

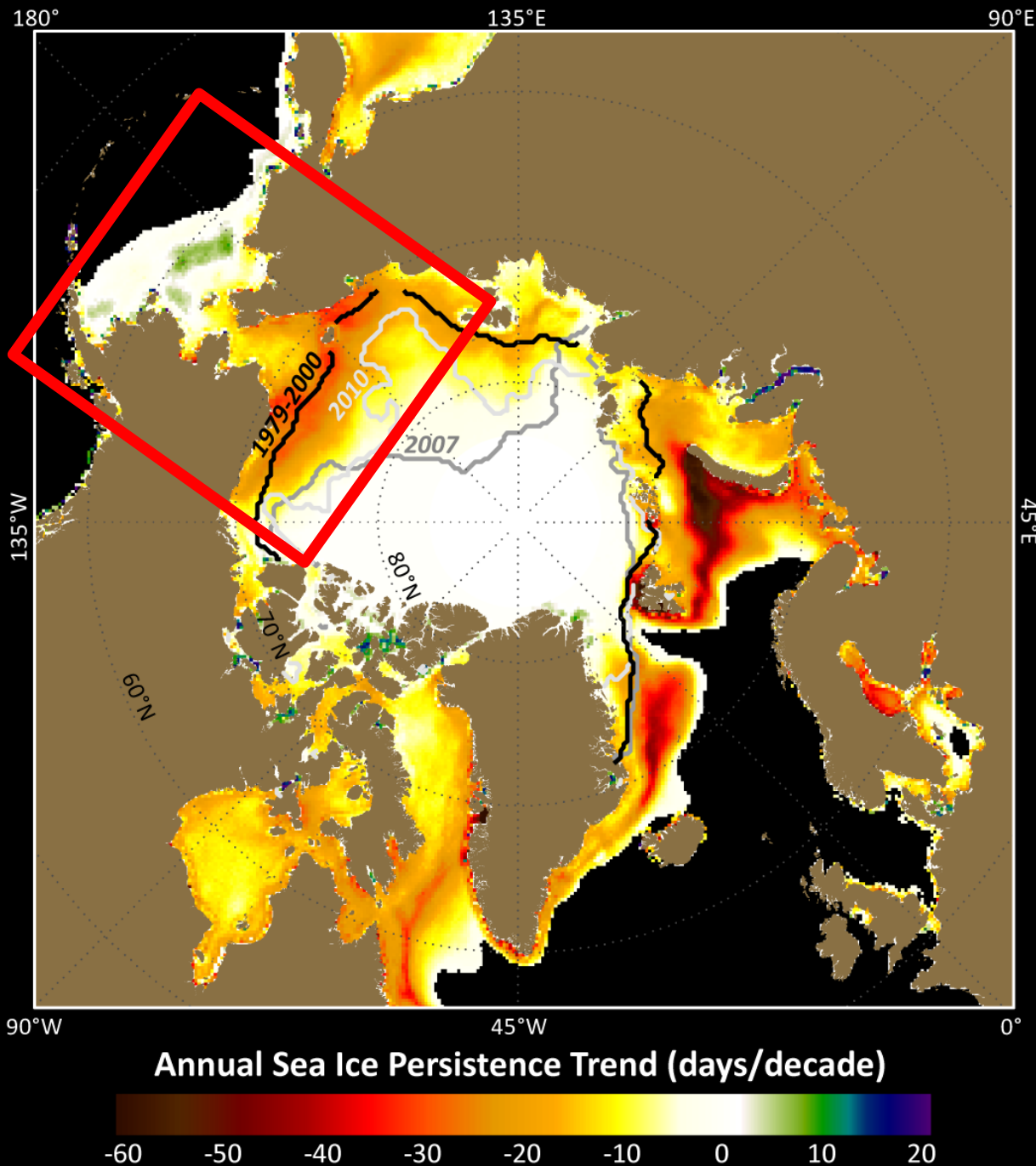


Satellite-Derived Trends across a Marine Distributed Biological Observatory in the Pacific Arctic Region

Karen E. Frey

Graduate School of Geography, Clark University, Massachusetts USA

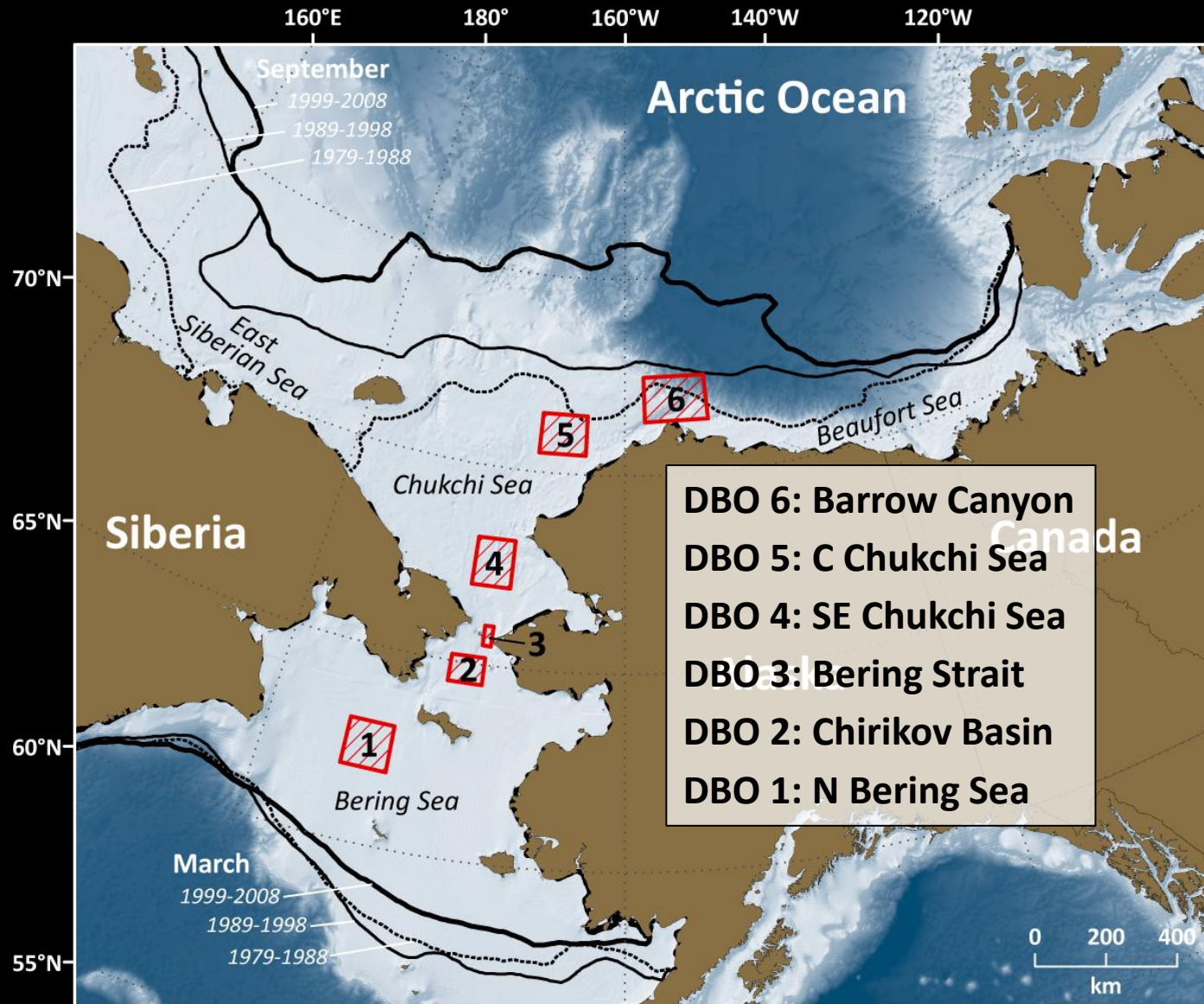
**Distributed Biological Observatory Workshop
Sidney, British Columbia, 15 November 2011**



Trends in Annual Sea Ice Persistence

Based on SMMR/SSM/I Sea Ice Concentrations (1979-2008)

Distributed Biological Observatory (DBO) Sites



- Regional “hotspot” locations along a latitudinal gradient will comprise the DBO sites
- DBO sites are considered to exhibit high productivity, biodiversity, and overall rates of change
- DBO sites will serve as a change detection array for the identification and consistent monitoring of biophysical responses

A Climatology of the DBO Sites

Sea Surface Temperature (AVHRR)

