

The 12th Russian-Norwegian Symposium  
Ecosystem dynamics and optimal long term harvest  
in the Barents sea fisheries



# Cyclic changes of climate and major commercial stocks of Barents Sea

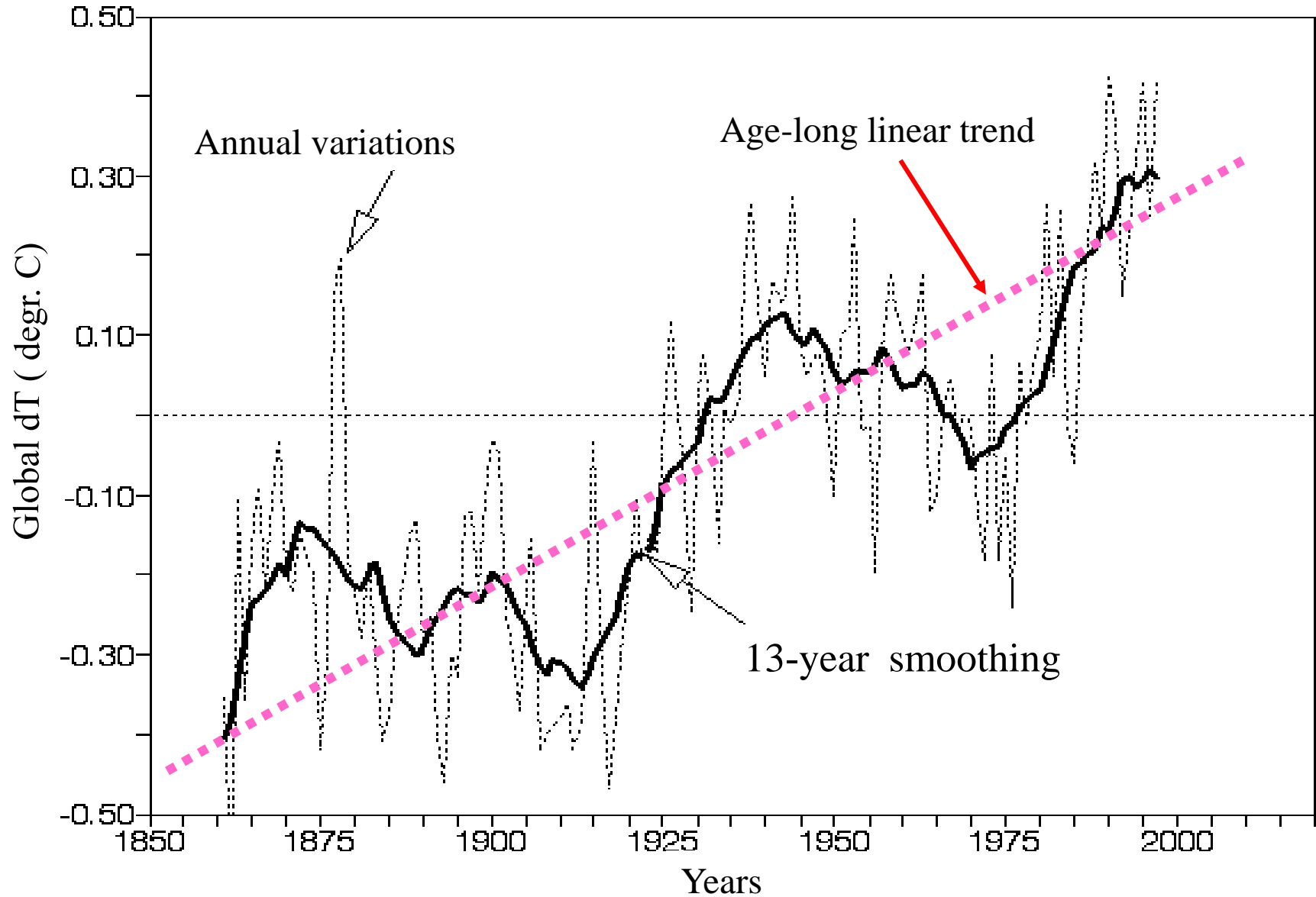
*L. Klyashtorin\**, *V. Borisov\** and *A. Lyubushin\*\**

*\* Russian Federal Research Institute of Fisheries and Oceanography (VNIRO)*

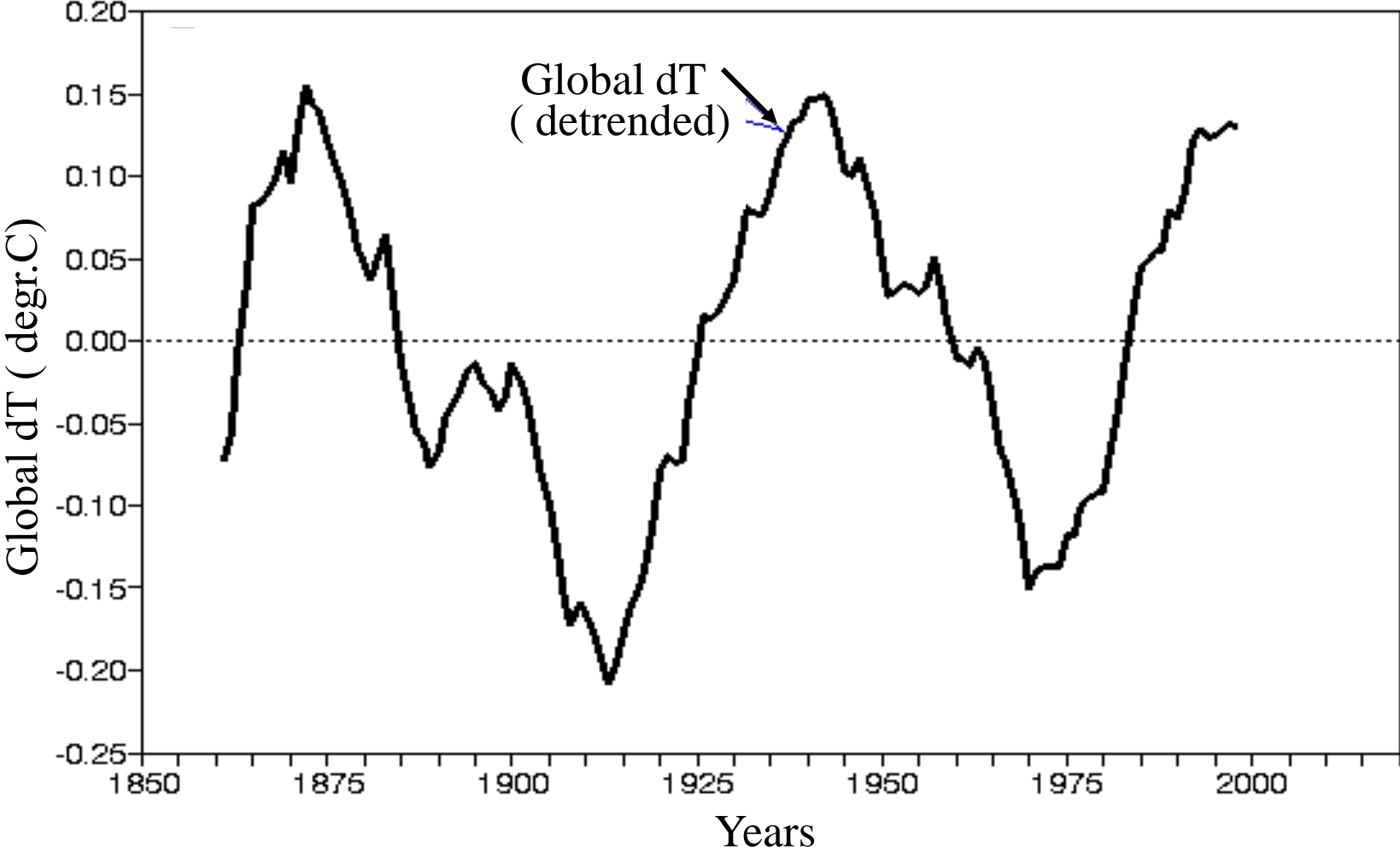
*\*\* Institute of Physics of the Earth, Russian Academy of Science*



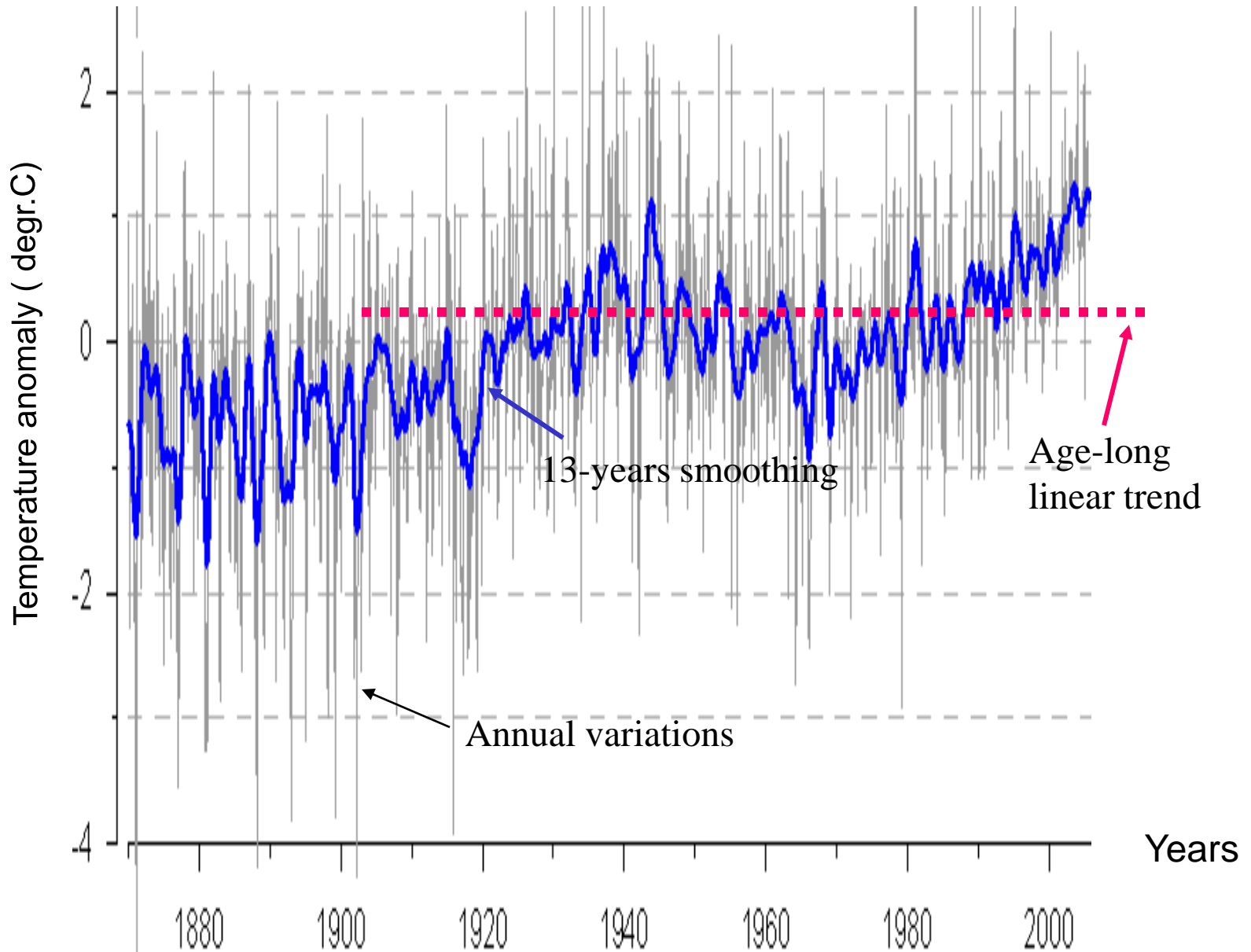
# Dynamics of surface air Global temperature anomaly (Global dT) 1861-2000 г.



