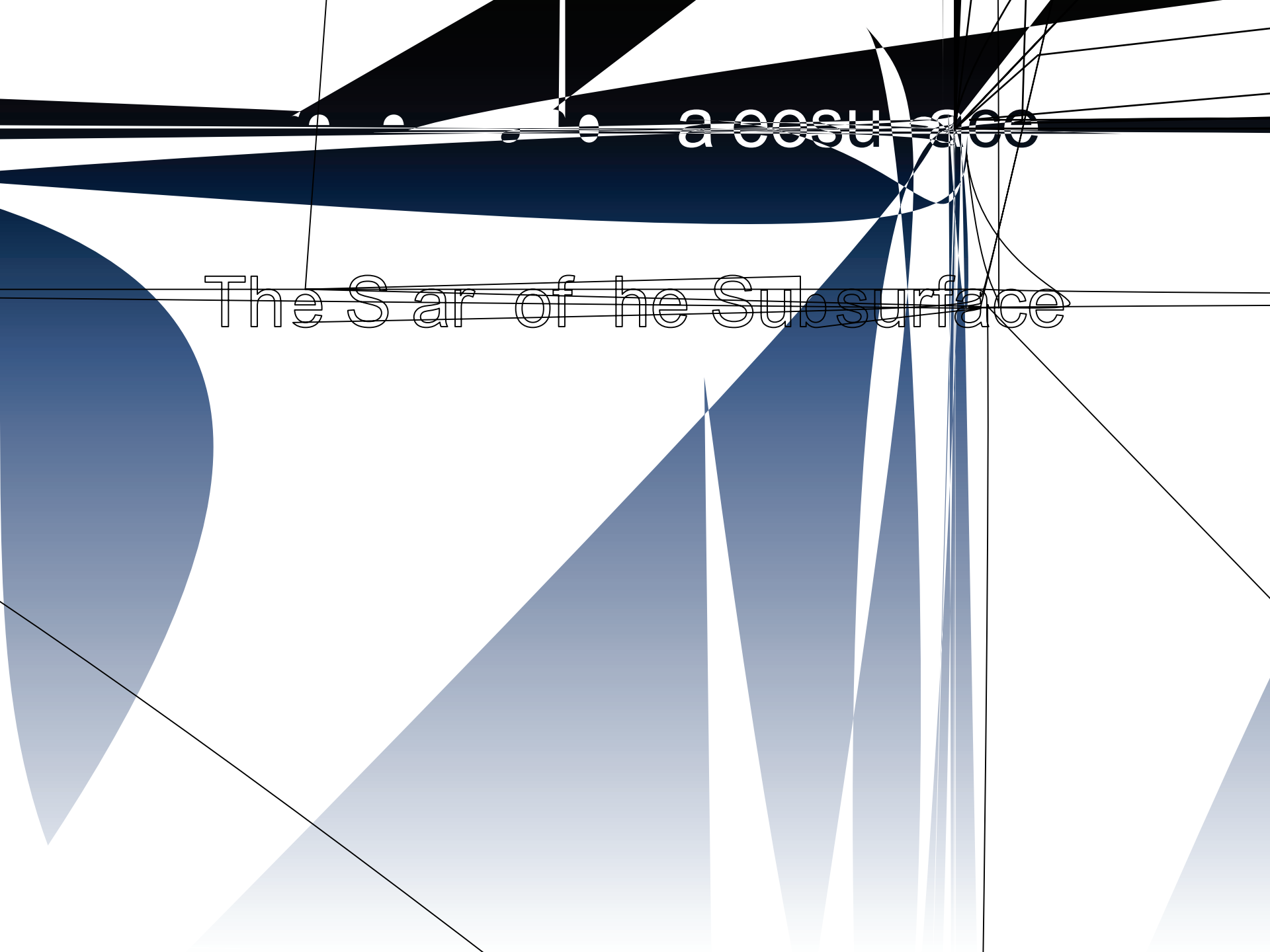

The S ar of he Sulsurface

# Why do we care?

Surface temperatures affect our calculated subsurface temperatures

Today
In the past

Proper attention to surface temperatures marks you as a careful worker

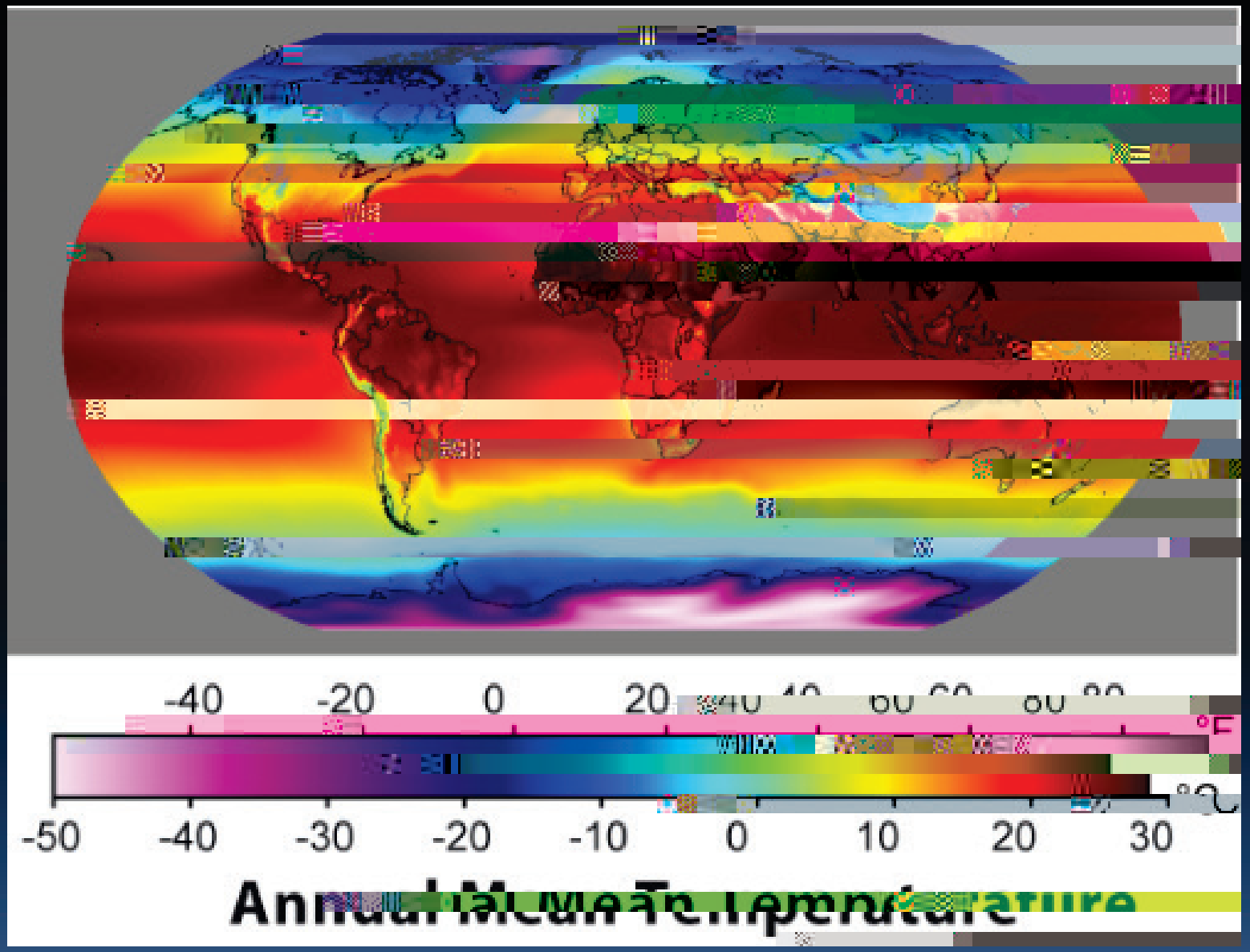
## Present-day surface temperatures

Onshore
Offshore

