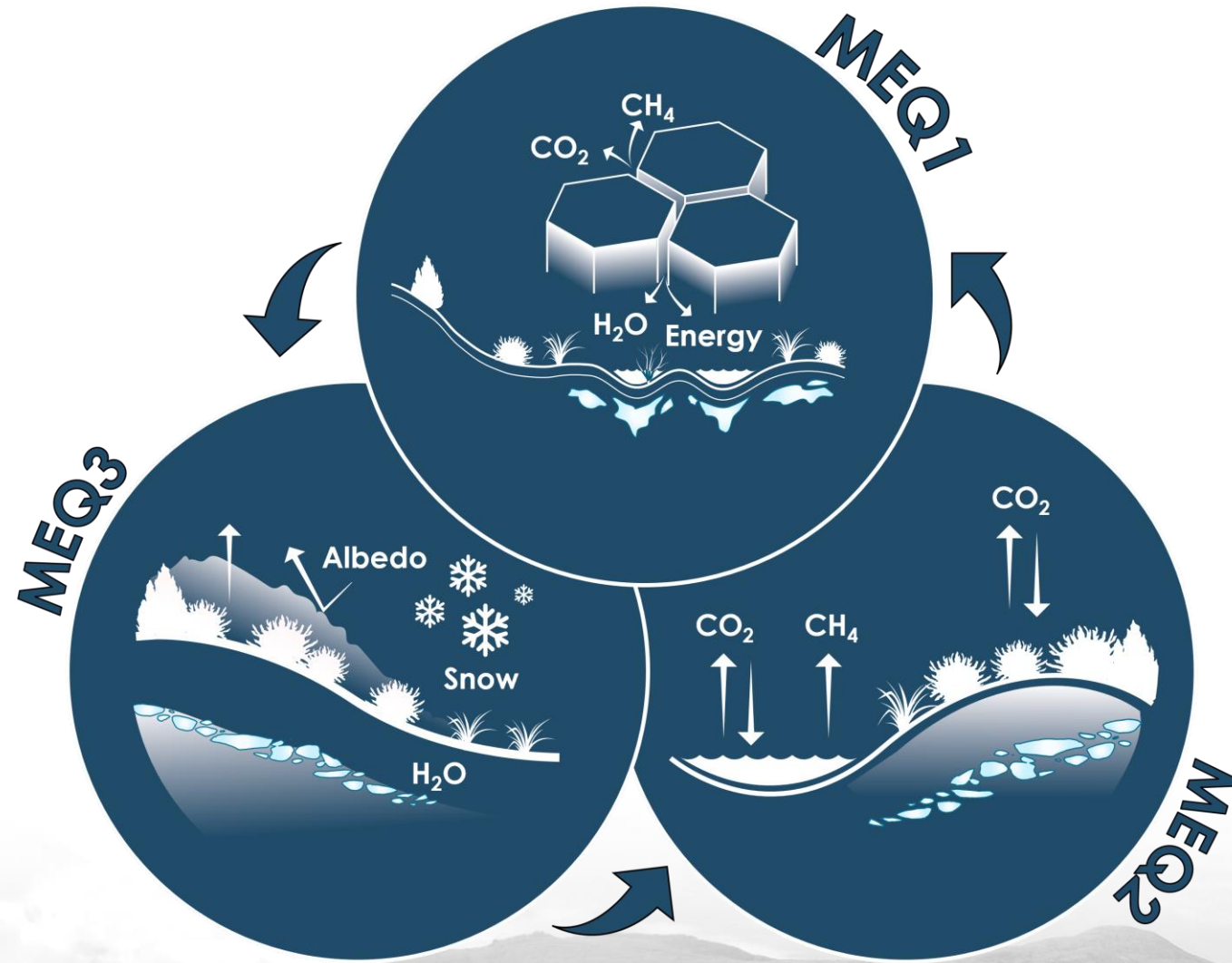
MEQ3



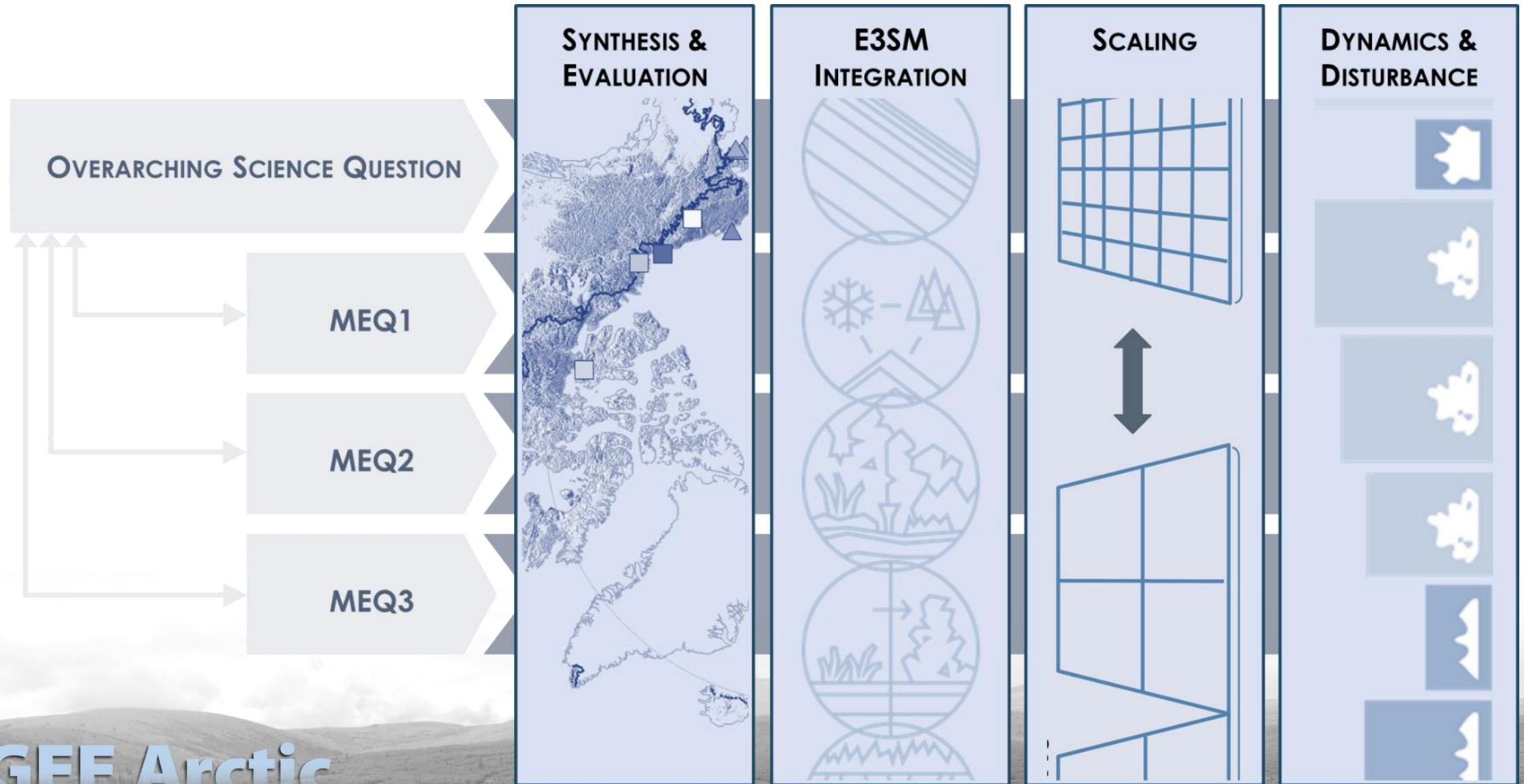
Impacts of changes in climate and seasonality of vegetation and snow?



