From Vulnerability to Adaptation
- Contribution of Space Technologies –

Coupling spatial data and high-resolution climate modeling in support for a strategy of climate change adaptation in Algeria

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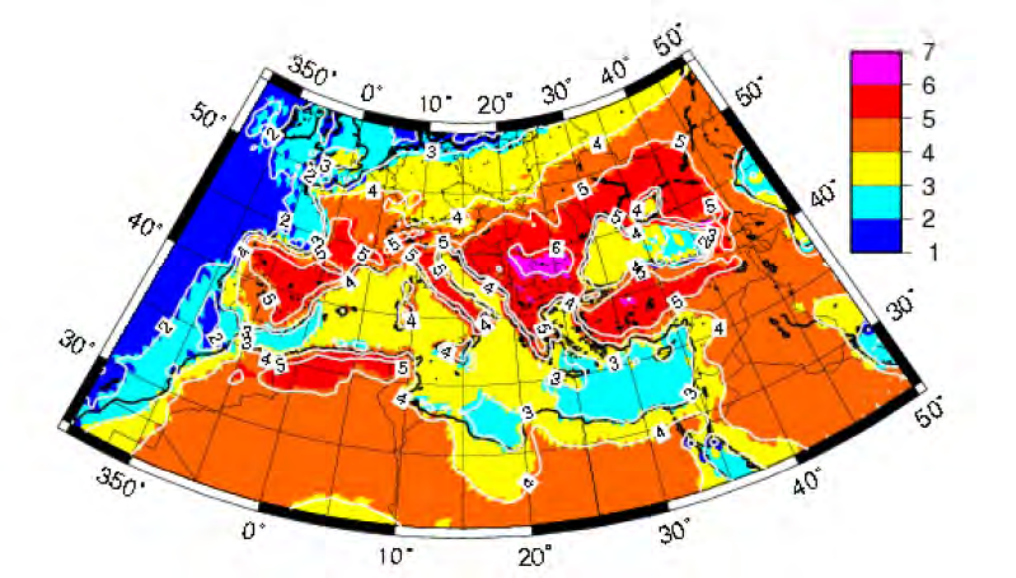
Mediterranean Region : a "hot spot" of Climate Change (IPCC)



Impacts of C.C. in the Mediterranean Region :

•Water : Changing the cycle due to increased evaporation and reduced rainfall ;

•Soils : acceleration of desertification,

•Terrestrial and marine biodiversity : moving northward and altitude of some species; extinction of less mobile or more sensitive species to climate; emergence of new species;

* Forests : increased forest fire risk; parasite risk.

✓ Increase in air temperature of 2.2°C to 5.1°C over the period 2080-2099 compared to the period 1980-1999 (IPCC, 2007, scenario A1B)

✓Marked decline in rainfall , between -4% and - 27% (IPCC, 2007, scenario A1B)

✓Increased drought resulting in a high frequency of days when the temperature exceeds 30°C (Giannakopoulos et al 2005).

✓Events extreme heat waves, droughts and floods more frequent and violent.

✓Rising sea level : 35 cm by the end of the century.

CIRCE Project

Regional Project on Climate Change in the Mediterranean Region - CIRCE (FP6 2008-2011)

The CIRCE Integrated Project aims to highlight impacts and possible adaptation actions of the climate change in the Mediterranean region, that includes Europe, North Africa and Middle East.

- Better understand the issues of climate vulnerability in the Mediterranean countries and their relationship with development strategies
- Develop useful knowledge to the decision process, whether for local, national, regional authorities or to the private sector, taking into account the biological, physical and chemical impacts of CC
- Develop present and future development strategies that could amplify, attenuate or relativize the "natural" impacts.