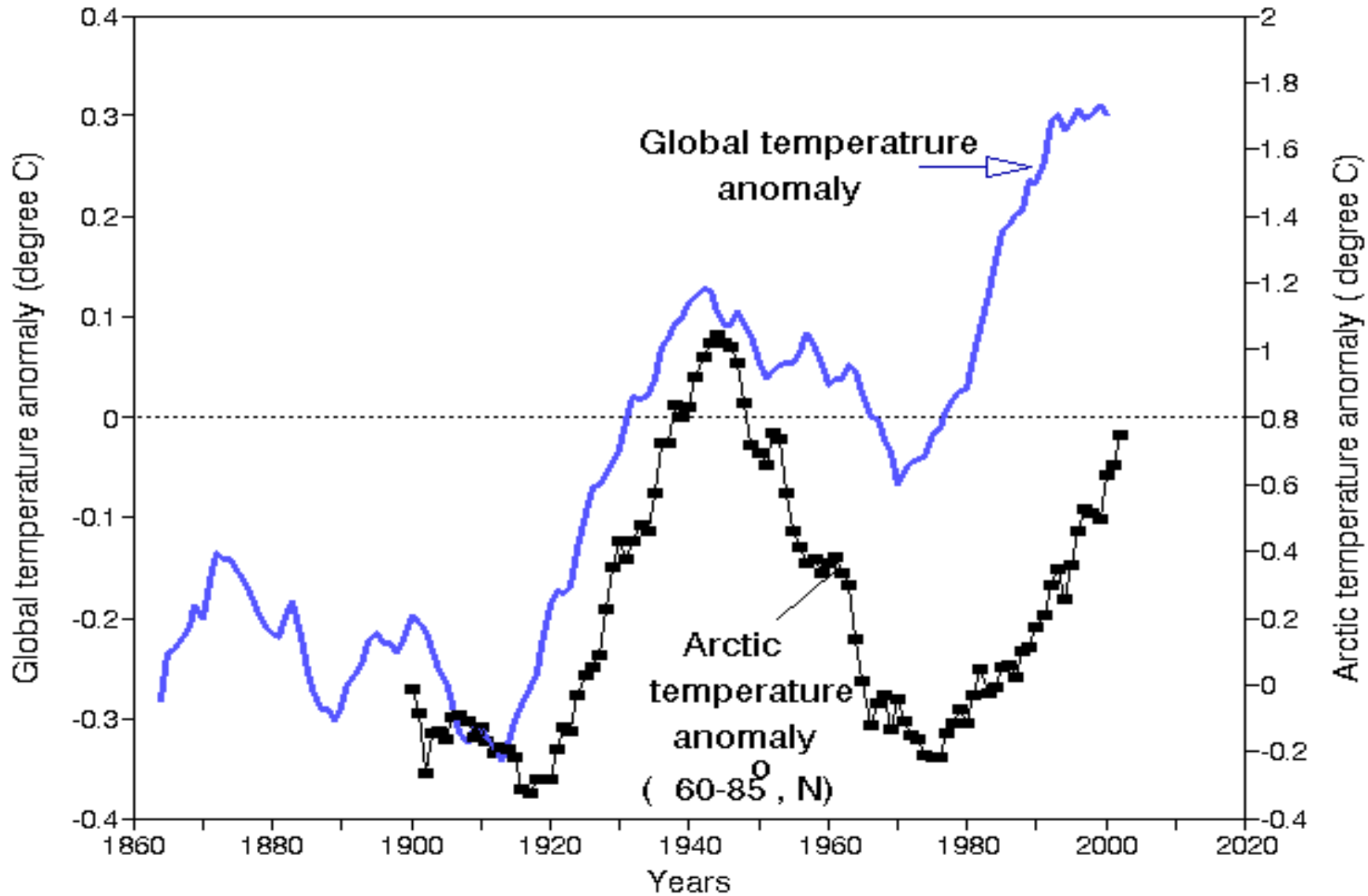
### Dynamics of detrended Global dT, 1861- 2000



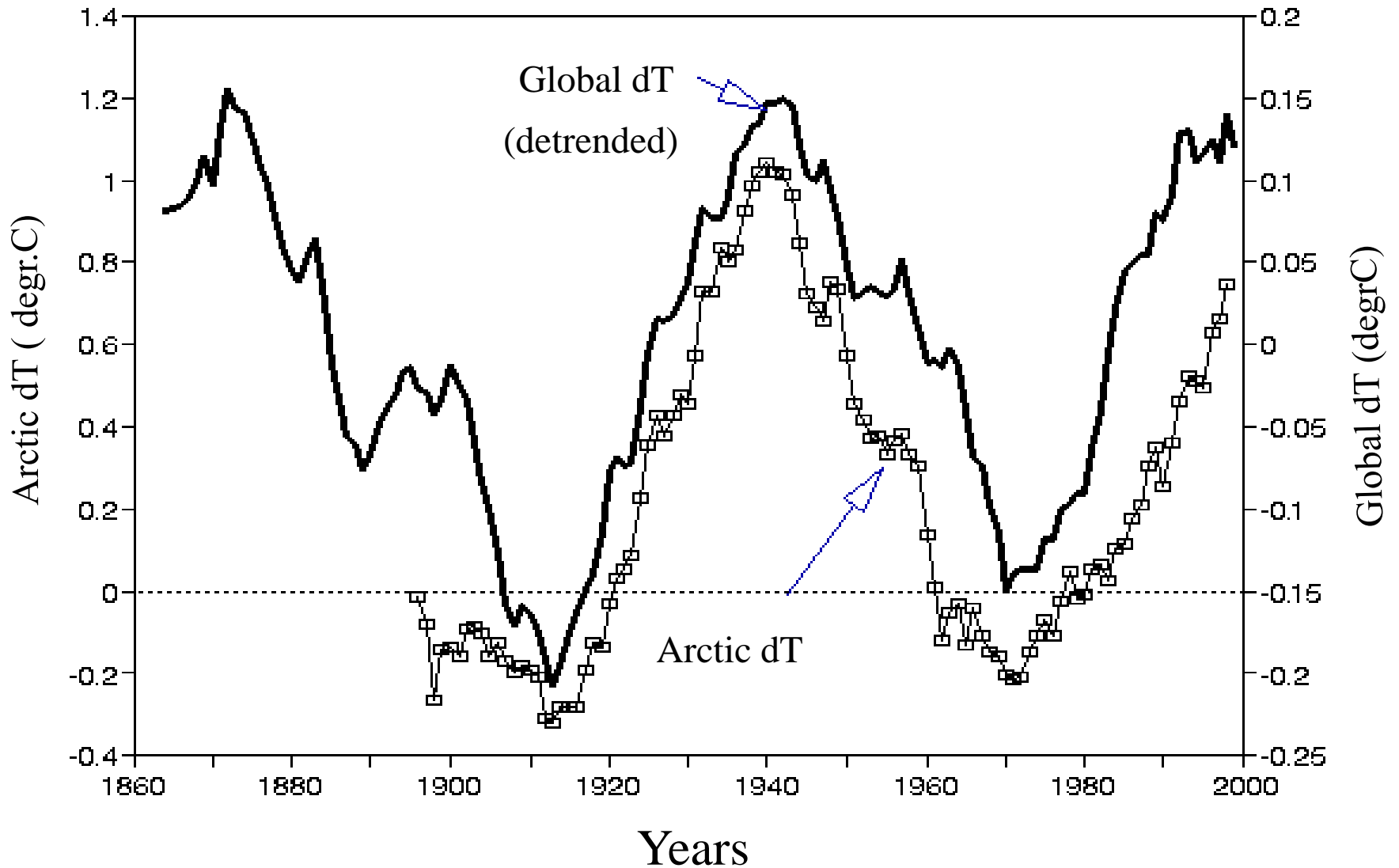
# Temperature dynamics of Arctic region ( 75-90° N) for the last 145 years (data of Hadley Centre)



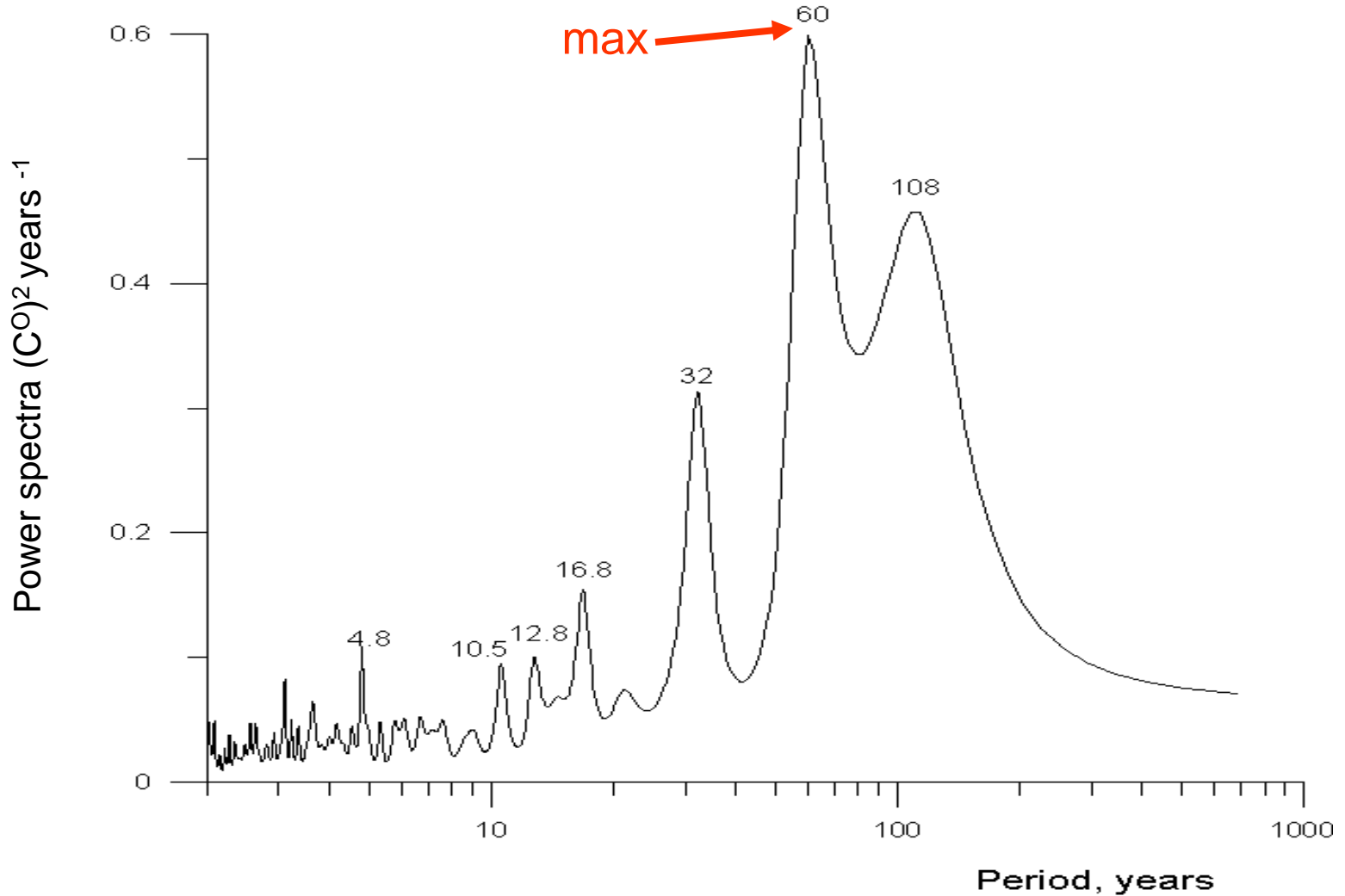
# Comparative dynamics of Arctic temperature anomaly (Arctic dT) and Global temperature anomaly (Global dT)



