

Past wave climate reconstruction through paleo shoreline analysis

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Background

Beach ridges serve as physical records of predominant wave direction. Along the Patagonian coast of Argentina, changes in relative sea level have preserved sequences of beach ridges on Last Interglacial and Holocene terraces. At Bahía Laura, a reference site in Patagonia, we apply MeePaSoL (Lim et al. 2022) to estimate dominant wave approach angles for modern, mid-Holocene, and Last Interglacial shorelines. We then use XBeach (Roelvink et al. 2003, Roelvink et al. 2009) to run a suite of numerical simulations aimed at identifying offshore wave conditions capable of generating the inferred nearshore wave patterns. The most plausible model scenarios provide insights into how regional wave climate may have changed over millennia. This approach helps us investigate past climate drivers and contributes to understanding future wave-climate dynamics in a changing world.

Works cited

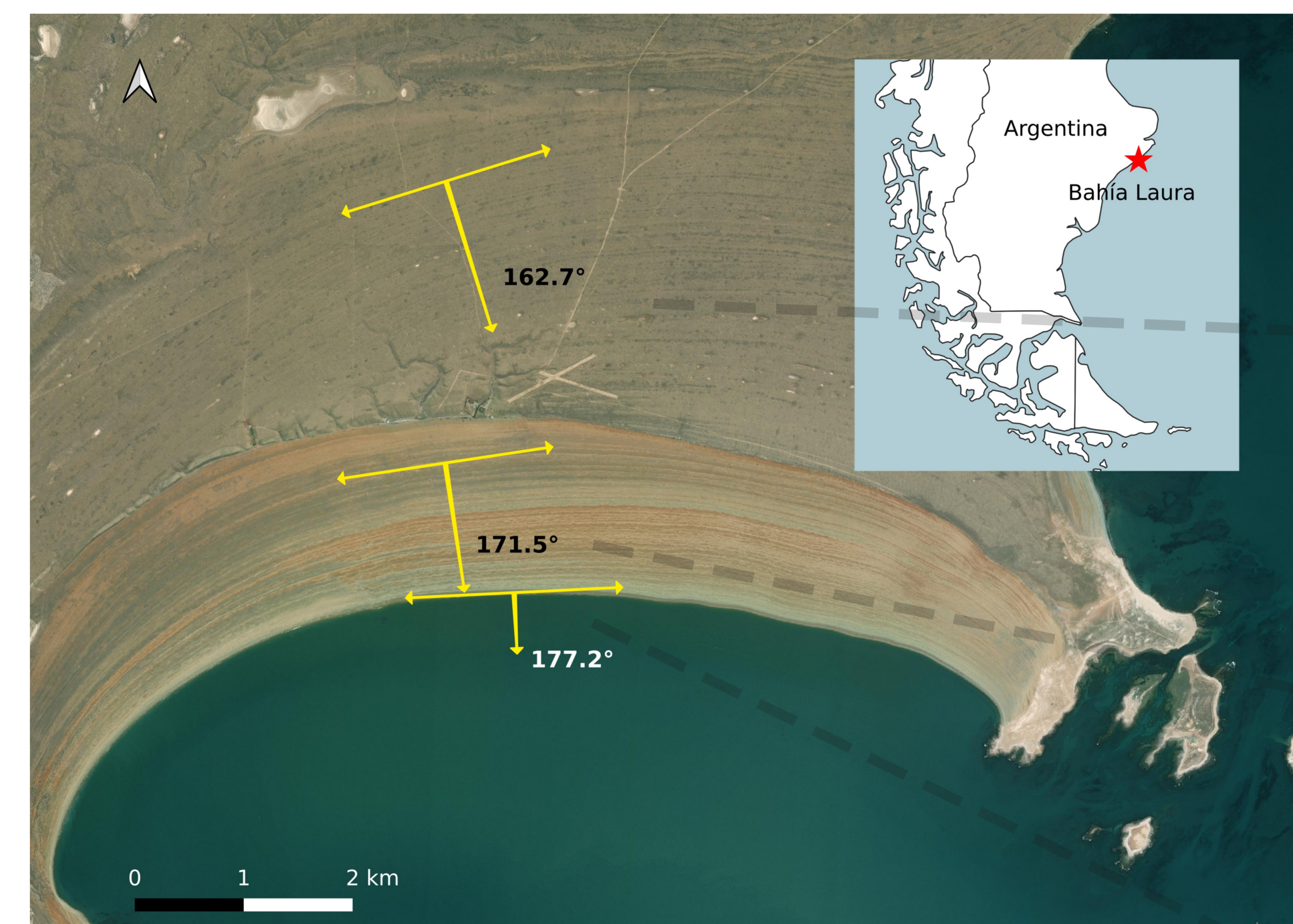
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Methods