Oran (Algeria) – A.R.C.E.

www.circeproject.eu

Climate science to implement adaptation policies in the Mediterranean

Partners involved in CIRCE project :

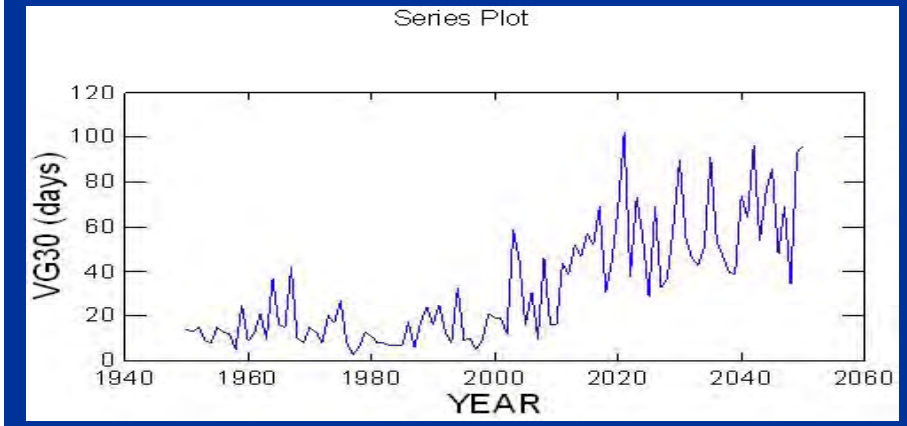
Algeria - Italy – Spain – Greece - France – Tunisia – Cyprus – Israel – Portugal – Egypt – Syria – Germany – U.K. – Austria – Netherlands – Switzerland - Denmark

Some CIRCE scientific results for Oran (Algeria) : 1950 - 2050

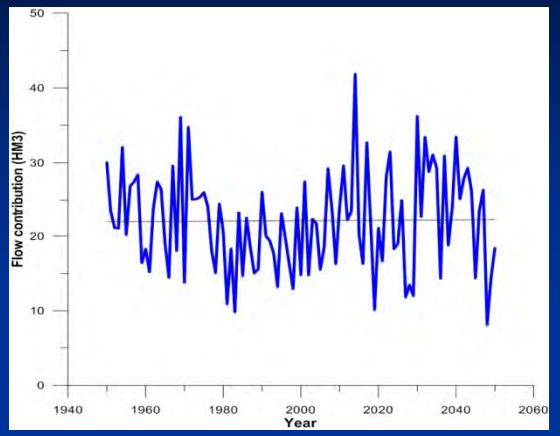
Climatic Conditions

Variable	Present climate (1961-1990)	Mid-century (2021-2050)	Long-term
T mean (°C)	13.7±0.29	15.3±0.47	+1.6±0.50
T max (°C)	20.5±0.40	22.3±0.53	+1.8±0.60
T min (°C)	14.2±1.31	15.6±1.28	+1.4±0.51
Précipitations (mm)	344.7±45.3	305.7±46.49	-39.0±63.45

Heat waves

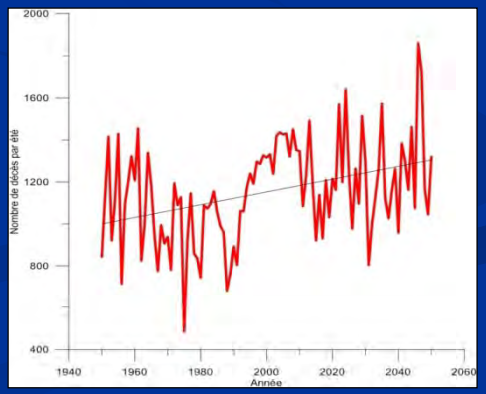


Water Resources



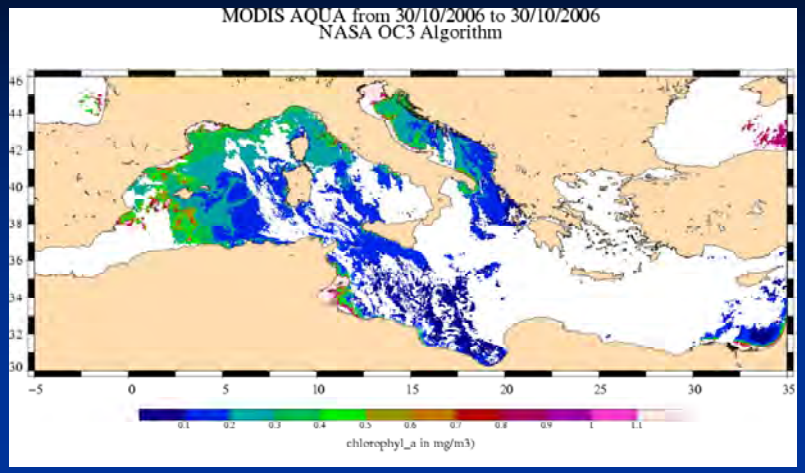
Evolution of flows at an hydrographic station estimated from simulated precipitations by ENEA model

