



ALASKA ECOLOGICAL CONSERVATION

Using NASA Earth Observations to Identify
Recent Changes in River Ice Phenology and Its
Impacts on Caribou Migration

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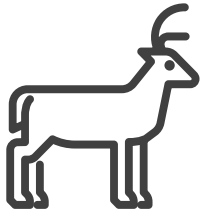


Christian Sarro

Presentation Outline

Study area,
partner,
& background
information

Introduction



Objectives

Converting community
concerns to project
objectives

Methodology

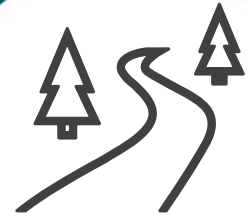


Results

End products, errors
& uncertainties

Using Earth
observations and
other data to
explore analysis

Conclusion



Future work,
conclusions &
acknowledgments

Caribou & Ice Relationship



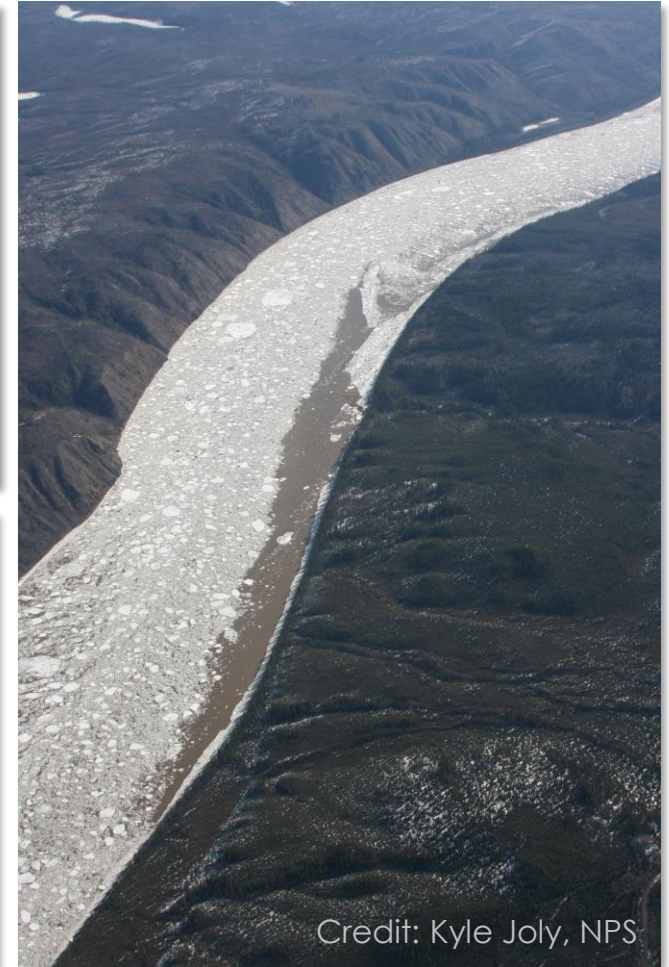
Changes in River Ice Phenology



Longer and Altered Migration



Less Reproductive Success
Less Predictable Migrations



Study Area & Period

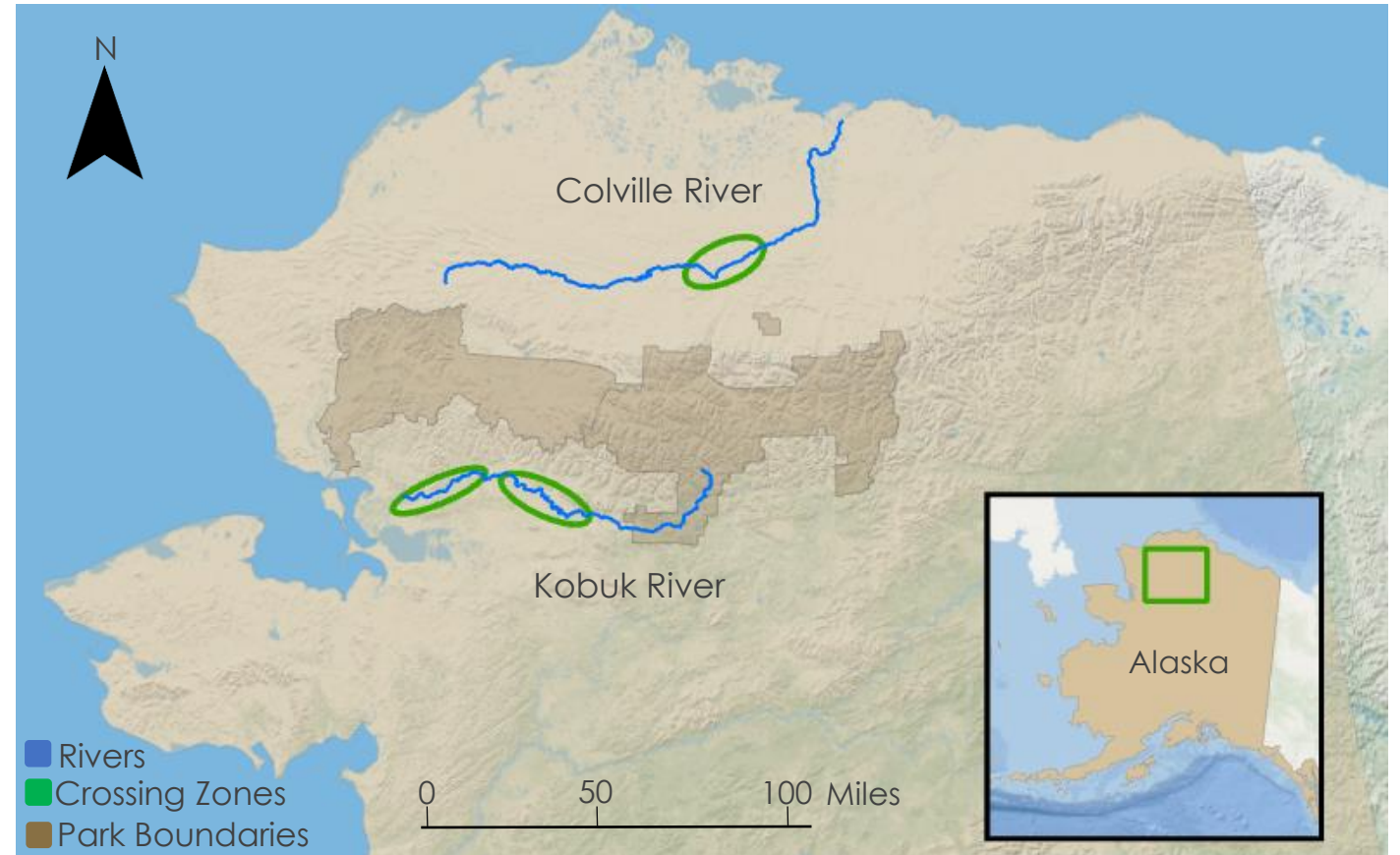


Study Area: Northwestern Alaska

- Colville River
- Kobuk River



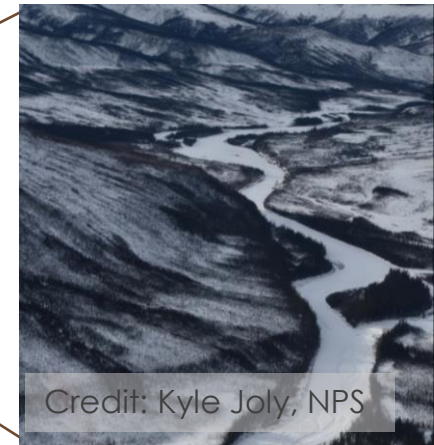
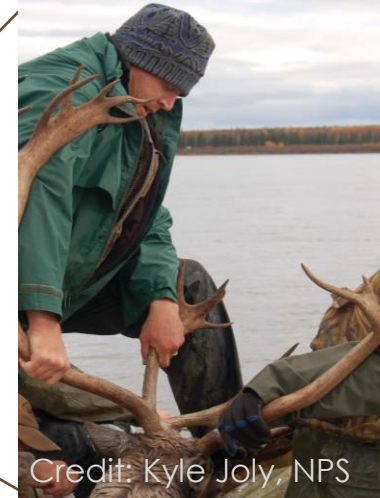
Study Period: 2017–2023,
September to November



Basemap: ESRI, GEBCO, Garmin, NaturalVue

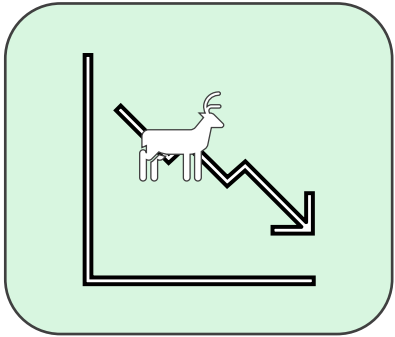
Partners

Dr. Kyle Joly, Wildlife Biologist
National Parks Service – Region 11: Alaska

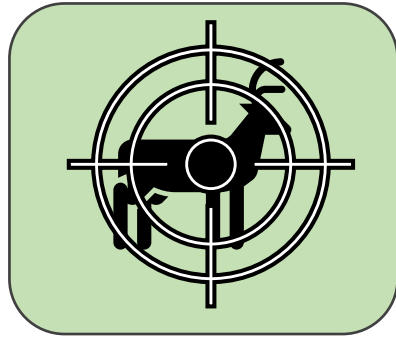


Community Concerns

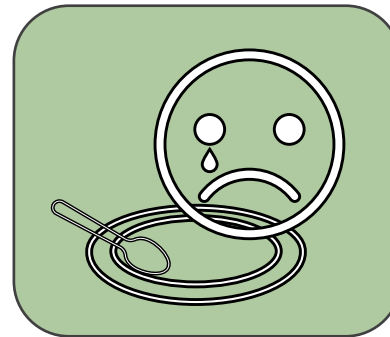
Changes in the timing of fall river freeze up causes...