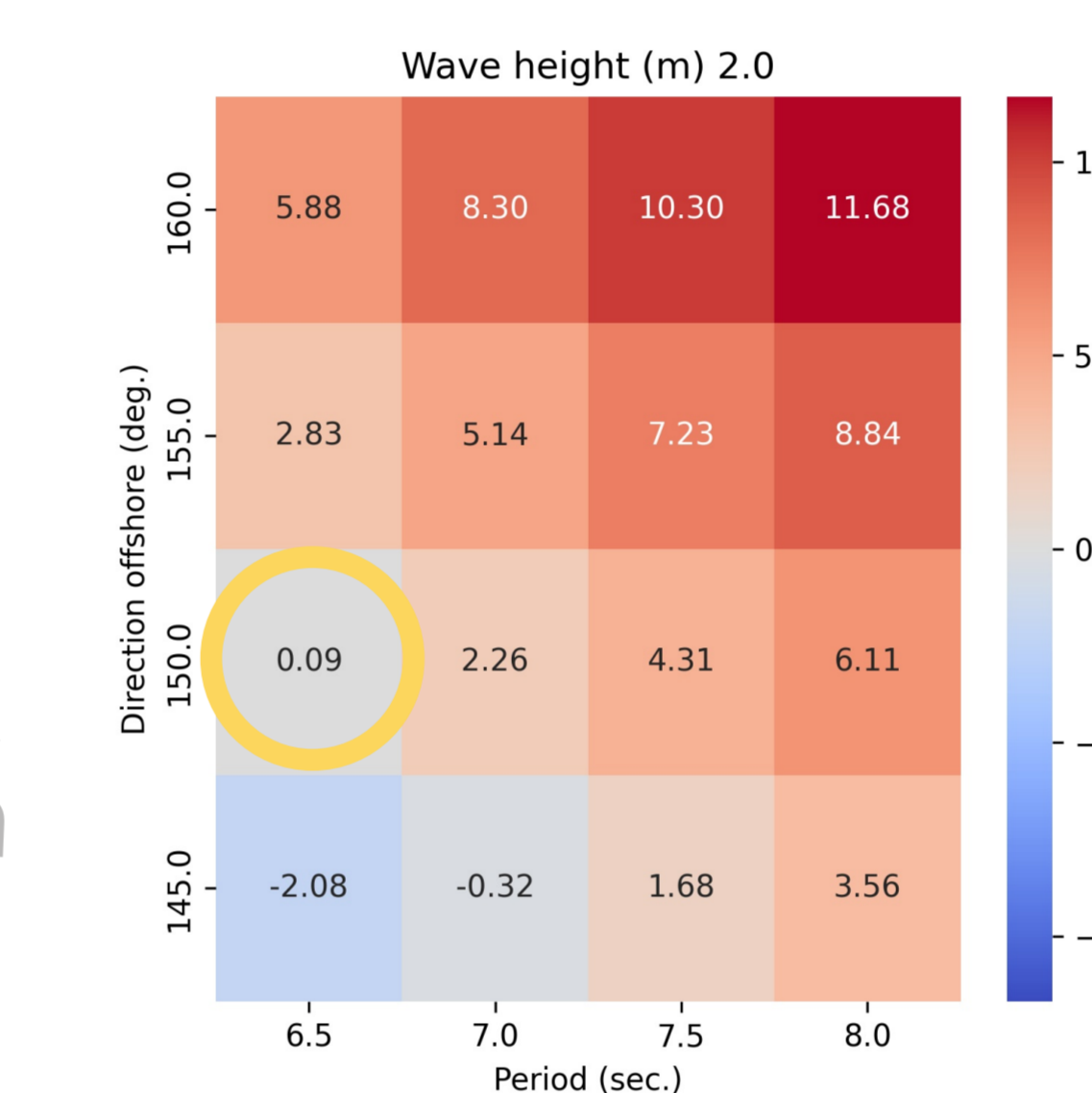
XBeach models for each scenario (modern, Holocene, MIS5e) were run with combinations of wave height (m), period (s), and offshore wave direction (°) chosen from {1.5, 2, 2.5, 3}, {6.5, 7, 7.5, 8}, and {145, 150, 155, 160, 165, 170, 175, 180}, respectively.

