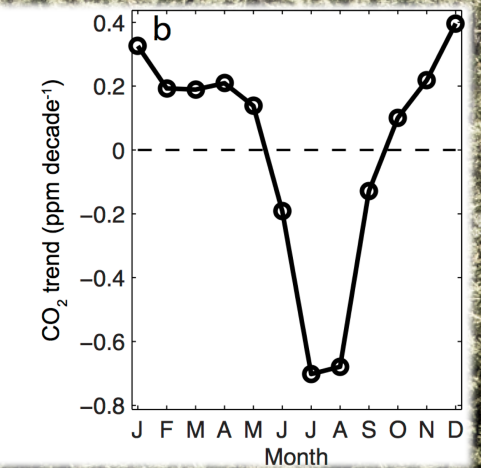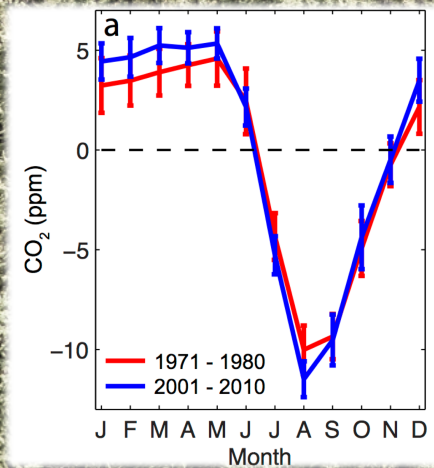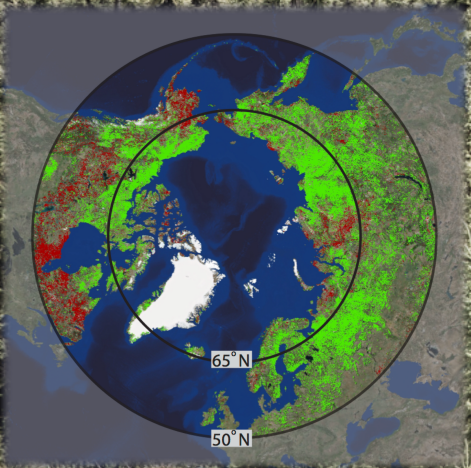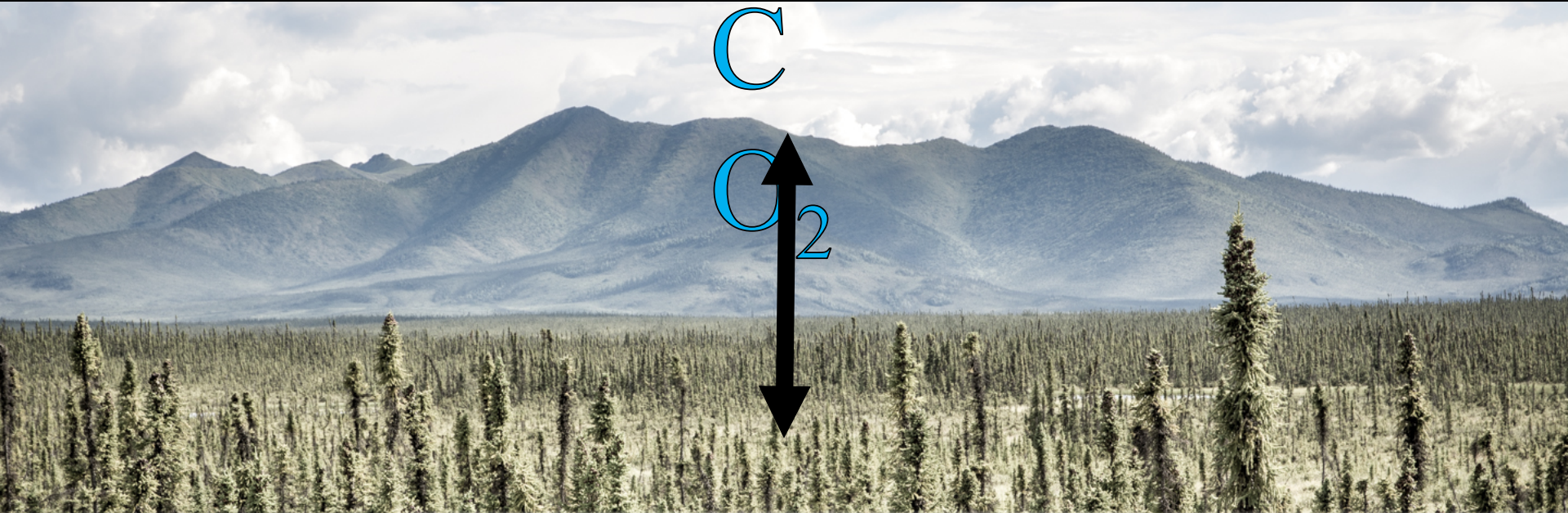# Rogers-02: Understanding the Causes and Implications of Enhanced Seasonal CO$_2$ Exchange in Boreal and Arctic Ecosystems

