

# Understanding Climate Change from a Historical Perspective

**Johnny Chan**

***Guy Carpenter Asia-Pacific Climate Impact Centre***

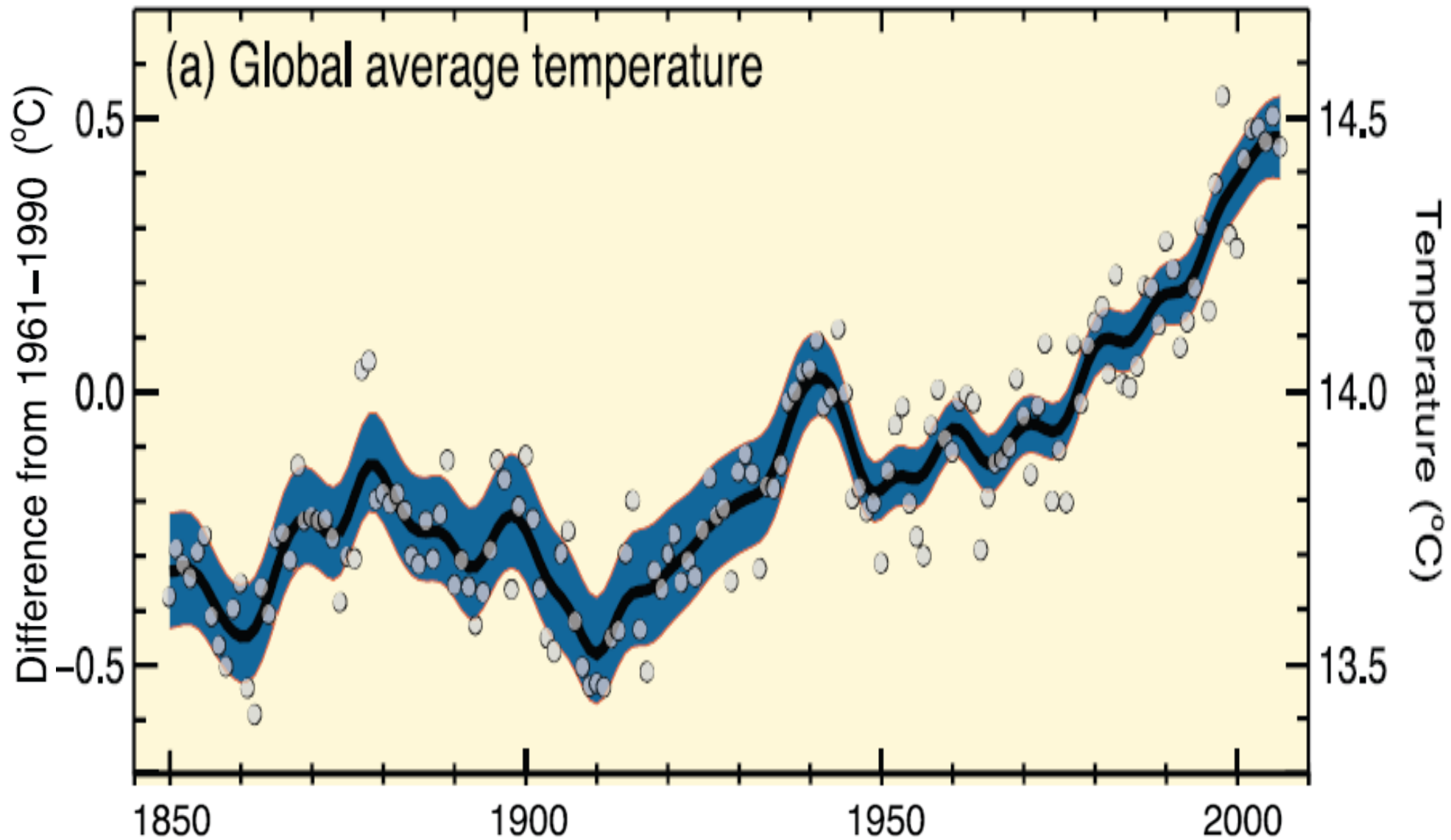
***School of Energy and Environment***

***City University of Hong Kong***

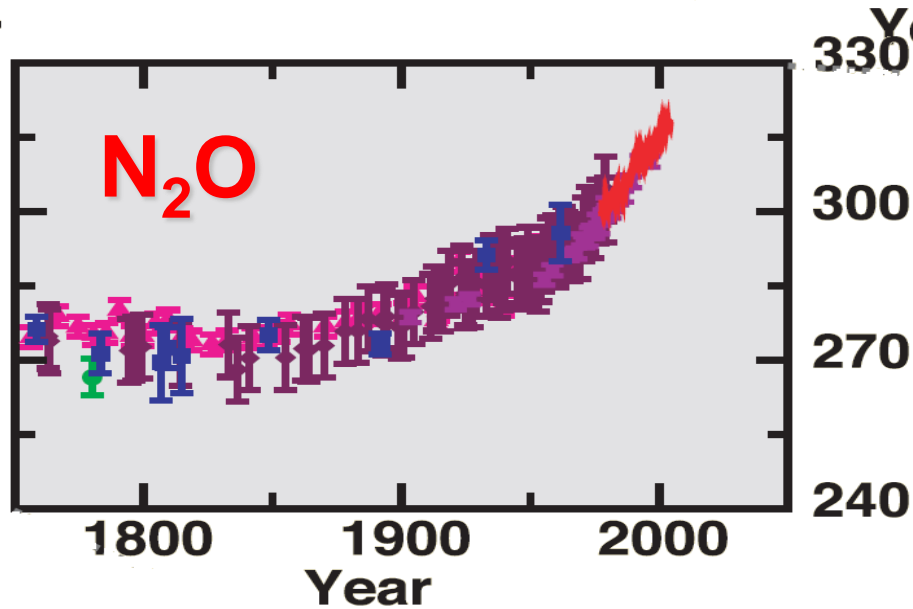
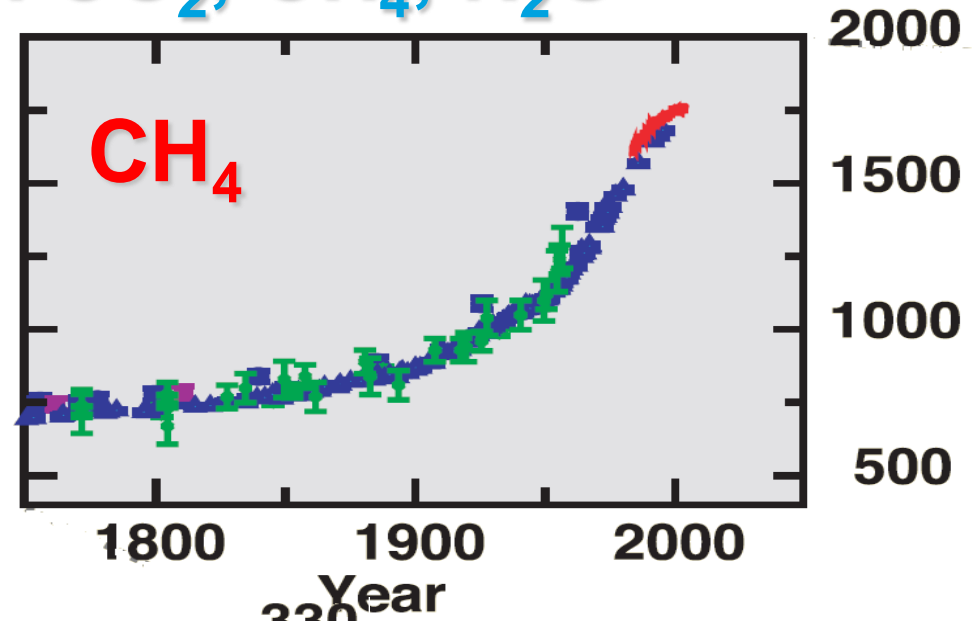
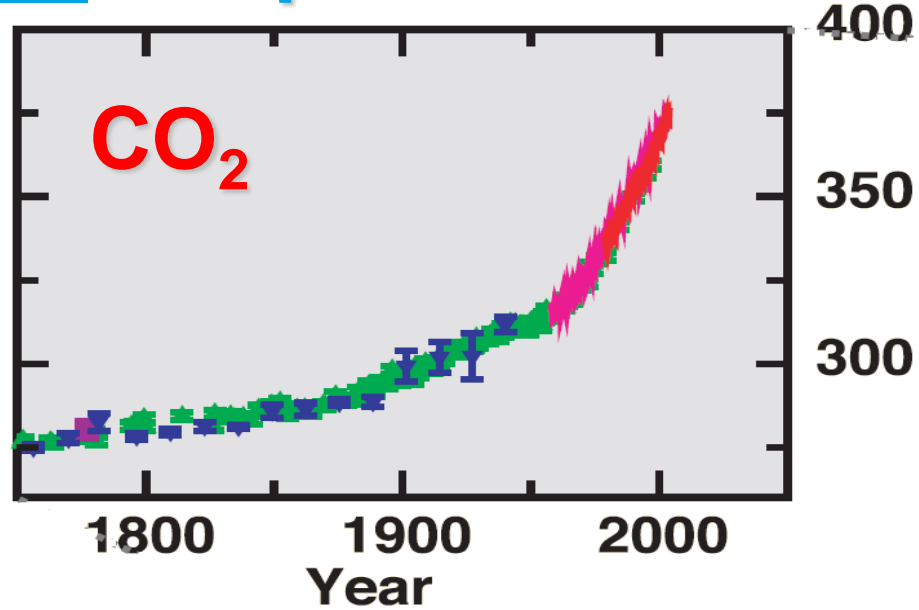
# Outline

- **Historical climate change**
- **The Milankovich cycles**
- **Changes in typhoon activity**
- **Summary**

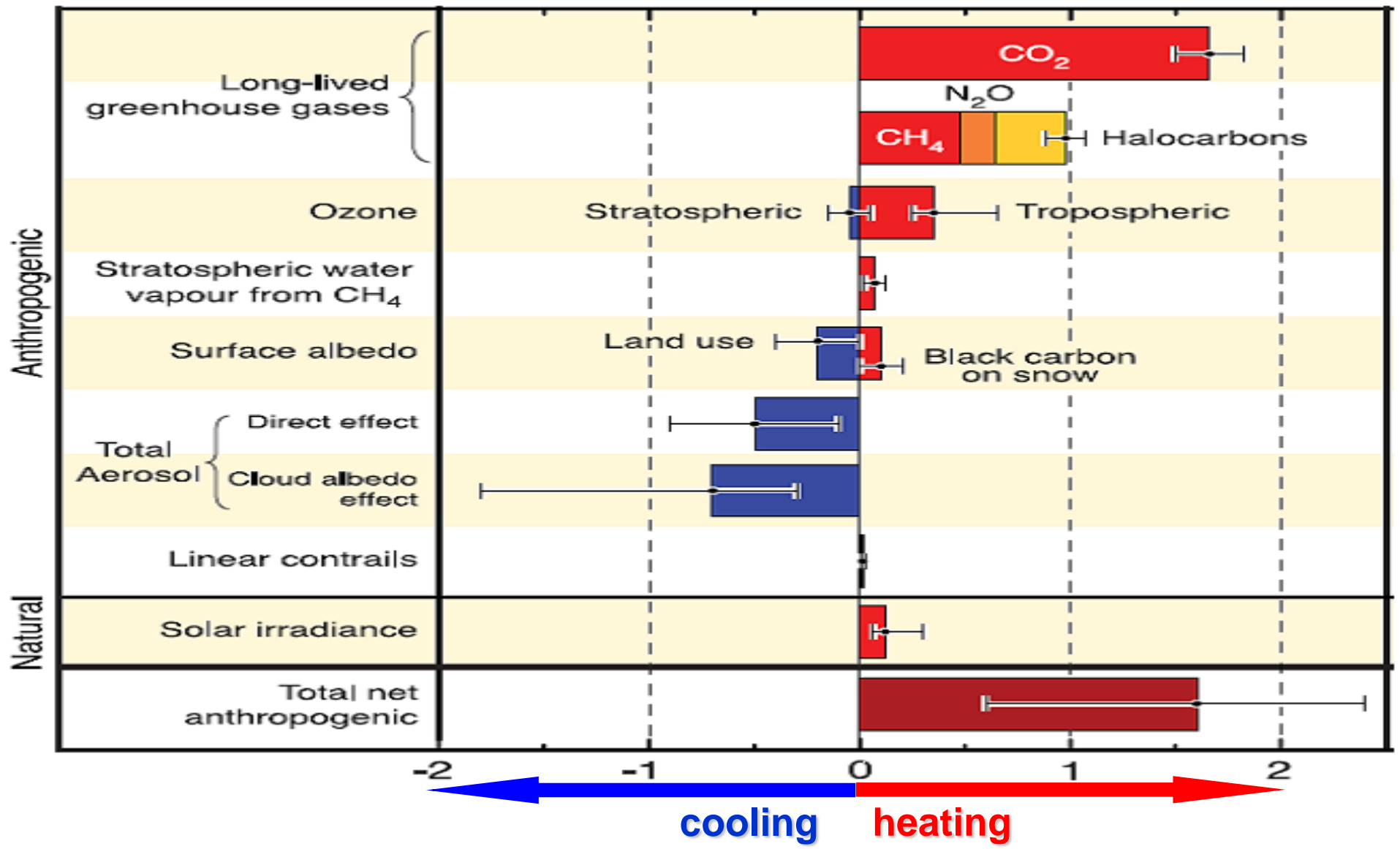
# Temporal variations in global temperature