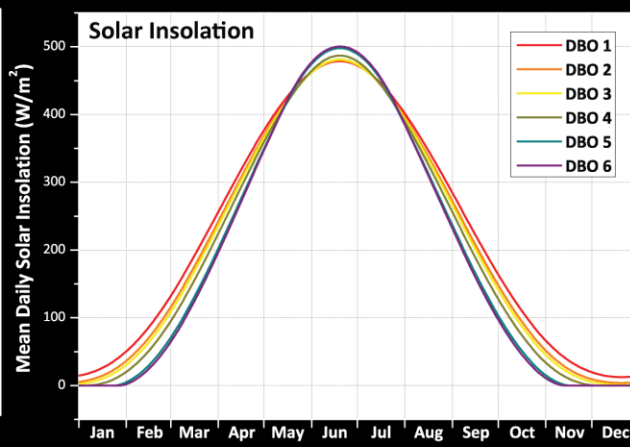
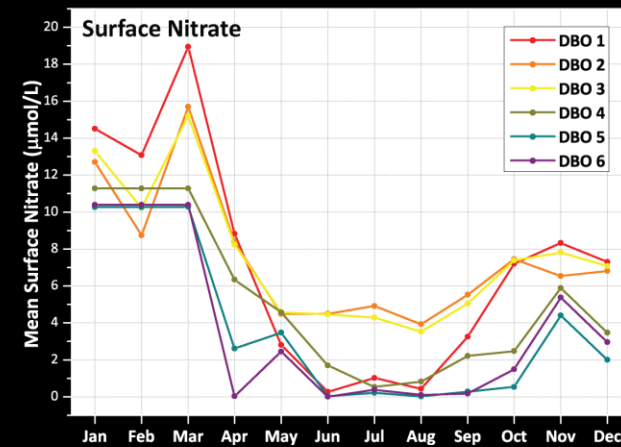
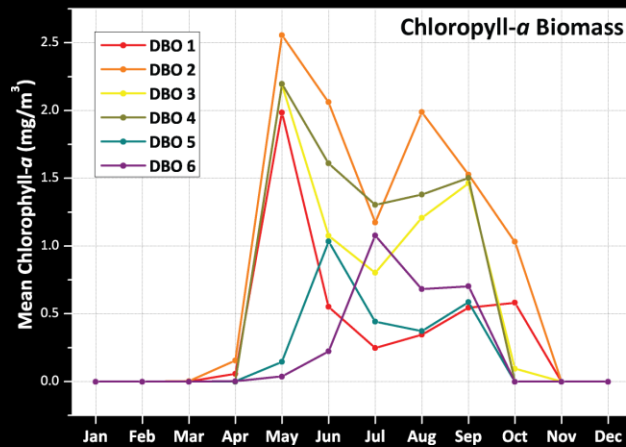
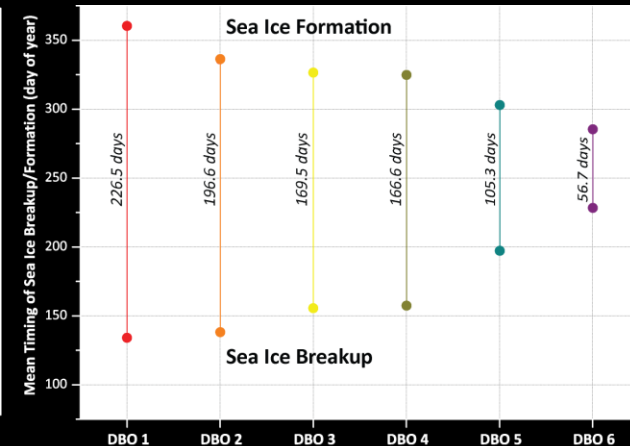
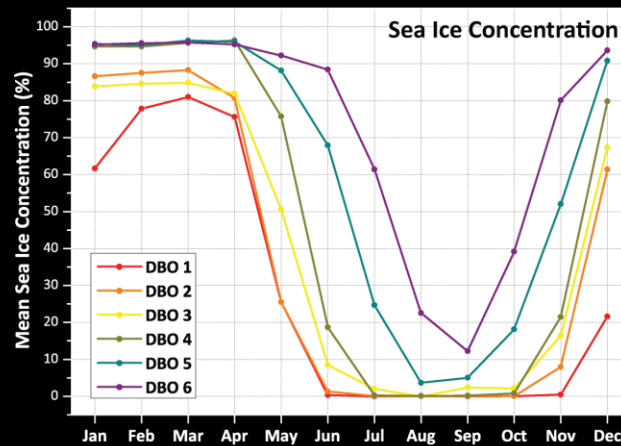
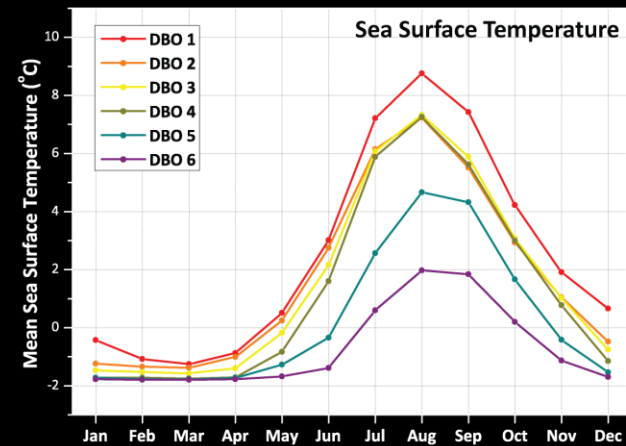
Sea Ice Concentration (SMMR/SSM/I)

Sea Ice Breakup/Formation Timing (SMMR/SSM/I)

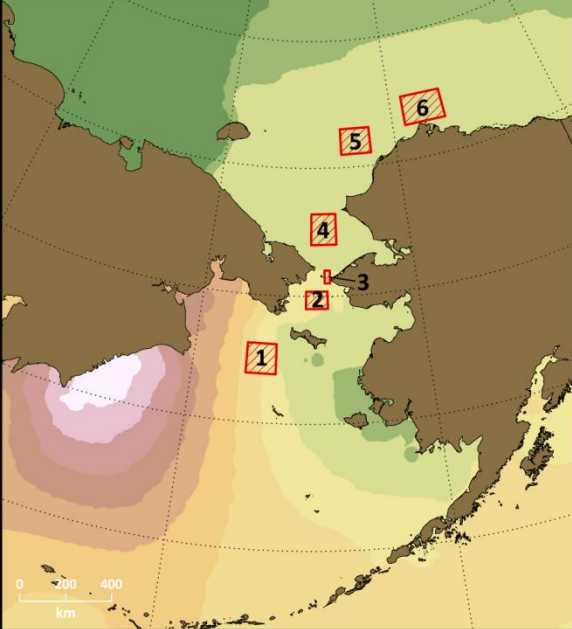
Chlorophyll-*a* Biomass (Globcolour)

Surface Nitrate (World Ocean Atlas)

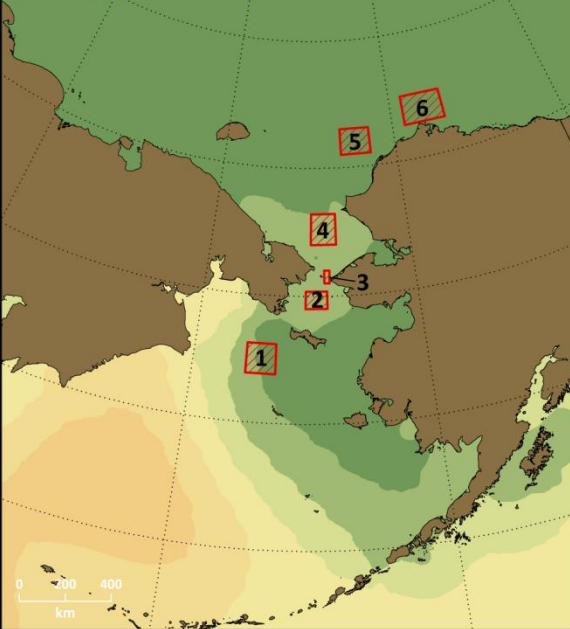
Solar Insolation (NASA)



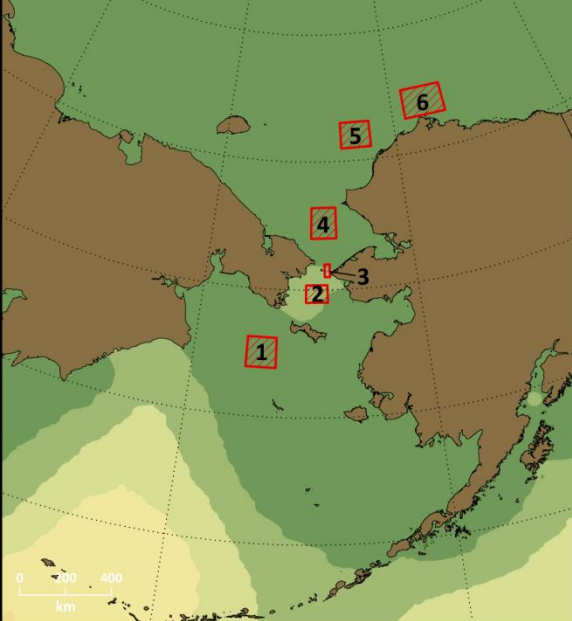
Winter (Jan-Mar)



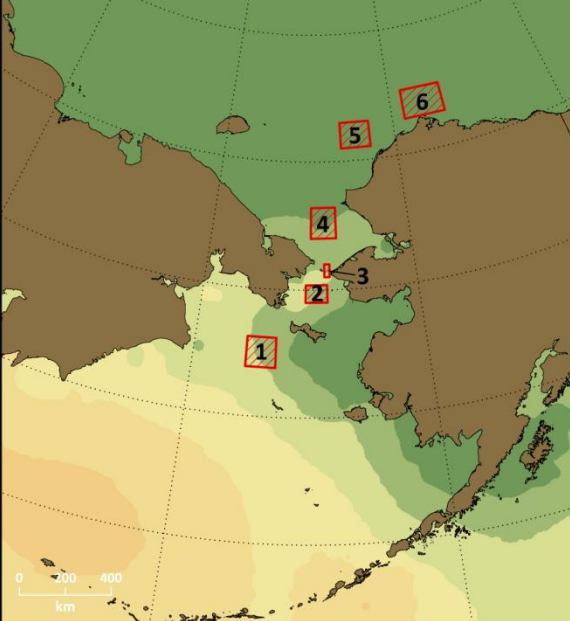
Spring (Apr-Jun)