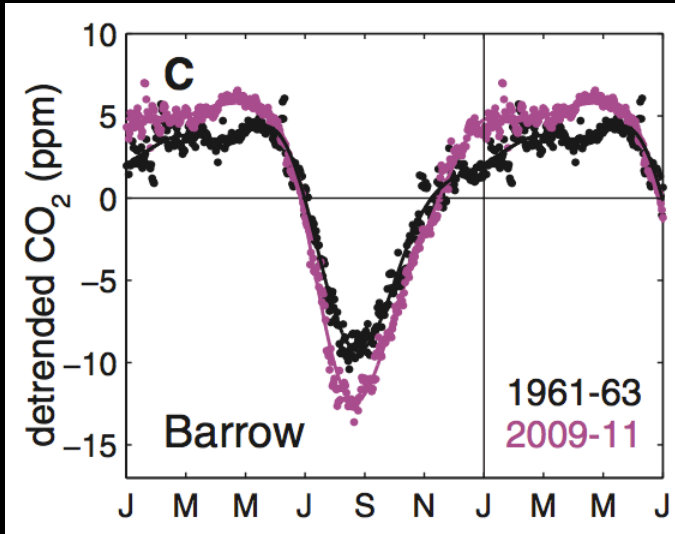PI: Brendan Rogers
Co-I's: Scott Goetz, Gretchen Keppel-Aleks, Sue Natali, Christopher Schwalm, Amber Soja
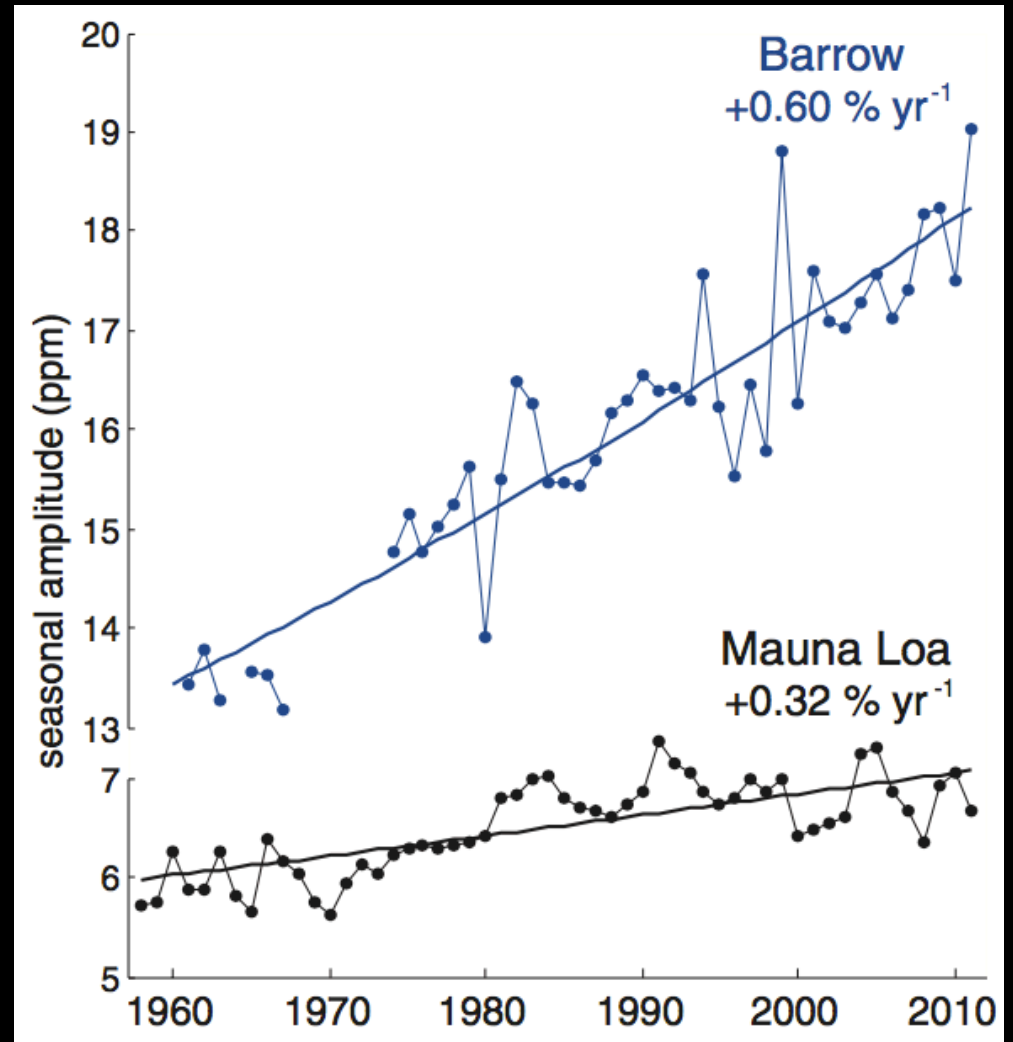Collaborators: Bruce Cook, Matt Hansen, John Kimball, Jeffrey Masek, Bill Riley, Kevin Schaefer

