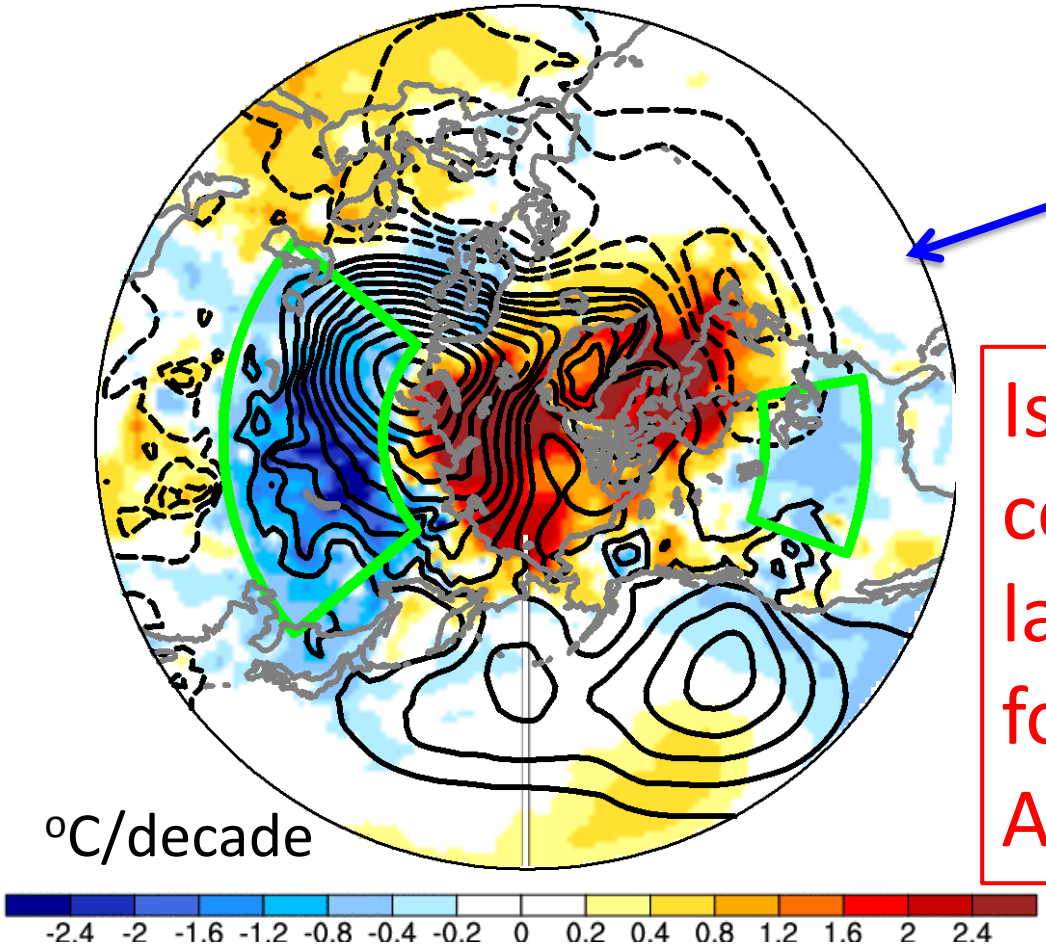
# Causes for the Recent "Warm Arctic, Cold Continents" Trend Pattern in Winter Temperatures




ERA-Interim 1990/91-2013/14 winter 2m-T/SLP trend

Is the recent winter cooling trend over mid-latitude continents a forced response to Arctic sea ice loss?

Lantao Sun, Judith Perlwitz and Martin Hoerling

NOAA CDPW, Denver, CO; October 29, 2015

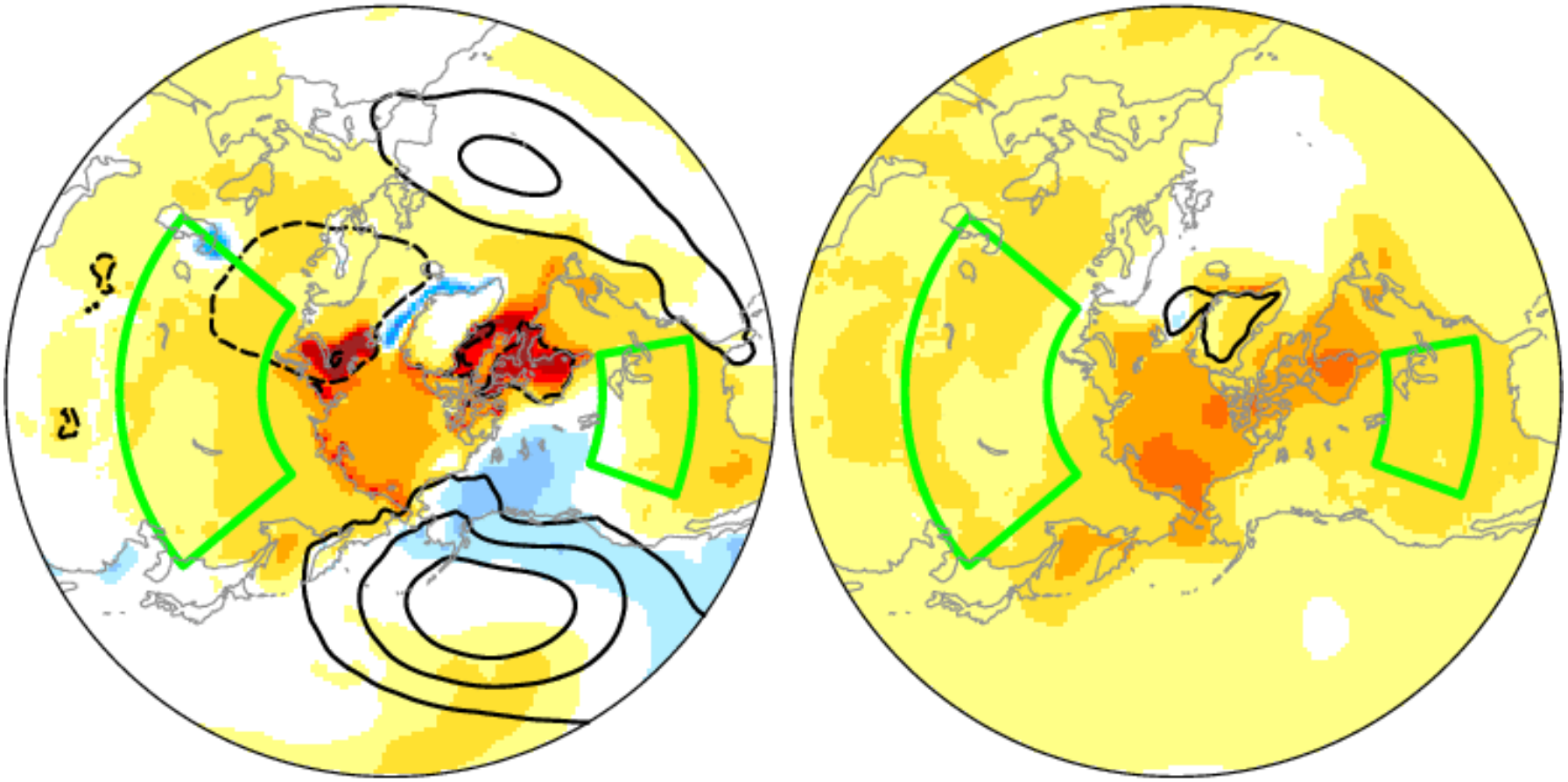
# Does recent Arctic change significantly influence mid-latitudes?

