DEVELOPING A NEW AUTOMATED TOOL FOR DETECTING AND MONITORING DUST AND SAND STORMS IN SUB-AFRICA USING MODIS AND METEOSAT SEVIRI-MSG DATA

Hosni Ghedira
Associate Professor of Civil Engineering
American University in Dubai
Dubai UAE
hghedira@aud.edu

1. ABSTRACT

In the last three decades, significant advances have been made in mapping and monitoring environmental changes from Earth Observation satellites across a range of spatial and temporal scales. For example, with the actual Earth observation satellites, we can observe large areas rather than sparse points and provide unique information about properties of the surface or shallow layers of the earth. Indeed, the extent of many environmental and meteorological events such as vegetation stress, fogs, sandstorms and droughts cannot be captured by ground measurements alone making remote sensing an indispensable tool in environmental monitoring. The harsh nature of sub-African region makes ground-based monitoring and mapping of their local environment difficult and expensive. However, in contrast with their appearing harsh nature, arid desert areas tend to be fragile ecosystems where little climate perturbations may cause tremendous changes in their landscapes. Additionally, due to their low precipitation rates, arid regions are the world's major source of atmospheric dust that has an impact on local, regional and global climate. Dust and sand storms create potentially hazardous air quality to humans, and adversely affecting climate on a regional and world-wide scale. Remote sensing has shown to be a valuable tool in detecting, mapping and forecasting such events. However, arid and semi arid regions have their specific and unique characteristics and vulnerability that require special attention in adapting existing remote sensing tools to be applied efficiently.

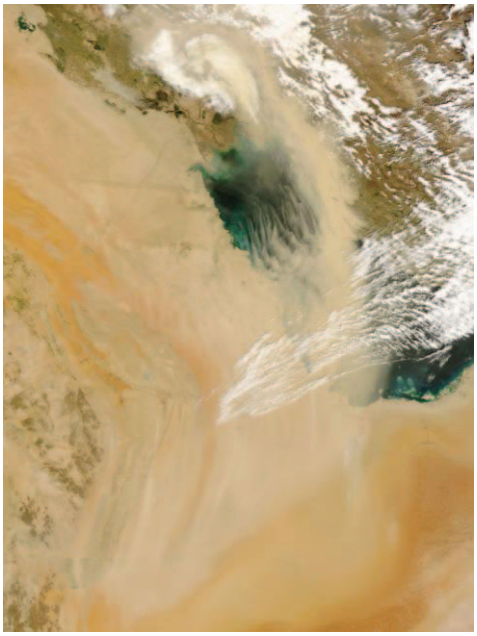

Figure 1: Sandstorm event over the Arabic Peninsula captured by MODIS in March 1st 2007.

Presently, most of the Earth satellite data is available to users free of charge (or with a minor processing fee) through different governmental space agencies or through their affiliated centers and programs such as NASA, NOAA and European Space Agency (ESA). The acquisition frequency of this data varies from 96 images per day for the European METEOSAT (~ 1km footprint) to 4 images per day for NASA/MODIS (~ 250 m footprint). Acquiring such data can benefit scientists and researchers by incorporating remote-sensing-derived information in their observation systems for environmental monitoring, evaluation and planning.

Application of geostationary and polar orbiting remote sensing in dust and sand storms has been widely investigated in the past two decades [1-2]. In this project, a neural-network-based technique will be used to detect and mask pixels with moving dust from SEVIRI HRV and the two other visible channels. This tool will be helped with a second neural network system that detect and extract predefined features in the dust and sandstorm fields. The obtained dust storm simulations will be then re-sampled and compared to the ones obtained by the NCAR WRF regional prediction model at 16-km resolution. Several well documented dust storm events that occurred between 2006 and 2008 will be used to calibrate and validate the developed tool.

This presentation will show the development stages of this technique and its validation on some recent dust storm events. An overview of current and potential applications of remote sensing in sub-African countries as well as the challenges that may be faced will also be presented.

2. REFERENCES

[1] Caquineau S. (2002) Mineralogy of Saharan dust transported over northwestern tropical Atlantic Ocean in relation to source regions. *Journal of Geophysical Research* 107(D15), 4251, doi:10.1029/2000JD000247.
[2] Evan, A. T., A. K. Heidinger, and M. J. Pavolonis (2006), Development of a new over–water advanced very high resolution radiometer dust detection algorithm, *International Journal of Remote Sensing*, 27(18), pp. 3903-3924.