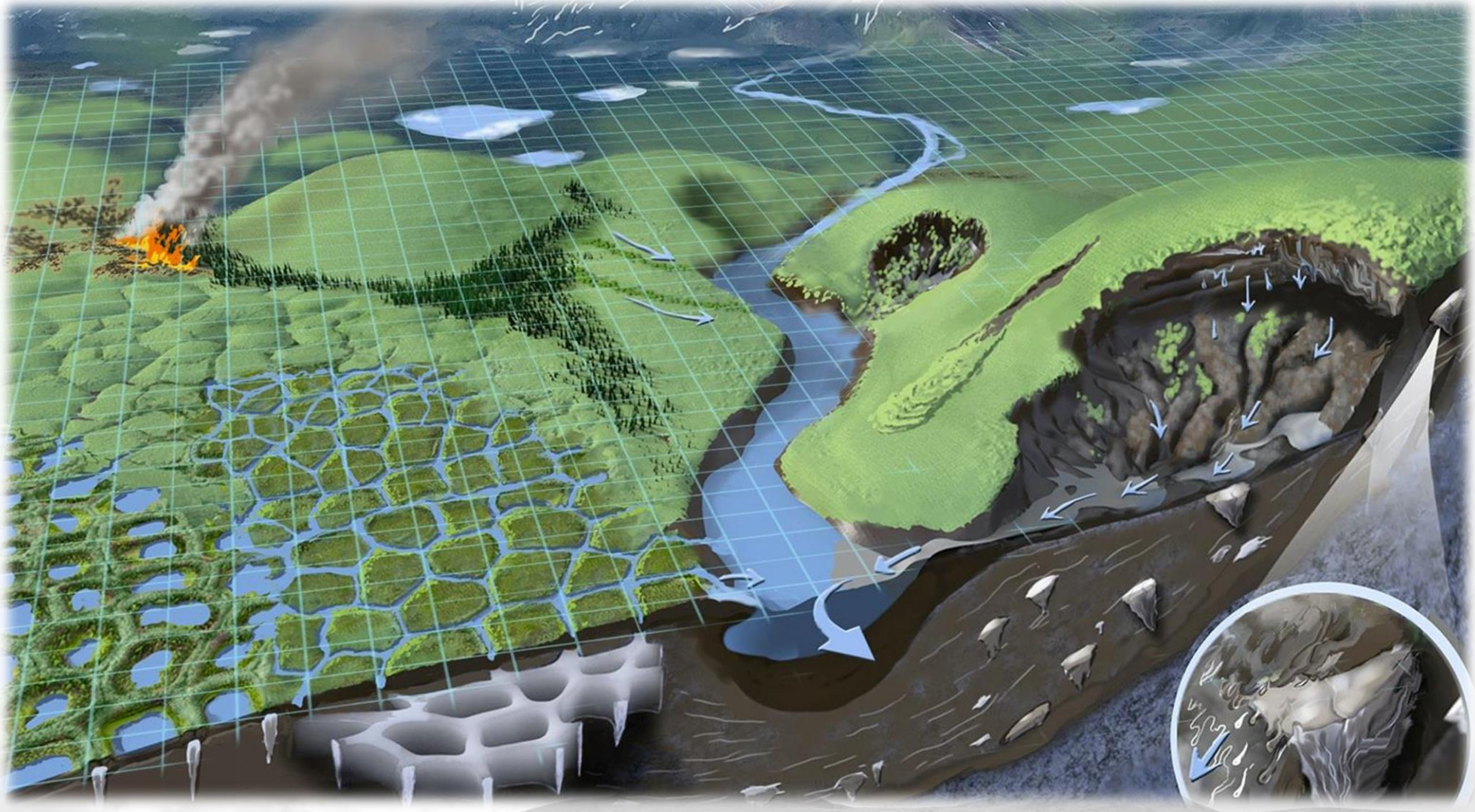
MEQs Evaluate and Inform Model Understanding