Summer (Jul-Sep)

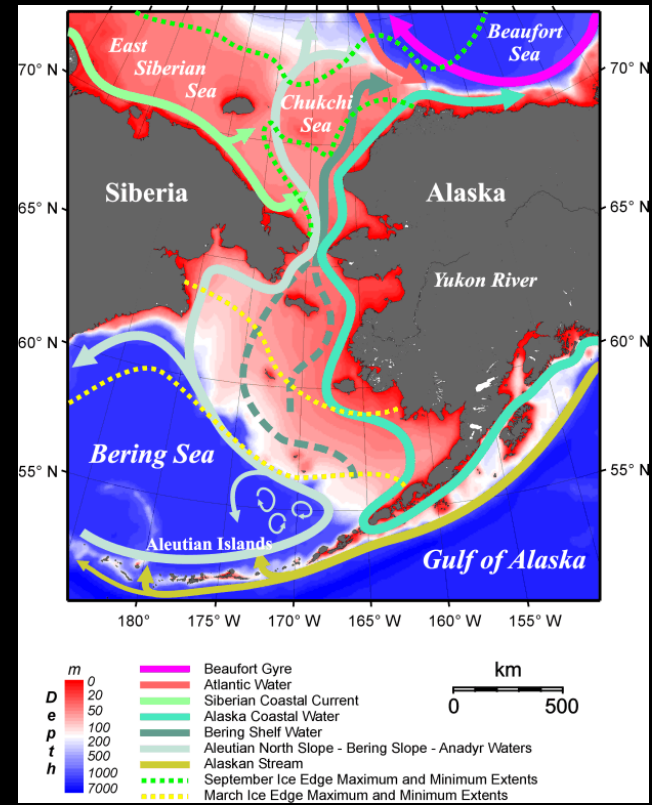
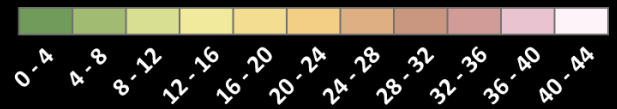


Fall (Oct-Dec)

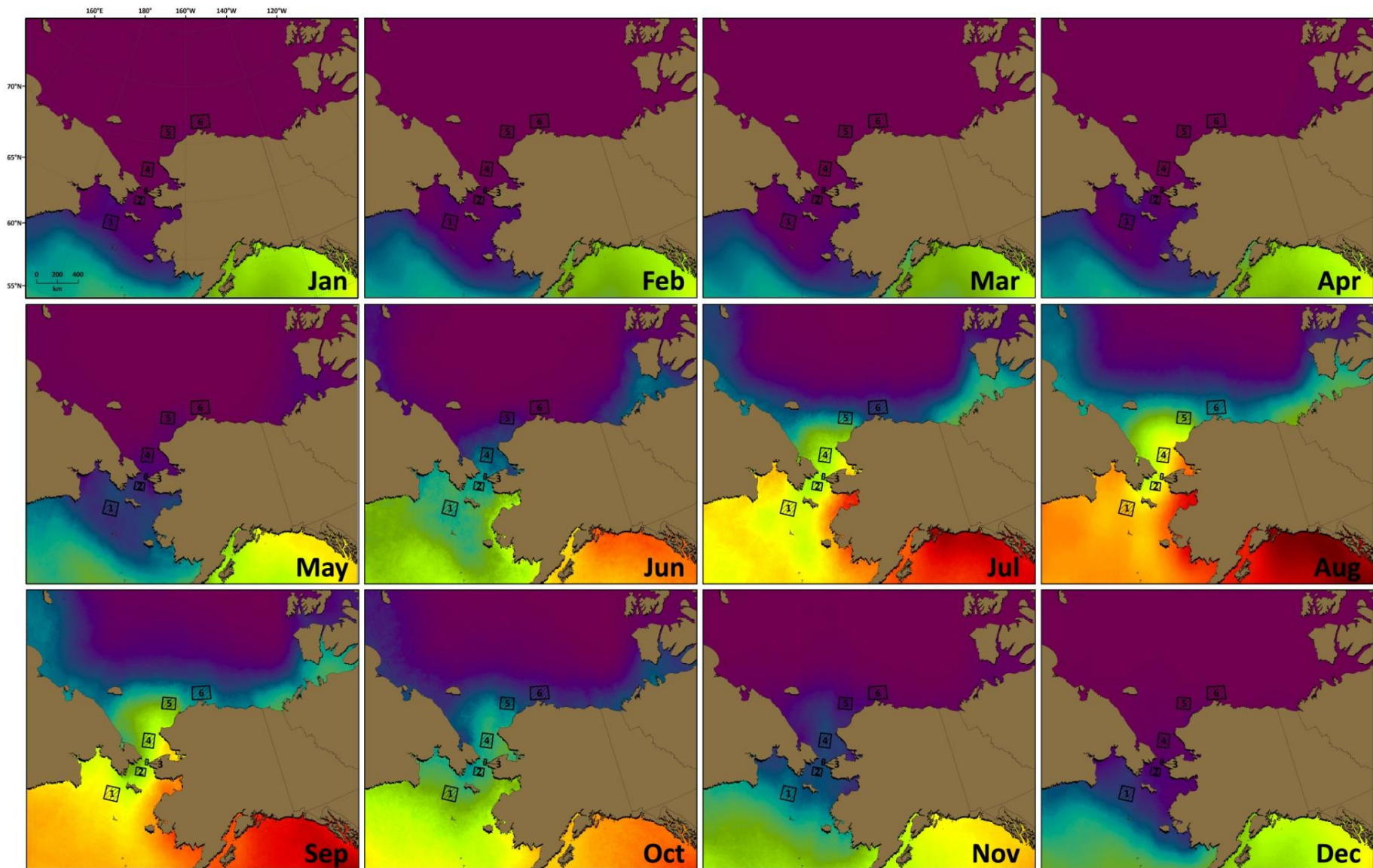


Seasonal Nutrient Distributions

Surface Nitrate ($\mu\text{mol/L}$)



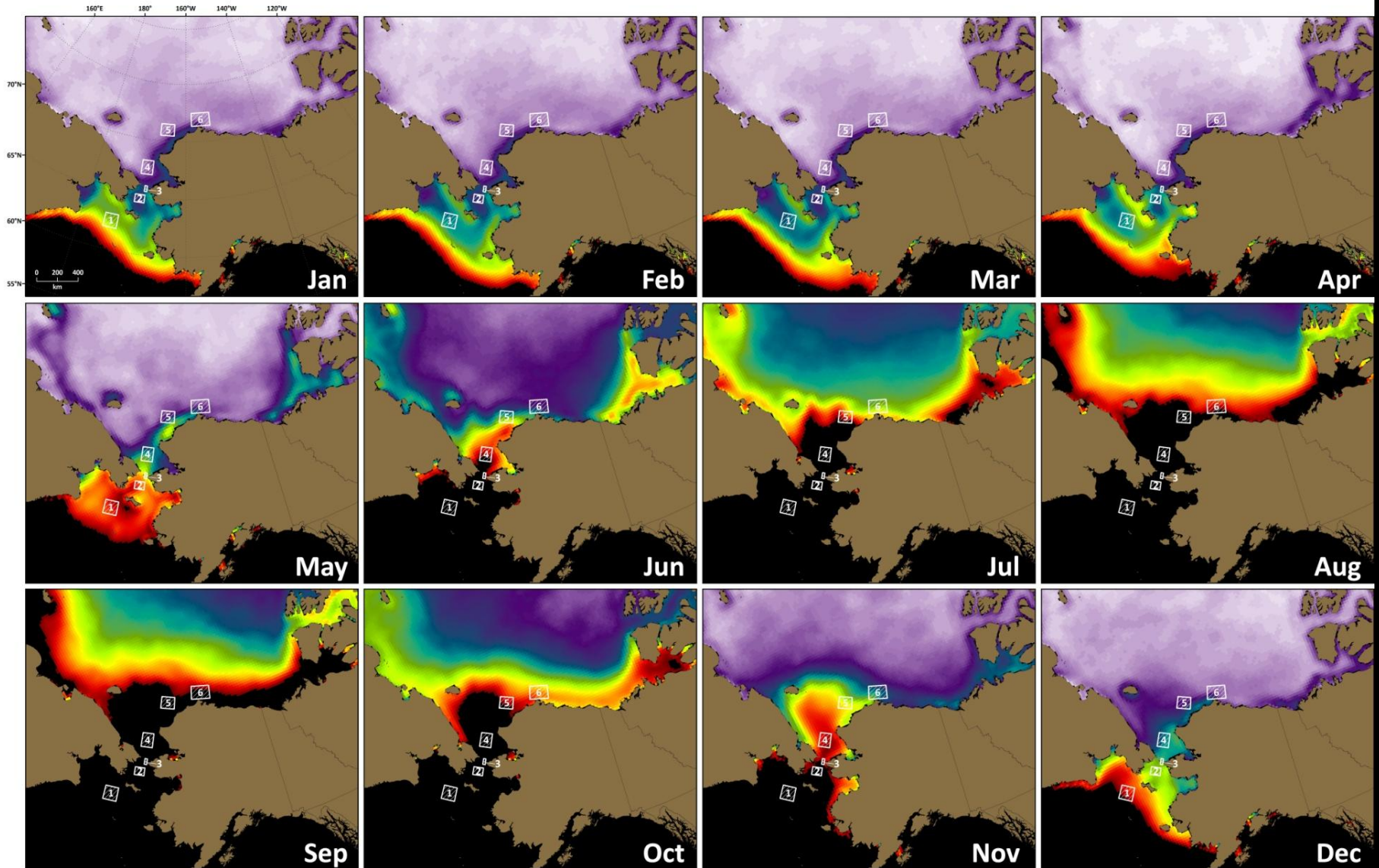
Mean Sea Surface Temperatures



Mean Sea Surface Temperature (°C)