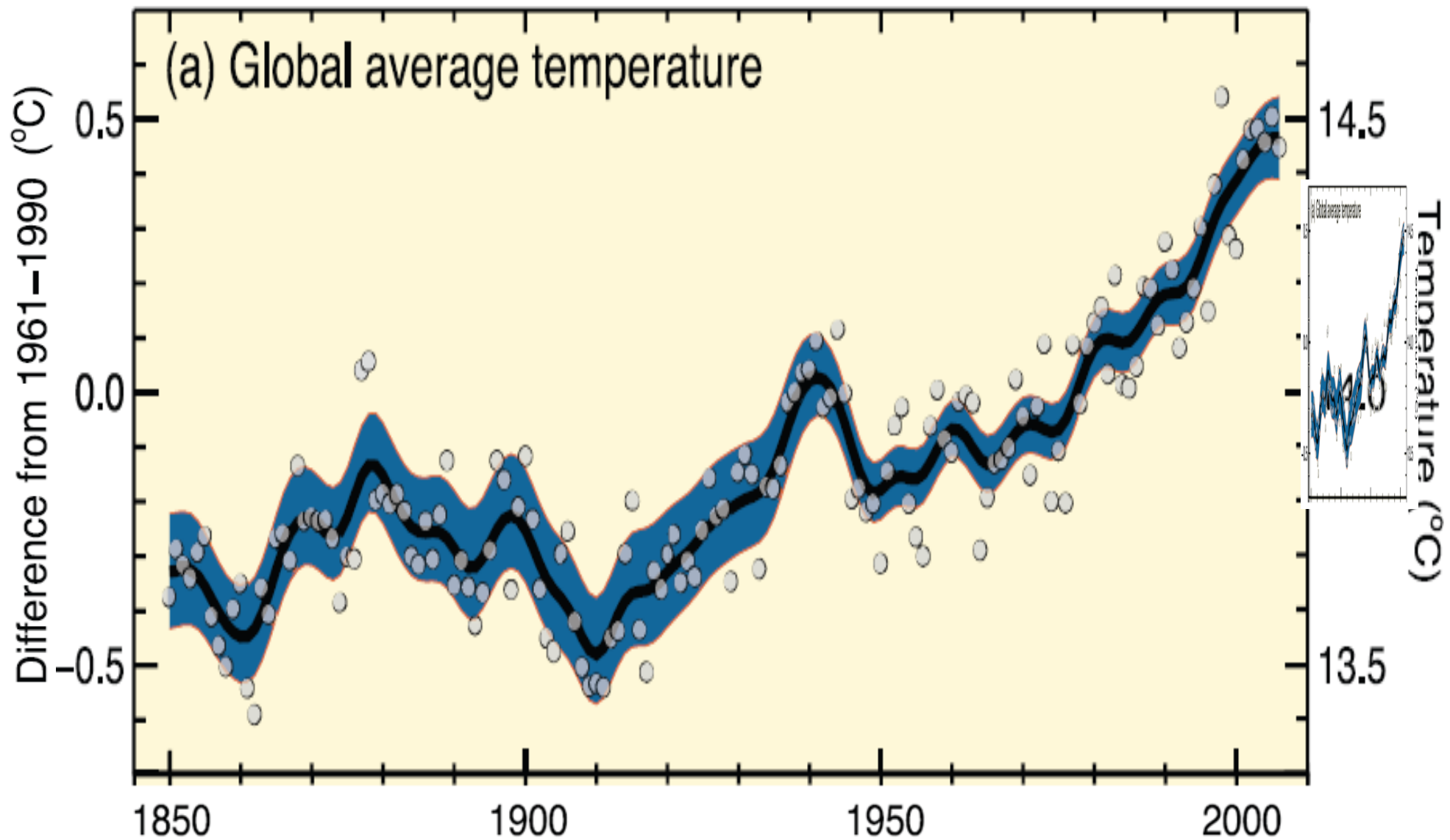
# Temporal variations in CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O



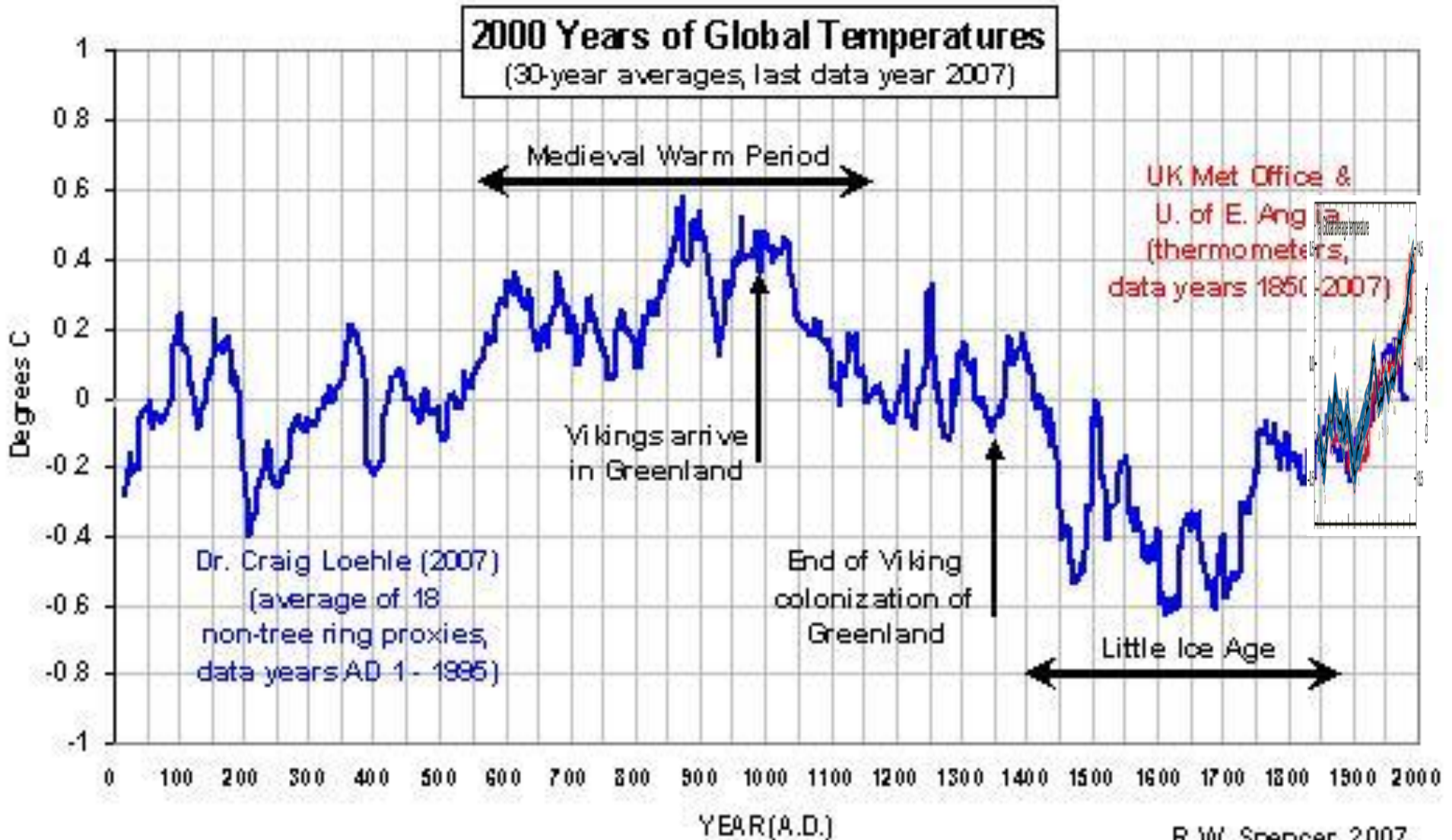
# Components that cause heating/cooling of the atmosphere



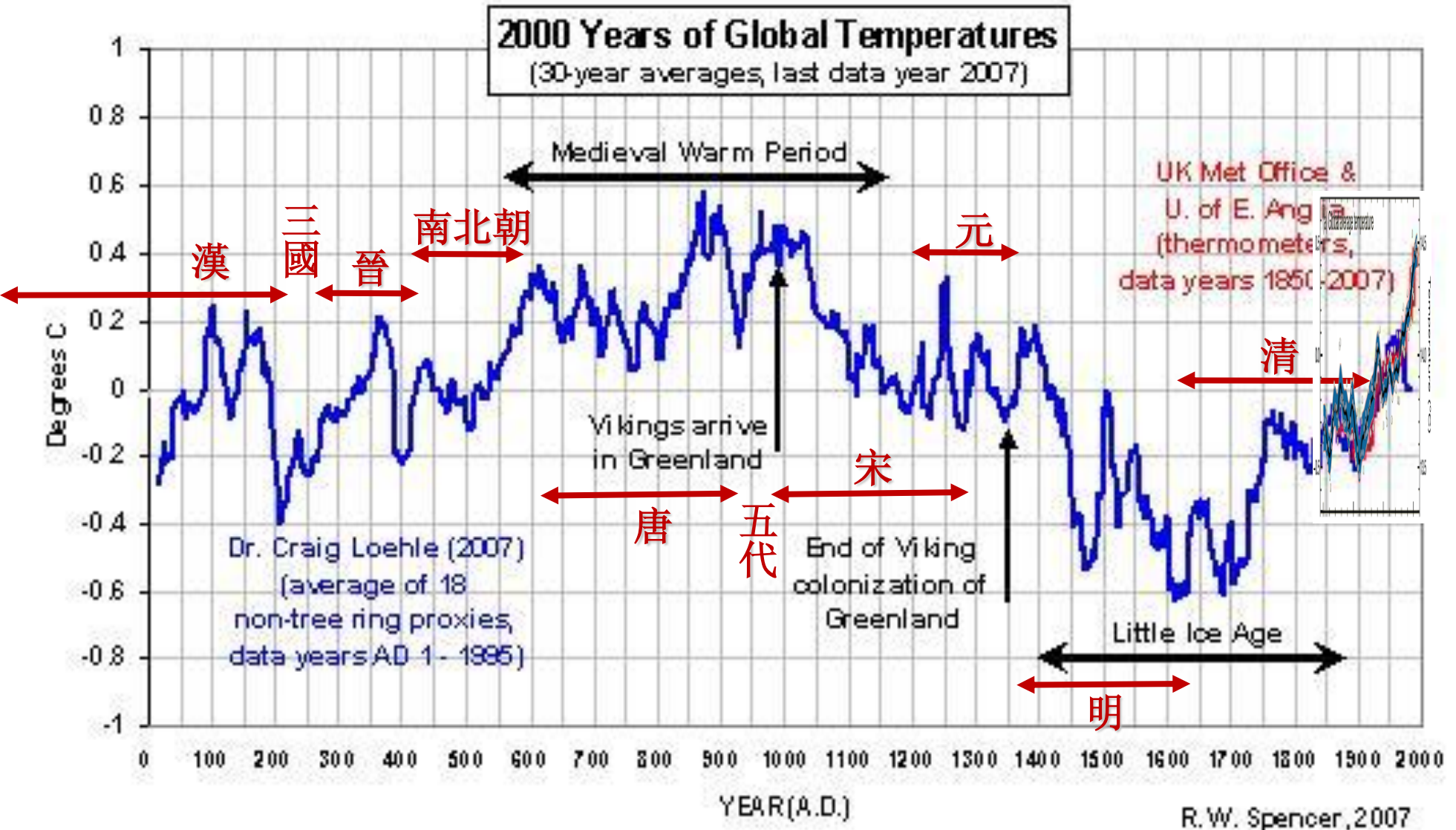
# Temporal variations in global temperature