## Paleosurface temperatures

Onshore
Offshore

# Present-day surface temperatures



# Examples of air temperatures

Port Moresby, PNG (9.67$^{o}$S, elev. 47 m)

Tsurf = 27.6 – 0.4 – 0.6 – 0.3 = 26.3$^{o}$C [26.9$^{o}$C]

PNG Thrust and Fold Belt (5.5$^{o}$S, elev. 2700 m)

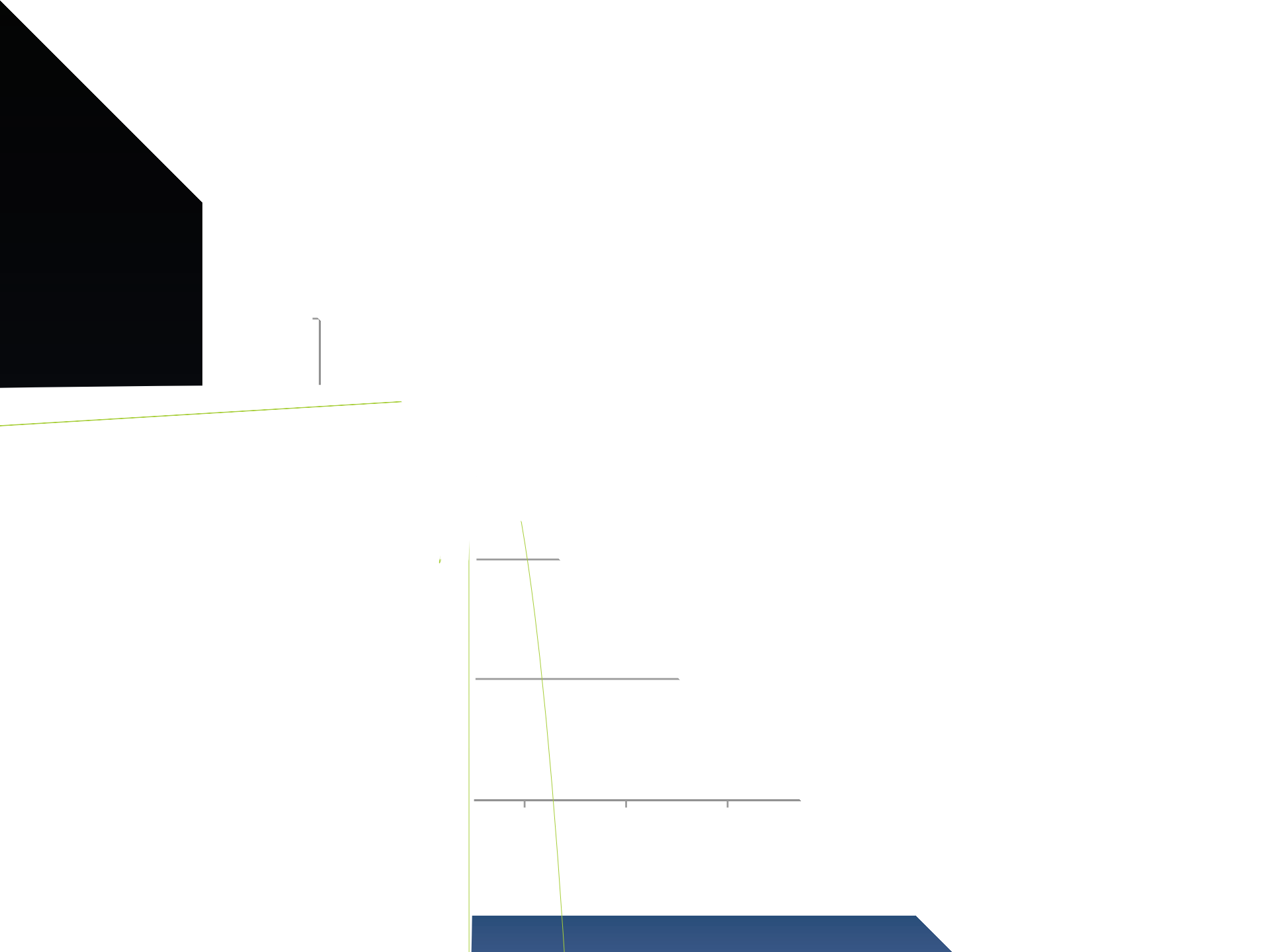
Tsurf = 27.6 – 0.2 – 0.2 – 17.3 = 9.9$^{o}$C