Rapid caribou
population
decline of 338,000
in the last
decade



A threat
to traditional
hunting
practices



Intensified
food
insecurity

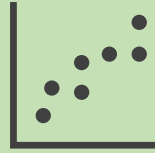


Economic
decline in
the region

Objectives

Time Series

- Plot optical and radar time series
- Analyze annual changes



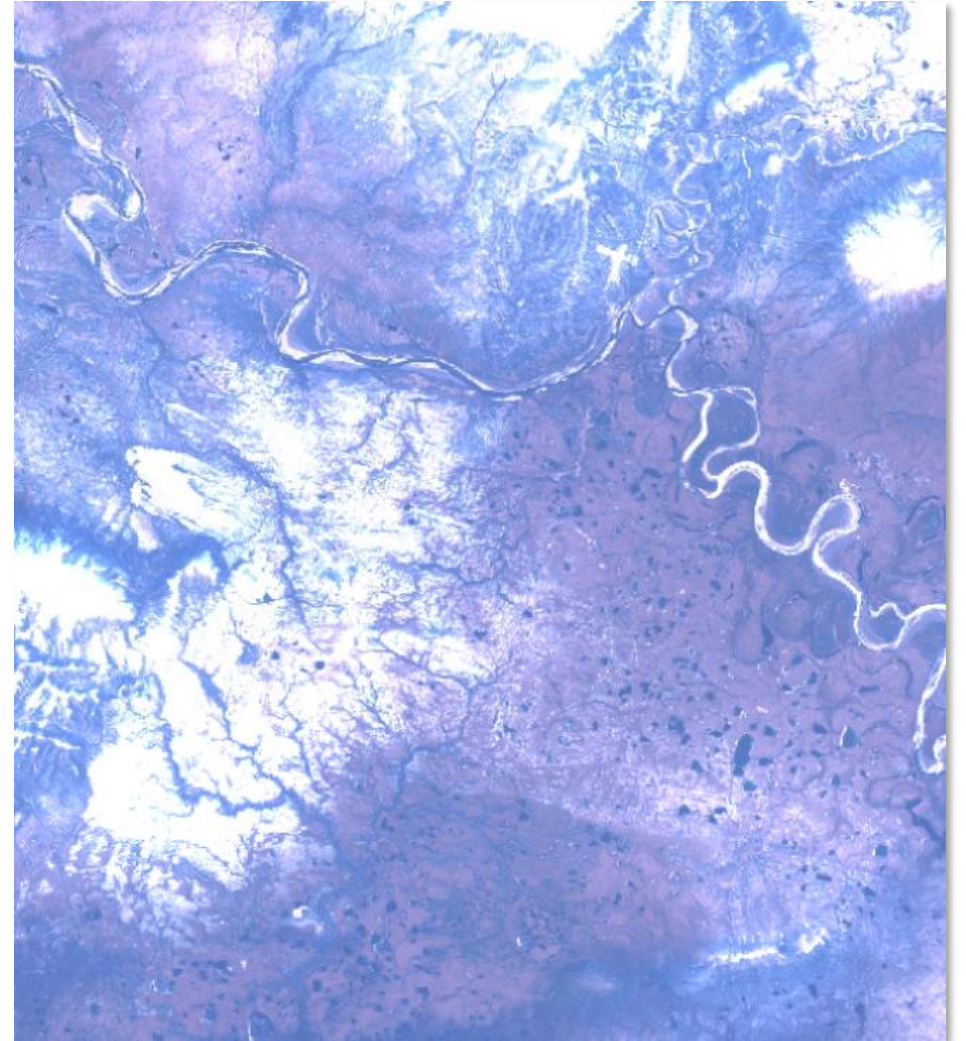
River Phases

- Detect liquid to solid changes
- Isolate uncrossable periods for caribou

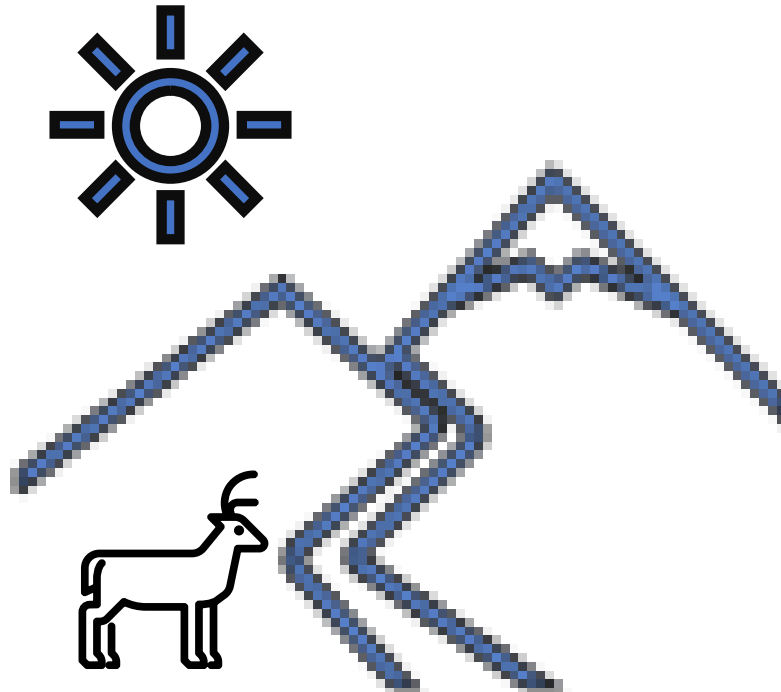


Feasibility

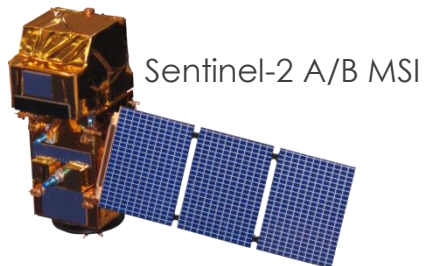
- Detect ice types
- Identify ice formation dates