# Temporal variations in global temperature

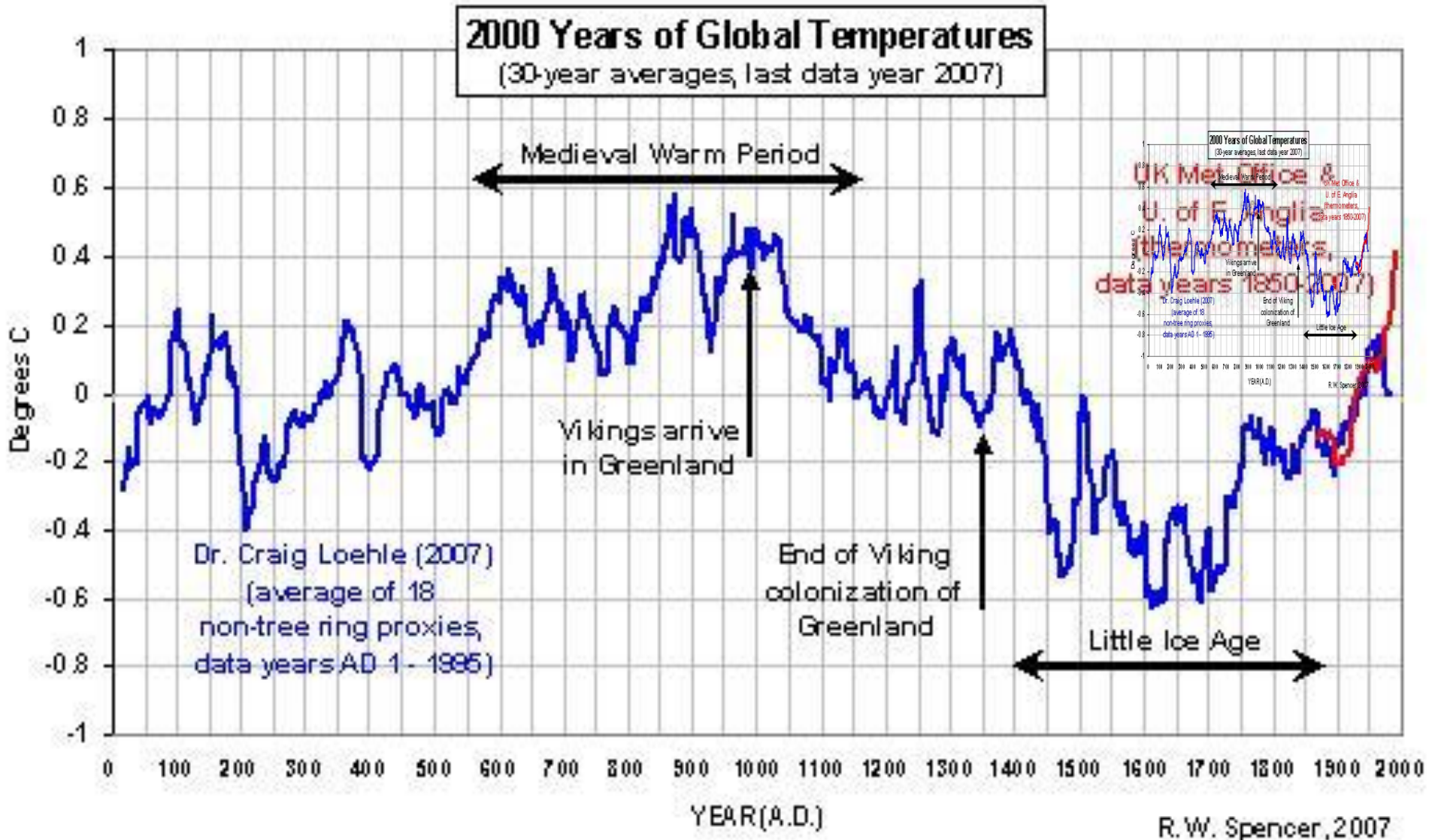


# Temporal variations in global temperature

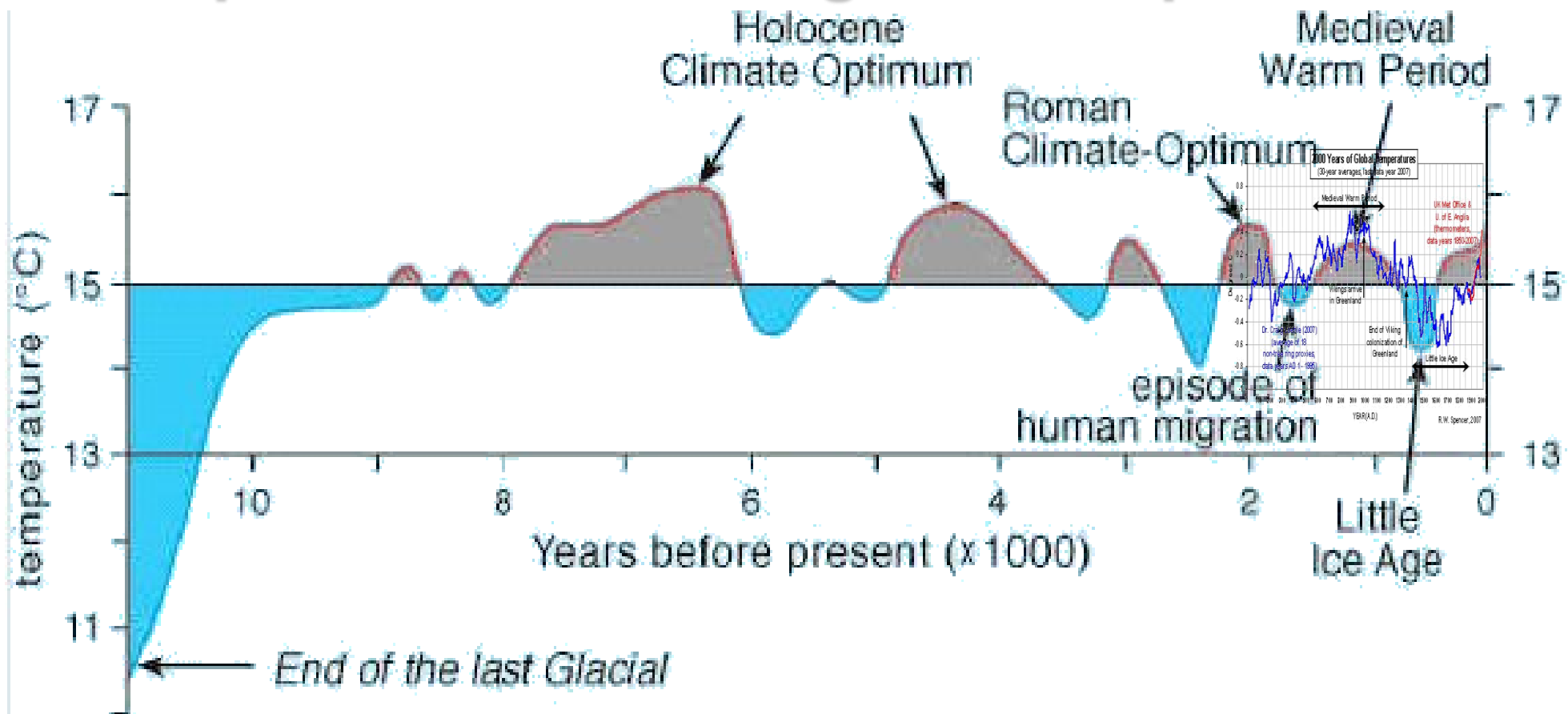




# Temporal variations in global temperature

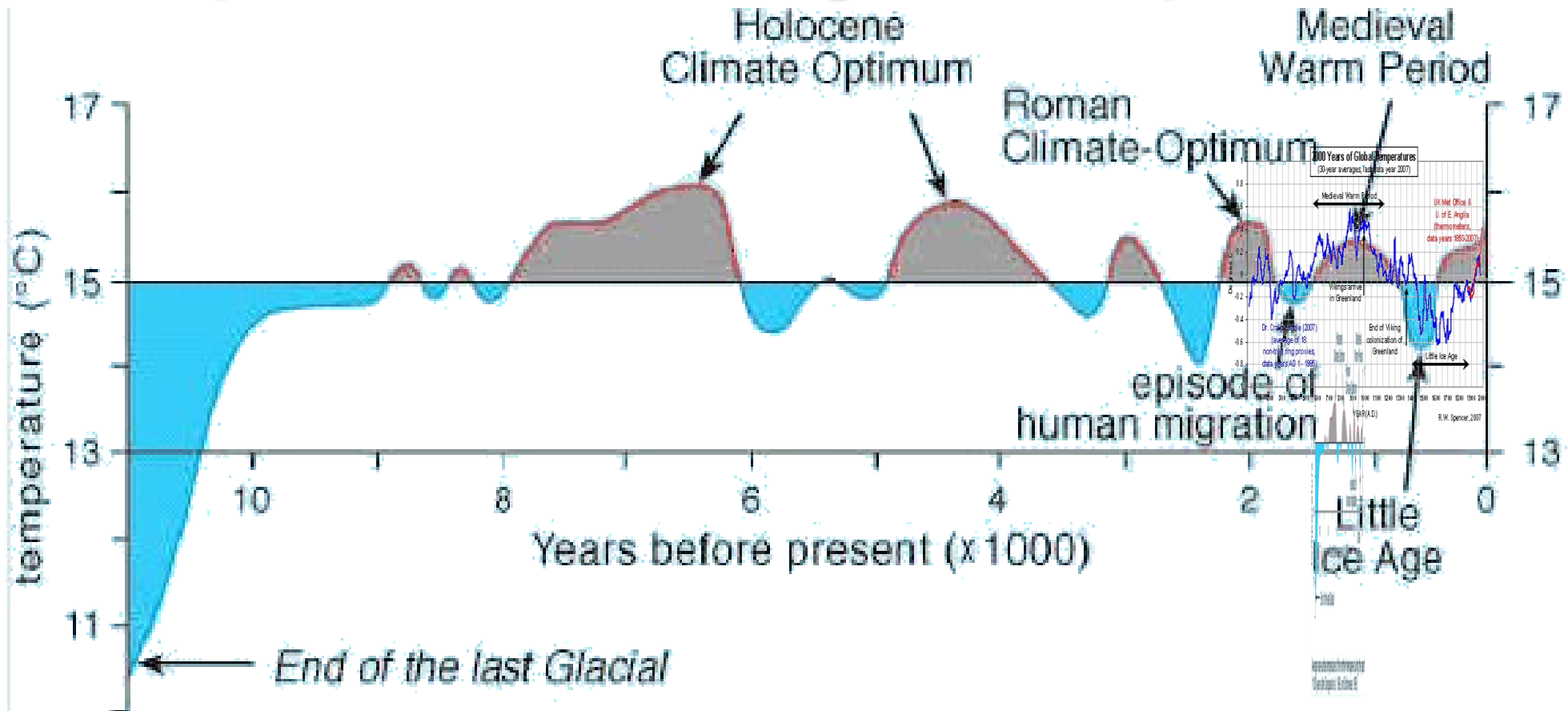


# Temporal variations in global temperature



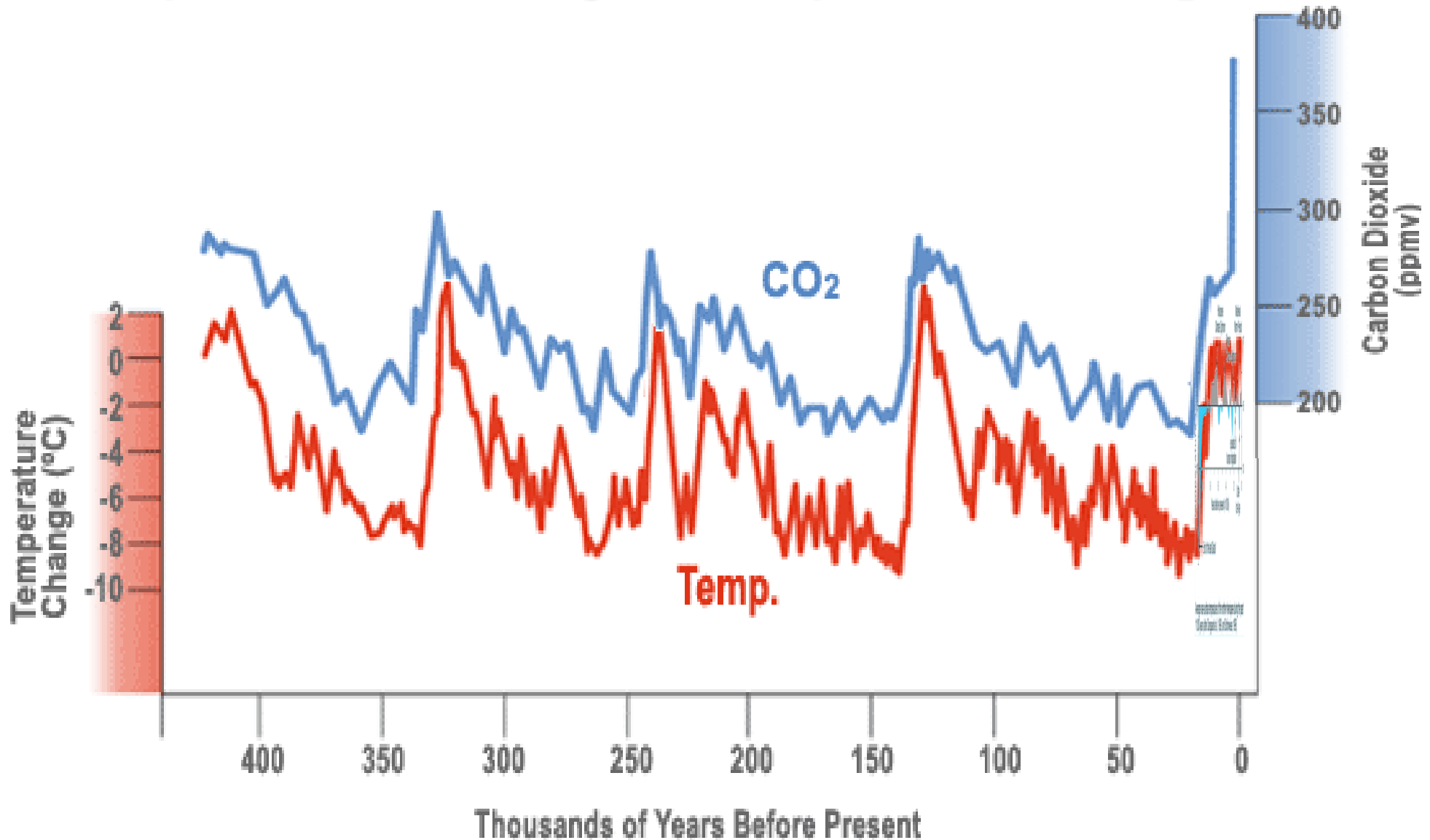
Average near-surface temperatures of the northern hemisphere during the past 11,000 years (after Dansgaard et al., 1969, and Schönwiese, 1995)

