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Intensification of the seasonal cycle of Sea Surface Temperature due to Greenhouse Warming

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Over the period from 1971-2010 global oceans have warmed by about 0.11°C per decade (upper 75 m). This warming is neither spatially, nor seasonally uniform. Here we address the question whether future greenhouse warming will bring about changes in the amplitude and phase of the seasonal cycle of sea surface temperatures (SST). We analyse RCP8.5 scenario simulations conducted with 5 Coupled General Circulation Models, as part of Coupled Model Intercomparison Project Phase 5 (CMIP5). Our results show that the amplitude of the SST seasonal cycle (defined here as the difference between climatological maximum and minimum temperature) increases by a factor of 1.2 to 2.5 towards the end of this Century (2080-2100). The amplification is not homogeneous with the largest changes occurring in the North Atlantic and North Pacific and smallest anomalies in the tropics. The key mechanisms behind this amplification is further analyzed by performing an upper ocean heat budget analysis. Our results suggest that the shoaling of the mean mixed layer depth in response to future warming is a primary driver for the amplification in the North Atlantic. In the North Pacific, the amplification can be traced back to an intensification of the seasonal amplitude of surface heat fluxes. More detailed regional analysis of the amplification mechanisms will be presented.

Keywords: Sea surface temperature, Mixed layer depth, seasonal cycle amplification, mixed layer temperature equation, greenhouse warming.