Earth Observations



Methodology – Optical Imagery



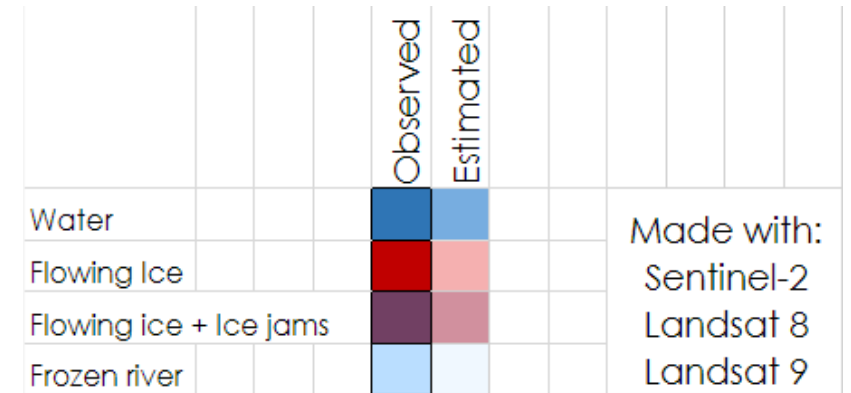
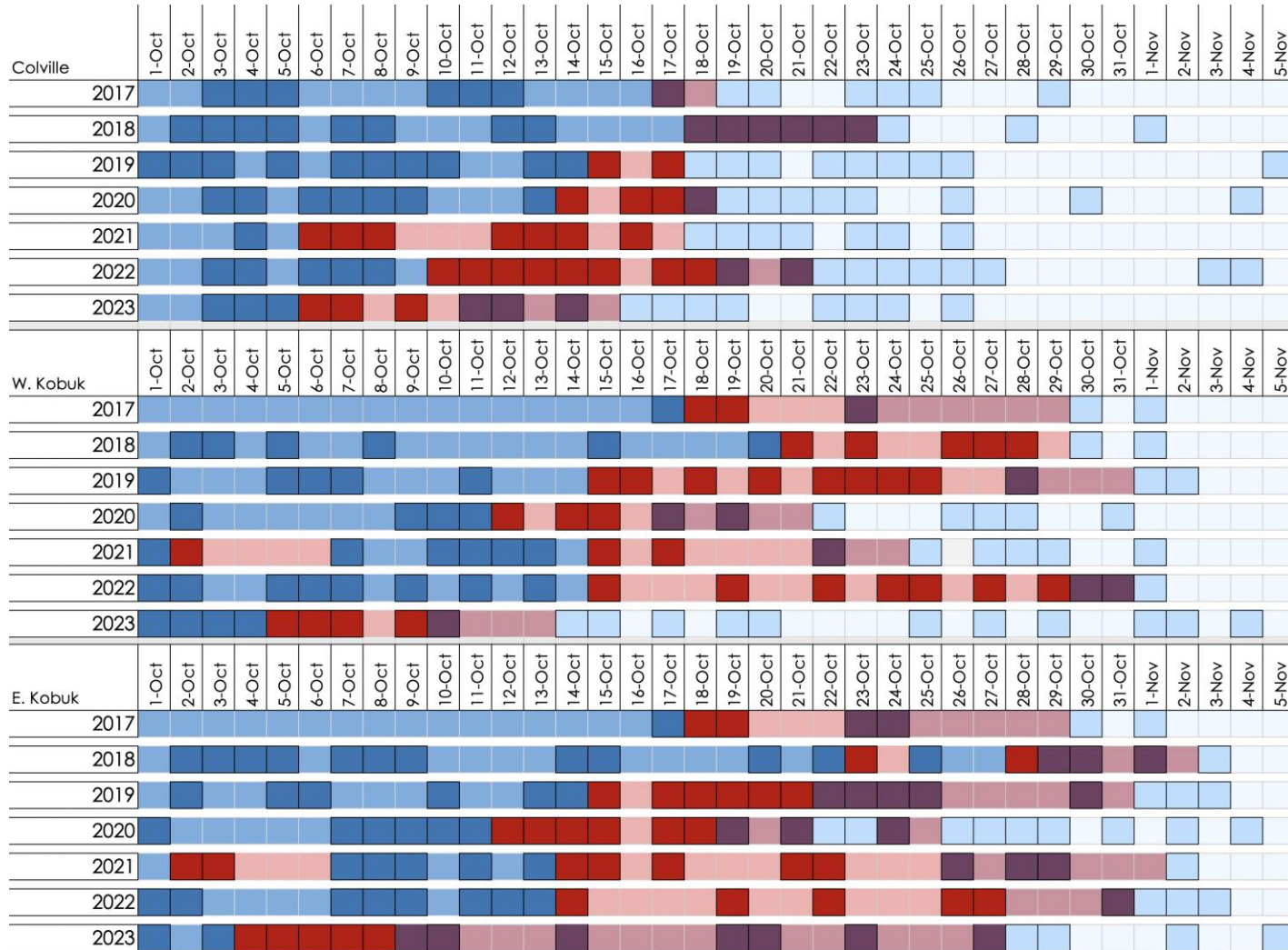
Time Series Plots

