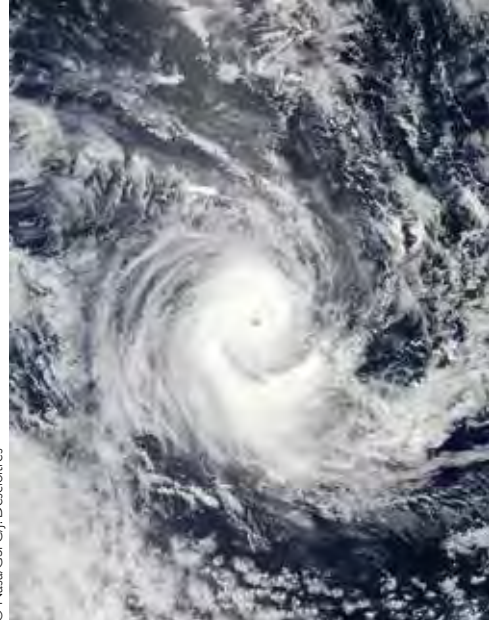


Extreme waves and tropical cyclones

Tropical cyclones are among the most devastating natural disasters, and the flooding they cause is responsible for over 90% of the human and material losses observed during these events.

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Cyclone Erica, which passed through New Caledonia on 13 and 14 March 2003.

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Climate change is causing global sea levels to rise, threatening certain Pacific islands such as the Kiribati and Tuvalu archipelagos. Under these conditions, the danger and impact caused by cyclones (including rainfall), which the Intergovernmental Panel on Climate Change (IPCC) has already predicted will become increasingly intense, are likely to exacerbate the coastal vulnerability of these already fragile nations. It is therefore important to study and model the extreme waves and water levels that these storms generate.

Tools that simulate the generation and propagation of cyclone waves show that, during cyclones, the height of waves approaching the coast can increase by 35-50% on average in tropical regions, and by up to 100% in the North Pacific. Even more astonishing is the fact that, through the long-distance propagation of cyclone waves, these same tropical storms can have an impact on distant regions such as the Equatorial Pacific, where such cyclones never occur.

... Tropical storms increase the vulnerability of low-lying islands ...

Research on a smaller scale has made it possible to draw up risk maps for the occurrence of cyclone waves along the coast of New Caledonia, as well as for coastal flooding in densely populated areas, where 70% of extreme water levels are due to tropical cyclone waves. These extreme waves, which can reach over a jaw-dropping 7 m, are predicted to hit the reefs every 100 years.

Lastly, for the lagoons of New Caledonia, data from several past tropical cyclones and virtual cyclone ensembles have been used to model the rise in sea levels along the coast, with surges of over 2 m

in narrow lagoons, especially in certain very densely urbanised sites. These extreme events can occur every 50 years.

The protective role of natural coastal ecosystems, such as mangroves and especially reefs, has been highlighted. However, these physical barriers are submerged during the most powerful cyclones, causing major flooding. In a climate change context, and in the most likely scenario, this flood risk would result in flooded areas doubling. The detailed mapping of surges in all New Caledonia's lagoons will eventually be used by public authorities to establish planning documents and climate change adaptation plans.



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Mangroves protect the coast from cyclones, New Caledonia.

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Children fishing on a reef flat in Reao, French Polynesia. © IRD/S.Andréfouët

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