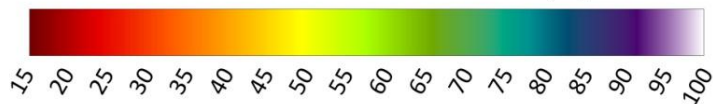


Mean Sea Ice Concentrations

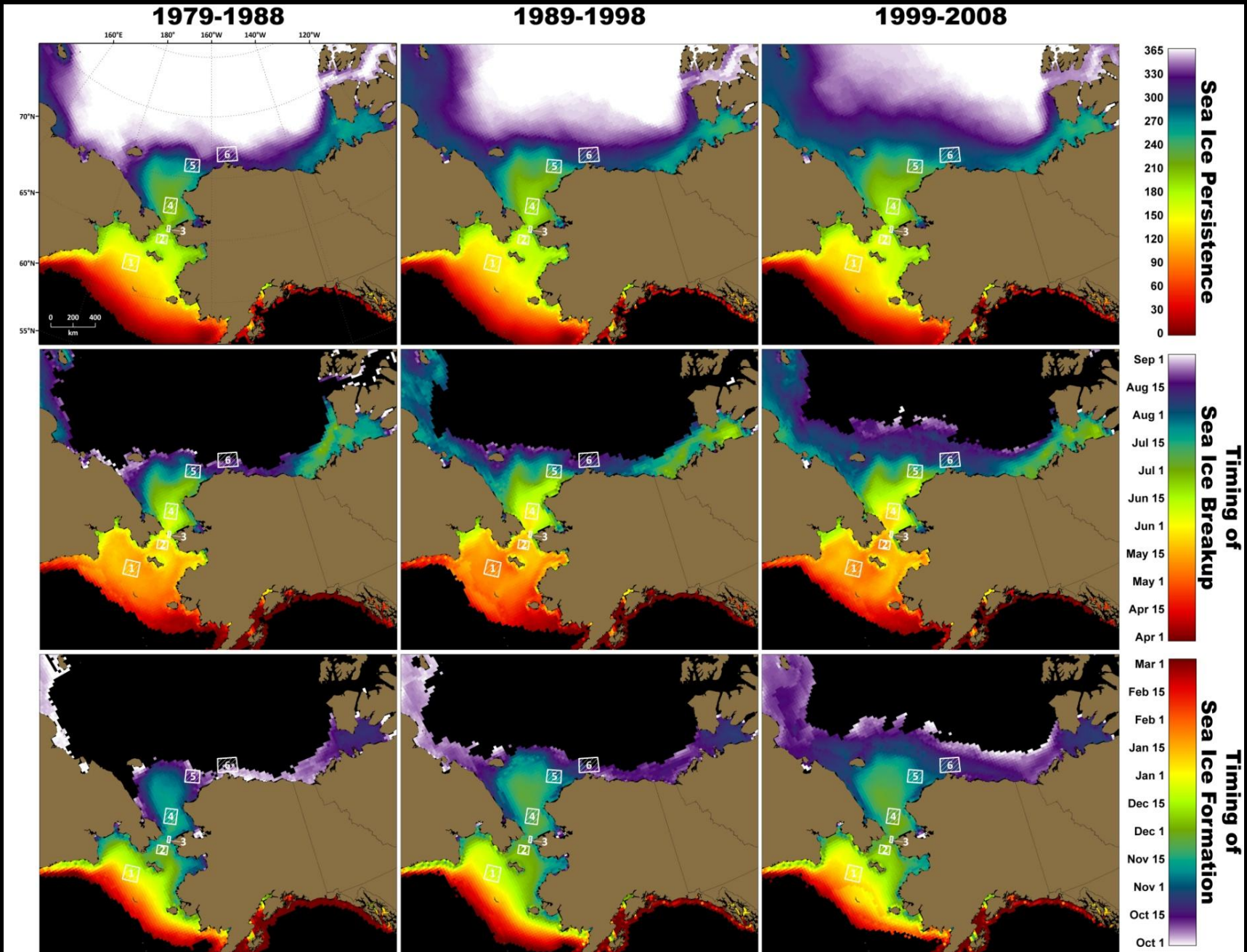


Based on SMMR and SSM/I
(1979-2008)

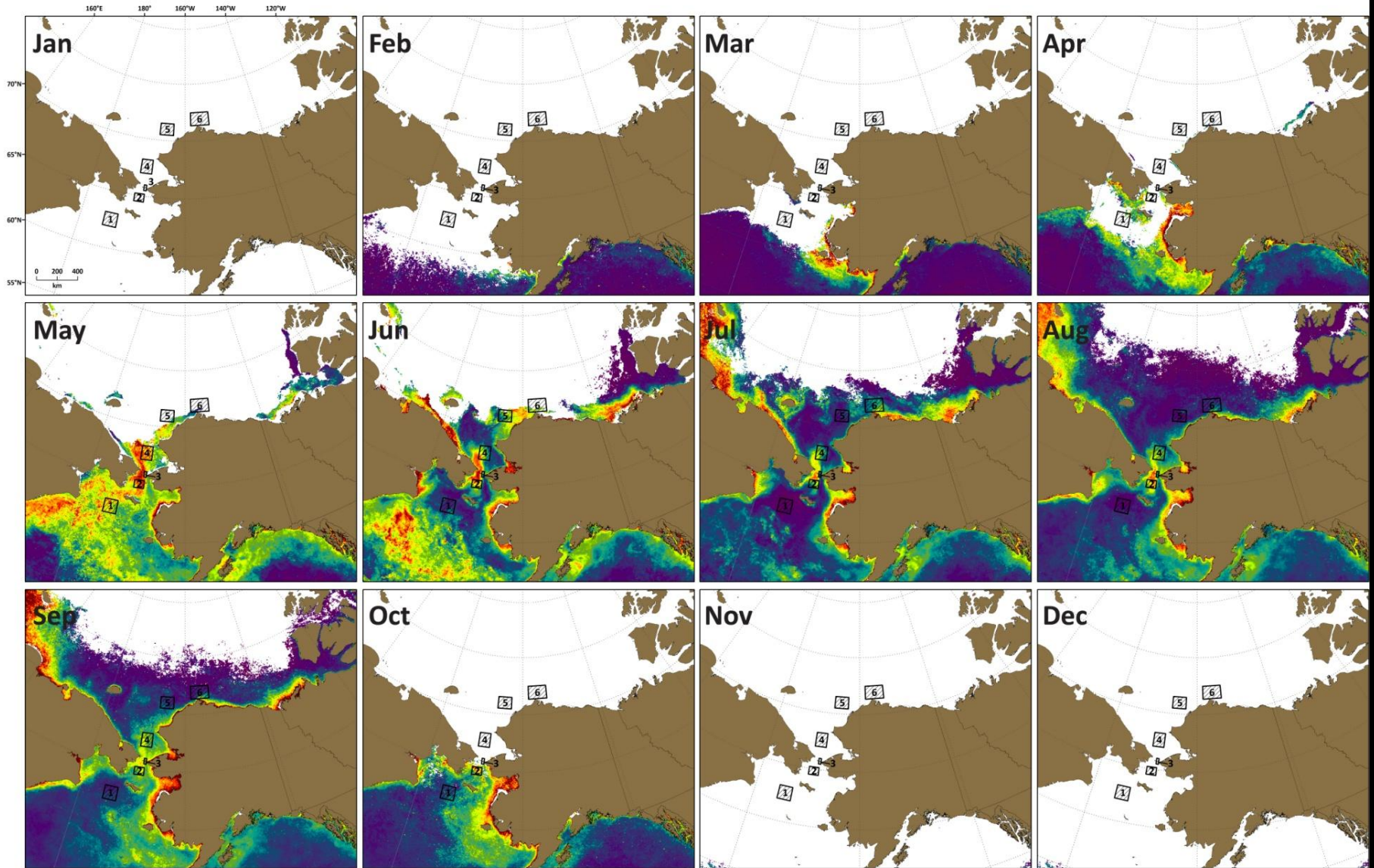
Mean Sea Ice Concentration (%)