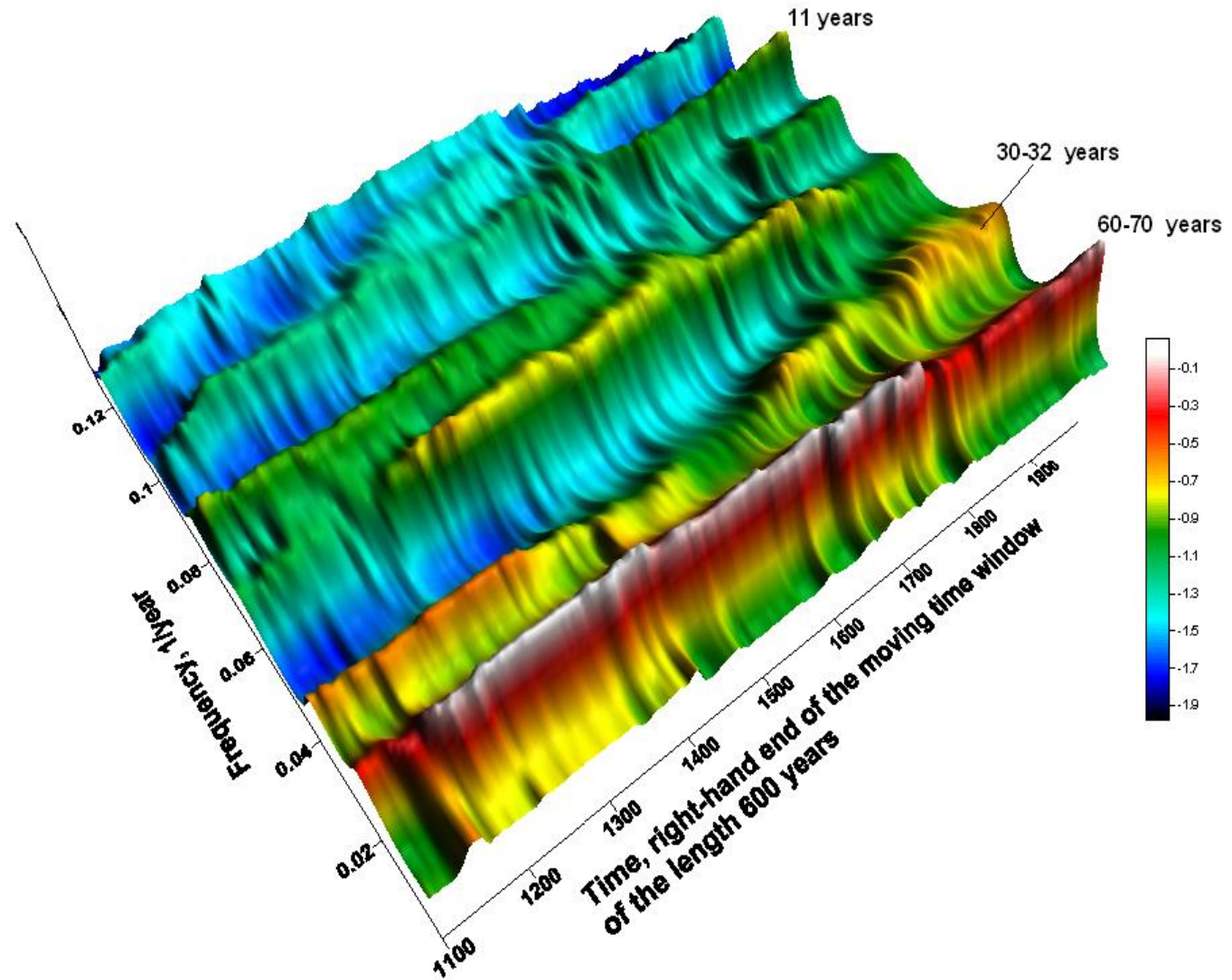
**Comparative dynamics of Arctic dT (zone of 60-85°N)  
and detrended Global dT (13-year smoothing)**



# Spectrum of periodical temperature fluctuation for 1400 years by Arctic pine tree rings



# 3-D diagram of periodical temperature fluctuations for 1400 years as analysed by Arctic pine tree rings

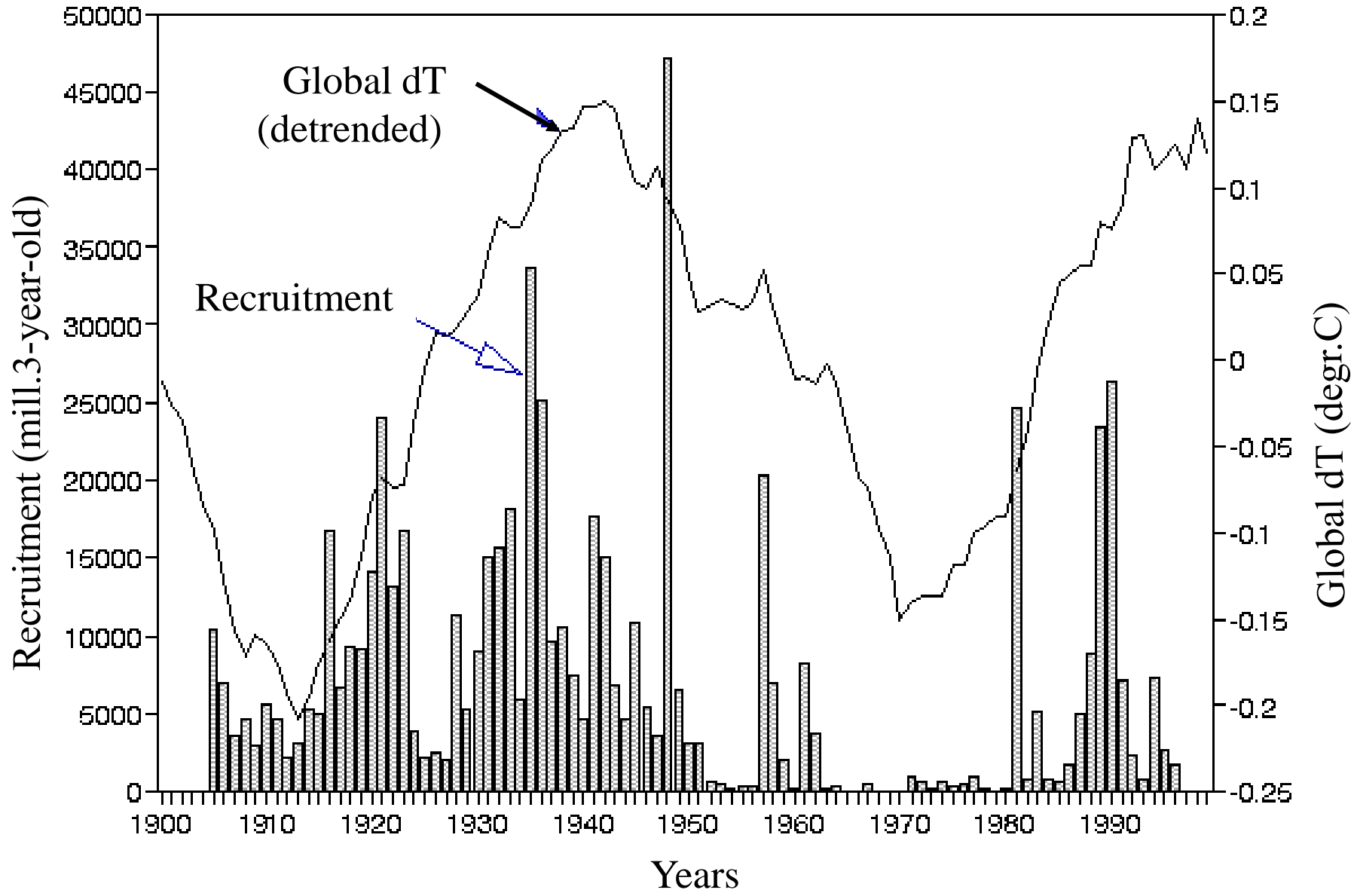




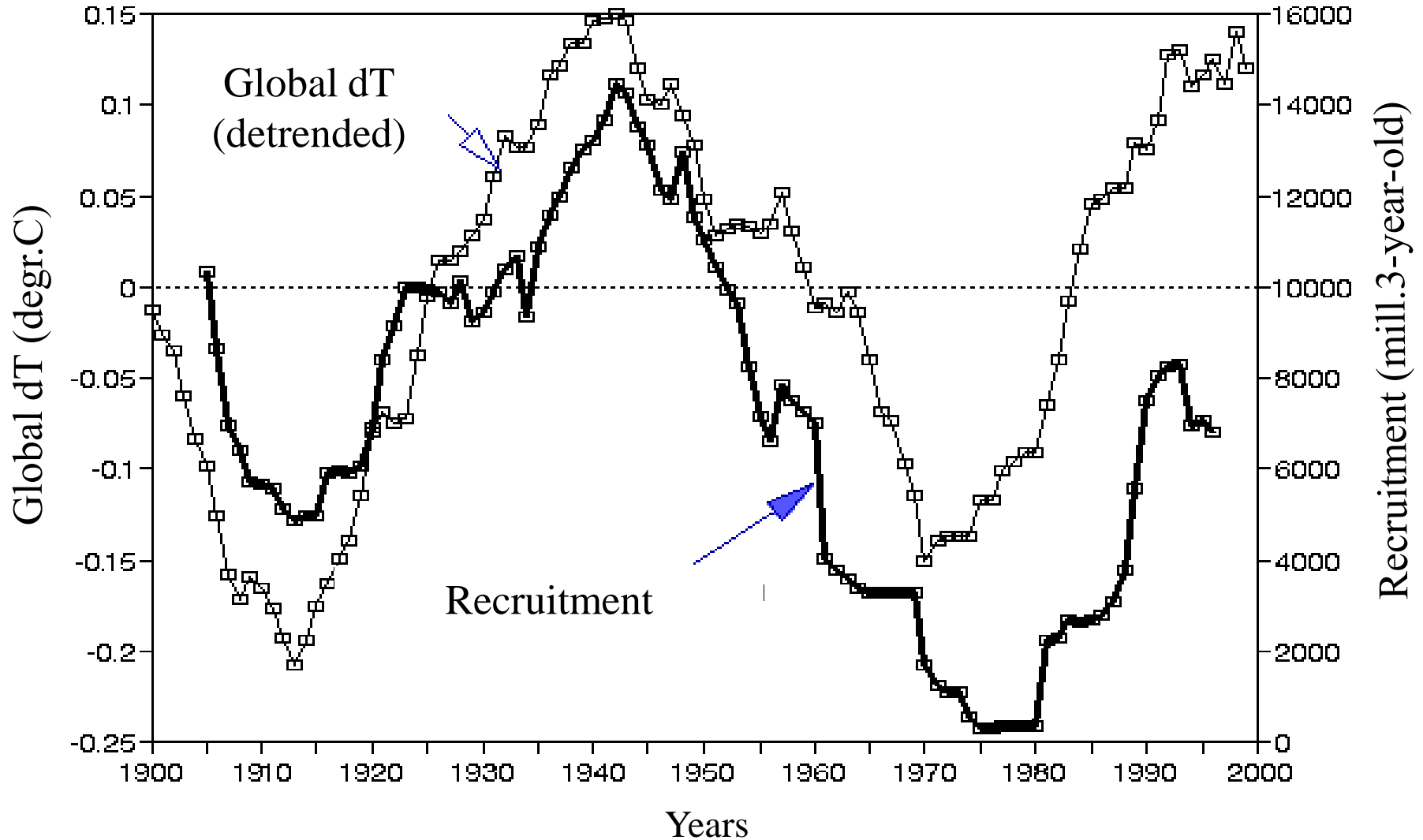
## Dominant periodicity in investigated time series within the frequency range of 20-100 years