# Confidence levels

Non-continental climates: ± 1.5$^{o}$C

Continental climates: ± 3.5$^{o}$C ??

Accuracy can be improved using weather data to calibrate a local model

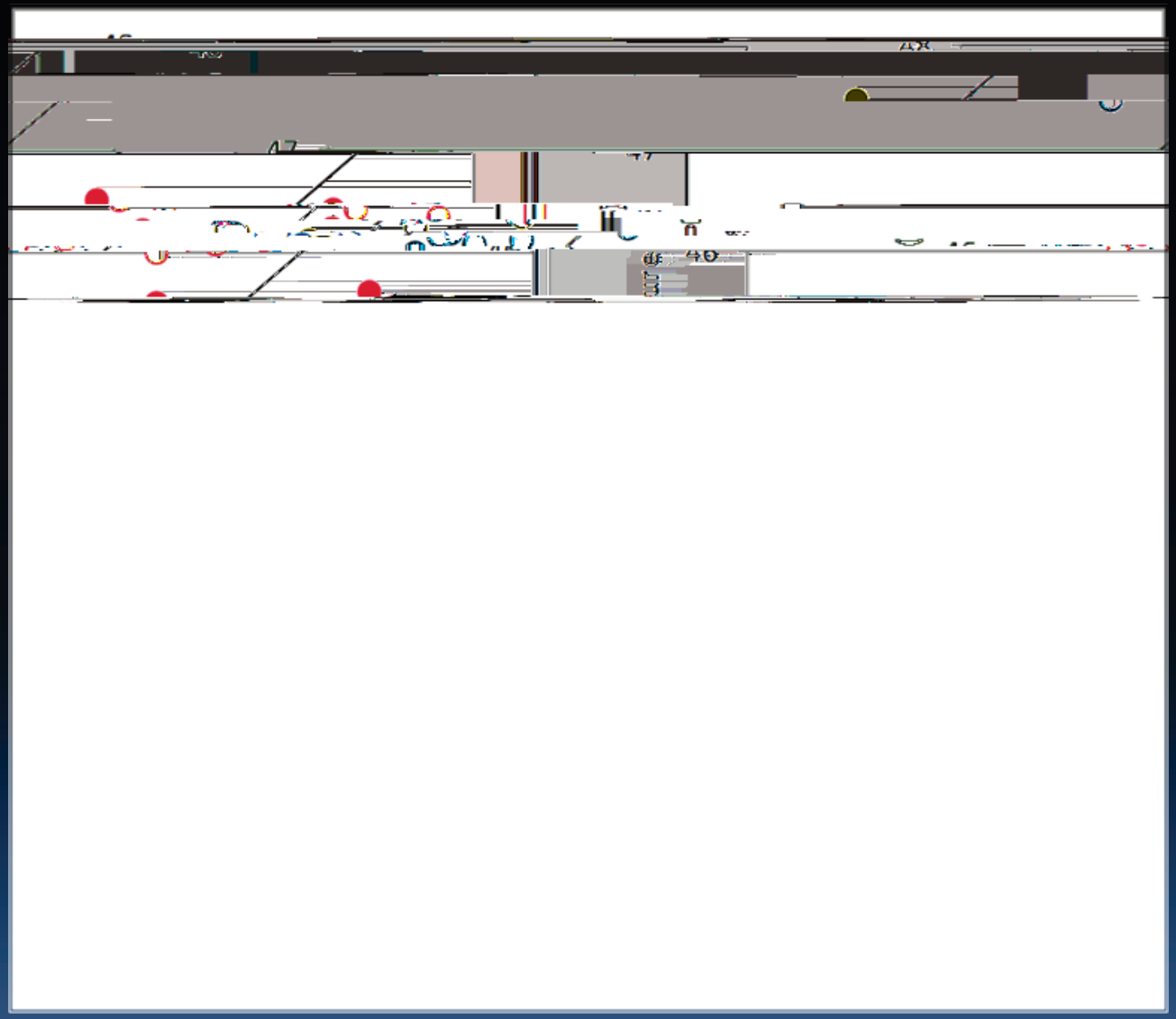


# Sources of weather data

www.worldclimate.com

Gives mean annual air temperatures, elevations, latitude, and longitude

# Powder River Basin: after calibration



# Local calibration in PRB

Adjust constants in latitude equation

Adjust adiabatic lapse rate