Bahía Laura study site

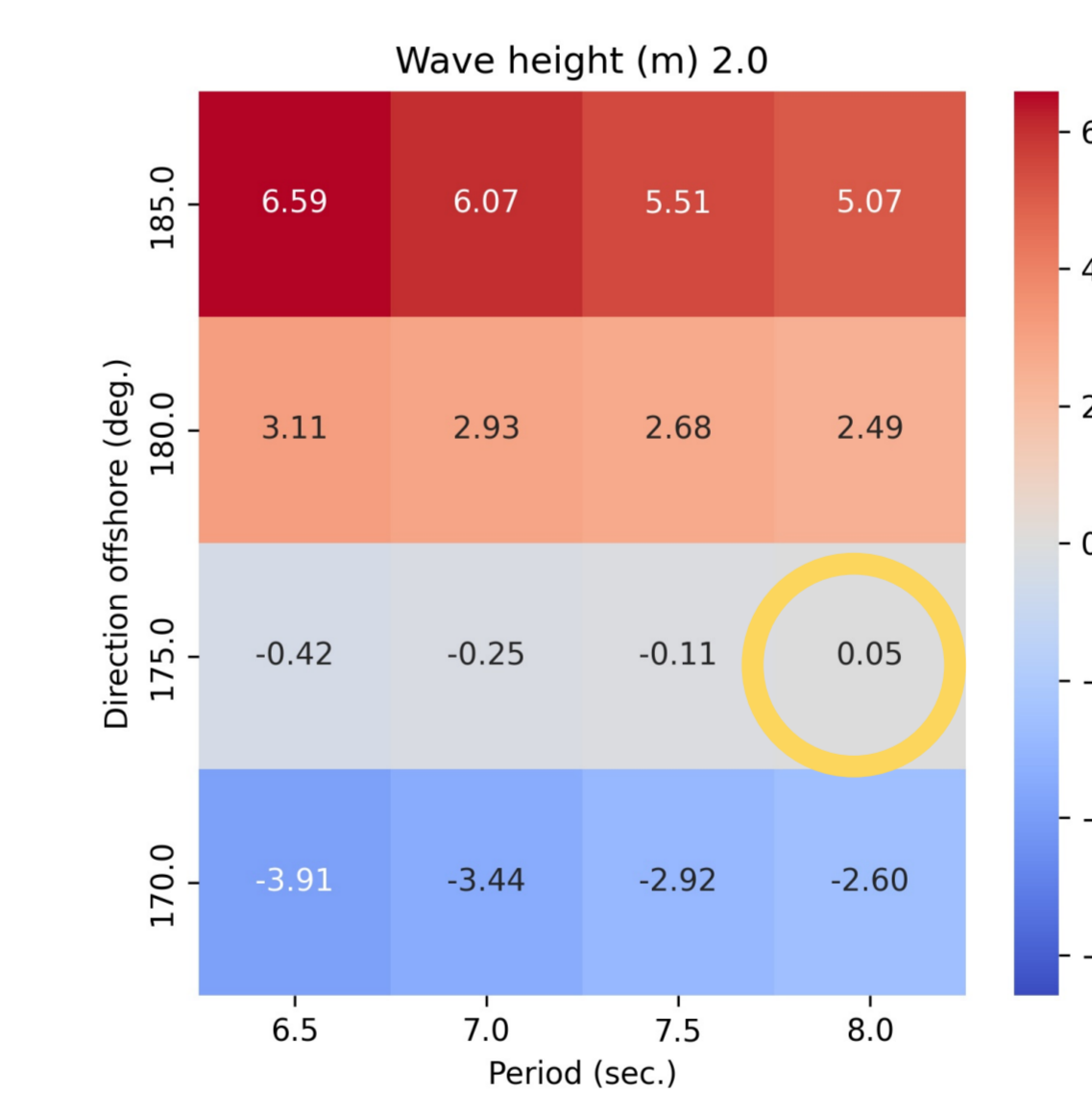


Predominant incident wave angle given by MeePaSoL software for the modern shoreline, a representative mid-Holocene shoreline, and a representative MIS5e shoreline. Map data from Esri imagery and Natural Earth.