Motivation & Background

Motivation & Background

(Graven et al., 2013)
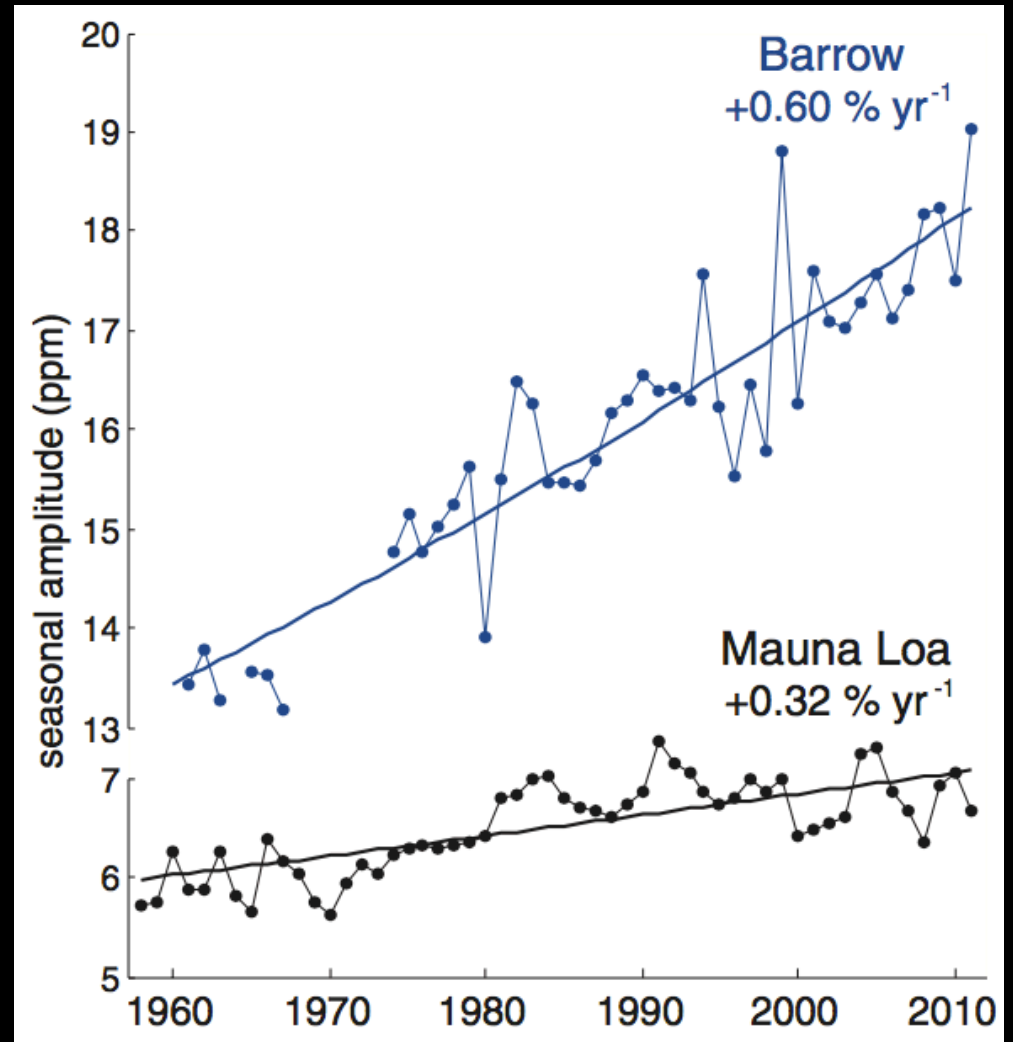