



# SEARCH

A wide-angle photograph of a snowy mountain landscape. The foreground is a vast, flat expanse of snow. In the middle ground, there is a dense forest of evergreen trees, some of which are covered in snow. The background shows rolling hills and mountains under a clear blue sky with a few wispy clouds. The overall scene is bright and clear, suggesting a sunny day in winter.

**Study of  
Environmental  
ARctic  
CHange**

# Arctic Changes Over the Past 35 Years

Winter Europe Temperatures ↑

Spring Alaska Temperature ↑

Permafrost temperature ↑

Growing Seasons ↑

Atlantic Water in Arctic ↑

Barents Sea Cod ↑

Greenland Shrimp ↑

N. American Caribou ↑

Norway Deer ↑

Arctic Sea Level Pressure ↓

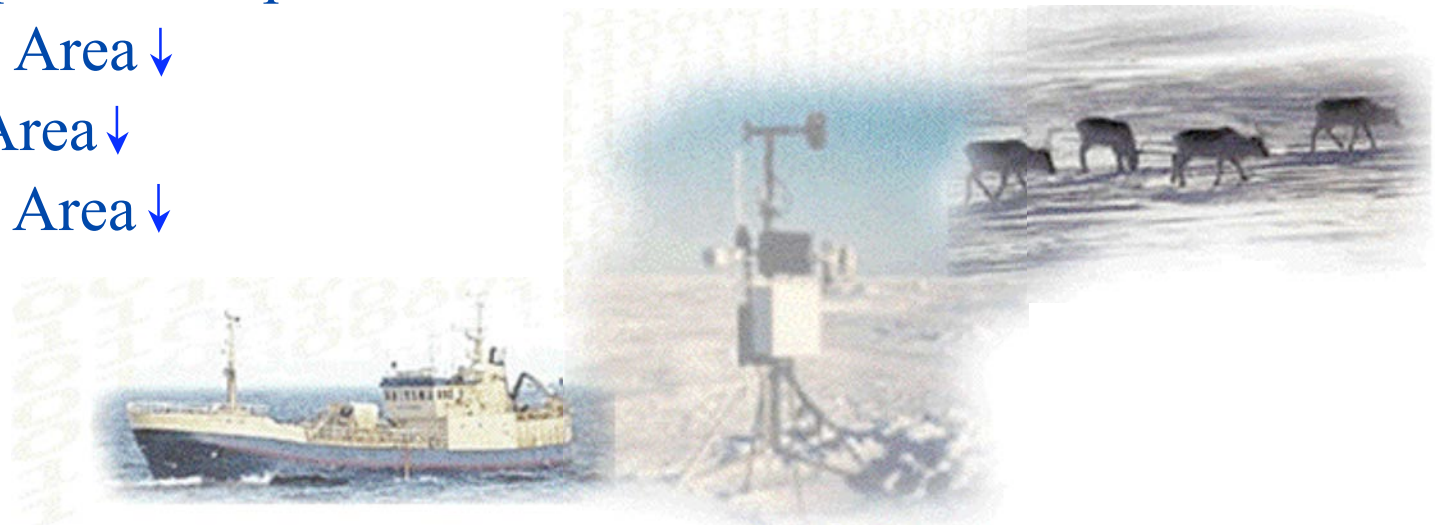
Stratosphere Temperature ↓

Sea Ice Area ↓

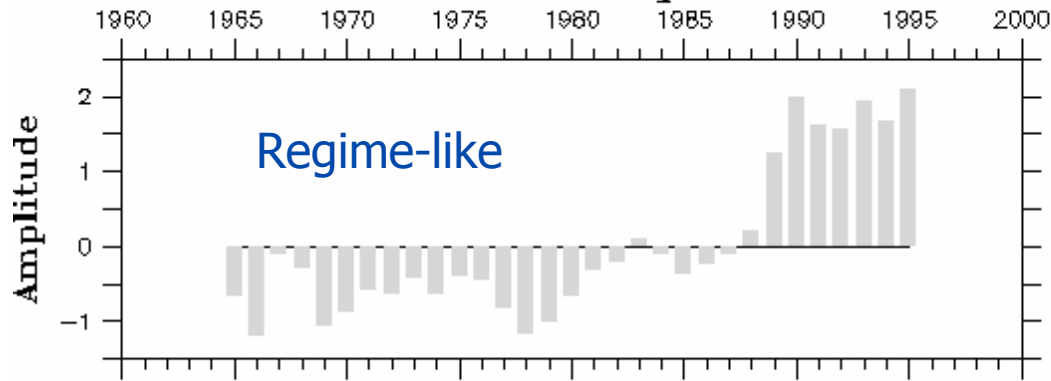
Snow Area ↓

Tundra Area ↓

Marine mammals ↓

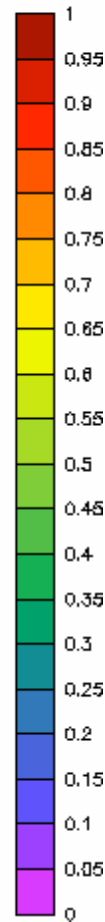
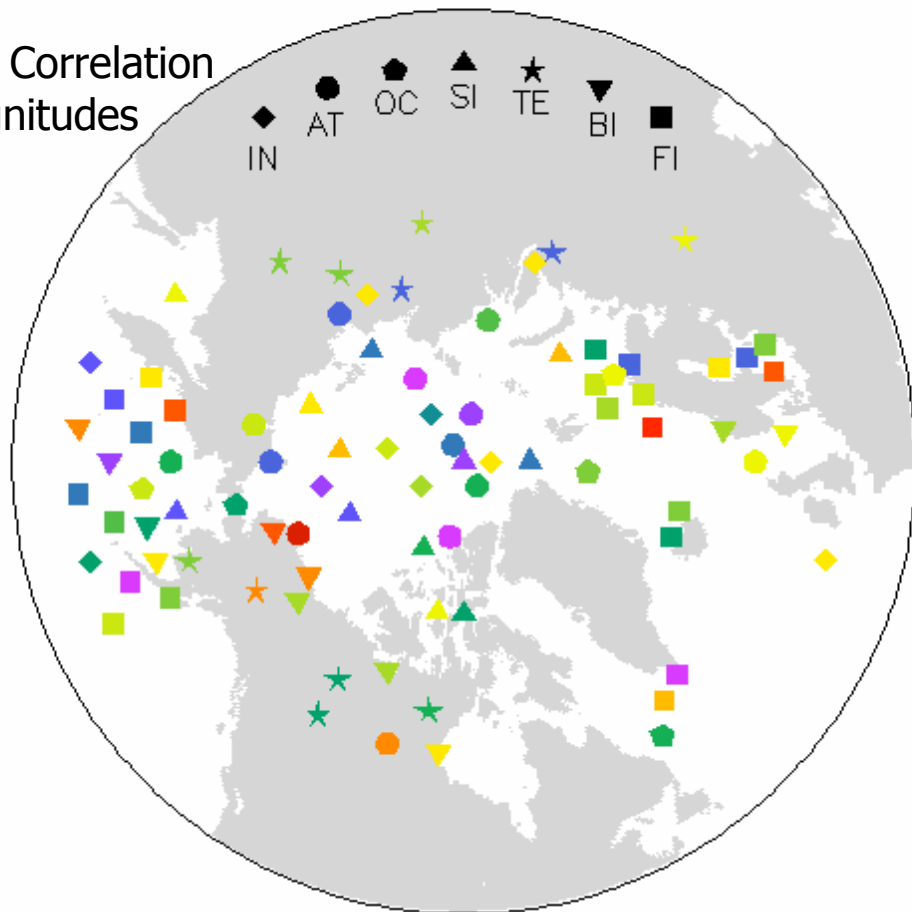


