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The impact of climate change on swell events significant wave heights from multiple origins

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Swell waves dominate the ocean surface, propagating across ocean basins, with minor attenuation. Here, a state-of-the-art swell tracking algorithm is applied to a global dynamic ensemble of CMIP5 wave climate simulations, isolating swell events from the remaining local sea state conditions based on the behavior of the peak wave period (Tp) and peak mean wave direction (MWDp). The swell events related significant wave height (Hs) projected changes for the late 21st century, as well as the overall contribution of swells from different origins to the total Hs projections, are then characterized. The propagation of the projected changes, from the overlaying winds (U10) at the wave generation areas, to the swell arrival locations, through swell waves, is also analyzed and quantified. Results indicate that the arriving swells' Hs projected changes, along the tropical and subtropical latitudes, are highly dependent on the direction of the incoming waves, being mostly compatible with the Hs and U10 projections at the respective wave generation areas, especially when statistical significance is accounted for. Clear implications on sediment transport, coastal accretion and erosion, and offshore infrastructures and navigation arise from the disproportionate flux of energy carried by swell waves in each direction, increasing the need for adequate measures to mitigate its effects, towards the end of the 21st century.