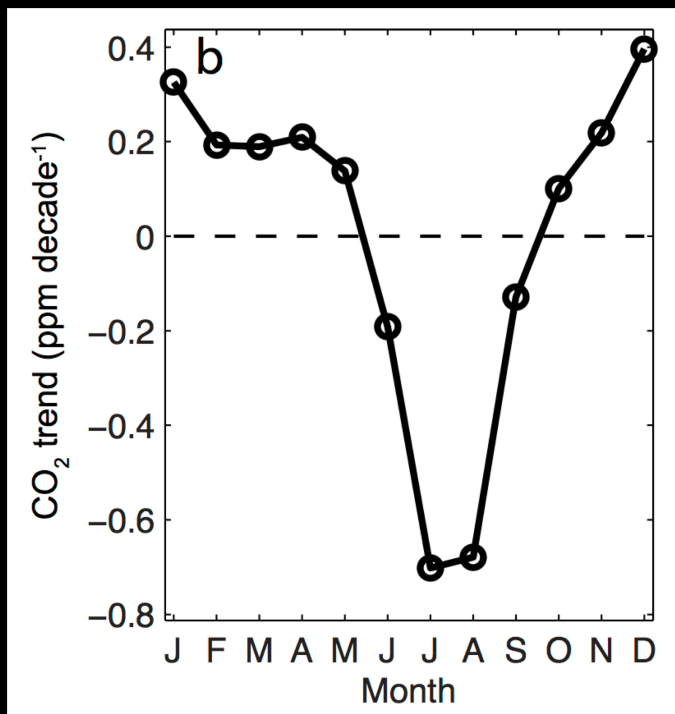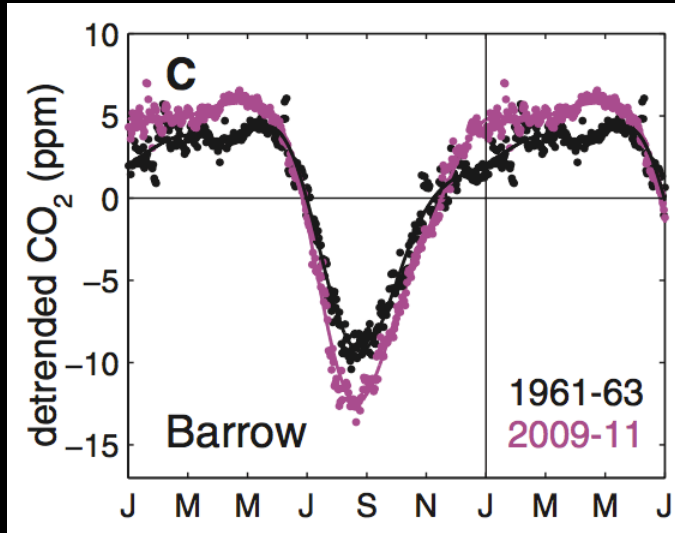
Motivation & Background