All Variables, 1965-95  
 Mode 1, Variance Explained 23.3%



Principal Component/EOF Analysis  
 Mode 1

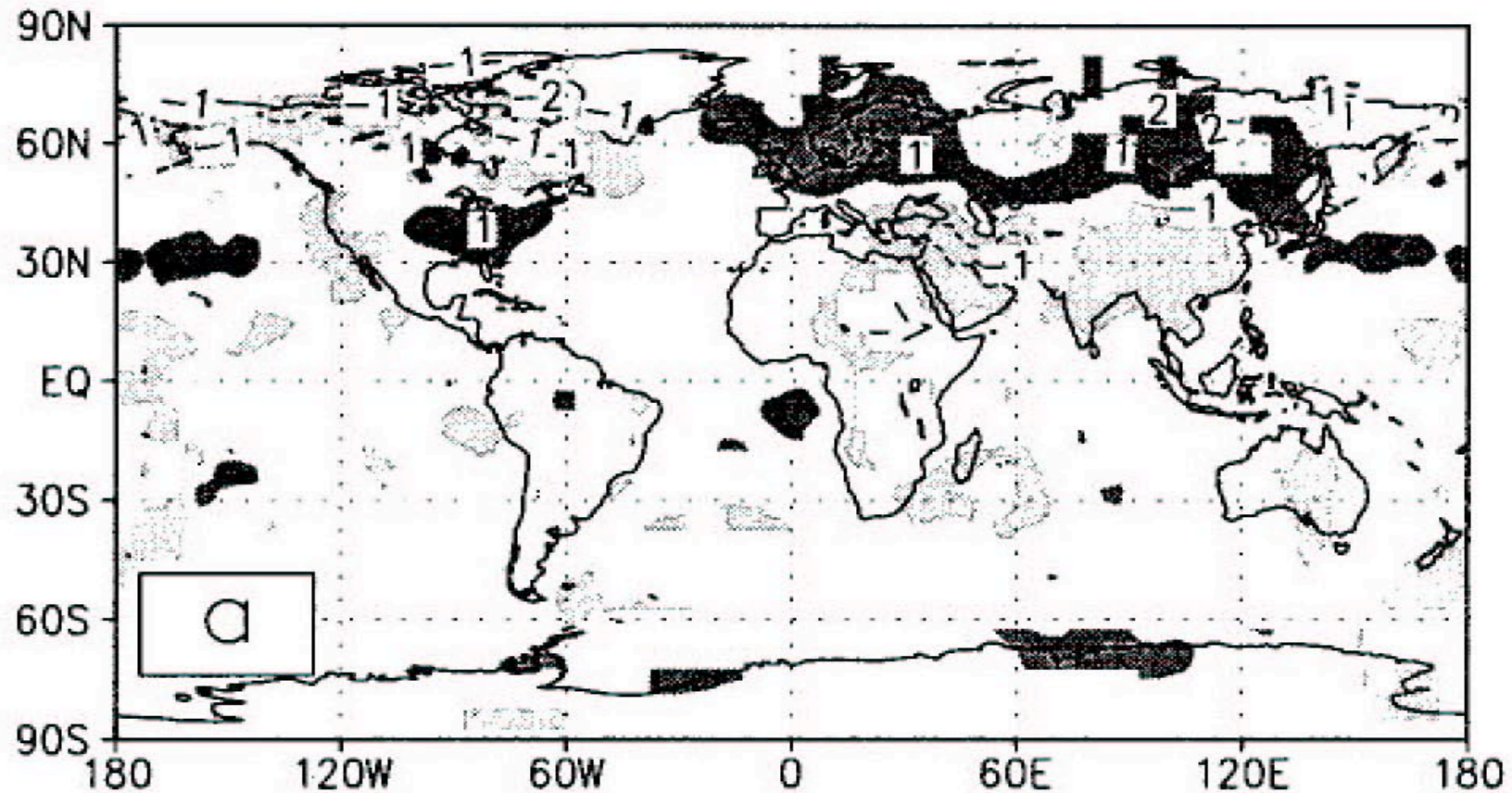
PC1 Correlation Magnitudes



86 time series

- Climate Indices
- Atmosphere
- Ocean
- Sea Ice
- Terrestrial
- Biology
- Fisheries