Sea Ice Persistence, Breakup, Formation

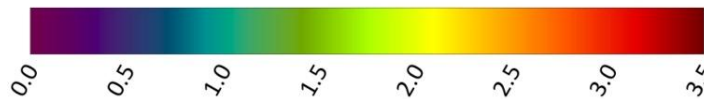


Mean Chlorophyll-a Concentrations

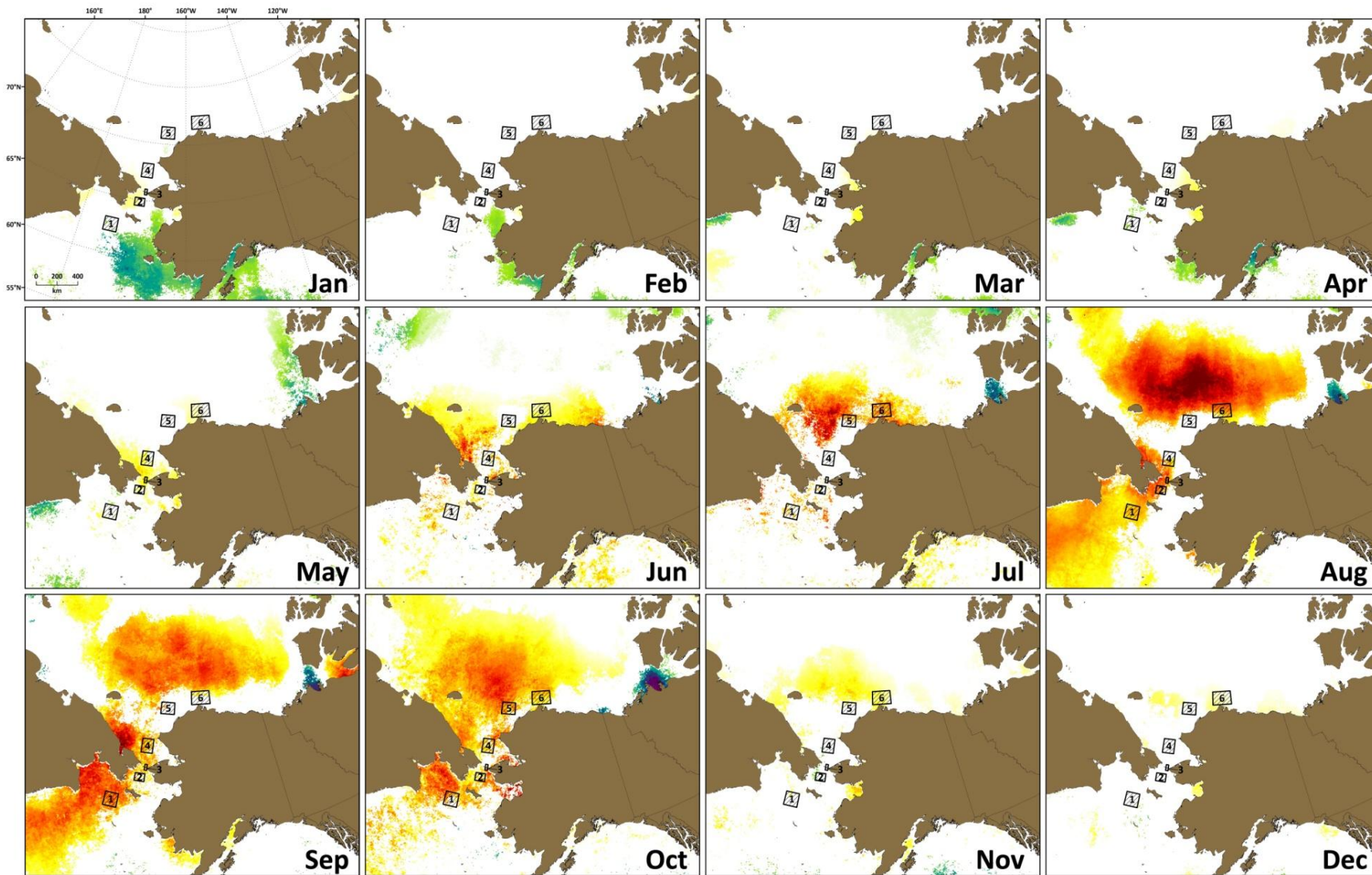


Based on Globcolour Chl-a
Concentrations (1998-2009)

Mean Chlorophyll-a Concentration (mg/m^3)

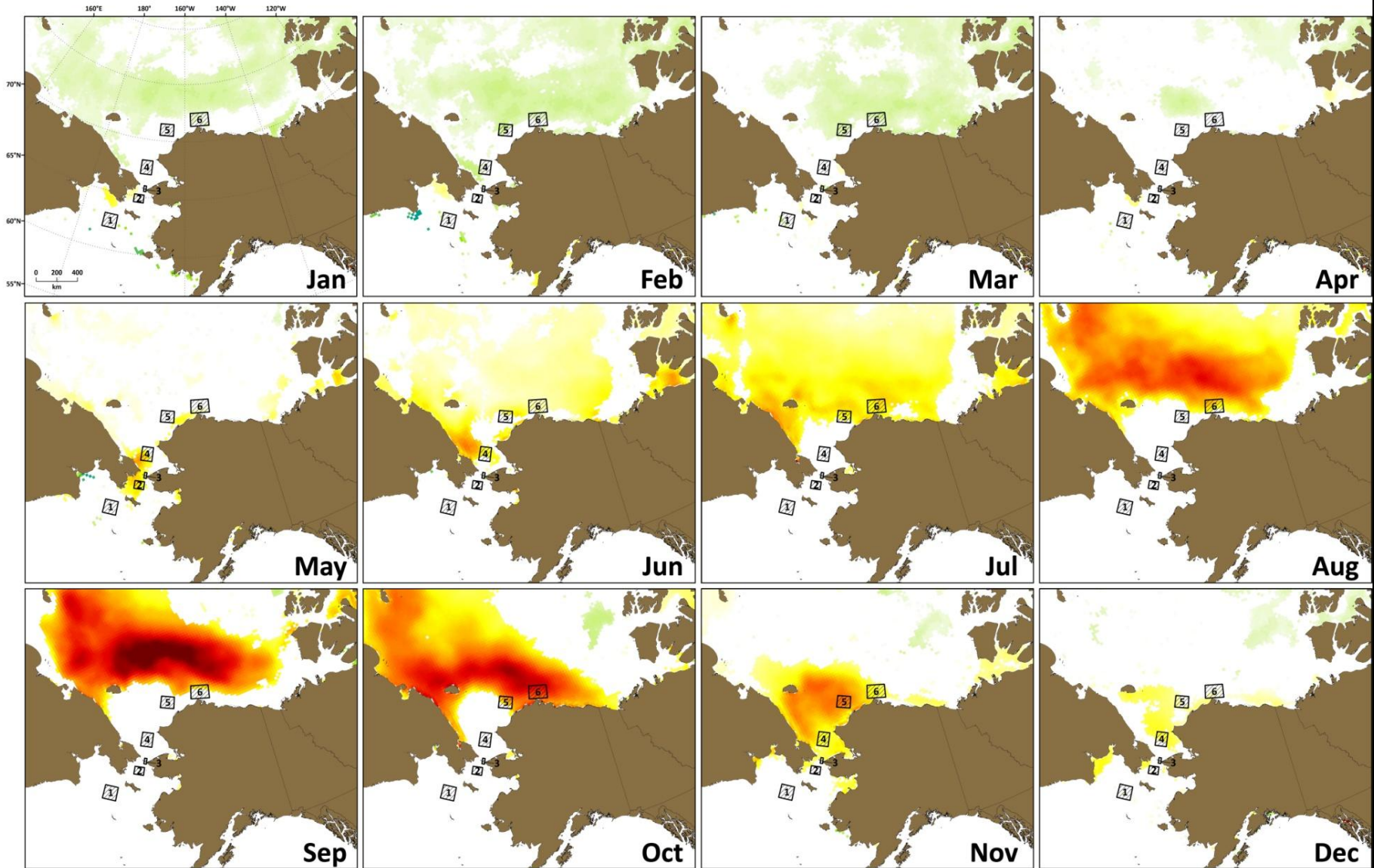


Trends in Sea Surface Temperatures

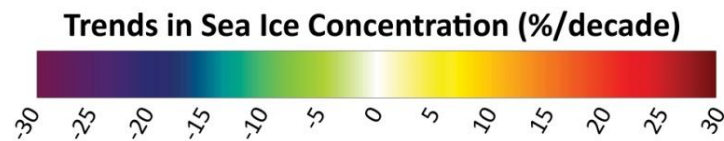


Based on AVHRR BSSTs
(1985-2009)

Trends in Sea Ice Concentration



Based on SMMR and SSM/I
(1979-2008)



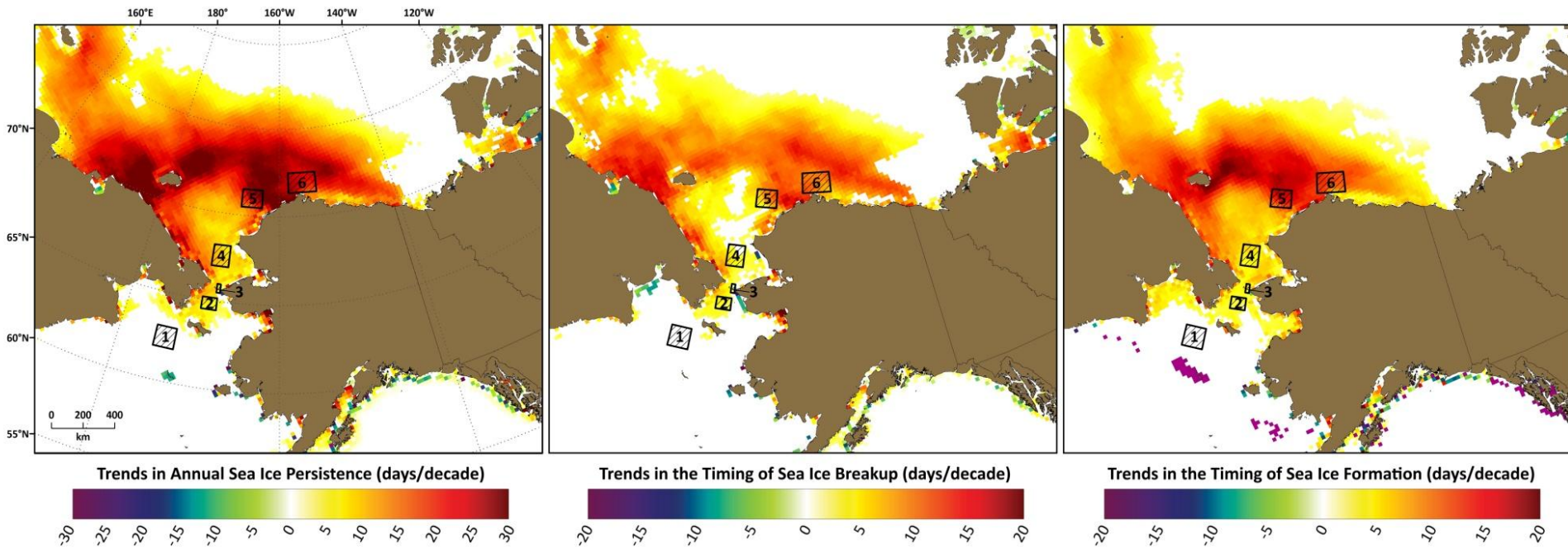
(Mann-Kendall, $p < 0.1$)

