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Projected disruption in seasonal timing of Arctic Ocean $p\text{CO}_2$

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Ocean acidification implies long-term changes in ocean CO_2 system variables modulated by changes in seasonal amplitudes. Further modulation, yet unexplored, may come from changes in timing of the annual cycle. For the CO_2 partial pressure ($p\text{CO}_2$), a winter high and summer low are observed in Arctic Ocean surface waters because thermal effects are outweighed by those from biology. Here the same timing was found with 9 Earth system models under historical forcing. Yet under a high-end CO_2 emission scenario, those models project that the summer low (relative to the annual mean) eventually reverses sign across most of the Arctic Ocean. In most models, that sign reversal inverses the chronological order of the annual high and low. The high moves from spring to summer and the low moves from summer to spring. The cause is the projected dramatic warming in summer sea surface temperature provoked by earlier retreat of seasonal sea ice. The increase in the summer $p\text{CO}_2$ extreme over this century is $29\pm 9\%$ greater than if there had been no change in seasonal timing, only the enhanced sensitivity of $p\text{CO}_2$ to its driving variables. Thus the projected change in extreme summer $p\text{CO}_2$ is 150 ± 50 μatm higher. Outside of the Arctic Ocean, projected changes in seasonal timing of $p\text{CO}_2$ are small.