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Modeling of urban form against sand accumulation in the city of Gourara in southern Algeria

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Abstract

In our present research, we focus on the modeling of airflow related to extreme weather events and natural disasters, such as sand accumulation, with urban form studies. The objective is to find which urban form can promote sand passing and reduce as much as possible stagnation of sand in the built environment (streets, alleys, etc.). The urban form design is discussed through the numerical simulation of airflow. We simulate the airflow behavior, especially the wind velocity, which is responsible of sand stagnation in some specific configurations. Various configurations of buildings were considered and different airflow behaviors were thus observed. The method of modeling was verified by following some best practice guidelines. In this study, a correlation was made between wind velocity and morphological parameters such as width of buildings and widths of the street that separates buildings, building height and building density. Results of our simulations show that some types of urban form can promote wind speed and help blow away the accumulated sand in the city.

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1. Introduction

As one of the driest regions of the world, the Gourara region faces now a difficult sand accumulation problem. This phenomenon is mainly caused by the severity of arid climatic conditions and the wrong choice of human settlements in *Erg*[†]. However, the wind is still the most important factor that is responsible in the production of this phenomenon. That is why we have devoted this paper to the study of this phenomenon in relation to the wind speed in order to find concrete solutions to the combat silting phenomenon in urban forms.

Nomenclature

D	spacing between rows
H	height of unit A
L	length of unit A
W	width of unit A
Z	height
Δ	spacing between units

1.1. Situation

Gourara is a town in Adrar Province, in south-central Algeria. Fig.01. Gourara is known for the red ochre color of its buildings. It is located on the south-eastern side of an oasis which supports the town's population. A sebkha (salt lake) lies further to the northwest, while the plateau of Tademaït rises to the southeast. [1]

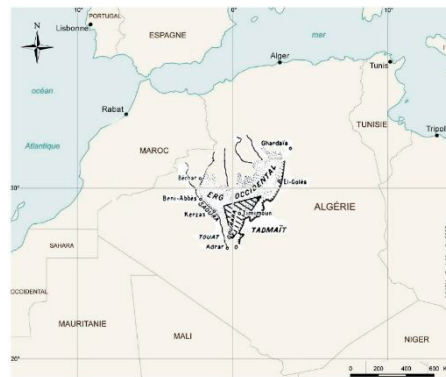


Fig 1: Localization of Gourara town in Algeria.

1.2. Climate

Gourara has a hot desert climate BWh^{\ddagger} (Köppen climate classification); with extremely hot summers and mild winters, and very little precipitation throughout the year. The silting is quite recurrent in the region of Gourara. This is due to the fact that the region is exposed to some periodic strong winds that can reach a speed of 8m/s in the northeast and southwest (ONM)[§].

[†] *Erg* is a vast area covered with sand and shifting dunes, as parts of the Sahara Desert.

[‡]*BWh* means dry and arid desert climate. The additional letter *h* means the dry arid climate is found in the subtropics.

[§] ONM: Algerian Meteorology Service. <http://www.meteo.dz/index.php>

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