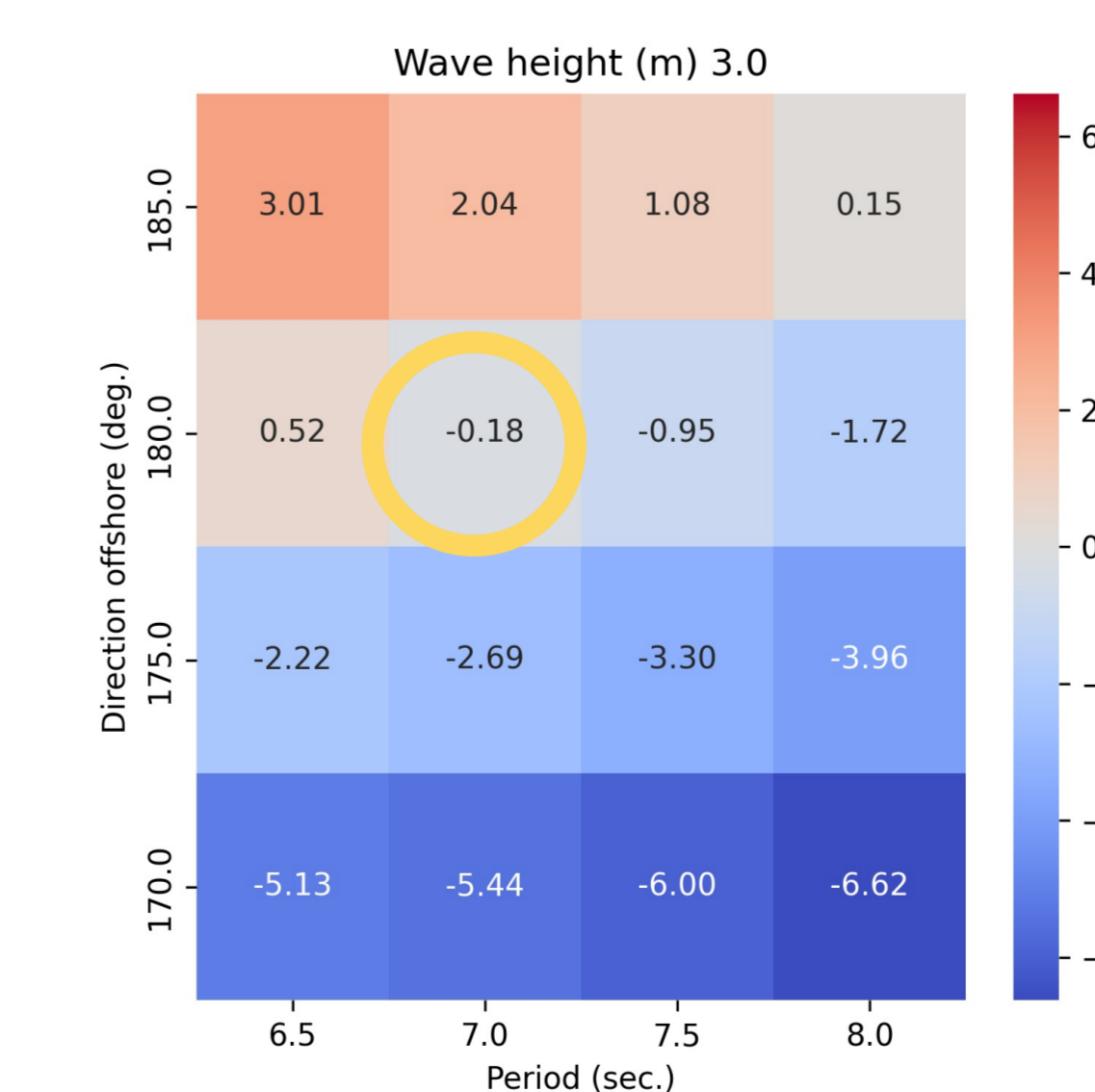
Model runs



150° offshore



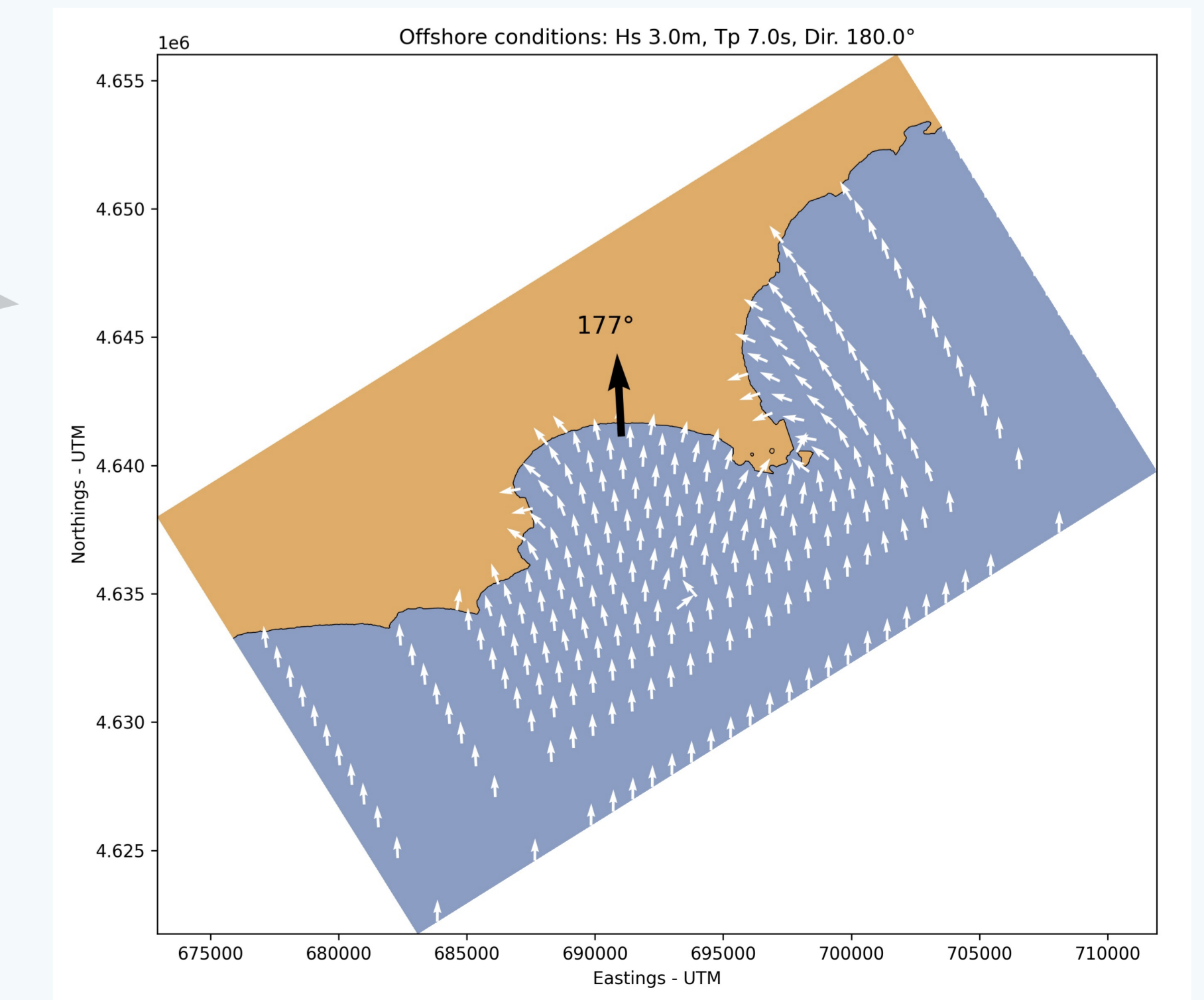
