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Meridional oceanic heat transport influences marine heatwaves in the Tasman Sea on interannual to decadal timescales

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Marine heatwaves pose an increasing threat to the ocean's wellbeing as global warming progresses. Forecasting marine heatwaves is challenging due to the various factors that affect their occurrence, including large variability in the atmospheric state. In this study we demonstrate a causal link between ocean heat content and the occurrence and intensity of marine heatwaves in the Tasman Sea on interannual to decadal time scales. Ocean heat content variations are more persistent than atmospheric drivers for marine heatwaves and thus provide better predictive skill on timescales longer than weeks. Using data from a forced global ocean model we show that ocean heat content fluctuations in the Tasman Sea are predominantly controlled by the oceanic meridional heat transport from the subtropics, which, in turn, is mainly characterized by the interplay of the East Australian Current and the Tasman Front. Variability in these currents can be linked to wind stress curl anomalies north of this region, following Sverdrup′s theory. Data from models and observations show that periods with enhanced upper ocean heat content are characterized by more frequent, longer, and more intense marine heatwaves on interannual to decadal timescales. Thus, the oceanic heat content in the Tasman Sea acts as a preconditioner and has a prolonged predictive skill compared to the atmospheric state (e.g. surface heat fluxes), making ocean heat content a useful indicator and measure of the likelihood of marine heatwaves.