

A coastal perspective of global wave trends in CMIP6

Lucy Bricheno, Ben Timmermans Joanne Williams, UK National Oceanography Centre



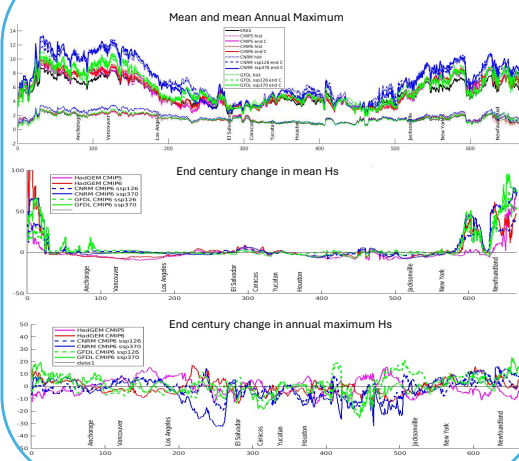
Global wave projections

An ensemble of CMIP6 driven waves have been analysed for variability around the global coast. Future projections for SSP126, SSP370, and SSP585 are presented. The inventive coastal map projection is a neat way to present complex spatial information, in an unweighted and unbiased fashion. This perspective gives a practical dataset of coastal exposure to waves and quantifies intra-model and scenario variability.

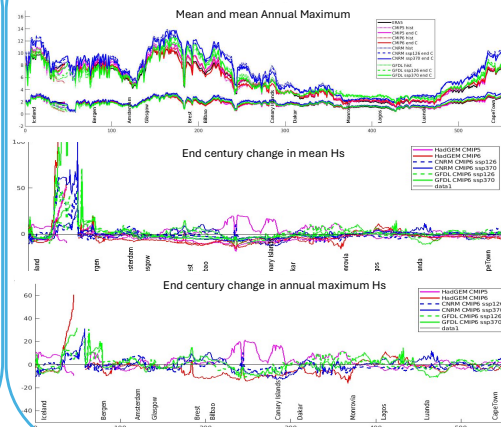


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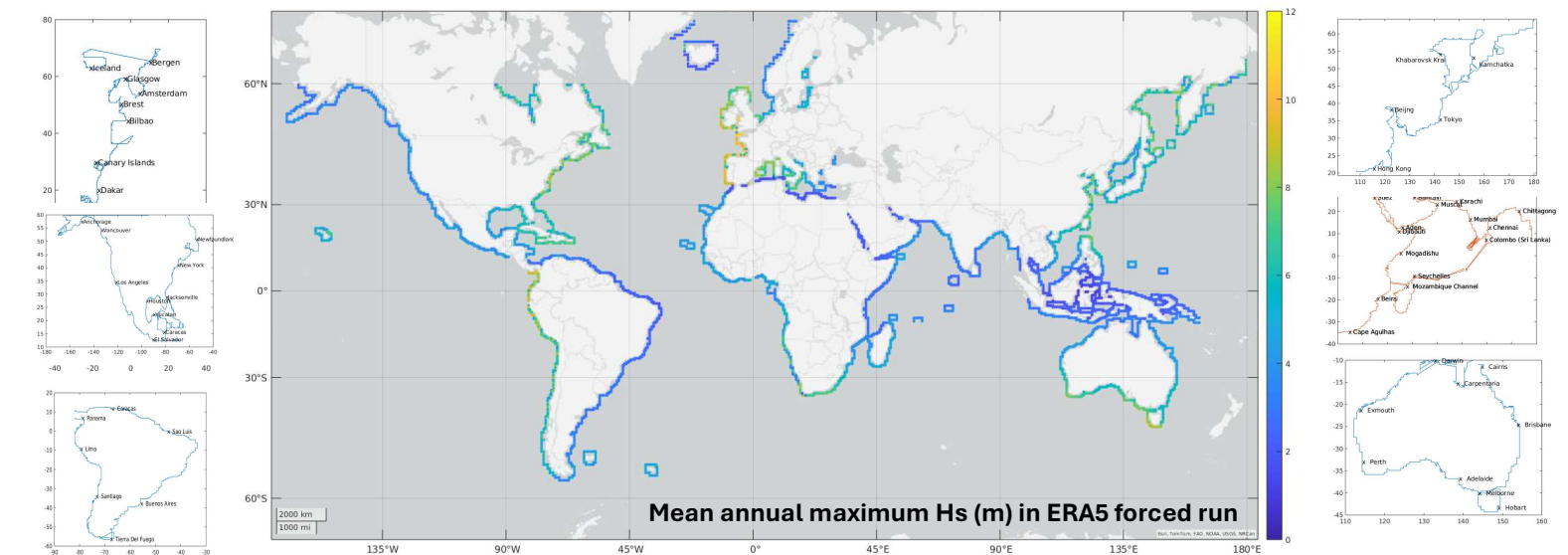
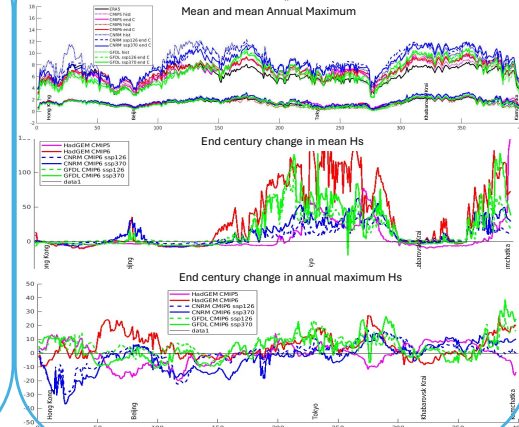
North America