# Temporal variations in global temperature



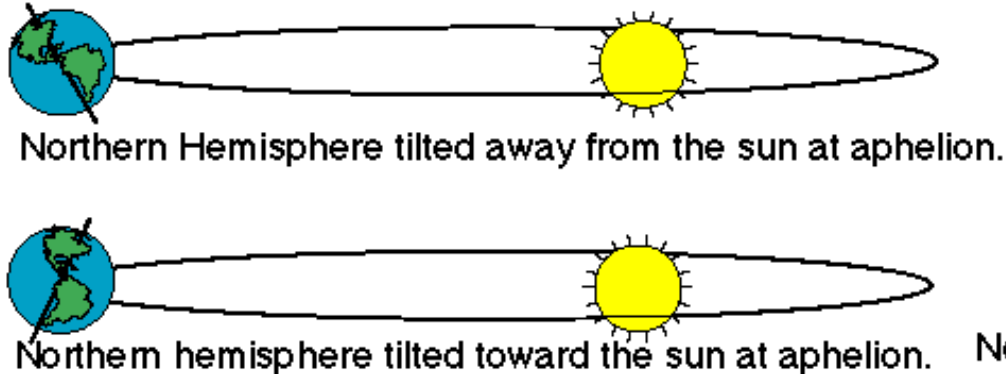
Average near-surface temperatures of the northern hemisphere during the past 11,000 years (after Dansgaard et al., 1969, and Schönwiese, 1995)

# Temporal variations in global temperature and CO<sub>2</sub>

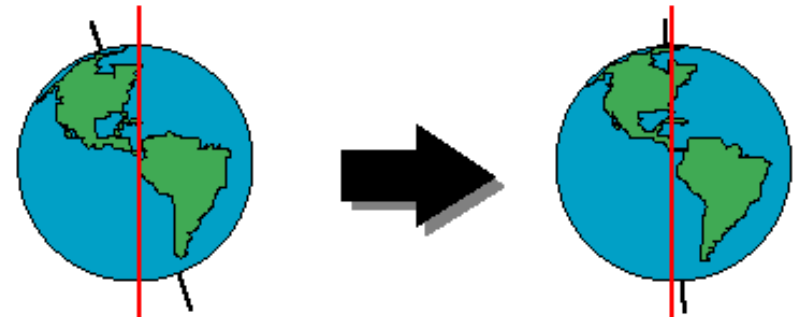


# Milankovich cycles – variations of the orbital parameters

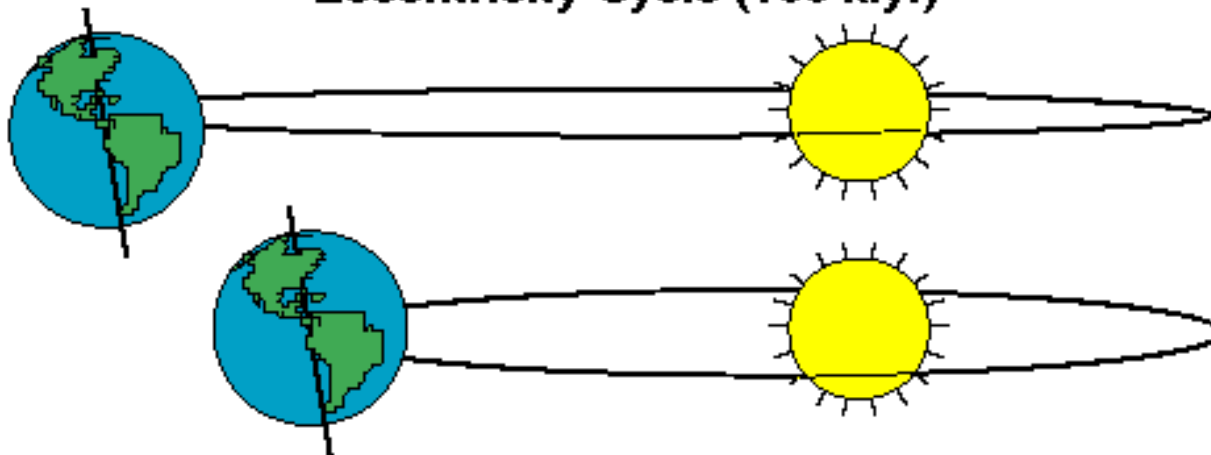
## Precession of the Equinoxes (19 and 23 k.y.)



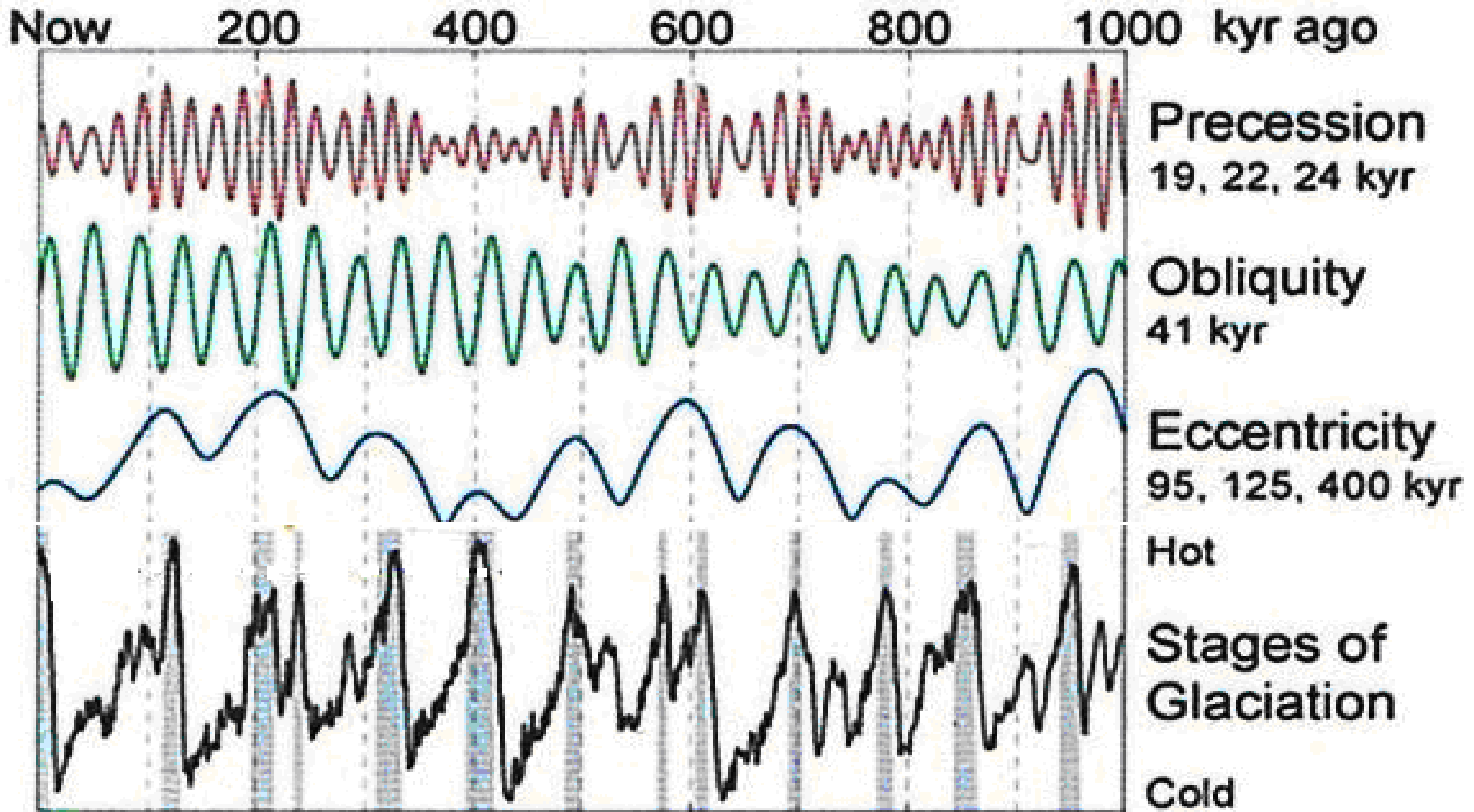
## Obliquity Cycle (41 k.y.)