Trends in Sea Ice Cover (1979-2008)

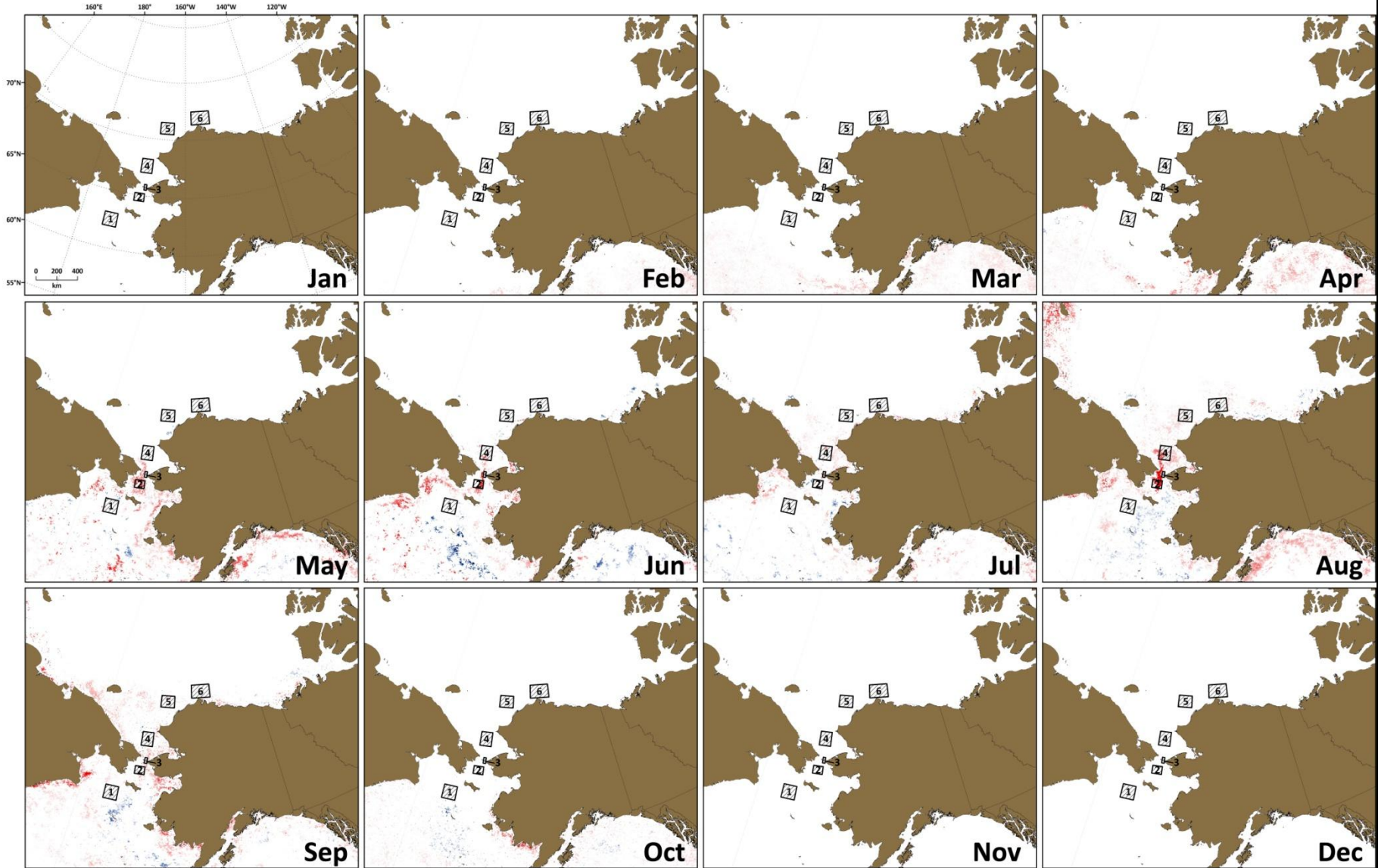
Annual Persistence

Sea Ice Breakup

Sea Ice Formation

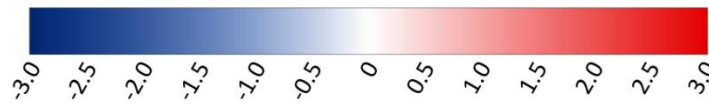


Trends in Chlorophyll-a Concentrations



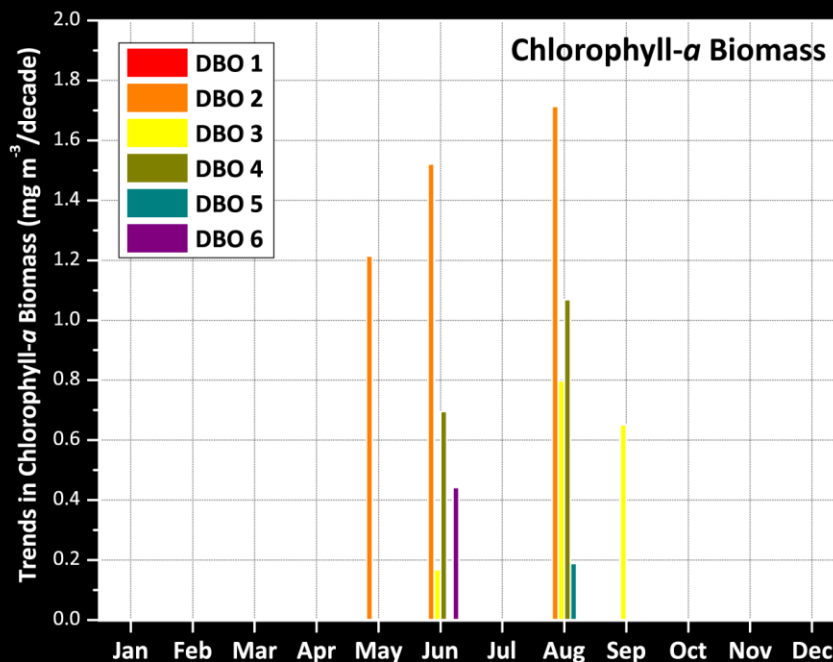
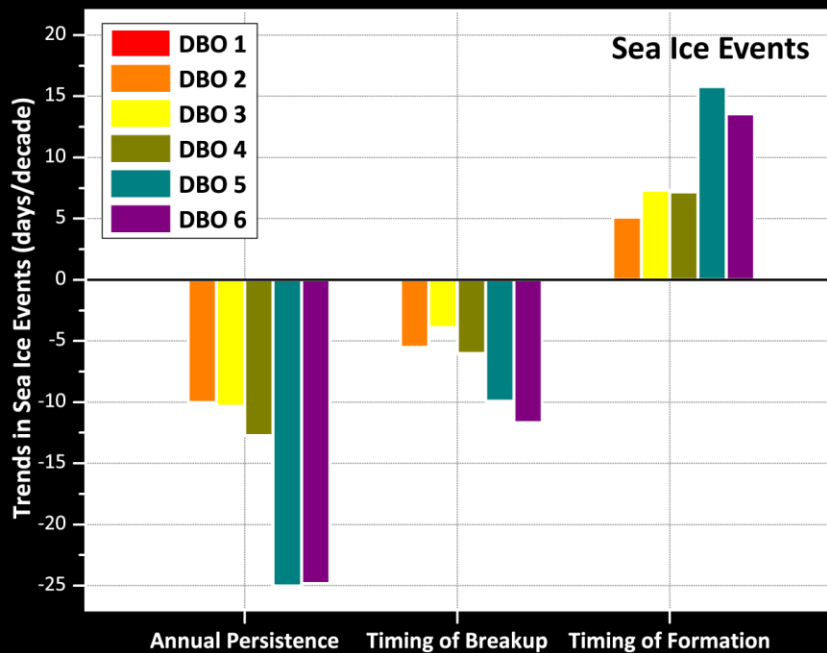
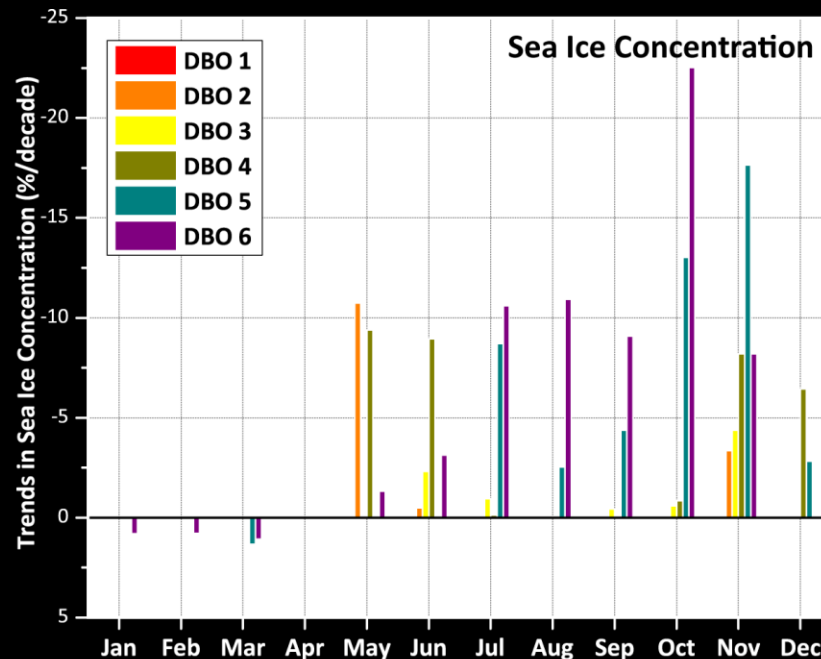
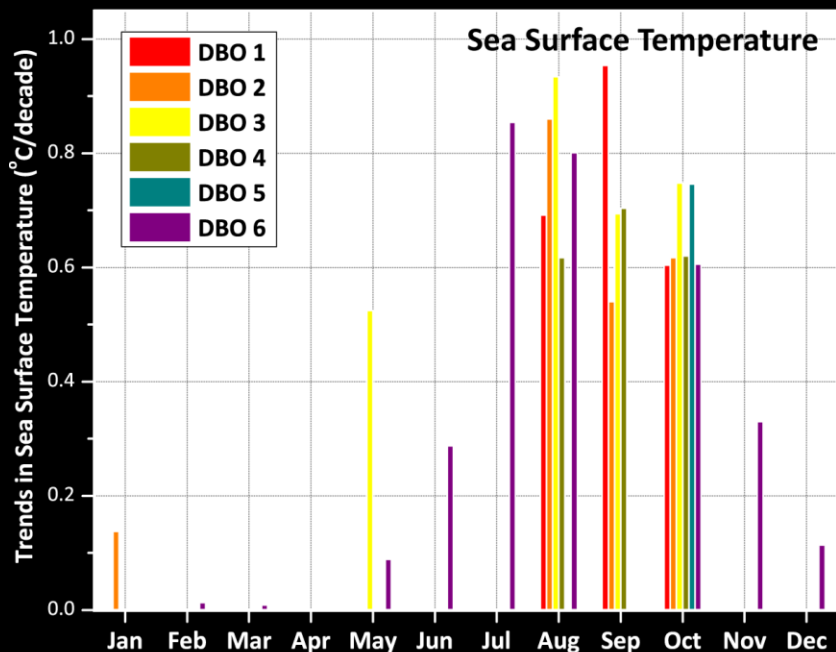
Based on Globcolour Chl-a Concentrations (1998-2009)