*High latitudes are sensitive to changes in atmospheric and oceanic circulation*



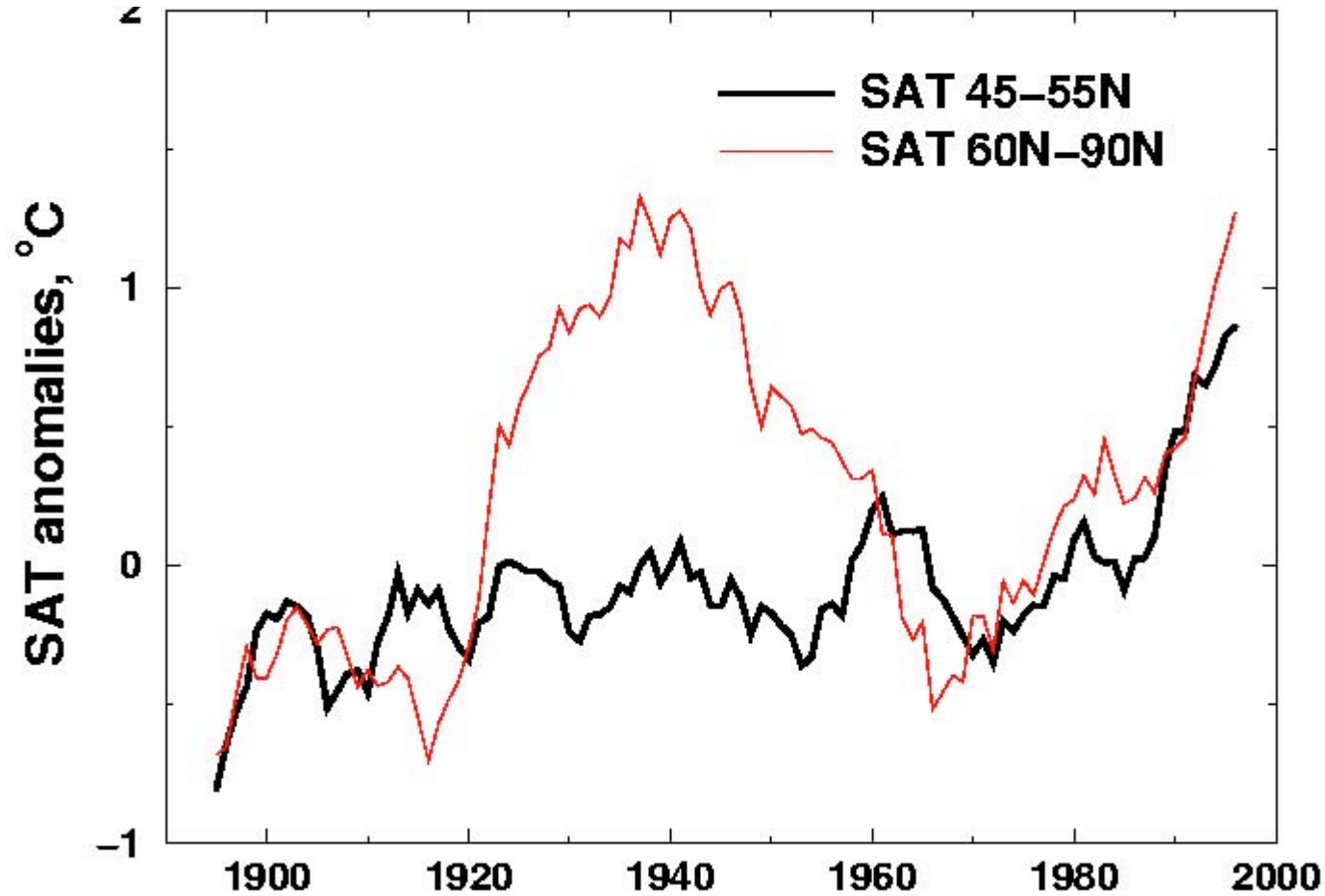
Temperature anomalies for NH winter following the eruption averaged for all six volcanoes with ENSO signal removed.