## Eccentricity Cycle (100 k.y.)



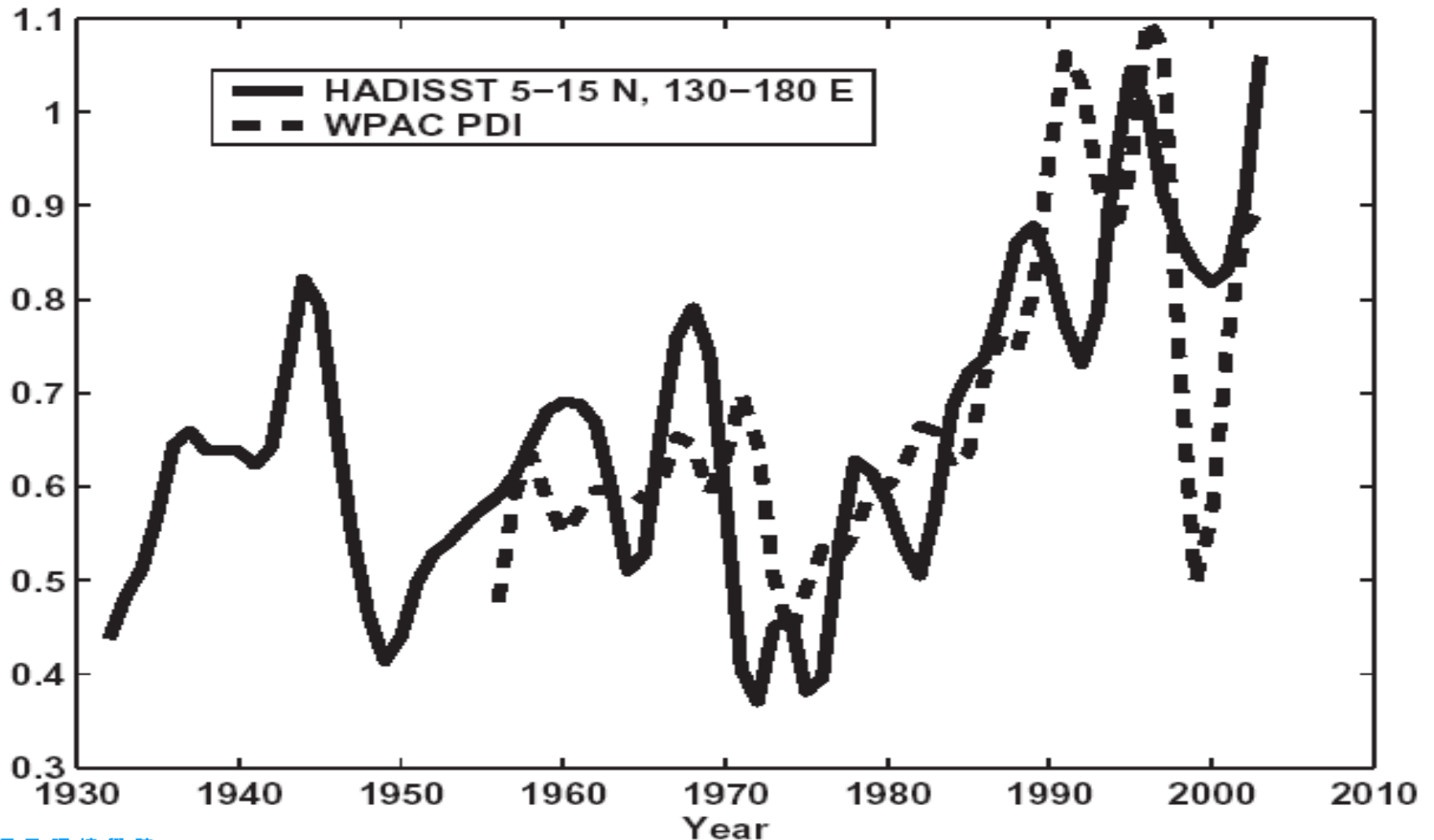
# Milankovitch cycles and glaciation



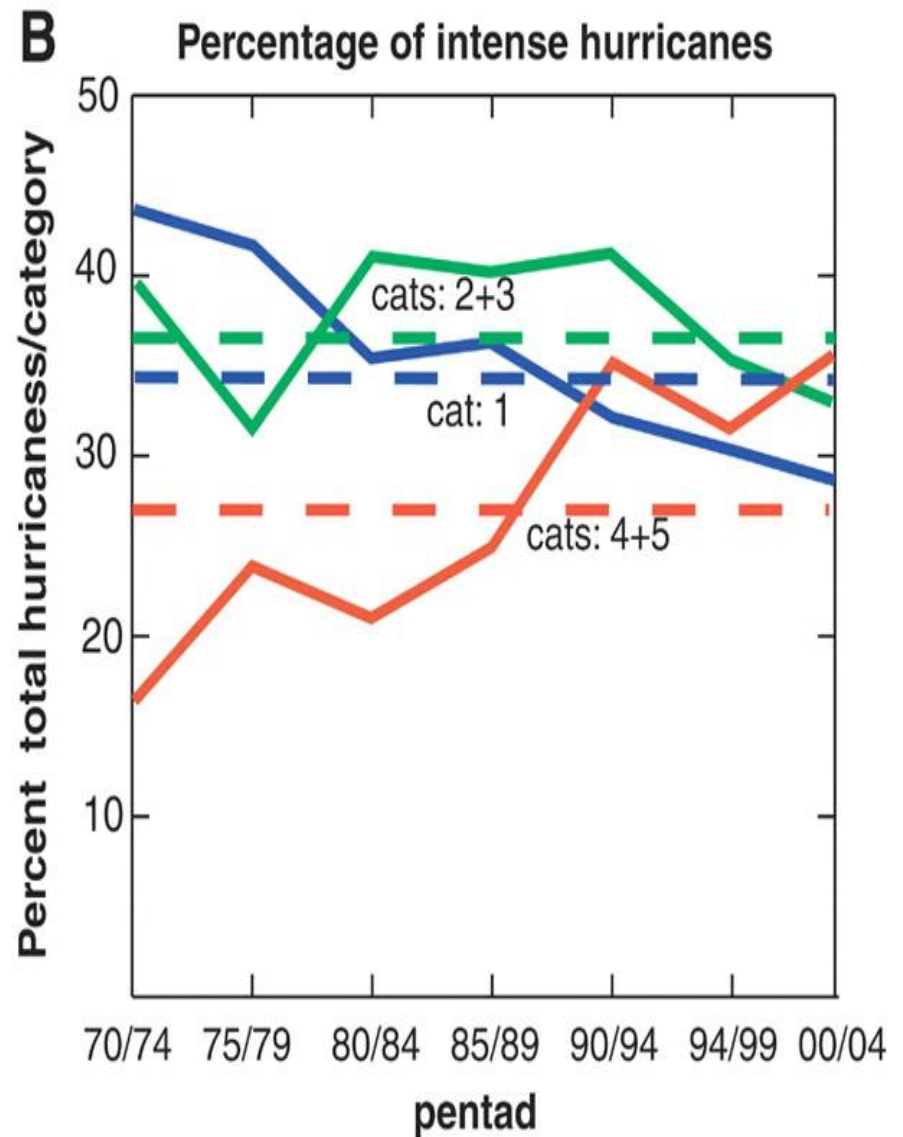
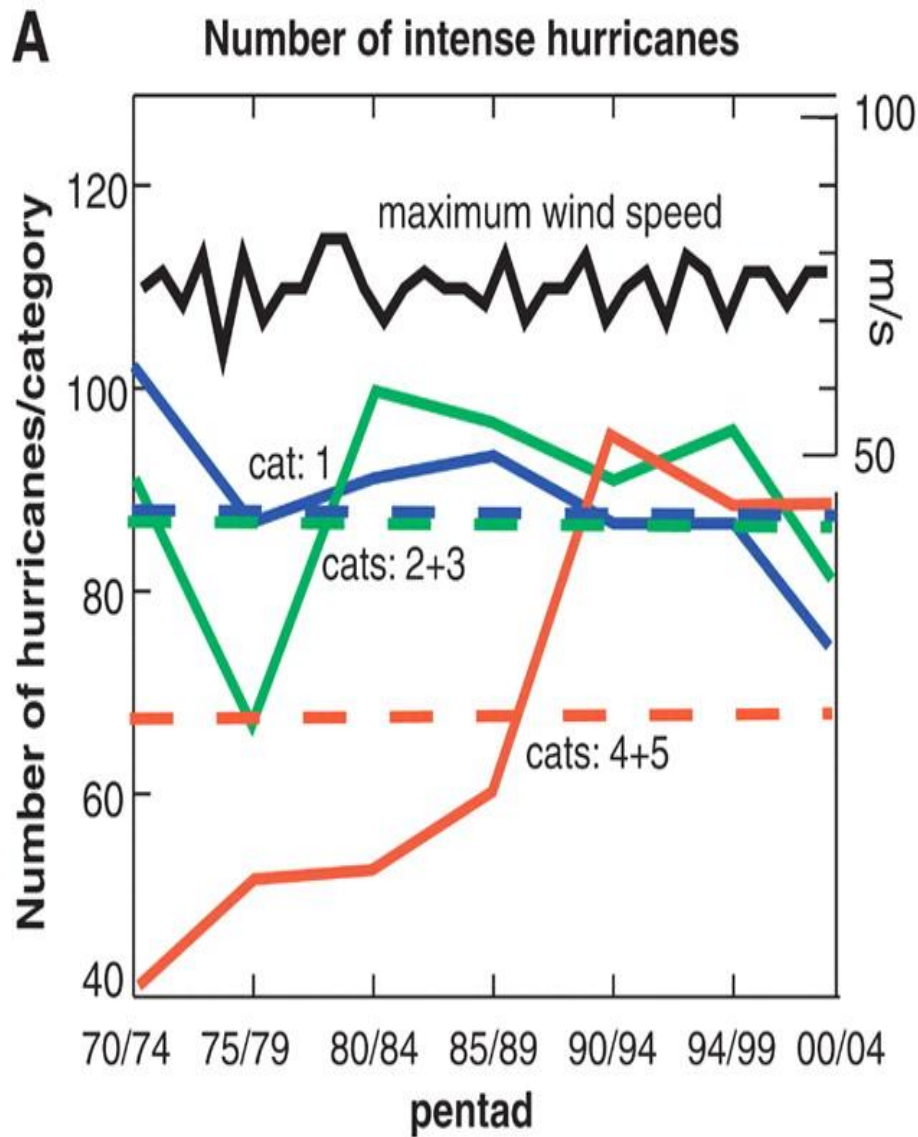
# Emanuel's (2005) *Nature* paper

