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Different response of sea surface temperature and sea ice to precession and obliquity between the two hemispheres

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The response of the climate system to astronomical parameters is an important scientific issue, but the internal processes and feedbacks need to be better understood. This study investigates the differences of the climate response to the astronomical forcing between the Northern (NH) and Southern (SH) hemispheres based on a more than 90,000-year long transient simulation using the model LOVECLIM. Our results show that the response of sea ice and sea surface temperature (SST) to precession and obliquity are different between the two hemispheres. Precession plays a dominant role on the NH sea ice. This is mainly due to its response to the local summer insolation and also, to a less degree, the influence of the northward oceanic heat transports. However, obliquity plays a dominant role on the SH sea ice through its influence on insolation and the westerly winds. As far as the SST is concerned, it shows a strong precession signal at low latitudes in both hemispheres. For the SST in the mid and high latitudes, obliquity plays a dominant role in the SH whereas precession is more important in the NH. This is largely due to the different response to insolation and feedbacks related to the different land-ocean distribution in the two hemispheres. Near the Equator, besides the precessional signal, the SST also shows strong half-precessional signal, which can be explained by the unique characteristics of the insolation variations at the Equator.