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When a slowly rotating aquaplanet is coupled to a dynamical ocean

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Planets orbiting in close distance from their stars have a high probability to be detected, and are expected to be slowly rotating due to strong tidal forces. By increasing the rotation period from 1 Earth-day to 365 Earth-days, we previously found that the global-mean surface temperature of an aquaplanet with a static mixed-layer ocean decreases by up to 27 K. The cooling is attributed to an increase of the planetary albedo with the rotation period, which is associated with the different distributions of the sea ice and the deep convective clouds. However, we had there assumed a fixed mixed-layer depth and a zero oceanic heat transport in the aquaplanet configuration. The limitations of these assumptions in such exotic climates are still unclear. We therefore perform coupled atmosphere-ocean aquaplanet simulations with the general circulation model ICON for various rotation periods ranging from 1 Earth-day to 365 Earth-days. We investigate how the underlying oceanic circulation modifies the mean climate of slowly rotating aquaplanets, and whether the day-to-night oceanic heat transport reduces the surface-temperature gradients and the sea-ice extent.