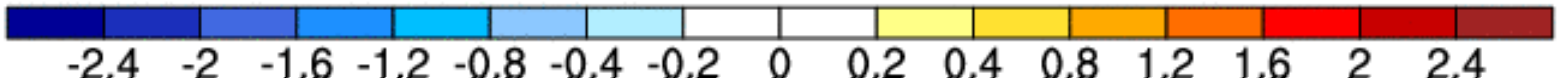
- Observational studies on Arctic warming-midlatitude extremes (Overland et al., 2011, 2015; Overland and Wang, 2015; Cohen et al., 2013; Francis and Vavrus, 2012, 2015); modeling evidence on Eurasia cooling resulting from Arctic sea ice loss (e.g., Honda et al., 2009; Kim et al., 2014; Mori et al., 2014).
- Challenged by other studies (e.g., Barnes, 2013; Screen and Simmonds, 2013; Hassanzadeh et al., 2014, Perlwitz, Hoerling and Dole., 2015, among many others).

# 1990/91-2013/14 DJF 2m-T/SLP trend (CI: 0.5 hPa decade$^{-1}$)

AMIP ensemble mean (70)

CMIP ensemble mean (58)



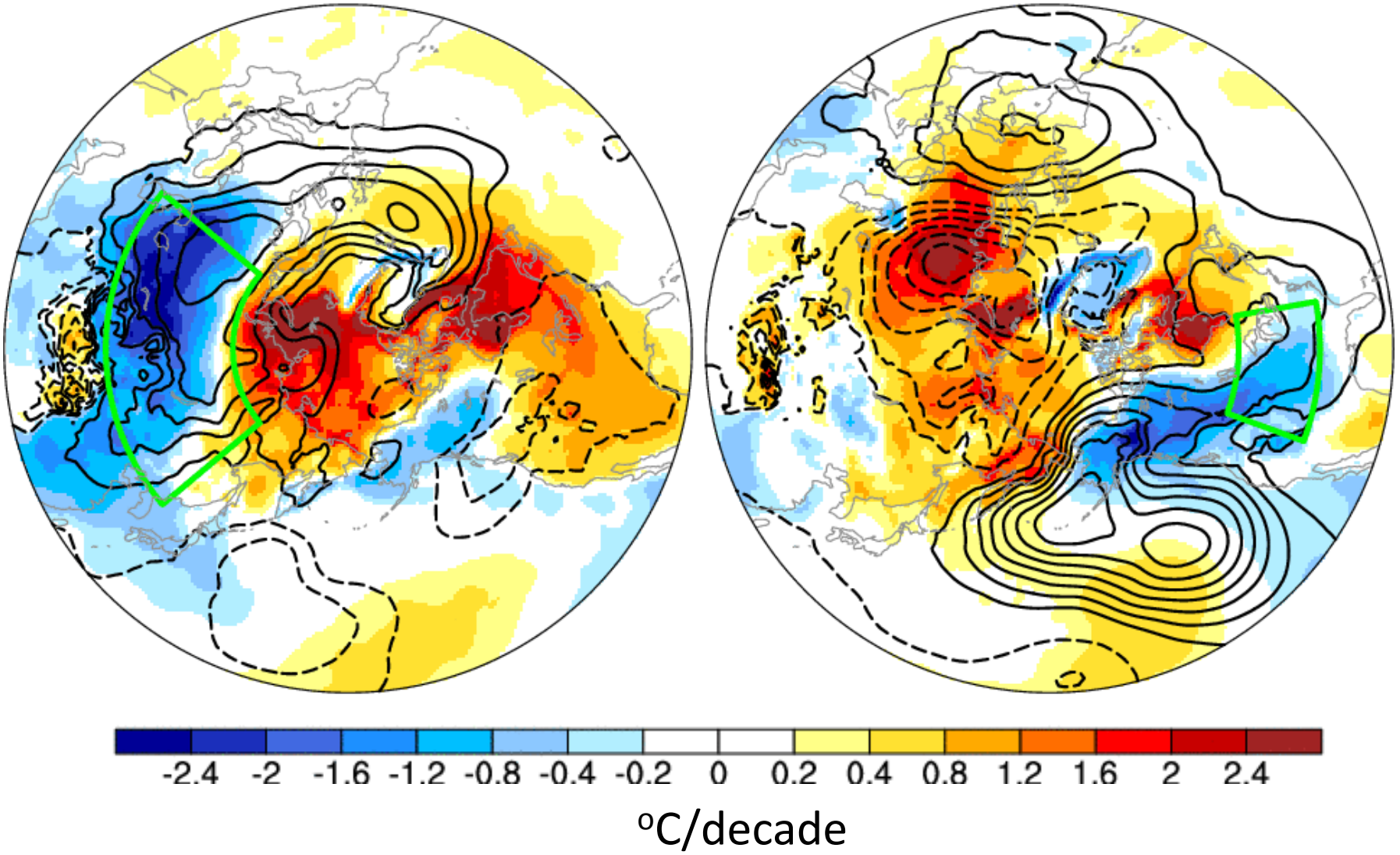