Time Series Maps

River phase changes

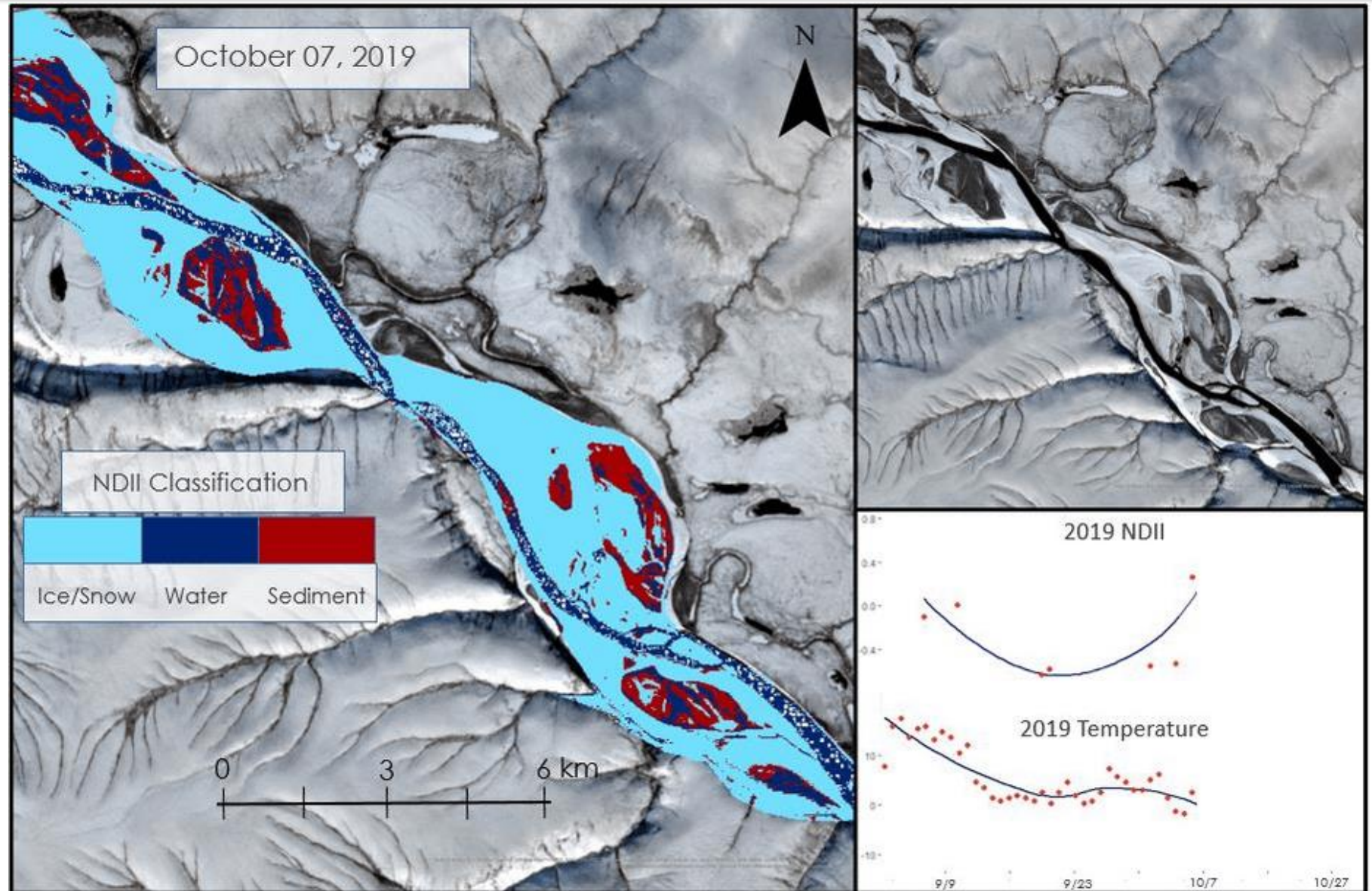
Yearly Fall Freezing Timeline

Results – Yearly Fall Freezing Timeline