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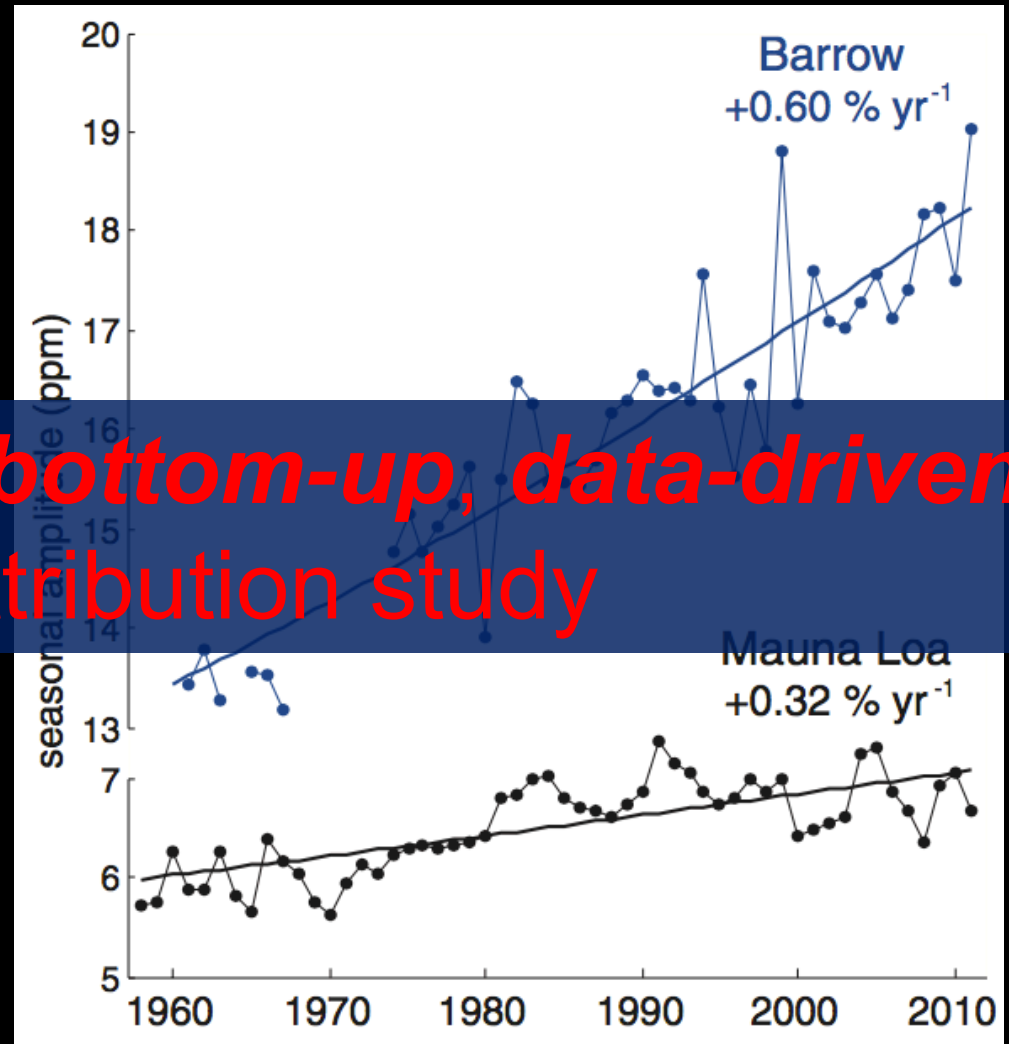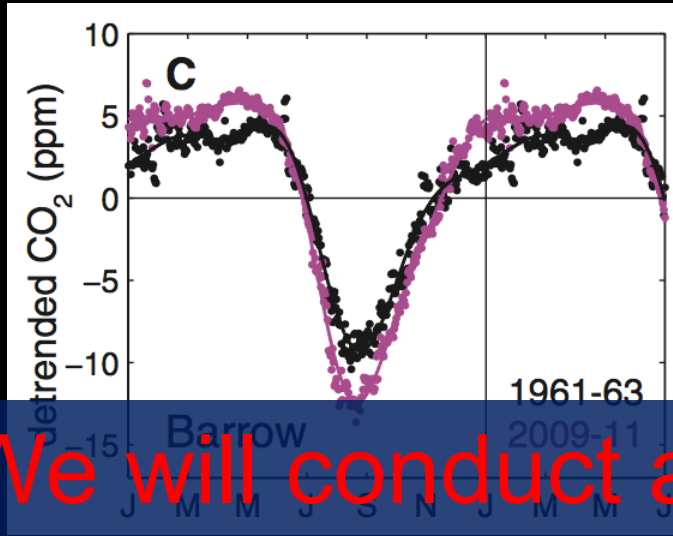
We will conduct a *bottom-up*, *data-driven* model attribution study
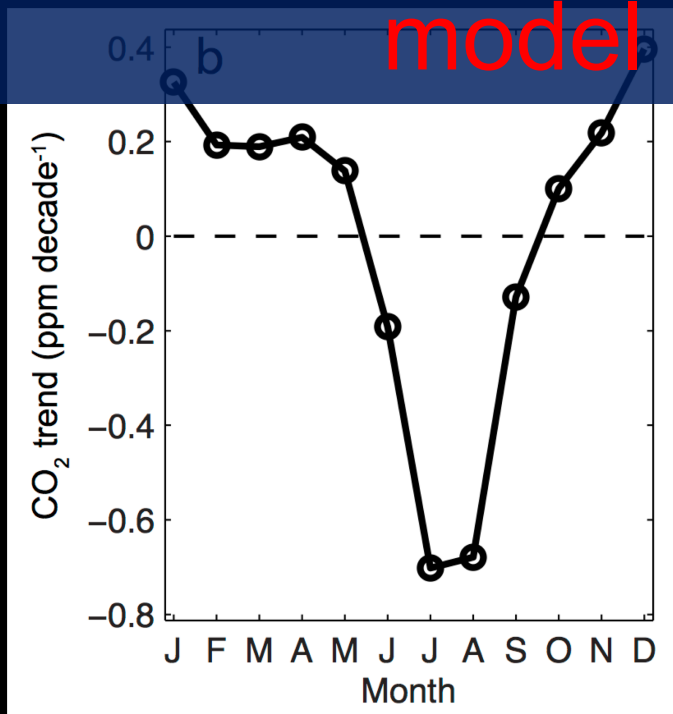
Hypotheses

