Inter- and intra-annual variability of NDVI and correlations to large-scale circulation patterns, sea ice, snow and cloud cover

Warming has flattened out and NDVI is declining in spring and fall.
Mean MaxNDVI (82-10) linked to Mean Sea Ice

Main PanArctic hypothesis:
Periods of reduced sea ice should correspond to warmer land temperatures and more rapid greening.

[Bhatt et al. 2010]
Remote sensing data & methods

- Data: 1982-2013 (32 yrs, weekly)
- Passive Microwave Sea Ice Concentration (25km)
- AVHRR Land Surface Temp. (25-km) SWI, [Comiso 2003]
- Gimms NDVI 3g+ (Max and Integrated) (14-km) Version that is corrected for Arctic, TI-NDVI [Pinzon et al. 2014]

- Divided Arctic Ocean (Treshnikov, 1985) to examine trends and variability in full tundra land domains
- Reanalysis Sea Level Pressure
- Globsnow
More Open Water & Nearby Land Warms
Trends 1982-2013

Open Water (May-Aug) magnitude change (%)  Summer Warmth Index percent change (%)
More warmth ==> Greener Arctic Tundra
Trends 1982-2013

MaxNDVI percent change (%)  TI-NDVI percent change (%)
Summer Warmth increases have slowed!
TI-NDVI increases have slowed!
MaxNDVI increases continue!
SWI declining over recent period!

SWI 82-98

SWI 99-13
Summer Sea Level Pressure (SLP)

Long term average
1982-2011

SLP change

Climatology

[Bhatt et al. 2013]
MaxNDVI trends stronger over recent period!

MaxNDVI 82-98

MaxNDVI 99-13
TI-NDVI declining over recent period!

TI-NDVI 82-98

TI-NDVI 99-13
Ts Spring/Fall warming & Mid-summer cooling
1982-2013

1982-98

1999-13
MaxNDVI Spring/Fall decline & Peak increase
1982-2013

1982-98

1999-13
SWI changing trends within season

- Alaska
- Taymyr
- Canadian Arch.
- July-August consistent with SLP trends
TI-NDVI changing trends within season

- June declines throughout domain
- July increases stronger & declines stronger
What could be affecting the trends?

• Cooling in summer?
  • Clouds
  • More clouds due to more moisture

• Declines of Biweekly MaxNDVI in spring & fall
  • Delayed growing season start
  • Snow!
SWI-SLP correlations Jun-Aug: Large-scale

Arctic SWI 1982-13

N.Hemisphere

Eurasia
Summary

- Moisture is likely important in this changing NDVI story.
- Need good snow data
- Large-scale climate

NH JJA SLP trends 82-13