

DEVELOPMENT OF A REAL-TIME URBAN REMOTE SENSING INITIATIVE IN THE MEDITERRANEAN REGION FOR EARLY WARNING AND MITIGATION OF DISASTERS

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ABSTRACT

This project brings together a group of world class experts from research partner institutions in three countries: Turkey, Morocco and the USA, to plan and implement the North Atlantic Treaty Organization (NATO) Science for Peace sponsored Mediterranean Dialogue Earth Observatory (MDEO).

The observatory comprises a network of real-time satellite remote sensing ground stations, to be established in Morocco.

This investigation will also include a networked geostationary receiving station for the European Space Agency's Meteosat. The primary objective of the project is to facilitate early warning and mitigation of a wide range of biogenic and anthropogenic disasters. The project will also address mitigation of epidemics and epizootics, through identification and monitoring of infectious disease vector and reservoir habitat.

Some examples of common concern among participating countries are flooding, storms, forest fires, climate change and its impacts, land use problems in agriculture, recent public health incidents, such as malaria, avian influenza, swine flu, as well as oil and hazardous chemical spills along the seashores [1]. Archival and real-time remote sensing and generation of near-real-time spatial data products, utilizing high performance computing clusters [2, 3], are planned throughout the life cycle of disaster management, including vulnerability assessment, infrastructure safeguards, early warning, emergency response, humanitarian relief, as well as post-disaster damage assessment, reconstruction and societal recovery [4, 5].

Index Terms—Mediterranean Dialogue Earth Observatory, Ground sensing station, early warning and

mitigation, disaster management, High Performance Computing

1. INTRODUCTION

A project is currently being undertaken to facilitate early warning and mitigation of a wide range of biogenic and anthropogenic disasters using remote sensing techniques [6, 7].

The objective is to develop a Mediterranean Dialogue Earth Observatory (MDEO), sponsored by the North Atlantic Treaty Organization (NATO) Science for Peace Programme.

The Observatory includes a network of real-time satellite remote sensing ground stations, to be implemented in Morocco, with a tracking station for polar orbiting satellites at Abdelmalek Essaadi University and Al Akhawayn University. Each location has specific geographical characteristics and among the two locations a range of complementary observations can be obtained. The project is led by a group of experts from Turkey, Morocco and the USA.

2. OBJECTIVES

The MDEO will provide real-time data from multiple satellites and archival data access in support of interdisciplinary research, with respect to early warning for an array of anthropogenic and biogenic disasters, including floods, storms, forest fires, climate change and its impacts, earthquakes, hazardous chemical and oil spills, famine, epidemics and epizootics [8, 9, 10].

The project will encompass interdisciplinary efforts by remote sensing scientists, domain scientists and information technology researchers. In addition, this project will facilitate collaborative research on identification of best management practices and decision

support, within the Moroccan government and in the non-governmental organization (NGO) context, for disaster vulnerability assessment, early warning, crisis management, environmental impact assessment and post-disaster reconstruction [11, 12].

Since the primary focus of the MDEO will be the application of real-time remote sensing for early warning and mitigation of biogenic and anthropogenic disasters, including epidemics and epizootics, there are multiple end-users for this project, including the WHO Regional Office, as an ineluctable direct result of the interdisciplinary approach to effective disaster management.

This collaboration, with support from NATO's Science for Peace and Security program, will result in installation of instruments to facilitate timely notification, mitigation and humanitarian response to an array of natural and man-made disasters, initially focusing on meteorological disasters and on public health disasters.

Moreover, the project will facilitate collaborative research on identification of best management practices and decision support [13], within the Moroccan context, for disaster vulnerability assessment, early warning, crisis management, environment impact assessment, emergency response, evacuation, disease outbreak containment, search and rescue, damage assessment and post-disaster reconstruction [14, 11].

3. INVESTIGATIONS ONGOING

Two ground stations are to be implemented soon at Abdelmalek Essaadi University, Tangier, Morocco and Al Akhawayn University, Ifrane, Morocco. Meanwhile a questionnaire is being prepared for distribution to several departments in both Universities to explore their familiarity with remote sensing applications and how it is being used.

The purpose is to assess resources in both universities that can support the MDEO project. In addition, a MDEO website is designed and will be maintained and upgraded by Tuskegee University [15], its aim is to reflect the NATO SfPP's project progress and to enhance data accessibility among potential users.

Moreover, significant progress has been made with respect to conference presentations and press reports related to the Project and its objectives.

Also, an outline of remote sensing courses to establish a diploma in remote sensing is being considered for submission to both Moroccan Universities. This is an outcome from the MDEO and it will certainly support the purpose and the activities of the MDEO projects.

To ensure the implementation of the end-results two actions have been taken [11]:

- Presentations were given by Co-Directors to faculty, administrators and graduate students, emphasizing the benefits of integrating real-time

and archival satellite data within multiple faculties in the Sciences, engineering and Social Sciences, as well as the need to interdisciplinary teams to address the multi-dimensional complexity of disaster mitigation.

- A survey is being undertaken at both Moroccan Universities to identify faculty with expertise in one or more of the array of disciplines relevant to near-real-time management and/or remote sensing applications (e.g. image analysis, spatial database development, signal processing, geoinformatics, emergency response, traumatology, triage, medical entomology, epidemiology, zoonotic diseases, fluvial geomorphology, desertification, food security, water resource management, landuse/landcover, toxicology, counter-terrorism, etc.). It is anticipated that the results of such survey will facilitate the identification both of likely stakeholders/end-users, as well as indigenous experts who could play a crucial role in providing on-going training.

The extensive array of meeting with stakeholders/end-users has been vital in developing practical mechanisms for on-going communication and for incorporating the ultimate data stream within the participating agencies' operational protocols [11].

4. PLANNED TASKS

Hardware and software related to ground stations will be installed, and the plan for systems management, data analysis and data distribution will be implemented. Archival and real-time remote sensing and generation of near-real-time spatial data products will be processed by High performance computing clusters [16, 17].

On the other hand, the project will develop a web-based Disaster Mitigation Hub, initially accessible to the initial partnering universities and collaborating end-users, and ultimately available to the global scientific community, in order to strengthen collective capacity for prediction and response to meteorological, environmental and public health disasters. MDEO will, moreover, serve as a training facility for remote sensing and disaster management for faculty and students throughout the region.

In parallel, a workshop on remote sensing and the MDEO project is being planned for managers at several universities and government departments. The objective is to raise the awareness of the possible applications that can benefit their departments. Also, an outline of remote sensing courses to establish a diploma in remote sensing is being considered for submission to Abdelmalek Essaadi University and Al Akhawayn University.

In addition, the working dynamics and relations of the Moroccan partners have created the opportunity to establish a training component and center in Rabat.

This center will be equipped with local storage and virtualization server and will offer some scholarships to students and researchers from the neighboring countries to attend short courses at the center, in order to increase the awareness and the knowhow of intelligently managing and mitigating disasters in the area.

The center will rely on leveraging the local connections of the Moroccan partners.

Also, during the next months, the MDEO website will continue to be maintained and upgraded and its URL address disseminated widely to potential stakeholders and end-users.

5. CONCLUSION

A Mediterranean Dialogue Earth Observatory (MDEO) project has been planned and is under implementation in Morocco.

The MDEO will use satellites and archival data to provide real-time outputs, related to early warning for anthropogenic and biogenic disasters, including storms, forest fires, floods, climate change, oil spills, etc.

The MDEO infrastructure comprises the ground receiving units, the post processing computer clusters and relevant storage, software and distributional network, installed at two universities in Morocco, Abdelmalek Essadi and AlAkawayn.

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