US Geological Survey PRISM Project

Pliocene Paleoclimate Research

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PRISM/PlioMIP Collaboration

Pliocene Research, Interpretation and Synoptic Mapping Project

Pliocene Model Intercomparison Project
Pliocene Research, Interpretation & Synoptic Mapping

PRISM History
Deep Time?
General theme of Soviet Era authors...

The Arctic ice is a great disadvantage, as are the permanently frozen soil (permafrost), dust storms, dry winds, water shortages in the deserts, etc. If we want to improve our planet and make it more suitable for life, we must alter its climate.

Geoengineering?

(Rusin & Flit, 1960)

Dam the Bering Straights, pump Arctic water to Pacific

Divert major rivers away from Arctic to central Asia

Accelerate the Greenhouse Effect

The US Advanced Research Projects Agency (ARPA) had a classified program 'Nile Blue' investigating National Security implications of deliberate or inadvertant climate modification by the Soviets.
Events leading to the National Climate Program in 1987

• **1970s** Budyko suggested reconstructions of Late Cenozoic (Eemian, Pliocene, Miocene, Eocene) climatic optima as palaeoanalogues for 21st century climate

  \[ \uparrow \text{CO}_2 \text{ in the past meant warmer conditions} \]

• **Early 1980s** State of climate predictions was less than encouraging to U.S. policy makers

• **1982** NAS suggested new deep time synoptic reconstructions were necessary

• **1988** USGS began its Warm Pliocene Project to produce a better synoptic view of the Pliocene; NASA agreed to model Pliocene climate using USGS boundary conditions
PRISM Goals

1. Reconstruct the Pliocene paleoenvironment to better understand the most recent interval of *Global Warmth* similar to that projected for the end of the 21st Century.
PRISM Goals

2. Provide digital data sets of boundary conditions that can be used to initialize and verify [Pliocene] paleoclimate simulations.
Why the Pliocene?  
A future beyond our experience

Mean Annual Global Temperature, relative to 1800–1900 (°C)

- Proxy Reconstruction
- A1FI
- A2
- B1
- Direct Observations

IPCC scenario based? MAT estimations

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800,000 year composite record of CO$_2$ variability from Antarctic ice cores
Benthic oxygen isotopes

Interglacial
(warm, less ice volume)

Glacial
(cool, more ice volume)

Pleistocene

Pliocene

You are here

No NH ice

C. wuellerstorfi

Northumbria/GMU
Why the Pliocene?

- The **PETM** was certainly warmer with more CO₂. Boundary conditions, methods.
- The **LIG** is certainly more accessible. Not much different from today.
- The **Pliocene** is a compromise: warming on the order of 2-3°C, boundary conditions mostly identical to present day, within reach of many of the proxy methods used for more recent climate reconstructions, biota extant.

Pliocene Yorktown Formation, SE Virginia
Climate System boundary conditions

Changes in:
- Solar Radiation
- Atmospheric Composition
- Land Features, Orography, Vegetation, Albedo, etc.
- Ocean Basin Shape, Salinity, etc.
PRISM3 Data Model Scheme

MARINE FOSSIL DATA

SEA LEVEL
TOPO

IKM
MAT
GEO

SST

DOT

BASISM

TRIFFID

HadAM3

BIOME4 Scheme from data

BIOME4 Scheme from model

TEVIS

VEG

(Stratigraphy Dowsett et al., 2010)