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Title:	Latitudinal Distribution of the Recent Arctic Warming
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Decadal-scale Arctic Climate Variability: Observations and Modeling (GC12B-06)

Latitudinal Distribution of the Recent Arctic Warming

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With thanks for additional contribution to

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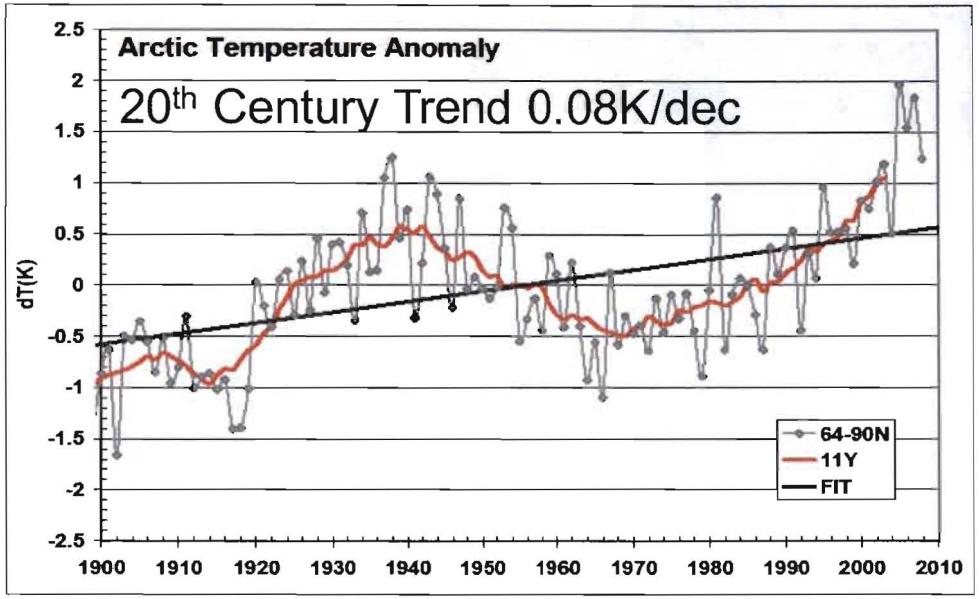
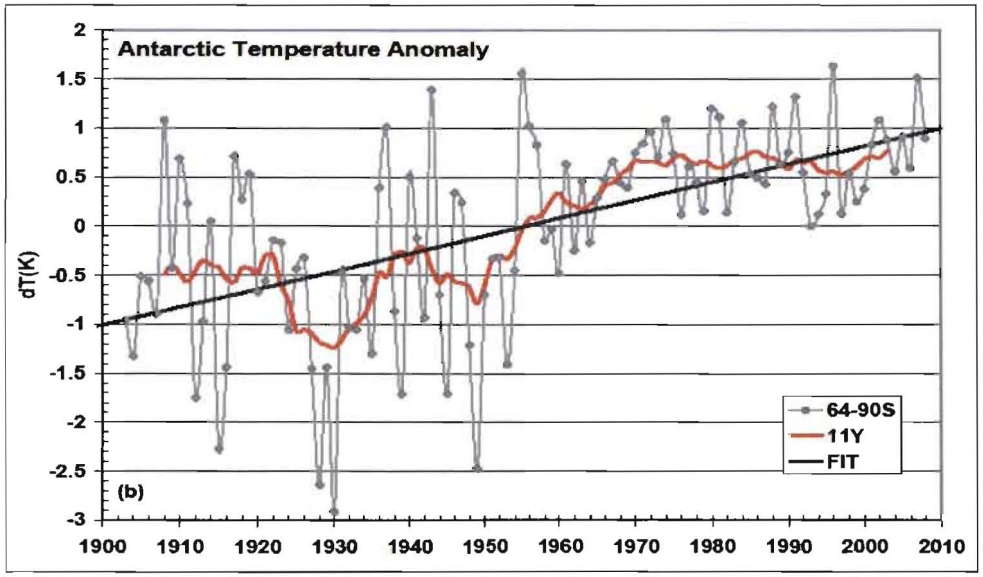
Latitudinal distribution of the recent Arctic warming