Growing season productivity	Winter respiration
Climate (summer warming)	Climate (winter warming)
CO_2	Productivity (labile substrates)
N	Snow (cover and depth)
Veg-tundra	Vegetation
Veg-boreal-cover	
Veg-boreal-deciduous	
Veg-boreal-age	
Permafrost (plant-available N & H_2O)	

Approach

1) Atmospheric CO_2 patterns & drivers (Keppel-Aleks)
   - Define metrics
   - Tracers in GEOS-Chem

2) Changes in boreal forests (Goetz, Soja)
   - Fire
   - Continuous Fields (PFTs), NDVI
   - Mortality & succession trajectories
   - Stand age
   - Case study in ABoVE domain

3) Model sensitivity simulations
   - Development
   - Data-informed experiments to address all hypotheses

4) Model intercomparison (Schwalm)
   - MsTMIP
   - New benchmarks

5) Synthesis and statistical modeling of *in situ* fluxes (Natali)
   - Extend winter respiration in tundra meta-analysis to annual & boreal forests
   - Functional response metrics (benchmarks)
   - Statistical models
     - Trends
     - Drivers and changes through time

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■ 1993	■ 1990	■ 1987	■ 1984	■ 1981
■ 1992	■ 1989	■ 1986	■ 1983	■ 1980
■ 1991	■ 1988	■ 1985	■ 1982	■ 1979

Links with ABoVE

- Science and knowledge overlap

- ABoVE Science Questions and Objectives
  - Disturbance regimes
  - Permafrost
  - Changes in flora
  - Carbon exchange
  - Snow
  - Climate feedbacks

- Validation of coarse-scale remote sensing products (case study of vegetation changes)

- Intercomparison will benefit from, and can contribute to, ABoVE MIP

- Synthesis of seasonal fluxes from *in situ* data (Natali project)

ABoVE

ARCTIC BOREAL VULNERABILITY EXPERIMENT

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