<b>Title of time series</b>	<b>Time series ( years)</b>	<b>Primary (dominant) peaks (years)</b>	<b>Secondary peaks ( years)</b>
<b>Greenland Ice cores</b>	<b>1422 (552-1973)</b>	<b>54</b>	<b>32</b>
<b>Arctic pine tree rings</b>	<b>1480 ( 500-1980)</b>	<b>60</b>	<b>32</b>
<b>Californian pine tree rings</b>	<b>1500 ( 479-1979)</b>	<b>76</b>	<b>32</b>
<b>Californian pine tree rings</b>	<b>8000 (-6000-1979)</b>	<b>55</b>	<b>20-35</b>
<b>Bottom sediments (Sardine)</b>	<b>1700 (270-1970)</b>	<b>57 and 76</b>	<b>33</b>
<b>Bottom sediments (Anchovy)</b>	<b>1700 (270-1970)</b>	<b>57</b>	<b>72 and 99</b>
<b>Global temperature anomaly (dT)</b>	<b>140 (1861-2000)</b>	<b>55</b>	<b>18</b>
<b>Atmospheric Circulation Index ( ACI)</b>	<b>110 ( 1891-2000)</b>	<b>50</b>	<b>19</b>

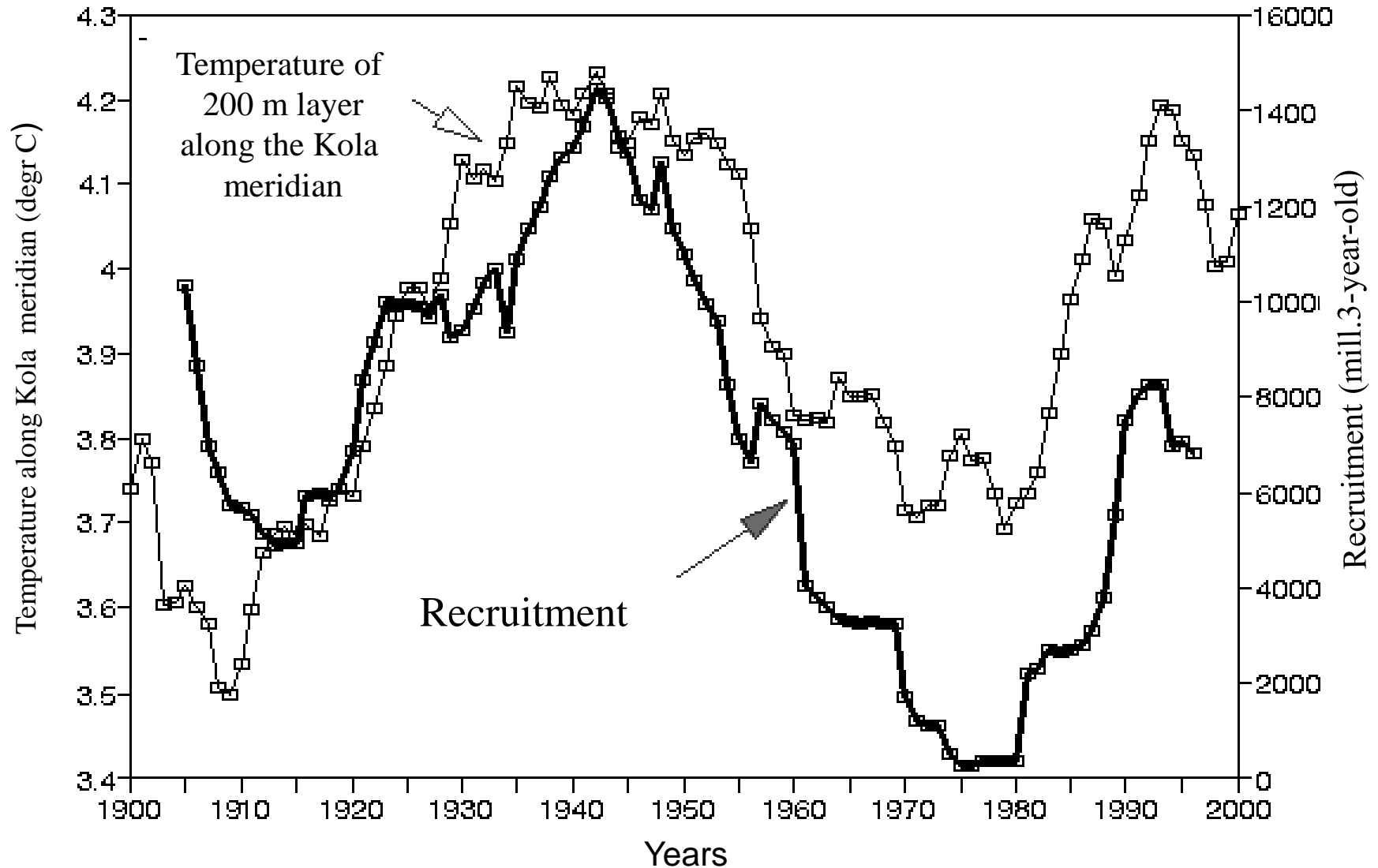
# Comparative dynamics of annual recruitment of Atlantic spring-spawning herring and detrended Global dT



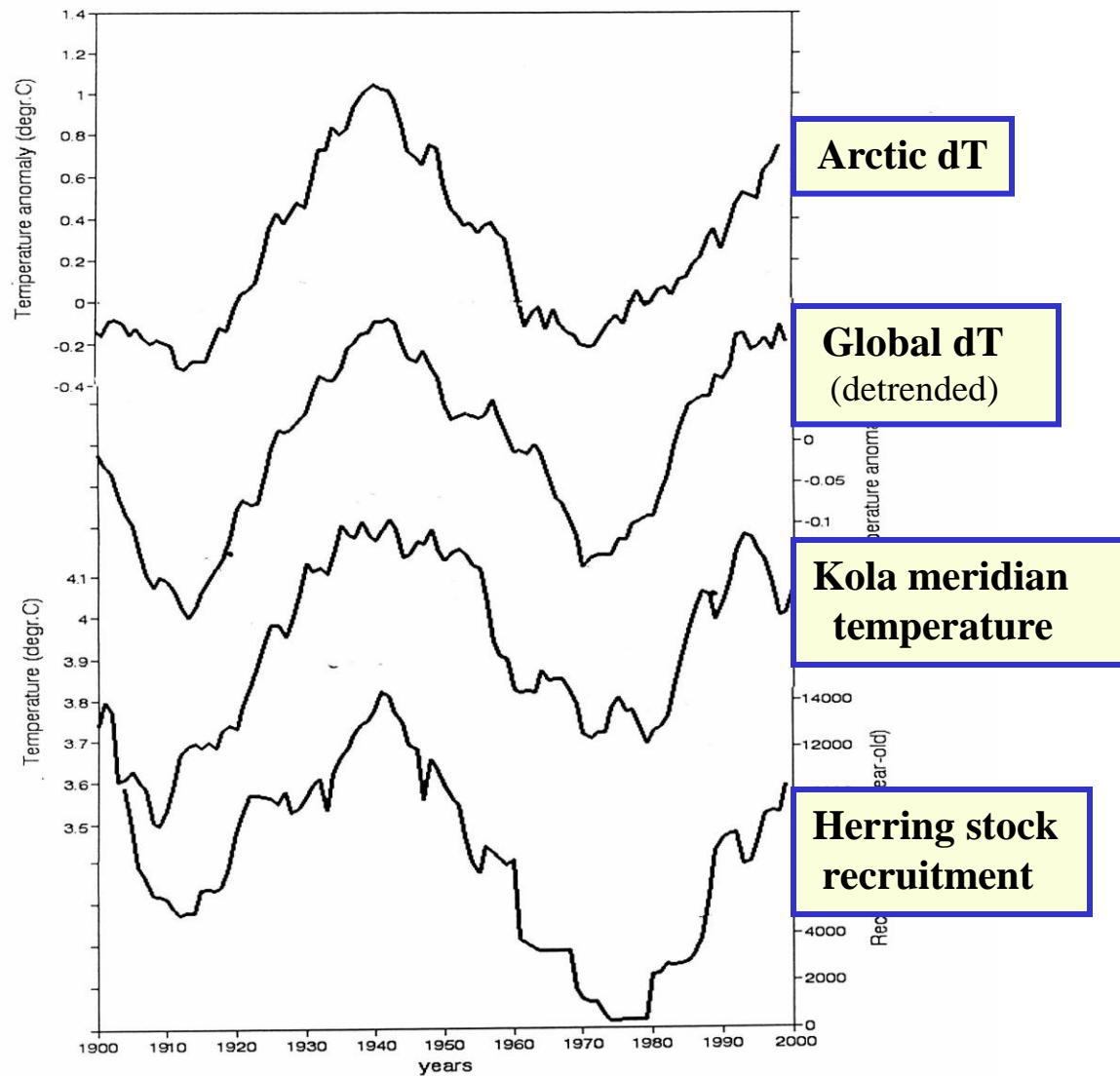
# Comparative dynamics of Atlantic spring-spawning herring recruitment and detrended Global dT (13-year smoothing)