Light shaded areas with anomalies  $<-0.25^{\circ}\text{C}$ ,

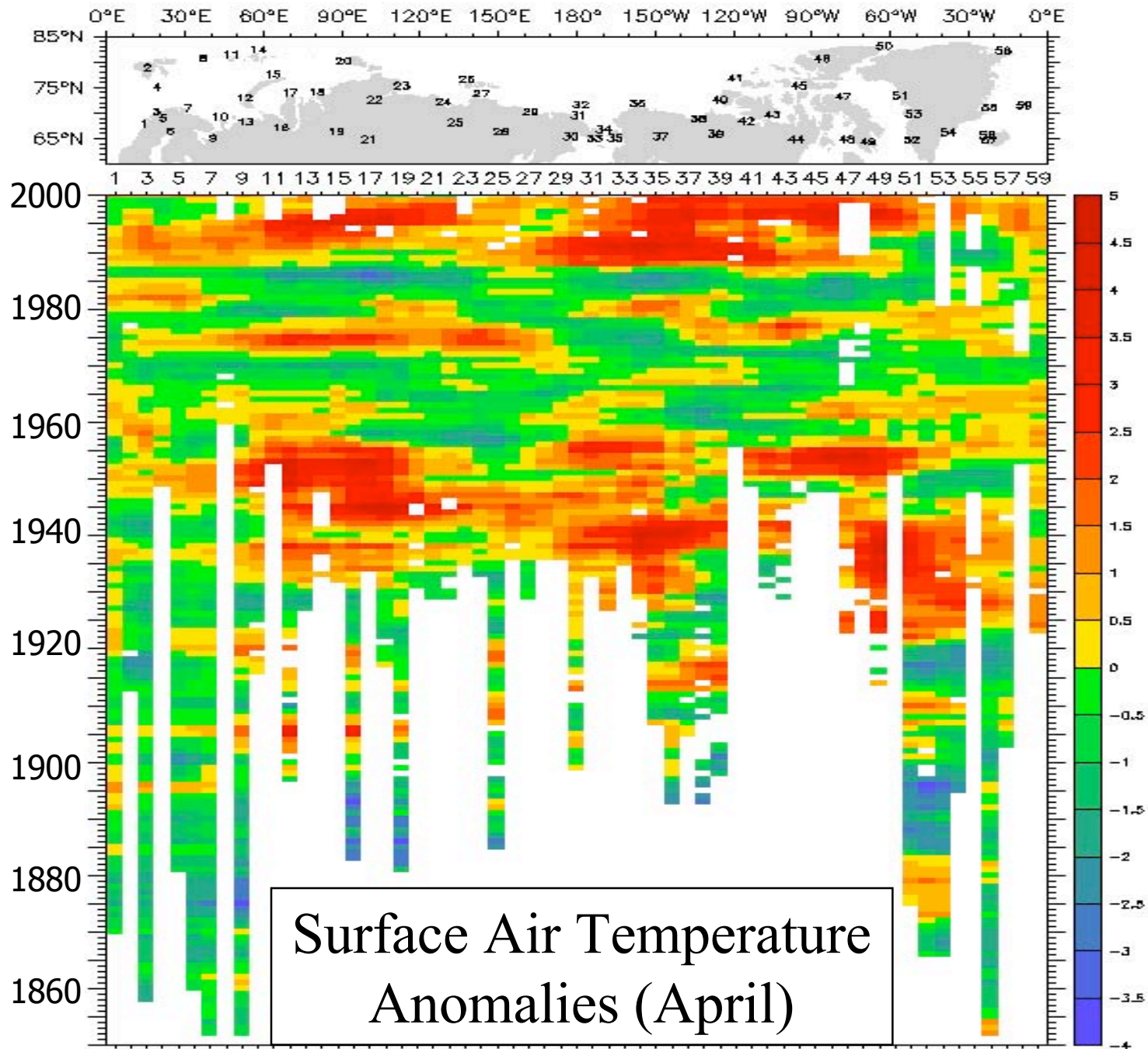
Dark shaded areas with anomalies  $>+0.25^{\circ}\text{C}$ .