Mortality



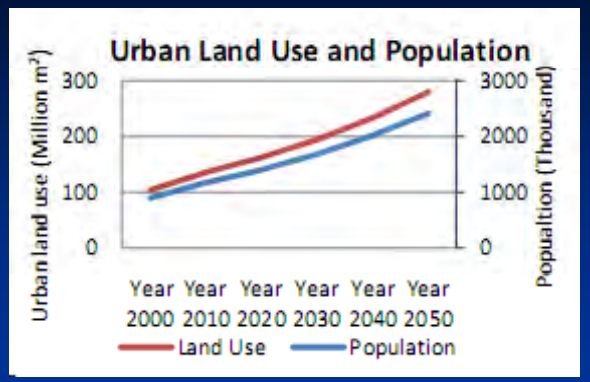
Evolution of mortality in summer, estimated for 1950-2050

Biophysical indicators



C.C. induce temperature changes that will alters the biological models and biodiversity, and may contribute to the emergence of some invasive exotic species such as jellyfish and green algae, which have impacts on socio-economic activities and genetic diversity.

Trends and socio-économic impacts



Growth of population and urban land use for Oran Region at various temporal horizons

It concern not only the environment, but also the economic and social dimensions of sustainable development.

In fact, C.C. poses a threat to the goals of economic development.

The risks posed by C.C. must be considered systematically in the development planning to strengthen the resilience of the country.

Algeria National Climate Plan (NCP) :

Strategy and action plan at different horizons (2015-2050), following an intersectoral approach, integrated with national development plans, taking into account :

- **Vulnerability to Climate Change,**
- **Development goals and**
- **Context of international negotiations.**

- **A major component : Local Climate Plans (LCP), based on vulnerability analysis conducted at the Wilaya (Department) level.**
- **LCP must identify strategy and adaptation policies at medium and long term, to reduce the vulnerability of territories to the impacts of CC as to put them in position to take advantage of the benefits of CC.**

Realization of vulnerability analysis = opportunity to develop …

- **Knowledge of resources, their vulnerability, pressures on them (use conflicts);**
- **Awareness of the local actors to take ownership of development issues and promoting new postures;**
- **Production of appropriate tools for decision-makers including local communities;**
- **Stimulation of societal assessments of activities that lead to an adaptation of human capital and economic of the territory (new jobs, green economy);**
- **Adoption and development of governance mechanisms at a local level.**

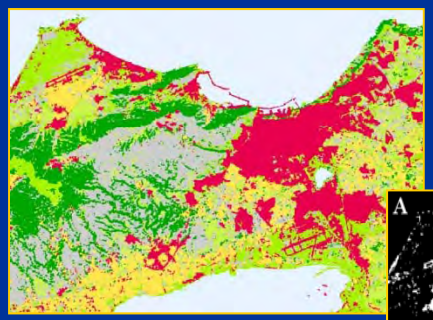
The future: a new project

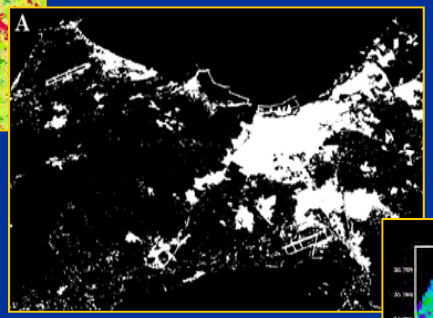
PROJET EMC2A

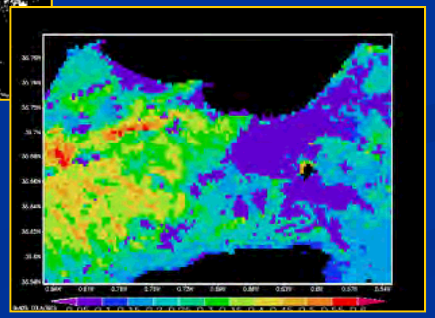
(Espace et Modélisation Climatique pour l'Adaptation en Algérie)