W. North Pacific

PDI: (max wind)<sup>3</sup>

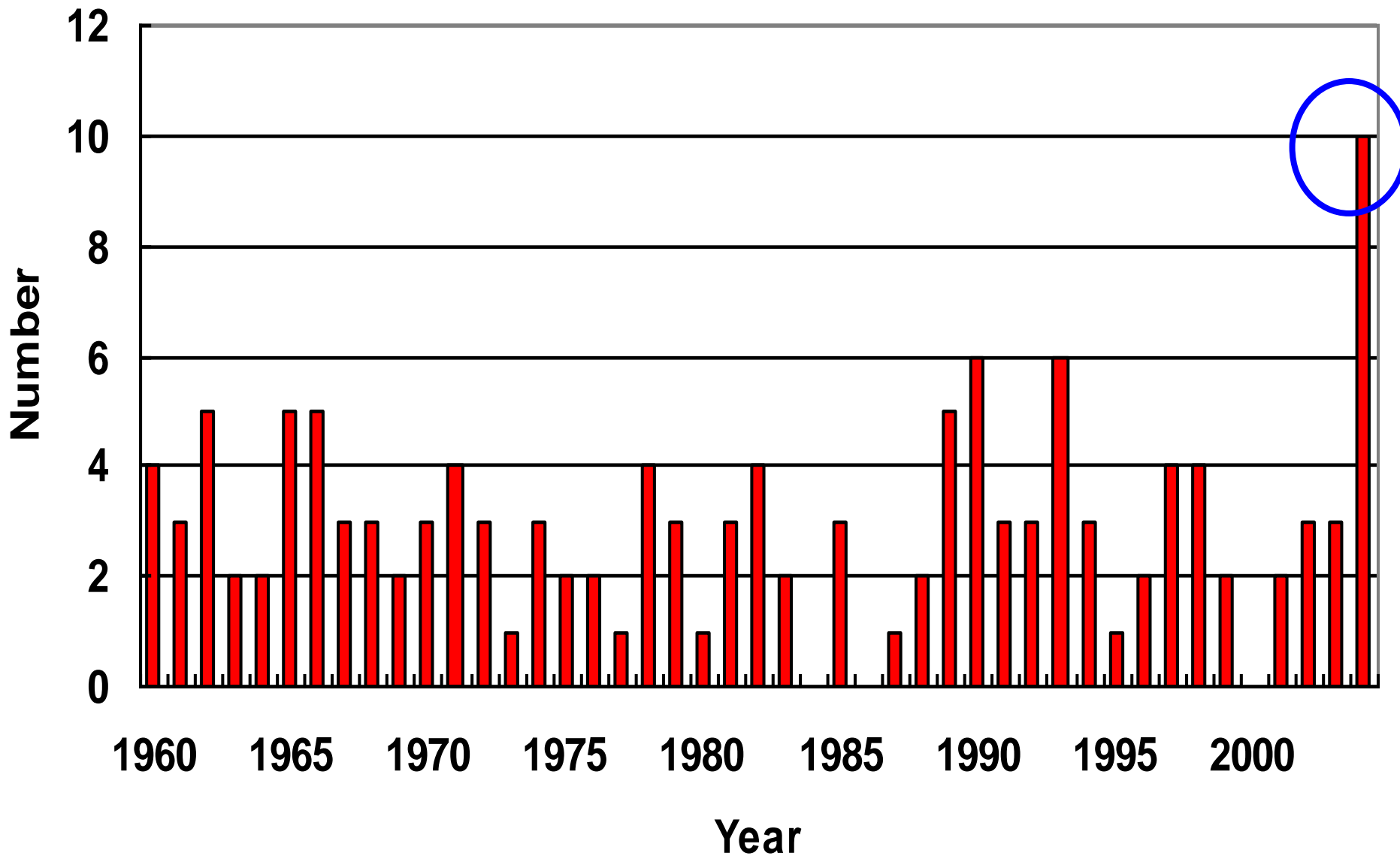


# Webster et al.'s (2005) Science paper



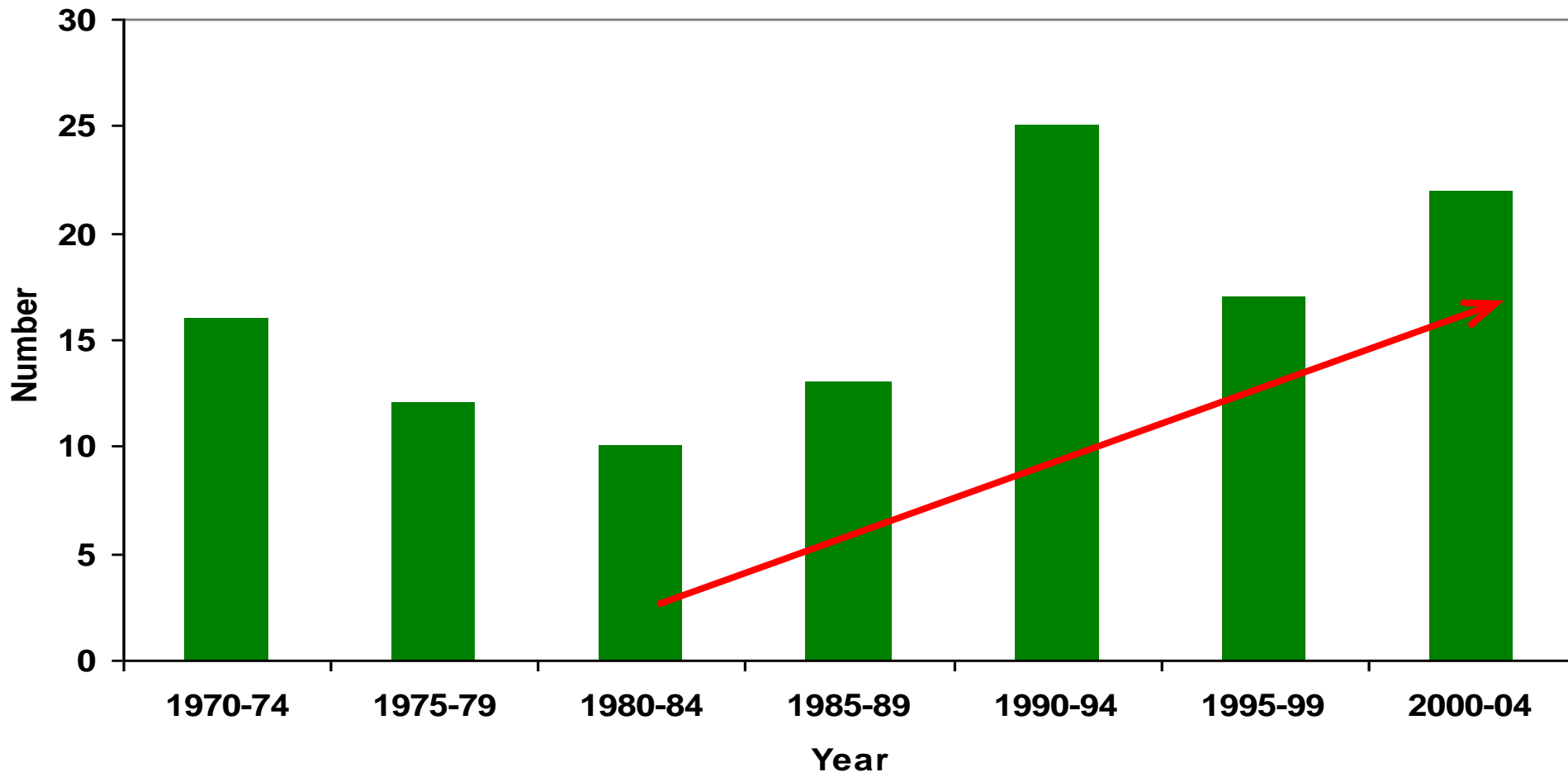


# Number of Tropical Cyclones Making Landfall in Japan

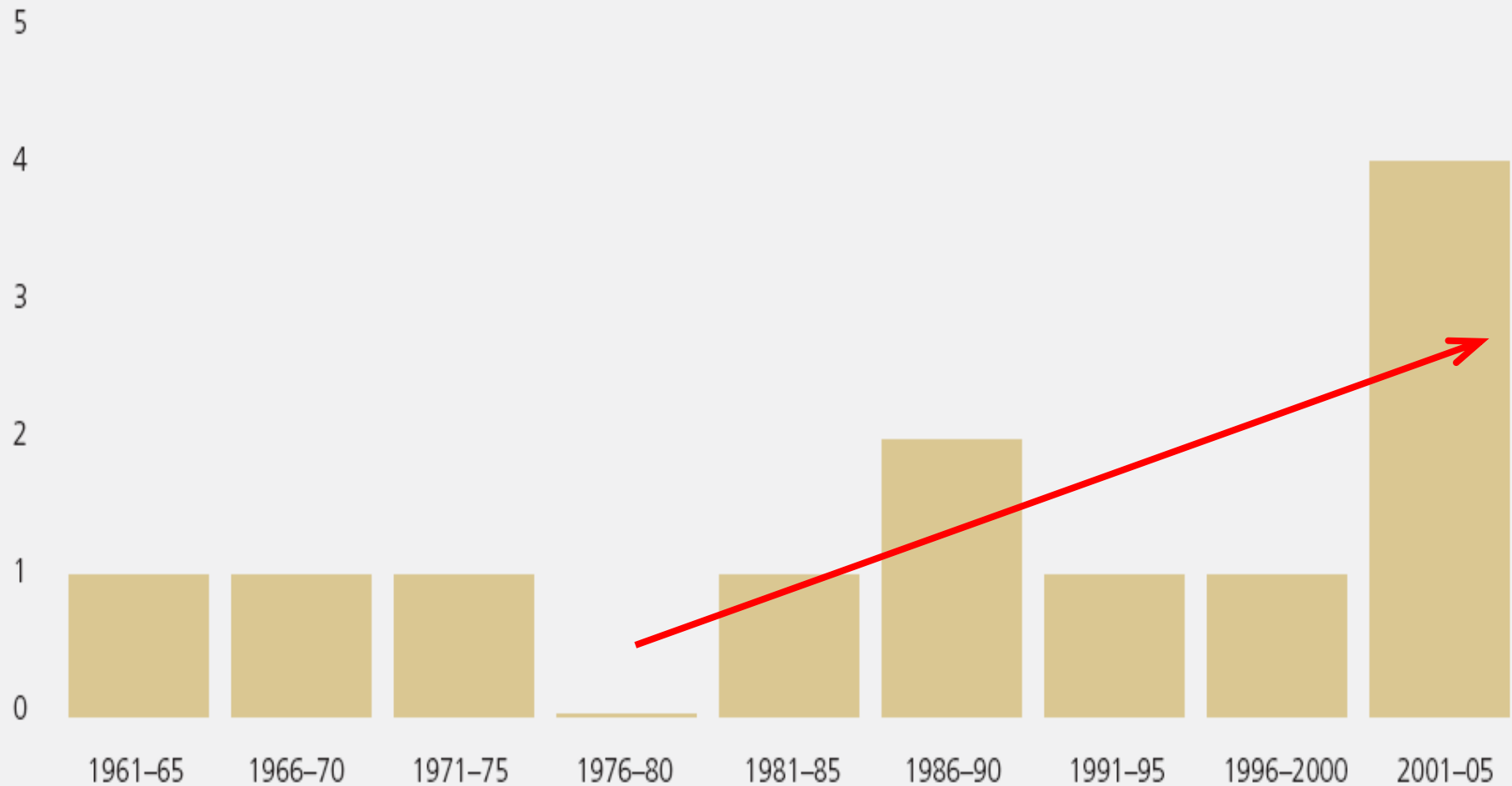


# No. of Tropical Cyclones Making Landfall in Japan and Korea Every 5-year period (1970-2004)

No. of Tropical Cyclones Making Landfall in Japan and Korea



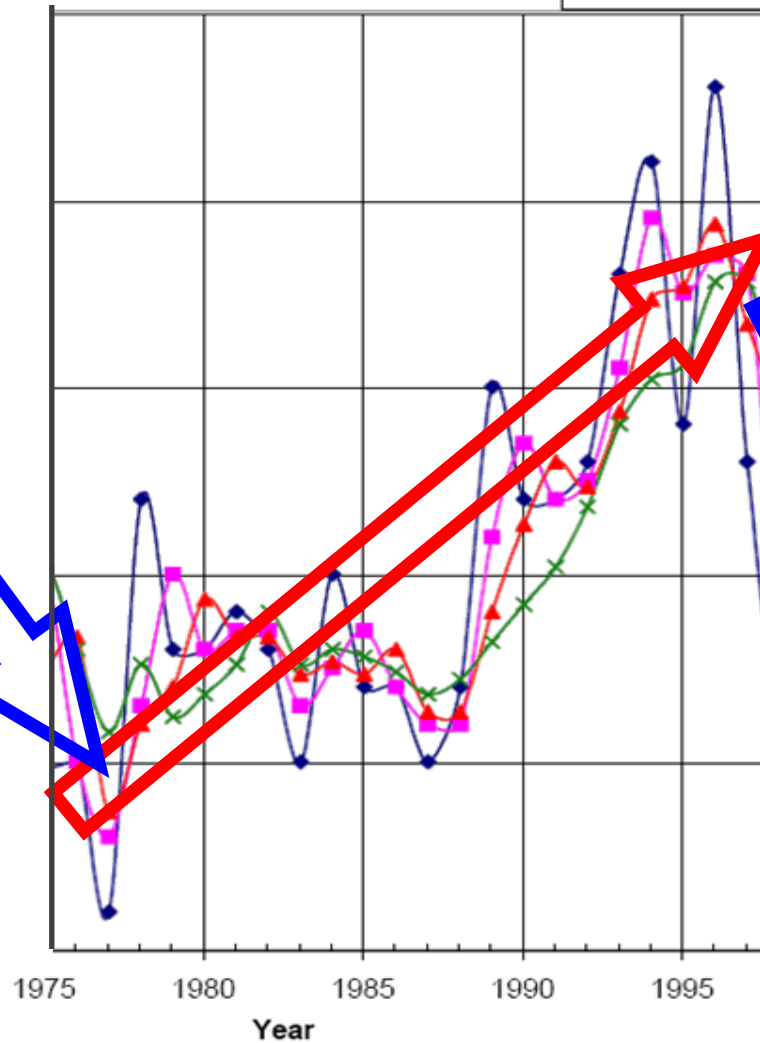
# No. of Typhoons Making Landfall in Zhejiang Province Every 5-year period (1960-2005)



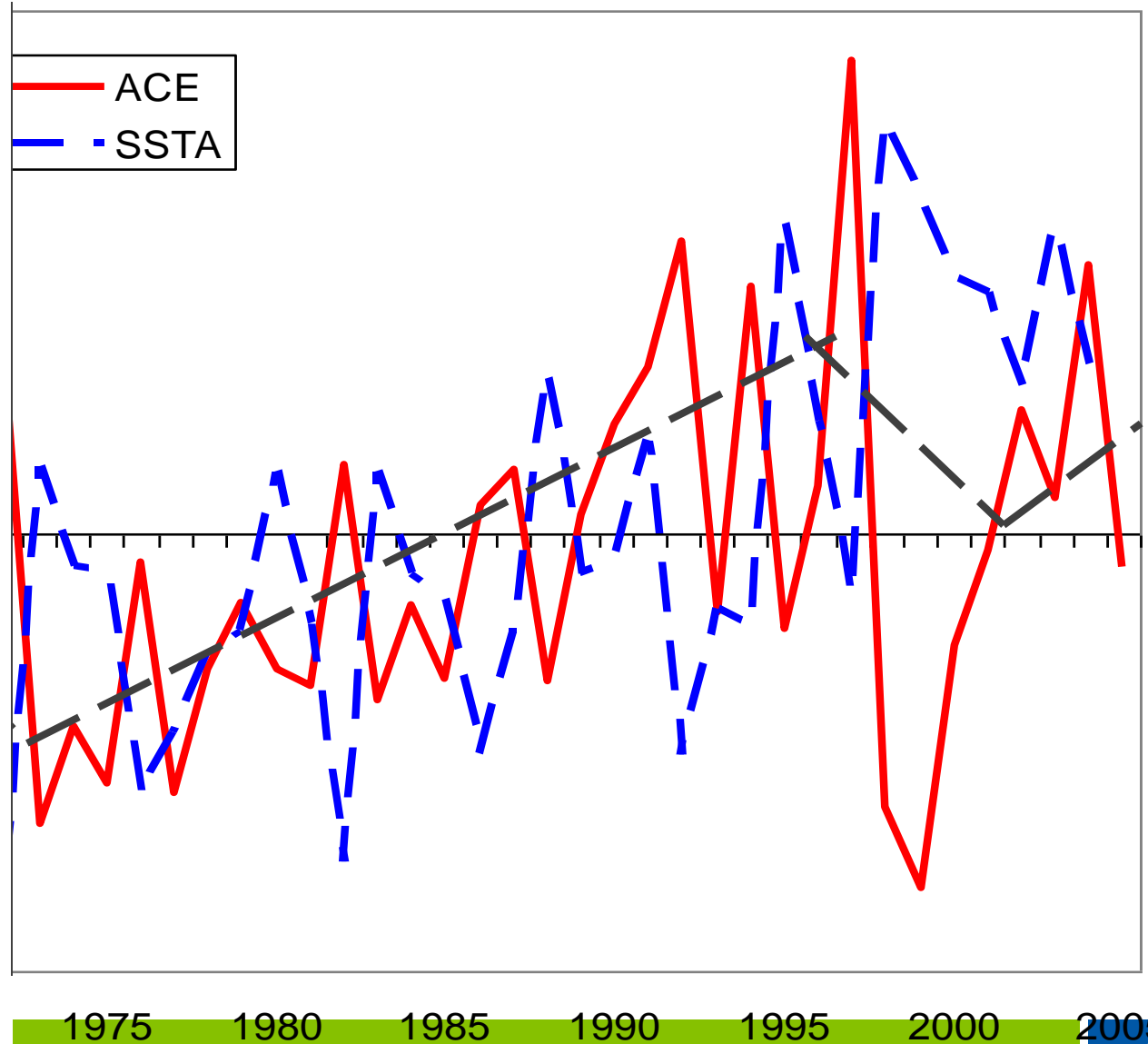
# Number of tropical cyclones in the western North Pacific

