Extreme sea levels and flooding driven by distant swells in Makemo Atoll, French Polynesia.



Figure 1. Satellite image of Makemo Atoll (@CNES), showing the location of Pouheva tide gauge.

Description

Tropical atolls are at the forefront of climate change and are currently facing an increase in coastal hazards due to sea-level rise, natural subsidence and coral reef degradation, locally questioning their inhabitability by the end of this century (e.g. Storlazzi et al., 2015). Makemo Atoll, localized in the Tuamotu Archipelago, French Polynesia, is a low-lying atoll populated by 825 inhabitant and connected to the Pacific Ocean through two main passes (Figure 1). The inhabited areas face extreme sea levels driven by distant austral swells and a preliminary analysis of tide gauge data at Pouheva (Figure 1) reveals that wave setup associated with these events regularly exceed one meter. Canavesio (2019) analyzed historical major events that impacted the atoll and estimated that the distant swells of 2011 and 1996 caused extreme sea-levels respectively reaching 1.5 m and 2.5 m above mean sea-level and induced substantial flooding. In this context, this 5 to 6 months internship aims to better understand the physical processes that control the development of such extreme sea-levels, combining the analysis of tide gauge data available in Makemo since 1999 with 3D phase-averaged numerical simulations using the modelling system SCHISM (Zhang et al., 2016). SCHISM is partly developed at LIENSs (e.g. Martins et al., 2022) and was already applied successfully in coral reef/lagoon environments (e.g. Gaffet et al., 2026; Schlüter et al., 2026, Ormières et al., 2027). This study is a contribution to the PPR Ocean and Climate FUTURISKS (https://futurisks.recherche.univ-lr.fr/), coordinated at the joint research unit LIENSs.

Hosting institution

This internship will be based at the joint research unit LIENSs, CNRS-La Rochelle University (https://lienss.univ-larochelle.fr/?lang=fr) and will be cosupervised by Xavier Bertin (CNRS Research Director) and Anni Schlüter (PhD Student).

Candidate profile

We are seeking a motivated Master 2 or engineering school student in physical oceanography, environmental fluid dynamics or civil engineering. The internship will require good skills in programming (Python/Matlab), data processing and signal analysis and numerical modelling. Knowledge of FORTAN will be an asset.

Application

Please send a CV and a motivation letter at xbertin@univ-lr.fr and aschlute@univ-lr.fr before the 15/11/2026 for a possible start in January 2027 (the internship is designed for a 5-6 months duration).

References

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