Trends in Chlorophyll-a Concentration (mg m⁻³/decade)

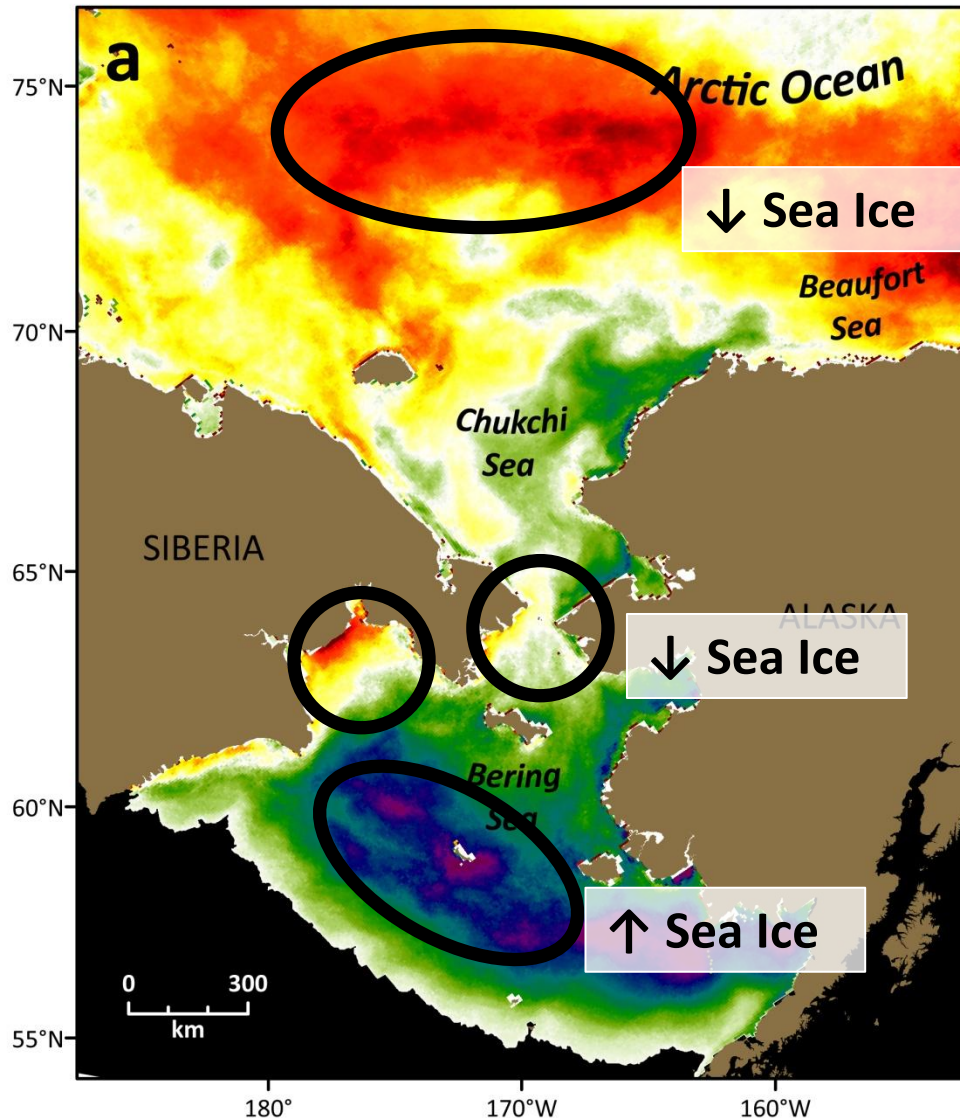


(Mann-Kendall, $p < 0.1$)

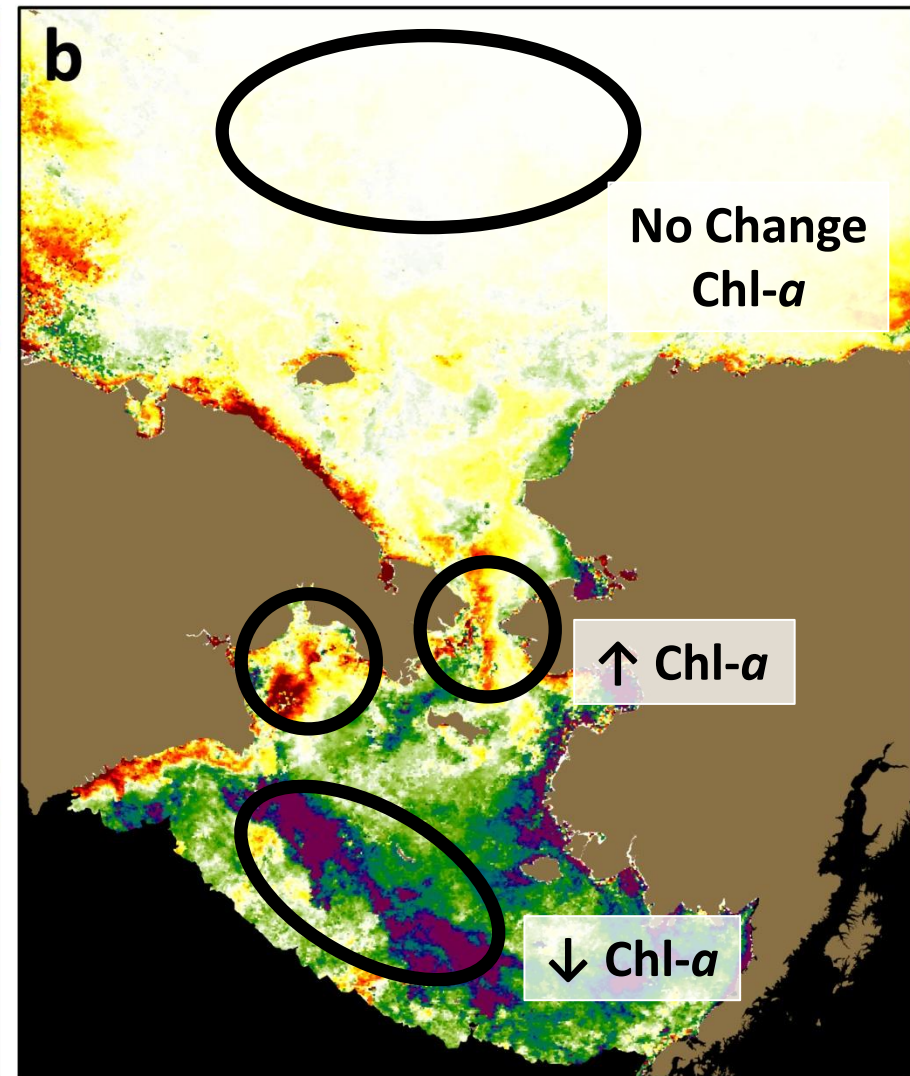
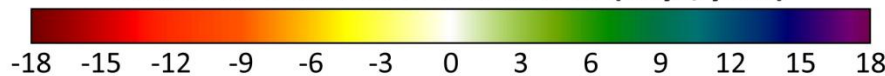
Trends in SST, Sea Ice Cover, Chl-*a* Biomass (Mann-Kendall, $p < 0.1$)



