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Islets of New-Caledonia lagoons in the perspective of Climate change and sea level rise

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Context and problematic: On July 7th 2008, UNESCO included parts of Lagoons of New Caledonia in the list of the Reef Diversity and Associated Ecosystems. Sandy islets from New Caledonian lagoons lie on lagoonal reef platforms or on the reef barrier. They have a major role in these specific and rich ecosystems, being the seat of nesting for turtles, seabirds, sea kraits etc. In addition, islets have a high importance in the Caledonian culture and way of life; economy of the islands has been developed around tourism and services with specific activities such as sports and relaxation. One of the recurrent issues for people and governmental agencies concerns the islets's future in the perspective of Climate Change and Sea Level Rise. In this context, the Coastal Observatory of New Caledonia (OBLIC) has initiated research about the recent and present evolution of islets in order to predict their "behavior".

Method Around twenty islets from the southwestern and eastern lagoons of Grande-Terre (New Caledonia main island) and one from Nokanhui atoll (Ile des Pins) have been studied. Such studies integrate field work and observations (erosion scars, accretion area, sedimentology, etc.) and analysis of historical photographs and satellites images. Geomorphological and sedimentological data have been collected during 2013 and 2014 field surveys. Past extensions of each islet have been interpreted using available aerial views and satellite sensing. Old aerial photographs are rather rare because islets being sometimes quite away from the shore, they were not covered by aerial survey of the main island. All available data have been integrated in a GIS. Thus, islets's reconstitution extends from one decade to 70 years. Time evolutions of shape and surface of each islet have been mapped in order to compute surface changes and the present percentage of coast's lengths in erosion, in accretion or stable. Moreover, the forcing factors such as winds, wave, tropical storms or cyclone, and the ENSO have been analyzed, in order to understand potential links with the islet behavior.

Results In terms of size and shape, a high diversity and a variety of evolution trends of islets during the past decades can be noticed. Actually, processes affecting the coast of each islet (erosion, accretion, stability) are highly variable. All islets have at least 50% of their coasts affected by erosion and for four this rate is close to 100%. Islets showing increasing surface during the past years are very rare. Analysis and observations show that five main stages constitute the life-cycle of Caledonian islets, namely: nucleation, growing, maturity, decay, relic or endangered. Changes of environmental parameters and forcing factors as well as the inherited geomorphology lead the islets from one stage to another. The becoming of each islet is linked to its past evolution, its present state and future evolution of environmental parameters. Parameters are linked to the climate variability like ENSO or IPO which control the intensity and direction of trade winds and the average sea level in the SW Pacific. Forcing factors include also extreme events like cyclones, storms and austral swells which can trigger at very short term powerful erosion or accretion with high impact on the islet. Sea level rise induced by the anthropogenic climate change has also to be taken into account. Using our data and informations and postulating that the current situation remains identical, we consider that : 19% of

the islets are in a critical state with a very likely disappearance in the next future (few years); 10% of the islets are in a critical situation with a likely disappearance in the next future and very likely disappearance in the middle term (next decades); 19% of the islets show a rapid evolution which can lead to their disappearance in the middle term but not in the next future; 10% of the islets are not endangered at short and middle time scale and 43% of the islets are not endangered at all (stable or accreting, large surface, relatively high altitude). Our results show that situations are contrasted from one islet to another. We have also to emphasize that uncertainties are higher for middle and long term future due to uncertainties about the sea level. Uncertainties are also linked to the potential reaching of a thresholds value (value and rates) which would lead to a modification of the resilience capacity of each islet. Thus, a coastal observatory will be of first importance in monitoring the impact of climate change and sea level rise on such systems.