Petr Chylek, Glen Lesins, Muyin Wang

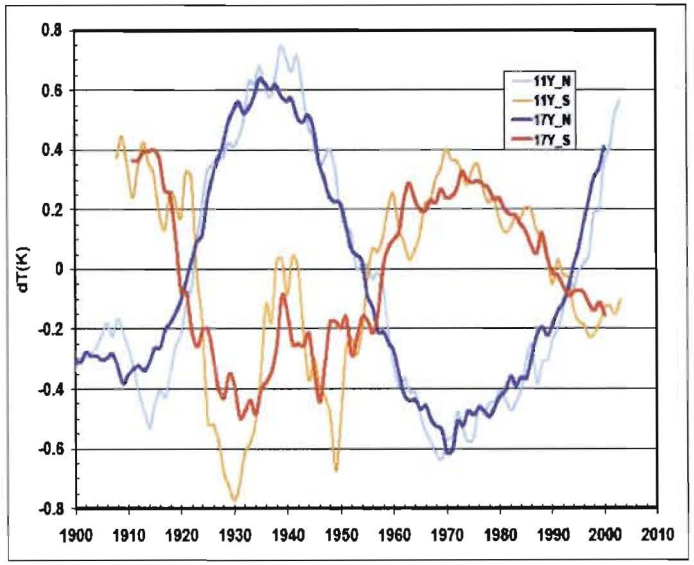
ABSTRACT

Increasing Arctic temperature, disappearance of Arctic sea ice, melting of the Greenland ice sheet, sea level rise, increasing strength of Atlantic hurricanes are these impending climate catastrophes supported by observations? Are the recent data really unprecedented during the observational records? Our analysis of Arctic temperature records shows that the Arctic and temperatures in the 1930s and 1940s were almost as high as they are today. We argue that the current warming of the Arctic region is affected more by the multi-decadal climate variability than by an increasing concentration of carbon dioxide. Unfortunately, none of the existing coupled Atmosphere-Ocean General Circulation Models used in the IPCC 2007 climate change assessment is able to reproduce neither the observed 20th century Arctic climate variability nor the latitudinal distribution of the warming.





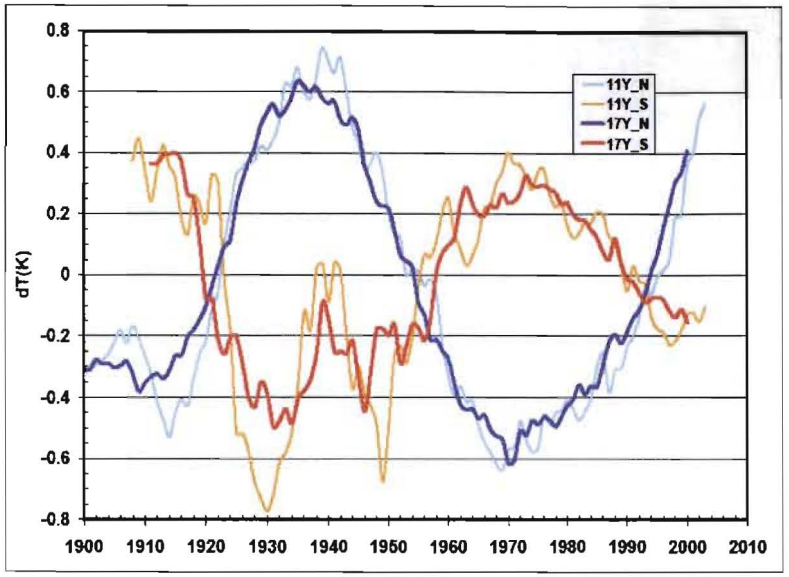
Polar temperature seesaw



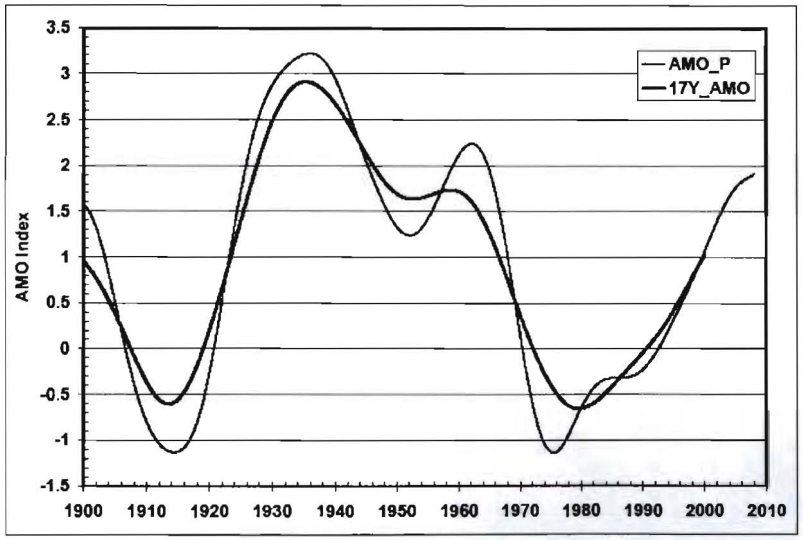
Detrended Arctic and Antarctic temperature