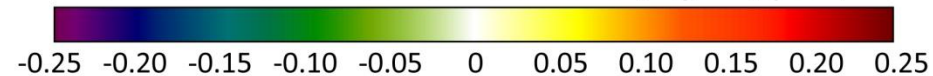
Recent Shifts in Sea Ice Persistence vs. Chlorophyll-*a* Biomass (2003-2009, AMSR-E/MODIS era)



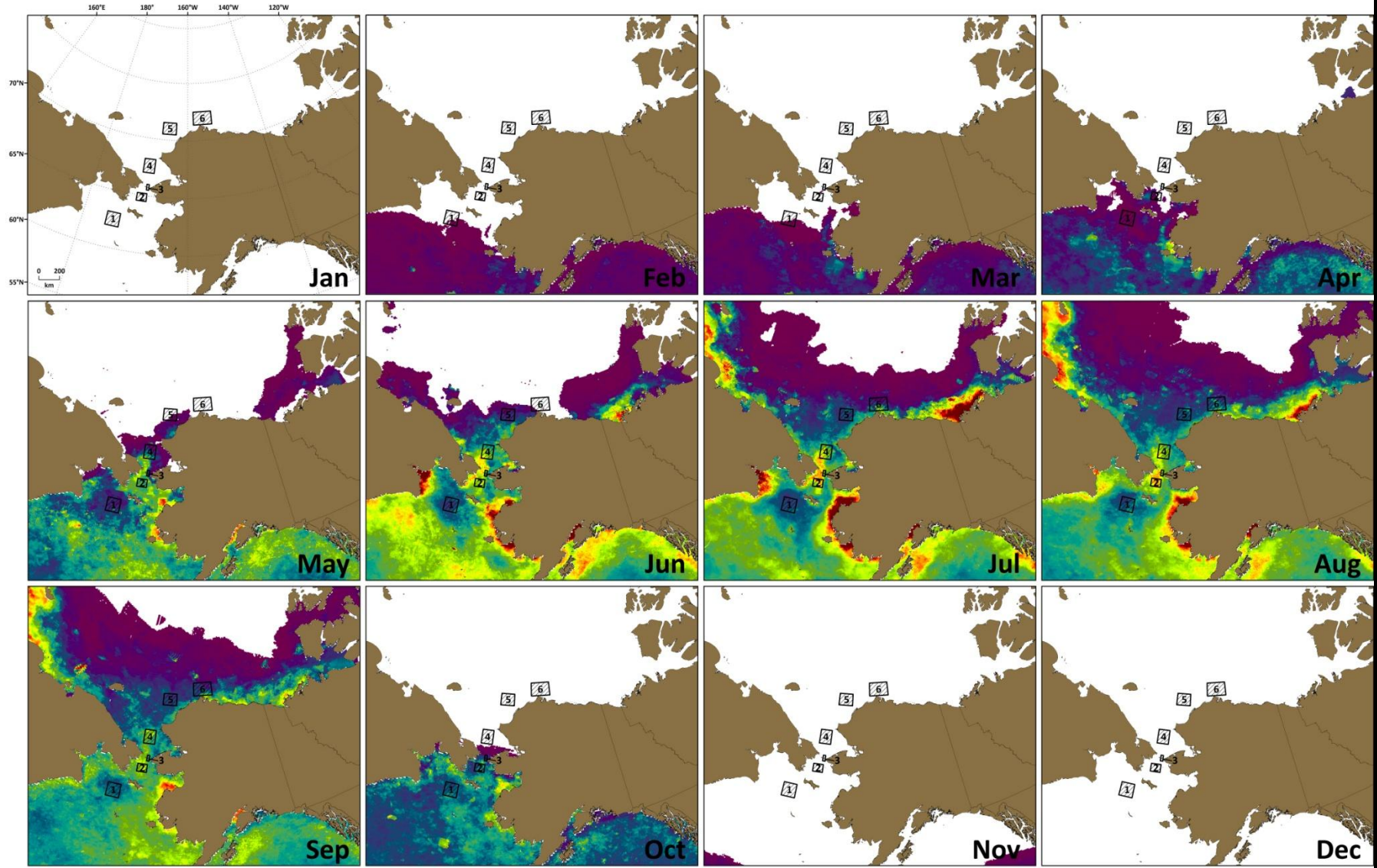
Shifts in Sea Ice Persistence (days/year)



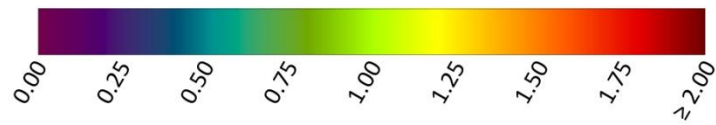
Shifts in Chl-*a* Concentrations (mg m⁻³/year)



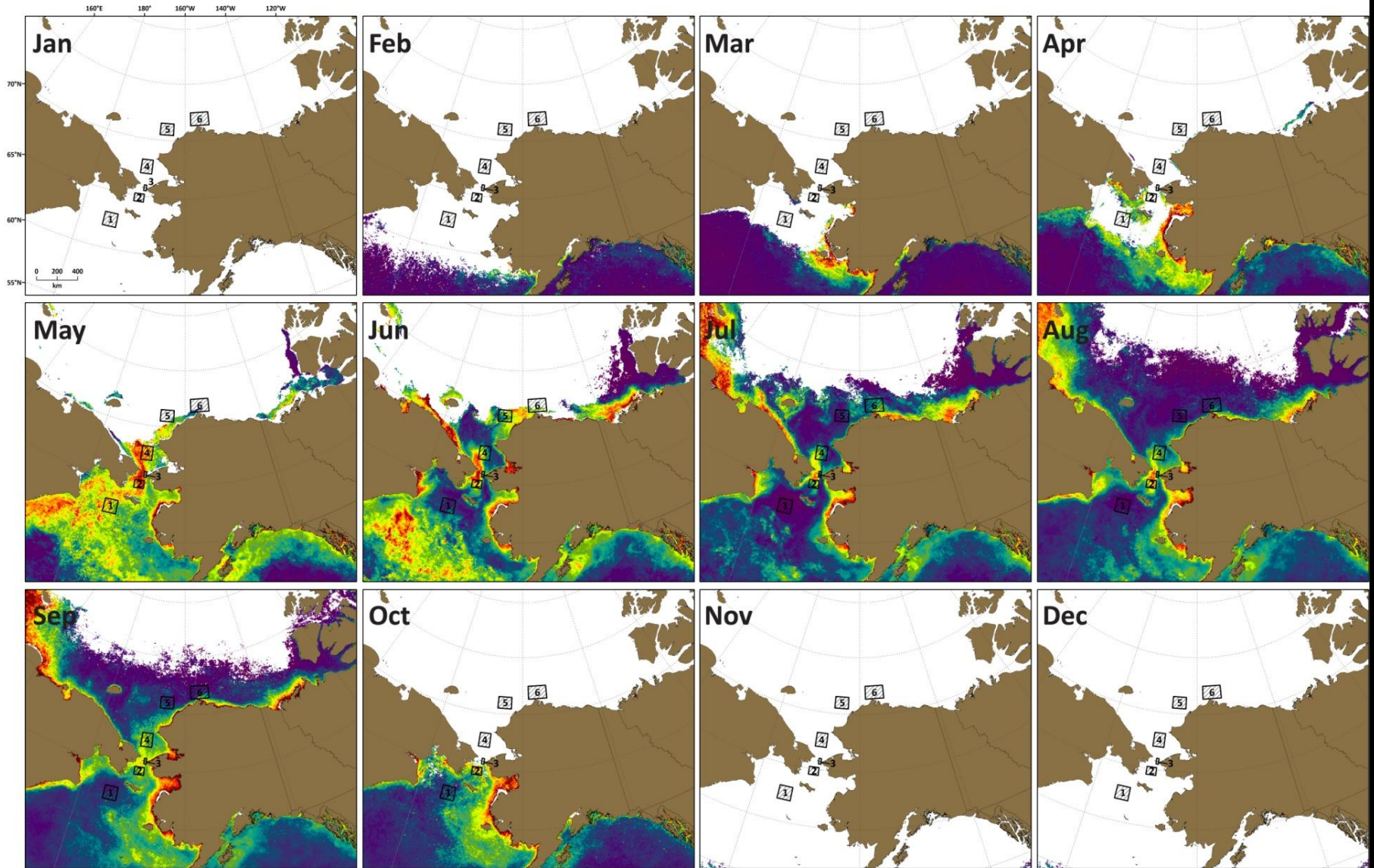
Mean Net Primary Production Rates



Net Primary Production ($\text{g C/m}^2/\text{day}$)



Mean Chlorophyll-a Concentrations



Based on Globcolour Chl-a
Concentrations (1998-2009)

Mean Chlorophyll-a Concentration (mg/m³)