Coupling spatial data and high-resolution climate modeling in support for a strategy for climate change adaptation in Algeria

Using the first version of the Mediterranean Climate Model on Oran region







Objectives of the project

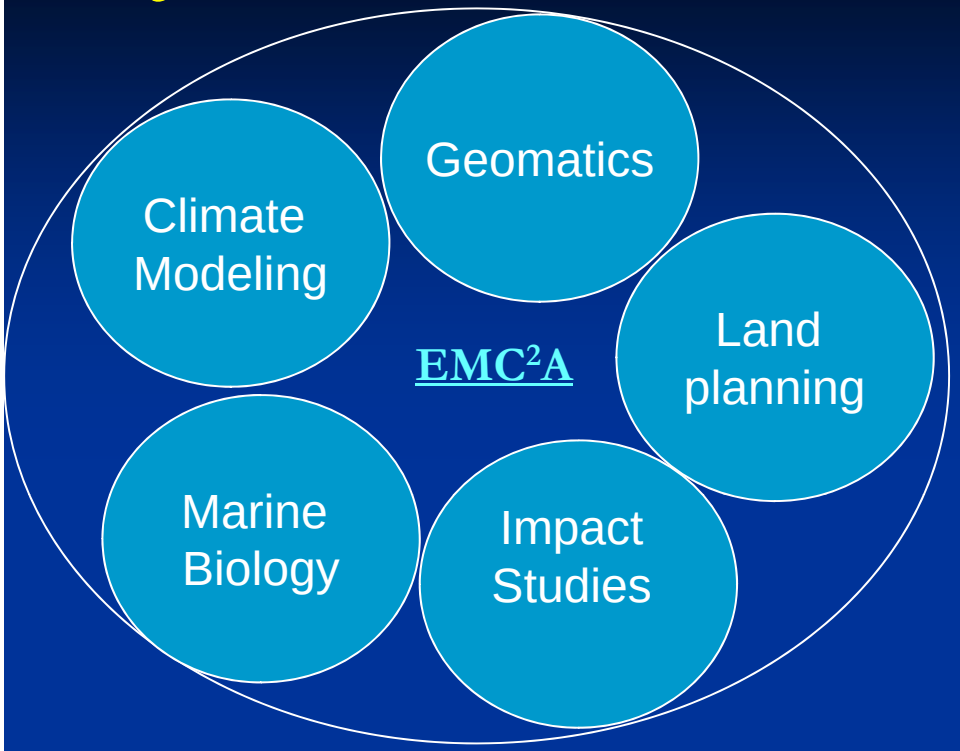
- Diagnose the state of the various ecosystems of Oran region, their evolution and their determinants in relation to climate;
- Build explanatory and predictive models for regionalized flow of water and carbon balance;
- Build explanatory, predictive models and regionalized flow and water balance and carbon;
- Simulate future changes in urban and peri-urban areas in response to the pressures of man and climate;
- Raise awareness of land management on the issue of sustainable management of urban systems.

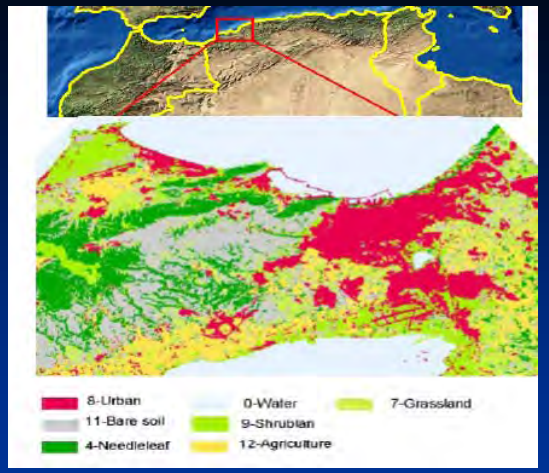
➢ Understanding the impacts of C.C. on manmade systems

➢ Develop and validate vulnerability assessment systems tools, dynamic indicators, forecasting tools for use by scientific community and policy makers to support local, regional and national strategies.