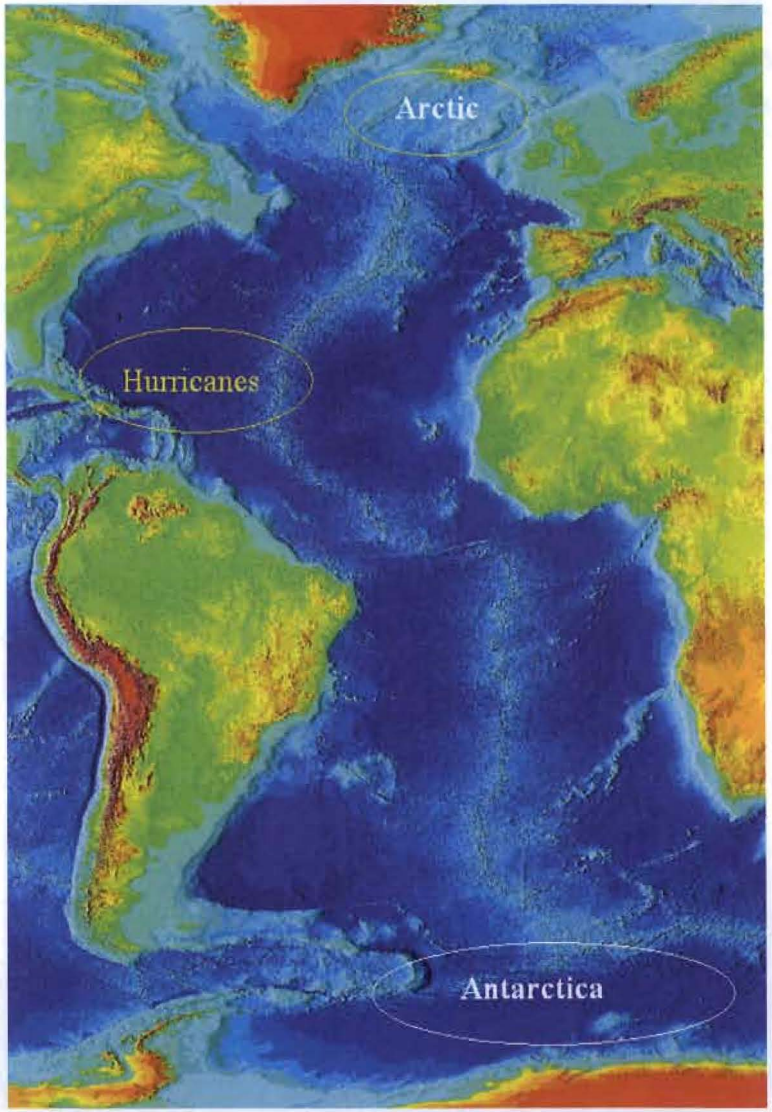
r = - 0.89

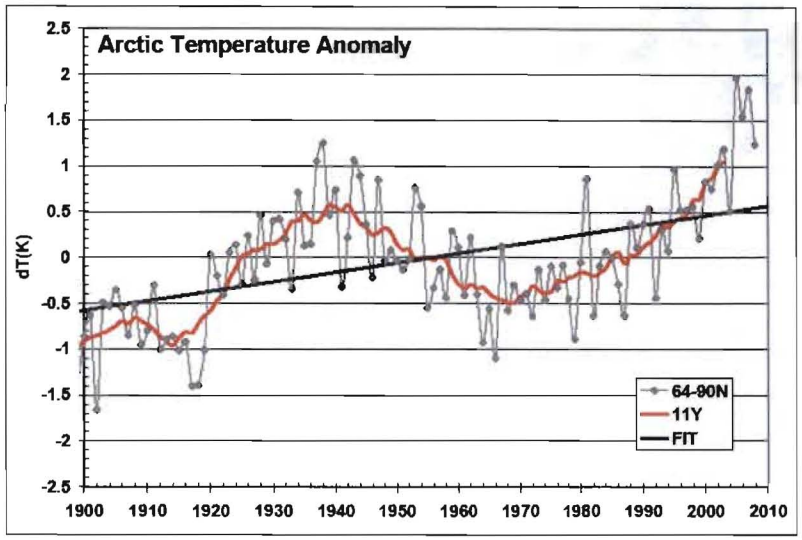
Polar temperatures and AMO



Atlantic Multi-decadal Oscillation



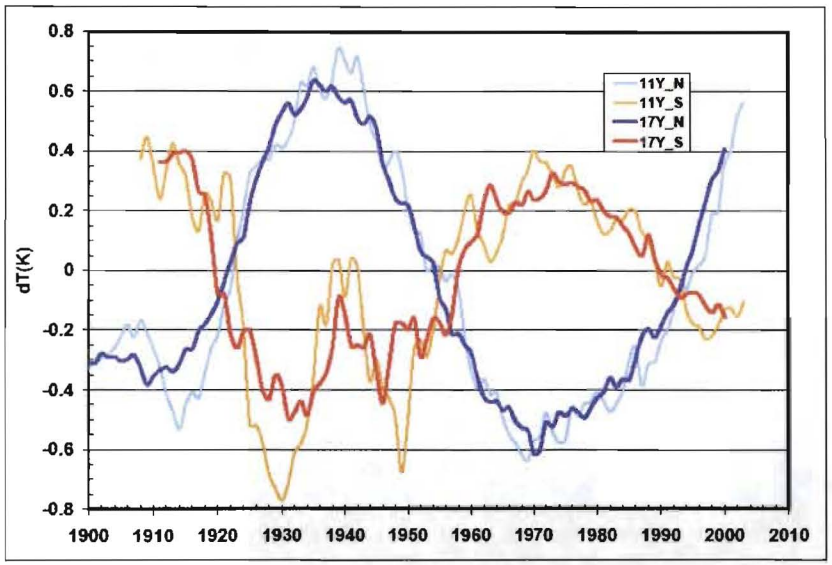




Arctic Warming 1970s-2000s