Crosscutting Science Activities Extend & Evaluate



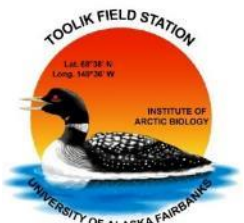
Understand Global Implications of Dynamic Arctic



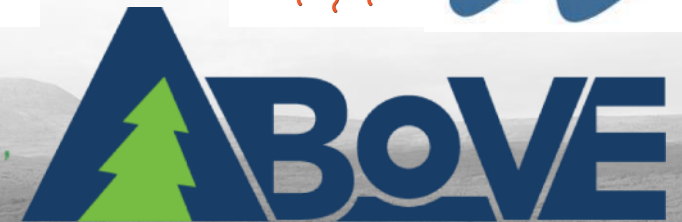
Collaborative Partnerships Across Institutions, Across the Arctic, Across Sibling Programs at DOE



MARY'S IGLOO NATIVE CORPORATION
COUNCIL NATIVE CORPORATION



FIELD, MEASUREMENTS,
AND EXPERIMENTS



NGEE Arctic
Next-Generation Ecosystem Experiments

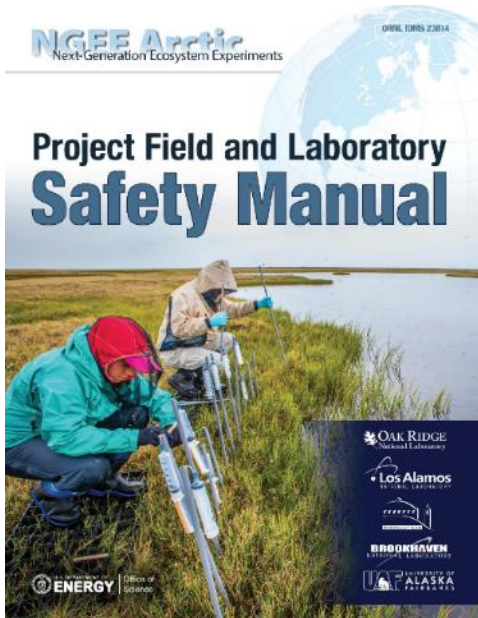
We are **grateful** for the time that we've had on the tundra and in arctic communities.



Find Out More About NGEE Arctic

Websites: ngee-arctic.ornl.gov + ess.science.energy.gov/ngee-arctic

Podcast: [The Unseen World of Climate Change](#) (Sound of Science)



Field to Model WORKSHOP

An intro to the **E3SM Land Model** for experimentalists
October 17-19 • Doubletree Hotel • Chattanooga, TN

Over the course of BER projects, modelers have had opportunities to participate in field work, and a group of modelers is now returning the favor! This bring your own laptop workshop is designed for scientists with limited or no experience running models to gain familiarity with the E3SM Land Model, using NGEE Arctic as a test case. Learn how simulation skills and a ModEx approach can inform experimental design and sharpen scientific discovery.

Activities	Takeaways
<ul style="list-style-type: none">Run the E3SM Land Model (ELM)Visualize and Interpret ELM simulation outputUnderstand how to use project data within ELM and identify opportunities to collect more model-relevant dataTest science questions using simulations of NGEE Arctic sitesForm working groups to advance use of ELM and ModEx for BER-funded science	<ul style="list-style-type: none">Your own copy of ELM in a format that is compatible with personal computers running Windows, Mac, or Linux operating systemsPackage of data and settings to run ELM at NGEE Arctic intensive field sitesStep-by-step tools to use ELM to investigate science questions

Organized by:
Shaun Sothik (ORNL), Tingting Yuan (ORNL), Benjamin Sullivan (ORNL), Kaletha Bennett (LANL), Vasily Salnikov (ORNL)

Register by August 31 at ngee-arctic.ornl.gov/modex

For more information, contact benjamin.sullivan@ornl.gov

The workshop is sponsored by the Biological and Environmental Research program, a key Department of Energy's Office of Science.