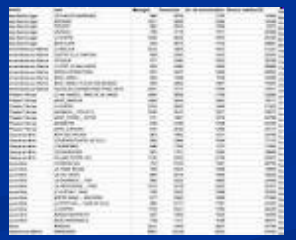
➢ Identify factors that determine vulnerability and responsiveness of urban societies to global environmental risks such as C.C.

Integrated and multidisciplinary approach





Spatial Data (Landsat, Modis, Alsat, …)

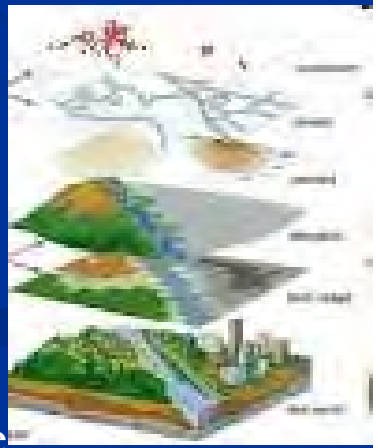


Field Data **Statistic data** **Plans**

Geomatics Tools

*** Databases on land use,**
*** Multi-temporal spatial images at different spatial and spectral resolutions**
*** Urban Databases, …**

GIS



Represent, understand and model the dynamics of environmental change

Assessment of vulnerability of an area climate, past, present and future is a major component for the development of an adaptation strategy and be based on sufficiently solid foundation for managing risk despite uncertainties related to C.C.

Vulnerability assessment = 3-components approach: by ecosystem, by sector, and transversal.

*** Sectoral approach → index of social and economic vulnerability.**

*** Ecosystem approach → geographical features and land use, impact of CC.**

*** Transversal approach → interactions between ecosystems and/or sectors, allowing for an approach to overall costs of climate change and adaptation strategies.**

The combined approach allows the finest possible knowledge territory. However, it should be emphasized the iterative nature of the study will be refined by incorporating additional data, the feedback and improving knowledge.

The proposed method is based on a vulnerability assessment regardless of future climate change (current vulnerability), thereby allowing the most detailed knowledge of the system (territory as a given natural and sociopolitical space) and the most realistic feasibility of adaptation estimation. Future vulnerability then combine the knowledge produced on the current vulnerability and socio-economic projections in the context of climate variability and more frequent extreme events.

The study consists of 3 basic steps:

1. **Assessing current vulnerability**: Determination of resilience, critical thresholds and coping ranges of the territory.
2. **Estimates of future conditions**: use of climate, environmental and socio-economic scenarios;
3. **Estimated future vulnerability** based on the results obtained in the previous steps

ASSESSING CURRENT VULNERABILITY

1. CARACTERIZING THE TERRITORY

* Physical characteristics : Based on a typology of ecosystems to define, retaining those for which the impacts of CC are more specific and identifiable (natural areas, coastline, forests, urban, rural, ...), at a level compatible with the inaccuracies related hazards (location, impacts).

* Socio-economic characteristics : inventory of activities with a significant socio-economic importance for the area (dominant sectors, marginal, ...) or in strong interactions with it.

* Climatic characteristics : Climate profile of the territory holding the most significant parameters (temperature, precipitation, wind patterns, ...); climate events affected the region (extreme events droughts, floods, heat waves, forest fires, landslides, ..., frequency, impact force).

2. ASSESSING THE VULNERABILITY

* Analysis of indicators of climate vulnerability

In connection with the global characterization of the area, focusing on trends of the main climatic parameters and associated hazards.

* Construction of a Vulnerability Matrix

Vulnerability Matrix (or impacts grid, of qualitative nature) : lists the climatic hazards identified and characterized according to the certainty of their occurrence, sectoral risks that they generate. The objective here is to obtain, for each activity selected and based on characteristics specific physical territory, a detailed analysis of potential impacts, qualitative indices of vulnerability to climate change, hazards.

* Experience feedback

Analysis of effects and consequences of extreme events on the area: effects on activities, people, ...

Beyond the study of vulnerability at T time, the feedback allows to follow the evolution of this vulnerability in order to determine the exposure of the system to climatic hazards, the sensitivity and the evolution of adaptability …

Satellite data, Geographic Information Systems (GIS), Indicators can be used to map the vulnerability and identify "hot spots" of vulnerability to different types of resources to activities or groups of individuals.