Linear trend contribution ~0.5K

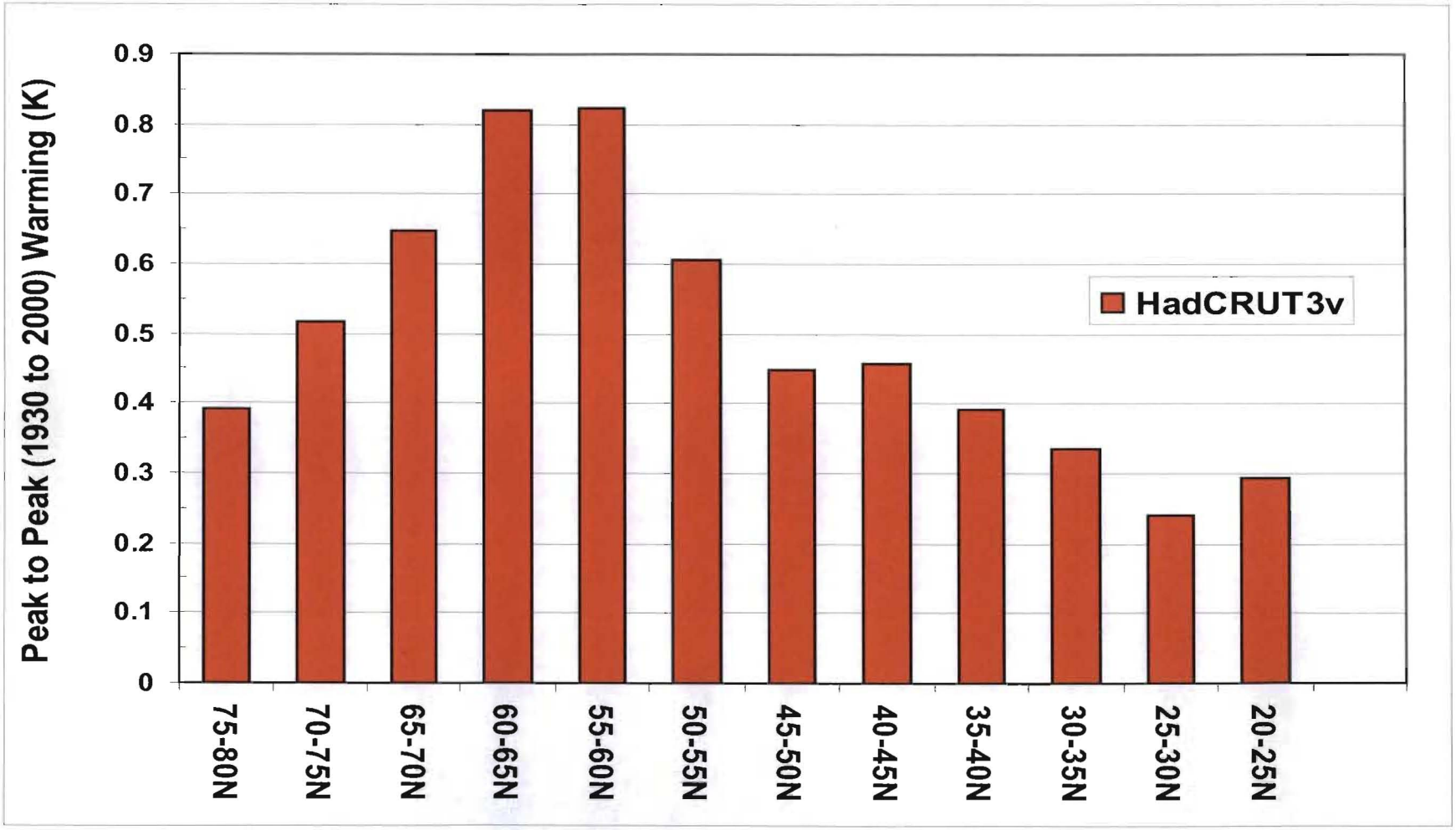
Multi-decadal variability ~1.0K



2/3 of the 1970-2000 warming is due to multi-decadal climate variability

1/3 due to other causes (GHGs,…)

