CONTRIBUTION OF INFRAGRAVITY WAVES TO STORM WATER LEVEL ALONG A LARGE INLET: IMPLICATIONS FOR FLOODING AND OVERTOPPING HAZARDS

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INTRODUCTION
Tidal inlets are transitional area between the ocean and an estuary or a lagoon. They are characterised by very complex hydro-morphodynamics processes, resulting from the interaction between tidal currents and waves with large and rapid water level changes. The coastline around the inner part of the inlet and more generally the entire lagoon often host important economic and touristic activities. In these environments, the studies of hazards associated with energetic events are mainly based on modelling approaches. However, the phase-averaged numerical models typically used for large-scale coastal applications exclude infragravity waves (long waves ranging from several tens of seconds to several minutes, noted hereinafter IG) and phase-resolving model are too computationally expensive for such large domains. Therefore, the propagation of waves from the open sea to the lagoon and in particular the characterisation of IG waves are still poorly understood (Bertin et al., 2018).

METHOD
To study the amplitude and spatial variability of IG waves in the Arcachon lagoon during storms, the Xbeach model (Roelvink et al., 2009) was implemented in surfbeat mode (SB mode). The model covers a domain of 30x30 km² with a spatial resolution ranging from 50 m to 10 m alongshore and 100 m to 5 m cross-shore (the finer resolution being at the inlet). Calibration and validation of the model were performed using an extensive *in situ* measurement dataset, collected over two field campaigns in winter 2021 and winter 2022 as part of the ARCADE research project (Bayle et al., this issue). For each modelled event, between 8 and 10 measurement points (Figure 1, black dots) were used to assess the model performance based on five parameters: water elevation; currents velocity and direction; IG waves height and period.

RESULTS
The simulated IG waves values match well the field measurement. IG waves (Hrms) reach 1-1.2 m in the outer part of the inlet and remain important at the coast in the inner part with values between 0.4 and 0.7 m (Figure 1). They progressively drop to a few centimeters in the inside part of the lagoon. The mechanisms involved in IG wave propagation, from bound waves outside the lagoon to free waves inside and at the inlet (dissipation of short waves leading to the destruction of the group structure) can be assessed with the model for different tidal level and currents magnitude. The simulations also show a great spatial variability of IG waves contribution to the total water level during high tide. They confirm the decisive role of IG waves in the overwash process that can affect the inner part of the Cap Ferret sandy spit during storms, as well as in the overtopping and overwashing occurring around the inner part of the inlet. In agreement with recent study realised in semi-sheltered area (Lashley et al., 2019), the presented work illustrates the need to better accounting for contribution of IG waves in inlets. Their contribution to extreme water levels can exceed both the wave setup and atmospheric surge contributions, and thus play a significant role in coastal flooding hazard in the lagoon.

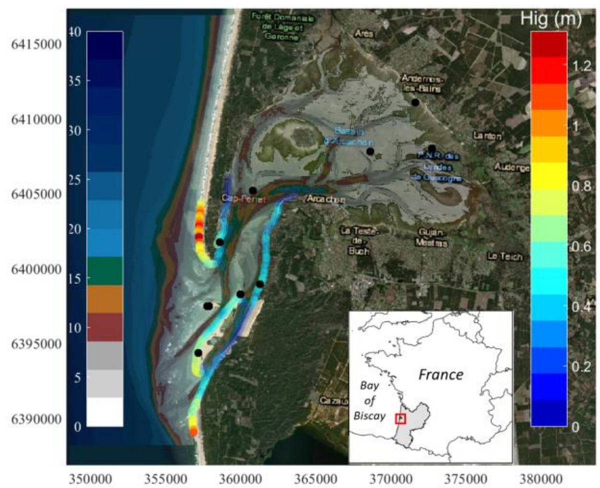

Figure 1 – Spatial distribution at the coast of the maximum IG waves simulated for moderate storm conditions. The black dots show the location of field measured data.

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