$^{o}$C/decade

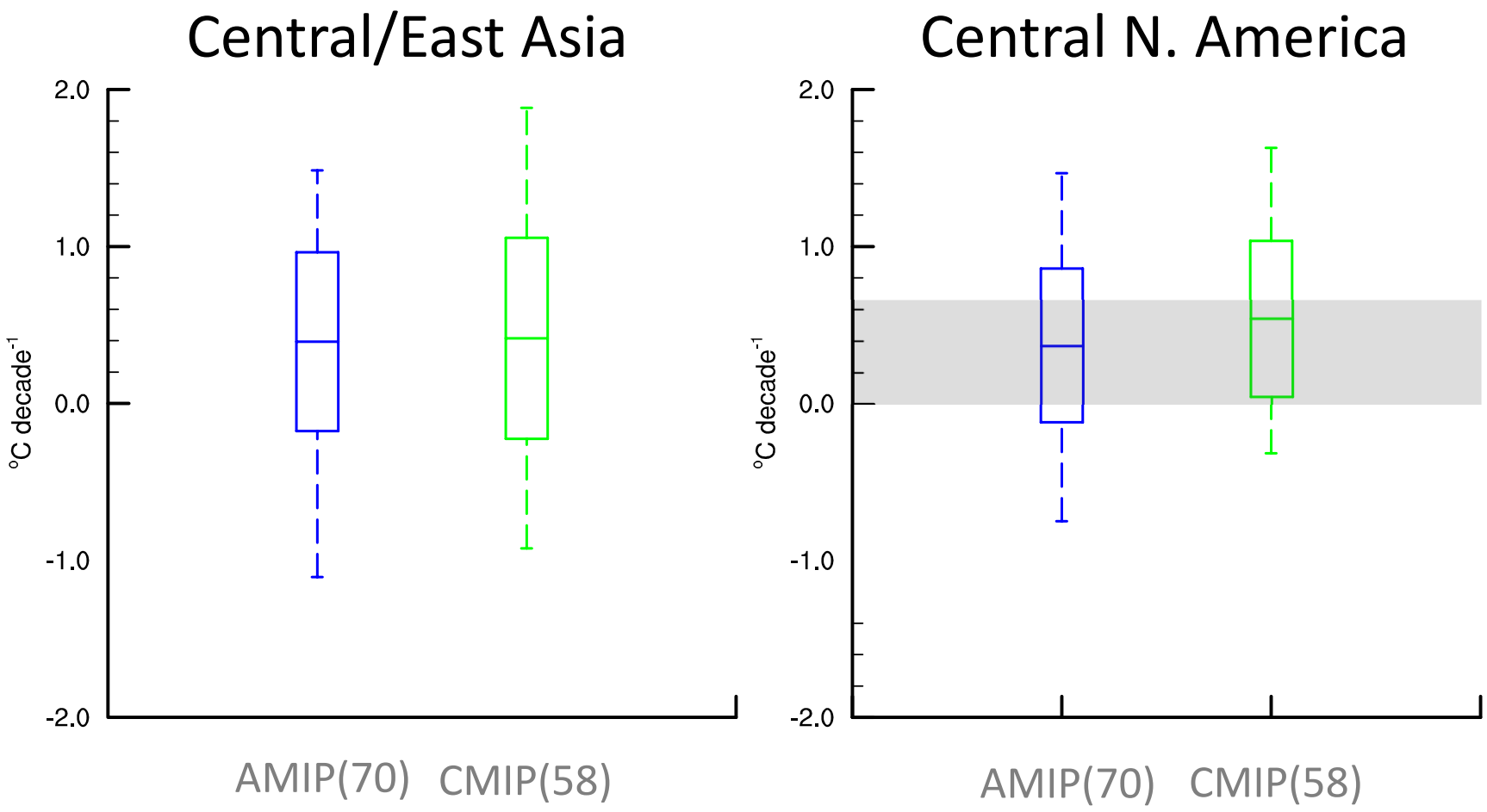
# Individual ensembles

AMIP Ensemble#45

AMIP Ensemble#40

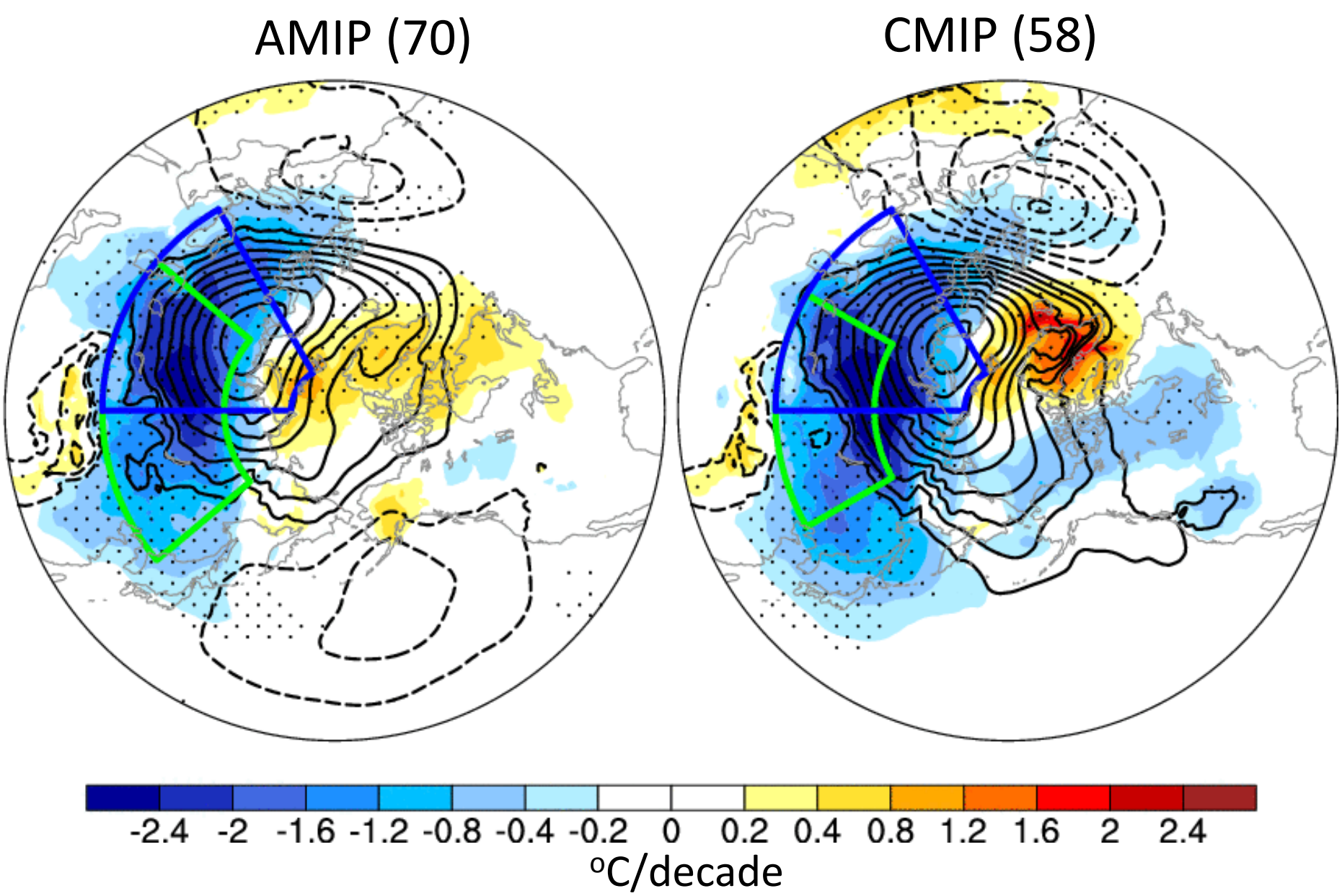


# Ensemble spread of temperature trend



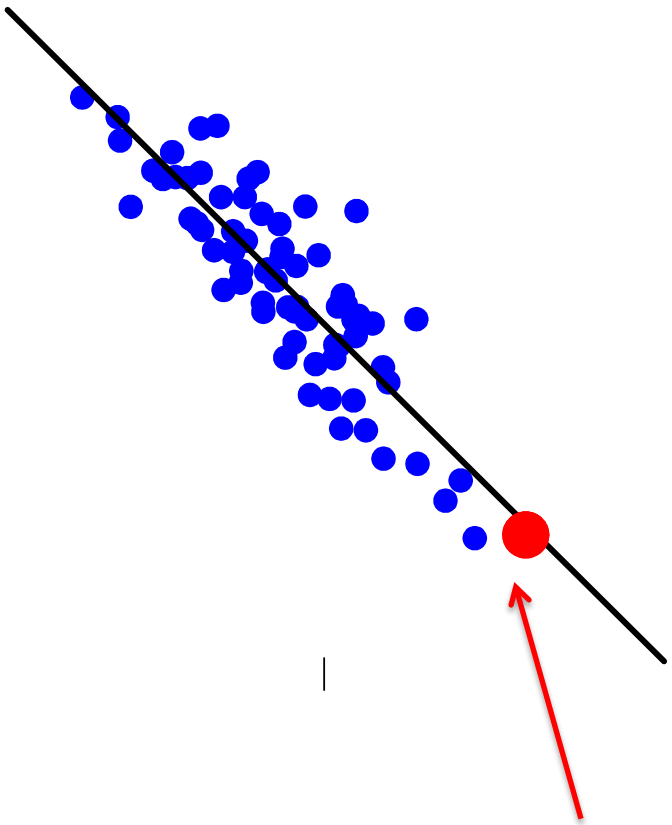
# Mechanism of the Winter Temperature Cooling Trend over Mid-latitude Continents