Latitudinal Distribution of the 1940-2000 Warming



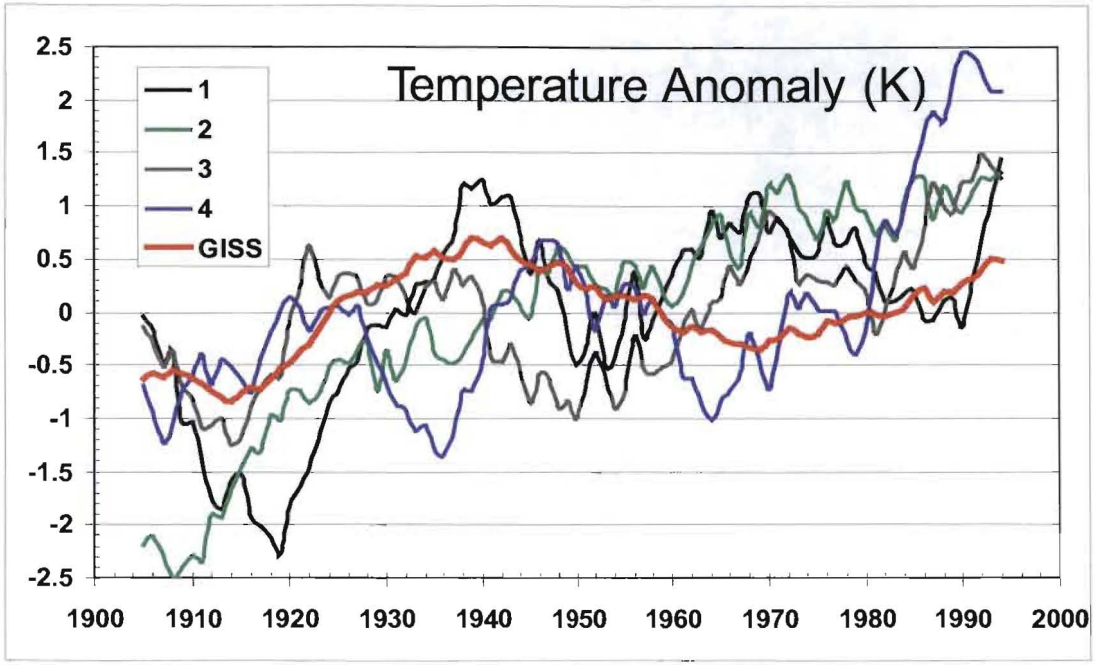
Observations

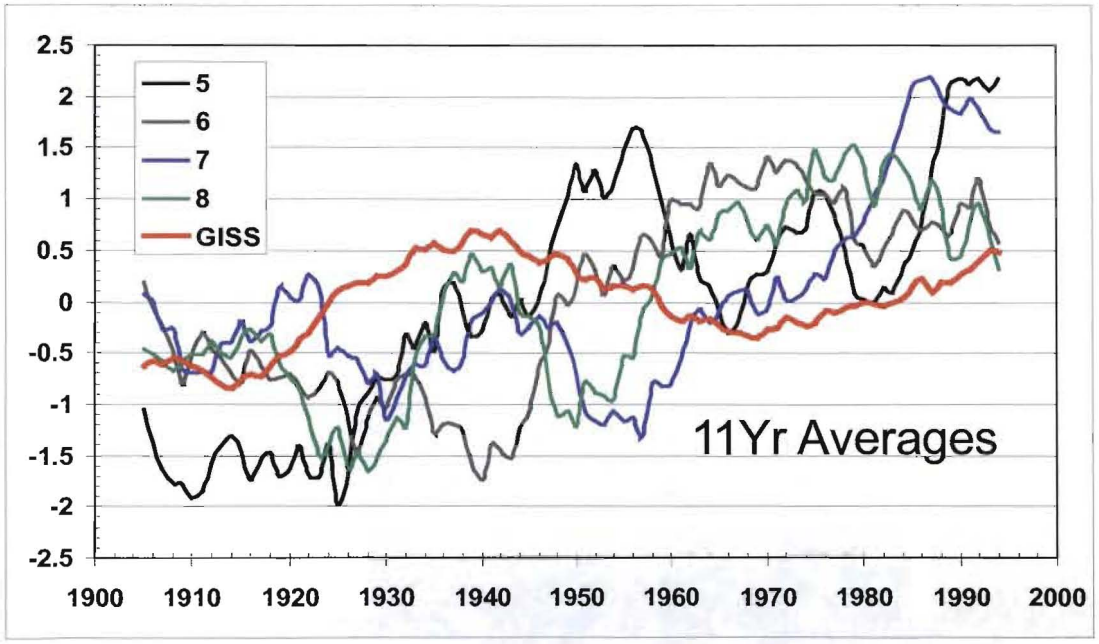
- 20th Century Arctic temperature **trend** (1900-1999) 0.80 K/century

- **Latitudinal distribution** of the1940-2000 warming peaks at 55-65 deg N

- De-trended Arctic temperature is highly correlated with the Atlantic **Multi-decadal** Oscillation **(variability)** (AMO)

P. Chylek, C. Folland, G. Lesins, M. Dubey, Twentieth century bipolar seesaw of the Arctic and Antarctic surface air temperatures, GRL 37, 2010





Models CMIP3 IPCC 2007

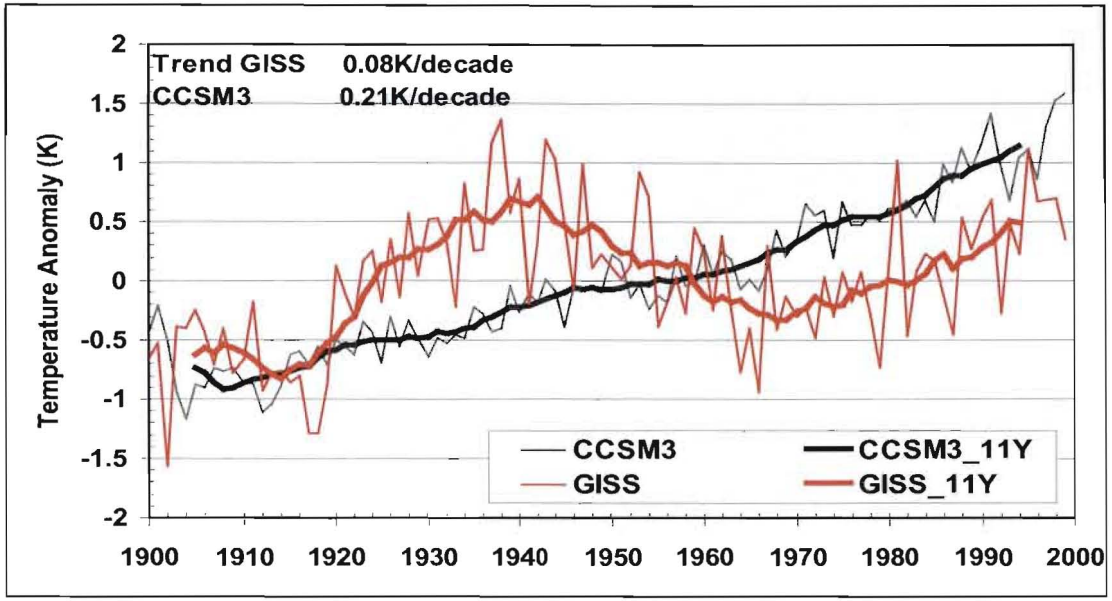
CMIP (Climate Model Intercomparison Project Phase 3)