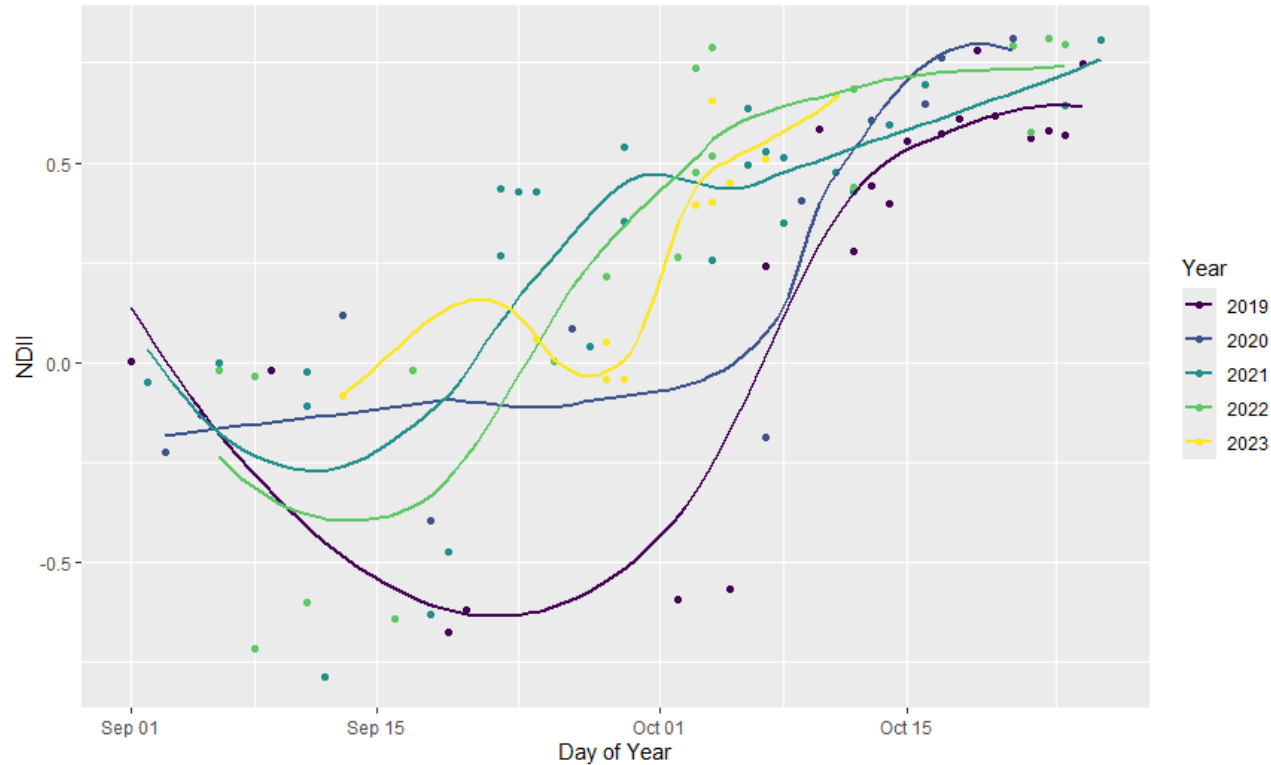
Results – Fall 2019 Freezing Timeline

Colville River

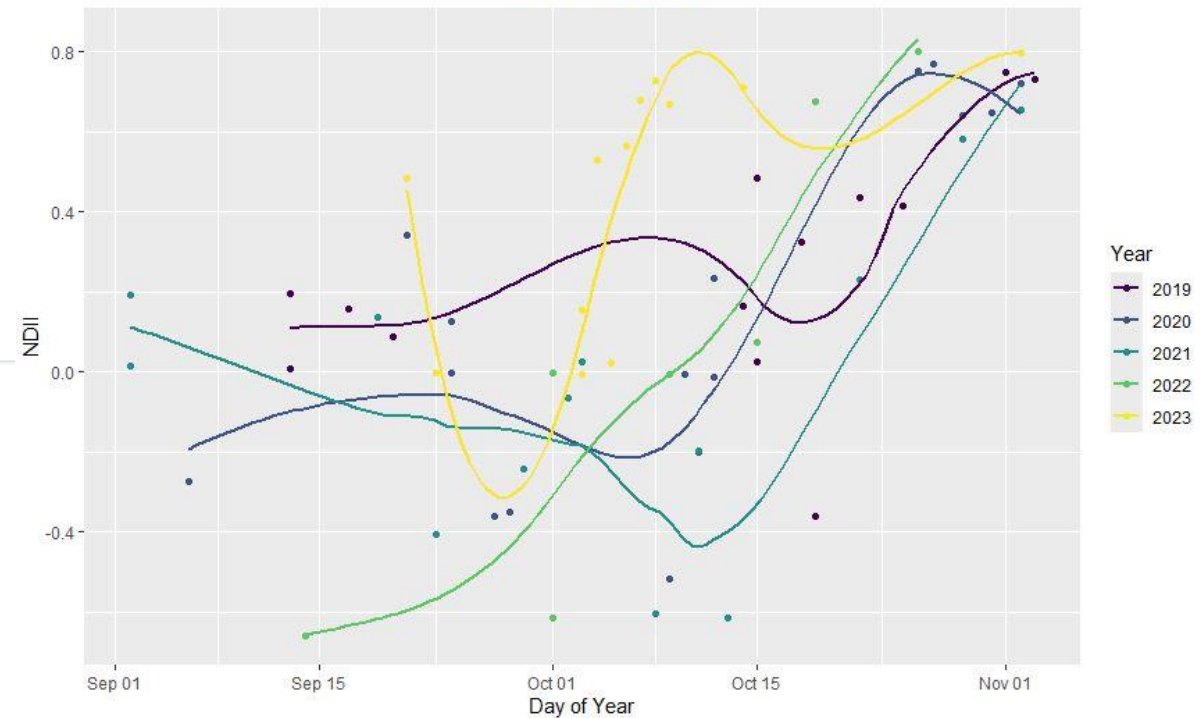


Results – Spectral Reflectance Time Series (NDII)

