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# Application of an artificial neural network to generate wave projections at southern African coasts

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In the past decades, severe so called ‚compound events' led to critical high water levels at the coasts of southern Africa and as a consequence to property damage and loss of human life. The co-occurrence of storm surges, wind waves, heavy precipitation and resulting runoff increases the risk of coastal flooding and exacerbates the impacts along the vulnerable southern African coasts (e.g. Couasnon et al. 2019). To mitigate these high-impacts, it is essential to understand the underlying processes and driving factors (Wahl et al. 2015). As compound flooding events at southern African coasts are dominated by wind waves, it is of great importance to investigate the regional wave climate to understand the wave forcing as well as the origin of the wave energy.

Wind waves around southern African coasts are affected by the complex interactions between the Agulhas current and the atmosphere. In the research project CASISAC* we analyse the present evolution of the Agulhas Current system and quantify its impact on the future regional wave climate. Ocean waves contributing to high sea levels can be generated offshore resulting in swell or closer to the coasts by strong onshore winds. To identify responsible atmospheric pressure fields that force high wind wave events we apply a hybrid approach: (1) linking south hemispheric pressure fields with offshore wave data using an artificial neural network and (2) determine the prevailing nearshore wave conditions by regional numerical wave propagation models (SWAN). By validating the modelled nearshore wave data from hindcast runs with wave buoy records, this approach allows us to predict future extreme wind wave events and thus potential flooding. In a next step, extreme value analysis is used to determine future return periods of extreme wave events. These results can contribute to the development of more reliable adaptive protection strategies for southern African coast.

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