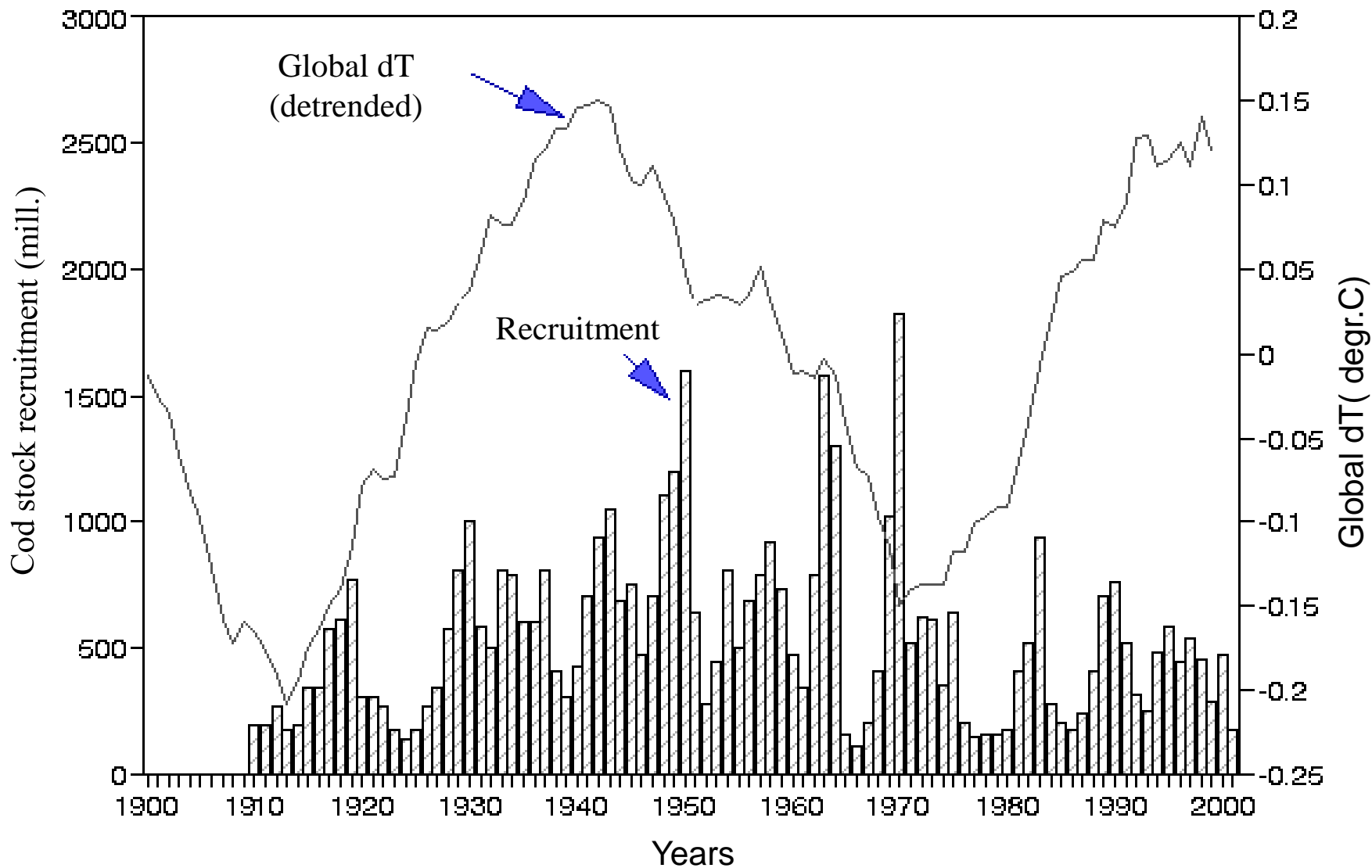
# Comparative dynamics of Atlantic spring-spawning herring recruitment and average temperature in the 200-m water column along the Kola meridian ( 13-year smoothing)



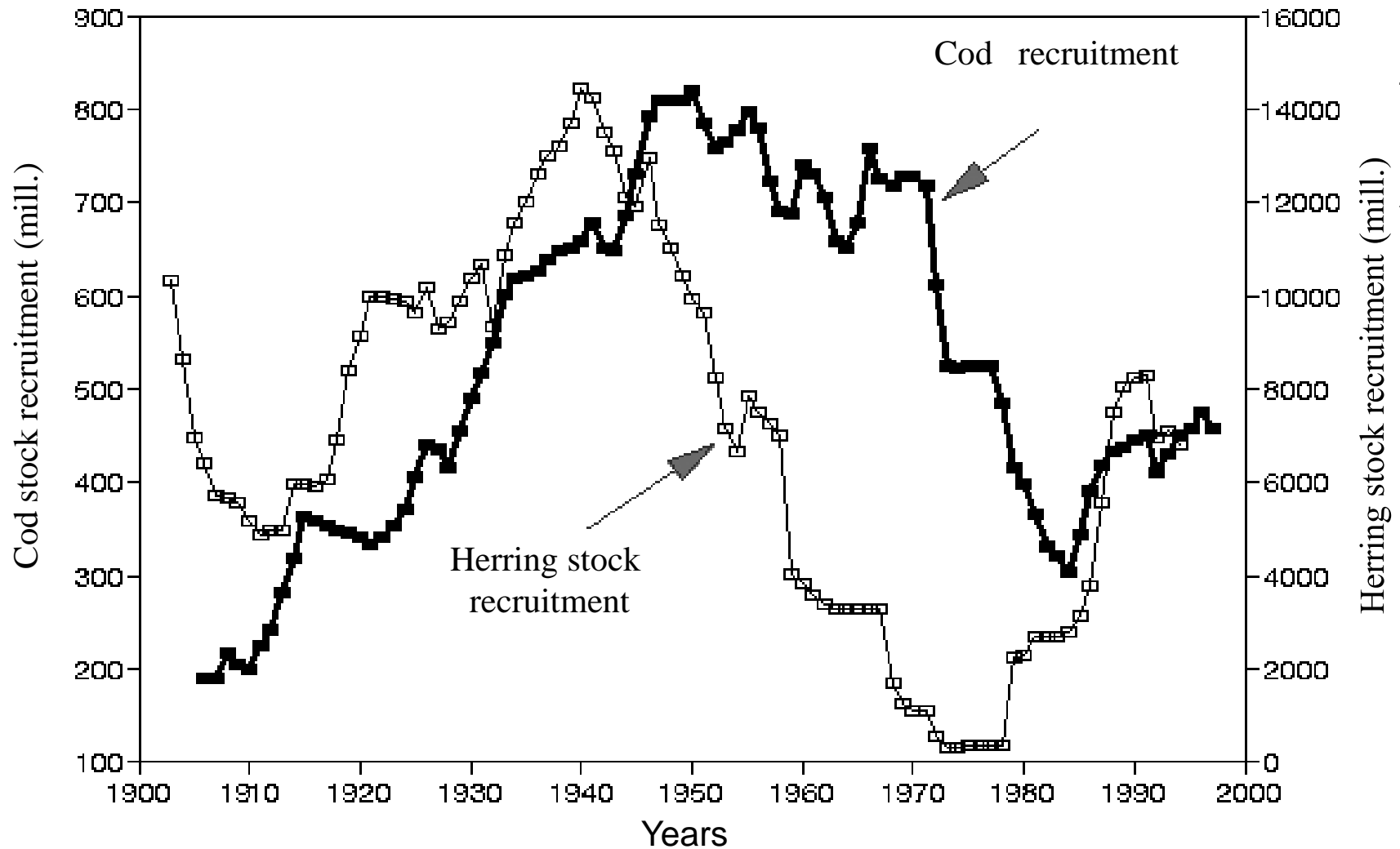
# Comparative dynamics of Arctic climatic indices and recruitment of Atlantic spring-spawning herring ( 13-year smoothing)



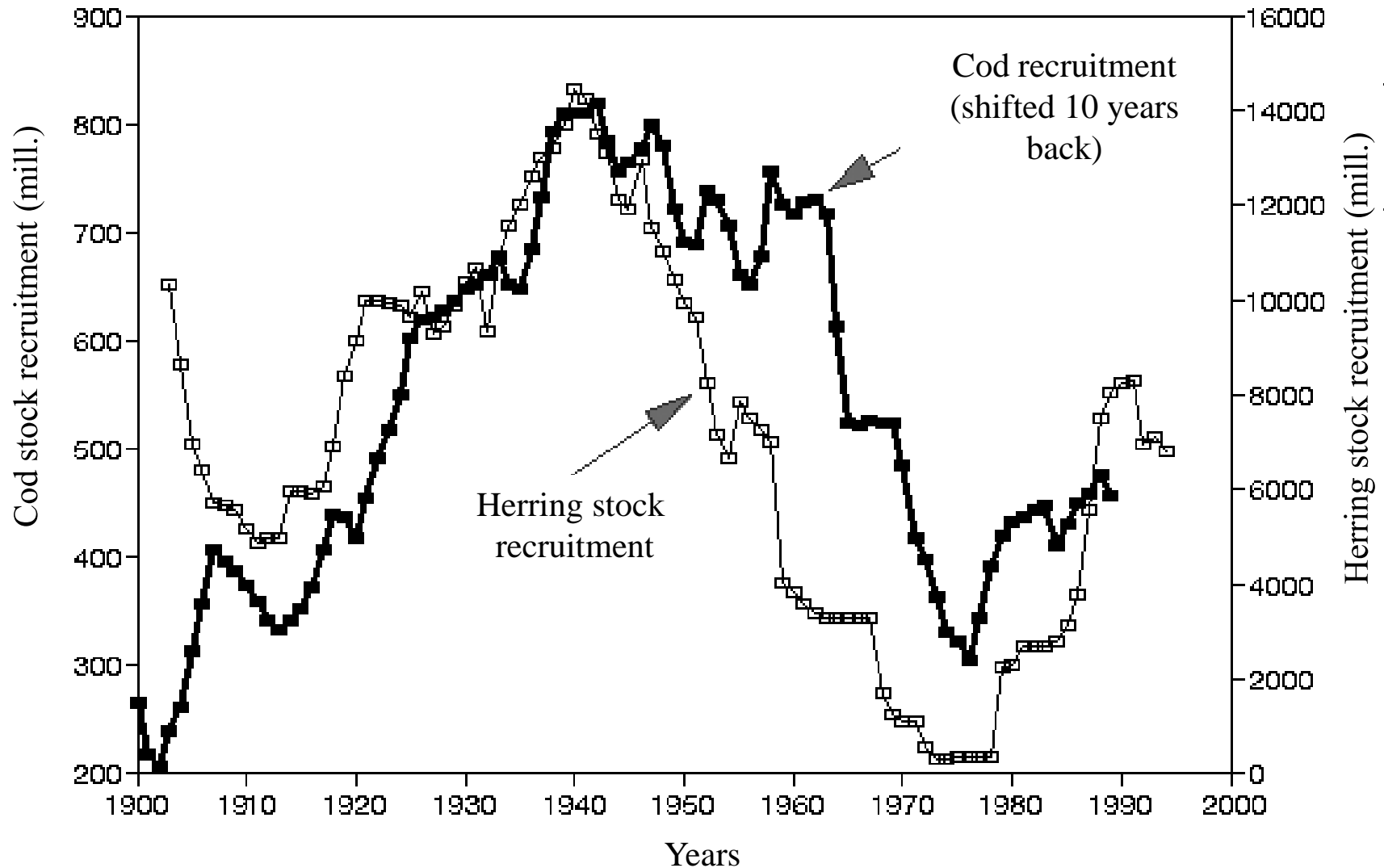
# Comparative dynamics of the North-East Arctic cod annual number of recruits and detrended Global dT