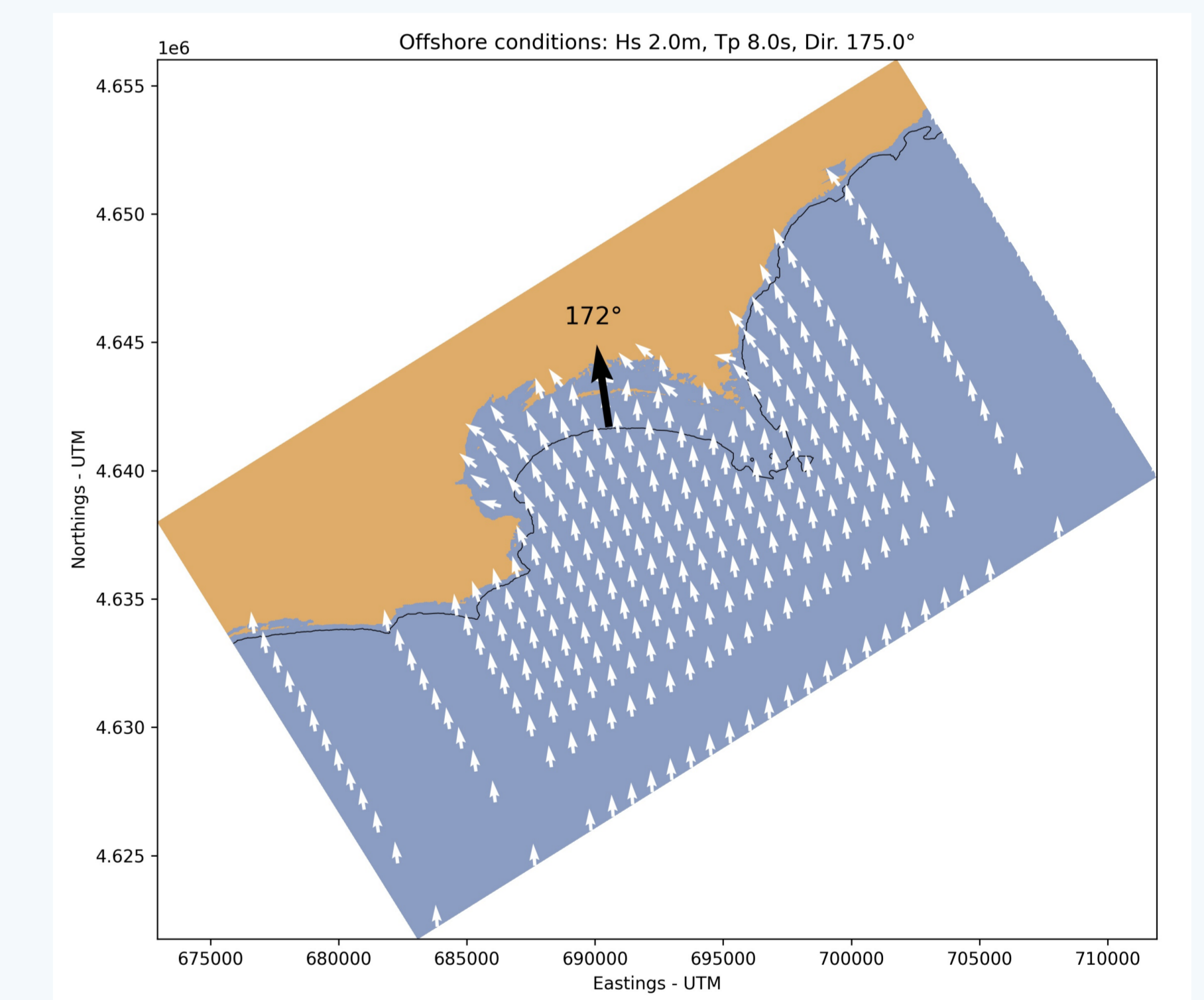
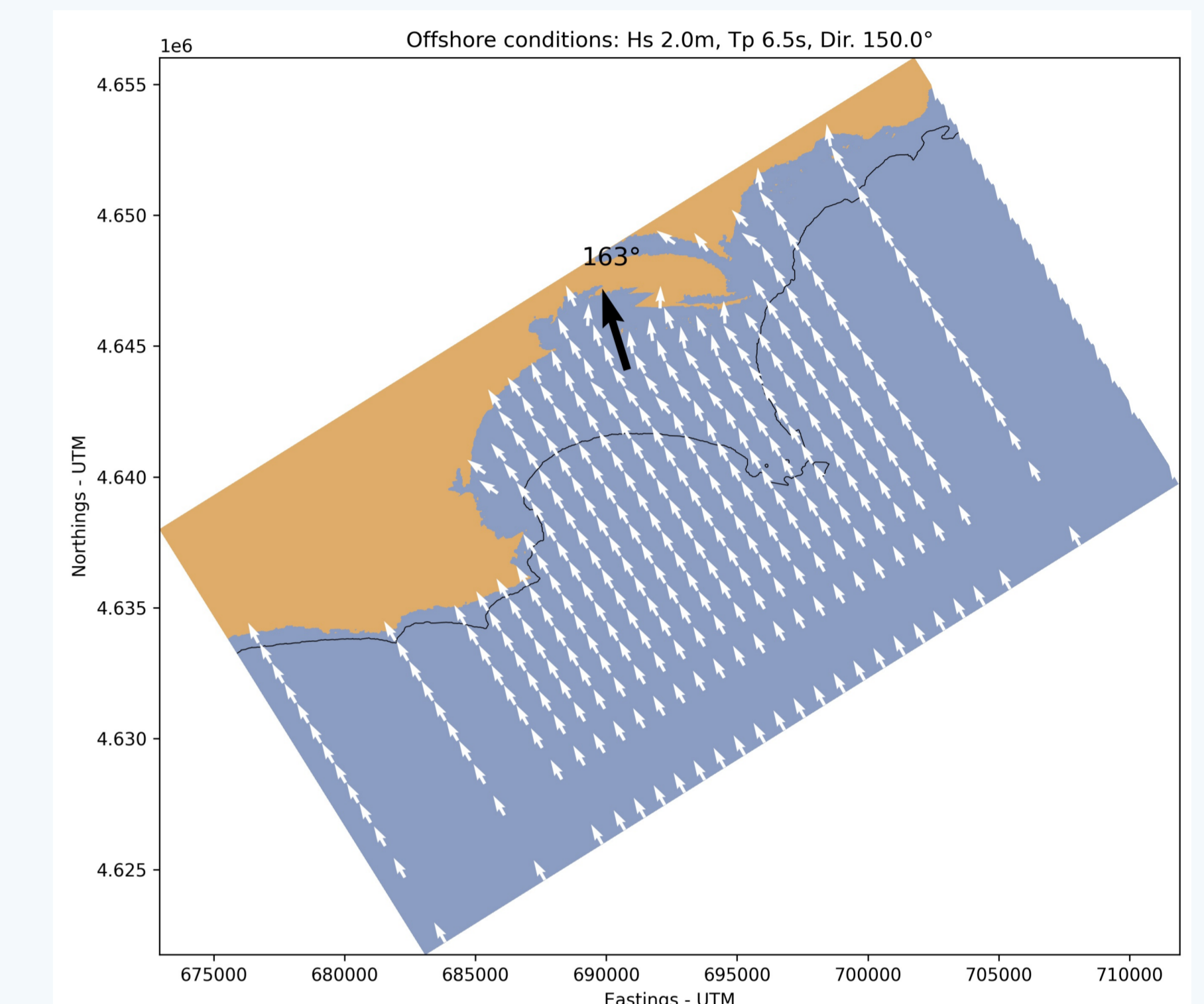
175° offshore



180° offshore

Difference between predominant wave approach angle given by MeePaSoL planform analysis and XBeach model wave angle calculated at breaker depth along shore normal vector from downdrift control point.

"Best" models



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