# SLP trend pattern associated with central/east Asia cooling

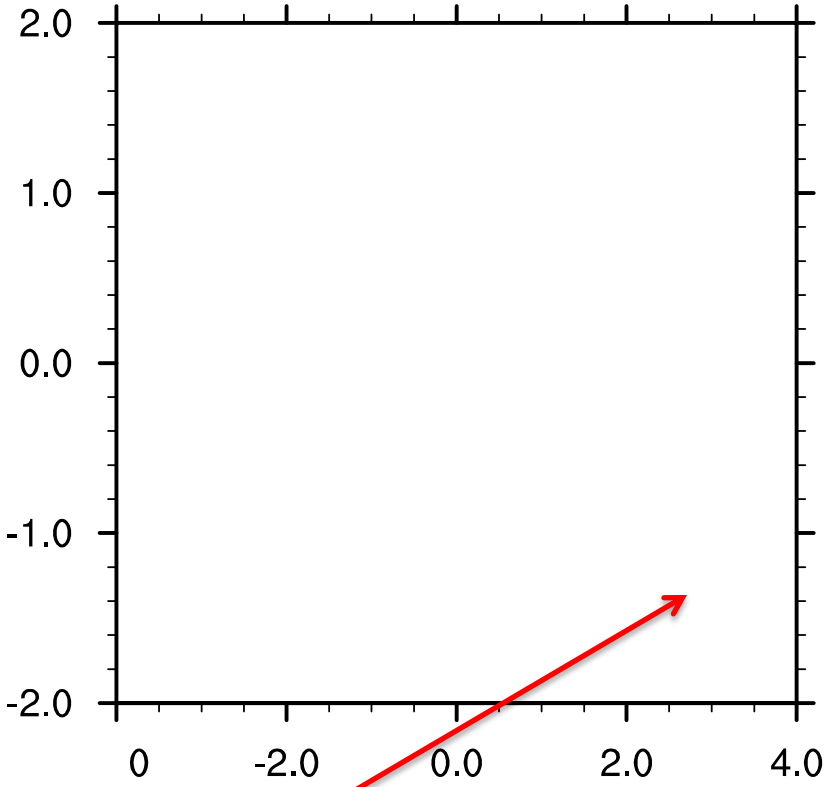


# 2m-T/SLP trend scatter plot for central/east Asia

AMIP (corr = 0.86)

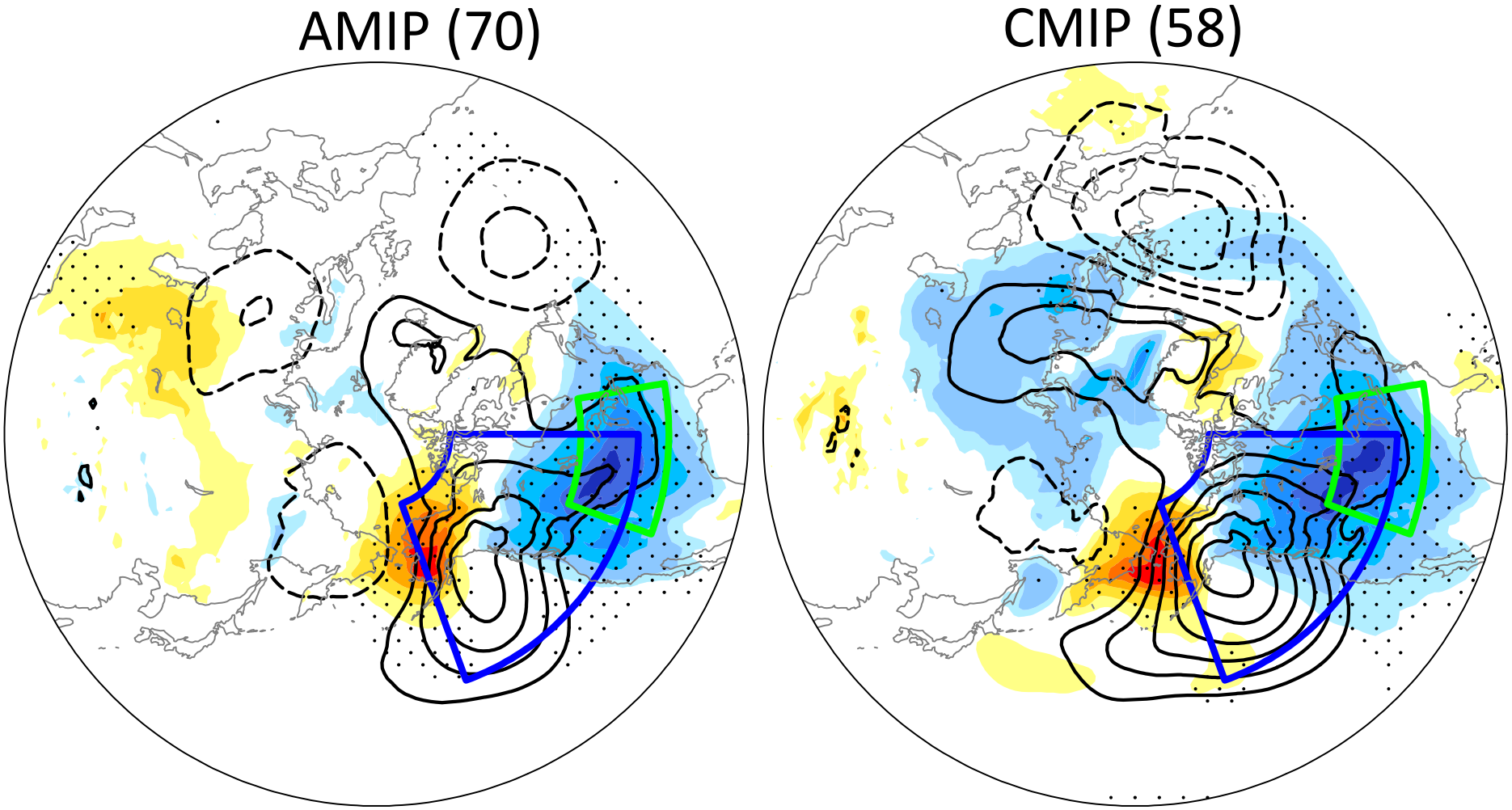


CMIP (corr = 0.89)