# Comparative dynamics of Atlantic spring-spawning herring and North-East Arctic cod recruitment (13-year smoothnig)

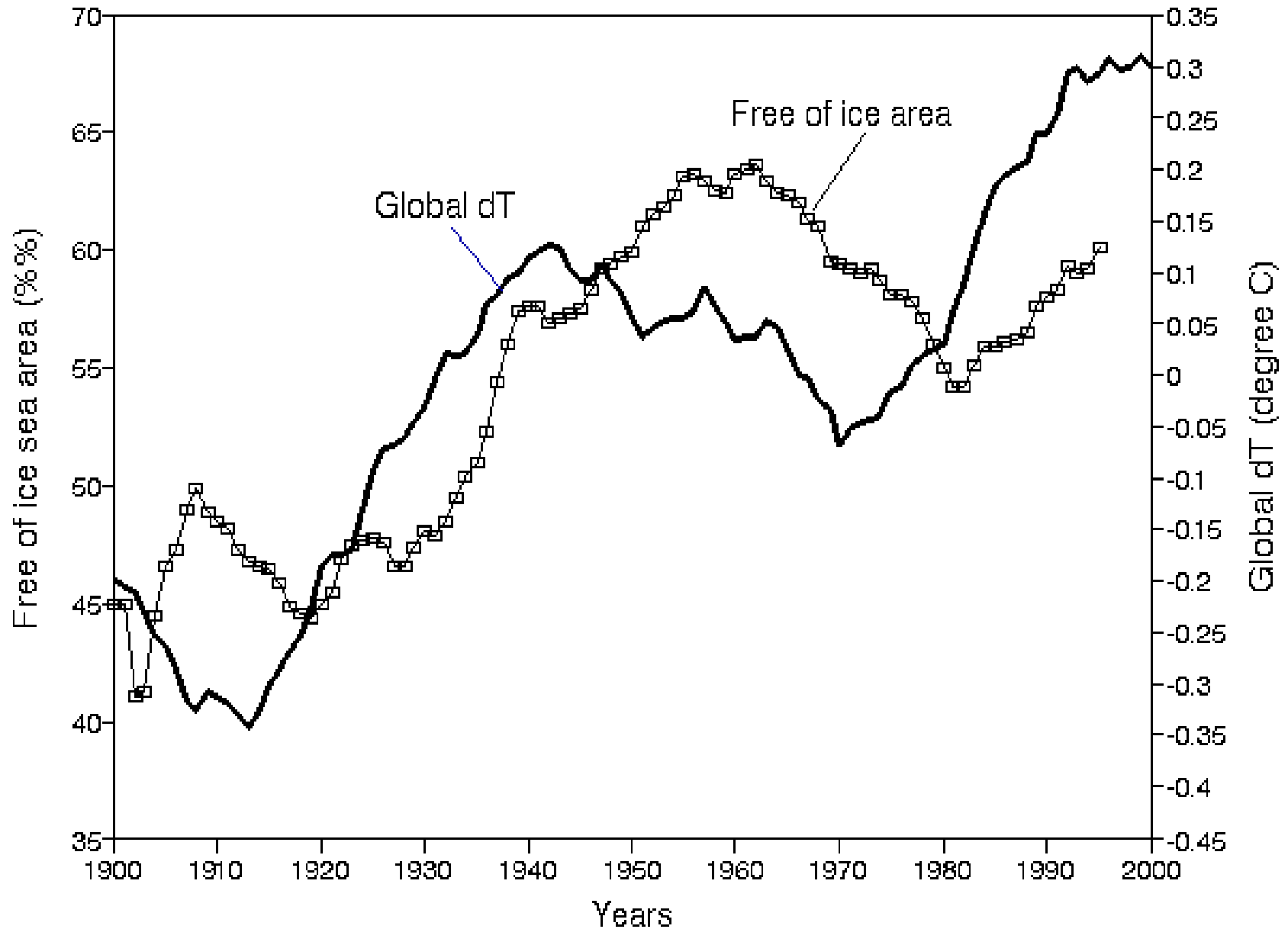


# Comparative dynamics of Atlantic spring-spawning herring and North-East Arctic cod recruitment shifted 10 years back (13-year smoothing)

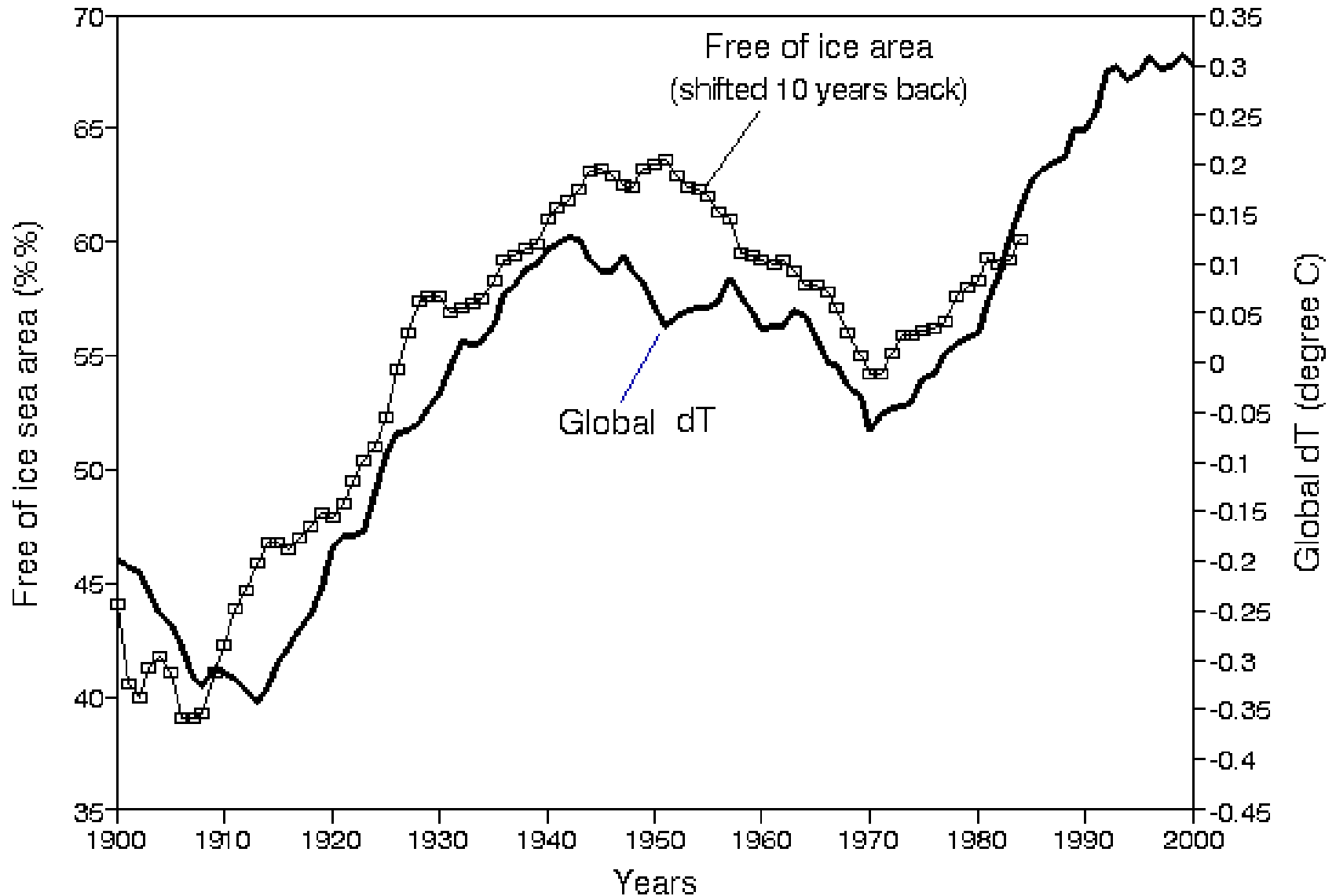




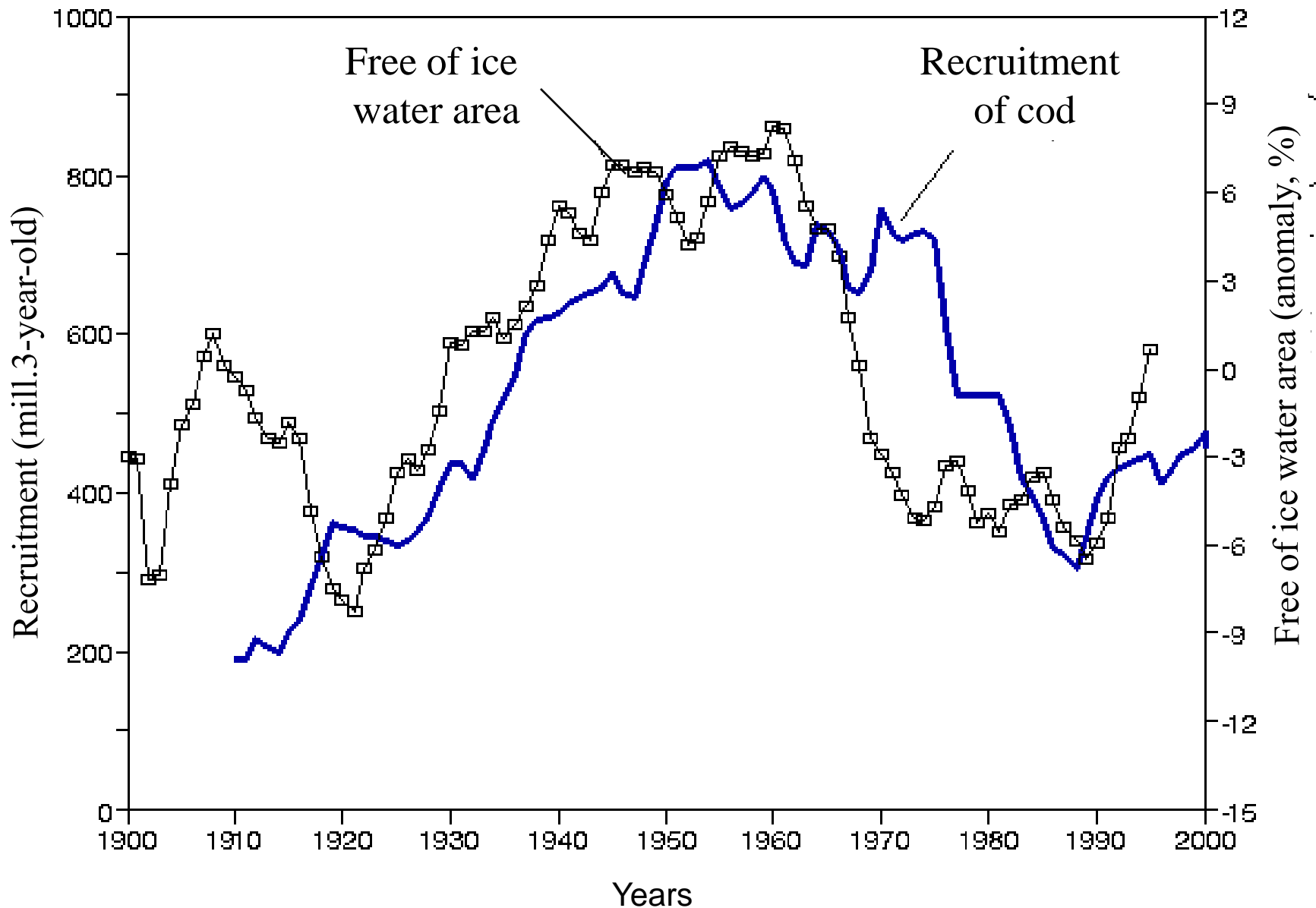
# Comparative dynamics of the Barents sea free of ice area and Global dT, (13-year smoothing)