Models better than average for Arctic (Wang et al 2007)

Presented results for CCSM3 (NCAR Atmosphere GCM+ LANL Ocean Model)

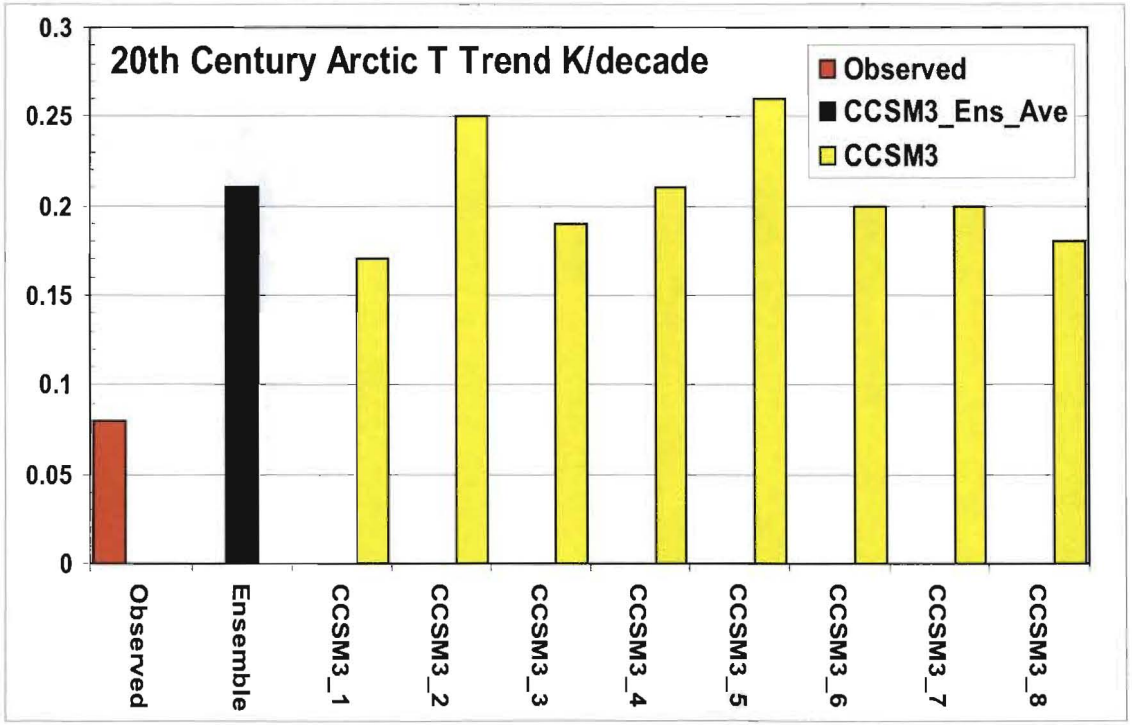
Eight simulations of the 20th Century temperature forced by known 20th century forcing (colors)

Compared to NASA GISS observed data (red)