**ERA-Interim**

# SLP trend pattern associated with central N. America cooling

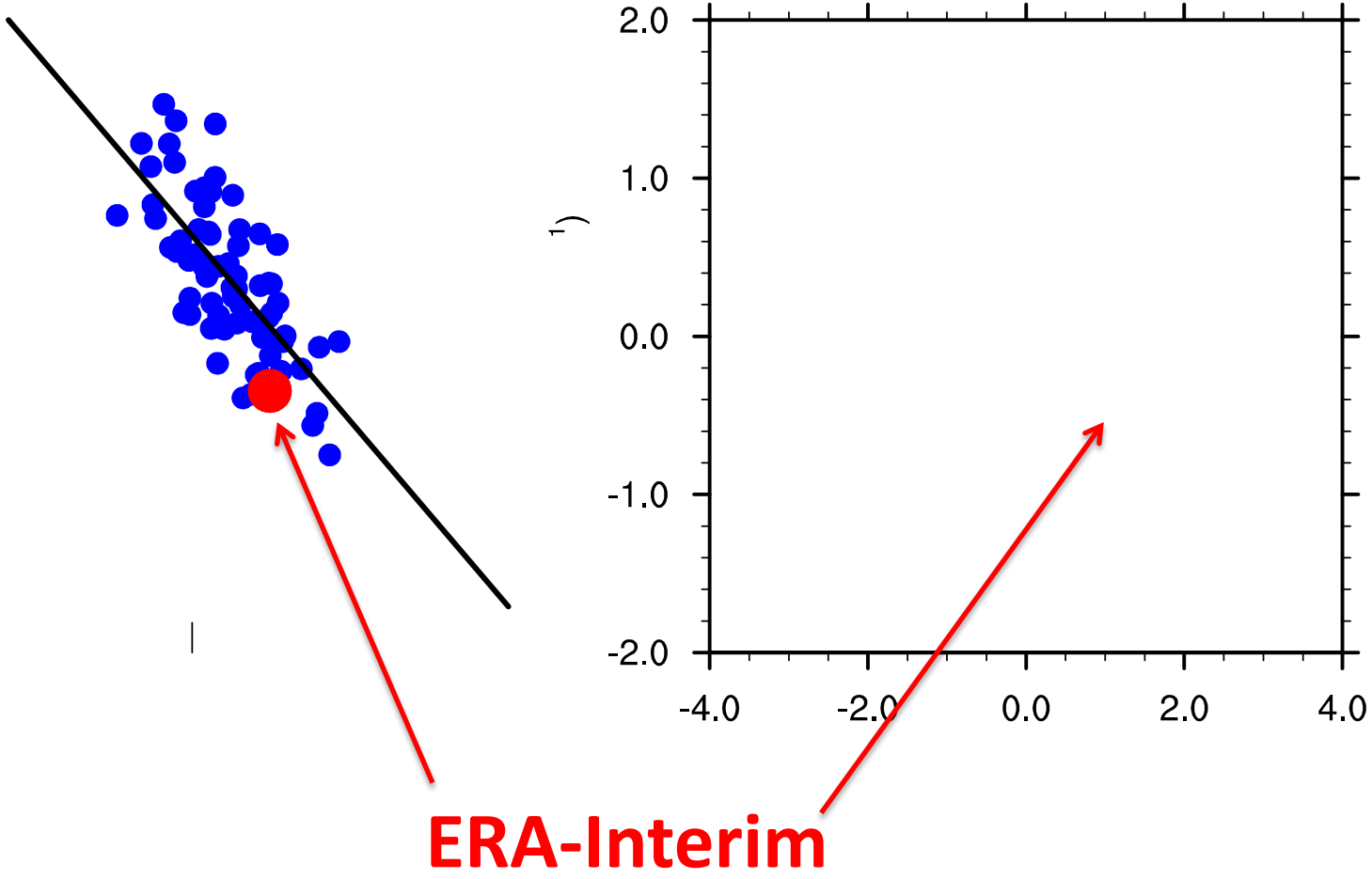



The circulation pattern is similar to that found in Kug et al. (2015) for North America cooling

# 2m-T/SLP trend scatter plot for central North America

AMIP (corr = 0.72)

CMIP (corr = 0.77)

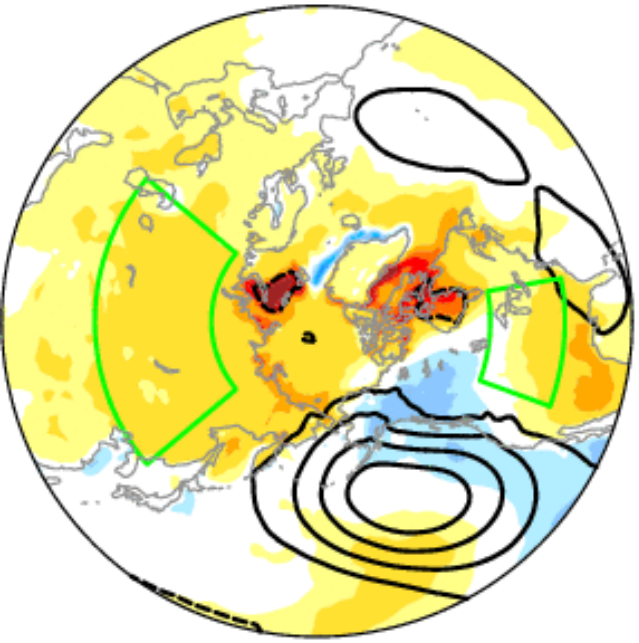


# Impact of Recent Arctic Sea Ice Loss on the Atmosphere

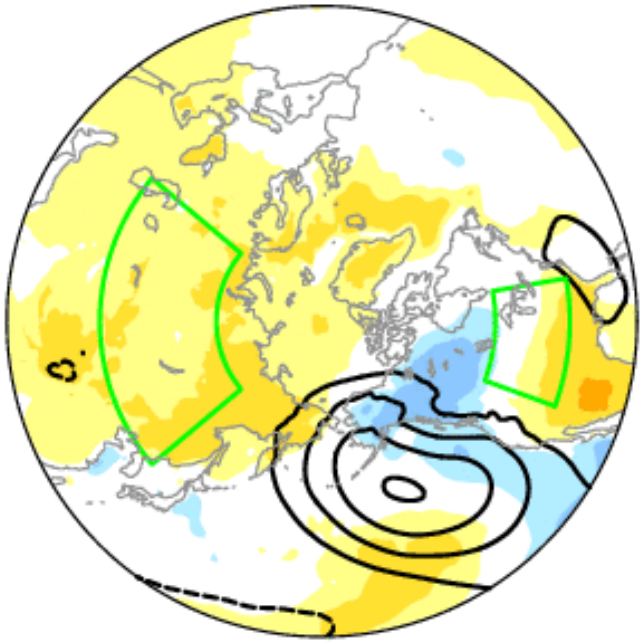
# 1990/91-2013/14 DJF 2m-T/SLP trend (CI: 0.5 hPa decade$^{-1}$)