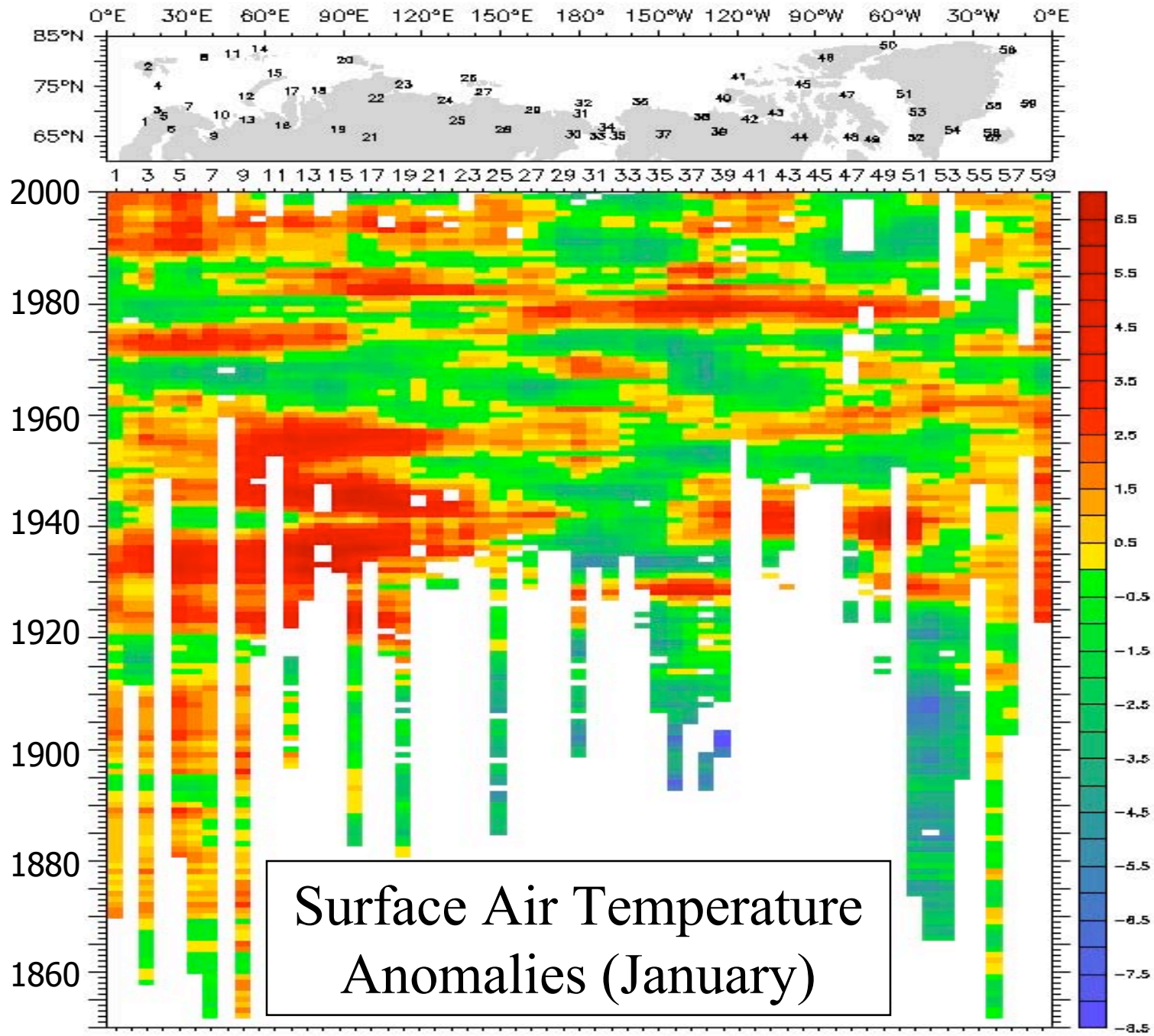
*Robock & Mao, 1995, J Climate*

# Zonal mean Surface Air Temperature anomalies Wintertime (Nov – Apr)



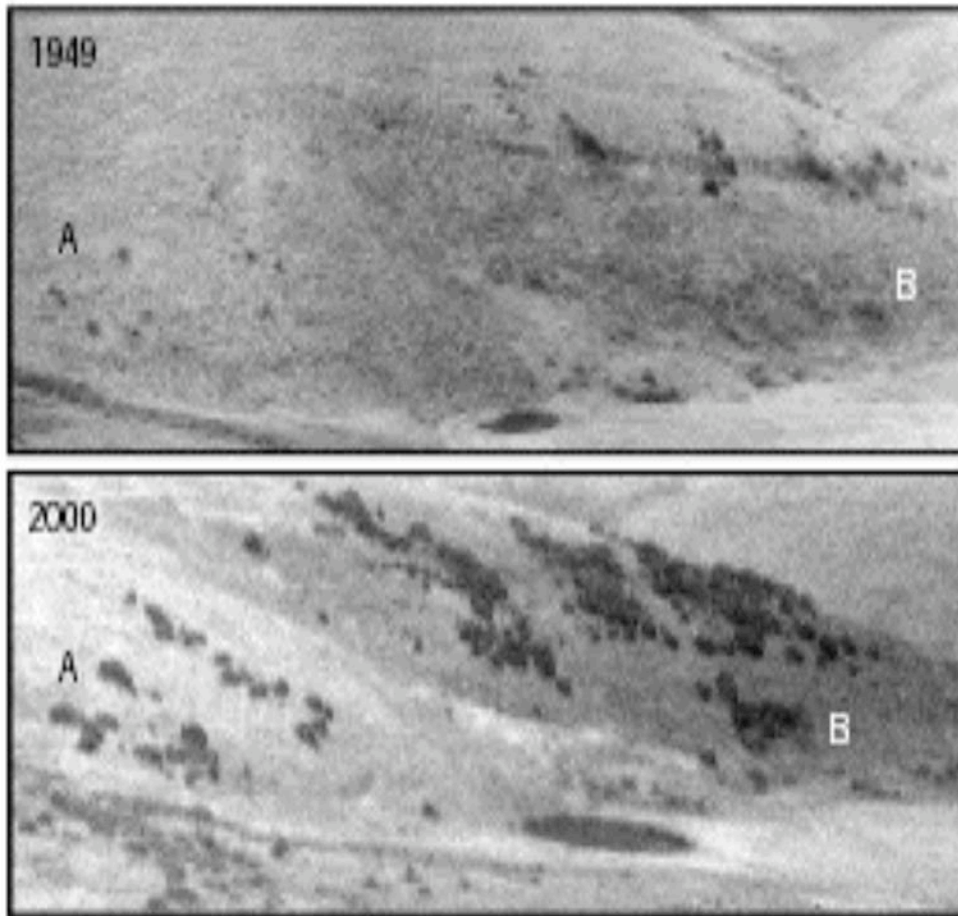
*Semenov et al, 2003*







## Feedbacks are important

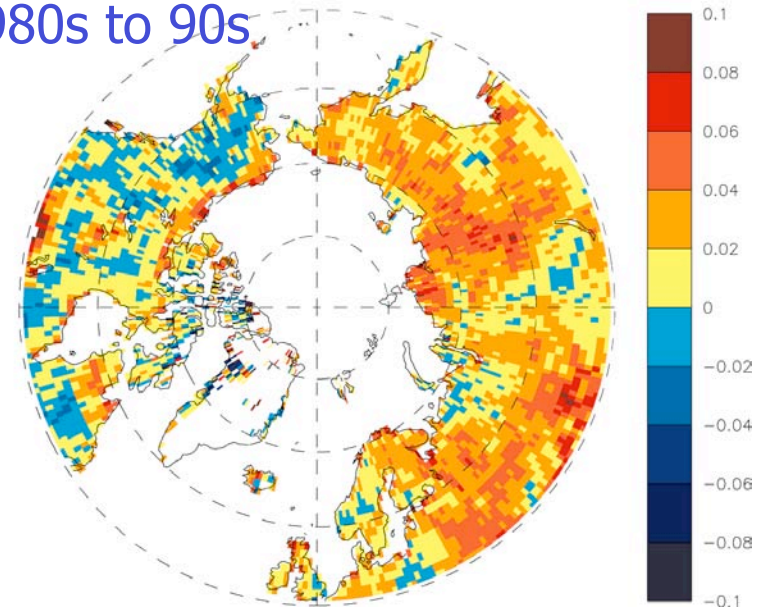


Photos from the Aiyak River (Alaska) show an increase in shrubs. Sturm et al., 2001, **Nature**

## The lost tundra areas between 1978 and 1998



## The change in NDVI from 1980s to 90s



# THEMES



This is an  
Open Science Meeting

- Change and Impacts Monday
- Feedbacks Tuesday
- Connection with Global Climate Wednesday

# Winter/Spring Arctic Oscillation (AO) Dynamics

