Modeling a modern-like pCO$_2$
Warm period with two versions
of IPSL AOGCM

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Study Background and Methodology

The MPWP (mid-Piacenzian Warm Period, 3.3-3.0 Ma) conditions:
• Warmer than present by 2-3 K, NH polar warm amplification > 10 K
• pCO₂: 400 ppmv (± 50 ppmv)
• SLR: +20 (±10) m higher than present
• GrIS volume: -75% than present; WAIS collapse and EAIS reduced

PlioMIP2 → specific interglacial period (MIS KM5c): similar orbital parameters to the present

Reconstructed land ice and paleogeography (PRISM4) for MIS KM5c(3.205 Ma) Modified from Dowsett et al., 2016

Applied model: French IPSL AOGCMs
1. IPSL-CM5A (Dufresne et al., 2013)
2. IPSL-CM5A2 (Sepulchre et al., 2020)

Objectives:
- MIS KM5c climate conditions under new boundary conditions.
- Climate system response to different forcings during warm conditions

Land sea mask in local grid for PlioMIP2

Experiment design

<table>
<thead>
<tr>
<th>Exp names</th>
<th>Models</th>
<th>Topography &amp; Ice sheet</th>
<th>CO₂ (ppmv)</th>
<th>Integration length (yrs)</th>
<th>Climatologies</th>
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<tbody>
<tr>
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<td>Modern</td>
<td>280</td>
<td>2800</td>
<td>Last 100 yrs</td>
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<td>IPSL-CM5A</td>
<td>PRISM4</td>
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<td>650+800</td>
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<td>PRISM4</td>
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<td>1500</td>
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<td>IPSL-CM5A2</td>
<td>PRISM4</td>
<td>450</td>
<td>1500+400</td>
<td>Last 30 yrs</td>
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<td>IPSL-CM5A2</td>
<td>PRISM4</td>
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<td>IPSL-CM5A</td>
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<tr>
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<td>IPSL-CM5A2</td>
<td>Modern</td>
<td>400</td>
<td>1500+400</td>
<td>Last 30 yrs</td>
</tr>
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</table>

Modified from Haywood et al., 2016

Modified from Dowsett et al., 2016
Main Results and Conclusions

Mean annual surface air temperature anomaly compared to the PI

- PlioMIP2 (IPSL) : MA SAT anomaly : $+ (2.2-2.3 \, ^\circ C)$, MA PRECIP anomaly : $+0.14 \, \text{mm/d}$.
- The closure of the high latitude seaways $\rightarrow$ an enhanced AMOC and northward heat transport Major factor for the increased warming at the high latitudes in PlioMIP2 relative to PlioMIP1.
- PlioMIP2 (IPSL) MDC : more consistent with data but still underestimate strong warming ($>4 \, ^\circ C$) in the data.