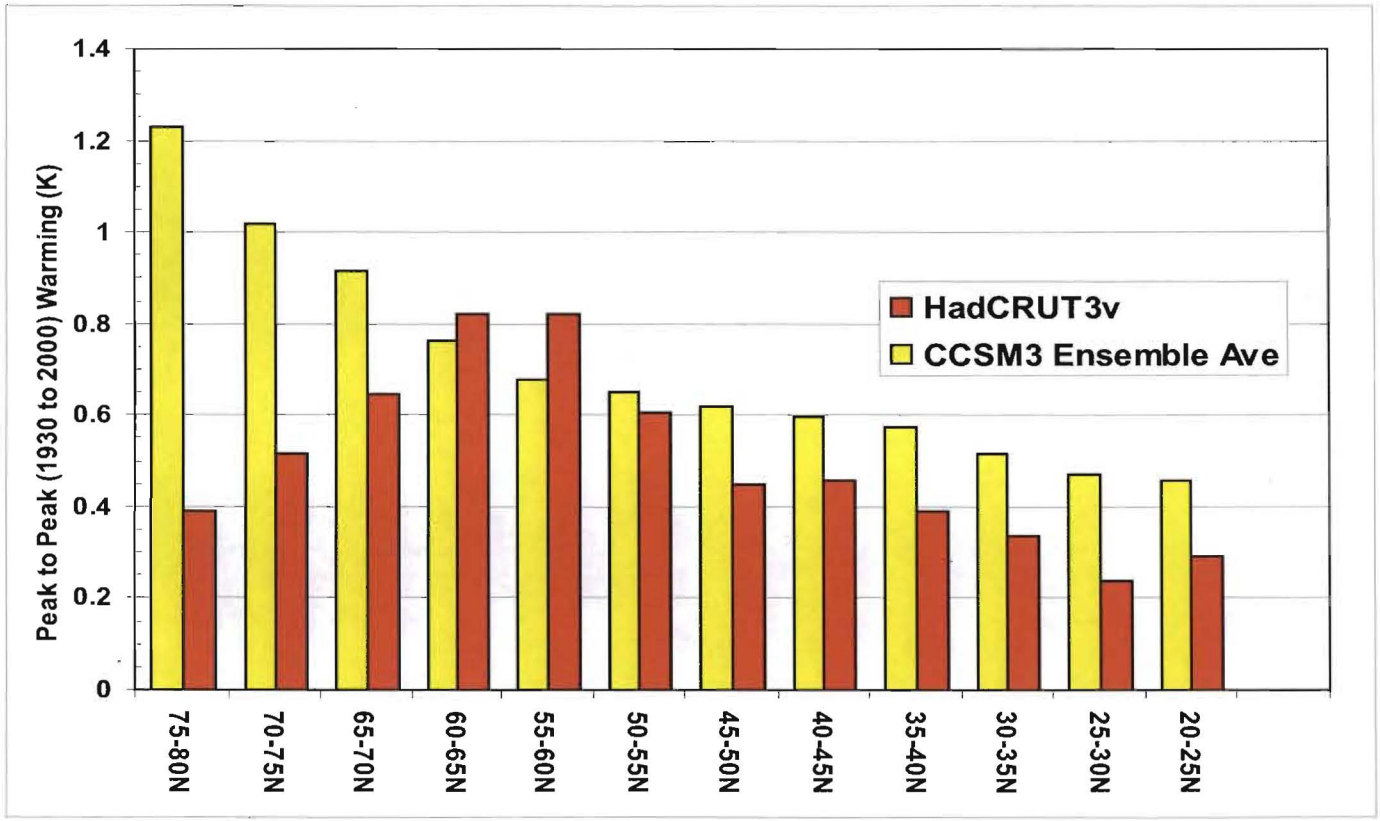
20th century temperature trend

Observed trend 0.08K/decade (red)



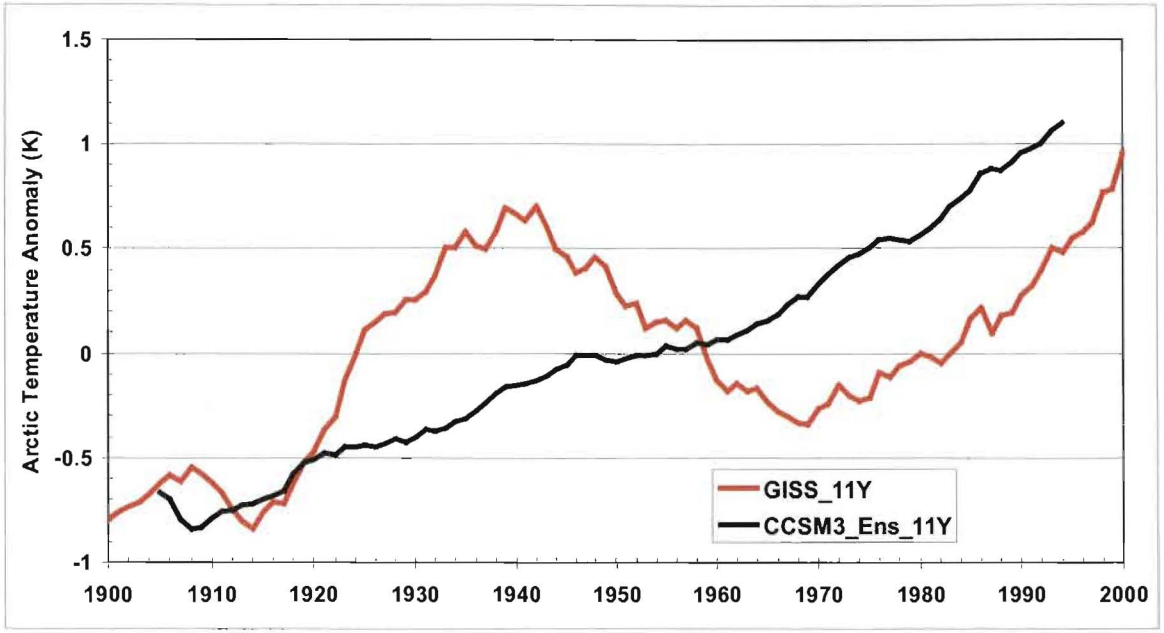
CCSM3 Model Ensemble Average trend 0.21K/decade (black)

Latitudinal 1940-2000 Warming Distribution



Observed (red)