The objective here is not to make a prediction for the evolution of the territory under climate change, but rather to identify the points of vigilance and opportunities for adaptation.

ESTIMATING FUTURE CONDITIONS

1. Future Climate

Climate modeling projections for time horizons defined scenarios (CIRCE);

2. Socio-economic foresight planning

Socioeconomic activities planned for the territory (analyze the possible consequences in terms of vulnerability : boost/decrease), relevant projections to temporal deadlines on population and human development, economic conditions, land use, water consumption, energy, ...

USE OF CLIMATE, ENVIRONMENTAL AND SOCIO-ECONOMIC SCENARIOS

Applying scenarios in which are taken into account the nature and pace of change future climate, changes in extreme climatic conditions, ... to examine the probability of over passing critical thresholds.

→ Extension of Vulnerability Matrix at timeframes defined in accordance with the National Climate Plan.

Analysis will highlight different levels of review :

- *Current vulnerability of the territory*
- *Areas with specific issues*
- *Prioritization of potential impacts*
- *Potential opportunities*
- *Identifications of actors*
- *Specific points of attention (areas / activities)*

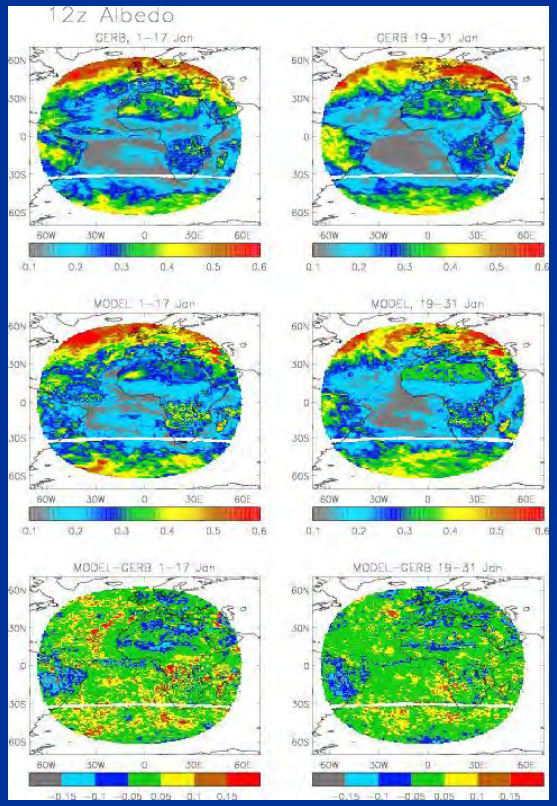
NOTE

It will be unrealistic to produce accurate forecasts because of the synergistic effect of accumulation of inaccuracies in each model's component, the variation in the time of adaptation ranges, etc..

SPACE TOOLS

- Monitoring Environment
- Knowledge Environment
- Preparation
- Action
- Detection signals of global change

One have now the necessary distance, consistent with the amplitudes signal of the C.C. (ex. Landsat program)



The space tool holds a special place in the system of data collection providing global dimension and continues to complement in situ data.

Building CLIMate change ADAPTation Capacity in Morocco, Algeria and Tunisia-CLIMADAPT

European Commission
TEMPUS

Objectives

Wider Objective :

- To support Enpi South countries in tackling Climate change through the implementation of new educational programs and the foundation of sustainable structures .

Specific Project Objectives:

- To develop and implement an Euro-Mediterranean Master Program on Climate Change and Risk Management in line with bologna requirements.

- To build a Mediterranean response to the climate change impact through the establishment of National Centres for climate change adaptation and the creation of a Regional Network.

Proposed Curricula

- Climate Change Problems and Impacts on Sustainable Development
- Natural Risk mangement
- Global change ecology
- Ecosystem modelling
- Socioeconomic and institutional dimensions of climate change
- Sustainable Coastal Zone Management and Climate Change
- Soil degradation and water balance
- Management of conservation organizations & lobbying
- Moderation, negotiation & conflict management
- Conservation & land-use management under global change
- Geographical information systems & remote sensing
- Spatial statistics & visualization