



Consequences of climatic change, sea level rise and society evolution on the Kerkennah archipelago coast and sabkha

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Interaction between human activities, climate evolution and sea level can be summarised in a system where every element impacts the others. In the Kerkennah archipelago (Tunisia), recent observations have shown that the climate has become more arid, that the sea level is rising and that the society is modernizing at least since 1970. In our work we tried to understand the relations between the elements of the socio-ecosystem of Kerkennah to identify potential causes of the coastline movements and sabkhas extension (low and salty areas).

Using photointerpretation (topographic map, Spot 5 image, aerial photographs) and remote sensing (2 landsat TM5 images), we detected and evaluated the movements of the coastline and of the sabkhas limits. Field data have also been added and all information has been used together in a GIS showing a significant retreat of the coastline (maximum of $41.2 \pm 6\text{m}$ in 47 years) and an increase in the surface of sabkhas (+18%) between 1963 and 2010. The same dataset has been reanalysed at a much finer spatial scale to correlate observed changes to human pressure. This showed that coast erosion rates are more important where the coastline is partially artificialized or just after the end of a dam or a rockfill. Advances to the sea observed on some portions of the coast are always linked to human infrastructures. We conclude that the climatic change and the sea level rise increased the physical vulnerability of the archipelago and that the human installations near the coast amplify this vulnerability. Similarly, the extension of sabkha surfaces is global and most likely due to a natural perturbation of the seasonal cycle in the sabkhas by the sea level rise and by the stronger aridity in summer. However, discrepancies exist between individual areas and can be explained by the presence of active fault and/or by the evolution of agricultural practices. Indeed, frequent periods of drought and the political will for development of the Kerkennah islands in the 1990 led to a modernisation of agriculture through the installation of irrigated and drained areas in which farmers use brackish water. These events were accompanied by a progressive abandonment of the traditional practices (around the palm grove) and the development of illegal irrigation outside of the drained areas. The risk of soil salinization therefore seems to be more important today than during the 1950.

Altogether, this study shows a significant increase in the vulnerability of the Kerkennah archipelago in response to both climate and social changes and stands as an example of climate/human interactions and of their measurable impacts.