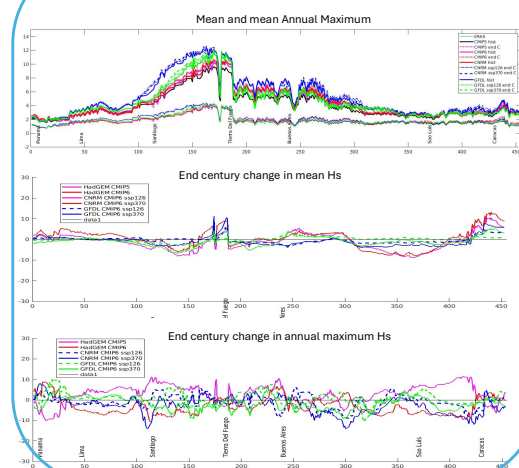
East Atlantic



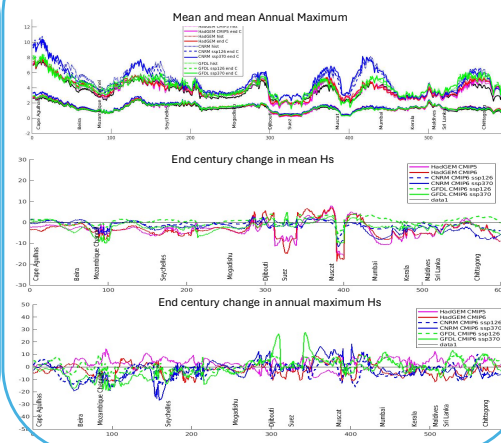
West Pacific



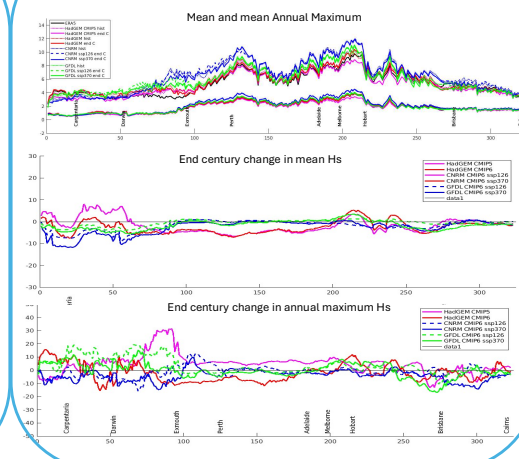
South America



West Indian Ocean



Australia



Approach

A consistent global WaveWatch III model is run, driven by a range of CMIP5 and CMIP6 wind and ice forcings. We consider both mean and mean annual maximum significant wave height as a measure of extreme wave conditions. A good spatial coherence is seen between CMIP models and ERA5, giving us confidence in the wave models' representation of historic conditions. There is a more significant spread among models for mean annual maximum conditions, particularly on those coasts in the paths of seasonal storm tracks.

Coastal accuracy of global models

How near to the coast do these data become 'representative' of an offshore condition, and at what depth and distance from the global models are no longer usable for these projections? Very close to the coast (1 grid box away) model results were found to be extremely noisy. This is due to the global model's inability to correctly capture nearshore bathymetry and coastal geometry. However, 2 and 3 steps back, we see a smoother and more coherent picture. While these projections will never be as good as regional models, we can still draw conclusions about the state and changes at the global coast.

Coherence of trends

In another test with higher resolution winds, a sensitivity is found – with the largest errors seen at the coast. Our results are presented in a regional breakdown to give practical local information for populations and infrastructure at the coast. Some areas of the coast with coherent trends in future projections are shown – more so in terms of average conditions. Future extreme wave projections have little coherence (diverging in magnitude and even direction of change). However average trends seen consistent in areas where waves change are driven by retreating sea-ice and changing storm track.