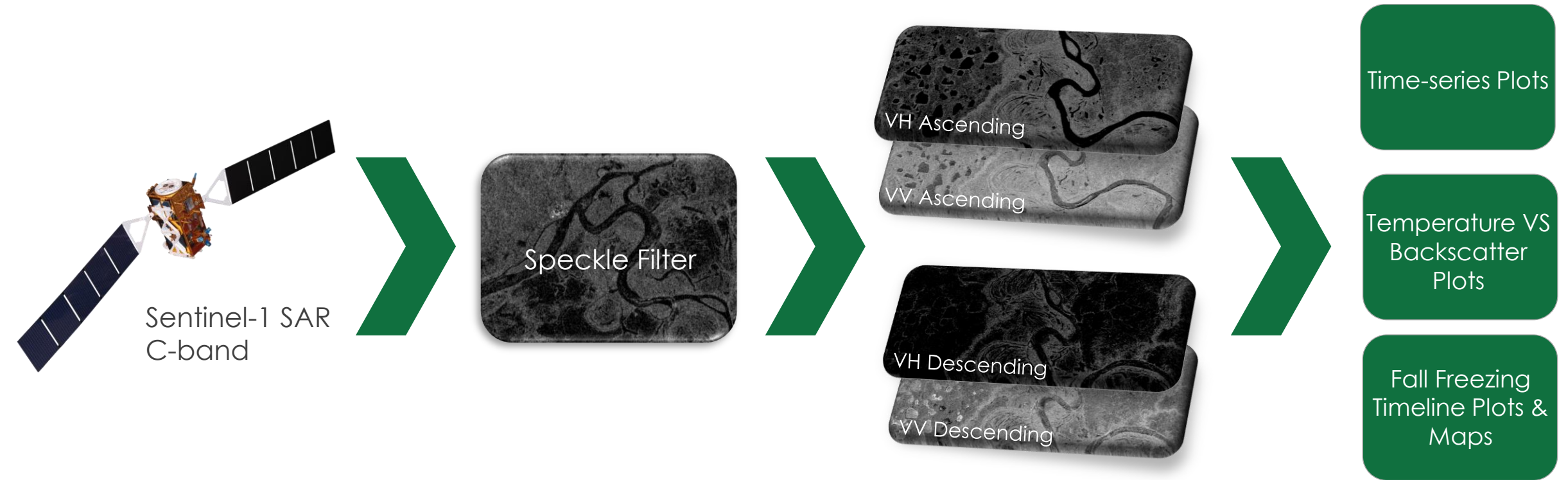
Colville 5 Year NDII



East Kobuk 5 Year NDII

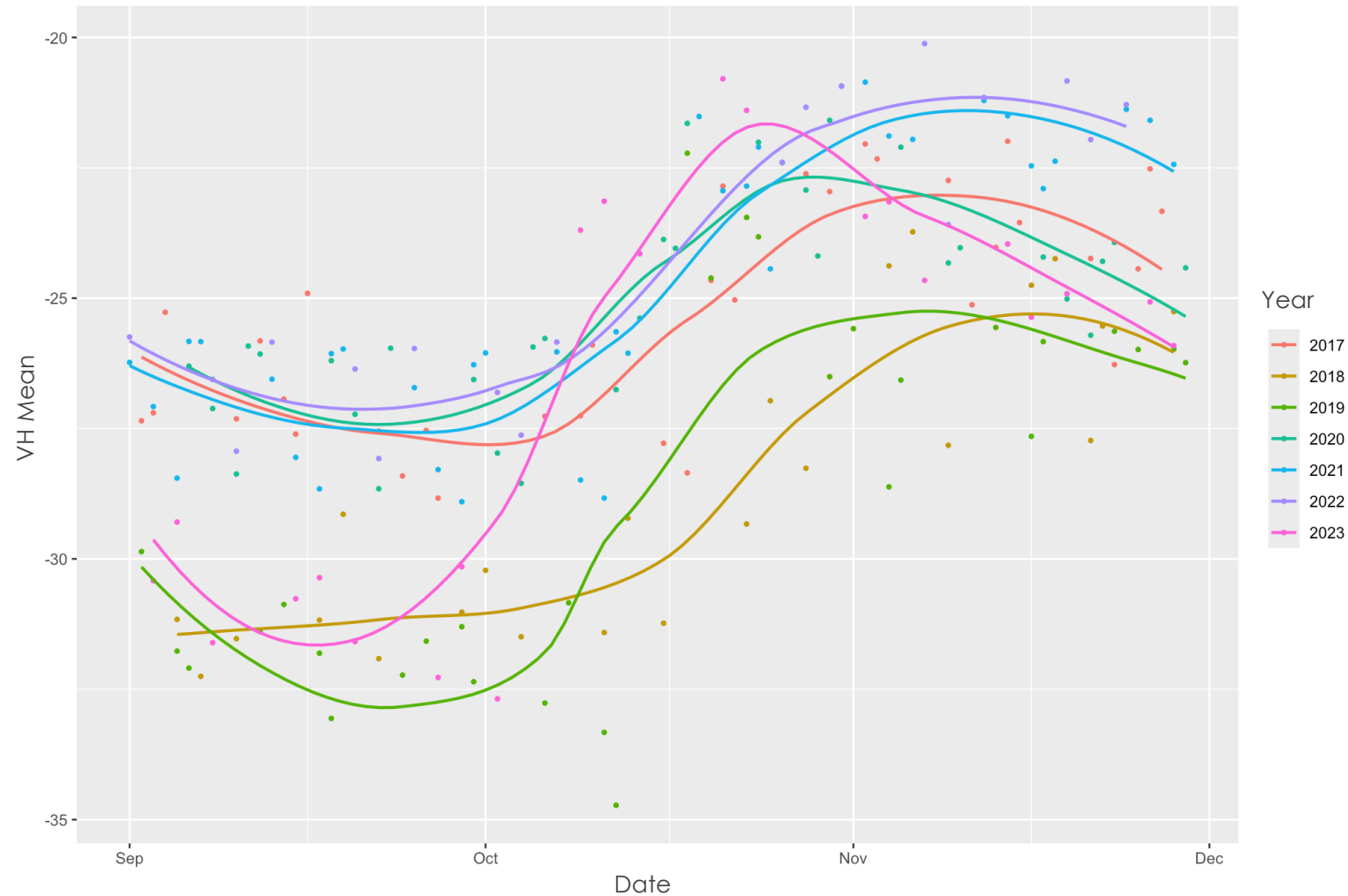


Methodology – SAR Imagery



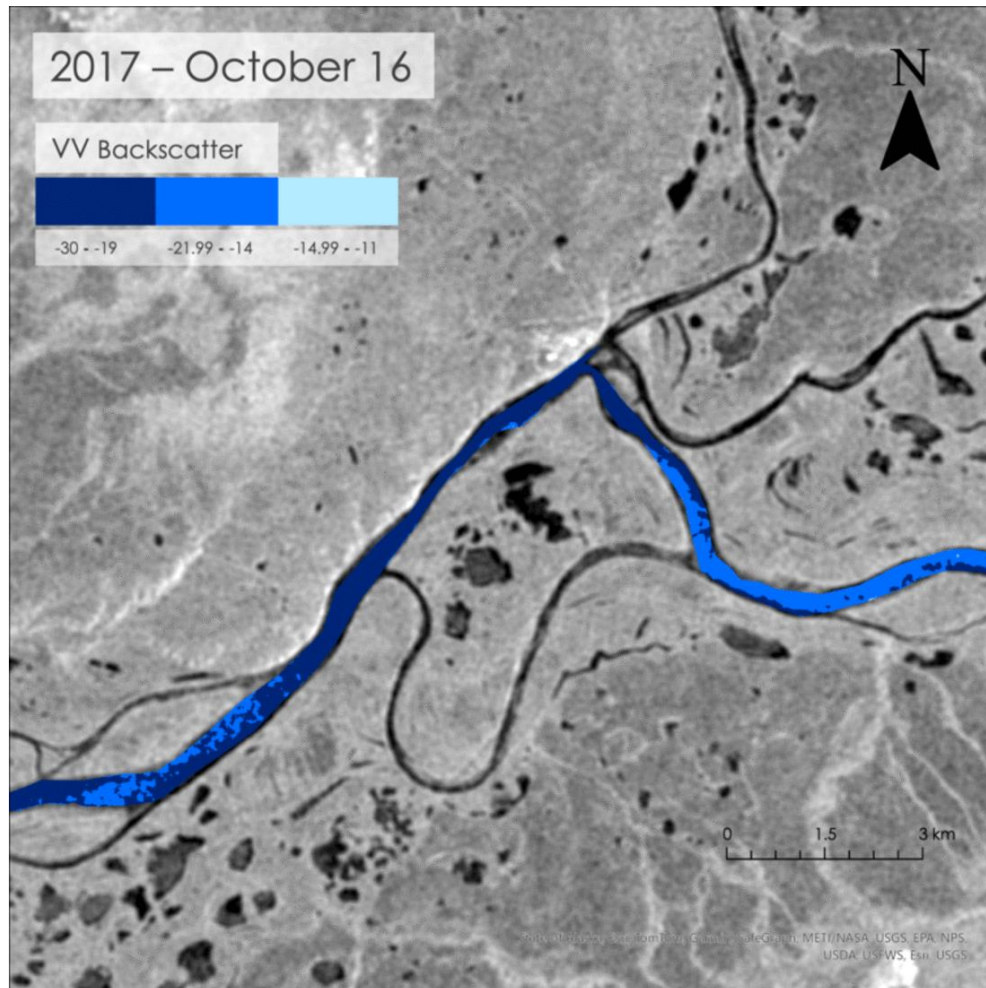
Results – Backscatter Time Series

West Kobuk VH Backscatter Mean – 2017 to 2023



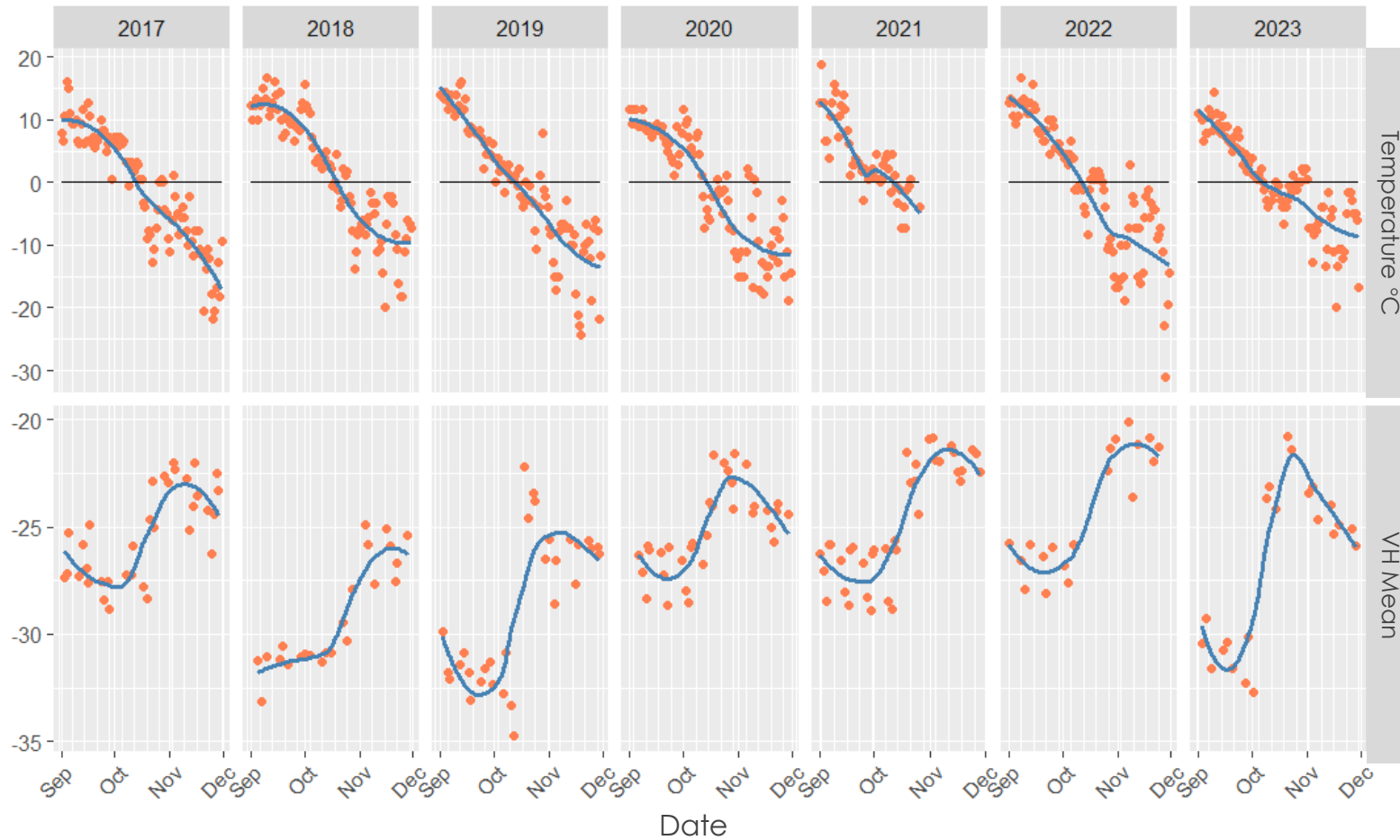
Results – Mid October Over the Years (2017–2023)

West Kobuk River



Results – Temperature VS Backscatter

West Kobuk River

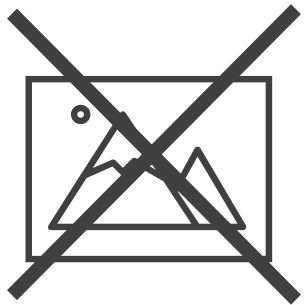


Results – Fall 2020 Freezing Timeline