Add dependence on longitude, since degree of continentality decreases westward into the mountains

In PRB 95% of calculated values are within 2.3$^{o}$F of measured values

# Present-day offshore “surface” temperatures

Actually they are sea-floor temperatures,

not water or air temperatures

Depend on

Water depth

Latitude

Degree of isolation of water body

# Nomograph of Beardsmore and Cull (2001)

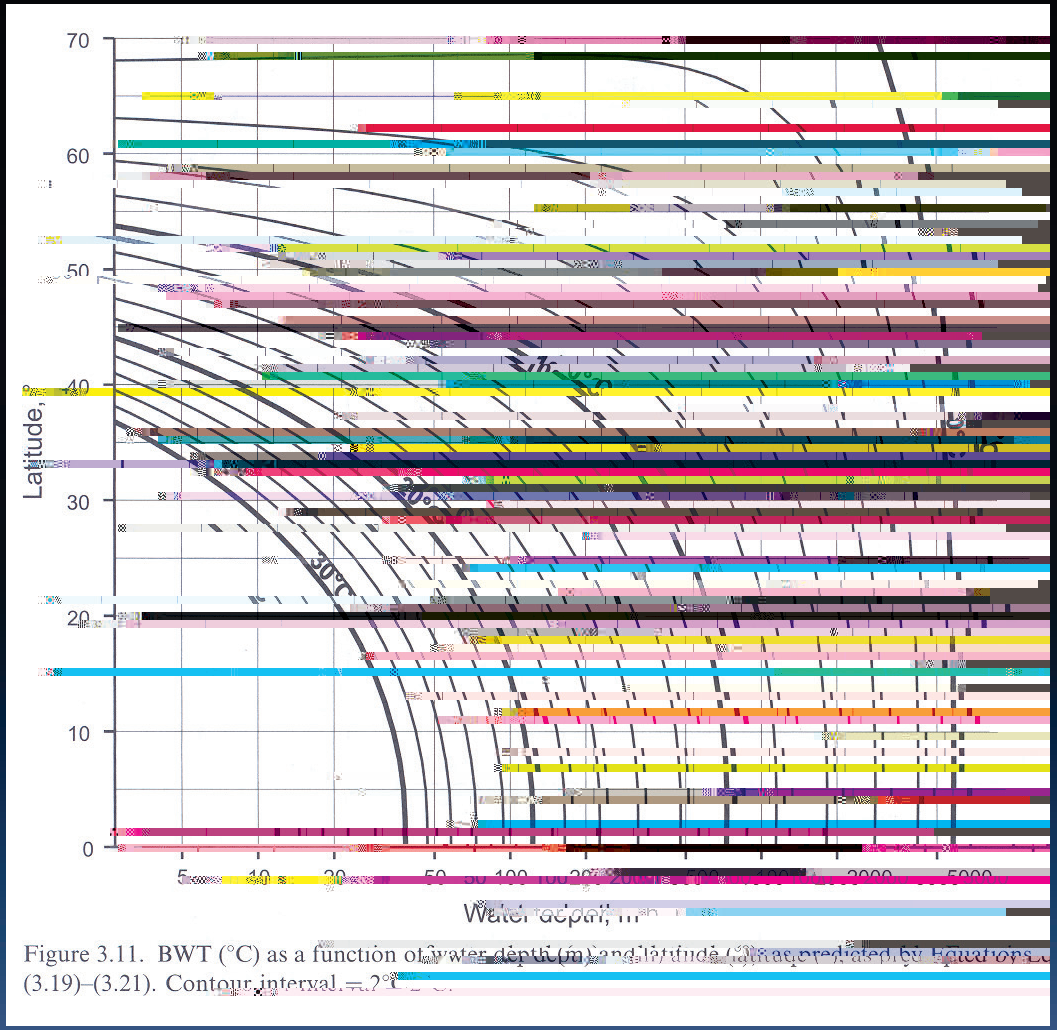
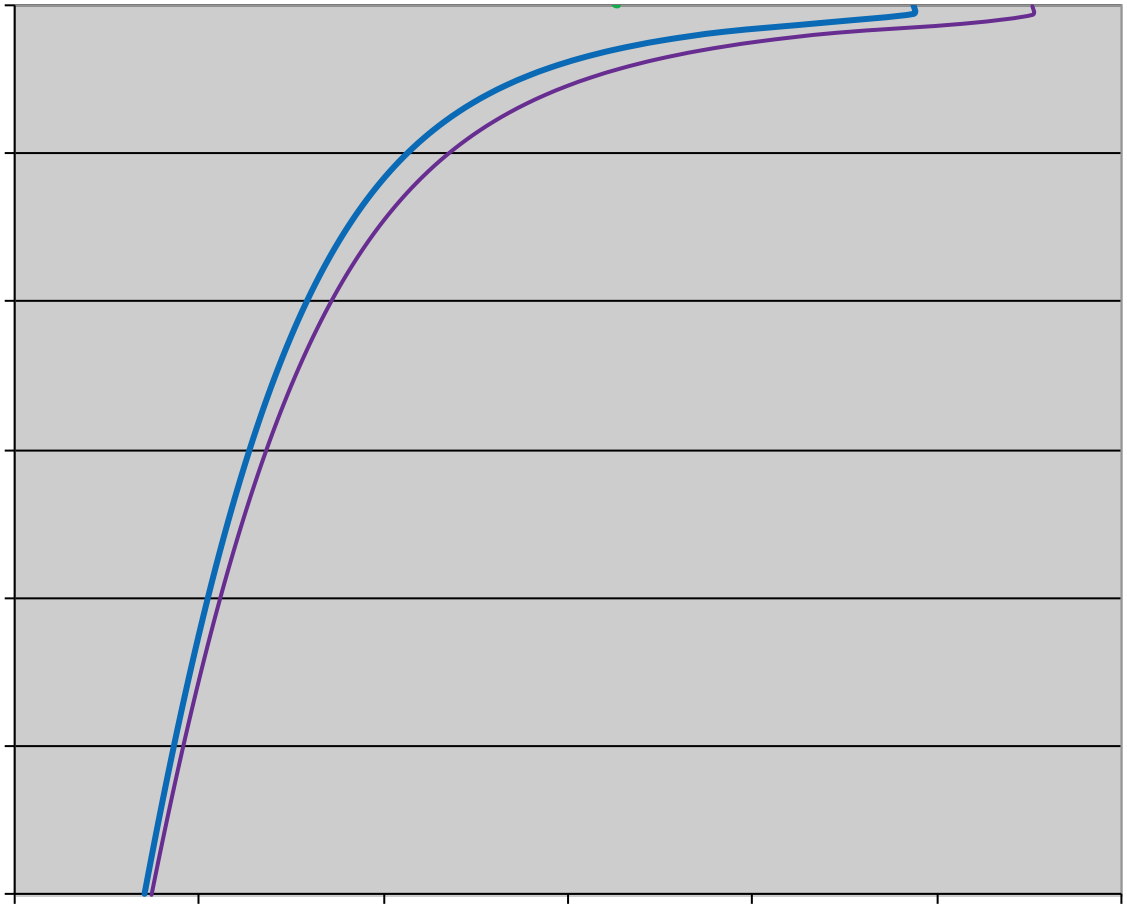