- **AMIP**: observed GHGs, SST and sea ice conditions.
- **CLIM_POLAR**: observed SST, GHGs and sea ice 1979-1989 climatology
- **ΔICE = AMIP – CLIM_POLAR**

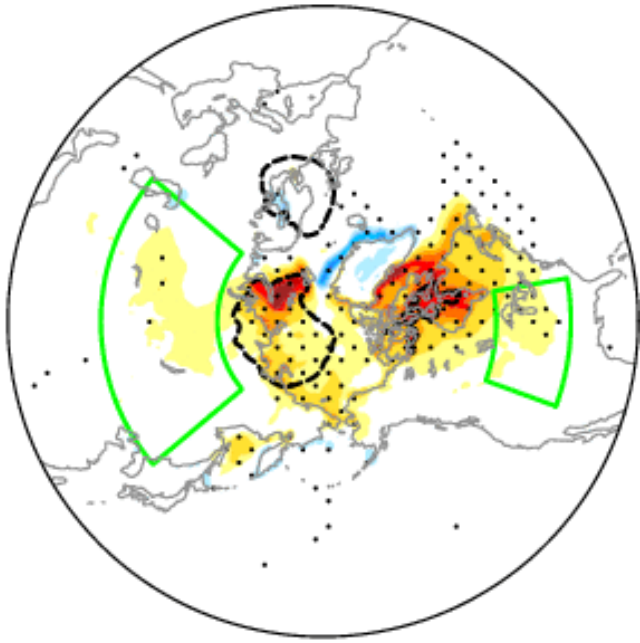
AMIP (50)



Clim_Polar (50)

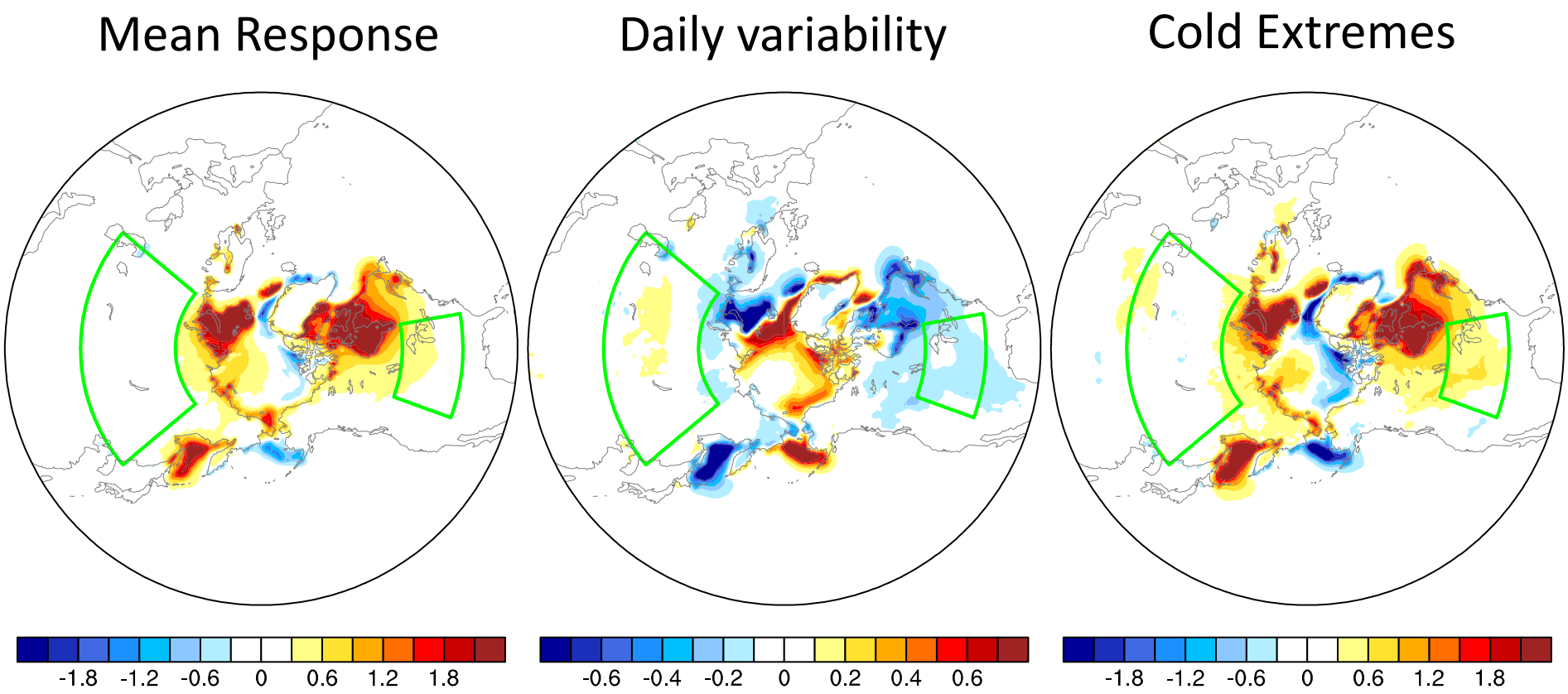


ΔICE (50)



In agreement with the modeling study of Screen et al., (2013); Li et al., (2015).