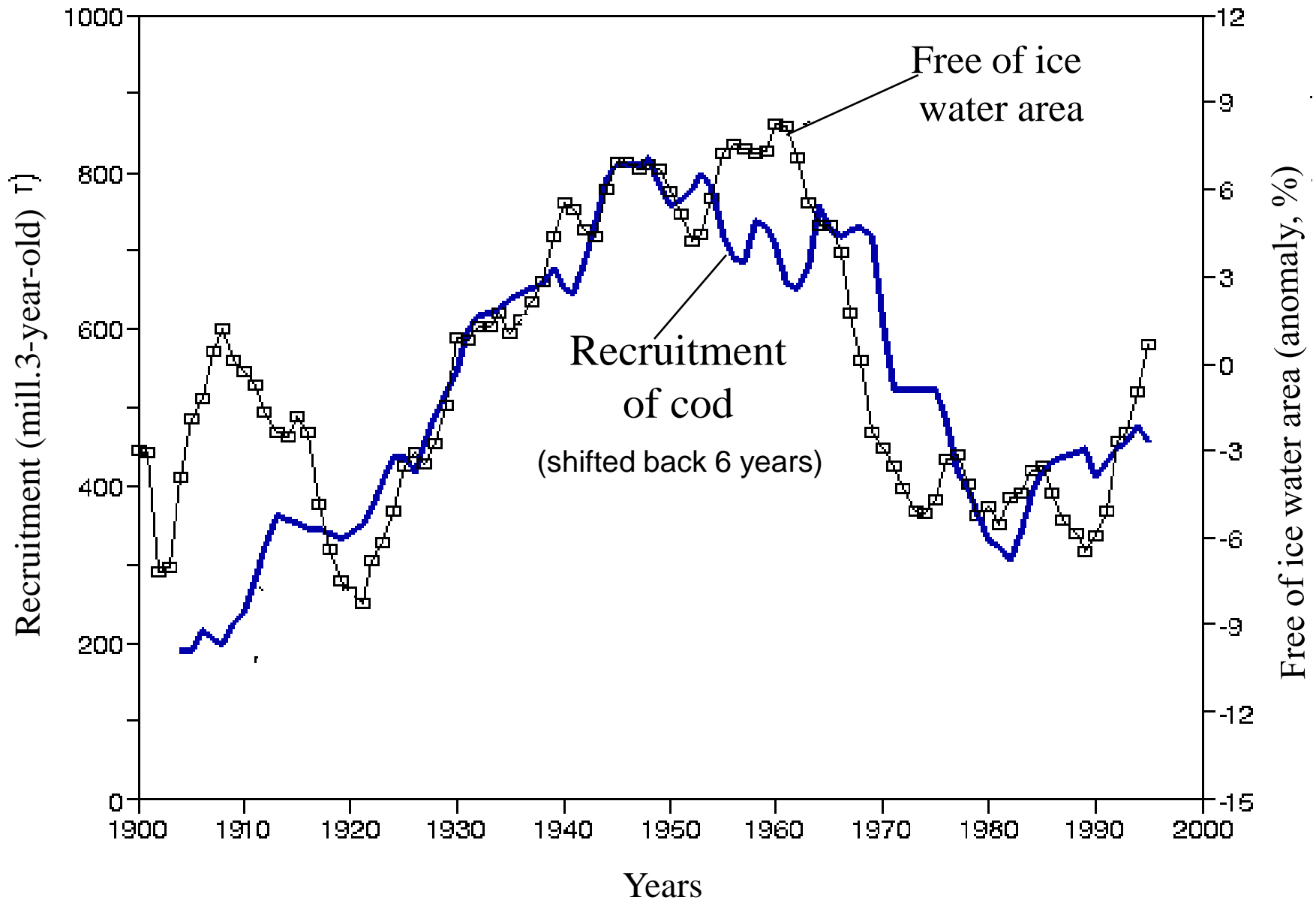
## Comparative dynamics of the Barents sea free of ice area shifted 10- years back and Global dT, (13-year smoothing)



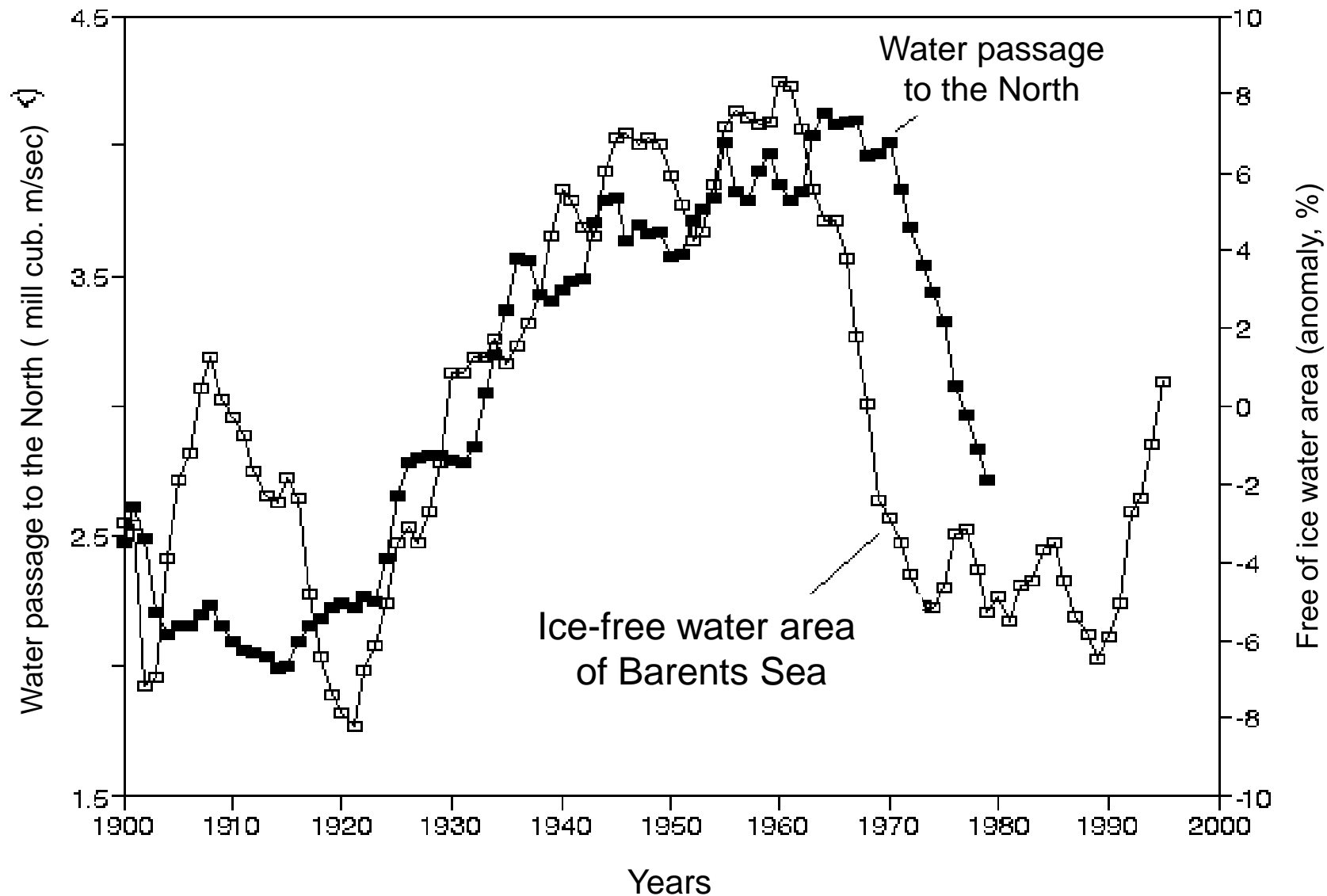
### Comparative dynamics of North-East Arctic cod recruitment and the Barents sea free of ice area (13-year smoothing)



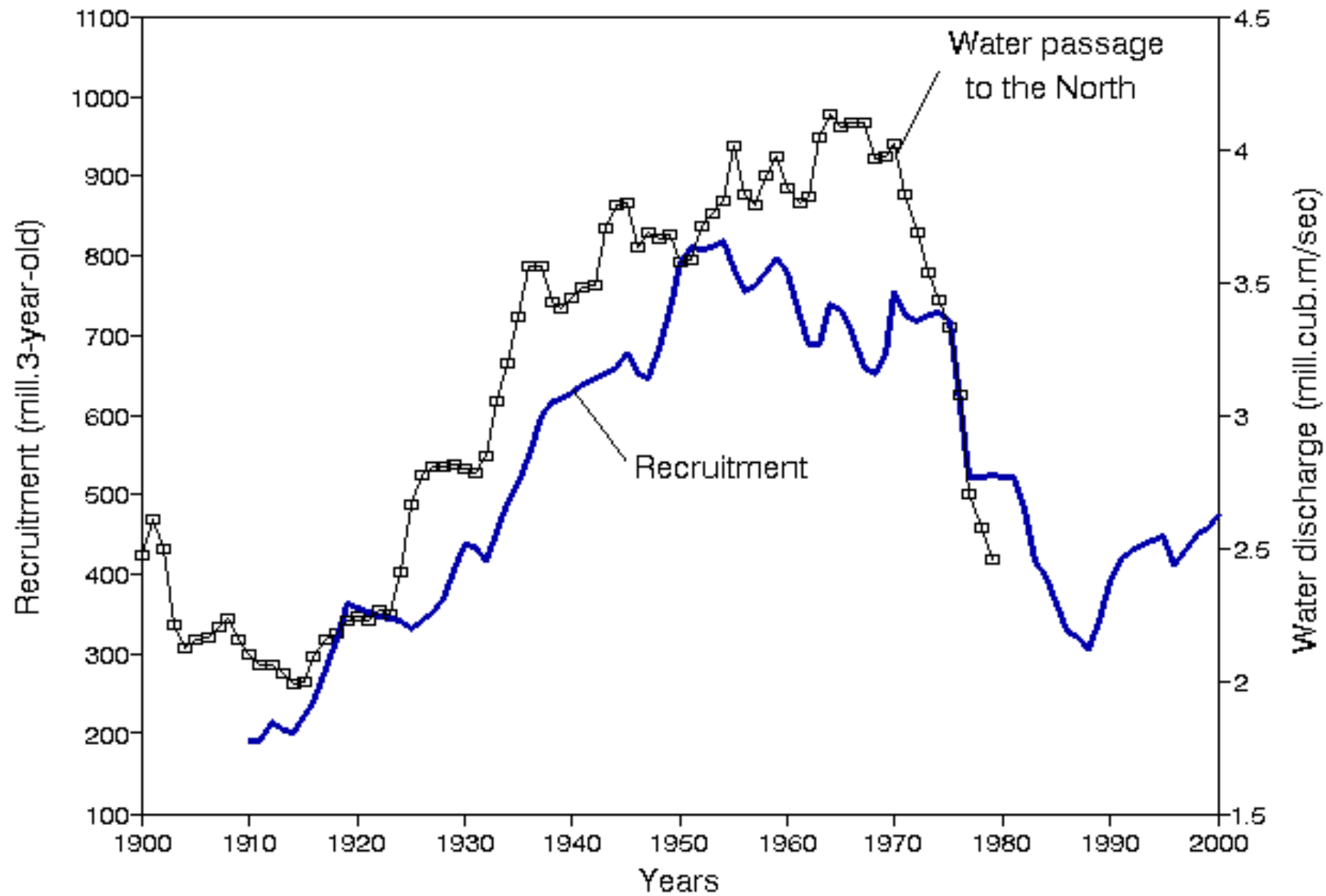
# Comparative dynamics of North-East Arctic cod recruitment (shifted by 6 year back) and the Barents sea free of ice area (13-year smoothing)