Figure 3.11. BWT (°C) as a function of water depth (m) and latitude (°) as predicted by Equations (3.19)–(3.21). Contour interval = 2°C.



# Use of measured bottom-water temperatures

Correction for depth?

Geographic relevance?

Changes in water circulation?

# Paleosurface temperatures

## Onshore and offshore

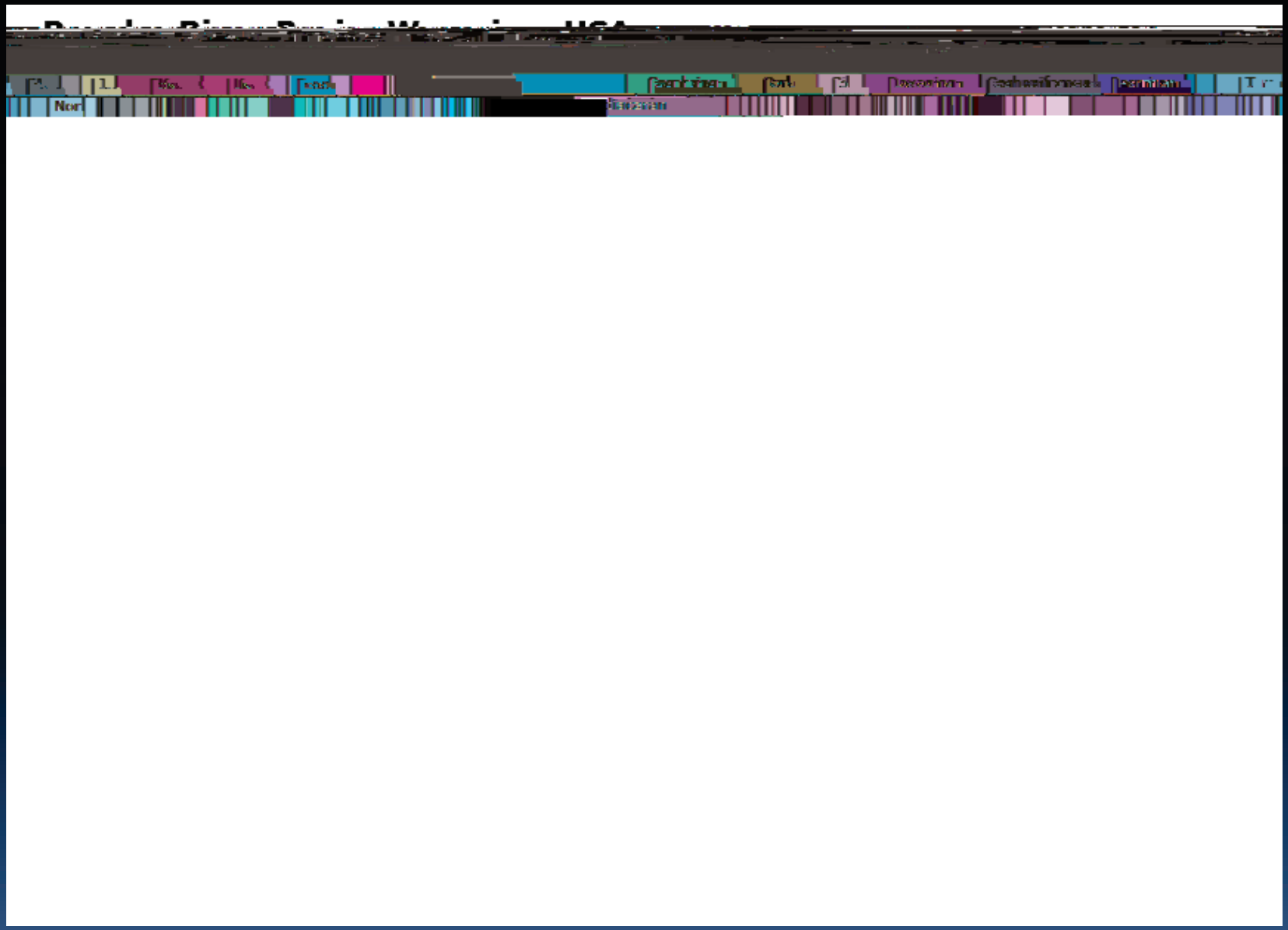
