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Insolation and CO_2 induced variations in the sea ice of the last nine interglacials

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The response of Arctic and Southern Ocean sea ice to insolation and CO_2 during the interglacials of the past 800,000 years was simulated with LOVECLIM, an Earth system model of intermediate. The individual contribution of insolation and CO_2 and their combined effect were quantified by using the factor separation technique (Ref1). In the Arctic, the simulated winter sea ice area show small variation between the interglacials, but the variation in summer is large. Insolation plays a dominant role in explaining the variation of the Arctic summer sea ice mainly through its dominant effect on the surface solar radiation. The situation is different in the Southern Ocean. Both summer and winter sea ice show significant variations between the interglacials with the amplitude being larger in austral summer. CO_2 plays a dominant role in the variation of Southern sea ice especially in austral winter mainly due to its dominant effect on the southward oceanic heat transport and on the surface energy budget over the Southern Ocean. As far as the impact of astronomical parameters is concerned, in the Arctic, precession and obliquity have similar weight in explaining the insolation-induced variation of sea ice. However, in the Southern Ocean, obliquity is definitely the most important in controlling both the winter and summer sea ice change. Precession is more important during austral winter than during austral summer, involving changes in meridional oceanic heat transport. Detailed analysis on the ocean-sea ice feedbacks will also be given.

Reference:
Ref1: Yin Q.Z. and Berger A., 2012. Individual contribution of insolation and CO_2 to the interglacial climates of the past 800,000 years. Climate Dynamics 38,709–724.

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