West Kobuk River

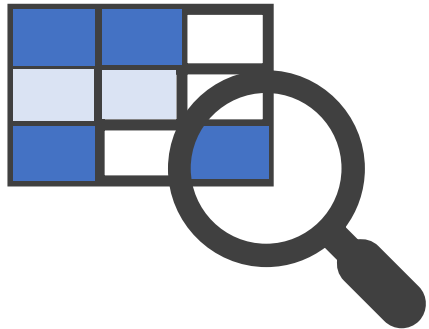
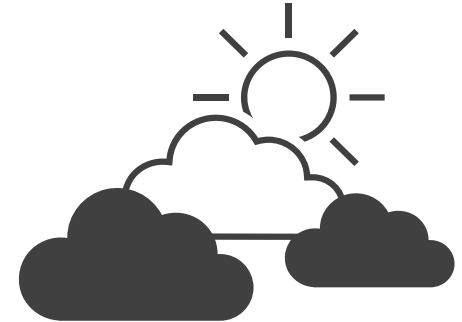


Results - Errors & Uncertainties



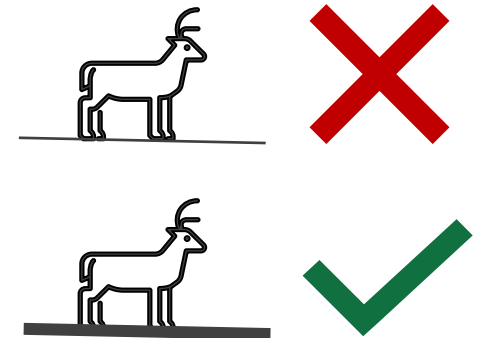
**Image
Availability**

**Cloud
Coverage**



**River Pixel
Identification**

**Caribou
Crossability**



Conclusion



SAR data appeared to be more successful than spectral reflectance in analyzing river ice presence



Optical imagery can better identify the ice onset date than SAR



Indices could not robustly distinguish between spectral similarities of snow, ice, and cloud

Effectiveness

Radar



Optical



Indices



Conclusion – Future Work

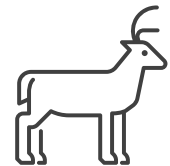
Missing Optical Imagery



Temperature Data Validation



Crossable Ice Thresholds



Ice Classification Model



Acknowledgments

- **Project Partner**
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- **Science Advisors**
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 - Seamore Zhu, Boston University PhD Student

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