# of all TC's in NorthWestPac

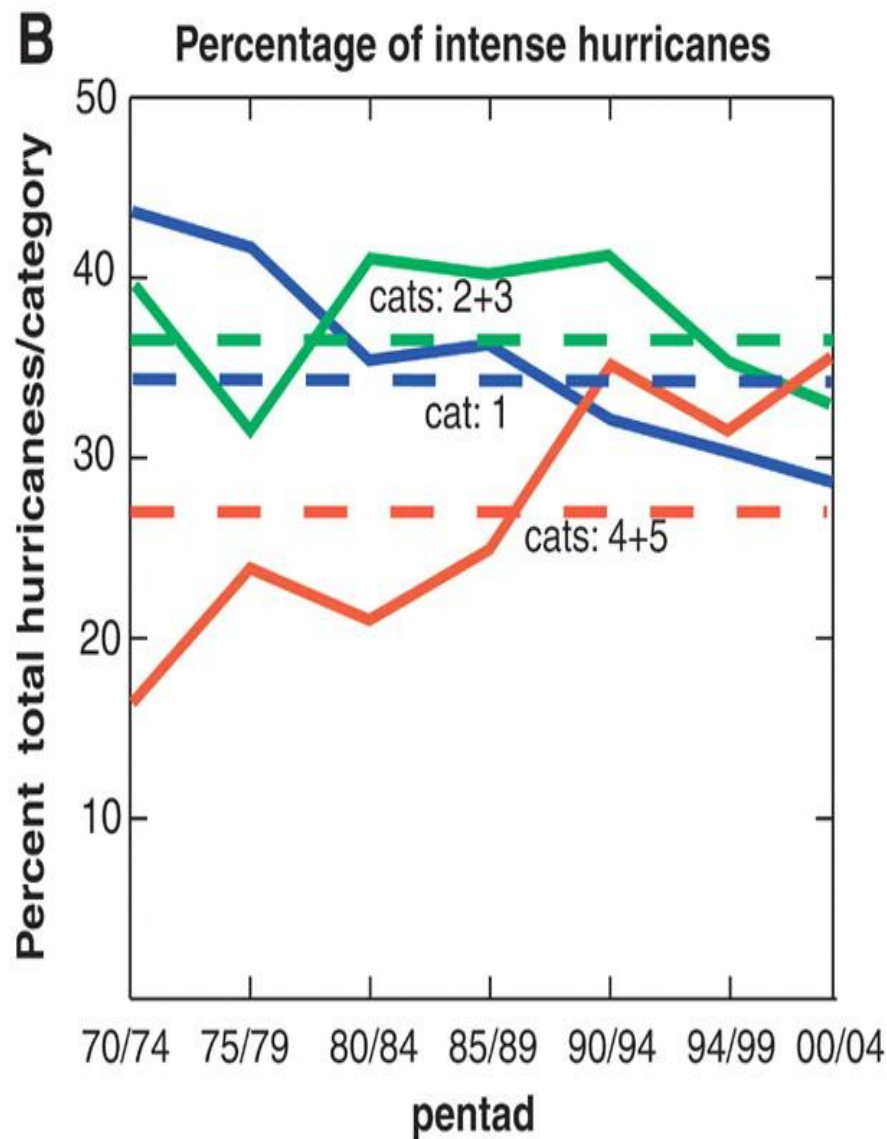
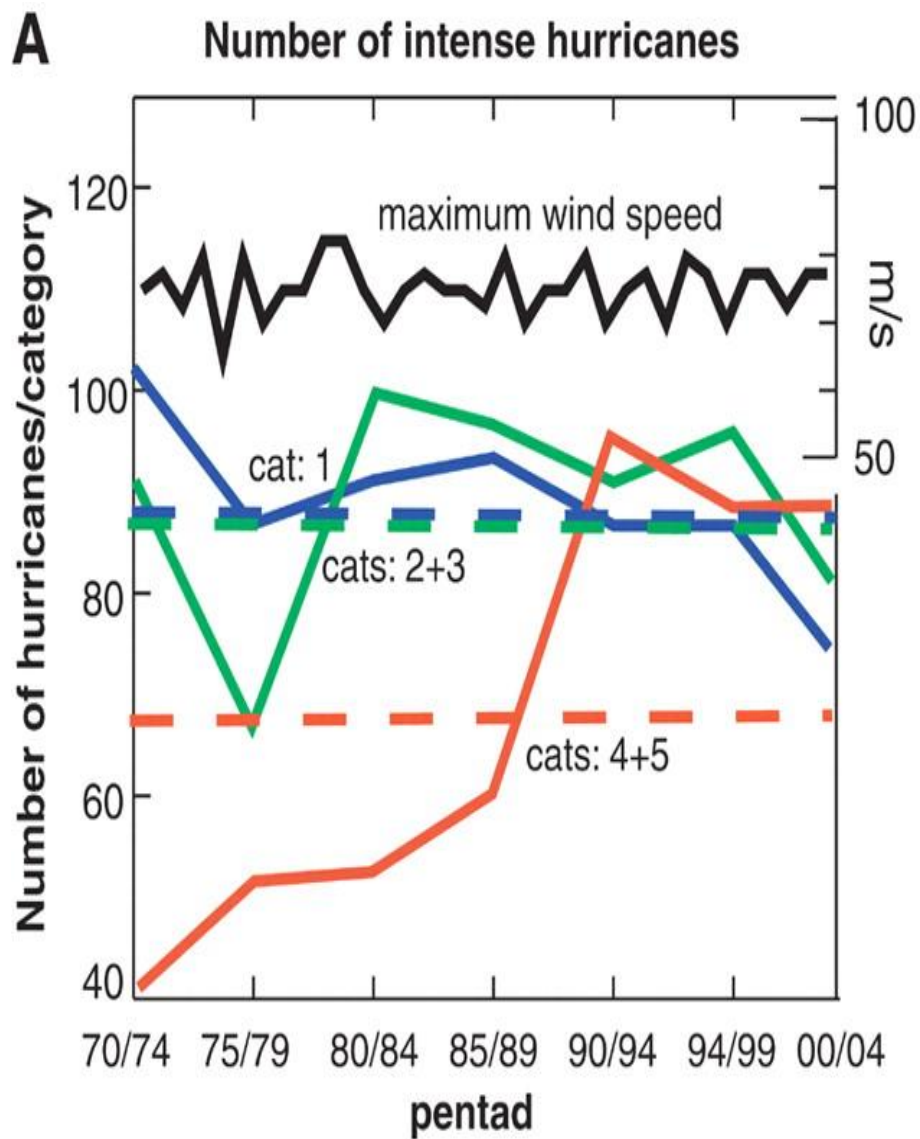
- Yearly data
- 2 year mean
- 3 year mean
- 5 year mean



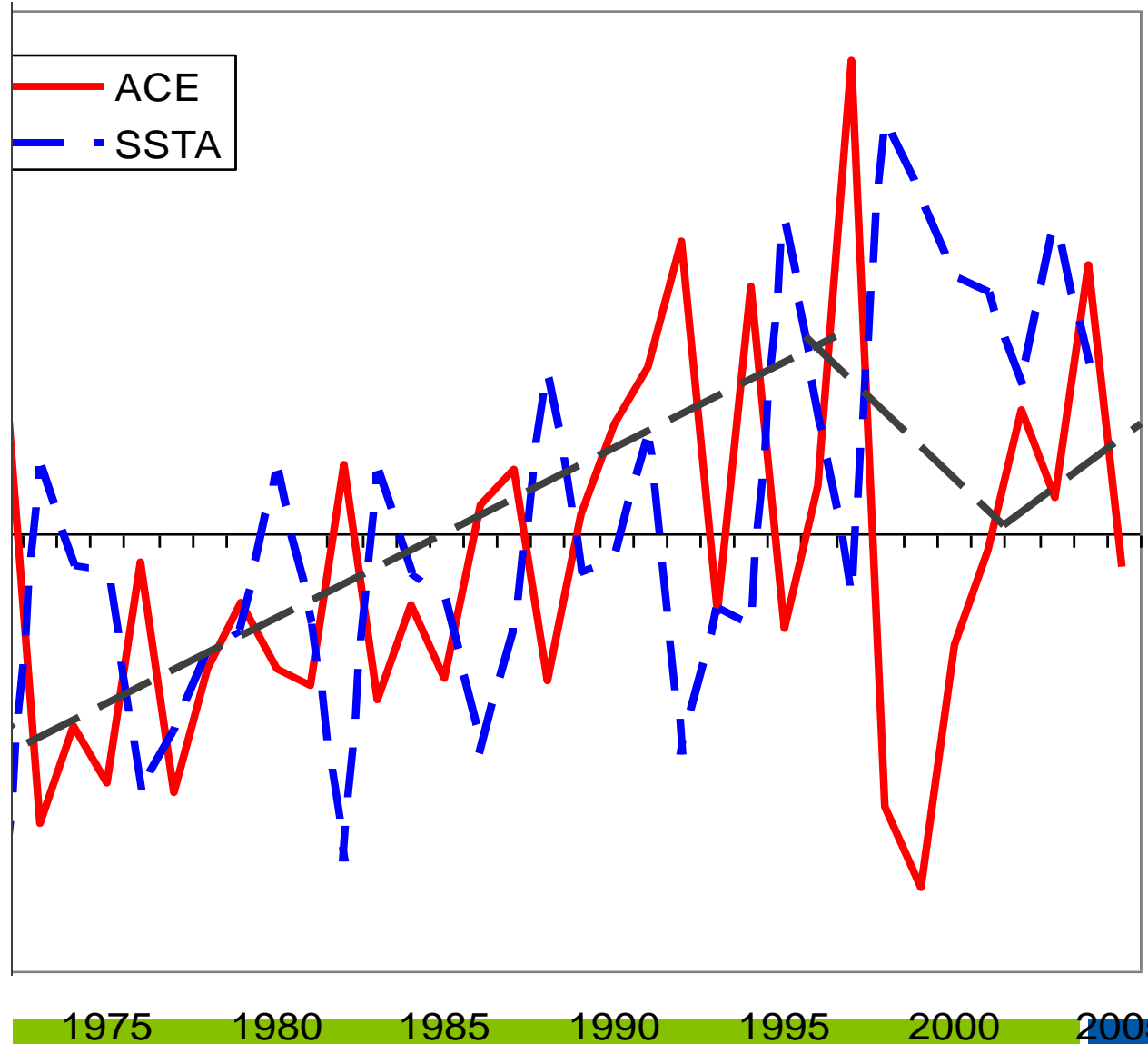
# ACE vs. May-Nov SSTA (5-30°N, 120-180°E)



# Webster et al.'s (2005) Science paper



# ACE vs. May-Nov SSTA (5-30°N, 120-180°E)



# No. of Category 4 and 5 Typhoons

	1975-89	1990-2004
<b>Number</b>	<b>75</b>	<b>115</b>
<b>Percentage</b>	<b>32</b>	<b>42</b>

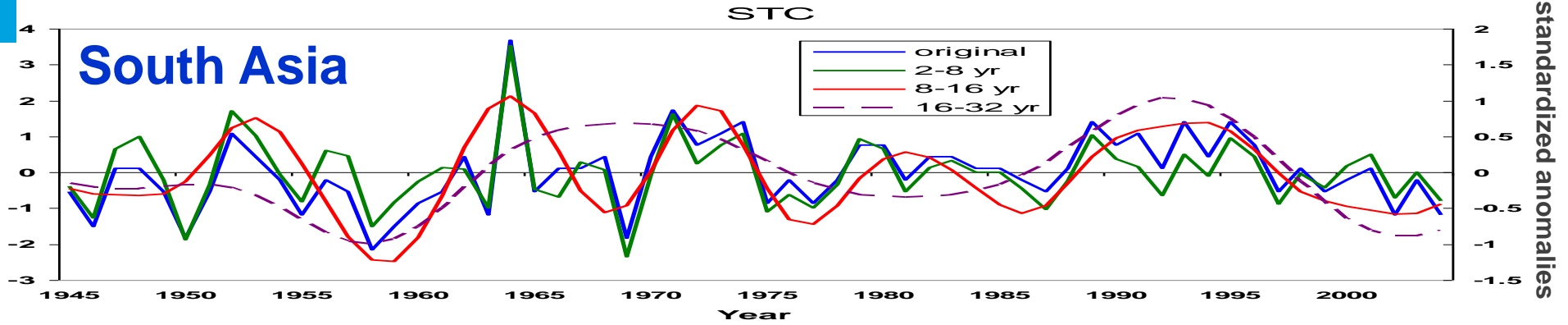


# No. of Category 4 and 5 Typhoons

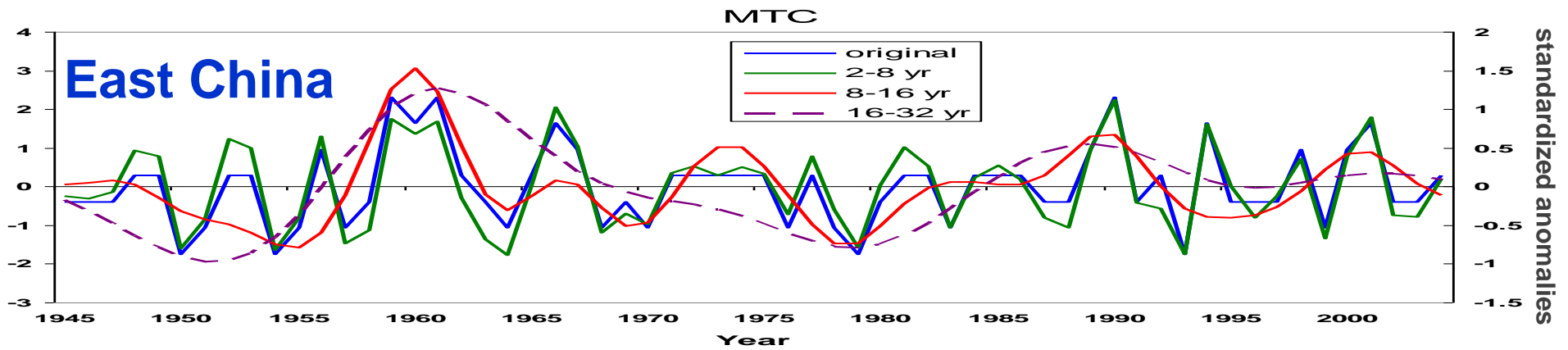
	1960-74	1975-89	1990-2004
Number	105	75	115
Percentage	37	32	42