Paleolatitude

Paleoclimate

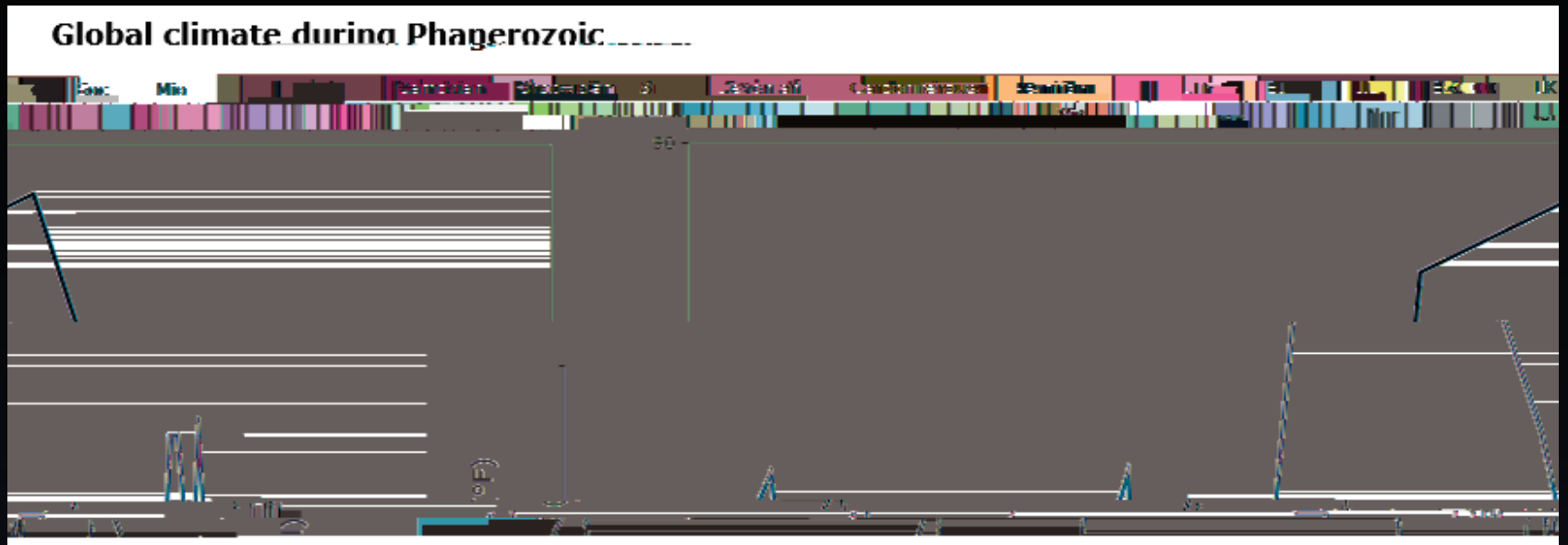
Paleoelevation

Paleobathymetry

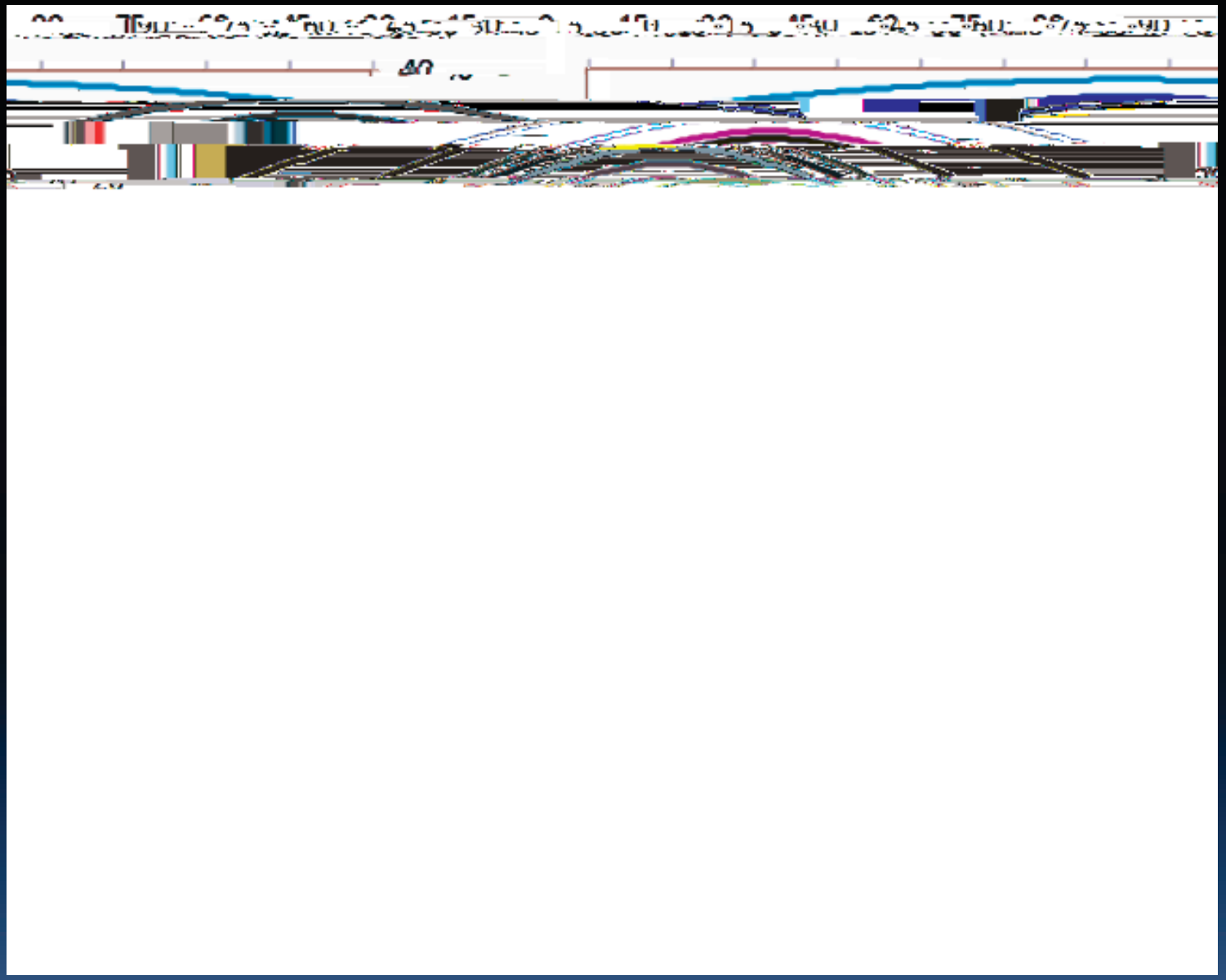
# Paleolatitude



# Paleoclimate



# Latitudinal dependence of effects of paleoclimate



# Paleoelevation

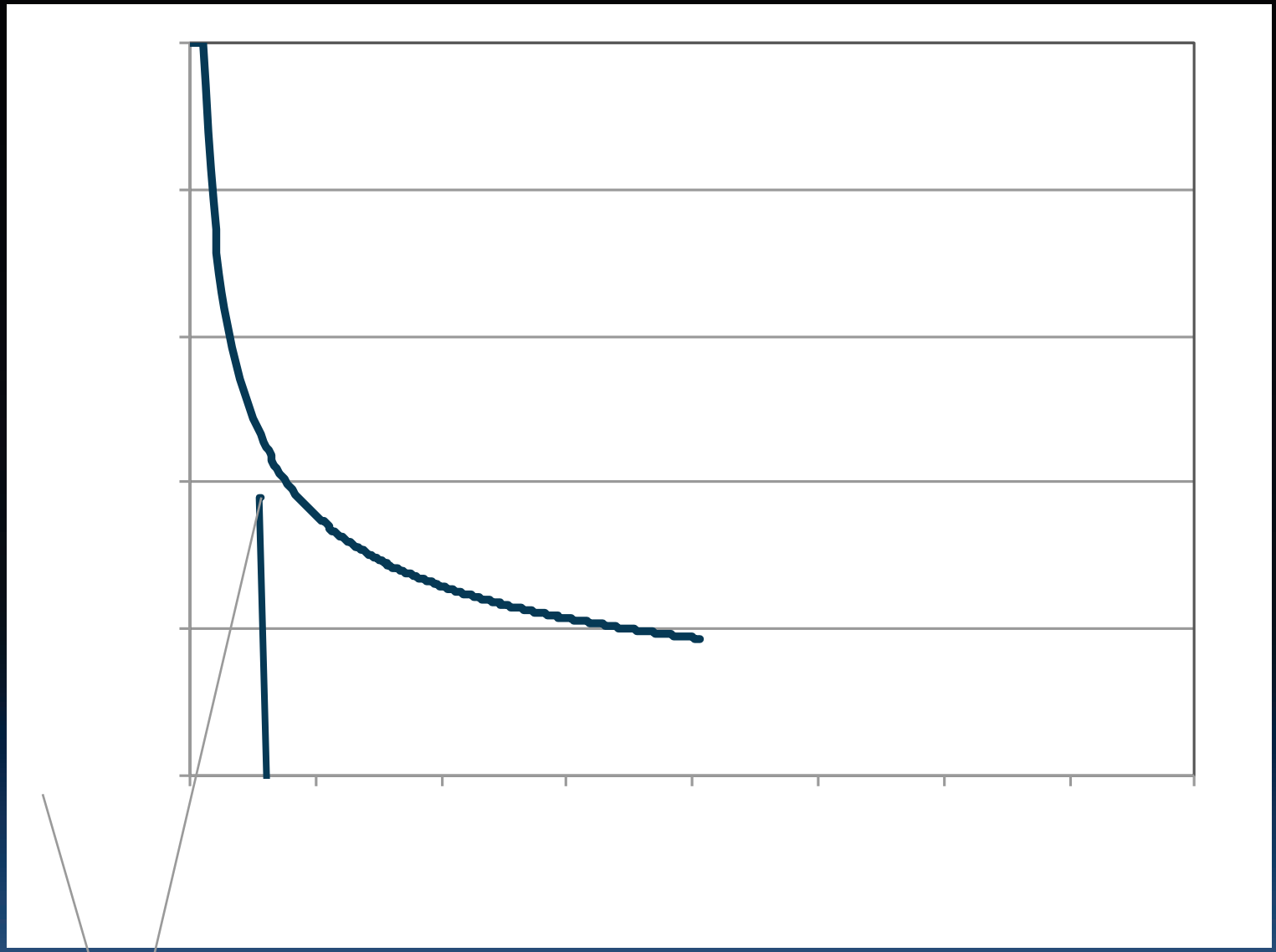
Adiabatic lapse rate assumed to be the same as today’s

