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▶ **To cite this version:**

Aurélie Maspataud, Gonéri Le Cozannet, Franck Desmazes, Stéphane Costa. Current practices and potential improvements in shoreline change studies supporting sea level rise and coastal adaptation in France. EGU - European Geosciences Union General Assembly 2018, Apr 2018, Vienne, Austria. hal-01714670

HAL Id: hal-01714670
https://brgm.hal.science/hal-01714670

Submitted on 21 Feb 2018

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Geophysical Research Abstracts
Vol. 20, EGU2018-12340, 2018
EGU General Assembly 2018
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Current practices and potential improvements in shoreline change studies supporting sea level rise and coastal adaptation in France

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As an overall sea level rise of about 20 cm has been observed since 1870, sea level rise reaches about 3.4 mm / year today. In a context of increasing global warming in the 21st century, sea level will continue to rise and, probably, accelerate if the goal of limiting warming to 2°C above the pre-industrial period is not achieved (Church et al., 2013). While future sea-level rise is recognized to be a major threat to coasts, coastal managers now require full information on uncertainties, high-end estimates, shoreline change projections and relevant adaptation options within the context of current practices and governance arrangements.

For the overall scientific community, low-lying and sandy coasts that are highly vulnerable to sea level rise associated with global and local scale climate change is nothing new. In such environments, sea-level rise will without doubt exacerbate coastal erosion, but the magnitude of this change remains poorly understood. Hence, the French coastal risk prevention policy considers a sea level rise scenario to quantify the "shoreline retreat" hazard.

The objective of this contribution is to propose methods for considering sea level rise in estimating the evolution of the sandy coastline (beaches) under climate change impact. This work aims at focusing on research developments that are transferable to the realm of operational applications, as expected in the development of coastal risk prevention plans.

An extensive work was carried out on research linking climate change and its impacts to shoreline change considering sea level rise assumptions. With regard to sea level rise, extended research works had produced results that could now be mobilized for public decision-making. These results concern: (a) regional variability of sea level; (b) its temporal dynamics, during the 21st century and for the next decades and centuries; (c) the vertical land motions ; (d) the associated uncertainties. Then, distinct suites of coastal impacts models, applicable on the dune-beach systems at decadal to centennial timescales, were selected: one based on the Bruun rule, and the other based on a simplified version of a dune toe evolution model (Larson et al. 2004; Ranasinghe et al., 2011). This study also highlights uncertainties in prospective scenarios for shoreline evolution: these uncertainties are not only related to sea-level rise, but also to other coastal processes affecting mean sea level (vertical land motion) and sediment dynamics (effects of waves and currents, sediment holes and sources, or human impacts). As a conclusion, considering uncertainties associated with the future shoreline positions in the French coastal prevention policy could have the immediate effect of reversing the current paradigm of the French coastal risk prevention policy, by substituting assumptions made at national scale with locally designed security margins in relation to stakeholder's risk aversion.