# DJF 2m-T Response to Arctic sea ice loss: 2004/05-2013/14 average

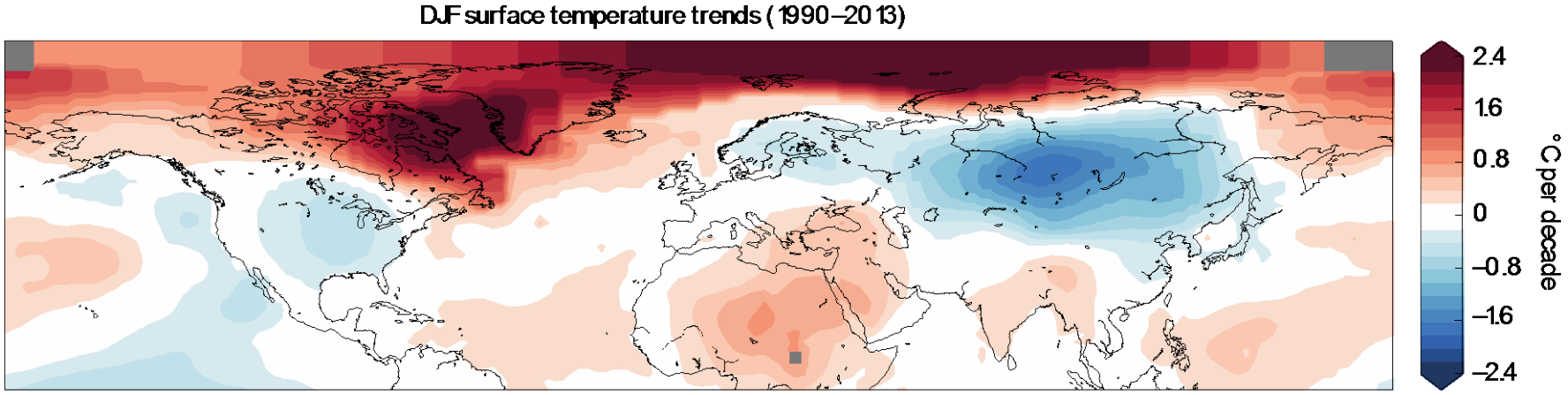



Decrease in daily temperature variability is consistent with Screen (2014) and Screen et al. (2015).

# Summary

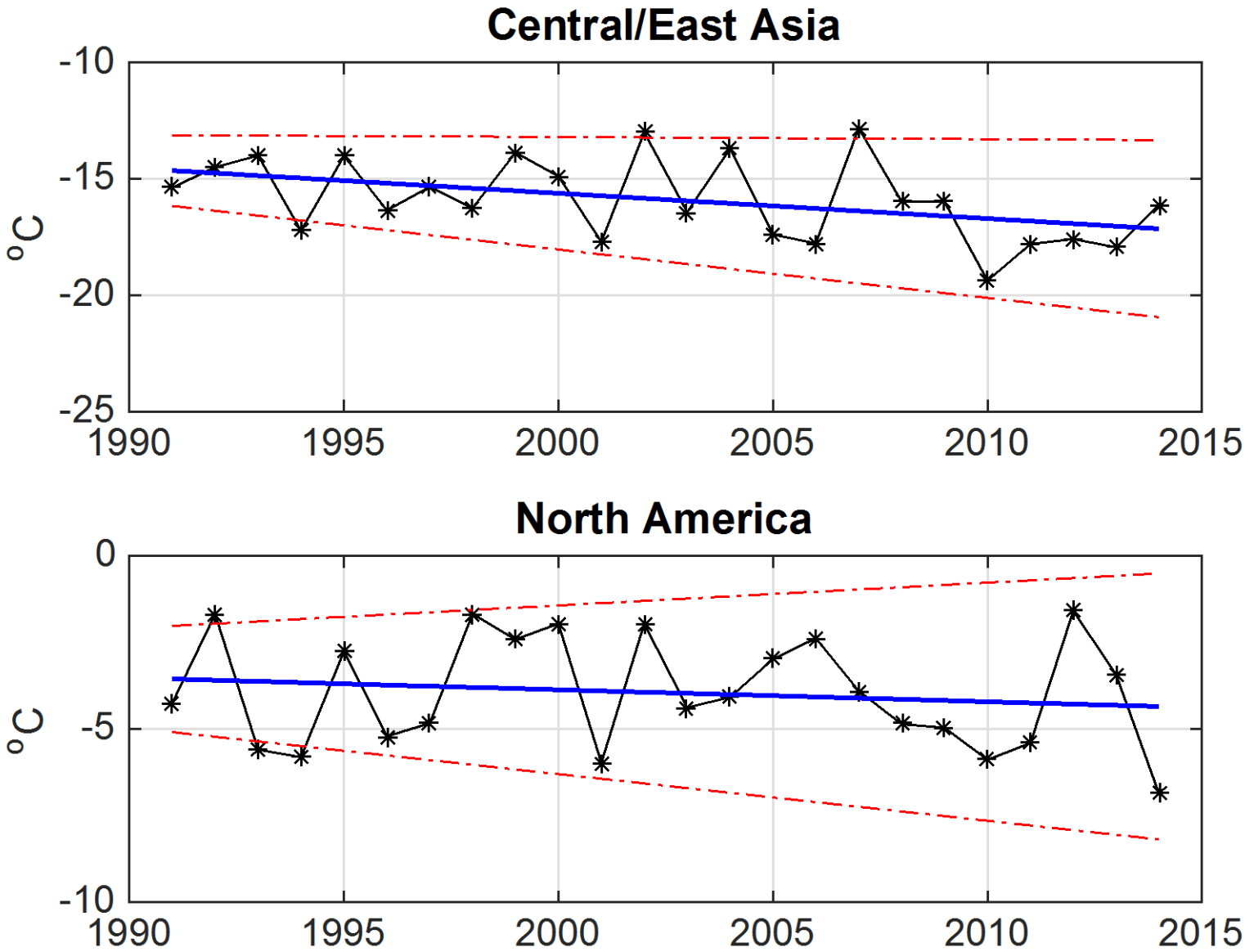
1. Observed recent cooling trend in central/east Asia and central North America is not a forced response either to radiative forcing or sea surface temperature.
2. Recent sea ice loss contributes to the warming in the Arctic, but not cooling over mid-latitude continents.
3. Arctic amplification *does* affect mid-latitude weather, however by *reducing* daily variability and *reducing* cold extremes.

# SUPPLEMENTARY FIGURES




Cohen et al. (2014) *Nature Geoscience*

# Uncertainties in observed trends



# Temperature trend over N America and C/E Asia