Sea level rise implications on shoreline changes: expectations from a retrospective analysis

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Sea level rise is a major consequence of climate change and is expected to threaten many low-lying and highly populated areas in the world. However, our understanding of the potential consequences of this phenomenon is limited by (1) the availability of validated sea level time series at regional scales, and more importantly, (2) a relatively poor understanding of the causes of long term coastal geomorphological changes.
In some regions, the rate of sea level rise is up to 3 times the global mean rate (estimated as 3.5 mm per year since the early 1990s); in other regions, the rate is slower than the global mean and sea level may even be falling. The main factor causing this regional variability is the non-uniform warming of the oceans, but other phenomena such as post-glacial rebound and gravitational effects associated with land ice melt also give rise to regional variability in absolute sea level change. Thus, in the past 50 years, sea level has not risen homogeneously on the global scale, which provides an opportunity to assess changes in regions where sea level increased (or decreased) the most.
This paper presents the overall approach of the CECILE project, whose objective is to assess the impacts of sea level variations on shoreline change. It focuses on assessing coastal impacts caused by sea level rise: firstly, the issue of the availability of regional sea level variation time series is addressed by merging the expertise of coastal geomorphologists with sea level experts (including integrating observations, geodesy, tide-gauge time series analysis, and climate modelling). For each site of interest, this includes the identification and quantification of all components of absolute and relative mean sea level variations, such as climate-induced sea level variations and continental subsidence and uplift at various spatial scales.
Secondly, because of the practical limitations of long term coastal modelling, improving our understanding of long term modelling is approached using historical observations, in which we analyse shoreline changes at a few number of tropical sites instead of focusing in a single site. This can be done using airborne remote sensing photographs acquired in the 50's, thus providing an integrated spotlight of coastal geomorphological changes in these areas (see Garcin et al. in this session. This approach pays particular attention to assessing changes that can be attributed to humans, as well as those that occur after specific extreme events. The knowledge database acquired through this process is expected to serve as an analogue for experts trying to assess the potential future impact of sea level rise, as well as to support the creation of a coastal geomorphological classification based on shoreline vulnerability to sea level rise and climate change.

This communication is supported by the French National Agency for Research (ANR) within its Planetary Environmental Changes (CEP) framework. We thank the French Polynesia Government (SAU) and the New Caledonia Government (DIMENC, DITTT) for providing data.