North Atlantic Piacenzian Data Model Comparison: PRISM4 and PlioMIP2

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Abstract

The mid-Piacenzian (Pliocene) climate represents the most geologically recent interval of long-term average warmth, relative to the last million years, sharing similarities with the climate projected for the end of the 21st century. Therefore, this period has been studied by both geoscientists and climate modelers for many years. A better understanding of regional late Pliocene conditions can provide insight into potential climate change impacts, enabling more informed policy decisions for mitigation and adaptation. Previous work comparing climate model results with geologic data highlighted key regional and dynamic situations where there was discord between mean annual SST estimates generated by climate model simulations and paleoenvironmental reconstructions. One key area identified was the mid- to high-latitude North Atlantic. Here, we present a comparison between alkenone-based North Atlantic PRISM4 (Pliocene Research, Interpretation and Synoptic Mapping Project, Phase 4) mean annual SST estimates and an ensemble of ten climate model simulations produced as part of PlioMIP2 (Pliocene Model Intercomparison Project, Phase 2). Our latest research demonstrates that improved experimental design incorporating temporal refinement of the paleoenvironmental reconstruction, and inclusion of new PRISM4 boundary condition data sets, significantly reduces discord between data and models.

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USGS science for a changing world

PRISM4

PP33C-1708

PlioMIP 2

Neogene Pliocene

Geologic Investigations of the Neogene

PRISM4 boundary conditions include updated paleogeography, soils and large lakes. Most significant change to paleogeography is a closed Bering Strait and Canadian Arctic Archipelago.

PlioMIP2 uses PRISM4 boundary conditions and a Pliocene orbit (3.205 Ma) similar to modern. That same interval was used by PRISM4 to generate alkenone SST and other paleoenvironmental estimates for North Atlantic sites.

Data – model comparison for 7 North Atlantic sites shows generally good agreement in low latitudes.

One coastal plain site (DEQ 161-592) is difficult to assess since it is an ocean grid point in many simulations.

In most cases models show a better fit to the higher latitude data than previous data-model comparisons.

Gradients are a better test of agreement than point by point comparisons for deep time DMC.

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A closed mid-Piacenzian Bering Strait yields a better fit between model simulations and proxy SST estimates.

A better understanding of regional late Pliocene conditions can provide insight into potential climate change impacts, enabling informed policy decisions for mitigation and adaptation. Previous work comparing climate model results with geologic data highlighted key areas of discord between SST estimates generated by climate model simulations and paleoenvironmental reconstructions. Here, we present a comparison between alkenone-based PRISM4 SST estimates and an ensemble of ten climate model simulations produced as part of PlioMIP2. Initial results demonstrate improved experimental design incorporating temporal refinement of the paleoenvironmental reconstruction, and inclusion of new PRISM4 boundary conditions, reduces discord between data and models.

Scan code for pdf:
The mid-Piacenzian of the North Atlantic Ocean

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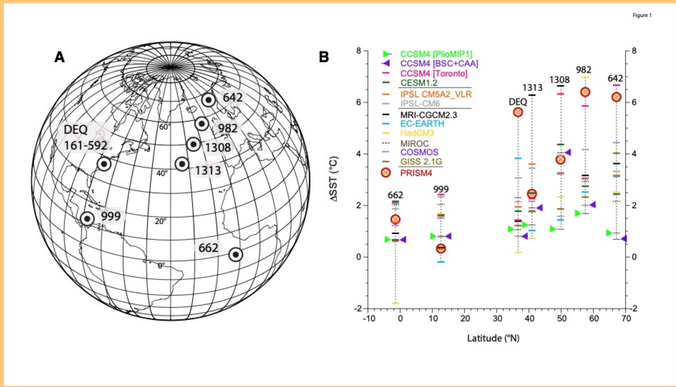
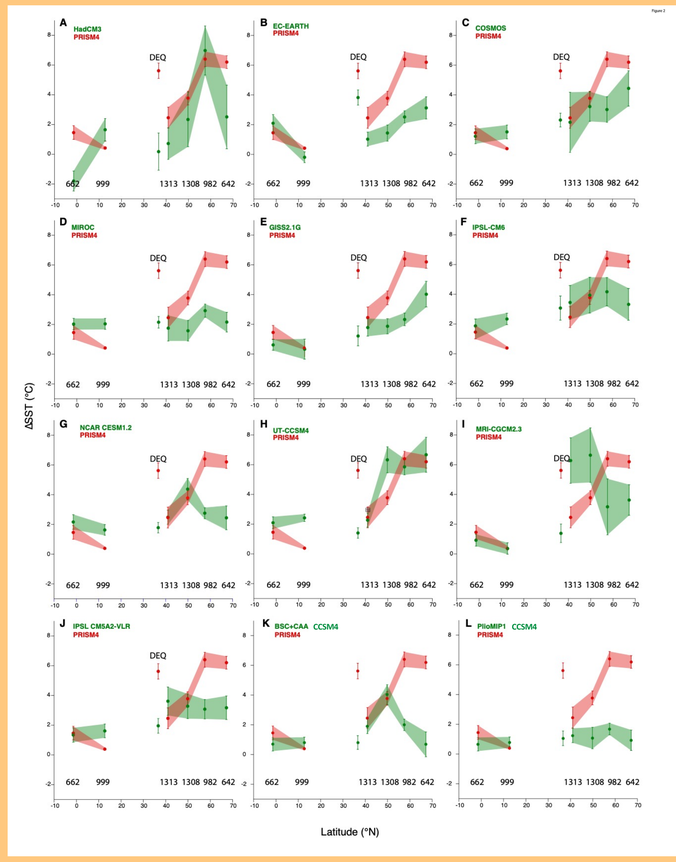
A closer look at PlioMIP2 comparison work in progress





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