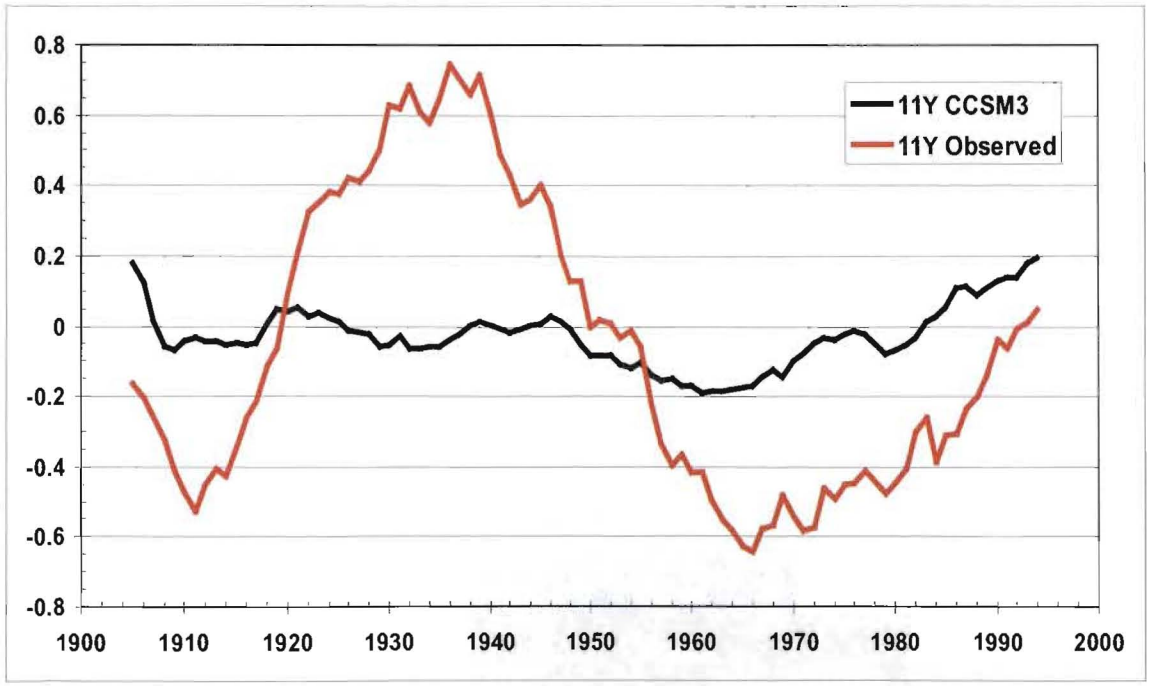
CCSM3 Model (yellow)



Multi-decadal variability

Observed temperature (red)

CCSM3 Model simulation (black)



De-trended observed temperature (red)

CCSM3 Model simulation (black)

Summary: Observations and Modeling

- 20th Century Arctic temperature **trend** 0.8 K/century
  MODEL: trend 2.1K/century

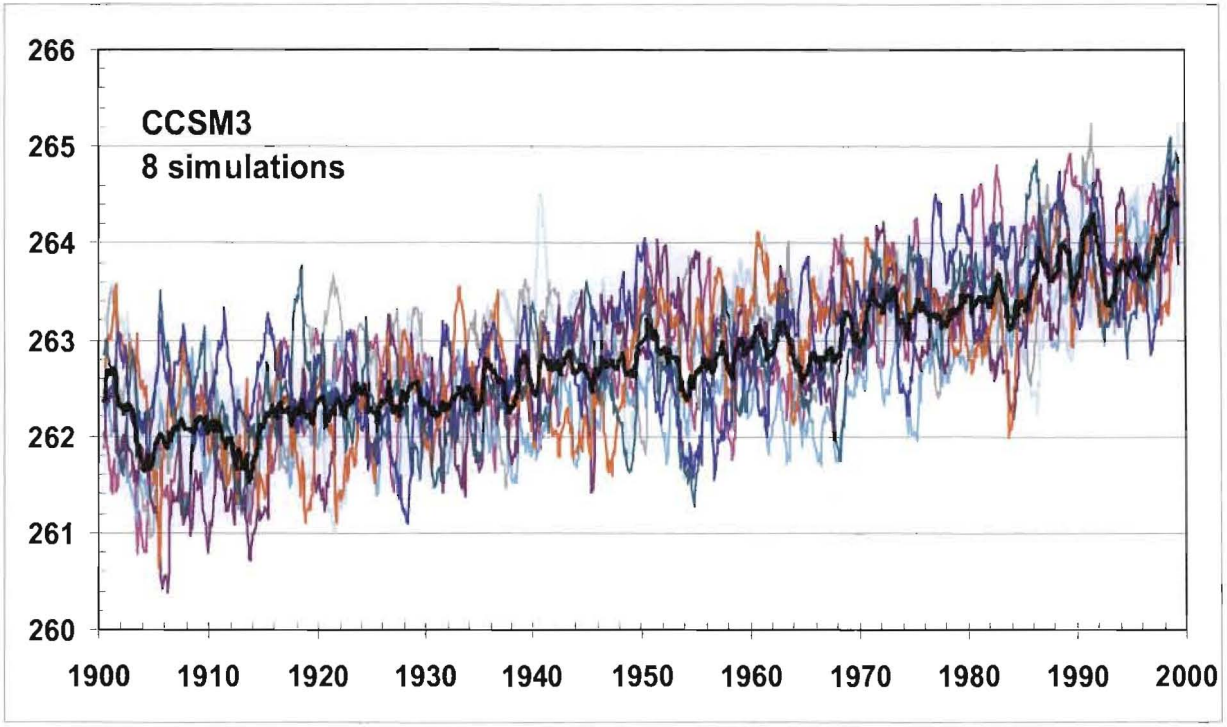
- **Latitudinal distribution** of the1940-2000 warming peaks at 55-65 deg and decreases northward
  MODEL: 1940-2000 warming peaks at high N latitudes

- De-trended Arctic temperature is highly correlated with the Atlantic **Multi-decadal Oscillation** (AMO)
  MODEL: No multi-decadal variability

CONCLUSION

(1) Current AOGCMs (CMIP3 IPPC 2007) cannot reproduce 20th century Arctic temperature variability

(2) AOGCMs need a considerable improvement before they can provide any realistic projections of the future Arctic climate (CMIP5?)


CCSM3
8 simulations
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