# Paleobathymetry

Based on Beardsmore/Cull algorithm using paleolatitude and paleobathymetry

Adjustment for climate change

# Effect of paleoclimate on seafloor temperatures0

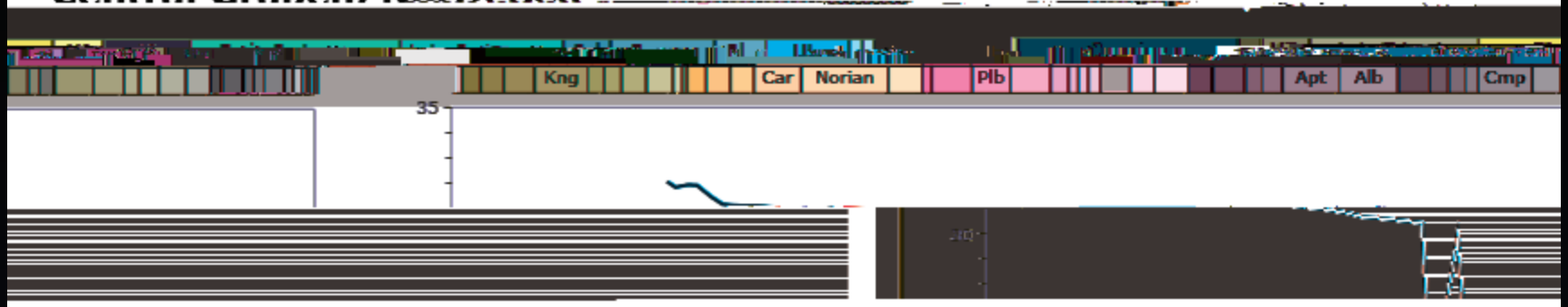


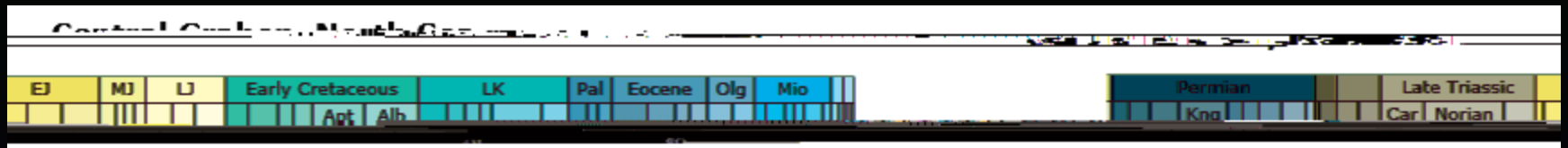
# Powder River Basin

## Powder River Basin

# Powder River Basin

# Central Graben, North Sea




EJ
MJ
LJ
Early Cretaceous
Apt
Alb
LK
Pal
Eocene
Olg
Mio
Permian
Kng
Late Triassic
Car
Norian

## Central Graben, North Sea

# Summary

“Surface” temperatures depend on many factors

Past, present

Concepts are simple but application is complex

Enabled by appropriate software

Of direct and indirect benefit