

## Seasonal feedback analysis on polar amplification in warm climate induced by orbit/CO<sub>2</sub> with vegetation change

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Past proxy records indicate the mid-Holocene (6ka) and the last interglacial (127ka) are warmer than the present-day due to the different orbital parameters of the Earth (Otto-Bliesner et al. 2013). In both periods, warming in high latitude is much larger than that of global average, a.k.a. polar amplification, which is also seen in CO<sub>2</sub>-induced climate warming projection. O'ishi and Abe-Ouchi (2011) used a vegetation coupled GCM and quantified the contribution of vegetation feedback to warming in 6ka and revealed the importance of vegetation feedback to reproduce the warming in high latitudes. In the present study, we applied a feedback analysis method proposed by Lu and Cai (2009) on 6ka, 127ka and doubled CO<sub>2</sub> by vegetation-coupled GCM experiments similar to O'ishi and Abe-Ouchi (2011) to reveal more detailed feedback mechanisms with and without vegetation feedback. The result shows vegetation feedback strengthens the polar amplification in all 6ka, 127ka and double CO<sub>2</sub> case, but the contribution of vegetation feedback is far larger in orbit induced case (6ka and 127ka) than doubled CO<sub>2</sub> case.

Keywords: polar amplification, vegetation feedback, paleoclimate modeling