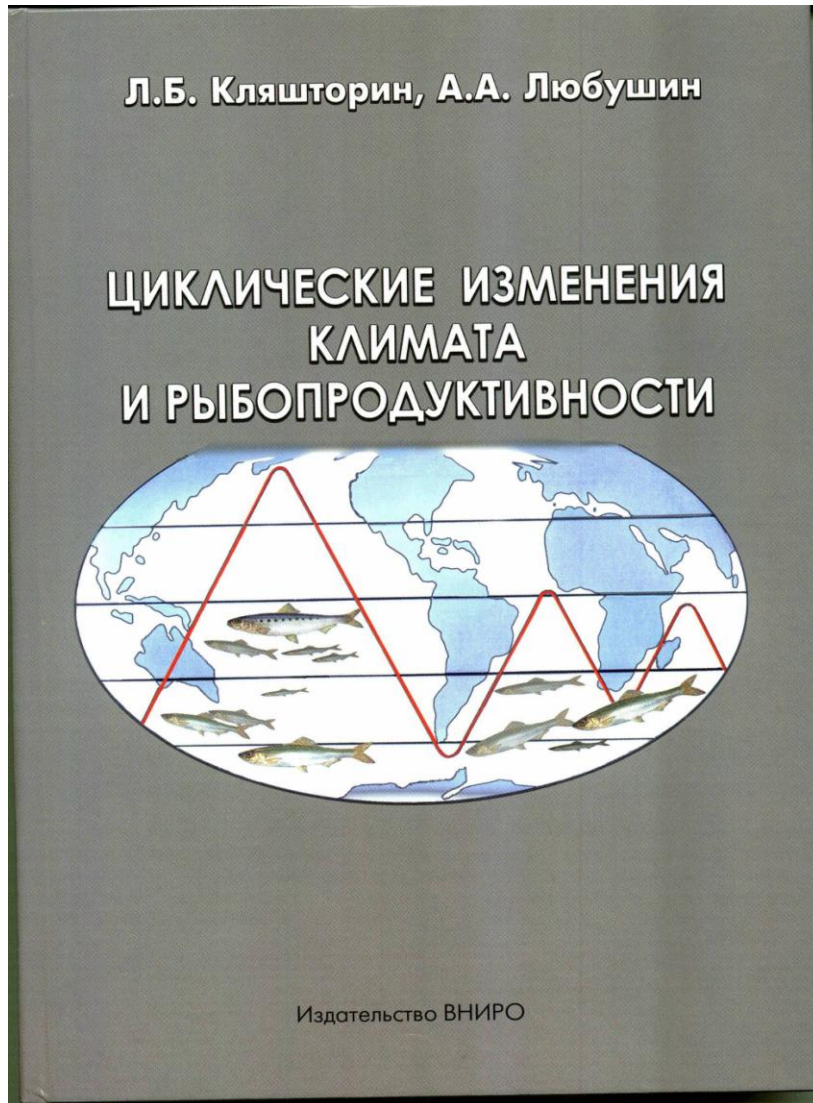
# Comparative dynamics of Atlantic water passage through Faroe-Shetland strait to the North and ice-free area of Barents Sea (13-year smoothing)



# Comparative dynamics of Atlantic water passage to the North through Faroe- Shetland strait and North-East Arctic cod recruitment (13-year smoothing)



# NEW BOOK



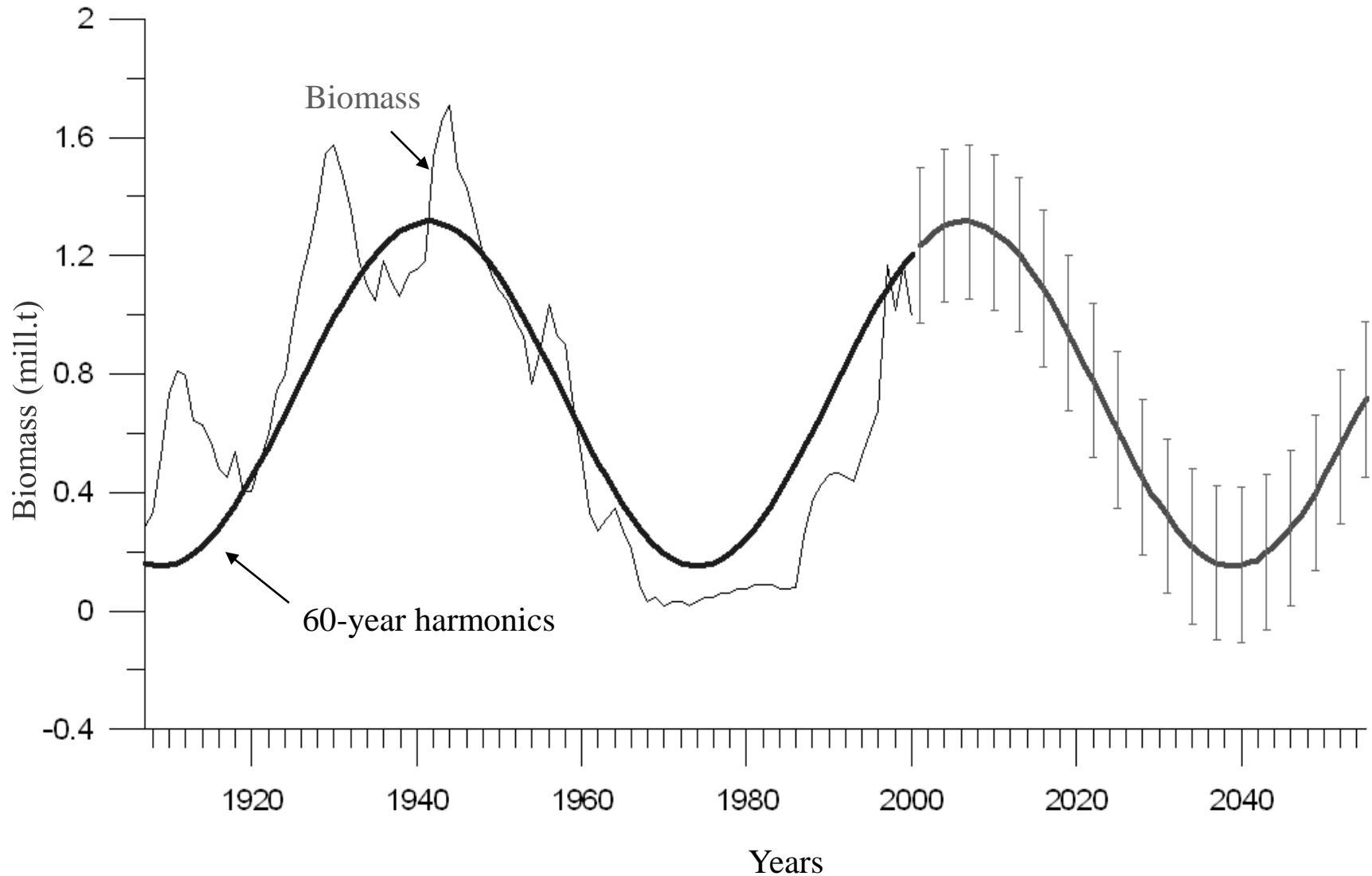
*L.B.Klyashtorin and A.A. Luybushin*

## **Cyclic climate changes and fish productivity**

VNIRO Publishing,, 234p., 160 figures,  
Moscow,Russia  
2005

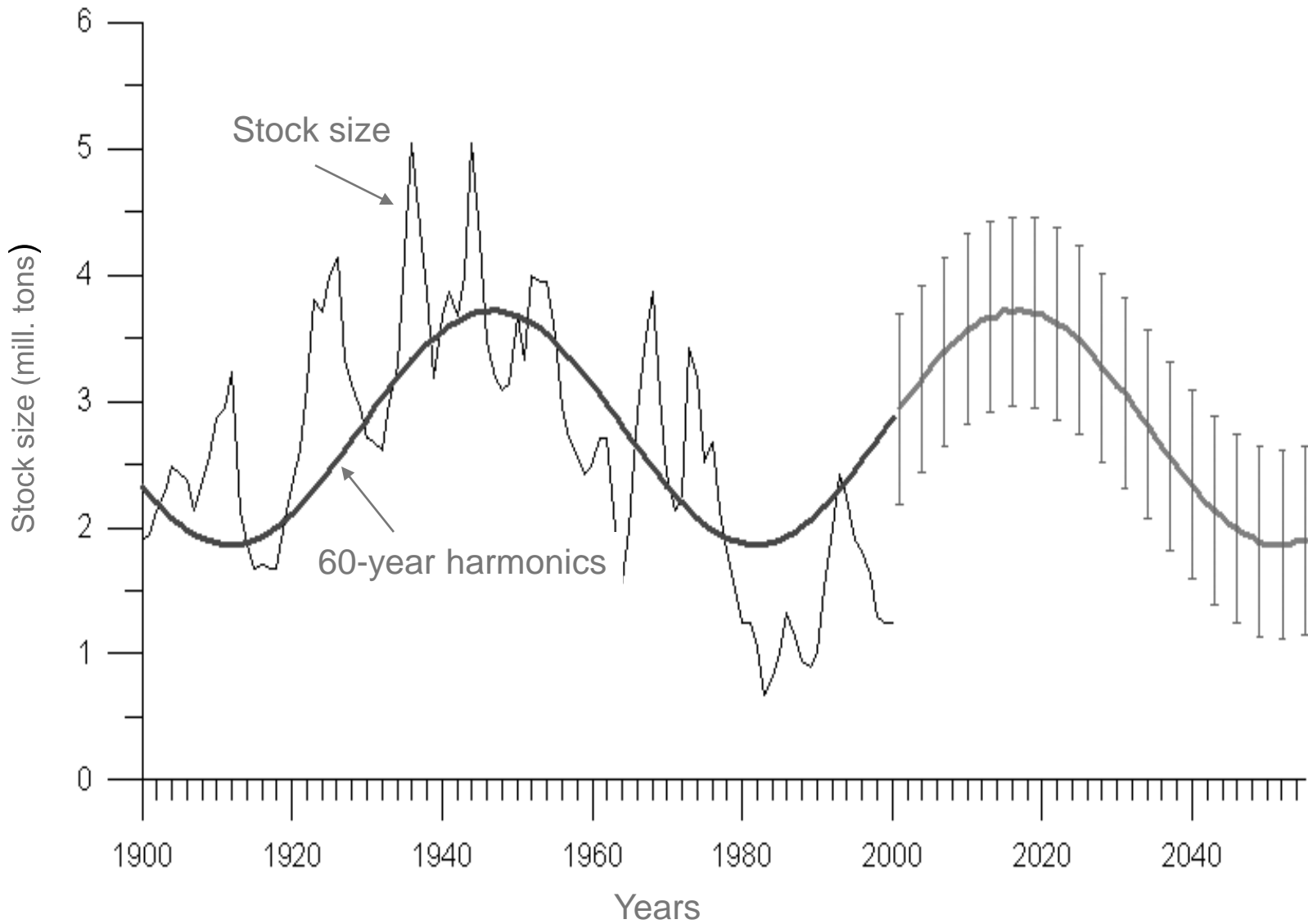
*Annotation ,Contents and Figure  
captions is in English*

## The projected trend of spawning stock biomass of Atlantic spring-spawning herring for the next 50 years.





# The projected trend of of North-East Arctic cod stock size for the next 50 years



**Thank you for attention!**