# Variations of Landfall in Different Regions in East Asia

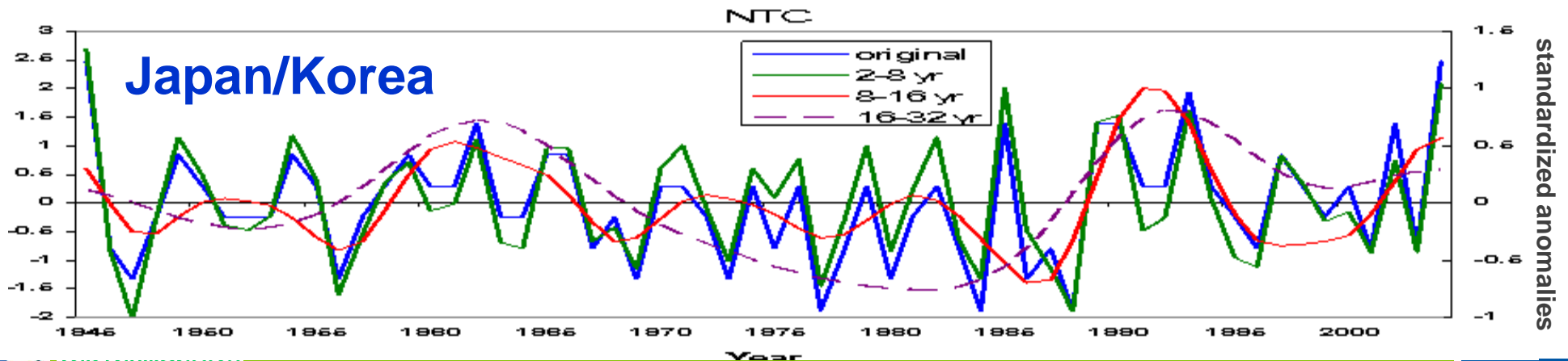
standardized anomalies



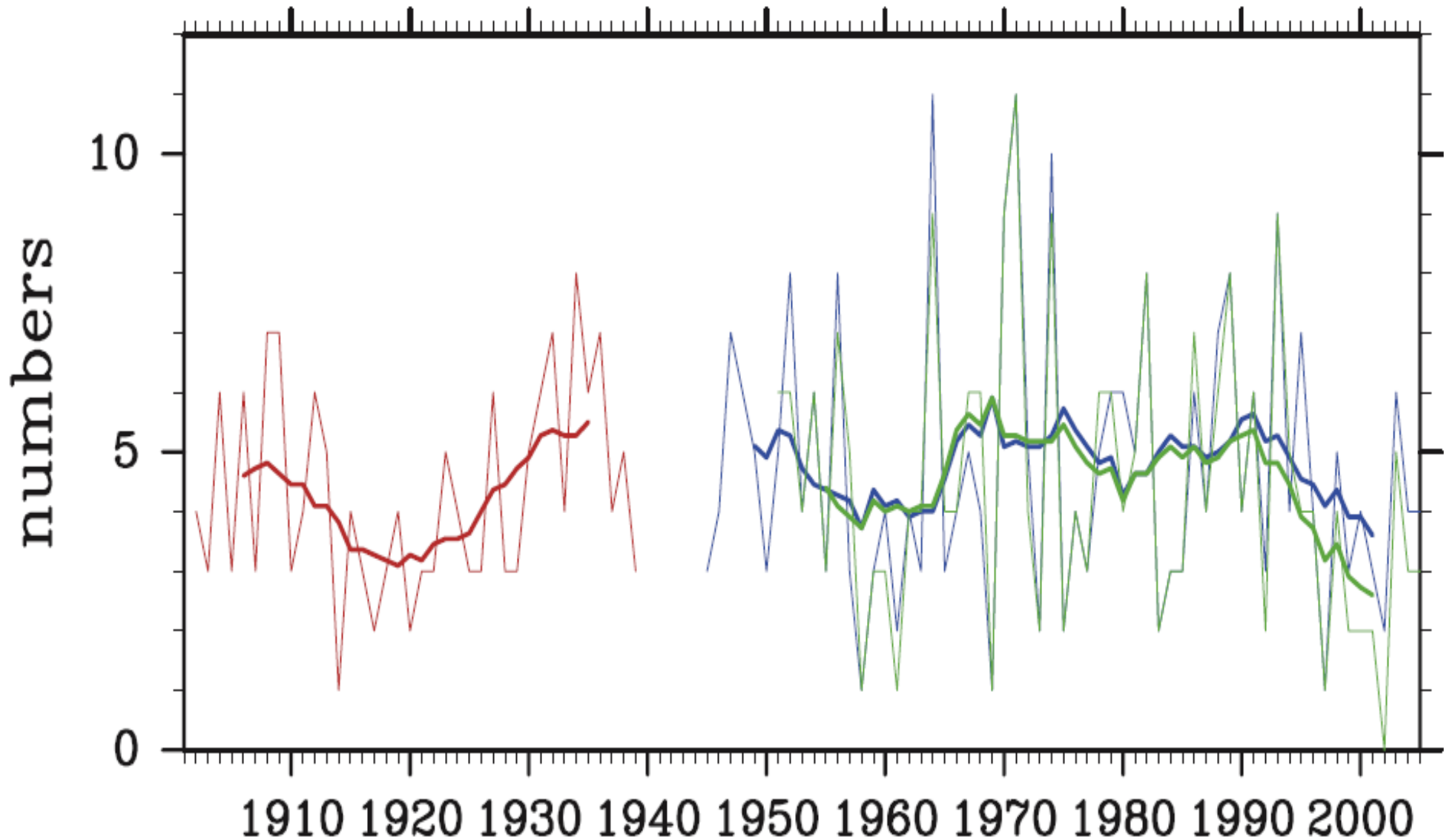
standardized anomalies



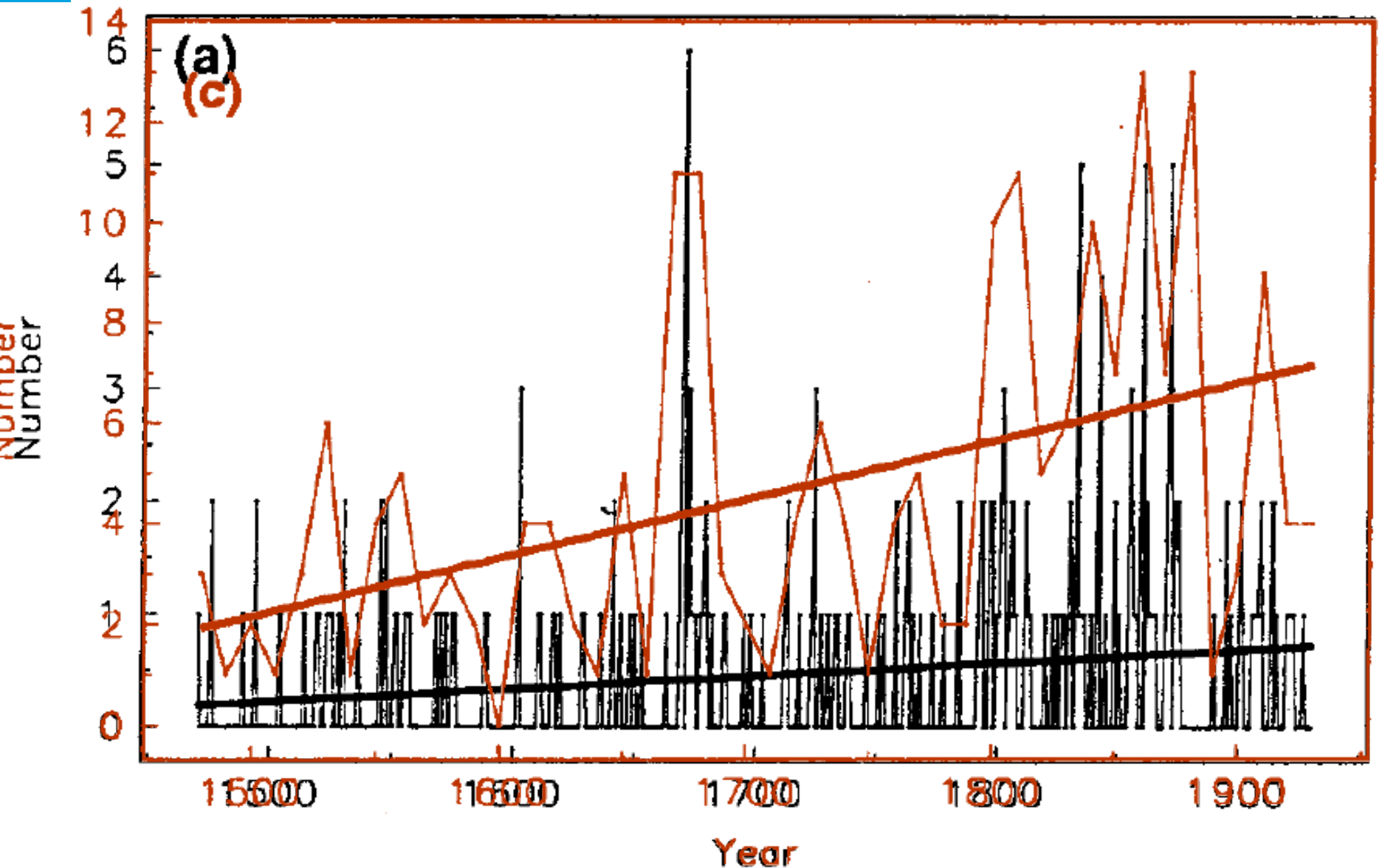
standardized anomalies



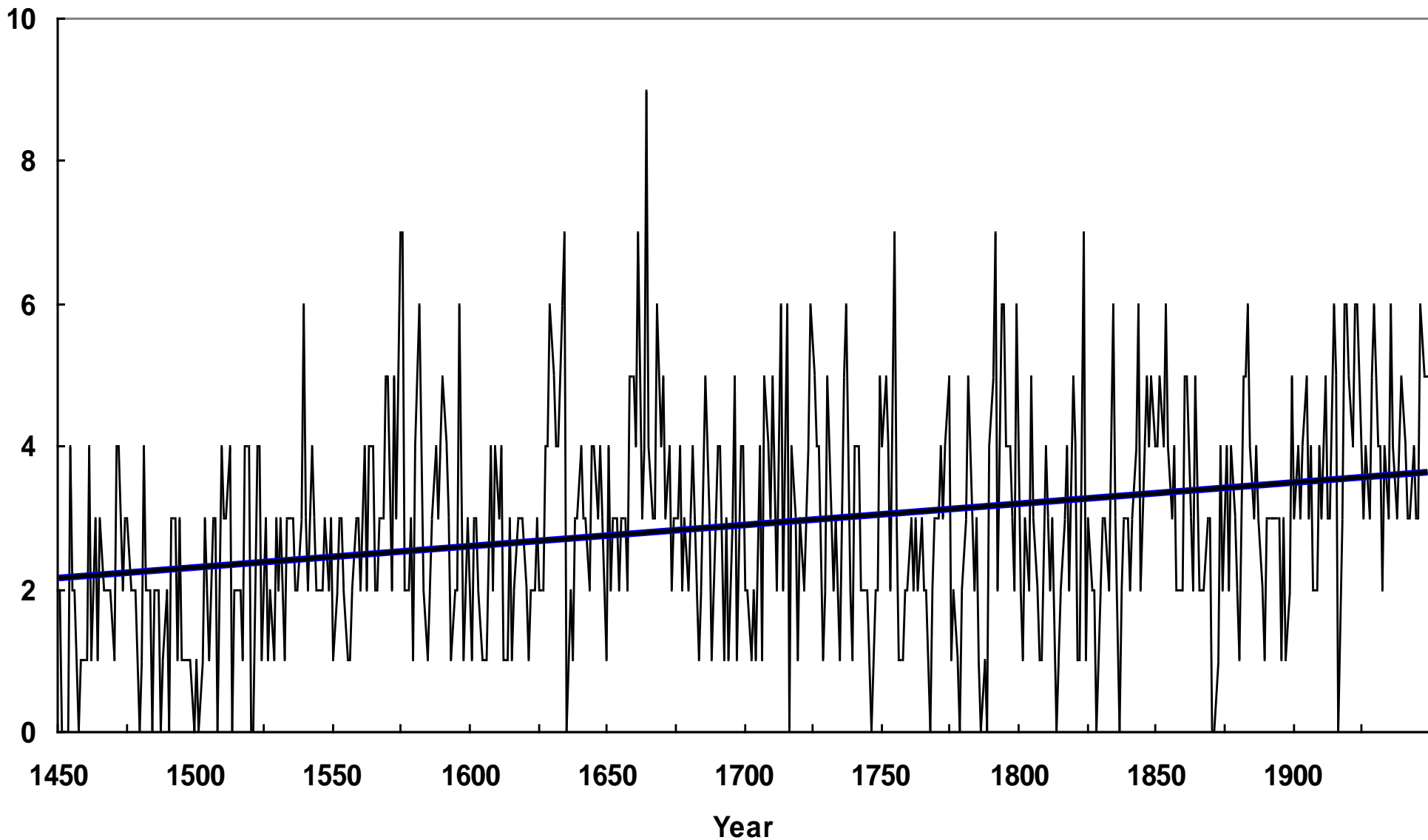
# No. of Typhoons Affecting the Philippines



# No. of Typhoons Affecting Guangdong Province



# No. of Typhoons Affecting East China



# Summary

- **Global temperatures have been on the rise during the last 100 years or so, at a rate which is faster than the natural cycle and therefore suggests that non-natural (i.e. anthropogenic) contributions are significant.**
- **Anthropogenic contributions are mainly in the form of a significant increase in greenhouse gases.**

# Summary

- Although we have seen the earth temperature at similar values as the present, the current CO<sub>2</sub> concentration is unprecedentedly high. This suggests that other factor(s) may be mitigating the effects of CO<sub>2</sub> and other greenhouse gases. More studies are necessary to understand this.
- Typhoon activity in East Asia has not been increasing during the last 60 years. Rather, it goes through periods of a few years to a few decades.

# Summary

- **Examination of historical records of typhoon activity also show periodicities ranging from decades to centuries. Although a small rising trend is found, it is not likely related to global warming.**
- **However, because of the increased moisture available in the atmosphere as a result of global warming, rainfall associated with typhoons is likely to be more severe.**